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# Why Do Firms Use Insurance to Fund Worker Health Benefits? The Role of Corporate Finance

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## Abstract

When a firm offers health benefits to workers, it exposes the firm to the risk of making payments when workers get sick. A firm can either pay health expenses out of its general assets, keeping the risk inside the firm, or it can purchase insurance, shifting the risk outside the firm. Using data on insurance decisions, we find that smaller firms, firms with more investment opportunities, and firms that face a convex tax schedule are more likely to hedge the risk of health benefit payments. We show how firms trade off the benefits that come from financing and investment characteristics with the costs of regulation when choosing insurance.

JEL Classification: G3, I13

Keywords: Self-insure, self-fund, hedging, human capital risk, health insurance risk, investment

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# 1 Introduction

When a firm offers health benefits to workers, it exposes the firm to the risk of making payouts when workers get sick. A firm can either pay health expenses out of its general assets, keeping the risk inside the firm, or it can transfer the task to an insurer such as Blue Cross Blue Shield, shifting the risk outside of the firm. Although nearly all large firms offer health insurance to their employees, firm responses to this risk vary significantly. In this paper, we analyze the firm's decision to manage this risk and demonstrate how financing and investment affect this decision.

Large firms can spread the risk of health payouts across a large number of employees, which makes paying out of general assets, or "self-funding," more attractive. Moreover, and of particular importance to policy makers, firms that self-fund health plans are exempt from state laws mandating that insurance offer coverage of specific benefits such as contraception, access to certain providers like physical therapists, and coverage of designated persons such as dependents.<sup>1</sup> If self-funding is largely a tactic to avoid insurance mandates, policy makers worry this will reduce the impact of new mandates or cause adverse selection in group health insurance markets.<sup>2</sup>

Nonetheless, in 2005, approximately 67 percent of firms purchased health insurance from providers such as Blue Cross Blue Shield rather than self-fund their health plans. Even 20 percent of very large firms with 500 or more employees still chose to contract with an insurer. This variation extends across industries as well; almost 40 percent of large firms in agriculture hedge fully compared to only 11 percent in financial services (Agency for Healthcare Research and Quality (2005)). Moreover, the magnitude of expected self-funding expenditures is economically important. Insurance expenditures are on average 1 percent of assets and 3 percent of cash flows in IRS benefit filings data. These amounts vary by industry, and account for up to 10 percent of cash flows for service industries.

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<sup>1</sup>In particular, firms that choose to self-insure and take on all risk from health insurance plans are exempt from certain state insurance laws and taxes and are subject instead only to federal Employee Retirement Income Security Act (ERISA) regulations.

<sup>2</sup>For recent concerns focused on the ACA insurance mandates and the health insurance exchanges, see Pear (2013), Weaver and Mathews (2013).

Why do so many firms continue to manage health benefit risk with insurance? Focusing solely on the benefits of risk-pooling and avoiding potentially costly mandates ignores important corporate finance effects. In particular, labor is an important input in firm production. When workers make claims on health benefits, the cost of labor to the firm fluctuates, changing the cash flows available for investment opportunities. To generate predictions about which firms purchase insurance and which firms self-fund their health benefit plans, we adapt the Froot et al. (1993) model of corporate hedging for labor risk. Firms have an investment opportunity that uses both physical capital and labor in production. Any required funding beyond internal general assets comes from costly external financing. Labor is either present and productive or “sick,” in which case labor requires a health payout to return to the present and productive state. If the firm does not hedge, then when labor is “sick” the firm pays the health benefit using internal funds, making the value of initial assets in place uncertain. Alternatively, the firm may hedge this risk and contract with an insurance company, paying a specified premium equal to expected medical costs regardless of the worker’s health outcome. Finally, the firm may partially hedge this risk by choosing to insure part of the risk and paying the remaining health benefit using general assets of the firm. We extend Froot et al. (1993) by incorporating an opportunity cost of avoiding benefit mandates. The model predicts that when firm value is concave or external finance is costly, a firm benefits from hedging with insurance. A firm will only partially hedge this health payout risk if there are positive opportunity costs from avoiding insurance mandates.

We test our model of risk-hedging with a rich dataset on firm benefit offerings and financial characteristics. Benefit offerings data come from administrative IRS filings. All firms with more than 100 employees that also offer health benefits must file Form 5500 with the IRS. Firms report whether their health plans are insured, self-funded, or some combination of the two that only partially hedges the risk of health-related payouts. We match the data on benefit arrangements to firm-level data from Compustat from 1992 to 2005. Using data on the insurance decisions of publicly-traded firms, we test the predictions of the model

with logit regressions of the hedging decision on proxies for investment opportunities, external finance, and concave firm value. One unique feature of our data is that we observe three different possible hedging outcomes, so we can test the extent to which firms hedge in addition to testing only whether firms hedge or not.

Our empirical results confirm investment opportunities, costly external finance, and concave firm value affect the hedging decision. Firms with more investment opportunities are more likely to hedge the risk of health benefit payouts if large health payouts prevent the firm from investing in profitable projects. Increasing Tobin's Q by one percent increases the probability of hedging by almost one percentage point. Second, when firms face costly external finance, they are more likely to purchase insurance. Purchasing insurance reduces the risk that health benefit payouts will tie up internal funds and force the firm to raise additional outside investment capital. Large firms are less likely to face costly external finance. A one percent increase in the log of total assets decreases the likelihood of hedging by six percentage points. Finally, firms that have a concave value of investment are more likely to hedge. Firms that use investment tax credits likely face a convex tax schedule, which in turn makes firm value concave. Firm value becomes concave because tax rates increase rapidly when the firm performs well, which increases firm value at a lower rate. We find that firms with a higher level of investment tax credits are six times more likely to hedge.

Our paper incorporates corporate finance explanations into the health insurance decision, which considerably improves our explanatory power compared with previous research. In addition, our analysis offers an explanation for the puzzle of insignificance or "wrong" sign of state insurance mandates. Previous work found mixed results on the relationship between self-funding and the state mandate environment, from firms avoiding mandates (Parente et al. (2001)), to an insignificant relationship (Park (2000)), to having the "wrong" sign in some years (Jensen et al. (1995)).<sup>3</sup> When we include the number of mandated benefits in each state for each year of our sample, we also find that a higher number of state

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<sup>3</sup>There is also a more general literature interested in the effects of mandates on prices and uninsurance rates. See LaPierre et al. (2009), Congdon and Showalter (2008), and Parente et al. (2001) for an overview.

insurance mandates, and, thus, a higher opportunity cost of hedging, does not decrease the likelihood of hedging. However, when we divide mandates into categories of mandating coverage in benefits, providers, or persons, we show grouping these categories together masks opposing effects. An additional mandated benefit, such as treatment for alcoholism, actually increases the probability of hedging by approximately one percent. Instead of being onerous, an additional benefit may improve employee health or ease adverse selection in the state market. However, an additional mandate requiring additional persons-covered, such as dependent students, decreases the likelihood of hedging by more than three percentage points, as self-funding firms avoid the mandate.

Because the model implies firms hedge the risk of health benefit payouts in order to reduce their reliance on costly external finance, we also examine how the funding of health benefits affects the sensitivity of investment to cash flow. This indirect test of the model allows us to control for unobserved firm heterogeneity. We find investment is at least five percent less sensitive to cash flow for firms that fully hedge this risk.

This paper offers several contributions to our understanding of how firms negotiate risk. First, our dataset is especially broad because health benefit risk is present across all industries, in contrast to, say, gold price risk. Second, health risk sidesteps the concern of firms using conventional financial products for speculative purposes rather than hedging. The dataset also allows us to identify a subsample of firms that only hedge part of the risk. Finally, Rampini et al. (2014) shows the presence of a collateral requirement complicates hedging analysis, but an advantage of health risk is that collateral is not required. In our work, we find that smaller firms are more likely to hedge, which helps reconcile the conflicting empirical tests of the Froot et al. (1993) risk management model.

In health policy, this work reveals several new and important determinants of firms' participation in health insurance markets. These determinants influence the insurance decision as much and sometimes more than previously examined characteristics on how new mandates would affect different firm types. Our results also demonstrate that different types of mandates have opposing influences on the self-insurance decision.

The rest of the paper proceeds as follows. In the next section, we review the related literature. In Section 3, we draw on Froot et al. (1993) to show how a firm chooses between self-funding worker health benefits or hedging with insurance. In Section 4, we describe the data and outline our empirical methodology. In Section 5, we examine how firm financial characteristics affect the likelihood of hedging, and we then investigate the effect of hedging on the sensitivity of investment to cash flow. Section 6 concludes.

## 2 Related literature

The limited previous empirical analysis tying firm characteristics with the self-funding decision has focused on firm size and variation in state mandates, but with puzzling results. Jensen et al. (1995) provide the most comprehensive tests of how state regulation affects the self-funding decision. The authors find evidence that state insurance regulation spurred firms to self-fund in the early 1980s, but that state regulations no longer influenced the self-funding decision by the mid-1980s. Marquis and Long (1999) also find the relationship breaks down by the 1990s. Even more puzzling, both Jensen et al. (1995) and Gruber (1994) find that self-funding firms voluntarily offer certain benefits more often than firms that are subject to state mandates, which contradicts the expectation that firms will self-fund to avoid offering these costly benefits.

On other margins of insurance offerings, previous work suggests non-regulatory features influence the decision to self-fund. Gruber (1994) and Marquis and Long (1999) find state mandates do not affect the rate at which firms choose to offer health insurance to employees, and Jensen and Morrisey (1990) find self-funded firms do not offer lower premiums than firms using insurance, despite the supposed savings from avoiding mandates. Acs et al. (1996) find populations covered by self-funded plans are similar despite a diversity of state regulatory environments.<sup>4</sup>

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<sup>4</sup>There is also an literature on how state mandates may affect other insurance markets besides employer-sponsored insurance. For example, Parente et al. (2001) review the effect of state-mandated benefit laws on premiums in the nongroup health insurance market, and Simon (2005) examines how state mandate reform affected small group markets.

Past empirical work consistently emphasizes firm size – measured as number of employees – as a determinant of the self-funding decision because larger firms can pool health risk more effectively (Jensen et al. (1995), Park (2000), Gabel and Jensen (1989)). Firm size, however, is correlated with many financial characteristics, and we show in our analysis these financial characteristics explain the variation in the self-funding decision more completely than simple risk-pooling explanations. To our knowledge, no previous work has included firm financial characteristics, either in empirical tests or theory.<sup>5</sup>

Beyond explaining a firm’s choice in the health insurance market, the self-funding decision fundamentally addresses how firms hedge risk. Vickery (2008) shows how one can use a hedging framework to understand how small firms choose between fixed and variable rate loans. Explanations of why firms may want to hedge include managerial risk aversion (Stulz (1984)), the convexity of firm value (Smith and Stulz (1985)), the costs of external finance, which give firms an incentive to use internal funds to pursue investment opportunities (Froot et al. (1993)), and earnings management (DeMarzo and Duffie (1995)).

Existing work on risk management sometimes suffers from the fact that firms can use standard financial products for speculating as well as hedging. Aunon-Nerin and Ehling (2008) overcome this problem by using a sample of firms that hedge risk by purchasing property insurance for which speculation would be tantamount to fraud. An advantage of looking at the health insurance decision is that health insurance is not tradeable, making it unlikely firms use health insurance for speculation. Additionally, the health insurance decision does not require collateral, avoiding any accompanying analytical complications (Rampini et al. (2014)).

Moreover, framing the decision to self-fund health benefit payments as a risk management problem allows us to capture a large cross-section of firms from many different industries. Past research on hedging details case studies of particular firms or focuses on

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<sup>5</sup>Feldman (2012) offers a theoretical model on the firm’s self-funding decision that does consider a firm’s trade-off between gaining incentives for the insurance firm to minimize claims (administrator moral hazard) versus losing incentives to invest in employee health (employer moral hazard). However, this model does not include any other firm objectives, such as how firms decide to finance investment. Notably, Feldman (2012) does note that, although size of the firm explains much of self-funding decisions, that the growth in popularity of self-funding has outpaced the growth in firm size.



firms in narrow industries such as gold (Tufano (1996)), oil and gas (Jin and Jorion (2006)), or utilities (Perez-Gonzalez and Yun (2013)). In the past, research has relied on surveys of managers (Nance et al. (1993)) or special data sets (Deshmukh and Vogt (2005)). Since our data are administrative tax data that firms must file in order to receive the tax benefits of offering health insurance, our sample covers all relatively large firms with a welfare benefit program.

### 3 How do firms finance health benefits?

To understand how firms finance health benefits, we introduce a model of a firm's choices under labor uncertainty. With this model, we are able to identify characteristics, both traditional and financial, that determine how a firm chooses to hedge this risk.

#### 3.1 Deciding to hedge health payout risk

Consider the following two-period model of a firm. The firm has some assets in place,  $A$ , and generates cash flows with an investment function,  $f(I, L)$ , that uses investment,  $I$ , and labor,  $L$ . Human capital is valuable to the firm, so  $L$  is constant as opposed to a continual hiring and firing framework. The production function  $f$  is increasing and concave so that  $\frac{\partial f}{\partial I} > 0$  and  $\frac{\partial^2 f}{\partial I^2} < 0$ . Labor receives a wage  $w$ . The net present value of the investment opportunity is  $f(I, L) - I - wL$ .

A key contribution of our model is that labor varies across states rather than across time. The labor input depends on if workers are healthy or sick. There is some probability  $p$  that labor is sick, which reduces labor input and also introduces a health benefit that must be paid on behalf of the worker. The alternate realization is that labor is healthy, hence the human capital is present and productive with a probability  $1 - p$  and no benefit payments need to be made.

The important consequence of the uncertain labor realization is that the firm has to make payments to restore labor to full productive capacity.<sup>6</sup> When labor is sick, a health

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<sup>6</sup>That is, the firm agrees to make payouts for any loss associated with pre-specified health events.

benefit payment  $h^s$  needs to be paid. One option is the firm pays this total amount  $h^s$  out of its general assets,  $A$ . That is, the firm makes a “self-funded” health payment. Internal funds are uncertain because of this labor risk.

Instead of financing the health payment itself through “self-funding,” the firm has the option of insuring this risk and moving the uncertainty out of the firm. In particular, the firm can contract with an insurance company to take on all the risk. The firm makes an actuarially fair premium payment of  $h^i$  upfront to the insurer that is equal to the expected payout; that is,  $h^i = E[h^s]$ . The firm’s internal wealth is now constant across the healthy and sick states. By purchasing insurance, the firm is fully hedging its risk.

Finally, the firm also has the option of partially hedging its risk. For example, the insurer agrees to pay a portion  $\alpha$  of the benefit in the state that labor is sick, and the firm pays the remaining  $1 - \alpha$ . In both healthy and sick states, the firm pays  $\alpha h^i$  to the insurer upfront. If there is a health shock to labor, the firm must additionally pay  $(1 - \alpha)h^s$  for labor to recover. The share  $\alpha$  is the amount of partial hedging.

If the firm pays for labor to recover, and the initial internal funds before the partial insurance decision are  $d$ , then final assets in place are  $A = d - \alpha h^i - (1 - \alpha)h^s$ . If there is no shock to labor, then the final assets in place are  $A = d - \alpha h^i$ . Internal wealth is uncertain, but the magnitude of risk is lower than under pure self-funding.

We use a binomial model of labor for illustration, but we can generalize to a larger firm. At a firm with many workers, the binomial distribution of sick and healthy workers will converge to a standard normal, and firms pay an actuarially fair premium  $H^i$  to insure all workers. Assets in place are  $A = d - (\alpha H^i + (1 - \alpha)\tilde{H}^s)$  where  $\tilde{H}^s$  is normally distributed with mean  $H^i$  and variance  $\sigma^2$ . The choice of  $\alpha$  is the amount of total labor health risk which is hedged.

The hedging decision does not only affect internal assets in place. If the firm makes the payment to the insurance company to hedge the labor risk, there is some opportunity cost,  $M(\alpha)$ , the amount of money forgone by using insurance, which increases in the hedging share,  $\frac{dM}{d\alpha} > 0$ . This opportunity cost could arise from various sources. The most commonly

cited reason is that when firms forgo using insurance, they qualify for ERISA exceptions. In particular, a self-funded firm does not have to offer certain benefits mandated by state regulations in its health insurance plan, and it is exempt from some state insurance premium taxes. In addition to the benefits of avoiding state regulation, a firm may be better at investing its funds than the insurance company.<sup>7</sup>

### 3.2 Solving for the optimal hedging ratio

In this section, we solve the model above, based on Froot, Scharfstein, and Stein (1993). To fund the investment, the firm can use either internal funds,  $A$ , or raise external capital,  $I - A$ , to fund production. The cost of raising funds externally,  $C(\cdot)$ , is increasing in the amount the firm borrows, so that  $C' > 0$ .<sup>8</sup> Figure 1 displays the firm's decision timeline. The firm chooses the hedging ratio at  $t = 0$ , when the firm pays the amount  $\alpha h^i$  to the insurer, for  $0 \leq \alpha \leq 1$ . After the hedging decision, during period  $t = 1$ , labor and internal funds are realized and investment decisions occur. After period  $t = 1$ , cash flows accrue.

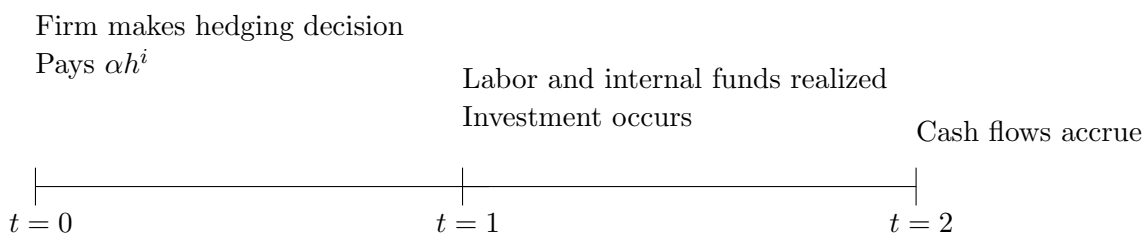


Figure 1: Model Timing

To find the optimal value of hedging, we solve the model through backwards induction. At time  $t = 1$ , the firm solves for optimal investment,  $I^*$ , given internal funds. The value of the firm before including the cost of mandates is the net present value of the investment opportunity minus the cost of external finance. The firm's problem is:

<sup>7</sup>See Rosenbloom (2005) Chapter 43 for more details on these issues.

<sup>8</sup>For simplicity, there is no discounting, so investors demand a return of zero.

$$\max_I f(I, L) - I - wL - C(I - A), \quad (1)$$

which yields some optimal investment,  $I^*$ . The value of the firm as a function of optimal investment is  $V(A) = f(I^*, L) - I^* - wL - C(I^* - A)$ . Including the opportunity cost of hedging,  $M(\alpha)$ , firm value is  $\hat{V}(A) = f(I^*, L) - I^* - wL - C(I^* - A) - M(\alpha)$ .

The firm now finds the optimal hedge. At  $t = 0$ , the firm's problem is:

$$\max_{\alpha} E[f(I^*, L) - I^* - wL - C(I^* - A) - M(\alpha)] \quad (2)$$

The maximization problem reflects both the benefits and costs of hedging risk. There is a cost to hedging risk, as captured by the mandate term. However, the benefits to hedging risk show up in three different ways. First, greater certainty frees up assets for investment opportunities,  $I^*$ . Second, reducing uncertainty in  $A$  reduces the need for external funding,  $C$ . Finally, since the hedging choice influences the value,  $I^*$ , the hedging decision depends on the production function,  $f(I^*, L)$  as well. These benefits of hedging are due to the financial characteristics and production features of the firm, rather than the state regulatory environment.

Simplifying the maximization problem, where  $\hat{V}(A) = V(A) - M(\alpha)$ , gives:

$$\max_{\alpha} E[\hat{V}(A)], \quad (3)$$

Since assets,  $A$ , are implicitly a function of the hedging choice,  $\alpha$ , the value function must be totally differentiated with respect to  $\alpha$ . The first order condition is:

$$E[V_A(A) \frac{dA}{d\alpha} - \frac{dM}{d\alpha}] = 0. \quad (4)$$

We simplify the above expression using Stein's lemma. The optimal hedge ratio is:

$$\alpha^* = 1 + \frac{E[dM/d\alpha]}{\sigma^2 E[V_{AA}]}. \quad (5)$$

### 3.3 The determinants of hedging

The optimal hedge ratio in Equation (5) lays out the tradeoffs a firm faces in choosing how much risk to hedge. Firms fully hedge when  $\alpha^* = 1$  and exclusively self-fund when  $\alpha^* = 0$ .

The right hand term is negative since firm value is concave,  $E[V_{AA}] < 0$ . Two characteristics drive concavity of firm value. First, the production function,  $f(I^*, L)$ , is concave. Second, unhedged labor risk increases the probability of having to seek out external funding, which is increasingly costly in the amount borrowed. The concavity of firm value demonstrates how both financial and production characteristics of the firm come through in the hedging decision. The greater the concavity of firm value, the smaller the negative right hand term becomes, which increases the optimal choice of  $\alpha$ . Concave firm value increases the probability that a firm hedges.

The  $E[\frac{dM}{d\alpha}]$  in the right hand side numerator is the positive increasing opportunity cost to hedging – the value the firm stands to lose when using insurance and, thus, having to offer all state mandated benefits and pay state insurance taxes. Costly mandates increase the probability that a firm hedges.

The  $\sigma^2$  in the denominator is the variance of health payouts. The smaller the variation of health payouts, the lower the probability of hedging. The largest determinant of health payout variance is the size of the insured population. The larger the covered worker population (and possibly worker dependents), the smaller the health payout variance.

From Equation (5), four main characteristics emerge as important predictors of the hedging decision. The first three predictors reflect the firm's production and financial characteristics, while the fourth reflects across-firm conditions. Previous work has focused only on the across-firm elements of number of covered workers and the state mandate environment. The three new predictions of the model are that firm financial characteristics of investment opportunities, costly external finance, and concavity of firm value also influence the hedging decision.

## 4 Data and empirical predictions

### 4.1 Constructing the firm-level insurance data set

We test the predictions of the model using annual data on health benefit plans, firm financial information, and the state regulatory environment between 1992 and 2005. We obtain data on health benefit plans from IRS Form 5500, which all firms must file if they offer welfare benefit plans with over 100 participants. We then pull all firms with welfare plans offering health, dental, or vision benefits. The data contains information on the total value of the benefit offerings and whether these plans use general assets, insurance, or a combination of general assets and insurance to fund benefits. Firms on average file two plans, and welfare plans are aggregated at the firm level.<sup>9</sup> We construct the final sample of firms by starting with the universe of Compustat firms, with variables on firms' financial information, and match the Compustat firms to the welfare benefit plans. Finally, we measure the regulatory environment using data from Blue Cross Blue Shield, which lists the year each state required insurers to provide a particular mandate. We match state mandate data to the firm-level data by the state Compustat reports for the firm's headquarters for each year.

Our final sample contains 3,186 firms and 11,156 firm-year observations. Using the IRS Form 5500 data and Compustat data limits the sample to larger, publicly-traded firms. However, our sample has several advantages. First, this sample collects more than ten times as many firms as used in Aunon-Nerin and Ehling (2008) (235 firms) and Jensen et al. (1995) (274 firms). Moreover, the variation in the choice between hedging and not hedging is quite large compared to previous research. Our setting of labor risk is also important economically, because the magnitude of potential health payments is large for many firms. In 2005, the last year of our sample, the average employer contribution was \$3,413 per enrollee for a single coverage plan and \$8,167 for a family plan enrollee. These

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<sup>9</sup>Although individual plan arrangements are also interesting, an aggregated measure of insurance is most appropriate in our question to examine the relationship of firm-level characteristics, such as costly external financing, to the firm's decision to manage health risks over all employees.

contributions had both nearly doubled from 1999 levels (Kaiser Family Foundation (2012)). An important component of risk is managing funding and expenditures along the year given unpredictable timing of health shocks.<sup>10</sup>

Table 1 shows firms' hedging choices across time in our sample. The table's rows show the breakdown of the three hedging choices at time  $t - 1$ , while the table's columns show the hedging choice at time  $t$ . Clearly the hedging choice varies more across firms than within firms. Observations in the diagonal – indicating firms that do not change hedging choice – encompass most of the observations. Firms' hedging choices are overwhelmingly persistent. The most common change is from fully insured to partially insured, followed by from partially insured to self-insured. There is not much switching between the two extremes of fully insured and self-funding, so our analysis of the partially insured group is an important contribution. We use this persistence to motivate our choice of empirical specification. We first focus on the different dimensions of cross-sectional variation before exploiting within firm variation with an indirect test of the model's predictions.

## 4.2 Explanatory variables

Table 2 explains key variables for the four main predictors of the model. The first column reports the predicted effect on the probability of hedging for each variable, followed by the definition of the key variables in each category. The last four columns show the mean and standard deviation for the full sample as well as three subsamples based on the choice of hedging. Almost half of the sample (4,744 observations) is fully insured (fully hedged or full insurance). Most firms (6,312 observations) choose to hedge at least part of the health benefit risk with a combination of self-funding and insurance (partially hedged or partial insurance). Only 100 firm-year observations make up the sample of firms that exclusively

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<sup>10</sup>This uncertainty along the year exists even in the presence of a stop-loss plan because of the delay between reporting claims and reimbursements. Firms can still face nontrivial risk annually in a stop-loss plan. A 1997 study for the Department of Health and Human Services found that approximately 70 percent of firms faced at least \$20,000 in individual risk and 50 percent of firms faced at least \$20,000 in aggregate annual risk. (Department of Health and Human Services (1997)). The level of risk faced annually in this health risk application is similar to other hedging applications, such as Guay and Kothari (2003).

self-insure by paying any benefits out of general assets (unhedged or self-funded).<sup>11</sup>

#### 4.2.1 Traditional determinants

We first discuss the Traditional Determinants in Table 2, which are factors from previous literature that the model includes. The first is the risk-pooling abilities of the firm, or the variance of health payouts,  $\sigma$ . We capture this variance with the number of persons-covered by the firm's health benefits. Rather than just using the number of firm employees, the IRS data includes employees enrolled in the health plans as well as dependents. This measure allows us to incorporate the fact that firms may be able to manage the risk pool by setting the optimal contract with the worker (Dranovea et al. (2000)). Increasing the number of covered workers and dependents should reduce the variance by spreading the risk over a larger population and decrease the probability of hedging. Fully hedged firms have many fewer enrollees, on average 8,600. The average for partially hedged firms is almost twice as large, at 14,000 employees plus dependents.

The other traditional determinant is the opportunity cost of hedging, which we capture with both the number and types of state insurance mandates. These laws require insurers to cover certain benefits, such as contraceptives, certain providers, such as marriage therapists, and certain persons, such as dependents. The mandates vary across time and across states. For example, all 50 states, plus the District of Columbia, mandated minimum maternity stay between 1995 and 1997, but only 23 states mandate coverage of contraceptives, with Ohio adopting in 1991 and Massachusetts and New York adopting in 2002. On average across our sample, there are 32 mandates, but the average number of mandates does not vary greatly between the three choice categories. Figure 2 shows the intensity of mandates

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<sup>11</sup>The IRS data indicates whether welfare plans offer health, dental, or vision benefits. It may be the case that many of the partially insured firms self-insure their health benefits (the bulk of risk and expenditures) while using insurance for the dental or vision plan. This may also explain why partially insured firms are so prevalent compared to self-funded only firms. Unfortunately, we are not able to separate out dental and vision components from health plans in the IRS reporting data because vision and dental are often combined in the same Form 5500 plan as the health benefit. Dropping all observations that include reporting dental or vision plans at all eliminates two-thirds of the sample, clearly leading to a biased sample of firms. However, in the results section, we discuss that this potential bias should only work against finding any distinct behaviors between the two groups. Improving separability of dental and vision would likely only strengthen our results.



across time and states. For each year, we group states into quartiles according to the number of mandates. The light blue states have the fewest mandates (below the 25th percentile) and the dark blue states have the highest number of mandates (above the 75th percentile). Panel A shows the distribution for 1992. Panel B shows the distribution for 2002 (the last year for which we have mandate data). While some states remain on one side of the distribution over time, others shift. For example, Idaho is in the first quartile (low mandates) in 1992 and 2002, and Maryland is in the fourth quartile (high mandates) in 1992 and 2002. On the other hand, Virginia shifts from the second to the fourth quartile between 1992 and 2002, and Louisiana shifts from the third to the first quartile. If a state mandates that insurance must cover certain benefits, a firm can avoid offering these mandated benefits by choosing to be unhedged. Firms headquartered in states with a larger number of mandates are less likely to hedge because, by self-funding, firms can avoid these mandates. Increasing numbers of mandates should decrease the probability of hedging by making it more onerous to use insurance and thus comply with ERISA.

#### **4.2.2 Financial determinants**

Figure 2 shows substantial variation in state mandates over our sample period, but Table 1 suggests firms do not respond to this variation by changing hedging behavior. In the last three categories of Table 2, we turn to the firm level financial characteristics previously ignored by the literature. These financial predictors are investment opportunities, costly external finance, and the concavity of the firm's value function. We use both Tobin's Q and research and development expenses to proxy for investment opportunities, following work in Nance et al. (1993) and Aunon-Nerin and Ehling (2008). Increasing either of these measures increases the probability of hedging because hedging frees up assets to devote to investment. Firms with more investment opportunities may be more constrained by leaving health payments unhedged, since payments will compete with more profitable opportunities or necessitate raising costly external funding. In Table 2, firms that fully hedge have a higher mean Tobin's Q of 2.363 versus 1.963 for partially hedged firms and 1.772 for unhedged firms.

Fully hedged firms have higher levels of research and development expenditures, at over 9 percent of assets on average, compared to firms without full hedging arrangements, which devote approximately 5 percent of assets to research and development.

We measure costly external finance with three different variables. The first is free cash flow, a proxy for resources available for investment, defined as operating profits scaled by total assets. Firms with higher free cash flows are less dependent on costly external finance and are less likely to hedge. The average values of free cash flow are indeed higher for unhedged and partially hedged firms than for fully hedged firms. Size is also important for costly external finance because larger firms have better access to capital markets and are less likely to face financial constraints (Hadlock and Pierce (2010)). Smaller firms may find external finance more costly because they are more likely to face future credit constraints (Vickery (2008)) or because the relative costs of financial distress are lower for larger firms (Warner (1977)). The data show fully hedged firms are smaller on average, suggesting larger firms are more likely to be unhedged or only partially hedged. Market leverage proxies costly external finance as a measure of firm debt. Higher debt may indicate difficulty obtaining external finance, thus increasing the probability of hedging. Table 2 shows that fully hedged firms have the lowest leverage ratios, but this relationship does not hold for partially hedged firms compared to self-funded firms. Finally, we include dividends following Nance et al. (1993) and Aunon-Nerin and Ehling (2008). Dividends may substitute for costly external finance if firms with dividends can divert these funds to profitable projects, but firms with dividend commitments may find it hard to reduce dividends if it sends a negative signal to the market about the strength of the firm. Table 2 indicates that firms that hedge have lower dividends.

The final component of firm financial characteristics is concave firm value. We include two different measures of concavity related to tax credits. Froot et al. (1993) note the concave production function arises naturally from a progressive corporate tax system because increases in firm value will be matched with increasing tax rates, effectively leveling out the firm's value function as income increases. Following Nance et al. (1993), the presence of

investment tax credits or tax loss carry-forwards indicate firms face convex tax schedules because they are attempts to move out of the concave portion of  $V(A)$ . We include investment tax credits scaled by total assets as well as tax loss carry forwards. Higher values of tax credits should increase the probability of hedging. In Table 2, the unadjusted levels of investment tax credits are similar across all three hedging categories, but fully-hedged firms have tax loss carry-forwards nearly twice as large as firms who partially hedge or are unhedged.

The results in Table 2 are suggestive, but we turn to a multivariate analysis to test how these variables affect the firm’s hedging decision. In our first empirical specification, we will focus on industry-level variation between fully hedging versus partially hedging since Table 2 notes that most firms are insured or partially insured, with a relatively small number of completely self-funded firms.

### 4.3 Empirical specification

Our first set of specifications address the characteristics that induce firms to hedge health risk, either fully through full insurance or partially, with some insurance and some self-insurance. The model predicts financial characteristics influence hedging if investment opportunities are large, external finance is costly, or if firm value is concave. Increased state mandates and number of employees induce firms to partially hedge rather than fully hedge. The regression framework for testing the hedging choice is:

$$Pr(\text{hedging choice}) = \Phi(\text{investment opportunities, costly external finance,} \quad (6)$$

$$\text{concavity of firm value, traditional determinants, } \epsilon).$$

We run logit regressions to explore which firm characteristics are associated with fully hedging labor health risk versus partially hedging. All regressions include year fixed effects, and we cluster standard errors at the firm level.

## 5 Results

### 5.1 Choosing how much to insure

Our main set of results shows which factors cause a firm to push all health risk outside the firm. Each column (1)-(4) of Table 3 reports results from a logit regression of the partial hedging choice, using a mix of insurance and self-funding, relative to full hedging by using insurance exclusively as in Equation (6). The dependent variable takes a value of one when the firm fully hedges and zero if the firm partially hedges. Each specification includes proxies for investment opportunities, costly external finance, concavity of firm value, and traditional determinants from the insurance mandate literature. The table shows marginal effects.

The results on choosing how much to insure clearly demonstrate the importance of corporate finance in the insurance decision. The probability that a firm outsources health risk increases with increasing investment opportunities, as shown in the first row of results. Tobin's Q increases the probability of fully hedging by 0.6 percentage points. The marginal effect of research and development expenditures is also positive and significant in the base regression, increasing the likelihood of hedging by 21.7 percentage points. These results are consistent with our hypothesis that firms with more investment opportunities are more likely to fully hedge health risk rather than partially hedge so that external financing constraints do not prevent firms from taking on good projects.

Costly external finance also matters in the decision of how much to insure. The marginal effect of size is negative and statistically significant; a small decrease in assets reduces the probability of hedging by 6.3 percentage points. Research focusing exclusively on health insurance markets also finds that size is a main determinant of self-funding (Acs et al. (1996), Garfinkel (1995), Gabel and Jensen (1989), Jensen et al. (1995)), but these studies use number of employees to measure size. In our model, size enters twice: through its effect on the risk pool and through the role of costly external finance. Our results confirm that size, measured by log of total assets, has explanatory power independent of the risk

pool, indicating that firm financial characteristics have an economically meaningful impact on the hedging decision. The effect of free cash flow is negative and significant, with a marginal increase decreasing the probability of hedging by nearly 18 percentage points. Higher free cash flows reduce dependence on external finance, decreasing the probability of fully insuring. The marginal effect of market leverage is negative and significant. Although counter to our hypothesis, the negative relationship between leverage and hedging may be reasonable when considering investment opportunities. Firms with growth opportunities – firms more likely to hedge with insurance – avoid costly leverage, so we observe a negative relationship between leverage and hedging.<sup>12</sup> The coefficient on dividends is not statistically significant.

The last important financial characteristic from the model is a convex tax schedule. Investment tax credits lead to a convex tax schedule and thus concave firm value. Investment tax credits, as a percent of total assets, have a large effect on the probability of completely insuring. A change of approximately one standard deviation, at the investment tax credit mean of 0.001 makes a firm over 6 times more likely to hedge. This finding is consistent with the prediction of the model where firms using investment tax credits prefer to fully hedge in order reduce uncertainty of concave firm value. There is no significant effect of tax loss carry forwards.

Turning to the health and policy literature predictions, we include covered employees and the number of state health insurance mandates in place for each year of our sample. Firms with more employees can essentially diversify the health risk across employees and insured dependents and lower the overall risk to the firm of health payments. As the number of employees increases, firms should be less likely to hedge. The marginal effect of covered employees in Table 3 shows an increase in the log of covered employees decreases the probability of fully insuring by 5.7 percentage points. Larger firms do take advantage of risk-pooling by self-funding some health payouts. Although number of covered employees

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<sup>12</sup>In our sample, the mean research and development expenses for firms without any interest expense is three times higher than firms with interest expense, suggesting that R&D intensive firms are reluctant to take on debt.

and firm size are highly correlated, including number of covered employees does not simply capture the effect of firm size in assets, which remains negative and significant. Using only one measure of firm size, as used in previous work on health insurance decisions, aggregates several important dimensions. Finally, the marginal effect of number of mandates is positive and statistically significant; the mandate “puzzle” holds true for this simple measure. We would expect an increasing number of mandates to decrease the probability of fully hedging, but our results show a small positive effect.

To solve this puzzle, in column (2) we disaggregate mandates by type and group them into three categories: mandated benefits, mandated providers, and mandated persons-covered. Increasing mandates on benefits actually increases the probability of completely hedging by 1 percentage points, with a significant marginal effect. Mandated benefits may actually reduce state-level adverse selection or directly benefit employees, so firms already offering these benefits do not find them costly. Gruber (1994) also finds little effect of mandates (without disaggregation), but cites that most firms already offer mandated benefits even in the absence of regulation, implying benefit mandates are not as onerous as other types of insurance mandates. On the other hand, an increase in persons-covered mandates decreases the likelihood a firm will use insurance exclusively and instead increases the chance the firm will opt to self-fund some portion of its health payouts to avoid mandates. An increase in mandates of persons-covered reduces the probability of fully hedging by 3 percentage points. Mandates on providers do not have a significant effect.

Disaggregating insurance mandates by type reveals the patterns underlying the “puzzle” of why mandates appear to have no effect, or even the wrong sign. Mandates on covered benefits are less onerous and increase the probability of using insurance, whereas mandates on persons-covered appear more onerous and have the opposite effect of causing firms to keep more health risk in-house in order to avoid these mandates.

We would like to control for worker characteristics that may affect the insurance contract, but adequate firm-level data on worker demographics is not publicly available. To address this concern, in column (3) we include industry-level fixed effects using two-digit

SIC codes because human capital and health likely vary across industries (Neal (1995)). Costly external finance (size and free cash flow) and concavity (investment tax credits) continue to be important drivers of the hedging decision. The effects of covered employees and disaggregated state mandates are robust to industry fixed effects. The marginal effects of our proxies for investment opportunities are still positive but are no longer statistically significant, possibly because at least some investment opportunities are industry specific.

Although we control for number and type of state mandates, we also allow the mandate environment to be more complex. As a robustness check, Column (4) shows estimates of our baseline specification including state fixed effects to account for unobserved state heterogeneity in the regulatory environment (Intrator et al. (2007)). The marginal effects of the financial characteristics are relatively unchanged with the exceptions of research and development and market leverage. Mandates no longer have a statistically significant effect. Taken together, these results suggest that corporate finance component is important to understanding the effects of state regulations.

In column (5) we incorporate the small set of firms that choose to self-fund exclusively and estimate an ordered logit specification. The dependent variable takes a value of 1 if the firms self-insures, 2 if the firm partially hedges risk, and 3 if the firm fully hedges risk with insurance. The table shows coefficient estimates. Results are qualitatively similar to the baseline specification. The results from the ordered logit suggest that while we observe most firms choosing full or partial hedging, the same determinants drive the outcome for the full spectrum of hedging options.

One disadvantage of the IRS Form 5500 data is that the firm may include health benefits as well as dental and vision benefits in one welfare plan. If it is the case that a firm self-insures its health benefits, but uses insurance to provide the dental and vision benefits, the largest portion of its health risk will actually be self-insured, since health is the largest expenditure category. This firm will be closer to completely self-insured compared to a firm that uses partial insurance among its health plans in addition to its dental or vision plans. However, the Form 5500 data does not make any distinction between the two in the

partial category. This inability to observe a more exact magnitude of “partial” should only add noise into our comparison of partial and self-funded, however, particularly in the case described above where a partially insured firm looks very similar to a completely self-insured firm. In this case, our results should be biased towards zero, against finding any difference between the two arrangements. We do, however, see significant differences, thus we expect measuring “partial” more precisely could strengthen our results.

There are other measures of the hedging decision that would be useful to include in the above analysis. For example, besides avoiding insurance mandates, self-funded firms also avoid some state insurance taxes. We included a time-varying measure of state premium taxes in our analysis, but the measure was not significant and did not change the effects of our main financial characteristics. We also included a measure of taxes that certain states levy on insured firms to help fund state high-risk pool insurance plans. We found a significant effect of high-risk pool taxes, where these taxes reduce the probability that a firm fully insures. However, the most complete historical data for the high-risk pool taxes we found for our study period was cross-sectional across states within one year. Nevertheless, our results do not change qualitatively if we include this implicit tax.

The results in Table 3 indicate that financial characteristics are an important part of the self-funding decision, quite distinct from the regulatory environment. Clearly, the presence of investment opportunities, costly external finance, and concave firm value impact the firm’s decision of how much insurance to use to manage health payout risks. We also are able to address the puzzle that state mandates have little effect, or a “wrong” effect, by revealing these findings result from underlying opposing effects of the type of mandate.

## **5.2 Differences in the contracting environment**

Results in the previous section indicate that financial characteristics play a major role in the firm’s decision to hedge health benefit risk. If risk-pooling were the most important determinant of the firm’s insurance decision, then all of the large, publicly-traded firms in our study should self-insure. Instead, we observe considerable variation in the insur-



ance decision. And these firms face substantial variation in the contracting environment stemming from relationships with workers, providers of capital, and regulators. We could control for the unobserved contracting environment by including firm fixed effects, but the persistent nature of the hedging decision makes it difficult to learn much about variation within firms.<sup>13</sup> Moreover, we don't only want to control for differences in the contracting environment, we want to understand how these differences influence the firm's insurance decision. In Table 4, we explore the nuances of the contracting environment by splitting the sample across three dimensions of variation – firm, industry, and state – to learn how marginal effects change.

Firm asset size has a significant effect on the hedging decision that is independent from measuring size using number of employees. In the first two columns of Table 4 we split the sample by size based on firm assets. Since smaller firms are more likely to find external finance costly, splitting on firm size reveals differences in the contracting environment between firms and the providers of capital. The first column shows results for the baseline specification for firms below the sample median for size, and the second column shows results for firms above the median size. Small firms with investment opportunities are more likely to hedge as suggested by the positive and statistically significant marginal effects of Tobin's Q and research and development. There is no statistically significant effect for large firms, which are less likely to be financially constrained. The negative marginal effect for free cash flow is only statistically significant for the large firm sample. Higher free cash flow may not be sufficient to alleviate costly external finance for the more constrained small firms and so on the margin does not affect the probability of hedging health benefit risk. The puzzling negative effect of market leverage is only statistically significant for small firms, consistent with the notion that firms with growth opportunities avoid costly leverage. Finally, the positive association between mandated benefits and hedging with full insurance is only present for small firms.

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<sup>13</sup>In unreported results we include firm fixed effects in our baseline specification and find that coefficients on size and covered employees are negative and statistically significant, suggesting costly external finance and size of the risk pool are the primary determinants of the hedging decision. Most other variables drop to the 10% significance level or below.

Firms within a particular industry may have important, though hard to measure, labor market or production characteristics that affect the decision to hedge. For example, labor market competitiveness can affect the worker’s outside option or the worker demographics of an industry may change the insurance premia, deductibles, or co-insurance rates. Our previous results are robust to industry fixed effects, but this only controls for unobserved variation in the contracting environment. Since we cannot measure the contracting environment, we explore variation by focusing on the hedging outcome rather than characteristics. We construct industry-level measures of the portion of firms that self-insure at least one plan using data from the Insurance Component of the Medical Expenditure Panel Survey conducted by the Agency for Healthcare Research and Quality. We match the industry level data for benefits and insurance premiums to the firm level data using SIC codes for 1992 to 2000 and NAICS codes for 2001 to 2005.<sup>14</sup> In columns (3) and (4) of Table 4 we split the sample into firms from industries that are below the median self-insurance proportion and firms from industries that are above the median self-insurance proportion. For firms in industries with lower rates of self-insurance (more hedging) the results are similar to the baseline results, but the marginal effects of our proxies for investment opportunities are no longer statistically significant. For firms in industries with higher rates of self-insurance (less hedging), more investment opportunities as proxied by Tobin’s Q increases the probability of hedging and size, measured by total assets and number of covered workers, decreases the probability of hedging. Marginal effects for the other financial determinants as well as state mandated benefits lose statistical significance. In industries that, on average, have fewer reasons to hedge, investment and costly external finance have a significant impact on the propensity to hedge.

Finally, in addition to the firm and industry contracting environment, we explore differences in the regulatory environment. We focus on the state level because of our evidence that state health insurance mandates are an important determinant in the hedging decision. In columns (5) and (6) of Table 4 we split the sample into firms from states that are below

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<sup>14</sup>The Medical Expenditure Panel Survey data begins in 1996, which we use for 1992 to 1995.

the median number of health insurance mandates and firms from states that are above median number of health insurance mandates. Splitting along this dimension yields two interesting results. First, firms from states with more health insurance mandates are more likely to hedge when there are more investment opportunities. The coefficient on Tobin's Q is positive and statistically significant for firms in the low state mandates sample but not the high state mandates sample. Second, when the number of state mandated benefits is low, none of the marginal effects of the mandates is statistically significant. In the sample with the relatively loose regulatory environment, the financial variables drive the hedging decision.

In sum, the results in Table 4 indicate that financial variables are important on the margin. With the passage of the Affordable Care Act, many more firms face insurance mandates besides those that choose to offer insurance voluntarily. Because we may expect this new group of firms to be exactly the marginal firm in any of these three dimensions, our results suggests that financial characteristics will play a more significant role in their decisions.

### **5.3 Insurance reduces investment cash flow sensitivity**

The results above show that both financial characteristics and the regulatory environment influence the firm's decision to hedge health benefit risk. We can also conduct an indirect test of the model's implications. Hedging health risk should mitigate investment constraints by freeing up internal assets for investment and allowing the firm to avoid funding with costly external finance. Therefore, we should observe that firms with higher levels of hedging have lower sensitivity of investment to their cash flow. As more risk is hedged – from no hedging, to partial, to full – the sensitivity of investment to cash flow should diminish.

This indirect test has an additional advantage in that it affords us the ability to examine within-firm effects for the financial characteristics that vary from year to year. Our results on the propensity to hedge use a cross-sectional analysis of firms, albeit with firm-level

clustering on the errors, because the hedging decision is persistent over time for the vast majority of firms, as we saw in Table 1. With this test, we can now look at within firm variation, we can include all three hedging types, and we can control for firm heterogeneity with firm fixed-effects.

To test investment cash flow sensitivity empirically, the regression of interest is:

$$I_{i,t} = \beta CF_{i,t} + \gamma Q_{i,t-1} + \theta_t + c_i + \eta_{i,t} \quad (7)$$

where  $I_{i,t}$  is investment for firm  $i$  at time  $t$ ,  $CF_{i,t}$  is firm cash flows,  $Q_{i,t-1}$  is a proxy for investment opportunities,  $\theta_t$  is a year specific intercept term,  $c_i$  is a firm-level fixed effect that captures unobserved heterogeneity, and  $\eta_{i,t}$  is an error term.

If we run Equation (7) on stratified samples by hedging status, the coefficient of interest is  $\beta$  on cash flows. In a world without costly external finance, investment should not depend on cash flow. When firms face costly external finance, however, increasing cash flows leads to greater investment spending, and  $\beta$  will be positive. If hedging reduces the sensitivity of investment to cash flows, then this  $\beta$  coefficient should be larger in the sample of firms that do not hedge. Essentially, firms that hedge are not as dependent on changes in cash flows to make their investment decisions, whereas as an unhedged firm's investment choices will be more constrained since they also may be needed for potential health payouts. Previous research in finance has employed some variation of this regression to test the effects of hedging other risks.<sup>15</sup> Deshmukh and Vogt (2005) employ this same methodology when testing the Froot et al. (1993) model in the context of derivatives as a financial hedging tools.

Table 5 shows the three main variables of interest for this empirical relationship.<sup>16</sup> Our measure of investment is capital expenditures scaled by total assets in the previous year. Cash flow is income before extraordinary items, plus depreciation and amortization, also scaled by total assets in the previous year. Finally, we include a control for investment

<sup>15</sup>See, for example, Fazzari et al. (1988), Kaplan and Zingales (1997), Lamont (1997), and Rauh (2006).

<sup>16</sup>We follow Rauh (2006) in our construction of these variables.

opportunities, Tobin's Q, which should have a positive relationship with investments made. Table 5 shows the summary statistics for these variables for the full sample and by hedging arrangement. Self-funded, Partial insurance, and Insurance correspond to unhedged, partially hedged, and fully hedged, respectively. Among the three hedging choices, average capital expenditures are not vastly different, at approximately 7 percent of the previous year's assets. Unhedged and partially hedged firms have higher average cash flow levels than the fully hedged firms, which might be predicted given our baseline results, that low cash flows make a firm more likely to try and hedge its risk. On the other hand, our proxy of investment opportunity, Tobin's Q, increases in the level of hedging chosen. The average value of Tobin's Q for a fully hedged firm is 2.327, compared to the Tobin's Q for an unhedged firm of 1.861. This is again consistent with our model's prediction that hedging is more attractive to firms with high investment opportunities. Capital expenditures, cash flow, and Tobin's Q are all Winsorized at the 1st and 99th percentile.

Table 6 shows results from estimating Equation (7). Panel A shows results using the full sample. The first column shows the relationship between investment sensitivity and cash flow for firms that do not hedge any part of the health risk with insurance. The coefficient on cash flow is positive, consistent with previous work finding that investment does depend on cash flow (Rauh (2006)). An increase in cash flow increases investment expenditures by 1.06 percentage points. Tobin's Q is positive, indicating that a higher value of investment opportunities also increases investment expenditure. However, our real interest is in the difference between the cash flow coefficient in the Full/Partial Hedging subsample versus the No Hedge subsample. The second column shows estimates for firms that partially hedge health benefits with a mix of insured and self-funded plans. The coefficient on cash flow is again positive and significant, but the magnitude is only half the size of the coefficient for the unhedged sample. The third column shows that for firms that fully hedge health risk by contracting with an insurer the coefficient on cash flow is not statistically significant.

While the results in the first three columns of Table 6 suggest the effect of cash flow on investment is lower when firms hedge, they do not indicate if these results are statistically

different from each other. The fourth column of Table 6 shows estimates for a variation of Equation (7) that includes two indicator variables to distinguish between firms that partially hedge and firms that fully hedge. The indicator variables are equal to one when the firm uses partial insurance or full insurance, and equal to zero if the firm does not hedge at all. We then interact the hedging indicator variables with the cash flow variable. Column (4) confirms the findings of the first two columns. The coefficient on cash flow, 0.059, is positive and significant. The coefficient on cash flow interacted with an indicator for firms that hedge at least some risk is negative but not statistically significant, while the coefficient on cash flow interacted with an indicator for firms that fully hedge is negative and significant. Firms that fully hedge labor risk reduce the sensitivity of investment to cash flow by 5.4 percent.

Panel B of Table 6 restricts the sample to firms that are in the dataset for at least five years. Because much of the IRS Form 5500 data required matching Compustat financial data by hand, this subsample ensures continuity over time in the analysis of firm level variation. Results are very similar to Panel A. Overall, these results indicate that fully hedging by purchasing insurance has the greatest impact on reducing investment cash flow sensitivity within a firm. More generally, these results are consistent with our previous findings that firms that face costly external finance when pursuing investment opportunities reap benefits from hedging.

## 6 Conclusion

We explore how firms hedge the human capital risk associated with paying out health benefits. Firms can choose to self-fund health benefits and keep the risk within the firm or hedge some of this risk by purchasing insurance. Firms do not have to hedge all of the risk, however, and can partially hedge using some combination of these two benefit arrangements. We adapt the model of Froot et al. (1993) to explore how corporate finance considerations impact the firm's insurance decision, which the extant literature, particularly

in health economics, has not addressed.

Using IRS Form 5500 data, which all firms must file to receive tax advantages from providing health benefits, we test the two main implications of the model. First, when firm value is concave, external finance is costly, or investment opportunities are large, firms benefit from hedging by using insurance. Firms will only partially hedge health payout risk, however, if there are positive opportunity costs from benefit mandates. Second, when firms hedge health risk by purchasing insurance, investment is less sensitive to cash flow. Empirical tests confirm both of these hypotheses. We provide limited evidence that the opportunity cost of hedging affects the decision to leave some of the risk unhedged. Importantly, we find that beyond insurance market characteristics or regulatory regimes, firm financial variables help drive the hedging decision. Existing work has previously ignored the firm's objective, instead relegating firms to a passive role in the choice between purchasing insurance and self-funding.

This paper also contributes to our understanding of risk management in several ways. It examines management of human capital risk by focusing on how firms choose to fund health benefit plans. Human capital risk is common to all firms, and firms already devote significant resources to health benefit plans. Moreover, because firms use health insurance for hedging purposes only, it does not have a speculative component, so we are able to obtain our estimates within a unique setting for understanding risk management behavior. Finally, this research sheds light not just on the firm's dichotomous decision to hedge or not, but also on the intermediate choice to leave some of the risk unhedged, a previously unexplored decision.

Finally, our results should help inform policy makers grappling with the role of the firm in the continuing health care reform efforts. For example, the Affordable Care Act includes provisions that may affect the use of private health insurance exchanges by firms in the United States. Without understanding how firm financing and investment policies affect the decision to self-fund health benefit plans or purchase insurance, however, it is difficult to predict which firms will react to a change in policy.

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Table 1: **Hedging Choice.**

This table shows firm hedging choice over the sample period 1992 to 2005. The rows show the hedging choice at  $t - 1$ . The columns show the hedging choice at  $t$ .

<u>From:</u>	<u>To:</u>	Fully Insured	Partially Self-Insured	Self-Insured
Fully Insured		3,070	335	3
Partially Self-Insured		18	4,596	13
Self-Insured		18	60	46

Figure 2: Mandates Across the States.

This table shows the prevalence of mandates across states in 1992 and 2002. Mandate data is only available through 2002. States in Quartile 1 are in the lowest quartile. States in Quartile 4 are the highest quartile. Panel A shows the distribution of mandates by state in 1992 by quartile. The 25th, 50th, and 75th percentiles in 1992 are 13, 17, and 21. Panel B shows the distribution of mandates by state in 2002 by quartile. The 25th, 50th, and 75th percentiles in 2002 are 23, 28, and 34.

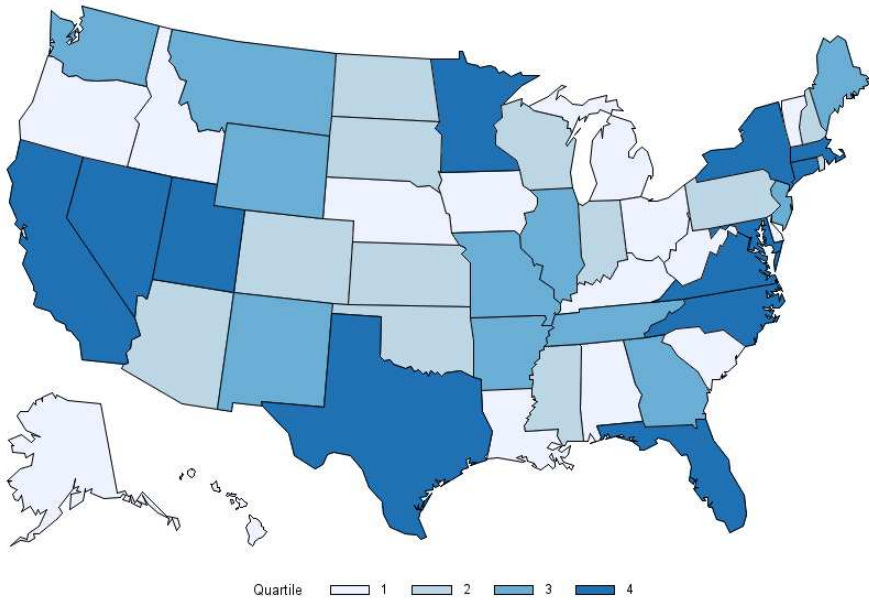
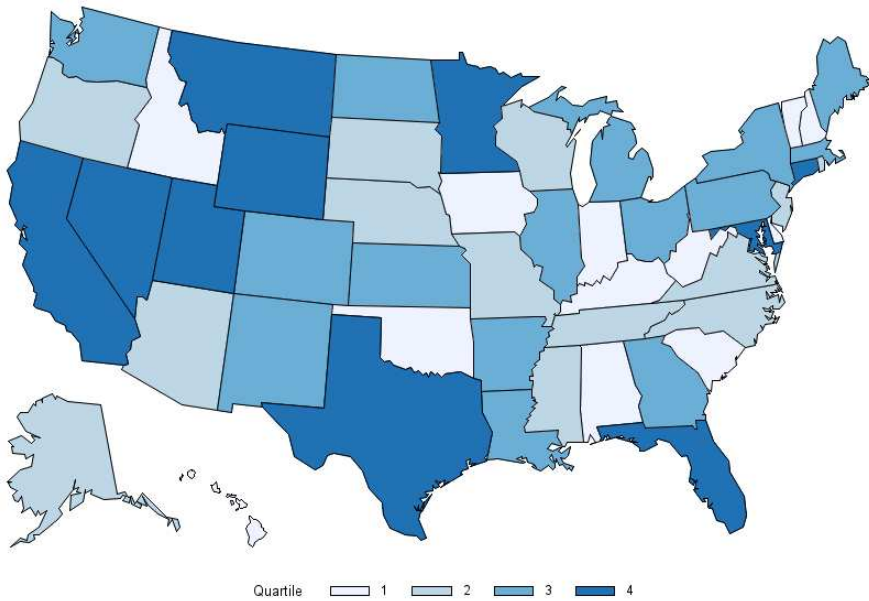


Table 2: **Summary statistics for firm characteristics and the hedging decision.**

The table shows summary statistics for firm characteristics. Observations are firm-year observations. The sample is from 1992 to 2005. There are 3,186 firms and 11,156 firm-year observations. Employees covered by firm health plans is from IRS Form 5500. State health insurance mandates are from Blue Cross Blue Shield. Financial data is from Compustat.

Hedging Prob.	Variable	Description	Full Sample	Insurance	Partial	Self-insured
			(N=11,156)	(N=4,744)	(N=6,312)	(N=100)
			Mean	Mean	Mean	Mean
			S.D.	S.D.	S.D.	S.D.
	<u>Traditional Determinants: <math>M, \sigma^2</math></u>					
-	State Insurance Mandates	Total number of mandates	32.458	33.186	31.891	33.690
			8.950	8.464	9.266	8.504
-	Covered Employees	Thousands of employees	11741	8632	14147	7413
			192401	191930	194227	24202
	<u>Investment Opportunities: <math>I^*</math></u>					
+	Tobin's Q	(Total assets - book value of equity - deferred taxes + market value of equity)/(Total assets at t-1)	2.132	2.363	1.963	1.772
			2.474	3.002	1.989	1.212
+	Research and Development	Research and development expenses scaled by total assets	0.066	0.092	0.046	0.038
			0.119	0.146	0.088	0.091
	<u>Costly External Finance: <math>C</math></u>					
-	Size	Log of total assets	5.438	4.901	5.843	5.346
			1.529	1.321	1.550	1.605
-	Free Cash Flow	Operating profits scaled by total assets	0.067	0.020	0.101	0.117
			0.208	0.250	0.162	0.103
-	Market Leverage	Long-term debt/(long-term debt + market value of equity)	0.173	0.137	0.198	0.226
			0.224	0.214	0.227	0.246
-	Dividends	common + preferred dividends scaled by earnings before depreciation, interest, and tax	0.035	0.024	0.042	0.062
			0.533	0.473	0.577	0.128
	<u>Concavity of Firm Value: <math>V_{AA}</math></u>					
+	Investment Tax Credit	Investment tax credit scaled by total assets	0.001	0.001	0.000	0.000
			0.009	0.014	0.002	0.003
-	Tax Loss Carry Forwards	Unused net operating loss carry-forward scaled by total assets	0.240	0.367	0.148	0.072
			1.002	1.305	0.688	0.195

**Table 3: Full vs Partial Hedging Decision.**

This table shows results from logit regressions. The dependent variable for the logit regressions in columns (1) to (4) is the firm's binary choice of the extent of hedging that takes the value 1 if the firm hedges risk fully and zero if the firm partially hedges health risk by purchasing health insurance. The dependent variable for the ordered logit regression in column (5) is the firm's choice of 1 if the firm self-insures and hedges no risk, 2 if the firm partially hedges risk, and 3 if the firm fully hedges risk. The table reports marginal effects in columns (1) to (4) and coefficients in column (5). Each specification includes year fixed effects. Variable definitions are in earlier tables. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% level, respectively. The sample is from 1992 to 2005. Standard errors clustered at the firm level in parentheses.

	(1)	(2)	(3)	(4)	(5)
Tobin's Q	0.008** (0.004)	0.006* (0.004)	0.004 (0.003)	0.006* (0.003)	0.027* (0.014)
Research and Development	0.217** (0.103)	0.131 (0.100)	0.039 (0.102)	0.013 (0.097)	0.539 (0.411)
Size	-0.063*** (0.009)	-0.066*** (0.009)	-0.076*** (0.009)	-0.066*** (0.009)	-0.257*** (0.034)
Free Cash Flow	-0.175*** (0.054)	-0.147*** (0.054)	-0.135** (0.055)	-0.136** (0.054)	-0.671*** (0.220)
Market Leverage	-0.114*** (0.043)	-0.077* (0.043)	-0.066 (0.044)	-0.050 (0.043)	-0.342** (0.171)
Dividends	-0.002 (0.009)	-0.002 (0.009)	0.001 (0.009)	-0.003 (0.009)	-0.010 (0.035)
Investment Tax Credit	6.403*** (2.163)	5.989*** (2.033)	5.630*** (1.921)	5.451*** (2.003)	23.814*** (8.259)
Tax Loss Carry Forwards	0.000 (0.010)	0.001 (0.010)	-0.001 (0.009)	0.001 (0.010)	0.011 (0.041)
Covered Employees	-0.057*** (0.008)	-0.060*** (0.008)	-0.054*** (0.009)	-0.066*** (0.009)	-0.217*** (0.033)
Mandates	0.002* (0.001)				
Benefits		0.010*** (0.003)	0.010*** (0.003)	0.002 (0.005)	0.040*** (0.011)
Providers		0.003 (0.003)	0.000 (0.003)	-0.014 (0.014)	0.010 (0.012)
Persons-Covered		-0.035*** (0.006)	-0.034*** (0.006)	-0.008 (0.014)	-0.146*** (0.024)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	No	Yes	No	No
State Fixed Effects	No	No	No	Yes	No
Observations	11,056	11,056	11,029	11,050	11,156

Table 4: **Firm, Industry, and State Differences in the Hedging Decision.**

This table shows results from a logit regression of the firm's hedge decision on proposed determinants. The dependent variable is the firm's binary choice of the extent of hedging that takes the value 1 if the firm hedges risk fully and zero if the firm partially hedges health risk by purchasing health insurance. The table reports marginal effects. Each specification includes year fixed effects. Left column is below sample median. Right column is above sample median. Variable definitions are in earlier tables. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% level, respectively. The sample is from 1992 to 2005. Standard errors clustered at the firm level in parentheses.

	Size		Industry Self-Insurance		State Mandates	
	Low (1)	High (2)	Low (3)	High (4)	Low (5)	High (6)
Tobin's Q	0.010*	0.003	0.004	0.037***	0.031***	0.001
	(0.005)	(0.004)	(0.003)	(0.014)	(0.009)	(0.003)
Research and Development	0.196*	-0.061	0.143	-0.039	0.080	0.061
	(0.106)	(0.193)	(0.105)	(0.224)	(0.174)	(0.119)
Size	-0.048***	-0.057***	-0.071***	-0.047***	-0.052***	-0.075***
	(0.017)	(0.013)	(0.009)	(0.016)	(0.012)	(0.011)
Free Cash Flow	-0.095	-0.282***	-0.137**	-0.263*	-0.203**	-0.145**
	(0.059)	(0.093)	(0.057)	(0.147)	(0.095)	(0.066)
Market Leverage	-0.133**	-0.047	-0.097**	0.041	-0.071	-0.048
	(0.057)	(0.051)	(0.045)	(0.090)	(0.062)	(0.055)
Dividends	0.004	-0.010	0.000	-0.014	-0.026**	0.021*
	(0.013)	(0.010)	(0.010)	(0.020)	(0.013)	(0.012)
Investment Tax Credit	6.315**	4.091**	5.590***	15.714	16.280**	4.353**
	(2.565)	(2.070)	(1.943)	(12.719)	(7.114)	(1.714)
Tax Loss Carry Forwards	0.005	-0.035	0.001	-0.030	0.010	-0.002
	(0.010)	(0.034)	(0.010)	(0.032)	(0.024)	(0.010)
Covered Employees	-0.025**	-0.068***	-0.062***	-0.049***	-0.047***	-0.070***
	(0.012)	(0.009)	(0.009)	(0.015)	(0.011)	(0.012)
Benefits	0.013***	0.005	0.011***	0.005	0.007	0.005
	(0.003)	(0.003)	(0.003)	(0.007)	(0.005)	(0.005)
Providers	0.003	0.002	0.003	0.001	0.006	0.002
	(0.004)	(0.004)	(0.003)	(0.006)	(0.005)	(0.004)
Persons-Covered	-0.038***	-0.023***	-0.037***	-0.026**	-0.015	-0.049***
	(0.008)	(0.007)	(0.006)	(0.011)	(0.011)	(0.007)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,740	5,316	9,034	2,022	4,360	6,696

Table 5: **Summary statistics for firm characteristics and investment-cash flow sensitivity.**

The table shows summary statistics for firm characteristics. Observations are firm-year observations. The sample is from 1992 to 2005. Financial data is from Compustat. Welfare benefit plan data is from IRS Form 5500.

Variable	Description	Full Sample	Self-funded	Partial	Insurance
		Mean	Mean	Mean	Mean
		S.D.	S.D.	S.D.	S.D.
Capital Expenditures	Capital expenditures scaled by total assets at t-1	0.068	0.075	0.070	0.063
		0.081	0.091	0.081	0.080
Cash Flow	Income before extraordinary items plus depreciation and amortization scaled by total assets at t-1	0.041	0.061	0.064	-0.006
		0.207	0.183	0.171	0.258
Tobin's Q	(Total assets - book value of equity - deferred taxes + market value of equity)/(Total assets at t-1)	2.072	1.861	1.972	2.327
		1.79	1.496	1.659	2.077



Table 6: **Investment Cash Flow Sensitivity.**

This table shows results from a regression of investment on cash flows by type of labor hedge. Each specification includes year and firm fixed effects. Variable definitions are in earlier tables. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% level, respectively. The sample is from 1992 to 2005. Standard errors clustered at the firm level in parentheses.

Panel A: Full Sample				
	(1)	(2)	(3)	(4)
	No Hedge	Partial Hedge	Full Hedge	Full Sample
Cash Flow	0.106** (0.046)	0.046*** (0.012)	-0.003 (0.009)	0.059** (0.026)
Cash Flow * Partial Hedge				-0.019 (0.026)
Cash Flow * Full Hedge				-0.054** (0.026)
Tobin's Q	0.025*** (0.008)	0.011*** (0.001)	0.010*** (0.001)	0.010*** (0.001)
Adjusted R <sup>2</sup>	0.280	0.135	0.140	0.144
Number of Observations	573	6,294	4,731	11,598
Number of Firms	309	1,956	1,760	3,315
Panel B: At Least 5 Years of Observations				
	(1)	(2)	(3)	(4)
	No Hedge	Partial Hedge	Full Hedge	Full Sample
Cash Flow	0.096*** (0.036)	0.054*** (0.015)	-0.004 (0.013)	0.096*** (0.033)
Cash Flow * Partial Hedge				-0.051 (0.034)
Cash Flow * Full Hedge				-0.083** (0.035)
Tobin's Q	0.018*** (0.008)	0.009*** (0.001)	0.011*** (0.002)	0.010*** (0.001)
Adjusted R <sup>2</sup>	0.302	0.135	0.155	0.154
Number of Observations	260	4,398	2,692	8,172
Number of Firms	142	1,064	798	1,796