The Effect of Rising Health Insurance Costs on Compensation and Employment

Priyanka Anand*
Mathematica Policy Research

March 25, 2013

Abstract

This paper examines the extent to which establishments in the U.S. respond to rising health insurance costs by adjusting employee compensation and employment. I examine this question using microdata from the National Compensation Survey, a panel dataset on compensation, health insurance coverage, hours worked, and employment for a sample of establishments across the U.S. These data are unique because they contain detailed information on health insurance plan participation, as well as contribution amounts by both employers and employees. Furthermore, the panel structure of the data allows me to analyze changes in compensation, employment, and health insurance costs within establishments over time. I find that establishments that offer health insurance reduce total compensation by $0.52 for each dollar increase in health insurance costs. Establishments primarily rely on increasing employee contributions when passing along the additional cost of health insurance to workers, while the effect on wages and non-health fringe benefits is approximately zero.

*I am grateful to Joe Altonji, David Berger, Erica Blom, Rebecca Edwards, Dora Gicheva, Rachel Heath, Lisa Kahn, Amanda Kowalski, Fabian Lange, Rick Mansfield, Costas Meghir, Vincent Pohl, Francis Song, and Joe Vavra for useful discussions. I also thank Keenan Dworak-Fisher and Mike Lettau for their invaluable assistance with the data. This research was conducted with restricted access to Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS. email: panand@mathematica-mpr.com

1 Introduction

The cost of providing employer-sponsored health insurance has increased dramatically over the past decade, with average premiums more than doubling from 2000 to 2010.[1] Since two-thirds of non-elderly individuals receive their health insurance through their employer, and employers typically pay a large fraction of health insurance premiums on behalf of their employees, a natural question to ask is how these rising health insurance costs impact employers' compensation and employment decisions. In this paper, I analyze the extent to which establishments respond to rising health insurance costs by reducing the compensation of workers. Further, I am able to decompose these changes in compensation into adjustments in wages, non-health fringe benefits, and employee contributions towards health insurance. Finally, I investigate whether rising health insurance costs have affected employment. I examine these questions using microdata from the National Compensation Survey (NCS), a panel data set that provides detailed information on the compensation, employment and health insurance coverage for a sample of occupations in establishments across the U.S.

The advantage of using panel data to examine the relationship between health insurance costs and labor market outcomes is the ability to examine changes in compensation, employment and health insurance costs within an occupation and establishment over time. This methodology helps overcome biases due to the existence of unobserved establishment and occupation characteristics that are correlated with both compensation and the generosity of health insurance. For example, establishments and occupations that attract high-ability workers typically offer high compensation and also generous health insurance plans. Panel data also allow me to compare the short- and long-run adjustments in compensation and employment in response to rising health insurance costs.

In addition to providing panel data, the NCS also contains detailed information on different components of employee compensation beyond wages, such as non-health fringe benefits and employee contributions towards health insurance premiums.[2] I can use these data to decompose the adjustment in compensation along a variety of dimensions. This is important because failing to incorporate all the dimensions of compensation may lead to underestimates of the extent to which establishments pass along increased health insurance costs onto the worker. Furthermore, comparing employer adjustments in these different dimensions allows me to assess worker preferences for different forms of compensation. For example,

[1] This figure is calculated using data from the Employer Health Benefits Annual Survey administered by the Kaiser Family Foundation [KFF, 2010].

[2] Examples of non-health fringe benefits are vacation pay, contributions towards retirement funds, and provision of other forms of insurance. A detailed list of the fringe benefits collected by the NCS can be found in the data appendix.

workers may prefer to give up some of their non-health fringe benefits before having their wages reduced. Similarly, it is possible that workers prefer adjustments in employee premium contributions over wages and non-health fringe benefits because they are directly tied to the source of the increased costs. Comparing the adjustment in these different outcomes provides insight into workers' preferences for how they are compensated.

My work improves on the existing literature in several important ways. First, I am one of the first to use of a panel data set to identify the relationship between health insurance costs and compensation.[3] The NCS is rarely used because the microdata can only be used on-site at the Bureau of Labor Statistics office in Washington, DC.[4] Instead, past work has relied on cross-sectional data, such as the CPS, and tried to identify exogenous variation in health insurance costs across individuals.[5] For example, Baicker and Chandra [2006] use regional variation in medical malpractice laws as an instrument for health insurance prices and find a 2% decrease in the wages of individuals covered by employer-sponsored health insurance in response to a 10% increase in premiums. Gruber [1994] analyzes the impact of mandated maternity benefits on various labor market outcomes and finds evidence of full group-specific cost shifting. Cutler and Madrian [1998] identify a positive relationship between health insurance costs and hours worked by comparing trends in the hours worked of individuals with health insurance to those without health insurance. I add to this literature by using panel data methods to isolate exogenous variation in health insurance costs.

Another important contribution of my work is that, to the best of my knowledge, it is the first to analyze the establishment response to rising health insurance costs along different forms of compensation beyond wages. Due to data constraints, the existing literature has focused on the trade-off between health insurance costs and wages without addressing adjustments in other forms of compensation, such as non-health fringe benefits or employee premium contributions [Gruber, 1994, Baicker and Chandra, 2006]. Some work has been done to understand the reasons why employers share the cost of health insurance with employees [Levy, 1998, Dranove et al., 2000]; however, little is known about whether employers increase employee premium contributions in response to rising health insurance costs. The

[3] Most existing work that uses panel data focuses on the relationship between wages and health insurance coverage [Kolstad and Kowalski, 2011, Miller, 2004, Olson, 1992]. Buchmueller and Lettau [1997] use the NCS to examine the relationship between wages and health insurance costs, but use data from 1987 to 1994 that lack information on the employee premium contributions. They also do not use the information on non-health fringe benefits.

[4] To my knowledge, the only other papers besides Buchmueller and Lettau [1997] to use the NCS microdata on health insurance are Gruber and Lettau [2004], who analyze the impact of tax subsidies on the decision to offer health insurance, Eibner and Marquis [2008], who look at trends in employer spending on health insurance over time, and Pierce [2008], who examines changes in compensation inequality over time.

[5] The CPS asks the respondent whether they are covered by employer-sponsored health insurance, but lacks information on the amount of the employer and employee contributions towards the premiums.

only mention of this issue comes from Gruber and McKnight [2003], who present evidence that rising medical spending is one of several reasons why employee contributions have increased over time but do not explore this issue in depth. Most existing work on fringe benefits analyzes the trade-off between wages and fringe benefits [Carrington et al., 2002, Simon and Kaestner, 2004, Woodbury, 1983], the effect of fringe benefits on labor demand [Buchmueller, 1999], and fringe benefits and labor mobility [Mitchell, 1982]; however, the trade-off between non-health fringe benefits and health insurance has not been explored.

I find that establishments that offer health insurance reduce total compensation by $0.52 for each dollar increase in health insurance costs. The establishment response is the same in both the short- and long-run. I decompose the effect on total compensation into the different components of compensation and find that establishments primarily rely on increasing employee contributions when passing along the cost to workers. The effect of an increase in health insurance costs on wages and non-health fringe benefits is approximately zero. I interpret these results through a theoretical model that builds on work by Summers [1989]. The model shows that compensation will decrease by less than the full cost increase if workers do not fully value the additional benefits they receive through the additional spending. In other words, workers would rather work for an establishment that does not offer health insurance than accept full pass-through of rising health insurance costs onto their compensation. As a result, establishments reduce total compensation by less than the full cost increase to avoid a worker shortage. The model also predicts that there should be a decrease in employment because establishments now have higher per worker labor costs; however, my empirical tests of this prediction are inconclusive.

This paper is organized as follows. Section 2 presents a theoretical model of the role of health insurance prices in the employment and compensation decisions of establishments. Section 3 describes the microdata from the NCS. Section 4 describes the empirical specifications I use to estimate the relationships highlighted in the theoretical model. Section 5 presents the main empirical results, followed by robustness checks in section 6. Section 7 concludes.

2 Theoretical Framework

The main purpose of this paper is its empirical contribution; however, a theoretical framework is useful to provide insight into how establishments that offer health insurance make their compensation and employment decisions in an environment where the cost of providing health insurance changes over time. It builds on work by Summers [1989] and Gruber and Krueger [1991]. In this model, there are two types of establishments: those that offer health insurance and those that do not. For simplicity, I do not model the decision to provide health insurance and instead assume that establishments provide health insurance if they have a cost advantage due to exogenous establishment characteristics, such as establishment size.[6,7] Establishments that offer health insurance provide their workers with a total compensation package, T, which is defined as wages, W, plus non-health fringe benefits that cost the establishment F dollars, minus the employee contribution towards the premium, C:

$$T = W + F - C.$$

In addition, establishments that offer health insurance must also pay a health insurance premium, P, for each worker. This results in the following labor demand function for establishments that offer health insurance:

$$L_H^d = L_H^d(T + P).$$

Establishments that do not offer health insurance offer a total compensation package, $\underline{T}$, which is defined as wages, $\underline{W}$, and non-health fringe benefits, $\underline{F}$. The labor demand function for establishments that do not provide health insurance is:

$$L_{NH}^d = L_{NH}^d(\underline{T}).$$

Workers have heterogeneous preferences for health insurance coverage, ϵ, which are driven by workers' preferences for risk or the availability of alternative sources of health coverage (for example, coverage through a spouse). ϵ is assumed to be uncorrelated with health status. In addition to their preference for health insurance coverage, workers value the quality of their health insurance plan which is measured through their monetary valuation of the premium, αP, where $\alpha > 0$. In the case where $\alpha = 1$, workers fully value each additional dollar of spending towards health insurance.[8] An individual will work for an establishment that offers health insurance if:

$$U(T + \alpha P, \epsilon) \geq U(\underline{T}).$$

[6]Establishment size is considered exogenous because optimal establishment size depends on many more important factors than the health insurance decision. Furthermore, there are large adjustment costs that prevent an establishment from choosing to dramatically increase their size in the short term in response to rising health insurance costs.

[7]This assumption is consistent with the empirical fact that large establishments are more likely to offer health insurance than small establishments.

[8]Even if $\alpha < 1$, individuals will work for an establishment that offers health insurance if they have a strong preference for health insurance coverage, ϵ.

There exists an ϵ^* that is a function of $(T+\alpha P)$ and $\underline{T}$ such that the worker is indifferent between working for an establishment that offers health insurance or not. All workers with $\epsilon > \epsilon^*(T+\alpha P, \underline{T})$ will work for establishments that offer health insurance, which produces the following labor supply function:

$$L_H^s(T+\alpha P, \underline{T}) = L_{tot} * \underbrace{\{1 - G[\epsilon^*(T+\alpha P, \underline{T})]\}}_{Pr(\epsilon > \epsilon^*(T+\alpha P, \underline{T}))},$$

where L_{tot} is the total number of workers in both markets and $G(\cdot)$ is the cumulative distribution function of ϵ. Similarly the labor supply function for establishments that do not provide health insurance is:

$$L_{NH}^s(T+\alpha P, \underline{T}) = L_{tot} * \underbrace{G[\epsilon^*(T+\alpha P, \underline{T})]}_{Pr(\epsilon \leq \epsilon^*(T+\alpha P, \underline{T}))}.$$

This model assumes 100 percent takeup of health insurance for workers in establishments that offer health insurance; the reasoning is that a worker who prefers not to receive health insurance should rather work at an establishment that does not offer it and receive higher compensation in other forms instead.[9]

Putting together the labor supply and demand functions for the two markets, plus a market clearing condition gives the following equilibrium conditions:

$$\begin{aligned} L_H^d(T+P) &= L_H^S(T+\alpha P, \underline{T}) \\ L_{NH}^d(\underline{T}) &= L_{NH}^S(T+\alpha P, \underline{T}) \\ L_H + L_{NH} &= L_{tot}. \end{aligned}$$

As shown in Appendix 1, these three conditions produce the following relationship between the premiums and total compensation in establishments that offer health insurance:

$$\frac{dT}{dP} = -\left[\frac{\frac{dL_H^d}{d(T+P)}\left(\frac{dL_{NH}^d}{d\underline{T}} + \frac{dL_H^s}{d\underline{T}}\right) - \alpha\frac{dL_H^s}{d(T+\alpha P)}\frac{dL_{NH}^d}{d\underline{T}}}{\frac{dL_H^d}{d(T+P)}\left(\frac{dL_{NH}^d}{d\underline{T}} + \frac{dL_H^s}{d\underline{T}}\right) - \frac{dL_H^s}{d(T+\alpha P)}\frac{dL_{NH}^d}{d\underline{T}}}\right]. \qquad (1)$$

This expression shows that if workers fully value an increase in premiums (i.e., $\alpha = 1$), there is a full pass-through of an increase in premiums onto total compensation for workers

[9]Table 3 shows that in reality 79% of workers in establishments take up health insurance when offered; perhaps this is because they value other characteristics of these establishments such as the location, fringe benefits, or the option value of having access to health insurance. I do not include take-up in the model because the focus of this paper is on compensation and employment.

in establishments that offer health insurance.[10] The intuition is as follows. An increase in premiums causes per worker labor costs to rise, which shifts the labor demand function down from L_d to L_d' in Figure 1. The premium increase also reflects an increase in the quality of health insurance through αP. Individuals are willing to accept a decrease in total compensation from establishments that offer health insurance if they value the additional spending on health insurance. This shifts the supply curve downward from L_s to L_s' in Figure 1. If $\alpha = 1$, the workers fully value the additional spending on health insurance and are willing to have their total compensation reduced by the full amount of the cost increase. If $\alpha < 1$, establishments that offer health insurance decrease total compensation by less than the health insurance cost increase.

The expression for $\frac{dT}{dP}$ differs from the model developed by Summers [1989] because it allows the outside option to vary with premiums. A constant outside option imposes the strict assumption that all establishments offer health insurance, and workers that do not want health insurance become unemployed. In reality, individuals have the option to work for establishments that do not offer health insurance, and these establishments also re-optimize their compensation packages in response to changes in health insurance premiums. My model implies that even in the more general case where the worker's outside option depends on P, total compensation is decreased by the full amount of the premium increases if $\alpha = 1$. This is the same conclusion produced by the Summers model.

The model also delivers the following prediction for the proportional change in employment:

$$\frac{dL_H}{L_H} = \eta_H^d \left(\frac{T_0 - T_1 - dP}{T_0} \right), \tag{2}$$

where T_0 and T_1 are the levels of total compensation before and after the price change and η_H^d is the elasticity of labor demand. The proportional change in employment in establishments that offer health insurance is zero if $\alpha = 1$ because the change in compensation exactly offsets the change in premiums: $T_0 - T_1 = dP$. Workers are willing to accept the decrease in total compensation because they receive equal value in the additional spending on health insurance. In this case, employment in both sectors stays the same. On the other hand, if

[10] For simplicity, taxes have not been included in the model, which would change the extent to which we would expect to see total compensation reduced dollar for dollar even if $\alpha = 1$. Wages, non-health fringe benefits, and employee premium contributions are typically subject to taxes, while employer premium contributions are not. As a result, employers could reduce wages and non-health fringe benefits by less than the amount of the premium increase due to the tax savings they would incur by spending more on premium contributions and less on taxable compensation. In contrast, there are no tax savings if the adjustment in total compensation occurs through employee premiums contributions (unless the firm offers a Section 125 plan). I will address taxation when interpreting the empirical estimates as evidence of full pass through.

$\alpha < 1$, the marginal workers in terms of their preference for health insurance coverage (ϵ) are no longer willing to accept lower compensation in exchange for health insurance. These individuals will go work at establishments that do not offer health insurance, and there will be a decrease in employment at establishments that offer health insurance. This decrease from L_0 to L_1 can be seen in Figure 1.

This model treats units of labor as discrete, but one can introduce divisibility of labor by defining labor as the number of workers employed times hours worked. This distinction introduces an additional decision for the establishment. As discussed by Cutler and Madrian [1998] and Baicker and Chandra [2006], an increase in health insurance costs would lead establishments to decrease the number of workers employed and increase hours worked because health insurance is a fixed cost.

Once total compensation and employment have been determined in market equilibrium, establishments that offer health insurance choose W, F and C. Until now, I assumed that the utility function is linear in its arguments. However, the extent to which establishments adjust wages, non-health fringe benefits, and employee contributions depends on the curvature of each form of compensation in the utility function:

$$U(W - C, F, P, \epsilon).$$

There are several reasons why some components of compensation may enter non-linearly in the utility function. For example, workers may have non-linear preferences for fringe benefits such as holidays and insurance contributions. The non-linear tax structure also affects some forms of compensation more than others. For the most part, wages and fringe benefits are taxable and employee contributions towards health insurance are made with post-tax dollars; however, there are important exceptions. Establishments can offer a Section 125 plan, which allows workers to make their health insurance contributions with pre-tax earnings. Even in the absence of a Section 125 plan, some components of fringe benefits, such as contributions towards life and disability insurance, are exempt from payroll taxes. These sources of non-linearities in the utility function determine the extent to which establishments adjust wages, non-health fringe benefits, and employee contributions in response to a change in health insurance costs.

In my empirical work, I will test if establishments that offer health insurance reduce total compensation in response to rising health insurance costs and whether there is full pass-through. I will also look for adjustments in the different forms of total compensation and consider how the tax structure may impact my empirical results. Finally, I examine the effect of rising health insurance costs on employment and hours worked in establishments that offer health insurance.

3 Data and Summary Statistics

My empirical analysis uses restricted microdata from the National Compensation Survey (NCS), a panel data set that provides information on the compensation, health insurance coverage, and employment of occupations in a nationally representative sample of establishments in the U.S. In this section, I describe the sampling design and structure of the NCS and provide summary statistics on the sampled establishments and occupations. Further details can be found in the data appendix.

3.1 National Compensation Survey

The NCS is administered by the Bureau of Labor Statistics to provide a comprehensive measure of employer labor costs over time. To this end, the NCS collects quarterly data on average wages, employer expenditures on fringe benefits,[11] hours worked, and employment for a selection of occupations within a random sample of establishments across the country. These data are published in their aggregate form in quarterly publications called the Employer Cost for Employee Compensation (ECEC) and the Employment Cost Index (ECI). The NCS also collects yearly data on the incidence and provision of health insurance plans. Starting with the cohort entering in 2003, establishments provide data on the monthly premium amounts paid by the employer and employee for all the medical, dental, vision, and prescription drugs plans in which workers in the sampled occupations are enrolled. This information is updated in March of each year and is published in the yearly NCS Employee Benefits publication. Unfortunately, no worker demographics are collected.

The NCS sampling design from 2003 to 2010 consisted of a three step process. First, a sample of geographic areas was chosen. Second, within these areas, a sample of establishments was chosen. Finally, a sample of occupations was chosen from within the selected establishments. To select the occupations, the data collector randomly chose four, six or eight workers from the list of employees, depending on the size of the establishment. The occupation-establishment of the selected workers became the unit of observation. In other words, the data were recorded as the average for all workers in the occupation and establishment without retaining any information for an individual worker. Once an occupation-establishment was selected for participation in the survey, it remains in the sample for approximately five years. The survey has a rotating panel structure, which means that one cohort (which represents one-fifth of the sample) is rotated out of the survey every year.[12]

[11]The categories of fringe benefits for which employer spending is collected can be found in the data appendix.

[12]More details about the NCS sampling design can be found in Chapter 8 of the NCS handbook, which is

The implementation of this unique sampling method can be demonstrated through an example. Suppose Restaurant A is selected into the NCS sample and has 25 employees. These employees represent three different occupations: waiters, managers, and cooks. For an establishment of this size, four workers are sampled from the employee roster: two waiters and two cooks. The data collector obtains wage, hours worked, and employer spending on fringe benefits for *all* waiters and *all* cooks in the restaurant. The average values for waiters and for cooks are recorded in the data, but no information about any particular worker is retained. The data collector then obtains enrollment information and the premium contributions for the health insurance plans in which the waiters and cooks are enrolled.

The NCS data have many advantages for this project, but there are also some challenges that must be addressed. The first is that each health insurance plan reports the premium amounts separately for single and family coverage, but no information is collected on how many workers are enrolled in these two types of plans. Data from the Medical Expenditure Panel Survey from 2003 to 2010 show that approximately half of private sector employees with health insurance through their employer were enrolled in single coverage versus family coverage plans [Branscome, 2005, Crimmel, 2011]. I therefore calculate the plan premium as the average of the single and family coverage premiums.

A second challenge that comes from using the NCS data is that information on wages, non-health fringe benefits, and hours worked is collected at the occupation-establishment level, whereas employer and employee premium contributions, employment, and plan participation are collected at the plan level. To get these variables at the same unit of observation, I calculate a health insurance price index for each occupation within an establishment that is weighted by plan participation.[13] The index is designed to capture changes that are driven by changes in plan premiums and not participation in different plans or changes in the plan characteristics; however, creating the index is complicated by the fact that the bundle of health insurance plans offered by the establishment could change from year to year. To address this issue, I use the following three step process to create a chained price index based on the price changes of health insurance plans that are offered in two consecutive years.

Step 1: Calculate the average weighted premium for the first year the occupation-establishment is in the sample. The first year the occupation-establishment is in the sample, $t = t_0$, is the base year of the price index. I calculate the price index for occupation i at establishment j in the base year as the average premium across plans, weighting each plan p by the percent of workers covered by employer-sponsored health insurance that are

available on the BLS website: http://www.bls.gov/opub/hom/pdf/homch8.pdf.

[13] In section 6, I conduct robustness checks using alternative measures of occupation-establishment level premiums.

enrolled in that plan in year t_0:

$$P_{ijt_0} = \sum_{p=1}^{N} P_{p(j)t_0} * Part_{ip(j)t_0},$$

where $P_{p(j)t_0}$ is the premium for plan p at establishment j at time t_0 and $Part_{ip(j)t_0}$ is the fraction of covered workers in occupation i that is enrolled in plan p at establishment j in year t_0.

Step 2: Create a ratio of the price change from time t to $t+1$ for plans that existed in both years. In the years following the base year, the bundle of health insurance plans offered to workers may change. To capture the change in prices from time t to $t+1$, I calculate the ratio of prices for plans that existed in both time periods. It is critical that at least one plan is offered by the occupation-establishment for two time periods in a row in order to control for plan characteristics and ensure that premium changes are driven by premium changes and not changes in plan characteristics.[14] I weight the plan premiums in both time periods by the percent of workers enrolled in employer-sponsored health insurance that participate in those plans at time t.[15] Using the same participation rates in the numerator and denominator allows the ratio to reflect yearly changes in prices and not changes in plan participation:

$$Ratio_{t+1,t} = \frac{\sum_{p=1}^{N} P_{p(j)t+1} * (Part_{ip(j)t} |\ p \text{ exists in both } t \text{ and } t+1)}{\sum_{p=1}^{N} P_{p(j)t} * (Part_{ip(j)t} |\ p \text{ exists in both } t \text{ and } t+1)}.$$

Step 3: Use the ratio of price changes to calculate the price index in the years following the base year. The price index at time t can be calculated as:

$$P_{ijt} = Ratio_{t,t-1} * Ratio_{t-1,t-2} * \cdots * Ratio_{t_0+1,t_0} * P_{ijt_0}.$$

I then convert the price index into an hourly rate by dividing it by the average hours worked. I do this to obtain a measure of health insurance prices that is in the same units as hourly wages and non-health fringe benefits.

One concern is that hours worked is endogenously determined. To address this issue, I predict the hours worked using the average values for the occupation, industry, commuting zone, and year. A commuting zone is a collection of counties that have strong commuting ties and is used throughout this paper as a measure of the establishment's local labor market.[16]

[14] 31.26% of occupation-establishments are dropped from the analysis because they do not have a plan that is offered for two time period in a row.

[15] The main results are robust to using plan participation in $t+1$ as the weight instead of t.

[16] For more information on commuting zones, see Tolbert and Sizer [1996].

Using this measure of predicted hours to calculate the hourly rate also resolves the problem of a mechanical correlation between premiums and compensation that would occur if both use the same measure of hours in the denominator. The BLS uses a different measure of hours worked to convert wages and fringe benefits into hourly measures.[17] As a robustness check, I re-run the analysis using the log yearly values of wages, non-health fringe benefits, and premiums instead of the hourly rates. This eliminates the problem of dividing by hours worked because yearly measures are not calculated using this variable. Using a log transformation has an additional advantage of reducing the impact of outliers on the estimates. The results will be discussed in Section 6.

Next, I use the hourly premiums to create a health insurance cost variable for establishments. In the theoretical model, all individuals that work for establishments offering health insurance take it up because they have selected into those establishments due to their high preference for health insurance. Empirically, however, there are some individuals who do not take up health insurance when it is offered to them. As shown in Table 3, the NCS estimates this number to be about 21% of workers. As a result, the cost of health insurance for the establishment is equal to the health insurance price index times the health insurance take-up rate in a given year. Establishments base their compensation on employment decisions on their expected health insurance costs, which is estimated as:

$$HICost_{ijt} = P_{ijt} * \widehat{Takeup}_{jt},$$

where the expected take-up rate for the establishment, $\widehat{Takeup}$, is calculated as the average take-up rate for establishments in the same industry at time t.[18] This measure of health insurance costs is the independent variable of interest in most of the regressions. The key dependent variable of interest, total compensation, is calculated as the wages plus non-health fringe benefits minus the expected employee contribution adjusted for health insurance take-up.

Finally, I limit the sample to non-unionized occupations in private establishments that participate in the survey for at least three years. I exclude unionized workers and state or local governments because both have a unique bargaining structure when determining their compensation and health insurance plans. I limit the analysis to establishments that are in the survey for at least three years to be able to compare short- and long-term responses of establishments.

[17]The process used by the BLS to calculate hourly wages and fringe benefits described in the data appendix.

[18]I assume establishments base their expectations on the contemporaneous take-up rate, instead of the lagged take-up rate, to avoid dropping observations their first year in the sample.

3.2 NCS Summary Statistics

In this section, I describe the average characteristics of the establishments and occupations in March 2010. The top half of Table 2 compares the average characteristics of establishments that offer health insurance to establishments that do not offer health insurance, weighted by BLS sampling weights to be representative of the average establishment in the U.S.[19] The table does not include establishments that added or dropped health insurance coverage since the previous year. This drops a small number of establishments (1.5% and 1.7% of establishments respectively), which implies that most establishments base their decision to offer health insurance on characteristics that tend not to change over time. The main difference between the two types of establishments is that establishments that offer health insurance are much larger in size, employing an average of 57 workers compared to an average of 15 workers in establishments that do not offer health insurance. This supports the idea that establishments offer health insurance if they are large enough to have a cost advantage and take advantage of risk pooling. Establishments that offer health insurance are also more likely to offer a Section 125 plan (34% compared to 11%), which allows workers to receive certain benefits on a pre-tax basis. Administrative costs may be a factor in the decision to offer a Section 125 plan, since establishments that offer a Section 125 plan tend to be large.[20] Given the inherent differences in the two types of establishments, I only include those that offer health insurance coverage in the main analyses.[21] The bottom half of Table 2 shows the type of health insurance plans offered by establishments. Most establishments offer just one plan, with only 9% offering two plans and another 9% offering more than two plans. The most common type of plan offered is through a preferred provider organization (PPO), with 69% of establishment offering at least one PPO plan, 37% offering at least one health maintenance organization (HMO) plan, and 5% offering a fee for service plan (FFS). Only 17% of establishments are self-insured.

Table 3 shows the average characteristics of workers, weighted to be representative of the average worker in the U.S. Workers that are offered health insurance earned an average wage of $21.85 per hour and received non-health fringe benefits worth $4.64 per hour. This is much higher than workers that are not offered health insurance, who earn an average wage of $13.38 and received non-health fringe benefits worth $1.24. Workers that are not offered health insurance tend to work fewer hours, with only 44% working full time. In contrast, 93% of workers that are offered health insurance work full time. The bottom

[19] I categorize an establishment as offering health insurance if it reports offering medical coverage to at least one of their sampled occupations and provides information for at least one health insurance plan.

[20] Establishments that offer a Section 125 plan have an average of 119 workers.

[21] The main results are robust to including establishments that do not offer health insurance in the analyses. This robustness test is described in Section 6.

half of Table 3 describes take-up and spending on health insurance. Approximately 79% of workers that were offered health insurance take it up, which is in contrast to my theoretical model which assumes that all workers in establishments that offer health insurance take it up. The average health insurance premium was $5.02, which produces an expected cost of $3.92 after adjusting the premiums for the expected take-up rate. Employees pay an average of 30% of the premium, which is about 7% of their wages. In contrast, employers expect approximately 9% of their total labor cost to go towards health insurance.

Figure 2 shows the average annual growth in compensation and health insurance costs from 2003 to 2010. Health insurance costs have been growing much faster than the annual inflation rate, with a growth rate as high as 14% from 2009 to 2010. This graph shows that the rise in health insurance costs has been a persistent phenomenon over time. As a result, establishments are likely to adjust the compensation and employment of their workers in response to premium growth instead of waiting for the trends slow down or reverse. In contrast to premiums, wages and non-health fringe benefits have been growing more slowly. For example, total compensation has increased by less than 2% each year since 2003.

Finally, I examine the sources of variation in health insurance costs. For plan-level premiums, I sequentially regress premiums on year, industry, and commuting zone dummies and calculate the R^2 for each regression.[22] This provides a measure of how much of the variation in premiums can be explained by adding each factor. Then I replace the industry and commuting zone with establishment and plan dummies to see how much of the variation is establishment- and plan-specific. I repeat this exercise at the occupation-establishment level by regressing the expected health insurance cost on year, occupation, commuting zone, and establishment dummies. The results of this exercise are shown in Table 4. The adjusted R^2 from these regressions reveals that the main sources of variation in costs come from variation in industries, establishments, and plans. For example, adding industry dummies increases the adjusted R^2 from 0.02 to 0.10 in the occupation regression and from 0.39 to 0.62 in the plan regression. Similarly, adding establishment dummies increases the adjusted R^2 from 0.12 to 0.21 at the occupation-establishment level and 0.85 to 0.92 at the plan level. This implies that industry and establishment level characteristics are important determinants of health insurance costs, perhaps because they are used by health insurance companies to predict health insurance expenditure.

Next, I look at the distribution of health insurance costs after controlling for year, establishment, occupation, and plan dummies. Figure 3 shows the distribution of the residual from the regressions shown in columns (5) and (10) of Table 4, which are the sources of variation in health insurance costs that I use for the main analyses in this paper. I also show the distri-

[22]The industry dummies represent the 6-digit NAICS code for the establishment.

bution of three year changes in health insurance costs within occupation-establishments and plans in Figure 4. Both graphs suggest that costs vary significantly across establishments, occupations and years, which I can use for identification in my empirical work.

The nature of a fixed effects analysis is that the exact source of variation in health insurance costs after controlling for year, occupation, establishment, and plan fixed effects cannot be pinpointed; however, I can turn to the existing literature for some insight. The broad consensus is that increased use of high-cost technology is the primary source of rising health insurance prices over time [Newhouse, 1992]. Regions that have experienced higher growth in medical spending are those that have higher rates of discretionary spending [Fisher et al., 2009, Sirovich et al., 2008], which would be an important explanation for the variation in premiums over time between establishments. The literature also shows that regions with higher growth in medical spending do not necessarily have better health outcomes. According to the Dartmouth Atlas of Health Care, the overuse of high-cost technologies can crowd out the use of low-profit, effective services [Baicker and Chandra, 2004]. These results suggest that increases in the cost of health insurance may not reflect better quality of health care for individuals, which would be reflected as $\alpha < 1$ in my theoretical model.

There are other factors that may play a more minor role in the growth of health insurance costs. For example, Newhouse [1992] and Cutler [1995] show that only a small fraction of the increase in medical spending can be explained by changing demographics, such as the aging population or higher income due to increased productivity. Policy changes, such as state mandated benefits, could affect health insurance costs over time; however, the Employee Retirement Income Security Act (ERISA) exempts establishments that self-insure from state laws and regulations regarding health insurance. As a result, large establishments that typically self-insure (which is 17% of establishments in the NCS data) will not see their premiums affected by policy changes. Finally, health insurance costs could be influenced by adverse selection if employees with low expected medical spending drop out of the health insurance market after a price increase. There has been evidence that adverse selection exists upon entry in the health insurance market, but workers do not adjust their health insurance choices over time due to high switching costs [Handel, 2011].

4 Empirical Strategy

This section describes the empirical strategy I use to estimate the behavioral responses highlighted in the theoretical model using the data from the NCS. The basic approach is to regress the outcomes of interest (total compensation, employee contributions towards health insurance premiums, wages, the value of non-health fringe benefits, employment, and hours worked) on health insurance costs, while controlling for observed and unobserved time-invariant plan, establishment, and occupation characteristics. Due to the structure of the data, outcomes are divided into those that are analyzed at the occupation-establishment level and those that are analyzed at the health insurance plan level.[23] Employee premium contributions are analyzed at the plan level:

$$C_{p(j)t} = \alpha_0 + \alpha_1 P_{p(j)t} + \alpha_2 X_{jt} + [\mu_{p(j)}] + Year_t + \epsilon^p_{p(j)t}, \tag{3}$$

where the employee contribution (C) and premium (P) are for plan p at establishment j at time t, and X_{jt} is a vector of the establishment size, whether the establishment is self-insured, and the average wage of health care workers in the commuting zone at time t.[24] The brackets indicate plan dummy variables that are only included in the fixed effects specification that will be described later, and $\epsilon^p_{p(j)t}$ is a plan-specific idiosyncratic term. These regressions are weighted by plan participation.

The remaining regressions (total compensation, wages, value of non-health fringe benefits, hours worked, and employment) are analyzed at the occupation-establishment level:

$$Outcome_{ijt} = \beta_0 + \beta_1 HICost_{ijt} + \beta_2 X_{jt} + Year_t + [\gamma_i + \rho_j] + \epsilon^o_{ijt}, \tag{4}$$

where the outcome and expected health insurance cost ($HICost_{ijt}$) are for a worker in occupation i at establishment j at time t. Expected health insurance costs are used in this regression (instead of premiums) to account for the workers that do not take up health insurance, which reduces the cost to the establishment. For example, an establishment that expects 80% of its workers to take up health insurance would only face an \$0.80 increase in expected health insurance costs per worker for every dollar increase in premiums. The occupation dummies that will be included in the fixed effect specification are categorized by their 6-digit SOC code. I exclude interactions between the occupation and establishment fixed effects based on the assumption that the relationship between occupations and the outcomes is not establishment-specific. ϵ^o_{ijt} is a occupation-establishment-specific idiosyncratic term. These regressions are weighted by worker level sampling weights in order for the results to be generalized to a randomly selected worker in the U.S.

Analyzing the relationship between health insurance costs and outcomes at the occupation-establishment level provides the average effect of an increase in health insurance costs for a worker in the occupation-establishment. These estimates do not shed light on whether establishments adjust the compensation and employment of all workers in the occupation-

[23]Health insurance plans are establishment specific in the NCS data.

[24]The reason for including the wage of health care workers will be discussed in depth when discussing endogeneity concerns in Section 4.2.

establishment equally in response to an increase in health insurance costs or target certain high-cost workers. Anecdotal evidence of how job offers are made seems to support the notion that wages and fringe benefits are not typically offered conditional on plan enrollment. On the other hand, Sheiner [1999] shows that older workers have lower wage growth in areas that have high health care costs and interprets these findings as evidence that firms target high-cost workers when passing on the cost of health insurance. This paper presents only average effects and remains agnostic about how these effects are distributed among workers.

4.1 Cross-Sectional OLS

Estimating equations (3) and (4) using cross-sectional data does not include the fixed effects that are denoted in brackets. The identifying assumptions for the cross sectional regression are:

$$E(\epsilon^p_{p(j)t}|P_{p(j)t}, X_{jt}, Year_t) = 0$$
$$E(\epsilon^o_{ijt}|HICost_{ijt}, X_{jt}, Year_t) = 0.$$

The identifying assumption for the cross-sectional occupation-establishment-level regressions is almost certainly violated. As discussed previously, establishments that attract high-ability workers typically offer high-cost health insurance plans and also higher compensation in other forms, such as wages and non-health fringe benefits. This would result in a positive bias in the total compensation, wage, and non-health fringe benefits regression coefficients. The plan-level identification assumption would be violated if workers who enroll in more expensive plans are asked to pay larger contributions. This would occur under the "fixed subsidy" model described by Levy [1998], where establishments contribute the full cost towards a minimum plan, and workers who want more coverage contribute the remainder of the premium for a more generous plan. The identification assumption would also be violated if establishments require high-wage workers to pay higher contributions, and those workers tend to enroll in more expensive plans.

To address these problems, I use the panel dimensions of my data. I consider two specifications. First, I estimate a fixed effects model that exploits deviations from the mean within a plan- or occupation-establishment over the entire period the establishment is in the sample. Second, I estimate a long differences model, which analyzes the differences within a plan- or occupation-establishment over a specified period of time. Both of these methods are designed to eliminate biases caused by time-invariant observed and unobserved characteristics of plans and establishments that are correlated with health insurance costs and compensation. The next two sections describe these two empirical models in more detail.

4.2 Fixed Effects

The occupation-establishment-level fixed effect regressions include establishment and occupation fixed effects (γ_i and ρ_j) that absorb the observed and unobserved time-invariant characteristics that may be correlated with health insurance costs and compensation. I add each of the fixed effects sequentially to see which of the two has the greatest effect. The plan-level regressions include plan fixed effects ($\mu_{p(j)}$) that absorb the time invariant characteristics of the health insurance plan that may be correlated with premiums and contribution amounts. The identifying assumption for both regressions is that health insurance costs are strictly exogenous after controlling for year, occupation, establishment, and plan:

$$E(\epsilon^p_{p(j)t}|P^T_{p(j)}, X^T_j, \mu_{p(j)}, Year_t) = 0$$
$$E(\epsilon^o_{ijt}|HICost^T_{ij}, X^T_j, \gamma_i, \rho_j, Year_t) = 0,$$

where $HICost^T_{ij} = (HICost_{ij1}, \cdots, HICost_{ijT})$, $P^T_{p(j)} = (P_{p(j)1}, \cdots, P_{p(j)T})$ and $X^T_j = (X_{j1}, \cdots, X_{jT})$. While the establishment, occupation, and plan fixed effects eliminate biases caused by time-invariant establishment and occupation characteristics, I am unable to pinpoint the source of the remaining variation to determine whether the identifying assumption is satisfied. In the absence of a valid instrument, the next best solution is to rule out specific endogeneity concerns through alternative regression specifications and robustness checks. One such concern is that productivity changes simultaneously affect compensation and health insurance premiums through changes in labor costs. Kochner and Sahni [2011] state that 56% of health care spending in 2010 went towards wages of health care workers, suggesting that premiums are likely to be responsive to changes in labor costs for workers in the health care industry. Any market-wide changes in labor costs are absorbed by the year fixed effects, but regional productivity changes could cause an upward bias in the estimates. I address this by controlling for the average wages of health care workers in the establishment's commuting zone each year.[25]

An additional endogeneity concern is that changes over time in the composition of workers are correlated with both compensation and health insurance costs. For example, an increase in the number of high-ability workers would result in higher compensation, but also higher premiums if those workers have a preference for expensive health insurance plans. To test for this, I create a measure of the relative compensation of occupations by regressing each measures of compensation (total compensation, wages, and non-health benefits) on 6-digit

[25] Another reason to include market-wide and regional productivity changes is to isolate the effect of changes in health insurance costs on compensation while controlling for the direct effect of productivity changes on compensation. Unfortunately, I am unable to control for establishment-level productivity changes.

occupation and year dummies:

$$Outcome_{ijt} = \gamma_i + Year_t + \xi_{ijt}.$$

The estimated coefficients on the occupation dummies, $\hat{\gamma}_i$, serve as the relative compensation measure for each occupation and a proxy for skill level. Then, I calculate the occupational skill level of each establishment by taking the sum of the compensation measure for the sampled occupations within the establishment, weighted by the share of workers that are in that occupation each year:

$$Comp_{jt} = \sum_{i=1}^{N} \hat{\gamma}_i * OccShare_{ijt},$$

where N is the number of sampled occupations in the establishment and $OccShare_{ijt}$ is the fraction of workers in the establishment that are in occupation i at establishment j in year t. Changes in $Comp_{jt}$ will reflect changes in the occupational skill level of the establishment. I regress this measure on health insurance costs, year, and establishment fixed effects to see if changes in worker composition are correlated with health insurance costs. The results in Table 5 show no evidence of this type of a relationship. As a result, I rule out the possibility that changes in worker composition are biasing my results.

4.3 Long Differences

It is possible that establishments are adjusting employee compensation and employment over long periods of time in response to the increase in health insurance costs. This would occur if some outcomes, such as wages and employment, are difficult to adjust in the short-run. To test this hypothesis, I use a long differences model, which looks at changes within an occupation-establishment or plan over a specified period of time. This method maintains the ability to difference out potentially endogenous time-invariant occupation, establishment, and plan characteristics:

$$\Delta_s Outcome_{p(j)t} = \alpha_1 \Delta_s P_{p(j)t} + \alpha_2 \Delta_s X_{jt} + Year_t + \Delta_s \epsilon^p_{p(j)t} \quad (5)$$

$$\Delta_s Outcome_{ijt} = \beta_1 \Delta_s HICost_{ijt} + \beta_2 \Delta_s X_{jt} + Year_t + \Delta_s \epsilon^o_{ijt}, \quad (6)$$

where Δ_s indicates an s year difference in the variable. I estimate the long differences model using values of s that range from 1 to 7, where the years can overlap between establishments, but not within an establishment.[26] If an establishment is in the sample for more than s years, I calculate Δ_s using the most recent year the establishment is in the sample. In contrast to a fixed effects model, which looks at mean deviations over the entire time period, a long difference model allows me to compare the establishment response in the short-run ($s = 1$) versus the long-run ($s = 3$). The specification where $s = 1$ is a first differences model. I use $s = 3$ as a measure of the long run because the sample size drops dramatically for longer time periods.[27]

The identifying assumptions for the long differences model are:

$$E(\Delta_s \epsilon^p_{p(j)t} | \Delta_s P_{p(j)t}, \Delta_s X_{jt}, \mathit{Year}_t) = 0$$
$$E(\Delta_s \epsilon^o_{ijt} | \Delta_s \mathit{HICost}_{ijt}, \Delta_s X_{jt}, \mathit{Year}_t) = 0.$$

The long differences model faces the same concern as the fixed effects model that the change in premiums over time may be endogenous if it is due to regional productivity changes. I address this concern by running a specification of this model that controls for the change in average wages for health care workers in the commuting zone over time.

5 Results

In this section, I present the results from the cross-sectional, fixed effects, first differences, and long differences estimates of the relationship between health insurance costs and total compensation, employee premium contributions, wages, non-health fringe benefits, employment and hours worked. I also take a preliminary look at whether changes in health insurance costs affect health insurance take-up rates.

5.1 Total Compensation

The theoretical model predicts that an increase in health insurance costs will cause a decrease in the total compensation of workers. There will be full pass-through of the cost increase onto total compensation if workers fully value the increased spending on health insurance. Table 6 shows the results from regressing the total compensation of workers (defined as

[26] For example, the sample can include occupations from establishment A with a difference from 2005 to 2008 and occupations from establishment B with a difference from 2007 to 2010. But the sample cannot include a difference from 2005 to 2008 and 2007 to 2010 for occupations in establishment C.

[27] The decrease in sample size is primarily due to missing values in the chained price index. Many establishments that are in the sample for more than 3 years have at least one year in which all the health insurance plans are updated. This creates missing values for that year and all subsequent years due to the gap in the chain. The findings are robust to using $s = 2$ as a measure of long run effects as well.

the hourly wages and the value of non-health fringe benefits minus the expected employee premium contribution) on health insurance costs. All of the regressions control for year, establishment size, whether the establishment is self-insured, and the average wage of health care workers in the commuting zone. Column (1) shows the results from a cross-sectional regression that does not include establishment and occupation fixed effects. The results imply a positive correlation between health insurance costs and total compensation, although this relationship is not statistically significant. As discussed in the empirical section, there is likely to be an upward bias in this coefficient because establishments that attract high-ability workers tend to offer higher total compensation and more generous health insurance plans. Column (2) reduces this bias by including establishment fixed effects, and column (3) adds occupation fixed effects. The coefficient becomes negative and statistically significant, which confirms that there exists a large upward bias in the cross-sectional regression. Adding the occupation fixed effects does not affect the estimates, which implies that most of the variation in premiums comes from between establishments. The findings imply that total compensation decreases by \$0.52 for each \$1 increase in hourly health insurance costs, which implies less than full pass-through of increased health insurance costs to workers.

The next regression specifications test the long run versus short run response of establishments to rising health insurance costs. Column (4) shows the results from the first differences model where $s = 1$ in equation (6), and column (5) increases the time period to $s = 3$. Comparing the results from these two specifications shows that the establishment response to a change in health insurance costs is approximately the same over a one year period of time as a three year period of time (a decrease of \$0.54 compared to \$0.51, respectively). These specifications confirm that there is not full pass-through of rising health insurance costs onto total compensation. Interpreting this through the theoretical model implies that workers do not fully value the increase in health insurance premiums.

In the next sections, I decompose the decrease in total compensation into adjustments in wages, non-health fringe benefits, and employee contributions, as well as examine the effect of an increase in health insurance costs on employment, hours worked, and health insurance take-up.

5.2 Employee Contributions

One method that establishments can use to decrease total compensation in response to a change in health insurance costs is to increase employee contributions. Table 7 shows the results from the plan-level regressions of employee contributions on plan premiums. The cross-sectional regression shows an increase in employee contributions of \$0.62 for every \$1 increase in premiums. Controlling for plan fixed effects reduces this coefficient to \$0.37, which is evidence of a positive bias in the cross-section. This could be attributed to expensive plans requiring relatively larger employee contributions than cheaper plans. The first difference and long differences estimates show a larger relationship between premiums and employee contributions of \$0.51 and \$0.40 respectively. These findings imply that increases in employee contributions are a major component of the adjustment in total compensation.

One might be hesitant to compare the results from the total compensation and employee contribution regressions given the estimate for total compensation was generated at the occupation-establishment level, and the estimate for employee contributions was generated at the plan level. To alleviate this concern, I re-run the employee contribution regression at the occupation-establishment level using the same health insurance price index that was used in the total compensation regression. The results are in Table 8 and estimate an increase in employee contributions of \$0.53 (in the long differences specification) to \$0.57 (in the fixed effects specification using both establishment and occupation fixed effects) for every \$1 increase in health insurance costs. These estimates confirm that the decrease in total compensation is primarily due to increases in employee contributions. Furthermore, the average percent contribution by employees towards health insurance is approximately 30% (as shown in Table 3), which implies that establishments are increasing the percentage contribution of employee contributions in addition to the level.

Finally, I consider the role of taxation in interpreting these results. As shown in Table 2, approximately 30 percent of establishments offer workers a Section 125 plan, which means workers in those establishments have the option to make pre-tax premium contributions. An increase in employee contributions for these workers is less costly than for workers without a Section 125 plan because they do not have to pay taxes on a larger portion of their income. The true cost of an increase in employee contributions to the average worker is:

$$\Pr(\text{Sect. } 125)\frac{d(\mathit{EECont})}{d(\mathit{HICost})}(1-\tau)+[1-\Pr(\text{Sect. } 125)]\frac{d(\mathit{EECont})}{d(\mathit{HICost})},$$

where τ is the income tax rate, Pr(Sect. 125) is the fraction of establishments that offer a Section 125 plan, and $\frac{d(\mathit{EECont})}{d(\mathit{HICost})}$ is the estimated increase in employee contributions due to an increase in health insurance costs. I will now provide a rough, back-of-the-envelope calculation of the true change in employee contributions after considering the availability of Section 125 plans. The average worker in the sample earns approximately \$39,000 a year, which puts them in an income tax bracket of 15% if they filed jointly in 2010.[28] Using

[28]The annual income was calculated using an average hourly wage of \$22 and working 36 hours a week for 50 weeks a year. This simple calculation does not consider deductions, personal exemptions, or any other circumstances that may lower an individual's taxable income.

$\tau = 0.15$ and Pr(Sect. 125)=0.3, a rough estimate of the true cost to the worker of a \$0.52 increase in employee premium contributions is \$0.50. Overall, the effect of taxation on the estimates is small.

5.3 Wages

In addition to increasing employee premium contributions, establishments have the option of decreasing wages in response to rising health insurance costs. As described in the theoretical model, the extent to which establishments adjust wages as opposed to employee premium contributions depends on how each form of compensation enters the workers' utility function. Table 9 shows the results from a regression of wages on hourly health insurance costs. As expected, the coefficient on hourly premiums is positive and significant in the cross-sectional regression results in column (1). This is due to the bias caused by unobserved characteristics of establishments and occupations that offer high wages and also expensive health insurance plans. Including fixed effects eliminates this type of bias. The fixed effects results in columns (2) and (3) reveal that the effect of an increase in health insurance costs on wages is small and not statistically significant. Using a long differences model to compare the changes over a one year versus three year period estimates a zero coefficient. These findings imply that establishments do not adjust wages in response to increased health insurance costs, which is likely to reflect workers' preferences for wages over other forms of compensation, such as employee contributions toward health insurance.

5.4 Non-Health Fringe Benefits

The third form of compensation I examine in this paper is non-health fringe benefits. Establishments may prefer to adjust along this dimension if the marginal utility of a dollar spent on non-health fringe benefits is less than the marginal utility from additional wages or employee contributions towards health insurance. Table 10 shows the results from a regression of the value of non-health fringe benefits on hourly health insurance costs. The results follow the same pattern as wages. Comparing the cross-sectional results in column (1) and the fixed effects regression results in columns (2) and (3) shows that there is a large positive bias due to the unobserved characteristics of establishments and occupations that offer more generous non-health fringe benefits and health insurance packages. The coefficients from the fixed effects, first differences and long differences model show that there is no effect on non-health fringe benefits in response to an increase in health insurance costs. These findings indicate that establishments do not adjust non-health fringe benefits in response to a rise in health insurance costs.

5.5 Employment and Hours Worked

The evidence presented thus far suggests that establishments reduce total compensation by less than the increase in health insurance costs. The theoretical model predicts that less than full pass-through should be accompanied by a decrease in employment, as shown in Figure 1. Establishments demand fewer workers due to their higher per worker labor costs, and workers that have a low preference for health insurance coverage will leave to work at an establishment that does not offer health insurance.

Table 11 shows the results from a regression of log employment on log health insurance costs. Both employment and health insurance costs are measured at the occupation-establishment level. The cross-sectional results in column (1) reveal a negative, statistically significant coefficient that disappears in the fixed effects, first differences, and long differences results presented in Columns (2) through (5). The coefficients become small and not statistically significant. I also look for evidence of a trade-off between the number of employees and hours worked. Since health insurance is a fixed cost, the establishment has incentives to decrease the number of workers employed and increase the hours worked. I show the results of the regression of log weekly hours on log health insurance costs in Table 12. Similar to the employment regressions, the coefficients are small and not statistically significant.

These results are puzzling because they imply that establishments have higher labor costs due to the increase in health insurance costs, but are not reducing employment. This is not sustainable for a profit-maximizing competitive establishment. One possible explanation for the puzzling results for employment and hours worked is that the labor demand is inelastic and therefore the expected impact on employment is small. Another possible explanation is that the labor market is not perfectly competitive, and the true market structure would have establishments absorbing part of the higher health insurance costs without decreasing employment. A final explanation lies in the method in which the employment and hours data are collected. The focus of the NCS is to provide information on the labor costs of establishments in the U.S. Employment and hours worked data are collected primarily for the purpose of generating sampling weights and for converting compensation to hourly measures. As a result, these variables are the last priority during the data collection process and may be less precisely measured than the compensation variables. For these reasons, one should exercise caution when interpreting the employment and hours worked results.

6 Robustness Checks

In this section, I check whether my empirical findings are driven by some of the assumptions and methods I used during the main analysis. I discuss all of the results in the following paragraphs.[29]

Log specification: The main analyses compare changes in the level of hourly health insurance costs to changes in the level of hourly compensation. There are two main disadvantages to this approach. First, using an hourly measure of compensation and health insurance costs may introduce measurement error because both the dependent and independent variables are divided by the hours worked. I tried to minimize this problem in the main analysis by using a different measure of hours worked to calculate each variable. An alternative is to eliminate the problem entirely by using yearly variables instead of hourly measures. The second issue is that using levels puts a lot of weight on outliers. A log specification transforms the variables to reduce the influence of large outliers. I re-run the analysis using log yearly health insurance costs as the independent variable and log transformations of yearly total compensation, salary, and spending on non-health fringe benefits as the dependent variables. The fixed effects model estimates a 0.53% decrease in total compensation in response to a 10% increase in health insurance costs, and the long differences model estimates a decrease of 0.48%. Since spending on health insurance is approximately 9% of the establishment's per worker costs (see the descriptive statistics Table 3), full pass-through of the 10% increase would be equivalent to decreasing total compensation by 0.9%. The log specifications show that the decrease in total compensation is slightly more than half of what it would be if there were dollar for dollar pass-through. This is consistent with the estimates in the main analysis. There is no evidence that establishments are adjusting wages and non-health fringe benefits, except for the long differences specification that predicts a small positive increase in non-health fringe benefits. Employee contributions increase by 0.95% in response to a 10% increase in health insurance costs, which is an extremely large effect. This is consistent with employee contributions being the primary method in which establishments respond to rising health insurance costs.

Include establishments that do not offer health insurance: All of the regressions in the main analysis only include establishments that offer health insurance to their workers. In this robustness check, I re-run the analyses including establishments that do not offer health insurance. The regressions include a dummy for offering health insurance and an interaction between offering health insurance and health insurance costs. The main conceptual difference between this specification and the main analyses is that establishments that do

[29]The tables with the results of the robustness checks can be provided upon request from the author.

not offer health insurance are included in the control group in this specification. The results from both the fixed effects and long differences models show that establishments decrease total compensation by \$0.51 for every dollar increase in health insurance costs, with employee contributions being the main component of total compensation that is adjusted. This is consistent with the main results. There is no evidence of a change in wages, non-health fringe benefits, or employment in response to a change in health insurance costs, although the fixed effects model estimates a small (0.9%) increase in hours.

Exclude individuals that work in a health-related profession: The fixed effects and long differences models control for changes in regional productivity by including the average wage of health care workers in the establishment's commuting zone. I conduct a robustness check that excludes these workers to rule out the possibility that including workers in the health care industry biases the results. The results are similar to those from the main analysis. Total compensation decreases by \$0.55 in response to a rise in health insurance costs in the fixed effects model and \$0.54 in the long differences model. This adjustment in total compensation is entirely due to increases in employee contributions; there is no evidence of establishments adjusting wages, non-health fringe benefits, employment, or hours worked.

Alternative measures of health insurance costs: The average health insurance cost for the occupation was calculated by creating a chained price index that controls for changes in plan participation over time. It was necessary to collapse plan premiums to the occupation-establishment level in order to have the outcomes of interests and health insurance costs at the same unit of observation. I now explore the use of two alternative measures of health insurance costs. First, I limit the sample to establishments that only offered one identical plan throughout the surveyed years, which represents 33% of the observations in the full sample. Plan premiums do not need to be averaged to the occupation-establishment level for these establishments because all workers are enrolled in the same plan. The results of the fixed effects model show that total compensation received by workers decreases by \$0.27 for each dollar increase in health insurance costs, with the long differences model showing a decrease of \$0.42 in absolute value. This is smaller than the results from the full sample, but still evidence against full pass-through of health insurance premium increases. Another check is to use the premium of the plan with the highest participation in the first year the establishment is in the survey. These estimates are also smaller than the main results, with total compensation decreasing by \$0.27 for each dollar increase in health insurance costs in the fixed effects model and \$0.20 in the long differences model. Nonetheless, both robustness checks provide further evidence against full pass-through onto total compensation and confirm that establishments do not adjust wages, non-health fringe benefits, and employment in response to rising health insurance costs.

Heterogeneous effects by establishment size: Establishments may respond differently to rising health insurance costs depending on their size. To check for heterogeneous effect by establishment size, I run the analyses separately for establishments that have less than 200 employees (small establishments) and for establishments that have 200 employees or more (large establishments). The effect for small establishments is consistent with the main results of the paper; small establishments reduce total compensation by \$0.57 for each dollar increase in health insurance costs, and most of this is attributed to increases in employee contributions. In contrast, large establishment reduce total compensation by \$0.29 for each dollar increase in health insurance costs, with employee contributions being the main component of this adjustment. These results suggest that both small and large establishments have less than full pass-through of health insurance costs, with large establishments adjusting.

Instrumental variables strategy: While fixed effects and long difference models are useful methods for eliminating problems with time invariant unobserved characteristics, there are some disadvantages to these approaches. The first is that fixed effects models tend to exacerbate attenuation bias from measurement error. The second is that one must assume that the variation in premiums is exogenous after including the fixed effects and other covariates, without pinpointing exactly what causes the variation. An instrumental variable strategy would address both of these problems by isolating variation in the premiums to an exogenous source and reducing measurement bias; however, it is very difficult to find an instrument that is correlated with health insurance premiums, but uncorrelated with wages, non-health fringe benefits, and employment.

I explore the use of a regional measure of Medicare spending that has been price-adjusted to isolate variation in Medicare spending that is due to differences in utilization:

$$AdjMedSpend = \overline{P}_{proc} \times Q_{proc},$$

where $\overline{P}_{proc}$ is a standard price of a procedure regardless of the geographic location and Q_{proc} is the use of a procedure.[30] Identification comes from variation in Q_{proc}, which is chosen by a medical practitioner based on their medical training, hospital culture, and personal preference [Gawande, 2009a,b]. These factors are unlikely to be correlated with wages, fringe benefits, and employment, except to the extent that they affect health insurance prices. Unfortunately, the first stage regression of health insurance costs on price-adjusted Medicare spending reveals a very weak relationship between premiums and utilization of medical procedures. One explanation is that Medicare spending may not be generalizable

[30]A detailed description of how this measure of Medicare spending is calculated can be found in Skinner et al. [2011].

to the private sector due to their difference incentives to restrain utilization, as shown by Philipson et al.. An area of future work will be to identify other sources of exogenous variation in premium prices to use as an instrument to test the main results of this paper.

7 Conclusions

This paper examines the effect of rising health insurance costs on the compensation and employment decisions of establishments that offer health insurance in the U.S. It uses a unique panel data set to overcome the biases due to unobserved time-invariant establishment and occupation characteristics that are correlated with health insurance costs and compensation. The data also allow for a more complete picture of the different dimensions along which establishments adjust compensation than what has been done in past work. Using fixed effects and long differences models, I find that establishments reduce total compensation by $0.52 for each dollar increase in health insurance costs. Most of this decrease in compensation is in the form of higher employee premium contributions, while wages and non-health fringe benefits are unaffected.

These findings have important policy implications for health care reform in the U.S. Health insurance costs continue to rise (although the increases have been smaller since 2010), and the Patient Protection and Affordable Care Act (ACA) includes provisions such as employer and individual mandates that may also effect the cost of health insurance. The CBO [2011] was tasked with analyzing the effect of the ACA on the federal budget, health insurance coverage, Medicare, premiums and labor markets, and some of their analyses assume full pass through of increases in health insurance related costs onto workers' wages. This paper suggests that those assumptions should be reconsidered in future estimates of the full impact of rising health insurance costs on labor market outcomes.

References

CBO's Analysis of the Major Health Care Legislation Enacted in March 2010, March 2011.

Employer health benefits annual survey. Technical report, Kaiser Family Foundation and Health Research and Educational Trust, 2010.

Katherine Baicker and Amitabh Chandra. The labor market effects of rising health insurance premiums. *Journal of Labor Economics*, 24(3), 2006.

Katherine Baicker and Amitabh Chandra. Medicare spending, the physician workforce, and beneficiaries' quality of care. *Health Affairs*, April 2004.

James M. Branscome. Employer-sponsored single, employee-plus-one, and family health insurance coverage: Selection and cost, 2003. Technical report, Agency for Healthcare Research and Quality, July 2005.

Thomas C. Buchmueller. Fringe benefits and the demand for part-time workers. *Applied Economics*, 1:551–563, 1999.

Thomas C. Buchmueller and Michael Lettau. Estimating the wage-health insurance tradeoff: More data problems? January 1997.

William J. Carrington, Kristin McCue, and Brooks Pierce. Nondiscrimination rules and the distribution of fringe benefits. *Journal of Labor Economics*, 20(2), 2002.

Beth Levin Crimmel. Employer-sponsored single, employee-plus-one, and family health insurance coverage: Selection and cost, 2010. Technical report, Agency for Healthcare Research and Quality, July 2011.

David M. Cutler. Technology, health costs, and the nih. September 1995.

David M. Cutler and Brigitte C. Madrian. Labor market responses to rising health insurance costs: Evidence on hours worked. *The RAND Journal of Economics*, 1998.

David Dranove, Kathryn E. Spier, and Laurence Baker. 'competition' among employers offering health insurance. *Journal of Health Economics*, 19:121–140, 2000.

Christine Eibner and M. Susan Marquis. Employers' health insurance cost burden, 1996-2005. *Monthly Labor Review*, June 2008.

Elliot S. Fisher, Julie P. Bynum, and Jonathan S. Skinner. Slowing the growth of health care costs - lessons from regional variation. *The New England Journal of Medicine*, February 2009.

Atul Gawande. Testing, testing. *The New Yorker*, December 14, 2009a.

Atul Gawande. The cost conundrum: What a texas town can teach us about health care. *The New Yorker*, 2009b.

Jonathan Gruber. The incidence of mandated maternity benefits. *American Economic Review*, 84(3):622–641, June 1994.

Jonathan Gruber and Alan B. Krueger. The incidence of mandated employer-provided insurance: Lessons from workers' compensation insurance. *Tax Policy and the Economy*, 5:111–143, 1991.

Jonathan Gruber and Michael Lettau. How elastic is the firm's demand for health insurance. *Journal of Public Economics*, 88:1273–1293, 2004.

Jonathan Gruber and Robin McKnight. Why did employee health insurance contributions rise? *Journal of Health Economics*, 22:1085–1104, 2003.

Benjamin Handel. Adverse selection and switching costs in health insurance markets: When nudging hurts. NBER Working Paper 17459, September 2011.

Robert Kochner and Nikhil R. Sahni. Rethinking health care labor. *The New England Journal of Medicine*, 365(15), 2011.

Jonathan T. Kolstad and Amanda E. Kowalski. Mandate-based health reform and the labor market: Evidence from massachusetts. Unpublished manuscript, November 2011.

Helen Levy. Who pays for health insurance? employee contributions to health insurance premiums. Princeton University Industrial Relations Section, Working Paper 398, 1998.

Richard D. Miller. Estimating the compensating differential for employer-provided health insurance. *International Journal of Health Care Finance and Economics*, 4, 2004.

Olivia S. Mitchell. Fringe benefits and labor mobility. *The Journal of Human Resources*, 17 (2):286–298, 1982.

Joseph P. Newhouse. Medical care costs: How much welfare loss? *Journal of Economic Perspectives*, 6(3):3–21, 1992.

Craig A. Olson. The impact of permanent job loss on health insurance benefits. July 1992.

Tomas J. Philipson, Seth A. Seabury, Lee M. Lockwood, Dana P. Goldman, and Darius N. Lakdawalla. Geographic variation in health care: The role of private markets.

Brooks Pierce. Recent trends in compensation inequality. Bureau of Labor Statistics, July 2008.

Louise Sheiner. Health care costs, wages, and aging. Federal Reserve Board of Governors, April 1999.

Kosali Ilayperuma Simon and Robert Kaestner. Do minimum wages affect non-wage job attributes? evidence on fringe benefits. *Industrial and Labor Relations Review*, 58(1): 52–70, October 2004.

Brenda Sirovich, Patricia M. Gallagher, David E Wennberg, and Elliot S. Fisher. Discretionary decision making by primary care physicians and the cost of u.s. health care. *Health Affairs*, 27(3):813–823, 2008.

Jonathan S. Skinner, Daniel Gottlieb, and Donald Carmichael. A new series of medicare expenditure measures by hospital referral region: 2003-2008. Technical report, The Dartmouth Institute for Health Policy and Clinical Practice, June 2011.

Lawrence H. Summers. Some simple economics of mandated benefits. *American Economic Review*, 79(2):177–183, 1989.

Charles M. Tolbert and Molly Sizer. U.s. commuting zones and labor market areas: A 1990 update. Economic Research Service Staff paper No. 9614, September 1996.

Stephen Woodbury. Wage and nonwage benefits. *American Economic Review*, 73(1), March 1983.

Appendix

A Proof of Comparative Statics

The three market clearing conditions are:

$$\begin{aligned} L_H^d(T+P) &= L_H^S(T+\alpha P, \underline{T}) && (7) \\ L_{NH}^d(\underline{T}) &= L_{NH}^S(\underline{T}, T+\alpha P) && (8) \\ L_H + L_{NH} &= \overline{L} && (9) \end{aligned}$$

Taking the total differential of equation 7 gives:

$$\frac{dL_H^d}{d(T+P)}(dT+dP) = \frac{dL_H^s}{d(T+\alpha P)}(dT+\alpha dP) + \frac{dL_H^s}{d\underline{T}}d\underline{T}$$

Solving this for $\frac{dT}{dP}$ gives:

$$\frac{dT}{dP} = -\left(\frac{\frac{dL_H^d}{d(T+P)} - \alpha\frac{dL_H^s}{d(T+\alpha P)}}{\frac{dL_H^d}{d(T+P)} - \frac{dL_H^s}{d(T+\alpha P)}}\right) + \left(\frac{\frac{dL_H^s}{d\underline{T}}}{\frac{dL_H^d}{d(T+P)} - \frac{dL_H^s}{d(T+\alpha P)}}\right)\frac{d\underline{T}}{dP} \tag{10}$$

To simplify this expression, I use the following notation:

$$A = \frac{dL_H^d}{d(T+P)} - \alpha\frac{dL_H^s}{d(T+\alpha P)}$$

$$B = \frac{dL_H^d}{d(T+P)} - \frac{dL_H^s}{d(T+\alpha P)}$$

Expression 10 can now be written as:

$$\frac{dT}{dP} = -\left(\frac{A}{B}\right) + \left(\frac{\frac{dL_H^s}{d\underline{T}}}{B}\right)\frac{d\underline{T}}{dP}$$

To solve for $\frac{d\underline{T}}{dP}$, I first plug condition 9 into condition 8:

$$L_{NH}^d(\underline{T}) = \overline{L} - L_H^S(T+\alpha P, \underline{T})$$

I then take the total differential and solve for $\frac{d\underline{T}}{dP}$:

$$\begin{aligned} \frac{d\underline{T}}{dP} &= \frac{-\frac{dL_H^s}{d(T+\alpha P)}\left(\frac{dT}{dP}+\alpha\right)}{\frac{dL_{NH}^d}{d\underline{T}} + \frac{dL_H^s}{d\underline{T}}} \\ &= \frac{-\frac{dL_H^s}{d(T+\alpha P)}\left(\frac{dT}{dP}+\alpha\right)}{C} \qquad \text{where} \qquad C = \frac{dL_{NH}^d}{d\underline{T}} + \frac{dL_H^s}{d\underline{T}} \end{aligned}$$

Plugging this into the expression for $\frac{dT}{dP}$ gives:

$$\frac{dT}{dP} = \frac{-A}{B} + \frac{\frac{dL_H^s}{d\underline{T}}}{B}\left[\frac{-\frac{dL_H^s}{d(T+\alpha P)}\left(\frac{dT}{dP}+\alpha\right)}{C}\right]$$

Solving this for $\frac{dT}{dP}$ gives:

$$\begin{aligned}
\frac{dT}{dP} &= -\left(\frac{AC + \alpha\frac{dL_H^s}{d\underline{T}}\frac{dL_H^s}{d(T+\alpha P)}}{BC + \frac{dL_H^s}{d\underline{T}}\frac{dL_H^s}{d(T+\alpha P)}}\right) \\
&= -\left[\frac{\left(\frac{dL_H^d}{d(T+P)} - \alpha\frac{dL_H^s}{d(T+\alpha P)}\right)\left(\frac{dL_{NH}^d}{d\underline{T}} + \frac{dL_H^s}{d\underline{T}}\right) + \alpha\frac{dL_H^s}{d\underline{T}}\frac{dL_H^s}{d(T+\alpha P)}}{\left(\frac{dL_H^d}{d(T+P)} - \frac{dL_H^s}{d(T+\alpha P)}\right)\left(\frac{dL_{NH}^d}{d\underline{T}} + \frac{dL_H^s}{d\underline{T}}\right) + \frac{dL_H^s}{d\underline{T}}\frac{dL_H^s}{d(T+\alpha P)}}\right] \\
&= -\left[\frac{\frac{dL_H^d}{d(T+P)}\left(\frac{dL_{NH}^d}{d\underline{T}} + \frac{dL_H^s}{d\underline{T}}\right) - \alpha\frac{dL_H^s}{d(T+\alpha P)}\frac{dL_{NH}^d}{d\underline{T}}}{\frac{dL_H^d}{d(T+P)}\left(\frac{dL_{NH}^d}{d\underline{T}} + \frac{dL_H^s}{d\underline{T}}\right) - \frac{dL_H^s}{d(T+\alpha P)}\frac{dL_{NH}^d}{d\underline{T}}}\right]
\end{aligned}$$

B Data Appendix

This appendix provides additional information about the National Compensation Survey (NCS). The microdata from this survey can only be accessed on-site at the BLS office in Washington DC. As described in section 3, the NCS had a three stage sampling process that results in the unit of observation for the data being the establishment-occupation for compensation variables and the establishment-occupation-plan for the health insurance plan information. Appendix table 1 shows the yearly sample sizes in the NCS, which includes both establishments that offer and do not offer health insurance, along with the sampled occupations and health insurance plans (when offered) in those establishments. The number of observations increases each year due to the addition of new cohorts over time. 2007 was the first year in which they had the full sample of all cohorts.

Establishments are contacted in March, June, September and December to update their compensation and employment data. They are asked to update their health insurance data in each March survey. The following provides a brief explanation of how each of the main variables used in this analysis were collected and/or calculated by the BLS.

- *Occupation employment:* Establishments are asked the number of workers that are employed in a given occupation, where the occupation is the most detailed level of job as defined by the establishment. Occupations are further divided by their union status and whether the job is full- or part-time. Occupation employment is updated every quarter. If data is not provided, the occupation employment is carried over from the past quarter.

- *Establishment employment:* Establishments are asked the total number of workers employed at the establishment. This variable is only asked upon initiation into the

Table 1: National Compensation Survey Yearly Sample Size

Year	# Estabs	# Estab-Occs	# Estab-Plans
2003	1,626	6,186	2,099
2004	3,576	13,426	4,849
2005	3,633	13,771	4,949
2006	5,653	20,873	8,385
2007	7,639	27,868	12,764
2008	7,379	26,163	13,838
2009	7,033	23,877	13,729
2010	5,212	16,912	9,770
Total	41,751	149,076	70,383

Observations include non-unionized workers in private establishments for which there exists compensation and health insurance data (if offered) for at least three years.

sample and is not updated unless there is a fundamental change in the structure of the establishment (such as a merger).

- *Hours Worked:* This variable is calculated by the BLS as the scheduled annual hours plus the annual overtime hours minus the annual leave hours.

- *Gross annual earnings:* This variable is calculated by the BLS as the straight time annual earnings plus annual overtime cost, non-production bonus costs and shift differential costs.

- *Hourly wage:* The BLS calculates this variable by dividing the straight time annual earnings by the scheduled annual hours for the occupation, which are the hours on a regular work schedule.

- *Hourly employer spending on fringe benefits:* Employer spending is collected for the following categories of benefits: premium pay for overtime, vacations, holidays, sick leave, other leave, shift differentials, non-production bonuses, severance pay, supplemental unemployment benefits, life insurance, health insurance, short-term disability insurance, defined benefit, defined contribution, social security, Medicare, federal unemployment insurance, state unemployment insurance, workers' compensation and long term disability. The BLS converts yearly spending on each of these categories to an hourly rate by dividing by the "Hours Worked" variable. This is in contrast to the hourly wage, which is calculated using the scheduled annual hours as the denominator.

- *Monthly Health Insurance Premiums:* The monthly premium for single and family coverage for each health insurance plan offered by the establishment is collected during the survey. The amount paid by the employer is entered separately from the amount paid by the worker. Data collectors also attempted to collect more detailed administrative data on health insurance plans through the Summary Plan Description (SPD), which is the administrative book for each health insurance plan. Unfortunately, the low retrieval rate of SPDs makes this data unusable for this study.

- *Plan participation:* This variable is calculated by the BLS as the number of workers in the occupation that are enrolled in a plan divided by the total number of workers in the occupation.

- *Self Insured:* Establishments are considered to be self-insured if the employer directly pays the cost of employees' covered health care expenses. No insurance company or service plan collects premiums and assumes risk.

- *Section 125 plans:* The BLS collects data on three types of Section 125 plans: flexible benefits plans (also known as cafeteria plans), dependent care reimbursement accounts, and healthcare reimbursement accounts. According to the data collection manual, flexible benefits plans are defined as plans that offer employees a choice of various permissible taxable benefits, including health insurance, vacations, retirement plans, and childcare.

There are two sets of sampling weights provided by the BLS: establishment weights and worker weights. The establishment weights are the inverse probability of being selected from the population of establishments in scope for the survey. The worker weights are the inverse probability of being selected from the population of workers in scope for the survey, which excludes the self-employed, private-household workers, federal government workers, and workers who set their own pay.

Figure 1: Market Equilibrium for Establishments that Offer Health Insurance

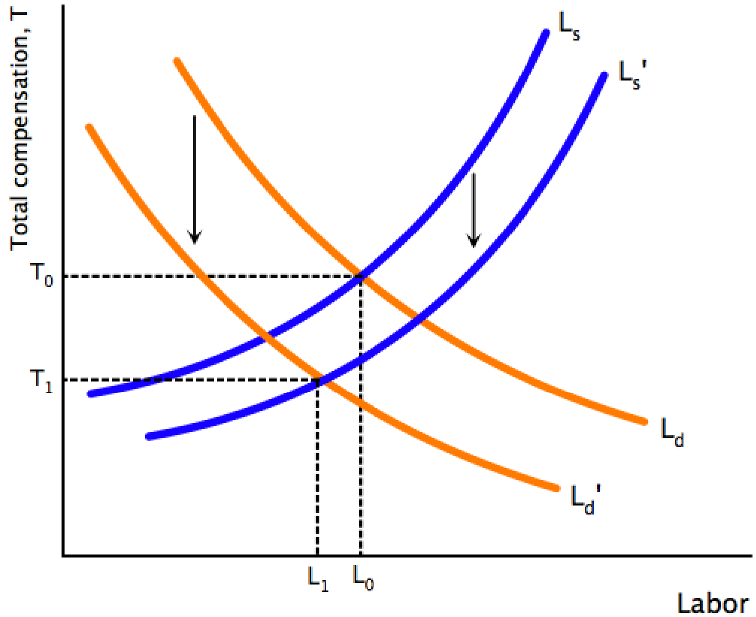
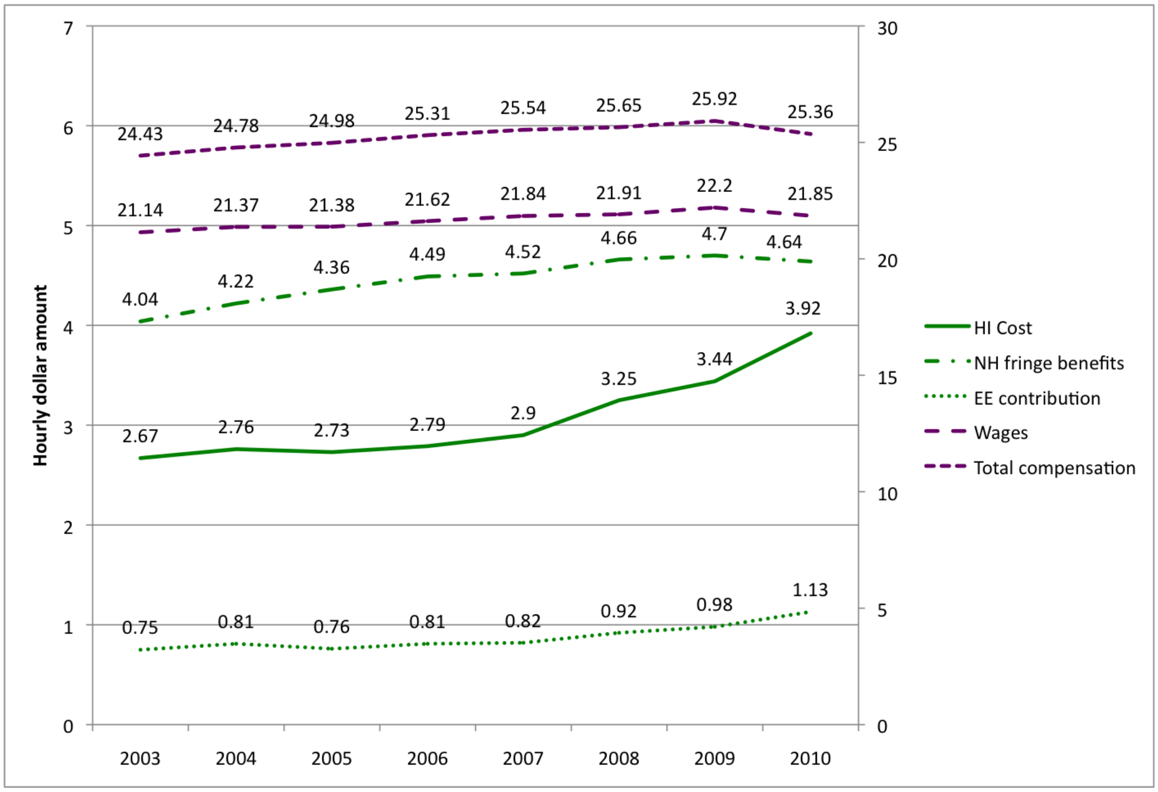
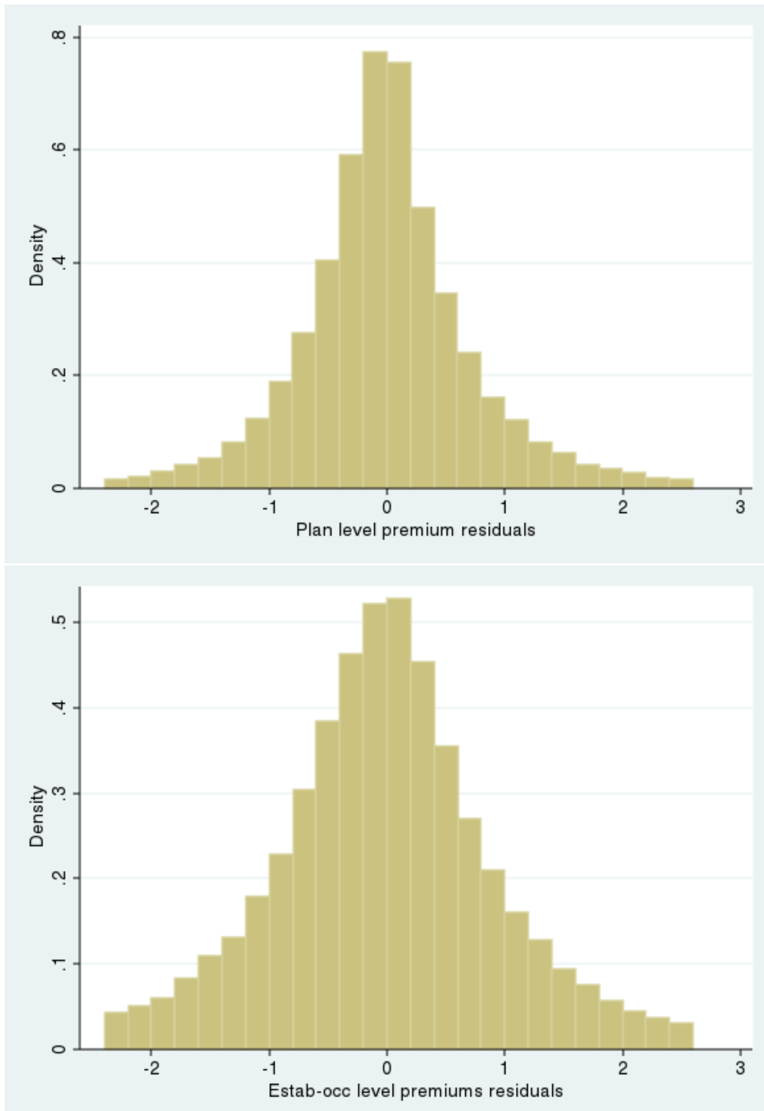


Figure 2: Average Growth in Health Insurance Costs and Compensation



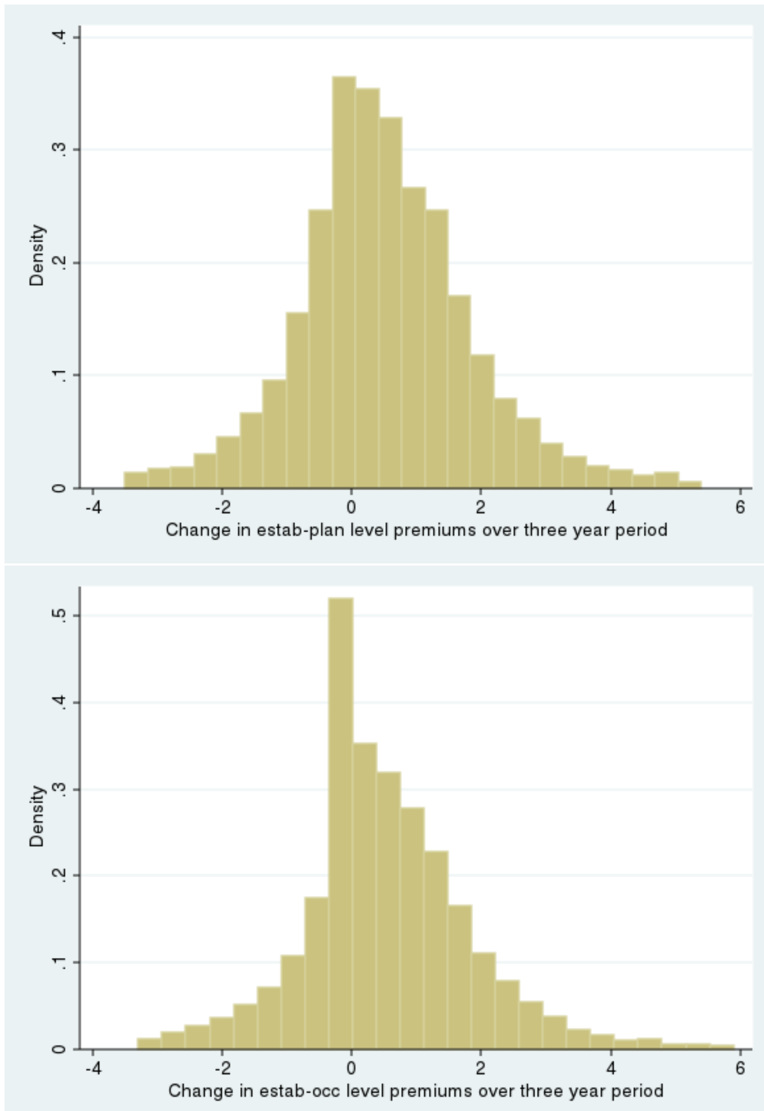
Data come from non-unionized occupations in private establishments in the National Compensation Survey in 2010 that have data on compensation and health insurance for at least three years (n=149,076). Expected health insurance costs (HI cost) are calculated as a chained price index weighted by plan participation and multiplied by expected take-up. Total compensation is defined as wages plus non-health (NH) fringe benefits minus the employee contribution towards health insurance. Employer spending on non-health fringe benefits are hourly dollar values and come from 16 categories that are listed in the data appendix.

Figure 3: Distribution of Residuals from Plan- and Occupation-Establishment-level Health Insurance Cost Regressions



The occupation-level residuals are calculated from regressing the health insurance price index on year, 6-digit occupation codes, and establishment dummies. The plan-level residuals are calculated from regressing the plan-level health insurance premiums on year and plan dummies.

Figure 4: Distribution of Three Year Differences in Plan- and Occupation-Establishment-level Health Insurance Costs



The three year differences are calculated as the difference within occupation-establishment (within-plan) between the health insurance cost in the final year the occupation-establishment (plan) was in the survey and three years earlier.

Table 2: Average Characteristics of Establishments, March 2010

	Offer HI		**Do not offer HI**	
	n=4,714		n=1,725	
Variable	**mean**	**sd**	**mean**	**sd**
Estab size	56.94	417.87	14.73	65.45
Avg # years in sample	5.21	1.25	5.21	1.25
Manufacturing	0.09	0.28	0.04	0.20
Section 125	0.34	0.47	0.11	0.32
Avg # of plans	1.43	1.35	-	-
Offers one plan	0.82	0.39	-	-
Offers two plans	0.09	0.28	-	-
Offers more than two plans	0.09	0.29	-	-
FFS	0.05	0.22	-	-
HMO	0.37	0.49	-	-
PPO	0.69	0.46	-	-
Self insured	0.17	0.38	-	-

Data come from private establishments in the National Compensation Survey in 2010 that have information on compensation and health insurance (if offered) for at least three years. Establishments that added or dropped HI coverage since the previous year are not included, which excludes 1.5% and 1.7% of the sample, respectively. Observations are weighted by sampling weights that are the inverse probability of being selected from the number of private establishments in the U.S. FFS indicates whether the establishment offers at least one fee for service plan, PPO is a plan from a preferred provider organizations, HMO is a health maintenance organization. Section 125 plans are those that allow workers to receive certain benefits on a pre-tax basis.

Table 3: Average Characteristics of Occupations Within Establishments, March 2010

	Offer HI n=16,912		Do not offer HI n=6,420	
Variable	**mean**	**sd**	**mean**	**sd**
Wage	21.85	15.53	13.38	10.03
Non-health fringe benefits	4.64	7.78	1.24	4.39
Hours per week	36.33	5.39	27.86	11.15
Full-time	0.93	0.25	0.44	0.50
Take-up HI	0.79	0.25	-	-
Avg hrly prem	5.07	3.02	-	-
HI cost	3.92	7.01	-	-
% prem paid by EE	0.30	0.17	-	-

Data come from non-unionized occupations within private establishments in the National Compensation Survey in 2010 that have information on compensation and health insurance (if offered) for at least three years. Occupations in establishments that added or dropped HI coverage since the previous year are not included, which excludes 2.7% and 5.9% of the sample, respectively. Observations are weighted by sampling weights that are the inverse probability of being selected from the number of workers in the U.S. that are not self-employed or private-household workers. Employer spending on non-health fringe benefits are hourly dollar values and come from 16 categories that are listed in the data appendix. Average hourly premiums are calculated using a chained price index weighted by plan participation. Health insurance costs (HI cost) are the health insurance price index multiplied by the expected take-up rate for the establishment.

Table 4: Sources of Variation in Health Insurance Costs

	Occ-estab level HI costs					**Plan-estab level premiums**				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Adj. R^2	0.015	0.098	0.114	0.121	0.213	0.392	0.623	0.752	0.853	0.924
Year	x	x	x	x	x	x	x	x	x	x
Industry		x	x	x			x	x		
Occupation			x	x	x					
Commuting Zone				x				x		
Establishment					x				x	
Plan										x

The dependent variable in each regression is the expected hourly health insurance cost. Variables are added sequentially to show how much of the variance in health insurance costs can explained by their inclusion. Data come from non-unionized occupations in private establishments in the National Compensation Survey in 2010 that have data on compensation and health insurance for at least three years (n=149,074 for occupation-establishment-level regressions and n=70,383 for plan-level regressions).

Table 5: Relationship between Health Insurance Costs and the Occupational Skill Level of the Establishment

	Occupational skill level of the establishment		
	Total compensation	Wages	NH Fringe Benefits
	(1)	(2)	(3)
HI cost	0.008	0.004	0.004
	(0.024)	(0.018)	(0.006)
R^2	0.871	0.869	0.882
N	39503	39503	39503

The dependent variable in each regression is the occupation skill level of the establishment, which is defined as the relative compensation of each occupation weighted by the number of workers in that occupation. Each regression uses a different measure of relative compensation: total compensation, wages and non-health fringe benefits. Standard errors (in parenthesis) are clustered at the establishment level. All regressions control for year and establishment dummies. All regressions are weighted by establishment level sampling weights.

Table 6: Effect of Health Insurance Costs on Total Compensation

	X-section	Fixed Effects		First Diff	Long Diff
	(1)	(2)	(3)	(4)	(5)
		Estab FE only	Estab + Occ FE		
HI cost	0.123	-0.513***	-0.517***		
	(0.365)	(0.108)	(0.095)		
Δ_1 HI cost				-0.538***	
				(0.112)	
Δ_3 HI cost					-0.510***
					(0.112)
R^2	0.051	0.546	0.719	0.174	0.063
N	149074	149074	149074	23918	23918

Standard errors (in parenthesis) are clustered at the establishment level. All regressions control for year, establishment size, being self-insured, and the average wages of health care workers in the commuting zone. Fixed effects regressions also include establishment and 6 digit occupation code dummies. All regressions are weighted by worker level sampling weights. Health insurance costs (HI cost) are the health insurance price index multiplied by the expected take up rate for the establishment.

Table 7: Effect of Health Insurance Costs on Employee Contributions (Plan Level)

	X-section	Fixed Effects	First Diff	Long Diff
	(1)	(2)	(3)	(4)
HI prem	0.621***	0.366***		
	(0.063)	(0.033)		
Δ_1 HI prem			0.507***	
			(0.055)	
Δ_3 HI prem				0.401***
				(0.052)
R^2	0.770	0.973	0.605	0.235
N	70383	70383	15298	15298

Standard errors (in parenthesis) are clustered at the establishment level. All regressions control for year, establishment size, being self-insured, and the average wages of health care workers in the commuting zone. Fixed effects regressions also include plan dummies. All regressions are weighted by plan participation.

Table 8: Effect of Health Insurance Costs on Employee Contributions (Occupation-Establishment Level)

	X-section	Fixed Effects		First Diff	Long Diff
	(1)	(2)	(3)	(4)	(5)
		Estab FE only	Estab + Occ FE		
HI cost	0.503***	0.561***	0.565***		
	(0.082)	(0.072)	(0.071)		
Δ_1 HI cost				0.543***	
				(0.110)	
Δ_3 HI cost					0.531***
					(0.107)
R^2	0.698	0.813	0.817	0.665	0.654
N	149074	149074	149074	23918	23918

Standard errors (in parenthesis) are clustered at the establishment level. All regressions control for year, establishment size, being self-insured, and the average wages of health care workers in the commuting zone. Fixed effects regressions also include establishment and 6 digit occupation code dummies. All regressions are weighted by worker level sampling weights. Health insurance costs (HI cost) are the health insurance price index multiplied by the expected take up rate for the establishment.

Table 9: Effect of Health Insurance Costs on Wages

	X-section	Fixed Effects		First Diff	Long Diff
	(1)	(2)	(3)	(4)	(5)
		Estab FE only	Estab + Occ FE		
HI cost	0.460*	0.038	0.036		
	(0.211)	(0.034)	(0.022)		
Δ_1 HI cost				0.003	
				(0.003)	
Δ_3 HI cost					0.010
					(0.007)
R^2	0.053	0.548	0.741	0.009	0.006
N	149074	149074	149074	23918	23918

Standard errors (in parenthesis) are clustered at the establishment level. All regressions control for year, establishment size, being self-insured, and the average wages of health care workers in the commuting zone. Fixed effects regressions also include establishment and 6 digit occupation code dummies. All regressions are weighted by worker level sampling weights. Health insurance costs (HI cost) are the health insurance price index multiplied by the expected take up rate for the establishment.

Table 10: Effect of Health Insurance Costs on Non-Health Fringe Benefits

	X-section	Fixed Effects		First Diff	Long Diff
	(1)	(2)	(3)	(4)	(5)
		Estab FE only	Estab + Occ FE		
HI cost	0.165*	0.010	0.012		
	(0.075)	(0.011)	(0.008)		
Δ_1 HI cost				0.002	
				(0.001)	
Δ_3 HI cost					0.011
					(0.010)
R^2	0.035	0.401	0.459	0.002	0.001
N	149074	149074	149074	23918	23918

Standard errors (in parenthesis) are clustered at the establishment level. All regressions control for year, establishment size, being self-insured, and the average wages of health care workers in the commuting zone. Fixed effects regressions also include establishment and 6 digit occupation code dummies. All regressions are weighted by worker level sampling weights. Health insurance costs (HI cost) are the health insurance price index multiplied by the expected take up rate for the establishment.

Table 11: Effect of Health Insurance Costs on Log Occupation Employment

	X-section	Fixed Effects		First Diff	Long Diff
	(1)	(2)	(3)	(4)	(5)
		Estab FE only	Estab + Occ FE		
ln(HI cost)	-0.158**	-0.008	0.012		
	(0.057)	(0.015)	(0.012)		
Δ_1 ln(HI cost)				0.021	
				(0.013)	
Δ_3 ln(HI cost)					0.025
					(0.019)
R^2	0.046	0.656	0.773	0.032	0.059
N	120421	120421	120421	20546	20546

The dependent variable is log occupation employment. Standard errors (in parenthesis) are clustered at the establishment level. All regressions control for year, being self-insured, and the average wages of health care workers in the commuting zone. Fixed effects regressions also include establishment and 6 digit occupation code dummies. All regressions are weighted by worker level sampling weights. Health insurance costs (HI cost) are the health insurance price index multiplied by the expected take up rate for the establishment.

Table 12: Effect of Health Insurance Costs on Log Weekly Hours

	X-section	Fixed Effects		First Diff	Long Diff
	(1)	(2)	(3)	(4)	(5)
		Estab FE only	Estab + Occ FE		
ln(HI cost)	0.015	-0.001	-0.002		
	(0.008)	(0.002)	(0.002)		
Δ_1 ln(HI cost)				-0.000	
				(0.000)	
Δ_3 ln(HI cost)					0.000
					(0.001)
R^2	0.003	0.643	0.684	0.000	0.000
N	129565	129565	129565	21700	21700

The dependent variable is log weekly hours worked. Standard errors (in parenthesis) are clustered at the establishment level. All regressions control for year, establishment size, being self-insured, and the average wages of health care workers in the commuting zone. Fixed effects regressions also include establishment and 6 digit occupation code dummies. All regressions are weighted by worker level sampling weights. Health insurance costs (HI cost) are the health insurance price index multiplied by the expected take up rate for the establishment.