Health Care Costs and Corporate Investment

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Abstract

Health care costs for U.S. employers have tripled in the past twenty years. By constructing a novel dataset of 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 greater 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 increasing health care costs limit firms' ability to expand physically or through 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 to cover the cost of workers' health care. Nearly 60% of working-age Americans receive health care through their employers, and most large firms voluntarily offer health insurance to employees to attract and retain talents. Health benefits are a non-negligible part of workers' compensation.

In 2018, US 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 and their impact on firms' operations, few studies have examined how firms' corporate decisions are affected by 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 their capital and R&D investment decisions.

The way in which health care costs affect investment is theoretically ambiguous. Long-standing belief and theory hold that employers pass on the increments in health care costs dollar for dollar to workers in the form of lower wages (Gruber, 1994; Summers, 1989), in a setting where labor and product markets are perfectly competitive. According to this "full pass-through" view, a rise in health care costs should only affect labor market outcomes and household decisions and have no impact on firms' production and investment.[3]

On the other hand, health care costs can increase investment by reducing worker mobility. In particular, the prevalence of employer-sponsored health benefits can create "job-lock," a phenomenon in which employees stay at their jobs for fear of losing health coverage (see, e.g., Garthwaite, Gross, and Notowidigdo, 2014; Madrian, 1994). This situation occurs because employees would not necessarily receive the same level of benefits in a new job,[4] and the

[1] National Health Expenditure Data, Centers for Medicare and Medicaid Services, Sponsor Highlights, 2018.

[2] Kaiser Family Foundation Employer Health Benefits Survey (KFF Survey), 2016. `https://www.kff.org/health-costs/report/2016-employer-health-benefits-survey`

[3] More recent research shows a partial substitution between wage and health benefits and a reduction in employment (Baicker and Chandra, 2005; Currie and Madrian, 1999; Lubotsky and Olson, 2015). But it is still unclear whether firms' investment would be affected.

[4] For example, the Health Insurance Portability and Accountability Act (HIPAA) allows firms to offer

differences in health benefits widen when health care costs increase. As a result, employees stay in their positions and are more likely to invest in firm-specific skills. This, in turn, enhances productivity, and motivates firms to increase corporate investment (see, e.g., Belot, Boone, and Van Ours, 2007; Jeffers, 2018).

Conversely, 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 opt to reduce investment. 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 might offer generous health plans and at the same time invest heavily. I address this issue by exploring two settings that introduce exogenous variations in the health care costs faced by employers. In these two settings, the exogenous variations change health care costs in opposite directions and for different components in the cost structure. The first identification strategy explores merger-induced local health insurance market concentration changes. The second is a quasi-natural experiment tied to state-level 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 use the concentration increase after insurer mergers

health benefit based on job tenure.

as the instrument for health care costs. 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 (Dafny, Duggan, and Ramanarayanan, 2012; Dranove, Gron, and Mazzeo, 2003; Starc, 2014). Because employers purchase health insurance policies or service from the commercial insurance market, market structure changes in the insurance industry affect the health care costs of employers.

The US insurance industry is regulated at the state level; insurers have persistent and heterogeneous market presence across states. I therefore examine the abrupt changes in state-level local concentration induced by national-level horizontal mergers. To measure concentration changes, I use the projected change in the Herfindahl-Hirschman Index (HHI).[5] Using this instrument, I conduct a two-stage least square regression analysis to look at how health care costs affect corporate investment.

The analysis first 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 estimates from the 2SLS analysis 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. A back-of-the-envelope calculation shows that, in 2016, a 10% increase in health care costs would have meant a $2.1 million expenditure for the median firm in the sample. The analysis estimates a corresponding reduction of $2.5 million in the median firm's total investment.

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 the purpose of mergers, 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

[5] Actual changes in the HHI following mergers could be tied to local economic conditions and thus not be orthogonal to corporate investment. 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 instrument.

overlap in only one state, thus reducing the likelihood that the merger is for expanding business in that particular state.[6] Second, the driving force behind the wave of mergers during my sample period was the enactment of the Medicare Modernization Act (MMA),[7] which opened up the senior care market to private insurers. In response to financial incentives created by Medicare expansion, insurers entered this market via mergers and acquisitions. Therefore, it is unlikely that insurer mergers were driven by real firms and their corporate investment opportunities.

My second identification strategy is tied to state-level medical malpractice tort reforms that reduce health care costs. Tort reforms aim to lessen the ability of patients to litigate and/or reduce patient damages in medical malpractice cases. Those reforms lower health providers' incentive to engage in excessive precautionary behavior and "defensive medicine" ex ante, resulting in lower medical treatment intensity (Currie and MacLeod, 2008; Frakes, 2012), which in turn reduces medical costs (Kessler and McClellan, 1996) and employer-sponsored health insurance premiums (Avraham, Dafny, and Schanzenbach, 2010).

Drawing on the tort reform dataset from Avraham (2018), I use a difference-in-differences research design to examine corporate investment changes by exploiting the staggered change of tort reforms across states that lower health care costs. Specifically, I focus on the tort reform concerning caps on noneconomic damages, that 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 how health care costs differentially affect firms with different characteristics.

The first dimension I investigate is labor composition. Firms' health costs depend on

[6] As a robustness check, I include only mergers in which the target and the acquiror have more than 30 overlapping states in operation, and the results hold.

[7] MMA initiated Medicare Part D, which offers prescription drug plans to Medicare subscribers; it also enhanced the Medicare Advantage market, in which Medicare health plans are offered by private companies that contract with Medicare.

the percentage of employees enrolled in their health plan. Not all employees may choose to participate in firms' health plan as these plans often includes an employee contribution. A potential tradeoff exists between the wage employees receive and whether they opt into the health plan. In particular, higher-wage workers are more likely to enroll for reasons of tax benefits and borrowing constraints (Gruber and Levitt, 2000; Rampini and Viswanathan, 2018). Because wages are highly correlated with employees' skill level, a similar pattern of enrollment is expected for high-skilled labor. Since firms with more high-wage or high-skilled workers have a higher enrollment rate and higher exposure to health care costs, my hypothesis is that these firms' investment decisions are affected more by health care costs changes than other firms'. 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/skills increase their investment more when there is a reduction in health care costs.

Next, I look into the process which firms purchase insurance policies from the private health insurance market. Firms' bargaining power relative to insurers affects the final price they pay. Having a higher bargaining power means firms can better insulate themselves from health care cost shocks when negotiating deals with health insurers. To measure bargaining power, I look at whether the firm works with multiple insurers or have a dominating insurer within the firm. During negotiation, the employer's threat to exit is more credible when it 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 in the firm, I find that firms with fewer insurer options experience a higher increase in insurance price, and reduce 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 because available funds have decreased, then the investment of constrained firms will be affected to a greater extent. Be examining subgroups of firms based on whether they are financially constrained, I demonstrate that more constrained firms increase their investment more when their health care costs decrease. To explore other potential channels, I examine the reallocation of inventors, and establish that health care costs reduce worker mobility. This provides suggestive evidence that health care costs might increase investment. However, baseline results show that this worker mobility channel is dominated by channels that predict a negative relation between health care costs and investment.

Finally, I investigate whether health care cost shock is 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 in the following three years. The average number of citations of the patent portfolio also increases. These findings indicate that health care costs affect 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 expands the emerging branch of literature that examines how labor market frictions affect investment decisions. For example, Bai, Fairhurst, and Serfling (2020) 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 that investigates how input costs affect investment by looking beyond minimum-wage sensitive industries and investigating an important component of labor costs, namely health care costs, that apply to almost all large firms.

Moreover, this paper intersects a wide range of literature studying the effect of labor markets on firm value and corporate decisions (e.g., Agrawal and Matsa, 2013; Chen, Kacperczyk, and Ortiz-Molina, 2011; Serfling, 2016). This paper is the first to document how health care costs, which are an important part of worker compensation, affect firms' corporate policies and outcomes. This paper also 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. Dafny, Duggan, and Ramanarayanan, 2012; Dranove, Gron, and Mazzeo, 2003; Starc, 2014). The results of my study show that this concentration adversely affects real business outcomes. Prior studies on employer-sponsored health benefits have investigated labor market outcomes and firms' decision-making on offering and plan generosity. These studies usually focus on small businesses (see Bundorf, 2002; Abraham, Feldman, and Graven, 2016), but I look at large firms and their corporate decisions. Almeida et al. (2020) examined how the ACA affected public firms and found no evidence of the deterioration of firm performance. My 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. In Section 6 I analyze the potential channels through which health care costs affect corporate investment and the implications for innovation production. Section 7 concludes.

2. Background

2.1. Employer-Sponsored Health Benefits

In the US, employers play a crucial role in the provision of health care. Employer-sponsored health benefits cover more than 150 million employees and their dependents. Employer plans have the highest enrollment among all available plan types, followed by Medicaid and Medicare, which cover 60 million and 40 million individuals, respectively. ACA marketplaces and the individual market cover 20 million people. Consumers usually prefer health plans offered by their employers over ones from the individual market because employer-sponsored health benefits have pricing advantages as a result of economies of scale and favorable tax treatment.

The cost of employer-sponsored health benefits has increased sharply in the past twenty years. In 2018, the average family plan premium was $19,616, up from $5,791 in 1999.[8]

[8]KFF Survey, 2018

Despite the cost rise, the generosity of plan benefits offered by large employers remain stable. This is because health benefits are important tools for firms to attract and retain talent in the US. Employers, especially large ones, are reluctant to reduce benefits out of concerns for their firm's reputation and employee morale.

For example, the employer contribution ratio has been steady over the past twenty years: a typical large employer contributes 80% or more of the cost for single premiums and 75% for family premiums. Anecdotal evidence shows that employers explicitly state their contribution ratio when introducing health plan offerings to employees, and might look bad if they change this contribution ratio easily.

Although offering health benefits is voluntary, large employers rarely cancel their plans. In the period 1999 to 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%.[9] In other words, big employers are not likely to use contribution ratio adjustments or termination of plans to buffer health care price hikes.

Another important feature for employer-sponsored health benefit is plans' funding methods. A firm can choose to fully insure or self-insure its plan or use a combination of the 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 design, and medical claim processing. Insurance companies, however, earn less profit per plan as TPAs compared to fully insurance, because they extract mark-up only through the administrating part. Some employers also buy stop-loss insurance for catastrophic losses.

Firms usually offer a menu of health plan options to employees. These plans can vary in the restrictiveness of the provider network, or in 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

[9] KFF Survey, 2018

plans. Their restrictiveness ranges from HMOs, which are the most restrictive and cover only in-network providers, to indemnity plans, which have no restrictions on the network status of providers. High deductible health plans (HDHPs)ïijŇwhich require a higher deductible and a lower annual premium, gained popularity in the mid-2000s. They are attractive to employees with few anticipated medical needs. However, employers usually offer HDHPs alongside traditional plans. In 2018, only about 5% of employers offered only HDHP. Employers, thus, cannot stop employees from accessing traditional plans that have lower deductibles and out-of-pocket caps. 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 contributed $12,444 for an HDHP family plan, and $12,121 for a PPO family plan.[10] What is more, HDHP deductible is usually lower for larger employers. Therefore, the introduction of HDHP cannot eliminate the health cost increase.

There is a large literature on employer-sponsored health insurance. Studies focus on employee preference (Bundorf, 2002), interaction between household demand and employer supply of health benefits (Abraham, Vogt, and Gaynor, 2006), and adverse selection problems (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 on any incremental increases in health care costs to workers in the form of lower wages (Gruber, 1994; Summers, 1989). However, more recent empirical have shown that there is 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 that Illinois school teachers' salaries are affected by insurance cost changes between 1991 and 2008. Nor do school districts respond to higher health insurance costs by reducing the number of teachers. These empirical findings on partial substitution between wage and benefits, together with the survey evidence on big employers' limited ability to cut benefit generosity, provide motivating evidence that increases in health care costs directly affect firms themselves.

[10] KFF Survey, 2018

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 among 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 of the Department of Justice and 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. More specifically, Dafny, Duggan, and Ramanarayanan (2012) look at how 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 show that the increase in local market concentration between 1998 and 2006 increases the premium by approximately 7% and that the insurance market exercises monopsony power on upstream health providers. Dranove, Gron, and Mazzeo (2003), in their study of local and national HMOs, 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) use a counterfactual analysis to examine the market for Medicare Advantage,[11] showing 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[12] 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.

[11] Medicare Advantage is a Medicare health plan offered by private companies that contracts with Medicare.

[12] Medigap pays some health care costs not covered by Medicare, such as copayments, coinsurance, and deductibles. Medigap policies are sold by private companies.

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 is legislative alteration, passed on a state-by-state basis, that reduces the ability of a victim to bring litigation or limits the type or amount of damages plaintiffs can claim. Medical malpractice tort reforms seek to limit medical malpractice lawsuits and damages. Medical malpractice liability accounts for a significant proportion of health care expenditure; the cost of medical malpractice is estimated to have been $55.6 billion in 2008 (Mello, Chandra, Gawande, and Studdert, 2010).

The most common medical malpractice tort reforms are caps on noneconomic damages that limit the amount a plaintiff can claim for physical pain and emotional suffering; caps on punitive damages that restrict the maximum claim for the purpose of punishing the defendant; collateral source reforms that 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 that prevent the plaintiff from collecting full damages from one "deep-pocket" defendant, restricting the proportion of damages to each defendant's share of responsibility. Periodic payment, split recovery, caps on total damages, patient compensation funds, and contingency fee funds are less common medical tort reforms. Avraham (2007) and Holtz-Eakin (2004) summarize these tort reforms and changes in states over time.

Medical malpractice tort reforms affect health care costs in two ways. First, tort reforms can lower health providers' liability costs 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 (Born, Viscusi, and Carlton, 1998; Viscusi et al., 1993). Second, tort reforms can change how health care providers practice. Fearing damage to their reputation and monetary loss from malpractice tort lawsuits, health providers may ex ante carry out excessive tests and procedures, a practice known as "defensive medicine," in order to demonstrate that there has been 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 reform reduces the practice of defensive medicine by decreasing the threat of potential lawsuits, which, in turn, lessens the intensity of treatment and lowers the medical costs for the 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% to 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 to show there was no deterioration in health care quality following reforms such as caps on noneconomic damages. Currie and MacLeod (2008) find that varying reforms could 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 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% in self-insured firms in the period 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 a 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. A firm must attach a Schedule A form 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 conduct matching using subsidiary names, again restricting on address and industry.

Table 1, Panel A, reports the summary statistics of health plan variables from the Form 5500-Compustat merged sample. It contains 43,740 firm-year observations, representing 5,425 unique firms from 1999 to 2016. The 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. In 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 proxy of firms' health care costs in Section 4. The advantage of scaling total insurance expense by Form 5500's number of participants, is that attenuation bias and possible correlation between firms' filing pattern and investment decisions can be avoided. This is because firms only need to file Form 5500 if they have more than 100 participants in a plan. Therefore, firms with participant numbers on or near the threshold enter or exit the sample through time. Also, firms file Form 5500 at the individual EIN level, so it is possible that not all plans are 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, time-varying bias depending on firms' reporting and participation patterns might be introduced.

The funding status of fully, self, or mixed insured is determined by several factors, including premium per person, third-party administrator (TPA) status, stop-loss status, and funding source (details can be found in the Appendix). Funding status is relevant because it indicates to what extent insurance expenses from Form 5500, Schedule A, stand for the total health care costs. For fully insured firms, insurance expenses approximate the entire health cost. For self-insured firms, insurance expenses do not include medical claim costs that employers pay from cash reserves directly,[13] and therefore are only a portion of their total health care costs. Table 1 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.

[Insert Table 1 Here.]

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.

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 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

[13] Insurance expenses for self-insured firms include costs such as stop-loss insurance premiums, network access fees and TPA fees.

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 to 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 in the employer-sponsored group health insurance market. Also excluded are targets that sold only part of their business, because this is unidentifiable in the NAIC dataset. There are 14 such mergers in the period 2005-2016. Table A.1 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 in how many states they both operated before the merger.

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 A.3 shows the states with changes to tort reform by year from 1990 to 2018.

4. Empirical Strategy and Results

4.1. Firm Investment Decision and Health Premium

I begin my analysis by looking at the relation between health insurance expense and investment at the firm-year level before moving on to formal identification. In this initial step, I examine how strongly the variation in employers' health expense is correlated with the variation in their corporate investment. Figure 1 shows the scatter-bar plot of the relation. The y-axis is $Investment/Asset$, which 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 $Investment/Asset$ in 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.[14]

The positive relation can be explained by firms' active response to an increase in health care costs, but it may also be an endogeneity problem. For example, at the market level, an economic boom in a local area may increase both investment and demand for health care, thus driving up the price of health insurance policies. At the firm level, a growing firm might increase its investment and provide more generous health benefits, thus driving up its health care spending. Therefore, in the next part, I investigate the effect of health care costs on firms' investment by exploring events that generate exogenous variations in employers' health care costs.

4.2. Insurance Market Mergers and Acquisitions

To examine how health care costs affect corporate investment, the first set of exogenous variations I use 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 (Dafny et al., 2012; Dranove et al., 2003; 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.

I first look at the competition dynamics for local health insurance markets. Figure 2 is a snapshot of the Herfindahl-Hirschman Index (HHI) in each state in 2004, 2008, 2012, and 2016. As shown by the graphs, there is great variation in the health insurance market HHI across states and across time, and many local markets are very concentrated. Table 2, 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 make up 68.6% of the total market share.

[14] The positive correlation persists for the subsample of fully insured firms.

These results confirm the previous findings on high concentration of the insurance market; the non-constant concentration across regions and time could provide sources of variations for the analysis.

Although changes in health insurance market concentration are largely orthogonal for individual non-insurance firms, the insurance market HHI itself may not be a good candidate to instrument health care costs. This is because both local insurance market competitiveness and firms' investment vary with regional economic conditions. To address this issue, I look at the induced change in concentration following insurers' merger and acquisition (M&A) activities. 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", which is the projected 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 that may correlate with local market conditions. The construction of the projected change in the HHI ($sim\Delta HHI$) is illustrated in Equation 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 $TargetShare$ 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.

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

[Insert Table 2 Here.]

I gather insurers' market share information from National Association of Insurance

Commissioners (NAIC). State-level market share data is available from 2004 to 2016. I also record the horizontal mergers in the health insurance market in the period 2004-2016. Table A.1 presents the list. Section 3.2 describes the data collection procedure.

To evaluate whether $c\_sim\Delta HHI$ is a valid instrument for premium changes, first we want to know whether it is a good representation of insurance market concentration changes. Table 2, Panel B, displays this result. 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 to the change in market structure in the next period, indicating that there is a readjustment in the local market after the mergers. To validate the instrumental variable (IV) strategy approach, I run the first stage regression of $c\_sim\Delta HHI$ on the average insurance expense per participant using Equation 2. Table 3, 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.

$$log(average\ insurance\ expense)_{imt} = \beta_1 \cdot c\_sim\Delta HHI_{mt-1} + \phi_1 \cdot controls_{it-1} + \alpha_{1i} + \lambda_{1t} + \epsilon_{1it} \quad (2)$$

Columns 2-4 of Table 3 show the instrumental variables two-stage-least-squares (IV-2SLS) results of average health insurance expense on investment, based on Equation 3 and instrumented by $c\_sim\Delta HHI$. The dependent variables in Columns 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, and 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 levels for all regressions. Since the effects of insurance company M&As

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).

$$Investment_{imt} = \beta_3 \cdot log(average\ \widehat{insurance}\ expense)_{imt-1} + \phi_3 \cdot controls_{it-1} + \alpha_{3i} + \lambda_{3t} + \epsilon_{3it} \tag{3}$$

[Insert Table 3 Here.]

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, the coefficient of -0.08 in Table 3, 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. I use the Medical Expenditure Panel Survey-Insurance Component (MEPS-IC) survey to calculate enrollment number and average health premium for this median firm.[15] According to the 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% respectively. 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 3 predicts a $2.5 million reduction in the total investment.

The inverse relation between health care costs and investment can be explained in two ways. First, a change in input cost affects firms' optimal scale, thus firms cut back investment. Second, firms use cash to pay for health expenses, and an increase in health costs decreases

[15] Form 5500 numbers are not used here, because aggregating the participant number and insurance expenses from Form 5500 could underestimate the actual total enrollment and health expenses. One reason for this is that Form 5500 does not require filing of plans with less than 100 participants. Also, insurance expenses are not necessarily equivalent to health expenses across the plans. See Section 3.1 for more details.

available cash and subsequent investment. The underlying mechanism is discussed in more detail in Section 6.

The key assumption for the analysis is that health insurer M&As affect corporate investment only through merger-induced health care price rise. It is therefore important to understand motivations behind insurer mergers, and whether those mergers correlate with firms' financial decisions in undesirable ways. For our case, the insurer mergers are likely to 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 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.[16] [17] In fact, in checking monthly Medicare Part D and Medicare Advantage enrollment data via the Centers for Medicare & Medicaid Services (CMS) [18], which are 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.

There might be concerns that the results are driven by the insurers' intention to capture a particular market. If the target operates only in one state, it is reasonable to suppose that

[16]For example, in the case of the merger between UnitedHealth and PacifiCare, 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."

[17]After MMA went into effect in 2006, insurers with large Medicare segments experienced significant revenue growth. Total revenues in 2006 increased by 48% for Humana and 52.8% for HealthSpring. On the other hand, the revenue growth in 2006 for less Medicare-focused firms Aetna and Cigna was 8% and -2%, respectively.

[18]https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/MCRAdvPartDEnrolData

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 decision to merge, as well as the impact of the merger, do not depend on a single market. There are six such mergers in total. I repeat the exercise from Table 3 using these mergers only, and Table A.2 shows that the results still hold when 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 insurance companies undertake the merger with the intent to capture customers from one or a few particular employers. This is because customers from a single employer is negligible when considering a national insurer's scope of operation. For example, the median employee number in the sample is fewer than five thousands, whereas the total medical enrollment of UnitedHealth is more than 30 million in 2008[19]. The M&A decision in the insurance market could not be driven by individual nonfinancial corporations' activities.

How heavily firms are affected by dynamics in the health insurance market depends on the extent to which they are fully or self-insured. Self-insured firms pay out employee medical claims directly and have less exposure to the price shocks from health insurance providers.[20] 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 move on to the setting of tort reforms, which results in 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,

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

[20]Still, they hire insurance companies as TPAs to set up their network and process claims.

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. Taking the literature into account, 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 damages and collateral source, as well as joint and several liability reforms.

4.3.1. Main Results

To investigate how health care 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. *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 in 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.

$$Investment_{imt} = \beta \cdot TortReform_{mt-1} + \phi \cdot controls_{it-1} + \alpha_i + \lambda_t + \epsilon_{it} \qquad (4)$$

Table 4 presents the results of using Equation 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 of 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. Combining 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 that of Currie and MacLeod (2008), who 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 when extending the sample period is extended back to 1990.

Figure 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.

[Insert Table 4 Here.]

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 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 states that reverse the reforms in the next year. The sample of control firms comprises firms headquartered in the states that did not experience changes in tort law during the sample period. Table 5 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(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(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 5, Panel C, shows the OLS regression results of specification 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 when I use five years before and after the enactment, or when I use one round of matching.

[Insert Table 5 Here.]

Product Liability In addition to tort reforms for medical malpractice, another major category of tort reforms is for product liability. It is possible 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, albeit, this is not likely. Different types of tort reforms are usually passed individually. Even in the domain of medical malpractice, there is a variation between the time of enactment and that of strike down among different torts, as shown in Table A.3. The tort reforms used in this set of analyses are specific to medical malpractice, excluding individual productivity liability tort reforms. Also, product liability constitutes only 1.9% of all tort cases in the US, whereas medical malpractice makes up to 14.5%.[21] Also, product liability tort reform centers around 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 excluding industries that are prone to product liability: machinery, automobile and truck, aircraft, transportation, and abrasive and asbestos products.[22] Table 6 shows the results. The results are unaffected after excluding the industries

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

[22] Machinery (Fama-French 48 Industry: 21), automobile and truck (Fama-French 48 Industry: 23),

that could 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).

[Insert Table 6 Here.]

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: the two chambers of the state legislature and the governor's office.

The results are shown in Table 7. 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, lobbists involved in medical malpractice tort reform are most likely hired by health care providers, liability insurance companies, and trial lawyers, not by business owners.

[Insert Table 7 Here.]

Geographical Dispersion I use the location of a firm's headquarters as the state in which the given insurer M&As and tort reforms affect the firm, following previous studies studying effects of labor law on firms (e.g., Agrawal and Matsa, 2013; Acharya, Baghai, and Subramanian, 2013). Ideally, the treatment should be weighed by employee composition across all states which the firm has establishments. However, Compustat only records a

aircraft(Fama-French 48 Industry: 24), transportation (Fama-French 48 Industry: 40), abrasive and asbestos products (SIC 3290-3293).

firm's incorporation and headquarters states, and does not track individual establishment locations. Assuming that a significant portion of operations and employees would be in the firm's headquarters state, using headquarters' location will only bias down the estimation magnitude compared to the ideal case.

To test whether this assumption is valid, and to confirm that using headquarters state is a reasonable approach, I explore whether geographically dispersed firms are less affected by health care shocks. Since firms that are more geographically dispersed have a lower percentage of employees in the headquarters state, if headquarters state does not matter, we will see no difference between firms who are more or less geographically dispersed. Otherwise, more dispersed firms would 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 each state name being mentioned. The dataset runs from 1995 to 2008, I use the extrapolation method to extend the data to suit my sample period. Results are shown in Table 8. Columns 1 and 2 are the subsamples that have been divided based on whether the number of states in which a firm is present exceeds the sample median. Column 4 is the subsample of the firms present in more than one state, and Column 5 is the firms that are present in only one state. Columns 3 and 6 are the interaction exercises. As the results show, firms that are more geographically dispersed are less affected when facing health care shocks than less dispersed firms.

[Insert Table 8 Here.]

Industry-Level Shocks In many cases, firms use health benefits to draw 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 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&As or medical malpractice tort reforms in Equations 3 and 4, I include industry-year fixed effects to the baseline analysis for the M&A and tort reform setting. The results are shown in Tables A.4 and A.5.

These 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 A.4 and A.5 are smaller than the baseline results in Tables 3 and 4, but they are not statistically different. The coefficient is smaller 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. Adding industry-year fixed effects might underestimate the average effects among all treated firms I investigated. Importantly, the results in Tables A.4 and A.5 demonstrate that the negative relation between health care costs and investment is not driven by transitory industry shocks.

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 has been established by 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 is that data contains only the insurance expense, which is not necessarily all of a firm's health care costs; it depends on whether the plan is fully insured. Therefore, I expect the effect of tort reforms on health expenses 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 A.6. The first three columns are the first stage results regressing *log*(*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 firms that are and are not 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% in the period 1999-2016. Including firms that are not fully insured lessens the statistical significance and economic magnitude in Columns 1 and 2. Columns 4-6 show the IV-2SLS results using $I(tort)$ as an instrument for $log(average\ insurance\ expense)$ on the fully insured subsample. The magnitude of 2SLS results is comparable to the M&A setting in Table 3.

5. What Types of Firms are Affected More?

5.1. High-Skilled Firms

Although most US public firms offered health care benefits to employees even before the enactment of the ACA,[23] firms' exposure to health care costs depends on employees' enrollment rate in 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. Not all employees will enroll in the offered health benefits because the plans are not without cost. First, employees need to pay the employee contribution. Second, health benefits are part of the compensation package, and accepting the benefits may affect the real wage an employee receives. Apart from the factors such as health risks and whether a spouse also has employer-sponsored health benefits, income is an important factor for employees' enrollment decisions. 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

[23] ACA requires firms having 50 or more full-time employees to offer health insurance or risk paying a penalty.

due to limited enforcement. Survey evidence also suggests that the employer-sponsored health plan enrollment rate increases as household income increases. 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% from the lowest quartile to the highest quartile of the average wage, respectively. This pattern is not driven by full-time status.[24] 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 9, 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 divided by higher and lower average industry wage in the setting of medical malpractice tort reforms. I use tort reforms because 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 data 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 9, 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 9 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 into higher and lower average industry

[24]See also Kaiser Family Foundation Analysis of National Health Interview Survey, 2014

skill levels, Table 9, Panel B, shows that firms with more high-skilled workers are affected more by changes in health care costs.

[Insert Table 9 Here.]

5.2. Insurer Availability

When purchasing insurance policies or services, firms bargain with insurers to set the price. Many factors 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, think about a hypothetical firm with an Atena HMO plan and a Cigna PPO plan. In negotiating the renewal of the Atena HMO plan, the firm finds the terms proposed by Atena unfavorable. The firm can threaten to divert employees to the Cigna PPO plan or move the HMO plan to Cigna, and therefore is in a better bargaining position with Atena compared with a firm only that only has Atena plans. If the firm switches to Cigna for its HMO plan, the cost would be lower compared to initiating the HMO plan with a new insurer. First, the searching cost is minimized because the firm already has a working relationship with Cigna. Second, 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 or not they have business with the merger parties. However, if a firm is working with multiple insurers or a more diverse base of insurers, it could better control the magnitude of price increases.

To examine how firms' insurer networks 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 insurers is two per year. To further account for how insurers split participants in firms, I also construct a *within-firm insurer HHI* measure, which is the sum of the squares of the insurer share of participants in 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&As for firms with varied network size and the within-firm insurer HHI. In addition to the set of controls used in my previous analysis, I also control for the geographic dispersion of firms, 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 the correlation between network size and geographical dispersion of firms. Table 10 shows the results. The first four columns are the results on samples split by whether or not a firm works with more than one insurer in that given year, and the last four columns are samples split by the insurer HHI. Columns 1, 2, 5, and 6 show the first-stage result regressing $log(average\ insurance\ expense)$ on $c\_sim\Delta HHI$, conditional on insurer network. The results suggest that firms with more insurer options or a lower within-firm insurer concentration are better able to insulate themselves from health premium price shocks. Columns 3, 4, 7, and 8 show the reduced-form results of regressing firm investment on $c\_sim\Delta HHI$. (The coefficient of the unsplit sample is -0.327 with t-statistics of -4.179.) The results in Columns 3 and 4 suggest that firms with more insurer options reduce investment less than those that only work with one insurer. Similarly, Columns 7 and 8 show that firms with an evener distribution of participants among insurers reduce investment less than the ones with more concentrated insurer networks.

[Insert Table 9 Here.]

6. Channels and Implications

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.

Scaling and Liquidity Channels Health benefits are offered as part of employees' compensation packages and are therefore a component of labor cost. An increase in labor costs 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 costs more in health benefits, firms may substitute low-skilled for high-skilled labor and cut investment in response to an increase in health care costs.

Table 11, Column 1, shows that after health care costs are reduced, assets grow at a faster rate. Firms' optimal scales increase and, therefore, encourage investment. Employment flow moving in the same direction as firm investment would also support the scaling channel. Table 11, Column 2, I look at Compustat *Employment* growth after tort reforms, and 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. Measurement issues may prevent further interpretation of the results. The Compustat *Employment* item does not measure firms' employment flow perfectly. Also, since high and low-skilled workers have differential demands when it comes to 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.[25] 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 CPS data (Baicker and Chandra, 2005) and industry-specific employee data (Lubotsky and Olson, 2015).

Besides the scale channel, health care costs also decrease investment through the liquidity channel. Fully insured firms pay the insurance company for policies on a monthly or 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' worth of projected health spending into their reserve. 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

[25] Almeida et al. (2020) use National Establishment Time Series (NETS) data and find a shift from domestic to foreign labor following health premium increases.

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 use available internal cash to increase investment.

To test this liquidity channel, I first check firms' cash level after health care costs change. Table 11, Column 5, confirms that after health care costs decrease, firms' internal cash increases. I then explore 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 12. I divide the firms into two categories based on how financially constrained they are, measured by whether the firm issues common 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 a lower profit level, respectively, that is, those that are more financially constrained. Columns 2, 5, and 8 show the subsamples of less financially constrained firms. Columns 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 that filed Form 5500, Schedule H,[26] show that both their contribution to their reserve and total expenses out of the reserve decrease following a reduction in health care costs.

[Insert Table 12 Here.]

Worker Mobility Channel Health care costs can not only reduce investment through scaling and liquidity channels, they can also increase investment by reducing worker mobility. Since health insurance is commonly offered through employment, workers tend to stay in their current jobs to retain their health coverage, a phenomenon known as "job-lock" (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, HIPAA allows employers to offer more generous plans to employees with longer job tenure. Hence, when someone transitions from being a seasoned employee to a new-hire, they chance

[26]Schedule H, "Financial Information," is voluntarily filed by firms with self-insured plans to report their financial information related to plan funding.

forgoing the favorable health plan of their old employer. When health care costs increase, the gap between health benefits offered by current and future employers widens. 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 corporate investment (e.g., Belot, Boone, and Van Ours, 2007; Jeffers, 2018).

To investigate whether health care costs discourage worker mobility, I examine a particular professional group of workers, inventors, and track their mobility as health care costs change. The advantage of focusing on inventors is that they are high-skilled workers, and therefore have higher demand for health benefits, as discussed in the previous section. Inventor information is obtained using the Harvard Business School inventor database and the USPTO patent database. Inventor mobility variables are constructed in a similar way as Ma, Tong, and Wang (2020). Table A.7 shows that when health care costs decrease, inventors are more likely to leave their current firm, or join the firm as new employees. The results indicate that higher health care costs help firms retain workers and firm-specific human capital. Thus it is possible that investment increases after health care costs rise. However, this channel is dominated by forces that lead to a negative relation between investment and health care costs.

Implication on Firm's Productivity It is important to know whether the effect of health care cost shocks is transitory, or whether they have a long-term impact on firms' productivity. Investment outcomes is not the only corporate policy that health care costs can change. Table 11 Column 3 and 4 show that firms also increase acquisition and advertising spending after health care costs decrease. If firms spend the cost-saving of health care on meaningful projects and improve their fundamentals, then curbs on health care costs are critical for businesses. If not, 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 (2020), 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 number of new patents produced following health care costs reduction, as well as the quality of new patents and the patent portfolio. The results are shown in Table A.8.

Columns 1-4 show that 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 at Columns 5-8, the average number of citations of a new patent applied after tort reform does not significantly change, but the average number of citations of all patent stock increases. This might be because firms are able to acquire more high-quality patents directly from the market for technology or through corporate M&As. Together, the results indicate that after health care costs decline, innovative firms are able to produce more patents and maintain a higher quality patent portfolio. [27] The results indicate that health care cost shocks can have a real impact on firms' future productivity.

[Insert Table A.8 Here.]

7. Conclusion

Health care issues have received much attention from both the public and policymakers in recent years. Despite employers' heavy involvement in health care provision in the US, the impact of health care changes on employers has been largely ignored. This paper highlights 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 of 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 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.

[27] Additional untabulated tests confirm that the results still hold after removing firms from the medical device industry.

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Figure 1. Correlation between Firm Investment and Average Health Care Costs

This figure presents the scatter-bar plot of the correlation between firms' total investment and average health care costs. The Y-axis $Investment/Assets$ is the sum of capital and R&D expenditure divided by lagged total assets. The X-axis is the log form of average insurance costs per participant. $Log(Average\ Insurance\ Costs)$ is divided into 30 equal-weighted groups, and the scatter graph shows the average $Investment/Assets$ within the group. The gray line shows the linear polynomial fit using the underlying raw observations.

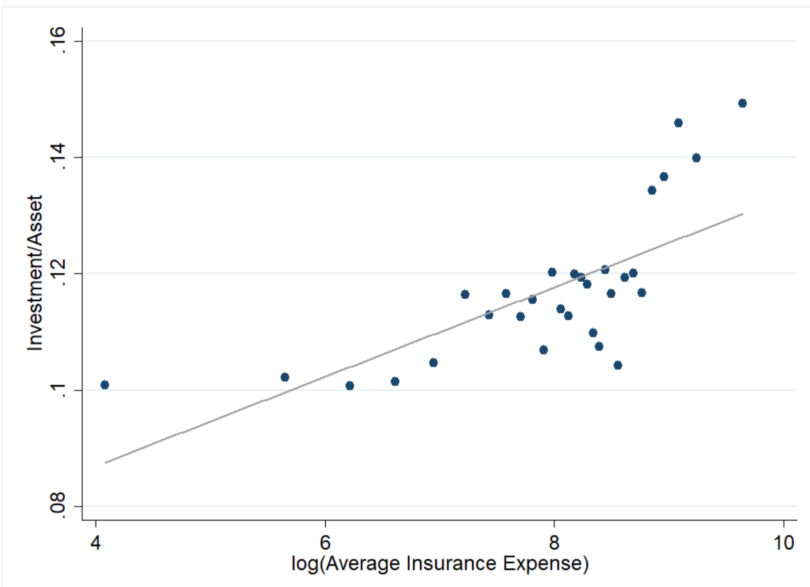


Figure 2. Health Insurance Market Concentration over Time

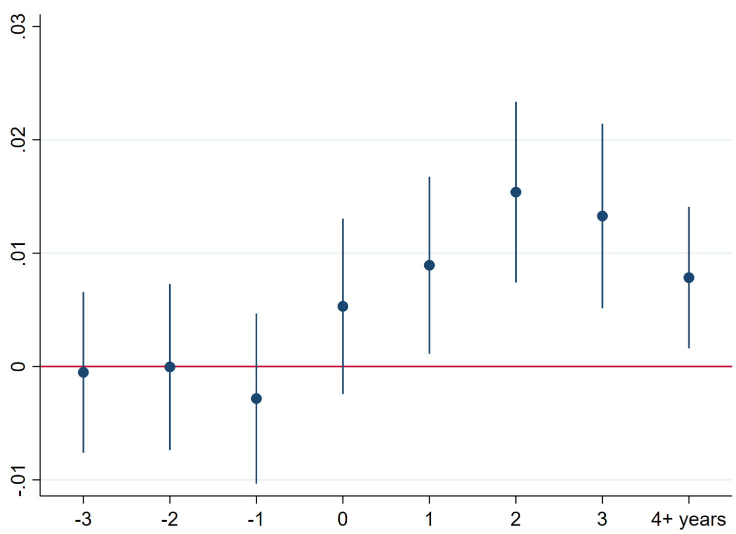
This figure shows the changes in health insurance market concentration across time and geographical regions. The plots present the state-level Herfindahl-Hirschman index (HHI), categorized into groups of fixed intervals and with increments of 500 (on a scale of 0 to 10,000), for 2004, 2008, 2012 and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

Figure 3. Difference in Investment by Year to Tort Reform Enactment

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 coefficient estimate and 95% confidence intervals are estimated using the following specification:

$$Investment_{imt} = \sum_{k=-4}^{4} \beta_k \{Treated_i \times n\ years\ to\ enactment\} + \phi \cdot firm\ controls_{it-1} + \gamma \cdot local\ controls_{tm} + \alpha_i + \lambda_t + \epsilon_{imt}$$

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. The specification includes 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, Q, PPENT, profit margin and age. Utility and financial firms are excluded from the analysis. Standard errors are clustered at the state and firm level.



Total Investment

Table 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

Table 2
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 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_simΔ 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_simΔ HHI	0.646***		0.726***	
	(4.953)		(4.408)	
l1.c_simΔ HHI		0.423***		0.452***
		(3.350)		(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

Table 3
Health Insurance Merger Effect on Firm Investment

This table presents how firms' 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 $log(average\ insurance\ expense)$ on $c\_sim\Delta HHI$. $Log(average\ insurance\ expense)$ 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 1. Columns 2-4 show the instrumental-variables-two-stage-least-squares (IV-2SLS) results using $c\_sim\Delta HHI$ as an instrument for $log(average\ insurance\ expense)$. 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; *INVESTMENT* 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(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(average insurance expense)	CAPEX	R&D	INVESTMENT
	(1)	(2)	(3)	(4)
c_simΔ HHI	3.676***			
	(5.257)			
log(average insurance expense)		-0.094***	0.011	-0.080***
		(-5.052)	(0.991)	(-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			

Table 4
Effect of Medical Malpractice Tort Reforms on Firm Investment

This table presents how firms' 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, which equals one if the reform is in effect in the given year during the sample period. 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	R&D	INVESTMENT	INVESTMENT
	(1)	(2)	(3)	(4)
Caps Noneconomic Damages	0.006**	0.009***	0.013***	0.013***
	(2.557)	(2.829)	(2.814)	(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

Table 5
Effect of Medical Malpractice Tort Reforms on Firm Investment: Matched Sample Analysis

This table presents how firms' 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 compromises firms headquartered in 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 to 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 that 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 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. All specifications include firm and year fixed effects. Columns 2, 5, and 8 includes state-level controls of income per capita and unemployment rate. Columns 3, 6, and 9 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 (N=1313)		Control (N=7072)		
	Mean	Std.Dev	Mean	Std.Dev	t stats
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 (N=920)		Control (N=1487)		
	Mean	Std.Dev	Mean	Std.Dev	t stats
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			R&D			INVESTMENT	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$I(Tort) \times I(After)$	0.009**	0.009**	0.010***	0.007*	0.007*	0.009***	0.014***	0.014***	0.017***
	(2.425)	(2.430)	(2.997)	(1.802)	(1.706)	(3.654)	(3.195)	(3.000)	(3.825)
$I(After)$	-0.001	-0.001	-0.003	-0.006**	-0.006*	-0.007**	-0.005	-0.005	-0.008*
	(-0.197)	(-0.240)	(-0.833)	(-2.067)	(-1.789)	(-2.721)	(-1.320)	(-1.240)	(-2.004)
Firm Controls	No	No	Yes	No	No	Yes	No	No	Yes
Macro Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,066	14,066	13,414	10,335	10,335	9,876	14,066	14,066	13,414
Adjusted R^2	0.470	0.470	0.528	0.688	0.688	0.754	0.621	0.621	0.688

Table 6
Effect of Tort Reforms on Firm Investment – Excluding Certain Industries

This table presents how firms' 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; *INVESTMENT* 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 the given 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)	INVESTMENT (3)	INVESTMENT (4)
Caps Noneconomic Damages	0.007**	0.008**	0.013***	0.014***
	(2.640)	(2.574)	(2.835)	(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

Table 7
Effect of Tort Reforms on Firm Investment – State Politics

This table presents the results of whether the effect of state-level medical tort reforms on firms' 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 that equals one if the Republican Party controls two or more of three state institutions: the two chambers 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	R&D	INVESTMENT
	(1)	(2)	(3)
$I(Tort)$	0.012***	0.010**	0.019***
	(2.881)	(2.054)	(2.808)
$I(Republican\ State)$	0.004***	0.000	0.005
	(2.823)	(0.019)	(1.417)
$I(Tort) \times I(Republican\ State)$	-0.005	-0.000	-0.005
	(-1.260)	(-0.119)	(-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

Table 8
Effect of Tort Reforms on Firm Investment – Geographical Dispersion

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**	0.013**	0.013**	0.009*	0.031***	0.031***
	(2.413)	(2.064)	(2.065)	(1.937)	(3.203)	(3.228)
$I(Tort) \times I(GeoDispersed)$			-0.004			-0.022***
			(-0.828)			(-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

Table 9
Firm Investment and Health Care Costs – Role of Labor Wage and Skill

This table presents how firms' investment decisions are affected by costs of providing health benefits to employees, conditional on the 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(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	Low	Interaction	High	Low	Interaction	High	Low	Interaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$I(Tort)$	0.013**	0.003*	0.003*	0.018**	0.005*	0.005	0.030***	0.006**	0.006**
	(2.517)	(1.893)	(1.946)	(2.218)	(1.717)	(1.467)	(2.844)	(2.328)	(2.228)
$I(Tort) \times I(HighWage)$			0.010***			0.013**			0.024***
			(4.041)			(2.501)			(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)
$I(Tort)$	0.010**	0.004**	0.004**	0.020***	0.004	0.004	0.026***	0.006***	0.006**
	(2.103)	(2.557)	(2.568)	(2.753)	(1.586)	(1.097)	(2.690)	(2.743)	(2.361)
$I(Tort) \times I(HighSkill)$			0.006***			0.016***			0.020***
			(2.594)			(2.958)			(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

Table 10
Firm Investment and Health Care Costs – Role of Insurer Availability

This table presents how firms' investment decisions are affected by the costs of providing health benefits to employees, conditional on firms' insurer networks. The sample is split into "Low" and "High" by whether a firm's number of insurers or the within-firm insurer HHI exceeds the sample median. The insurer HHI is computed as the sum of the squares of the insurer share of participants in a firm. A high number of insurers and a low HHI indicate that firms have higher bargaining power. Insurer information is from Form 5500, Schedule A. Columns 1, 2, 5, and 6 show the first stage result regressing $log(average\ insurance\ expense)$ on $c\_sim\Delta HHI$, conditional on insurer network. $Log(average\ insurance\ expense)$ 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 1. *Geo Disp* is the number of states that a firm operates in in the given year, and the data is from Garcia and Norli (2012). Columns 3, 4, 7, and 8 show the reduced-form results regressing firm investment on $c\_sim\Delta HHI$. The dependent variable *INVESTMENT* 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(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.

DepVar=	log(avg insurance expense)		INVESTMENT		log(avg insurance expense)		INVESTMENT	
	Number of Insurer				Within-Firm Insurer HHI			
	> 1	= 1	> 1	= 1	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
c_simΔ HHI	0.117	5.683***	-0.086	-0.593***	0.659	5.945***	-0.043	-0.574***
	(0.091)	(5.691)	(-0.966)	(-8.770)	(0.519)	(5.283)	(-0.496)	(-9.518)
Geo Disp	0.004	0.004	0.000	-0.001	0.006	0.004	0.000	-0.001
	(1.028)	(0.490)	(0.862)	(-0.826)	(1.456)	(0.599)	(0.776)	(-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

Table 11
Health Care Costs and Firms' Other Outcomes

This table presents how firms' other corporate outcomes are affected by the 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, which equals one if the reform is in effect in the given year. The dependent variables *Asset Growth* is the difference of the natural algorithm of assets between the given year and the year before; *Employment Growth* is the difference of the natural algorithm of employment between the given year and the year before; *Advertising* is the Compustat advertising expenditure divided by total assets; *Acquisition* is the Compustat acquisition expenditure scaled by total assets; *Cash* is the Compustat cash item divided by total assets. 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.

	Asset Growth	Employment Growth	Advertising	Acquisition	Cash
	(1)	(2)	(3)	(4)	(5)
$I(Tort)$	0.037***	0.010	0.002**	0.003*	0.021**
	(2.766)	(1.640)	(2.019)	(2.006)	(2.213)
Year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	61,770	58,973	25,256	59,776	61,779
Adjusted R^2	0.244	0.148	0.771	0.114	0.481

Table 12
Firm Investment and Health Care Costs – Role of Financial Constraint

This table presents how firms' 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" and "Less Constrained" by whether or not the firm pays a common dividend, firm size in relation to the sample median, or whether the 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 Constrained (1)	Less Constrained (2)	Interaction (3)	More Constrained (4)	Less Constrained (5)	Interaction (6)	More Constrained (7)	Less Constrained (8)	Interaction (9)
$I(Tort)$	0.016***	0.004*	0.004	0.018**	0.008**	0.008***	0.020**	0.008**	0.008***
	(2.767)	(1.818)	(1.146)	(2.298)	(2.480)	(2.947)	(2.616)	(2.211)	(3.056)
$I(Tort) \times I(Constrained)$			0.011**			0.011**			0.012***
			(2.469)			(2.571)			(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	46,553	14,855	61,408	29,356	32,052	61,408	28,264	32,141	60,405
Adjusted R^2	0.652	0.640	0.665	0.651	0.668	0.675	0.649	0.661	0.671

Table A.1
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), both must be US firms with a valid National Association of Insurance Commissioners (NAIC) code, and both must 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 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

Table A.2
Health Insurance Merger Effect on Firm Investment (National-Level Mergers Only)

This table presents how firms' 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 $log(average\ insurance\ expense)$ on $c\_sim\Delta HHI$. $Log(average\ insurance\ expense)$ 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 1. Columns 2-4 shows the instrumental-variables-two-stage-least-squares (IV-2SLS) results using $c\_sim\Delta HHI$ as an instrument for $log(average\ insurance\ expense)$. 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; *INVESTMENT* 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(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(average insurance expense)	CAPEX	R&D	INVESTMENT
	(1)	(2)	(3)	(4)
c_simΔ HHI	3.976***			
	(5.018)			
log(average insurance expense)		-0.101***	0.016	-0.085***
		(-6.668)	(1.584)	(-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.3
Summary of State Medical Malpractice Tort Reforms, 1990-2018

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 (Avraham, 2018). Panel A lists the enactment and strike down of the four most common medical malpractice reforms from 1990 to 2016: caps on noneconomic damages, caps on punitive damages, collateral source reform, and joint and several liability reform. The years with no tort changes are omitted. Years of strike down are the first year that the reform is no longer in place. Panel B lists states that have reforms in place before 1990.

Panel A: Tort Reforms, 1990-2018

	Caps Noneconomic Damages		**Caps Punitive Damages**		**Collateral Source Reform**		**Joint and Several Liability Reform**	
	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						

Panel B: States of Tort Reforms Enacted before 1990

Caps Noneconomic Damages	AL AK CA CO HI ID KS MD MA MI MN MO NH OH OR UT WV WI
Caps Punitive Damages	AL CO FL GA IL KS LA MI NE NV NH OR TX VA WA WI
Collateral Source Reform	AL AK AZ CA CO CT DE FL GA HI IL IN IA KS KY MA MI MN MT NE NV NJ NY ND OH OR RI SD TN UT WA
Joint and Several Liability Reform	AK AZ CA CO CT FL GA HI ID IA KS KY LA MI MN MO MT NJ NM NY ND OK OR SD TX UT VT WA WV WY

Table A.4
Health Insurance Merger Effect on Firm Investment – Industry Shocks

This table presents how firms' 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 $log(average\ insurance\ expense)$ on $c\_sim\Delta HHI$. $Log(average\ insurance\ expense)$ 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 1. Columns 2–4 shows the IV-2SLS results using $c\_sim\Delta HHI$ as an instrument for $log(average\ insurance\ expense)$. 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.

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.

	First Stage	IV-2SLS		
	log(average insurance expense)	CAPEX	R&D	INVESTMENT
	(1)	(2)	(3)	(4)
c_simΔ HHI	2.759***			
	(3.796)			
log(average insurance expense)		-0.082***	0.020	-0.061**
		(-3.414)	(1.412)	(-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 A.5
Effect of Medical Malpractice Tort Reforms on Firm Investment – Industry Shocks

This table presents how firms' 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, which equal to one if the reform is in effect in the given year during the sample period. 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)	INVESTMENT (3)	INVESTMENT (4)
Caps Noneconomic Damages	0.003**	0.009**	0.008***	0.008***
	(2.204)	(2.430)	(3.328)	(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

Table A.6
Effect of Tort Reform on Insurance Expense Using Form 5500 Data

This table presents the relation between health care insurance premiums from Form 5500 and firm investment decisions using the variations from medical malpractice tort reforms. The sample period is 1999–2016, the years for which Form 5500 data are available. The first three columns are the first stage results regressing *log*(*average insurance expense*) on the indicator of tort reform for caps on noneconomic damage. *Log*(*average insurance expense*) 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 data. 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 show the IV-2SLS results using $I(Tort)$ as an instrument for *log*(*average insurance expense*) on the fully-insured subsample. The dependent variables in Columns 4–6 *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. 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.

	First Stage log(avg insurance expense)			IV-2SLS CAPEX	IV-2SLS R&D	IV-2SLS INV
	All	Exclude Fully-insured	Fully-insured only	Fully-insured only		
	(1)	(2)	(3)	(4)	(5)	(6)
$I(Tort)$	-0.045	-0.045	-0.111**			
	(-1.031)	(-0.807)	(-2.482)			
log(avg insurance expense)				-0.089**	-0.069	-0.125**
				(-2.186)	(-1.197)	(-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			

Table A.7
Health Care Costs and Inventor Mobility

This table presents how firms' inventor reallocation is affected by health care costs in the quasi-experiment setting of tort reforms. The sample period is 1999-2010. I track inventor mobility at the inventor-firm-year-level and aggregate inventor movement to firm level. The independent variable is medical malpractice tort reform of caps on noneconomic damages, which equals one if the reform is in effect in the given year. *I(Move)* and *I(Join)* are dummy variables indicating whether any inventors leave or join the firm in the subsequent one to three years.
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: Inventor Movement Across Firms						
	I(Move)			I(Join)		
	1 Year	2 Years	3 Years	1 Year	2 Years	3 Years
	(1)	(2)	(3)	(4)	(5)	(6)
$I(Tort)$	0.059***	0.056***	0.061***	0.068***	0.051**	0.043
	(2.920)	(3.210)	(3.568)	(3.563)	(2.181)	(1.290)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,769	10,769	10,769	10,769	10,769	10,769
R-squared	0.497	0.559	0.596	0.512	0.556	0.582

Table A.8
Health Care Costs and Firms' Innovation

This table presents how firms' innovation is 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, which equals one if the reform is in effect in the given 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)
$I(Tort)$	0.111**	0.303**	0.093**	0.256**	0.016	0.026	0.022***	0.059***
	(1.995)	(1.999)	(2.535)	(2.438)	(0.590)	(0.291)	(2.862)	(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

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	Income before extraordinary items divided by sales
q	(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 the state level.
simΔHHI	The difference between the sum of the pre-merger HHI of target and acquiror and the HHI of post-merger combined two firms.
c_simΔHHI	The sum of simΔHHI 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).

A. Form 5500 Data

A.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 of a certain size and with certain 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. Form 5500 does not contain information on co-payment or co-insurance, nor does it differentiate between family and single plans.

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 firms using Employer Identification Numbers ("EIN") reported in Form 5500. I then merge the Form 5500 data with Compustat universe using EIN as well as name matching.

A.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-insured. Generally speaking, if the per capita premium amount reported is below $1,800[28] 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 is treated as self-insured. Mixed insure is defined as

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

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 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.