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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. We analyze the firm's decision to manage this risk. Using data on the insurance decisions of publicly-traded firms, 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. Health risk is common to all firms, making this application an important contribution to understanding firms' hedging decisions. Additionally, we reveal new and important determinants of the hedging decision relative to regulatory regimes. We also show that hedging health risk mitigates investment-cash flow sensitivities.

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 important new dimensions of 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.[1] If self-funding is largely a tactic to avoid insurance mandates, policy makers are concerned this will lessen the impact of new mandates or cause adverse selection in group health insurance markets.[2]

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 the agriculture industry hedge fully compared to only 11 percent in financial services (Agency for Healthcare Research and Quality (2005)). The magnitude of spending to potentially self-fund 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, but can account for up to 10 percent of cash flows for service industries.

[1] 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.

[2] 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 escaping 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 financial assets and labor to increase firm value. 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 about one percent. 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 total assets decreases the likelihood of hedging by nine percent. Finally, firms that have a concave value of investment are more likely to hedge. Firms that use tax loss carry-forwards and 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 five 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)).[3] 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 insurance mandates, and, thus, a higher opportunity cost of hedging, does not decrease

[3]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.

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 almost three percent, 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 test how the funding of health benefits affects the sensitivity of investment to cash flow. We find investment is at least 3.3 percent less sensitive to cash flow for firms that hedge health risk by purchasing insurance. Moreover, the sensitivity of investment to cash flow is lower for firms that fully hedge this risk.

This paper offers several contributions to our understanding how firms negotiate risk. First, our dataset is especially broad because health insurance risk is present across all industries, in contrast to, say, oil price risk. Second, health risk sidesteps the concern of firms using hedging vehicles as speculation. The dataset also allows a partial category between fully hedged and completely unhedged. 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 supports existing theory of hedging in the absence of collateral requirements.

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.[4]

[4]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 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.[5]

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)). In contrast to previous work, the health insurance risk here is large relative to other firm expenditures and operations (Guay and Kothari (2003)).

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 the accompanying analytical complications (Rampini et al. (2014)).

Moreover, framing the decision to self-fund health benefit risks as a risk management

[5]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.

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 firms in narrow industries such as gold (Tufano (1996)), oil and gas (Jin and Jorion (2006)), or other commodities. 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 is administrative tax data which 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 Model description

In this section, we describe a model of a firm with labor uncertainty. The firm can address this uncertainty with options to hedge risk, including self-funding.

3.1 Model setup

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

The labor input will vary depending on if a worker is healthy or sick. Labor input is a random variable that depends on a verifiable human capital investment, n. An agent who has made this human capital investment can produce a level of labor of $n > 0$. There is probability p the labor realization is $n > 0$, and a complementary probability it is zero; that is, $Pr(L = n) = p$ and $Pr(L = 0) = 1 - p$. The uncertainty of the labor realization reflects two possible states: healthy or sick. Either the labor, and hence the human capital, is present and productive so the realization of labor is $n > 0$, or the worker is sick, in which case the labor realization is $n = 0$.

The important consequence of the uncertain labor realization is that the firm has to make payments to restore labor to full productive capacity.[6] One option is the firm pays some amount h^s in the event the labor realization is zero. That is, the firm makes a "self-funded" health payment out of its own general assets when the worker is sick. Internal funds are uncertain because of this labor risk. The firm's internal wealth, A, is a random variable because health payments are uncertain.

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 pay h^i upfront to an insurance company. The payment is the actuarially fair premium, which is the expected payout or $h^i = E[h^s]$. 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 share the insurer pays in the state where labor is sick is α, and the share that the firm pays is $1-\alpha$. In both states, the firm pays αh^i to the insurer upfront. If there is a shock to labor so that $L = 0$, the firm must additionally pay $(1-\alpha)h^s$ for labor to recover to $L = n$. The share α 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. At a firm with many workers, the binomial distribution converges 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 σ^2.

Importantly, if the firm makes the payment to the insurance company to hedge the labor risk, there is some opportunity cost, $G(\alpha)$, the amount of money forgone by using insurance, so which increases in the hedge share, $\frac{dG}{d\alpha} > 0$. This opportunity cost could

[6] That is, the firm agrees to make payouts for any loss associated with a pre-specified health event.

arise from various sources. One commonly cited reason is that when firms choose not to use insurance at all, they are exempt from many of the insurance requirements under the ERISA exemptions. In particular, a self-funded firm does not have to offer certain benefits mandated by state regulation 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.[7]

3.2 Adaptation of Froot, Scharfstein, and Stein (1993)

The firm has internal funds A and raises external capital $I - A$ to fund production. The cost of raising funds externally is $C(\cdot)$. Assume this cost is increasing in the amount the firms borrows, so that $C' > 0$. For simplicity, there is no discounting, so investors demand a return of zero. The value of the firm before including the opportunity cost to hedging is the net present value of the investment opportunity minus the cost of external finance. That is, $V(A) = \max_I f(I, L) - I - wL - C(I - A)$. Given the assumption that the production opportunity is concave and the cost of external finance is increasing in the amount borrowed, firm value is concave, $V_{AA} < 0$.

Following the analysis in Froot et al. (1993), the firm will prefer to hedge its uncertain first period income given a concave production function due to Jensen's inequality. Figure 1 illustrates the timing of events. At $t = 0$, the firm chooses the optimal hedge, α. At $t = 1$, the firm chooses the optimal investment, taking assets in place as given. At $t = 2$, the cash flows from the investment opportunity accrue.

To find the optimal investment and hedging strategy, we solve the model backwards. At time t=1, the firm solves for optimal investment, I^* given internal funds. The firm's problem is:

$$\max_I f(I, L) - I - wL - C(I - A), \tag{1}$$

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

[7] See Rosenbloom (2005) Chapter 43 for more details on these issues.

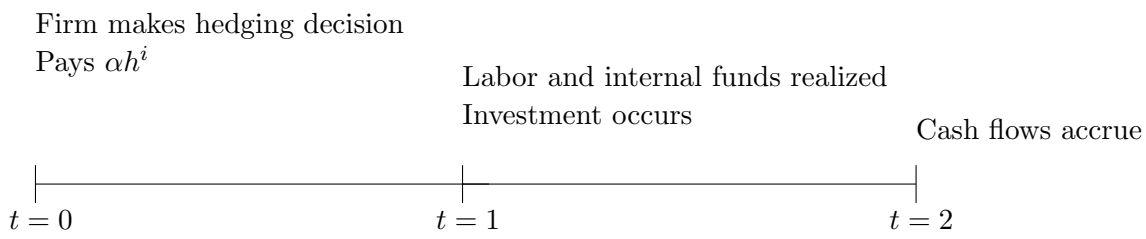

Figure 1: Model Timing

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

$$\max_{\alpha} E[\hat{V}(A)], \tag{2}$$

where $\hat{V}(A) = V(A) - G(\alpha)$. The first order condition is:

$$E[V_A(A)\frac{dA}{d\alpha} - \frac{dG}{d\alpha}] = 0. \tag{3}$$

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

$$\alpha^* = 1 + \frac{E[dG/d\alpha]}{\sigma^2 E[V_{AA}]}. \tag{4}$$

The optimal hedge ratio in Equation (4) lays out the tradeoffs a firm faces in choosing how much risk to hedge. The $E[\frac{dG}{d\alpha}]$ 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. The σ^2 in the denominator is the variance of health payouts. The final term in the denominator is the concavity of the firm value function which is negative, $E[V_{AA}] < 0$. Thus, the fraction on the right hand side is negative.

Recall a decision to fully hedge is $\alpha^* = 1$ and to fully self-fund is $\alpha^* = 0$. Equation (4) shows if there were no opportunity cost to hedging, the right hand side fraction term is equal to zero and the firm optimally chooses to hedge all risk from the uncertain labor

realization, $\alpha^* = 1$. When there is a positive and increasing opportunity cost to using insurance to manage risk, however, an increasing negative fraction on the right hand side reduces the optimal choice of α^* to less than 1, and firms will prefer to partially hedge the labor risk. As the marginal opportunity cost of hedging is higher, the firm is less likely to fully hedge by using insurance. The firm is more likely to fully hedge, however, as the variance of health shocks increases – as the covered worker population decreases, for example. Greater concavity of the value function, V_{AA}, reduces the magnitude of the (negative) right hand side fraction, which indicates that greater concavity increases the likelihood of fully hedging. The concave investment opportunity and costly external finance imply firm value is concave. Using general assets to self-fund health payouts restricts the assets available for investment opportunities and forces the firm to raise capital from increasingly expensive external sources.

4 Data and empirical predictions

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 limit our analysis to 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.[8] 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, to measure the regulatory environment, we match data from Blue Cross Blue Shield, which lists the year each state required insurers to provide a particular mandate, to the firm-level

[8] Although individual plan arrangements may be interesting, an aggregated measure of insurance is most appropriate because our question examines the relationship of firm-level characteristics, such as free cash flow, to the firm's decision to manage health risks over all employees.

data by the state Compustat reports for the firm's headquarters.

Our final sample contains 1,931 firms and 5,077 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 seven 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. The setting of our hedging decision is also economically important, because, at firms with a large number of employees, the magnitude of potential health payments are large. 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 contribution amounts had both nearly doubled from 1999 levels (Kaiser Family Foundation (2012)). Besides final yearly spending, an important component of a firm's risk is managing funding and expenditures along the year given unpredictable timing of health shocks.[9]

Table 1 reports the variables we use in our empirical analysis and shows the definition, mean, and standard deviation of each variable. Table 2 reports these summary statistics by firms' hedging choice. We group the variables by investment opportunities, costly external finance, concavity of firm value, and the opportunity cost of hedging. The first column of both Table 1 and Table 2 shows the predicted effect on hedging from increasing each variable.

The model predicts firms with more investment opportunities, costly external finance, concave firm value, or a low opportunity cost of hedging are more likely to hedge. Table 2 offers preliminary evidence for the theoretical predictions. It shows summary statistics for benefit arrangements by funding choice: firms that pay out of general assets (self-funded), firms that use insurance (insurance), and firms that use a combination of the two arrange-

[9]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 face nontrivial risk annually as well 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).

ments (partial). In terms of risk management, these benefit arrangements correspond to firms that are unhedged, firms that fully hedge, and firms that partially hedge, respectively. Under each benefit arrangement type, the first column shows the mean, and the second column shows the standard deviation of the variable. The bottom rows of Table 2 show the number of firm-year observations using these benefit arrangements. The most common benefit arrangement is partial, using a combination of self-funding and insurance, followed by fully insured, and finally self-funded.[10]

We measure investment opportunities with Tobin's Q and research and development expenditures, following the work in Nance et al. (1993) and Aunon-Nerin and Ehling (2008). Firms with more investment opportunities have two options when assets are constrained by health payments: either forego more profitable opportunities or raise external funds that are costly, either of which will increase the probability of hedging health risk. In Table 2, firms that fully hedge have a higher mean Tobin's Q of 2.049 versus 1.839 for partially hedged firms and 1.686 for unhedged firms. Fully hedged firms have higher levels of research and development expenditures, at over 5 percent of assets on average, compared to firms without full hedging arrangements, which devote less than 3 percent of assets to research and development.

We include several proxies for costly external finance. The first is size, measured by the log of total firm assets. 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)). Increasing size should reduce the cost of external finance and decrease the probability of hedging. The data shows fully hedged firms are smaller on average, meaning larger firms are more likely to be unhedged or

[10]Recall that the IRS data lists welfare plans offering 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 separate plans for vision and dental may be combined in the same Form 5500 as the health plan. If we dropped all observations which included reporting dental plans at all, this would drop two-thirds of the sample, clearly leading to a biased sample of firms who never offer dental. 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.

only partially hedged. Our second proxy for costly external finance is free cash flow. 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. In addition to size and free cash flow, we use a measure of debt as a proxy for costly external finance. Hedging makes default less likely, so firms with more leverage are more likely to hedge. Table 2 shows that fully hedged firms have the lowest leverage ratios, but this relationship doesn't hold for partially hedged firms compared to self-funded firms.

The second firm characteristic predicting hedging behavior is concave firm value. Froot et al. (1993) note the concave production function arises naturally from a progressive corporate tax system. A progressive tax system means that increases in firm value will be matched with ever increasing tax rates, effectively leveling out the firm's value function as income increases. If the firm faces a leveled-out value function, then reducing risk is beneficial, since the concave firm value reduces returns to uncertain taxable firm value. Following Nance et al. (1993), the presence of investment tax credits or tax loss carry-forwards indicate firms may face convex tax schedules. These tax characteristics either cause or intensify concave firm value. Thus, a greater presence of investment tax credits or tax loss carry-forwards 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 final category of Table 2 reports measures of the opportunity cost of hedging given the state regulatory environment. The cost of hedging is proxied by the number and type 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. These 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. 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. The number of mandates do not vary greatly between the three choice categories, but unhedged firms face an average of about 34 mandates in their states compared to only about 33 in the partially hedged cases.

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. First, note that most firm-year observations are for plans that are insured and partially insured, while a relatively small number of firms have completely self-funded health benefit plans. We will focus on fully hedging versus partially hedging, although we also examine all three hedging arrangements for robustness.

4.1 Empirical methodology

We use the data to perform two main empirical tests. The first addresses the characteristics that induce firms to hedge health risk. The model predicts firms are more likely to hedge if investment opportunities are large, external finance is costly, or if firm value is concave. Opportunity costs of hedging induce firms to partially hedge rather than fully hedge. The regression framework for testing the hedging choice is:

$$Pr(hedgechoice) = \Phi(\text{Tobin's Q, research and development, size, free cash flows, leverage, tax loss carry-forwards, investment tax credits, mandates, } \epsilon). \quad (5)$$

Our empirical methodology is to run limited dependent variable regressions to explore which firm characteristics are associated with fully hedging labor health risk, partially hedging, or not hedging at all.

The second empirical test measures how hedging mitigates investment cash flow sen-

sitivities. In particular, we verify that if hedging indeed mitigates problems with costly external finance, then we should also observe lower sensitivity of investment to cash flow. In the absence of opportunity costs in Equation (4), the firm facing a concave production function or costly external finance prefers to fully hedge. When there is an opportunity cost, however, the firm is better off implementing a partial hedging strategy. This partial hedge should mitigate the sensitivity of investment to cash flow. Our empirical methodology is to run investment cash flow sensitivity regressions to see if firms that hedge or partially hedge have a lower sensitivity. The regression of interest is:

$$I_{i,t} = \beta CF_{i,t} + \gamma Q_{i,t-1} + \theta_t + c_i + \eta_{i,t} \tag{6}$$

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, θ_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. Previous research has employed some variation of this regression.[11] Firms that partially hedge should have a lower β. 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.

5 Results

5.1 Choosing how much to insure

We first ask the question, "What factors cause a firm to push all labor health risk outside the firm?" Each column (1)-(5) of Table 4 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, the two most common choices in the data. The dependent variable takes a value of one when the firm fully hedges and zero otherwise. The table reports marginal effects. Each specification includes proxies for investment opportunities, costly external finance, and concavity of firm value. We also include proxies for opportunity costs

[11] See, for example, Fazzari et al. (1988), Kaplan and Zingales (1997), Lamont (1997), and Rauh (2006).

from mandates and risk-pooling to test predictions from the insurance mandate literature.

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 coefficients. Tobin's Q increases the probability of fully hedging by between 0.8 and 1 percentage point. The coefficient on research and development expenditures is also positive and significant in the base regression, increasing the likelihood of hedging by 24 percent. 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 at -0.091. 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 we show here financial characteristics of large firms influence hedging for reasons beyond risk-pooling. Smaller firms find raising external funds more difficult, so the size result speaks to other financial constraints. The coefficient on free cash flow is negative and significant in all specifications, with a marginal effect of -0.289. Higher free cash flows reduce dependence on external finance, decreasing the probability of fully insuring. Note also that the marginal effect of free cash flow is nearly twice as large as the simple risk-pooling effects of size for the average firm. The coefficients on market leverage, a measure of debt, are insignificant. We will continue to include market leverage as an important control, but it does not have predictive power on its own.

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, with marginal effects between 5.5 and 5.9. 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 the number of state health insurance mandates in place for each year of our sample. Note 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 the coefficient is near zero and insignificant.

To solve this puzzle, we disaggregate mandates by type and group them into three categories: mandated benefits, mandated providers, and mandated persons-covered. Column (2) reports the results of breaking state mandates into benefits, providers, and persons-covered categories. Increasing mandates on benefits actually increases the probability of completely hedging, with a positive and significant coefficient. 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 percent. 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 see these opposing effects hold throughout the robustness specifications beyond the baseline specification, with approximately the same magnitude of marginal effects.

Although we control for number and type of state mandates, we also perform speci-

fications to allow the mandate environment to be more complex. As a robustness check, Column (3) shows estimates of our baseline specification including state fixed effects to account for unobserved state heterogeneity in the regulatory environment (Intrator et al. (2007)). Relative to the first column in Table 5, the pseudo-R^2 of column (3) is fifty percent larger, increasing from 0.089 to 0.129, while the significant variables' marginal effects are largely unchanged. This increase in explanatory power suggests the state regulatory environment does indeed affect the decision to hedge with insurance.

In specification (4) of Table 4, we shift our focus from the costs of hedging to the effect of labor risk characteristics. A second major prediction of the insurance literature is that firms with larger numbers of employees can better predict health payouts, so large firms should be less likely to use insurance. Ideally, we would like to test this hypothesis with detailed characteristics on workers at the firm, but these data are not publicly available. Instead, we proxy for risk using the number of employees. Firms with more employees can essentially diversify the health risk across employees and lower the overall risk to the firm of health payments. As the number of employees increases, firms should be less likely to hedge. In specification (3), an increase in the log of the number of employees decreases the probability of fully insuring by 8.4 percent. Larger firms do take advantage of risk-pooling by self-funding some health payouts. Although number of employees and firm size are highly correlated, including number of employees does not completely remove the effect of firm size. This finding shows using one aggregate measure of firm size, as used in previous work on health insurance decisions, aggregates several important dimensions.

To address worker characteristics in the absence of demographic information, specification (5) includes industry-level fixed effects using two-digit SIC codes because human and health capital likely vary across industries (Neal (1995)). When we control for unobserved heterogeneity at the industry level in column (5), we find the fit of the regression improves by even more than fifty percent, and our main findings still hold that financial constraints drive the hedging decision, though the coefficient on Tobin's Q is no longer statistically significant.

One disadvantage of the IRS Form 5500 data is that the firm reports the aggregate of its welfare plans, including health plans as well as dental or vision plans in one form. If it is the case that a firm self-insures its health plans, but uses insurance to provide the dental and vision plan, 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 coefficients on our main financial characteristics. We also included a measure of taxes which 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. Because the other firm characteristics, as well as state mandate data, vary over years and states, the high-risk premium results are more suggestive without yearly variation.

The results in Table 4 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. In the next section, we provide robustness checks to these findings by examining the differences in hedging choices between all three hedging types, including the smaller number of firms who completely self-fund by using no insurance to manage health risk.

5.2 Choosing between no insurance, full insurance, or some insurance

In our next set of results , we include the third, but least common, hedging choice of using no insurance at all for health risk. Table 3 compares all three categories using a multinomial logit model of the firm's insurance decision. In each specification, the left column shows the outcome for firms that use insurance exclusively, or fully hedge, and the right column shows the results for firms that use a combination of general assets and insurance, or partially hedge. The base case is where the firm uses no insurance, but instead uses general assets exclusively to fund all health payouts, or self-funded.

The first results to note in the multinomial setting are that the mandate results show the same opposing effects for using insurance to manage health risks. The marginal effect of a benefit mandate is positive, increasing the probability of being fully insured by approximately 8 percent, and increasing the probability of partially insuring by approximately 4 percent. Mandating these benefits at the state-level may actually reduce the cost of offering benefits by minimizing adverse selection in the state market or directly benefitting employees' health. On the other hand, persons-covered mandates decrease the probability of using insurance in favor of the base case to completely self-fund. More persons-covered mandates decrease the probability of fully insuring by 25 percent in specification (1) and decrease the probability of even partially insuring by 12.6 percent. In comparison to increasing benefits for employees, mandating persons-covered may benefit dependents more than the employees.

The second clear result from Table 3 is that fully insured firms show distinct patterns from partially insured firms when compared to the base case of no insurance. The base case

of no insurance is a much smaller set of firms, and the results show that first-order differences in the insurance decision are between partial and full insurance, while self-funding firms may be a distinct case.

The first column of Table 3 compares firms that fully insure to those that don't use insurance. The model predicts firms with more investment opportunities should be more likely to hedge health risk, in order to reduce the need for costly external finance. Investment opportunities do increase the probability of fully hedging, as shown by a positive and significant marginal effect on Tobin's Q of 0.118. The marginal effect of size is negative and statistically significant, reducing the probability by over 22 percent that firms use insurance exclusively. This result suggests smaller firms, which might find external finance costly, are more likely to fully hedge, or that the risk-pooling effects of a larger firm make it less likely to use insurance exclusively. None of the coefficients on debt are statistically significant.

The right hand column under specification (1) shows results for firms that partially insure by using a mix of insurance and general assets to fund health payouts. The results comparing the choice of some insurance to none are not quite as straightforward as comparing fully insured to none. The marginal effects of investment opportunities are not significant. The marginal effect of size is significant, but positive, when the model predicts size should actually decrease the probability of hedging. Although this result indicates larger firms are more likely to partially hedge compared to completely self-fund, larger firms often offer a greater menu of plan options. Adding additional plan options may mean firms contract out some plans.[12] A similar effect may explain the counterintuitive marginal effect that investment tax credits decrease the probability of using some insurance relative to no insurance. One explanation for this result is that both a more sophisticated tax strategy and forgoing all insurance require an advanced level of administrative management, which we cannot observe. Importantly, our results on the decision to partially hedge suggest there is a significant difference between choosing to use insurance at all and the choice of how

[12]In our Form 5500 IRS data, we are unable to distinguish how many plans compose the total benefit offerings of a firm, just the total value of the offerings and how they were funded. See the note in the Data section.

much insurance to use. This further supports the results from Table 4.

In sum, we find evidence in Table 3 for the model's predictions between the extreme options of fully insuring versus completely self-funding. However, we also find evidence that the decision to manage the extent of insurance is distinct from the decision to use no insurance at all. The decision of how much insurance to use is important since the summary statistics in Table 2 indicate this decision is much more common.

5.3 Choosing when to insure at all

The results in the previous sections demonstrated several corporate finance characteristics which determine the choice of insurance to hedge health risk, in particular the distinct decision to partially hedge health risk versus sending out all risk by using insurance completely. As robustness, we also include results similar to the previous hedging literature without the extent of partial versus full, but instead examining only whether firms hedge any or not at all. We examine the firm's decision to hedge, without accounting for the difference between partially hedging and fully hedging. The first column in Table 5 reports results from the logit estimation of firms who choose to either partially or fully hedge compared to the base case of no hedging. As shown in the previous section, it is clear that the extent of hedging is the more salient decision compared with the use of any insurance at all. The coefficients on financial variables are not significant. Grouping both of these categories together to understand risk behaviors obscures the two arrangements' separate effects.

One interesting dimension of the comparison of any hedge to no hedge decision is that the findings on insurance mandates still hold. Again, firms facing more mandates on benefits are more likely to use insurance to hedge risk. On the other hand, an increased number of mandates on persons-covered decreases the probability of a firm choosing to use insurance to manage health risk. The significance of these results in every specification suggests a more constant effect on all firms of the mandate environment, compared with firm characteristics being more intricately linked to the extent of hedging. These findings suggest our ability to separate out partial versus complete insurance is an important contribution to

understanding how firms manage risk that previous work could not capture.

5.4 Investment cash-flow sensitivity

We now turn to the model's implication for the role of hedging in the firm's financing and investment decision. In particular, hedging should mitigate the effect of cash flow on investment when a firm faces costly external finance. Furthermore, the version of the model presented above indicates that when there is some cost to hedging from regulations such as mandates, firms are better off by partially hedging. We explore these predictions by estimating Equation (6) for firms that fully hedge by purchasing insurance, for firms that remain unhedged by self-funding health benefits, and for firms that partially hedge by using some combination of self-funding and insurance.

Panel A of Table 6 shows variables used in exploring the implications of the hedging decision for finance and investment. We follow Rauh (2006) in our construction of these variables. Capital expenditures, cash flow, and Tobin's Q are all Winsorized at the 1st and 99th percentile. Panel B of Table 6 shows the mean and standard deviation by the benefit arrangement which firms use to hedge labor risk. These summary statistics suggest firms that fully hedge by purchasing insurance have lower cash flows relative to firms that do not hedge, at 3.5 percent of total assets versus over 7 percent for both partial and unfunded. Firms that fully hedge also have a higher Tobin's Q relative to firms that do not hedge, at an average of 2.096 versus as low as 1.692 on average for unfunded firms.

Table 7 shows results from estimating Equation (6). The first column shows estimates for firms that hedge either all or part of the health risk with insurance for at least one benefit arrangement. The second column shows estimates for firms that self-fund health benefits. In both cases, the coefficient on cash flow is positive and significant. The cash flow coefficient is 0.018 for firms that hedge with insurance, but the coefficient is 0.095 for firms that do not hedge, indicating the effect of cash flow on investment is lower for firms that hedge at least some of the risk associated with health benefits. Investment is five times more sensitive to cash flows for a firm that self-funds its health plan – an effect that is

consistent with the model. The magnitudes of the effects are comparable to other studies that find evidence of sensitivity of investment to cash flow.

While the results in the first two columns of Table 7 suggest the effect of cash flow on investment is lower for firms that fully hedge, they do not indicate if these results are statistically different from each other. The third column of Table 7 shows estimates from a version of Equation (6) that includes a dummy variable equal to one if firms hedge interacted with the cash flow variable. The results confirm the findings of the first two columns. The coefficient on cash flow, 0.052, is positive and significant, but the coefficient on cash flow interacted with an indicator for firms that hedge at least some risk is negative and statistically significant. Firms that hedge labor risk reduce the sensitivity of investment to cash flow by 3.3 percent.

Finally, the last column of Table 7 reports results for how much hedging with health insurance reduces investment-cash flow sensitivity. We construct 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 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. The coefficient on cash flow is again positive and statistically significant. The coefficient on cash flow interacted with the partial hedging indicator is negative but is not statistically significant. The coefficient on cash flow interacted with the full hedging indicator, -0.047, is larger in absolute value than that of the partial hedge and is statistically significant. These results that fully hedging by purchasing insurance has the most impact on reducing investment cash flow sensitivity.

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 research and development is 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: **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 1,931 firms and 5,077 firm-year observations. Financial data is from Compustat. State health insurance mandates are from Blue Cross Blue Shield.

Hedging Probability	Variable	Description	Mean	Standard Deviation
	Investment Opportunities			
+	Tobin's Q	(Total assets - book value of equity - deferred taxes + market value of equity)/(Total assets at t-1)	1.908	1.827
+	Research and Development	Research and development expenses scaled by total assets	0.038	0.081
	Costly External Finance			
–	Size	Log of total assets	5.612	1.608
–	Free Cash Flow	Operating profits scaled by total assets	0.099	0.179
+	Market Leverage	Long-term debt scaled by book value of equity	0.476	10.906
	Concavity of Firm Value			
+	Investment Tax Credit	Investment tax credit scaled by total assets	0.001	0.013
+	Tax Loss Carry Forwards	Unused net operating loss carry-forward scaled by total assets	0.294	1.171
	Cost of Hedging			
–	State Insurance Mandates	Total number of mandates	33.004	8.676

Table 2: **Summary statistics for firm characteristics by benefit arrangement.** The table shows summary statistics for firm characteristics. All variable definitions are in earlier tables.The sample is from 1992 to 2005.

		Benefit Arrangement					
		Self-funded (Unhedged)		Insurance (Full Hedge)		Partial (Partial Hedge)	
Hedging Prob.	Variable	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
	Investment Opportunities						
+	Tobins Q	1.686	1.213	2.048	2.23	1.831	1.527
+	Research and Development	0.033	0.081	0.052	0.101	0.028	0.061
	Costly External Finance						
–	Size	5.707	1.76	5.073	1.459	5.985	1.587
–	Free Cash Flow	0.1	0.278	0.069	0.208	0.121	0.137
+	Leverage	0.498	3.14	0.216	14.888	0.659	7.514
	Concavity of Firm Value						
+	Investment Tax Credit	0.002	0.018	0.002	0.02	0.001	0.003
+	Tax Loss Carry Forwards	0.249	1.378	0.433	1.438	0.2	0.897
	Cost of Hedging						
–	State Insurance Mandates	33.848	8.502	33.343	8.34	32.682	8.911
	Number of Observations	269		1966		2,836	
	Collectively Bargained	18		67		194	

Table 3: **Hedging Decision: Multinomial Logit.**

This table shows results from a logit regression. The dependent variable is the firm's insurance choice. The base case is self-fund. 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 in parentheses.

	(1)		(2)		(3)	
	Full Partial	Partial	Full	Partial	Full	
Tobin's Q	0.138**	0.086	0.112*	0.071	0.154**	0.106*
	(0.059)	(0.059)	(0.058)	(0.059)	(0.062)	(0.062)
Research and Development	0.621	-0.356	-0.148	-0.728	-0.024	-0.49
	(1.087)	(1.115)	(1.063)	(1.090)	(1.111)	(1.136)
Size	-0.249***	0.125***	-0.253***	0.125***	-0.122**	0.056
	(0.046)	(0.044)	(0.045)	(0.043)	(0.062)	(0.060)
Free Cash Flow	-0.45	0.665	-0.387	0.684	-0.743	0
	(0.526)	(0.538)	(0.517)	(0.527)	(0.562)	(0.570)
Leverage	-0.001	0.001	-0.001	0	-0.001	0.001
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Interest Coverage	-0.005	-0.002	-0.005	-0.003	-0.005	-0.003
	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)
Convertible Debt	0.972	0.519	0.967	0.521	0.801	0.483
	(0.656)	(0.656)	(0.673)	(0.675)	(0.660)	(0.660)
Preferred Stock	-0.967	-0.588	-1.132	-0.69	-0.953	-0.749
	(0.715)	(0.713)	(0.748)	(0.753)	(0.731)	(0.732)
Investment Tax Credit	0.134	-22.042**	0.762	-21.194**	0.198	-18.548**
	(2.707)	(9.427)	(2.692)	(9.382)	(2.573)	(9.393)
Tax Loss Carry Forwards	-0.014	0.038	0.002	0.045	-0.017	0.022
	(0.080)	(0.081)	(0.083)	(0.084)	(0.080)	(0.081)
Collectively Bargained	-0.454	-0.148	-0.391	-0.132	-0.44	-0.151
	(0.285)	(0.266)	(0.286)	(0.266)	(0.286)	(0.267)
Mandates	-0.007	-0.014*				
	(0.009)	(0.008)				
Benefits			0.084***	0.034*		
			(0.018)	(0.018)		
Providers			-0.032	-0.027		
			(0.020)	(0.019)		
Persons Covered			-0.249***	-0.132***		
			(0.043)	(0.043)		
ln of Employees					-0.199***	0.110*
					(0.068)	(0.066)
Observations	5,077	5,077	5,077	5,077	5,054	5,054

Table 4: **Full vs Partial Hedging Decision.**
This table shows results from a logit regression. 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. 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 in parentheses.

	(1)	(2)	(3)	(4)	(5)
Tobin's Q	0.014***	0.011**	0.011**	0.013**	0.008*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Research and Development	0.231*	0.132	0.049	0.122	0.178
	(0.121)	(0.121)	(0.124)	(0.120)	(0.132)
Size	-0.091***	-0.092***	-0.099***	-0.044***	-0.104***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)
Free Cash Flow	-0.289***	-0.275***	-0.280***	-0.194***	-0.245***
	(0.059)	(0.058)	(0.060)	(0.058)	(0.060)
Leverage	0	0	0	0	0
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Interest Coverage	0	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Convertible Debt	0.086	0.084	0.064	0.055	0.093
	(0.070)	(0.071)	(0.072)	(0.071)	(0.072)
Preferred Stock	-0.067	-0.083	-0.054	-0.026	-0.031
	(0.088)	(0.089)	(0.090)	(0.089)	(0.092)
Investment Tax Credit	5.252**	5.124**	4.880**	4.186*	5.145**
	(2.167)	(2.154)	(2.211)	(2.175)	(2.151)
Tax Loss Carry Forwards	-0.012	-0.01	-0.012	-0.009	-0.014*
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Collectively Bargained	-0.069**	-0.056			
	(0.035)	(0.036)			
Mandates	0.002*				
	(0.001)				
Benefits		0.012***			
		(0.002)			
Providers		-0.002			
		(0.002)			
Persons Covered		-0.029***			
		(0.005)			
ln of Employees				-0.075***	
				(0.008)	
State Fixed Effects	No	No	Yes	No	No
Industry Fixed Effects	No	No	No	No	Yes
Pseudo R^2	0.089	0.098	0.128	0.101	0.134
Observations	4,808	4,808	4,821	4,789	4,836

Table 5: **Hedging Decision.**

This table shows results from a logit regression. The dependent variable is the firm's binary hedge choice that takes the value 1 if the firm hedges risk fully or partially with at least some insurance and zero otherwise. The table reports marginal effects. 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 in parentheses.

	(1)	(2)	(3)	(4)	(5)
Tobin's Q	0.006**	0.004*	0.004	0.006**	0.003
	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
Research and Development	0.003	-0.024	-0.05	-0.01	-0.001
	(0.051)	(0.048)	(0.043)	(0.052)	(0.049)
Size	-0.001	0	-0.001	-0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Free Cash Flow	-0.004	0	0.006	-0.024	0.003
	(0.024)	(0.022)	(0.021)	(0.026)	(0.022)
Leverage	0	0	0	0	0
	0.000	0.000	0.000	0.000	0.000
Interest Coverage	0	0	0	0	0
	0.000	0.000	0.000	0.000	0.000
Convertible Debt	0.033	0.03	0.019	0.029	0.012
	(0.031)	(0.031)	(0.027)	(0.031)	(0.027)
Preferred Stock	-0.036	-0.039	-0.027	-0.04	-0.015
	(0.035)	(0.035)	(0.029)	(0.035)	(0.027)
Investment Tax Credit	-0.12	-0.094	-0.134	-0.114	-0.158
	(0.125)	(0.120)	(0.117)	(0.121)	(0.114)
Tax Loss Carry Forwards	0.001	0.002	0.002	0	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
Collectively Bargained	-0.011	-0.009		-0.011	
	(0.015)	(0.014)		(0.015)	
Mandates	-0.001				
	0.000				
Benefits		0.002***			
		(0.001)			
Providers		-0.001			
		(0.001)			
Persons Covered		-0.008***			
		(0.002)			
ln of Employees				0	
				(0.003)	
State Fixed Effects	No	No	Yes	No	No
Industry Fixed Effects	No	No	No	No	Yes
Pseudo R^2	0.01	0.023	0.076	0.011	0.084
Observations	5,077	5,077	4,870	5,054	4,732

Table 6: **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.

Panel A: All Firms

Variable	Description	Mean	Standard Deviation	Observations
Investment-Cash Flow				
Capital Expenditures	Capital expenditures scaled by total assets at t-1	0.070	0.085	5,675
Cash Flow	Income before extraordinary items plus depreciation and amortization scaled by total assets at t-1	0.067	0.187	5,720
Tobin's Q	(Total assets - book value of equity - deferred taxes + market value of equity)/(Total assets at t-1)	1.902	1.563	5,506

Panel B: By Benefit Arrangement

	Benefit Arrangement					
	Unfunded		Insurance		Partial	
Variable	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Capital Expenditures	0.075	0.096	0.068	0.089	0.069	0.083
Cash Flow	0.073	0.177	0.035	0.235	0.081	0.158
Tobin's Q	1.692	1.194	2.096	1.886	1.853	1.436
Observations	269		2,009		2,833	

Table 7: **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 in parentheses.

	Full/Partial Hedge	No Hedge	All Firms	
Cash Flow	0.018***	0.095**	0.052***	0.054***
	(0.004)	(0.041)	(0.019)	(0.016)
Cash Flow * (Full/Partial)Hedge			-0.033*	
			(0.019)	
Cash Flow * Partial Hedge				-0.017
				(0.019)
Cash Flow * Full Hedge				-0.047**
				(0.019)
Tobin's Q	0.011***	0.025***	0.011***	0.011***
	(0.000)	(0.005)	(0.000)	(0.000)
Adjusted R^2	0.14	0.23	0.14	0.15
Number of Observations	11,710	616	12,326	12,326