HEALTH INSURANCE COST AND PREMIUM SHARING*

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Abstract:
We develop a model of cost sharing for firms that offer multiple insurance plans. We assume that firms offer one low quality plan and one high quality plan. Under the assumption of wage rigidities we found the employee's contribution schedules are a function of the premiums in the previous period as well as the changes in both premiums over time. We test our hypothesis using data from the Employer Health Benefit Survey. We restrict the analysis to firms that offer HMO and PPO plans. We find that the own premium elasticities are generally larger than 1, confirming that as the cost of health insurance goes up, employers shift the cost of insurance onto employees.

JEL code: J33, I11

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1. Introduction

Health insurance premiums have increased rapidly over the last decade, at a rate much higher than the general wage growth. In fact, the hourly cost of health insurance doubled between 2000 and 2010, wages grew only by 33% over the same period.[1] As health insurance costs have become a larger component of the total compensation package paid by employers, researchers have paid greater attention to the issue of access to health insurance through employer sponsored plans. Most of the existing literature has focused on the extensive margin of health insurance access, i.e. whether firms make employer sponsored plans available to their employees. Significantly less attention has been paid to the intensive margins –how much of the cost of providing health insurance is paid for by firms or the average quality of these insurance plans. This paper focuses on the first of these intensive margins, specifically on the question of how the price of health insurance affects how firms offering multiple health insurance plans determine the worker's contribution toward each plan.

The literature on the firm's decision to include health insurance in the compensation packages for workers has concluded that this decision is typically price inelastic.[2] In fact, while the percentage of firms that offered health benefits decreased from 68% in 2000 to 59% in 2009, this drop seems to be driven primarily by firms employing less than 10 workers (Kaiser/HRET, 2009, Exhibit 2.2). The percentage of large firms (i.e. firms that employed more than 200 employees) that offered health insurance did not change at all during the same period. Large firms almost universally offer health benefits (99%), and this rate has remained unchanged over the same time period. We argue that, although the premium size may not have an impact on a firm's decision to offer health insurance, it could have an effect on the employer's decision at the

[1] Bureau of Labor Statistics, "Employer Costs for Employee Contribution" , various years (http://www.bls.gov/schedule/archives/ecec_nr.htm)
[2] See Table 1 in Marquis and Long (2001) for a summary of the results in this literature.

intensive margin, i.e. how to split the cost with workers. In fact, the percentage of firms paying for the entire cost of a single coverage plan decreased dramatically from 32% in 2001 to 18% in 2009, (Kaiser/HRET, 2009, Exhibit 6.15). In light of this evidence, the question of how premium sharing between employees and employers responds to increases in health insurance premiums becomes a pressing one because a shift of the cost of health insurance on workers may affect the probability that a worker will sign up for the company plan. In fact, Cutler (2003) shows that most of the recent decrease in employer sponsored health insurance coverage can be explained by a decrease in take-up rates by employees due to an increase in the cost born by them rather than a decrease in offering rates by employers. In this study we want to disentangle what has affected this shift of the cost of health insurance on workers and specifically whether the size of the premium itself is a determinant of the cost sharing selected by the firm. We show that this is not a trivial question since, in a world of prefect sorting and flexible wages, health insurance premiums should not affect a worker's contribution, at least for the low quality plan.

The issue of premium sharing is of particular importance for large firms, since they are the least likely to drop health insurance from their compensation package. However, large firms are also more likely to offer multiple plans. In 2001, 56.7% of firms with more than 50 employees offered more than one plan in 2001, while only 12.5% of smaller firms offer multiple plans (Crimmel, 2003). Hence, the question of how the increase in the cost of health insurance affects premium sharing cannot disregard the fact that large firms offer multiple plans. For this reason, we develop a model of cost sharing for firms offering multiple health plans. This is an important contribution to the current literature, since previous studies all assume that each firm offers only one plan, which is an unreasonable assumption for large firms. Our theoretical model predicts that, under the assumption of wage rigidities, cost sharing should be affected by the growth of

the health insurance premium relative to the growth in wages, which fits the stylized facts stated above fairly well. We estimate our model using information on firms that offer both Health Maintenance Organization (HMO) plans and Preferred Provider Organization (PPO) plans. Empirically we find that the premium elasticities of the worker's contribution are generally all greater than 1, implying that as health insurance premiums increase firms shift the burden of the premium onto workers. The rest of the paper is organized as follow: the next section reviews the literature on this topic. Section 3 describes the model and section 4 outlines the methodological strategies adopted for the estimation. Section 5 describes the data while the empirical results are discussed in Section 6. We conclude with some final remarks on the main finding of this paper.

2. Literature review

In a world of perfect sorting, firms would choose to offer only one health insurance plan, if any: firms that have access to cheaper health insurance would offer health insurance (Goldstein and Pauly, 1976). Workers will sort themselves across firms according to their preferences for health insurance versus monetary wages and, because employer contributions are tax exempt, no employee contribution will be required. In a more realistic model, firms do not necessarily hire workers with homogeneous preferences with respect to health insurance coverage. Under this scenario, the employee's share of the premium should increase in the level of the premium since the benefit of sorting should increase as the premium increases. Levy (1997) tests this hypothesis using age and gender to proxy for a worker's demand for health insurance. The author finds a small price elasticity of the worker's contribution to the premium size (0.82 percent) and concludes that, although sorting plays a significant role in determining how firms set their worker's contribution schedule, it alone explains only a small part of the employee share.

A number of studies view premium sharing as a mechanism to sort workers according to their ability to obtain health insurance through alternative forms of coverage. For example, Shore-Sheppard et al. (2000) and Buchmueller et al. (2005) found that the share of the premium passed on to workers increases with the proportion of employees eligible for Medicaid. Similarly, Dranove et al. (2000) and Vistnes et al. (2006) found that employers raise employee contributions to encourage them to obtain coverage from their spouses' employers. Both Dranove et al (2000) and Vistnes et al (2006) control for premium size. While they found that an increase in the premium leads to an increase in the dollar amount that it is paid by the worker, they found a negative or insignificant effect on the on the share of the premium that is passed on to workers. Dranove et al (2000) concludes that, since premiums also reflect unmeasured plan quality, their results may be due to endogeneity.

Gruber and McKnight (2003) finds that the growth in health insurance premiums (proxied by the average state per-capita spending on medical care) and HMO penetration explain respectively 47 and 32 percent of the decline in the probability that an employer offered a health plan free of charge to its workers from 1982 to 1996. The tax subsidy on employer contribution and the availability of coverage outside the firm had only marginal roles. Marquis and Long (2001) estimate the level of employer contribution to the health insurance premium as a function of current labor market conditions. Among other factors, they found that the employer's premium share is higher when the firm operates in tighter labor market conditions, when there is greater union penetration and a greater share of workers are employed in big business. They do not control for insurance premiums, although they found that state income tax rates do not have a significant impact on the employer's contribution.

More recently, papers have examined the role wage rigidities might play in how firms distribute the burden of higher plan premiums. Sommers (2005) develops a simple theoretical model predicting that wage rigidities might cause firms to pass of some of the costs of rising health insurance premiums by lowering real wages (raising wages less than the rate of inflation). Using the March supplement of the CPS, the empirical analysis provides some support for the theoretical model for low-wage workers during a period of rapid premium growth. Vistnes and Selden (2011) use regional variations in premium and general inflation to identify the effect of wage rigidities on both employers' health insurance decisions using the 2000-2005 waves of the Medical Expenditure Panel Survey-Income Component. They find that firm responses to rapid increases in plan premiums vary according to firm characteristics. Premium inflation lowers the probability that small, low-wage employers will offer health insurance while larger low-wage employers continue to offer insurance but reduce eligibility. Both raise employee contributions when faced with rapidly rising premiums. By contrast, high-wage employers increase deductibles. While the MEPS-IC is a good data source for analyzing premium sharing decisions, the fact that it contains information on one plan per firm excludes it as a viable data source for the present study. Baicker and Chandra (2006) match worker-level data from the CPS with data on health insurance plans from the MEPS, assigning the average premium for that worker's state and year as the premium faced by the individual. They find that rising premiums result in lower wages in addition to a higher probability of being unemployed and fewer hours worked. Overall, these papers support the notion that wage rigidities, combined with rapidly rising wage premiums might lead firms to use premium sharing as a way of containing the rising costs of health insurance.

Vistnes et al. (2006) estimates the effect that the individual coverage premium has on the "marginal employee premium contribution", i.e. the difference between the contributions for individual and family coverage. Except for the latter study, the existing literature has primarily focused only on the determinants of premium sharing assuming that firms offer only one health plan. When multiple plans are offered, often a weighted average premium is used. However premium aggregation may not be a reasonable estimation strategy since the evidence suggests that there are interrelations between the premiums of alternative health plans. For example, Feldman et al (1993) found that offering an HMO increases the weighted average premium of a firm offering multiple plans. Both Baker and Corts (1995) and Mossirey et al. (2003) conclude that this increase in the average premium is due to the fact that higher HMO penetration decreases the premium on HMO plans but it increases the premium in non-HMO plans, such as PPO or conventional plans. The finding that HMO penetration can affect health insurance premiums together with Gruber and McKnight (2003)'s hypothesis that higher HMO penetration induces employers to increase worker's contribution (to push worker toward the cheaper option), lead to conjecture that HMO insurance premiums can have different effects on the premium sharing set by the firm for each of its health plans. By assuming that firms offer only one plan, the current literature has failed to shed light on this important aspect. This paper aims at filling this gap by presenting a model of the contribution schedule set as a function of the premiums of all the type of plans offered by a firm.

3. Theoretical background

A firm offers all employees the same wage, w, and two health insurance plans with different quality levels, Q_L and Q_H, and associated premiums P_L and P_H. The firm must choose

the employee contributions to each type of health plan, C_L and C_H. The wage offer w represents the salary that workers are expected to earn during each year of employment at the firm, which is supposed to last more than one period. Employees receive utility from net income (w- C) and their health insurance, with the higher quality plan yielding greater utility. That is, $U\left(w-\overline{C},Q_L\right)<U\left(w-\overline{C},Q_H\right)$. Hence, $C_H > C_L$ otherwise workers will always choose the high quality plan. Employees are heterogeneous according to their preferences over the quality of health insurance. If a worker opts for Q_L, he receives a payoff ε_L, while if he opts for Q_H, he receives a payoff ε_H. Both ε_L and payoff ε_H are measured in dollars. Assume that these payoffs are i.i.d. with sufficiently large mean that essentially all individuals purchase insurance at prevailing prices. Assuming utility functions are linear in income and benefit of chosen coverage, a worker will opt for Q_L if $w^* + \varepsilon_L - C_L \geq w^* + \varepsilon_H - C_H$, or:

$$\varepsilon_L - \varepsilon_H \geq C_L - C_H. \quad (1)$$

Let $\alpha = \varepsilon_H - \varepsilon_L$ with $\varphi(\alpha)$ denoting the probability density function and $\Phi(\alpha)$ the cumulative distribution function of the right hand side of equation (1). Then $p=\Phi(C_L - C_H)$ represents the probability that an individual will choose a high quality plan given the contribution scheme C_L and C_H. Hence $\frac{\partial p}{\partial C_L} > 0$ and $\frac{\partial p}{\partial C_H} < 0$.We assume that $\frac{\partial^2 p}{\partial C_L^2} = \frac{\partial^2 p}{\partial C_H^2} = 0$

At the time when a worker is considering whether to accept a job, s/he has the option of working for a firm that does not offer health insurance and pays a wage $\overline{w}$. He would then have to buy a health insurance plan privately. Hence, the agent will accept the offer $\{w, C_L, C_H\}$ only if

$$(1-\tau)w + E_{max}\{\varepsilon_L - C_L,\ \varepsilon_H - C_H\} \geq (1-\tau)\overline{w} + E_{max}\{\varepsilon_L - P_L,\ \varepsilon_H - P_H\}, \quad (2)$$

where τ represents the income tax rate. Equation 2 captures the fact that, given premiums P_L and P_H, a worker may prefer a low (or high) quality plan when purchasing insurance privately, but

s/he can prefer a different plan when purchasing the insurance through the employers, depending on C_L and C_H.

Let $\Gamma(a, b)$ denotes $E_{max}\{\varepsilon_L - a,\ \varepsilon_H - b\}$. Then $\Gamma[C_L, C_H]$ denotes the expected benefit of purchasing insurance through employment, and $\Gamma[P_L, P_H]$ denotes the expected benefit of purchasing insurance privately. We can rewrite equation (2) as:

$$(1-\tau)w + \Gamma[C_L, C_H] \geq (1-\tau)\overline{w} + \Gamma[P_L, P_H]. \quad (3)$$

Equation 3 says that an individual will accept a compensation package $\{w,\ C_L,\ C_H\}$ if w plus the benefit of purchasing health insurance through the employer are higher than the wage of the firm that does not offer health insurance plus the benefit of purchasing health insurance on the market. The firms cost minimization problem becomes:

$$\min \{w + (1-p)\ (P_L - C_L) + \ p(P_H - C_H)\}$$

$$\text{s.t. eq. (3)}, C_L \geq 0, w \ \& \ C_H > 0, \quad (4)$$

Lemma 1: An employer will require no contribution toward the low quality plan $\hat{C}_L = 0$ and a contribution toward the high quality plan $\hat{C}_H = \ (P_H - P_L) + \frac{\tau}{(1-\tau)} p / \frac{\partial p}{\partial C_H}$

Proof: see Appendix A

Lemma 1 implies that an employee's contribution to the high quality plan is increasing in the premium of the high quality plan and decreasing in the price of the low quality plan. Also, when τ=0, the firm will contribute the same amount toward each plan, $(P_H - C_H) = \ (P_L)$. This result is consistent with Levy (1997)'s "fixed subsidy" hypothesis. Hence, the firm pays for the cost of the low quality plan and employees that want to upgrade to a high quality plan pay for the difference between the cost of the high quality and the low quality plan. As τ increases, the employer's contribution to the high plan becomes $P_H - C_H = \ P_L - \frac{\tau}{(1-\tau)} p / \frac{\partial p}{\partial C_H}$ which is larger than the employer's contribution to the low quality plan (P_L) since $\frac{\partial p}{\partial C_H}$ is negative. This

illustrates the familiar trade-off between the tax advantage of lower employee contributions (because employer's contributions are not taxed) and the incentive to encourage employers to bear the full cost of insurance.

If wages are flexible, there is no interior solution for the low quality plan because any increase in the premium can be absorbed by a decrease in the wage rate. Employers (and workers) can benefit from a lower wage rate and fully subsidized health insurance coverage, due to the tax preferential treatment of insurance. However, only 16 percent of firms offered single coverage free of charge to its workers in 2011, down from 24 percent in 2002 (EHS 2011, Exhibit 6.14). Sommers (2008) claims that for employers to require employees to pay a contribution to participate in an employer sponsored health insurance plan one needs to assume some form of wage rigidities. In fact, if wages are sticky, the employer will respond to the increase in the cost of health insurance by requiring a contribution toward the premium.[3] Thus, we extend our model to allow for wage rigidities. In particular, we want to determine C_L^{t+1}, C_H^{t+1} and w^{t+1} such that $w^{t+1} \geq \hat{w}^t$, where $\hat{w}^t$ is the equilibrium wage in the previous period. Assume the ongoing wage in the relevant industry ($\overline{w}$) increases by a factor γ and the premiums of the low and high quality insurance plans increase by β_L and β_H respectively.In period t+1, equation 3 becomes:

$$(1-\tau)w^{t+1} + \Gamma(C_L^{t+1}, C_H^{t+1}) \geq (1-\tau)(1+\gamma)\overline{w} + \Gamma[(1+\beta_L)P_L^t, (1+\beta_H)P_H^t] \quad (3a)$$

Then, the minimization problem in period t+1 can be stated as:

$$\min \left\{ w^{t+1} + (1-p^{t+1}) \left((1+\beta_L)P_L^t - C_L^{t+1} \right) + p^{t+1} \left((1+\beta_H)P_H^t - C_H^{t+1} \right) \right\}$$

$$\text{s.t. eq. (3a)}, C_L^{t+1} \geq 0, \; C_H^{t+1} > 0 \text{ and } w^{t+1} \geq \hat{w}^t \quad (4a)$$

[3] Alternatively a firm could decrease the level of generosity of the coverage by selecting plans that require high co-payments or the amount of deductibles. While we take this option into consideration in the empirical analysis, we will herein focus only on the effect of sticky wages on the worker's contribution.

where p^{t+1}=$\Phi(\mathrm{C}_{\mathrm{L}}^{t+1} - \mathrm{C}_{\mathrm{H}}^{t+1})$. Assuming the sticky wage constraint is binding, the firm will require a contribution for employees to subscribe to low quality plans and increase the contribution toward the high quality plan of the same amount (fixed subsidy hypothesis).

Lemma 2: If the sticky wage constraint is binding, the employer will ask a contribution toward the low quality plan $\tilde{C}_L^{t+1} = \varphi(\gamma, \beta_L, \beta_H, P_L^t, P_H^t)$ implicitly defined by:

$$\overbrace{-(\gamma\bar{w})}^{1} + \frac{1}{(1-\tau)}\overbrace{\{\Gamma[\mathrm{P}_{\mathrm{L}}^{\mathrm{t}},\ \mathrm{P}_{\mathrm{H}}^{\mathrm{t}}] - \Gamma[(1+\beta_L)\mathrm{P}_{\mathrm{L}}^{\mathrm{t}}, (1+\beta_H)\mathrm{P}_{\mathrm{H}}^{\mathrm{t}}]\}}^{2}$$

$$-\frac{1}{(1-\tau)}\overbrace{\left\{\Gamma\left[0, (\mathrm{P}_{\mathrm{H}}^{\mathrm{t}} - \mathrm{P}_{\mathrm{L}}^{\mathrm{t}}) + \frac{\tau}{(1-\tau)}p^t/\frac{\partial p^t}{\partial C_H}\right] - \Gamma\left[0, (1+\beta_H)\mathrm{P}_{\mathrm{H}}^{\mathrm{t}} - (1+\beta_L)\mathrm{P}_{\mathrm{L}}^{\mathrm{t}} + \frac{\tau}{(1-\tau)}p^{t+1}/\frac{\partial p^{t+1}}{\partial C_H^{t+1}}\right]\right\}}^{3}$$

$$+\left[(\hat{p}^{t+1})^2 - (\tilde{p}^{t+1})^2\right]\frac{\tau}{(1-\tau)}/\frac{\partial p^{t+1}}{\partial C_H^{t+1}}\,.$$

Proof: see Appendix B

The first term indicates the effect on $\tilde{\mathrm{C}}_L^{t+1}$ due to an increase in the industry wage. The faster the industry wage grows, the lower the contribution toward the low quality plan, as the sticky wage constraint becomes less binding. The second and third terms show the effect of β_L and β_H on $\tilde{\mathrm{C}}_L^{t+1}$. Note that the second term is positive when $\mathrm{P}_{\mathrm{L}}^{\mathrm{t}}$ increases because Γ is a decreasing function of β_L (i.e. the expected benefit of purchasing health insurance in the market is lower when $\mathrm{P}_{\mathrm{L}}^{\mathrm{t}}$ increases). As such $\tilde{\mathrm{C}}_L^{t+1}$ is expected to increase with β_L. The third term is negative when $\mathrm{P}_{\mathrm{L}}^{\mathrm{t}}$ increases because Γ is an increasing function of β_L (i.e. the expected benefit of purchasing coverage from the employer is higher when $\mathrm{P}_{\mathrm{L}}^{\mathrm{t}}$ increases since the contribution toward the high quality plan goes down). However, since this effect has a negative sign, it also indicates that $\tilde{\mathrm{C}}_L^{t+1}$ should increase with β_L. Hence both terms indicates that $\tilde{\mathrm{C}}_L^{t+1}$ should increase with β_L. It is not possible to determine *a priori* the sign of the effect of β_{H} on $\tilde{\mathrm{C}}_L^{t+1}$ because an increase in $\mathrm{P}_{\mathrm{H}}^{\mathrm{t}}$ decreases both the expected benefit of purchasing health insurance in the market and the expected benefit of purchasing coverage through employment. Again, since the third term appears in equation (viii) with a negative sign, the final effect depends on the

relative size of the two terms. Similarly, $\tilde{C}_H^{t+1}$ should increase with β_H, but it is not possible to determine *a priori* the sign of the effect of β_L.

4. Methodology and estimation strategy

The theoretical model posits that firms offering two health insurance plans will set the worker's contribution towards the plan premium as a function of both premiums in the previous period as well as the change in the premiums between the two periods. Also, the model predicts the worker's contribution is a function of the industry's wage growth. Hence we use industry dummies to control for industry wage growth. Finally, the contribution schedule should be affected by the preferred tax treatment of the employer's contribution. Unfortunately, we cannot compute the marginal tax rate of employees because we do not know in which state the firm is located. However, since we observe multiple observations per firm, we assume the state fiscal legislation is constant over time (at least over a short period) and we control for this factor by means of firm fixed effects.

We restrict our analysis to firm that offer two types of plans: Preferred Physician Organization (PPO) and Health Maintenance Organization (HMO) plans. For empirical purposes, it is quite irrelevant which one is the high quality and the low quality plan, because the econometric specification for each worker contribution is identical. However one could reasonably consider PPO plans as the high quality plans because they offer more flexibility in terms of the choice of health care services and providers. We estimate the log of a worker's contribution in firm "*j*" at time "t" to the monthly premium for each plan ($ContrHMO_{j,t}$, $ContrPPO_{j,t}$) as a function of both premiums in the previous year in logs ($PrmHMO_{j,t-1}$**,**

$PrmPPO_{j,t-1}$) and the change in the log of each premium from the previous period ($\Delta PrmHMO_{j,t}$, $\Delta PrmPPO_{j,t}$):

$$ContrHMO_{j,t} = \alpha_i + \alpha_1 prmHMO_{j,t-1} + \alpha_2 prmPPO_{j,t-1} + \alpha_3 \Delta prmHMO_{j,t} + \alpha_4 \Delta prmPPO_{j,t} + \gamma X_{j,t} + \varepsilon^1_{j,t}$$
$$ContrPPO_{j,t} = \beta_i + \beta_1 prmHMO_{j,t-1} + \beta_2 prmPPO_{j,t-1} + \beta_3 \Delta prmHMO_{j,t} + \beta_4 \Delta prmPPO_{j,t} + \delta X_{j,t} + \varepsilon^2_{j,t}$$

where X is a vector of firm characteristics including indicator variables for urban location, union membership, firm size measured by the level of employment, region (Northeast, Midwest, and West with South serving as the comparison group), and a series of industry dummy variables.

The model in the previous section assumes that the probability a worker will select a plan decreases as the plan becomes more expensive (i.e. $\frac{\partial p}{\partial c_H} < 0$). However, the higher premium could also reflect an improvement in the quality of the coverage (Jensen and Morrisey, 1990). In this case, an increase in the premium should not necessarily translate into fewer workers selecting a given plan, unless one conditions on the quality level of the health insurance plan and controls for factors that may affect the demand for better quality health insurance. Hence we also estimate an extended version of our model which includes variables for plan characteristics such as the annual deductible, an indicator variable for whether the firm's plan is self-insured (rather than underwritten), co-pay and coinsurance rates for each of the following: office visits, hospital visits and generic drug prescriptions, and the hospital visit per diem, if any. Furthermore we include a set of work-force characteristics that may affect the demand for health insurance quality, such as the fraction of employees who are making less than $25,000 per year and if the firm makes the health insurance plans available to part-time and temporary workers. We prefer to estimate the model with and without the plan characteristics because we acknowledge these variables can potentially be endogenous. In fact, as noted in footnote 4, an employer may

respond to an increase in the health insurance premium with a decrease in the generosity of the coverage, by selecting plans that require higher co-payments and deductibles.

We use two alternative approaches to estimate our model. We exploit the panel nature of the data used for the estimation to control for unobservable characteristics among firms that may be correlated with premium sharing. Since the dependent variable is censored to take values between zero and one, first we use the Tobit estimator. Our use of the Tobit estimator means we can only control for firm-level random effects. However, a firm's unobserved heterogeneity may be correlated with the included variables. Moreover, we recognize that our sample is not representative of the entire universe of firms in the US, but is restricted to firms that offer both a PPO and an HMO plan. To address both issues we also estimate a linear fixed effects model. We believe that a fixed effects model is better suited than a selection model to control for sample selection biases because one can identify alternative selection processes. For example, one could think of the selection process as the probability that a firm offers both plans, or as the probability that a firm does not require a contribution to the low quality plan. No matter what the underlying selection process is, the fixed effects estimator should be able to consistently estimate the model, as long as the selection process is determined by the time invariant characteristics α_i and β_i (Ackerberg et al, 2007, p. 4209)

5. Data

The estimation employs the 2005-2010 waves of the Employer Health Benefits Survey collected by the Kaiser Family Foundation and the Health Research and Educational Trust. These datasets contain rich information on the types of plans offered by firms, key characteristics for the types of plans offered and key employer information. Completed surveys are available

for 1,932 firms in 2005, 1,932 firms in 2006, 1,839 firms in 2007, and 1,776 firms in 2008, 1,892 firms in 2009 and 1,892 firms in 2010, leading to a total sample size of 11,136 firm-year observations. The numbers of observations reflect a response rate of just under fifty percent in each year. KFF and HRET attempted to repeat interviews with firms in successive waves of the survey. In order to maintain the general structure of the sample size, non-responding firms were replaced with a firm belonging to the same industry and size category. The survey identifies ten industry and seven firm size categories.[4] Interviews were also attempted with non-responding firms from the previous year, so that a firm may be included in the survey in non-consecutive years. The six-year sample includes 1,725 firms that participated in two out of the six years, 1,656 firms that participated in three years, 1,823 firms that participated in four surveys, 2,233 that participated in five surveys and 1,887 firms participated in all six years.

The information contained in the surveys was obtained through interviews with each firm's benefits manager or human resources manager. Employers are asked whether they offer plans grouped into five categories: conventional plans, health maintenance organization (HMO) plans, preferred provider organization (PPO) plans, point of sale (POS) plans and high-deductible plans (HDP) linked to either a health retirement or health savings account. If the firm offers any plans in a particular category, then information is gathered on the largest plan in that category. Thus, we cannot compare premium sharing between plans in the same category, only between plans across categories. For firms with multiple establishments, it is possible that the largest plans in each category are offered to employees at different locations. To the extent this occurs, it should push the coefficients on the cross-plan variables towards zero since there is no

[4] The industries are: Mining, Construction, Manufacturing, Transportation / Utilities / Communication, Wholesale, Retail, Finance, Service, Government, and Healthcare. The firm size categories are: 3-9 workers, 10-24 workers, 25-49 workers, 50-199 workers, 200-999 workers, 1000-4999 workers, and 5000+ workers.

reason to believe premium prices at one location will have an impact on cost sharing at another location, at least when controlling for firm fixed effects.[5]

The estimation in this paper focuses on two categories: HMO and PPO. These two types of plans represent the most common plans offered by firms. Table 1 shows that roughly 75 percent of firms offer a PPO plan, while nearly one-in-three offer an HMO. By contrast, over the entire sample period, less than twenty-one percent of firms in the sample offer POS plans, with a downward trend in this category (less than fifteen percent of firms offered POS plans in 2010). Also, HMO and PPO plans represent the vast majority of enrollment for the firms in the sample. In fact, PPO and HMO plans together account for nearly eighty percent of enrollees in each year of the survey. Moreover, the statistics in Table 2 show that HMO and PPO plans are the two plans most likely to be sponsored together by the same firm. Slightly less than one-third of firms offering a PPO also offer an HMO plan (Table 2), while roughly one-in-ten will offer a POS plan along with the PPO plan. Conversely, over seventy-two percent of firms offering an HMO also offer a PPO. Thus, focusing on firms which offer both a PPO and an HMO plan serves as an excellent starting point for the analysis.

Table 3 presents the average premium, worker's contribution and contribution share for all four plan types by year, for the estimation sample. All monetary values are deflated using the CPI and presented in 2005 dollars. The average premium has increased (in constant dollars) each year for all plans over the period under analysis, although the increase was larger for HMO plans (20.48 percent over the five year period) than for PPO plans (14.31 percent). Together with this increase in the health insurance premiums, we observe an increase of the size of the worker's contribution. Concurrent with the rise in premiums, workers' contributions have risen even more

[5] Kaiser and HRET have added a question as to whether the firm is a single or multiple establishment entity; however this information is only available beginning in 2008. Focusing on single establishment firms leads to a greatly reduced sample size.

rapidly. The workers' share of the premium rose from 16.66 (16.51) percent to 20.06 (19.2) percent for single HMO (PPO) plans. Even with the modest increase in the workers' share of the burden, firms have absorbed most of the rising cost of health insurance.

Table 4 presents summary statistics for the key variables used in the analysis (again, all monetary values are presented in 2005 dollars). Firm-year observations are excluded from the final sample if any of the key variables are missing, the firm reports having changed industries or region at any time during the sample period. Given the highly aggregated nature of the industry categories, it is very likely that changes in industry reflect bad information, including the possibility that different firms have been assigned the same id. Therefore, it is safer to omit these firms. While it is highly plausible that a firm will relocate its primary location to another part of the country (witness the movement of insurance firms from the Hartford, Connecticut area to Charlotte, North Carolina) this move is likely to be accompanied by or reflect other significant changes for the firm which may also affect its health insurance offerings and premium sharing. The latter exclusion results in a loss of seven firms and twenty firm-year observations, while the former excludes another seven firms and nineteen observations. The loss of such as small number of observations is deemed acceptable compared to the potential gain from eliminating the confounding factors described above.

There are 2,659 firm-year observations for firms offering both an HMO and a PPO plan. The average monthly premium for single plans is $406.22 and $350.83 for PPO and HMO plans, respectively. This finding reinforces our assumption that the HMO is the low quality plan and the PPO is the high quality plan, since the low quality plan has to be cheaper than the high quality plan. The average employee's premium share for PPO plans for single coverage is 20.1 percent. For HMO plans, the corresponding figure is 17.6 percent. These statistics show on

average employees pay a smaller share of the premium for HMO plans. Furthermore, the data show significant variation in plan costs and contribution rates. In PPO plans, the average co-pay for an office visit is $14.33 while the average hospital visit co-pay is $61.46 and $8.54 for generic drug prescriptions. Although HMO plans are cheaper, they have higher co-pays: the average co-pay for an office visit is $15.32 while the average co-pay is $105.59 for a hospital visit and $8.98 for generic drug prescriptions. These variables provide some indication of the plan's quality; however it is not the only indicator. PPO plans offer enrollees greater physician choice, and are less likely to require referrals from the primary physician in order to see a specialist. Thus, because of these features, PPO plans are generally considered better by potential enrollees than HMO plans offering otherwise similar characteristics.

Since the estimation sample only includes the roughly one-in-four firms providing both types of plans, it is natural to ask whether these firms differ in some significant way from those firms which do not offer both plan types. Columns 2-3 provide sample means for key variables for three groups of firms: those offering both types of plans, those offering HMO plan(s) only and those offering only PPO plan(s). Firms offering both types of plans are similar in terms of the quality and cost of the HMO plans offered; the average premium and co-pays are similar across the two groups. Furthermore, the premium share incurred by employees is also very similar. However, firms offering both types of plans have a substantially lower annual deductible, on average. Firms offering both plan types have more expensive PPO plans and higher worker contribution to PPO plans. The finding is consistent with results in the literature that higher HMO penetration should decrease the HMO plan premium and increase the PPO plan premium. As such firms offering an HMO plan should have on average more expensive PPO plans. Consequently, since a worker contribution to the PPO plan is a function of the gap

between the two premiums, it is expected to be higher for firms that offer an HMO plan if HMO penetration increases the PPO premium. Moreover, if a firm offers only a PPO plan, there is no compatibility constraint on the contribution for the high quality plan and the firm has an incentive to lower the worker contribution to the PPO plan to capitalize on the tax advantage of the employer contribution.

Firms offering both types of plans have a much lower annual deductible but are much larger and far more likely to be unionized. The difference in firm size and unionization helps to explain how these firms are able to offer plans with much lower annual deductibles as larger firms receive better rates from health insurers or unions can bargain a more generous health insurance package. While there are some important differences between the types of firms in terms of plan quality and cost sharing, these differences are relatively small except in terms of the annual deductible.

6. Results

Before turning to the main results, we test the key predictions of the naïve model which assumes the wage constraint is not binding. Lemma 1 predicts that the firm requires no contribution to the low-quality plan while the workers' contribution to the high-quality plan depends on the difference between the high and low-quality premiums. The fixed subsidy hypothesis can be easily generalized to allow for a sorting mechanism of the type described in Dranove et al (2000). In that case, the contribution to the low quality plan should depend on the low quality plan premium also, while the contribution to the high quality plan continues to be a function of the difference between the two premiums. We test the latter set of predictions by regressing the log employee's contribution for each type of plan against the log monthly

premium for both plan types.[6] Both models are fitted first using the random effects Tobit estimator and then using fixed effect OLS estimation. We estimate both the basic (excluding plan characteristics) and extended (including plan characteristics) models for HMO and PPO plans. Since the premium and contribution variables are in logs, the coefficients represent elasticities. All models control for year and industry fixed effects.

Columns 1-4 (table 5) provide results for the models using the log of the workers' contribution to the HMO plan as the dependent variable. The results in column 1 are for the basic model fitted using the Tobit estimator. The results indicate that employees' contributions to both types of plans are positively correlated with the own-plan price and negatively correlated with the cross-plan price. The latter result is unexpected (according to the naïve model) since the worker contribution to the low-quality plan (HMO) should be independent from the PPO premium. When applying the fixed effects estimator (column 2), the results indicate workers' contributions for HMO plans depend only on the own-plan price, as predicted by the model. Both models suggest a premium elasticity of the worker's contribution of about 1. The Tobit results also show that larger firms require a greater contribution while unionized workplaces have lower employee contributions to HMO plans. These effects disappear in the fixed effects model, mostly likely due to the fact that unionization and firm size does not change much from year to year. Additionally, workers in firms with a higher fraction of low income workers have higher contributions.

Columns 3-4 present the results for the extended model using Tobit and fixed effects estimation, respectively. Including plan characteristics as explanatory variables does not take away from the coefficients of primary interest. Except for generic drug co-pay in the Tobit

[6] Note that, instead of imposing the restriction that the high quality plan premium should not affect the low quality worker contribution, we choose a more flexible model to test whether this restriction is actually binding.

model, none of the plan characteristics show a statistically significant effect on employee contributions. One might be tempted to interpret this as showing that employee's contributions are not a function of plan characteristics. However, given we control for the premium, these results show that employees do not pay more for better quality plans than is already reflected in the higher premium associated with providing a better quality plan.

Turning to the results for employees' contributions to PPO plans, we see similar patterns when fitting the basic model. As predicted by the theoretical model, the workers' contribution to the PPO plan is positively correlated with the PPO premium and negatively correlated with the HMO premium in the Tobit model (column 5), but the latter becomes insignificant in the fixed effects model (column 6). The estimates of the own price elasticity are always greater than 1 suggesting that, at least for PPO plans, employers do tend to shift the cost of health insurance onto workers as the PPO premium increases. Again adding in controls for plan characteristics does not significantly alter the coefficients on the key variables. The results obtained using the Tobit estimator show that the employee contribution decreases as the hospital visit per diem increases, but increases as the hospital visit co-pay increases. The latter result seems to suggest that workers with lower quality PPO plans also contribute more towards their premiums. However, this result is likely picking up firm fixed effects in terms of the generosity of the benefits package. Indeed, the fixed effects estimates show that workers facing higher co-pays for generic drugs tend to have lower contributions towards their PPO plans.

Next, we turn to the results based on Lemma 2 laid out in section 3 (Table 6). All empirical models include the full set of controls listed in Table 5, but only the coefficients for the relevant variables are reported. Unfortunately our sample size is cut in half because we can

include only observations for which we have information on the insurance premiums in the previous period.

The results from the Tobit regression for the HMO plan (column 1) support the prediction of our theoretical model: the contribution is positively correlated with both the change in monthly HMO premiums and the lag HMO premium, while the worker's contribution to the HMO plan is found to be negatively correlated with both changes in the PPO premium and the lagged PPO premium. Column 2 presents the results from the HMO plan fixed effects estimation. These results continue to show a strong own-price effect on worker's contributions. However, the cross-price variables show mixed results. The contribution to the HMO plan is now increasing in the lag PPO premium (however the coefficient is only statistically significant at the ten percent level). While this result may at first seem counterintuitive, it does not violate the model's predictions since the effect of the PPO premium on worker contributions to the HMO could be positive or negative depending on the relative magnitude of change in the expected benefit from purchasing the health insurance plan in the market rather than from the employer.

After including plan characteristics, the coefficients on the change in the HMO premium, the lag HMO premium and the lag PPO premium increase in magnitude and the latter is now significant at the five percent level (column 3-4). Contrary to the results in Table 5, we find that the own premium elasticity of the worker's contribution for PPO plans is larger than 1, suggesting that the firms respond to a PPO premium increase by shifting more of the burden to workers when wages are not flexible. For example, using the results in column 4, we find that a 10 percent increase in last period's HMO premium results in a 14 percent increase in the

worker's contribution to the HMO plan in the current period and a similar increase in the HMO premium growth rate results in a 13.37 percent increase in the workers' contribution.

The workers' contribution to the PPO plan is positively correlated with both the lagged PPO premium and the change in the PPO premium and negatively correlated with the lagged HMO premium and change in the HMO premium (column 5 and 7). In the fixed effects estimates, we continue to observe positive and highly statistically significant coefficients on both the lagged PPO premium and the change in the PPO premium variables (column 6 and 8). While the coefficients on the HMO premium variables continue to be negative, they are no longer statistically significant. The results suggest a large elasticity on the lag PPO premium. As the lag PPO premium increases by 10 percent, the worker's contribution toward the PPO increases by twice as much.

Overall, the results for the model assuming wage rigidities show stronger support for the theoretical model in the random effects Tobit model. However, once we control for firm fixed effects, some of the cross premium variables become insignificant. These latter results should be viewed with some caution since we only have an average of 2.1 observations per firm. It is well established that the fixed effects estimator may suffer from significant attenuation bias in short panels.

Robustness Checks

In addition to the attenuation bias that accompanies fixed effects estimation, there are other features of the data that may add additional noise leading to underestimation of the key coefficients. For all robustness checks, fixed effects estimation is employed to fit the extended model, and the full set of controls are included. For the sake of brevity, only the coefficients for

the four premium variables are presented. Table 7 presents the results of two robustness checks performed on both the HMO and PPO contributions. For the first robustness check, we keep only consecutive observations for firms. Recall that Kaiser/HRET attempt to reintroduce firms that dropped out of the sample. In these cases, the change in premium variables capture changes over two years. This may dilute the relationship between past premiums and current burden sharing.

The results of this robustness check are presented in the first two columns of table 7. This exclusion results in the loss of twenty-eight firms and fifty-three observations from the sample. The results are generally consistent with those presented in column 4 of table 6, however the coefficients are somewhat smaller in magnitude and the coefficient on the lag PPO premium is now statistically significant at the ten percent level. By contrast, the results for the PPO contribution show larger coefficients for three of the four primary variables and the coefficient on the change in the HMO premium becomes significant at the ten percent level (compare to column 8 in table 6). In general, the results for both plan types are similar.

The second robustness check excludes employers who report more than fifty percent of their employees make less than $20,000 per year. Health care costs represent a higher fraction of total labor costs for these low-wage firms, placing even greater pressure on them to pass on rising health insurance premiums to their workers. The results, presented in columns 3-4 are similar to those presented in columns 4 and 8 of table 7. The relationship between contributions and premiums and premium changes are smaller in magnitude for the HMO contributions and the results no longer show a statistically significant effect of either lagged PPO premiums or PPO premium changes on employee contributions to HMO plans. By contrast, the PPO model

continues to show strong own price effects and now shows a significant, negative impact of changes in the HMO premium on employee contributions to the PPO plan.

As a final robustness check, we take into account the possibility that including both lagged premium variables and change in premium variables while controlling for fixed effects may be slicing the data too finely given that we only have an average of 2.1 observations per firm. Table 8 presents results for the extended models (again fitted via fixed effects estimation) excluding one of the cross price variables at a time. Columns 1 and 4 recreate the key results from columns 4 and 8 of table 6, respectively. Column 2 presents the key results excluding the lagged PPO premium. The results show that the coefficient on the change in the PPO premium is negative and statistically significant at the five percent level. Excluding the change in the PPO premium (column 3) results in a positive and highly statistically significant coefficient on the lagged PPO premium, while excluding the change in the HMO premium variable yields results that show virtually no correlation between lagged HMO premiums and current employee contributions towards the PPO plan. These results, combined with the reduction in the standard errors (due in part to the change in sample size) suggest that the model specification is placing significant demand on the remaining variation once we control for firm fixed effects. Overall, the results presented in the robustness checks continue to show strong support for most of the theoretical model's predictions.

7. Conclusions

This paper developed a simple model of how firms determine employee contributions towards health insurance premiums when multiple plans of different quality are offered. We derive the conditions for premium sharing under two possible scenarios: (1) the flexible wage;

(2) wage rigidities. Our model predicts that when there are no wage rigidities and workers can sort themselves across firms according to their preferences for the wage/health insurance trade off, the employer should provide the low quality plan health insurance free of charge and ask individuals who prefer a higher quality insurance plan to pay the difference in the premiums of the two plans. When we include wage rigidities, the employee's contribution toward each plan becomes a function of the wage growth in the industry, the premium growth over time, and the level of the both premiums in the previous period.

The empirical estimation using firm-level data from 2005-2010 is based on the assumption that HMO plans are low quality plans and PPO plans are high quality plans. This selection was supported by the fact that PPO plans are on average more expensive than HMO plans. The results for the naïve model reject the hypothesis of perfect sorting, because we found that employee's contribution to an HMO plan is a function of the HMO premium. The result that employee's contributions to HMO plans are affected also by the PPO premium (at least in the random effect Tobit) questions the validity of the flexible wage hypothesis. In the model assuming wage rigidities, the results obtained via random effects Tobit estimations show strong support for our predictions. However, once we control for firm fixed effects, some of the cross premium variables become insignificant. Overall, the results highlight the importance of (1) running separate regression for the worker's contribution to each plan and (2) including both premiums in the regression rather than an average or just the own premium as done in previous research, since each premium has an opposite effect on the contribution level sets by the firm for each plan. Consequently, using only one premium and one contribution level would lead to an underestimation of the true responsiveness to the employee's contribution to the plan premium. Finally, assuming wage rigidities leads to bigger elasticity estimates than using a model with

flexible wages. Hence the results of the specification based on the wage rigidity assumption better explain the recent shift of the cost of health insurance on employees. Overall, we found that the employee's contributions to PPO plans are more sensitive the own premium increases than employee's contributions to HMO plans.

This study focuses only on employee contribution's setting toward individual coverage plans only. Future research should extend this analysis to derive the conditions for employees' contributions when a firm offers both individual and family coverage plans.

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Table 1: Offer and coverage rates for different types of plans

	2005	2006	2007	2008	2009	2010	2005-2010
Percent of firms offering a conventional plan	9.93	9.62	7.88	5.91	3.79	3.86	6.83
Percent of firms offering an HMO plan	35.37	33.75	32.46	32.43	31.8	32.08	32.98
Percent of firms offering a PPO plan	76.64	74.78	74.39	74.32	76.2	77.48	75.65
Percent of firms offering a point of sale plan	25.05	22.42	22.89	21.57	18.14	14.48	20.73
Percent of employees enrolled in a conventional plan	3.96	4.56	2.91	2.65	1.65	1.43	2.86
Percent of employees enrolled in an HMO plan	20.32	19.22	17.88	18.24	17.69	17.51	18.48
Percent of employees enrolled in a PPO plan	60.65	58.4	57.87	57.8	59.26	60	59
Percent of employees enrolled in a point of sale plan	15.07	14.17	15.81	14.07	12.32	9.14	13.41
Number of observations	1,832	1,923	1,839	1,776	1,874	1,892	11,136

Table 2: conditional probability of offering a particular type of health insurance plan

Of the firms offering an HMO plan:	2005	2006	2007	2008	2009	2010	2005-2010
Percent offering a PPO plan	71.76	71.65	73.53	71.00	73.49	74.79	72.69
Percent offering a POS plan	23.92	20.8	19.43	20.66	14.77	13.67	18.95
Of firms offering a PPO plan:							
Percent offering an HMO plan	33.12	32.34	32.09	30.98	30.67	30.97	31.7
Percent offering a POS plan	13.82	12.44	11.11	10.30	8.26	6.48	10.38
Of firms offering a POS plan:							
Percent offering an HMO plan	33.77	31.32	27.55	31.07	25.88	30.29	30.16
Percent offering a PPO plan	42.27	41.53	36.1	35.51	34.71	34.67	37.87

Table 3: Premiums, worker contributions and shares by plan type

Health Maintenance Organization (HMO):	2005	2006	2007	2008	2009	2010	2005-2010
Monthly premium for single coverage	321.55	331.45	342.61	361.64	370.74	387.42	351.84
Worker's contribution for single coverage	52.17	53.93	56.43	59.56	66.84	77.43	61.09
Percent worker's contribution for single coverage	16.66	16.9	16.9	16.84	18.67	0.206	17.18
Observations	646	649	597	576	596	601	3,665

Preferred Physician Organization (PPO):	2005	2006	2007	2008	2009	2010	2005-2010
Monthly premium for single coverage	360.86	367.37	374.08	381.89	398.59	412.51	382.76
Worker's contribution for single coverage	57.54	59.86	61.87	62.55	70.26	76.45	64.86
Percent worker's contribution for single coverage	16.51	16.92	17.25	17	18.26	19.2	17.54
Observations	1,401	1,438	1,368	1,320	1,428	1,452	8,407

Table 4: Summary statistics

	HMO and PPO	HMO Only	PPO Only
Worker's monthly contribution: single PPO plan	80.9		57.95
	(65.44)		(53.65)
Worker's monthly contribution: single HMO plan	60.28	63.21	
	(49.03)	(67.79)	
Monthly premium for single PPO plan	406.22		371.86
	(120.9)		(115.99)
Monthly premium for single HMO plan	350.83	354.97	
	(91.92)	(109.97)	
Total employment*	4,543.1	1,682.81	1,506.69
	(15,223)	(12,658.9)	(6,440.1)
Percent employee's low income (<$20,000)	13.34	18.73	17.26
	(18.17)	(23.43)	(21.12)
Urban location indicator	0.949	0.892	0.785
	(0.22)	(0.311)	(0.411)
Union indicator	0.481	0.251	0.269
	(0.5)	(0.434)	(0.443)
Part time workers eligible for insurance indicator	0.598	0.468	0.402
	(0.49)	(0.499)	(0.49)
Temporary workers eligible for insurance indicator	0.086	0.074	0.049
	(0.28)	(0.262)	(0.216)
Northeast region indicator	0.243	0.354	0.166
	(0.429)	(0.354)	(0.372)
Midwest region indicator	0.442	0.273	0.664
	(0.83)	(0.273)	(0.942)
West region indication	0.218	0.27	0.137
	(0.413)	(0.444)	(0.344)
Annual deductible single PPO	291.51		428.27
	(359.35)		(569.29)
Self insure dummy PPO	0.603		0.53
	(0.489)		(0.499)
Office visit co-pay PPO	14.33		16.33
	(8.51)		(9.07)
Office visit coinsurance rate PPO	2.78		2.65
	(6.47)		(6.65)

Hospital visit co-pay PPO	61.46		47.31
	(134.34)		(125.97)
Hospital visit coinsurance rate PPO	7.78		7.9
	(8.39)		(9.19)
Hospital visit per diem PPO	4.83		3.21
	(34.36)		(25.7)
Generic drug co-pay PPO	8.54		9.04
	(4.54)		(5.02)
Generic drug coinsurance rate PPO	1.91		2.27
	(6.07)		(6.75)
Annual deductible single HMO	64.03	148.27	
	(211.8)	(372.91)	
Self insure dummy HMO	0.344	0.18	
	(0.475)	(0.385)	
Office visit co-pay HMO	15.32	16.99	
	(6.35)	(7.22)	
Office visit coinsurance rate HMO	0.373	0.263	
	(2.417)	(2.269)	
Hospital visit co-pay HMO	105.59	106.75	
	(159.09)	(178.33)	
Hospital visit coinsurance rate HMO	2.14	2.545	
	(5.62)	(6.433)	
Hospital visit per diem HMO	13.9	20.85	
	(58.78)	(75.87)	
Generic drug co-pay HMO	8.98	9.99	
	(3.91)	(4.417)	
Generic drug coinsurance rate HMO	0.857	0.556	
	(4.31)	(4.052)	
Observations	2,589	960	5,419

All monetary values reported in 2005 dollars.
*Total employment variable top-coded at 500 employees in 2008.

Table 5: Regression results under the flexible wage scenario

	Log of contribution to HMO Plan				Log of contribution to PPO Plan			
	RE Tobit	FE	RE Tobit	FE	RE Tobit	FE	RE Tobit	FE
	1	2	3	4	5	6	7	8
Log of monthly HMO premium	0.948***	0.962***	0.934***	1.025***	-0.409***	-0.106	-0.410**	-0.202
	(0.1408)	(0.199)	(0.147)	(0.219)	(0.134)	(0.222)	(0.179)	(0.231)
Log of monthly PPO premium	-0.336**	0.081	-0.250*	0.131	1.270***	1.491***	1.18***	1.423***
	(0.137)	(0.205)	(0.139)	(0.218)	(0.130)	(0.2853613)	(0.191)	(0.293)
Log total employment	0.111***	0.002	0.106***	-0.004	0.064***	-0.035	0.055**	-0.044
	(0.024)	(0.037)	(0.025)	(0.037)	(0.023)	(0.034)	(0.024)	(0.032)
Percent employees low income	0.006***	0.005*	0.006***	0.005*	0.003*	0.003	0.003	0.003
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
Urban indicator	0.092	0.622	0.112	0.615	0.284	0.723	0.247	0.782
	(0.213)	(0.525)	(0.216)	(0.564)	(0.186)	(1.076)	(0.185)	(1.138)
Union indicator	-0.494***	-0.242	-0.475***	-0.240*	-0.397***	-0.240	-0.299***	-0.040
	(0.091)	(0.149)	(0.093)	(0.130)	(0.083)	(0.221)	(0.083)	(0.208)
Part time workers eligible	0.079	-0.038	0.087	-0.017	-0.035	-0.066	0.010	-0.028
	(0.068)	(0.069)	(0.068)	(0.065)	(0.065)	(0.077)	(0.058)	(0.073)
Temporary workers eligible	-0.041	0.036	-0.031	0.025	0.047	0.132	0.073	0.198
	(0.107)	(0.106)	(0.109)	(0.110)	(0.102)	(0.150)	(0.127)	(0.170)
Northeast indicator	0.131		0.167		0.103		0.146	
	(0.140)		(0.142)		(0.122)		(0.098)	
Midwest indicator	-0.00061		-0.001		-0.033		-0.024	
	(0.0719)		(0.073)		(0.062)		(0.053)	
West indicator	-0.743***		-0.737***		-0.537***		-0.468***	
	(0.142)		(0.143)		(0.123)		(0.120)	
Self-insured			0.059	-0.052			0.100	0.025
			(0.075)	(0.082)			(0.073)	(0.110)

Annual deductible			3.5E-5	3.8E-5			6.4E-6	6.1E-5
			(1.2E-4)	(9.3E-5)			(8.2E-5)	(9.9E-5)
Office visit co-pay			0.009	0.003			-0.003	-0.002
			(0.006)	(0.006)			(0.004)	(0.007)
Office visit coinsurance rate			0.008	0.002			-0.008	-0.012
			(0.013)	(0.005)			(0.007)	(0.009)
Hospital visit co-pay			0.0001	-0.0002			0.0003*	0.0002
			(0.0002)	(0.0002)			(0.0002)	(0.0002)
Hospital visit coinsurance rate			0.004	-0.001			0.006	0.004
			(0.006)	(0.005)			(0.004)	(0.004)
Hospital visit per diem			-0.0003	0.0004			-0.002*	-0.002*
			(0.0005)	(0.0005)			(0.001)	(0.001)
Generic drugs co-pay			0.017**	0.009			0.012	0.013
			(0.008)	(0.007)			(0.008)	(0.012)
Generic drugs coinsurance rate			0.010	0.0039			-0.003	-0.007
			(0.007)	(0.004)			(0.005)	(0.005)
Constant	-0.406		-1.186		-2.001*		-1.624	
	(1.190)		(1.221)		1.097		(1.371)	
R-squared		0.0827		0.0890		0.0954		0.1044
Observations	2589	2589	2470	2470	2589	2589	2438	2438
Firms	1243	1243	1217	1217	1243	1243	1206	1206

All models include year and industry indicators.
Clustered standard errors in parenthesis

Table 6: Regression results under the wage rigidity scenario

	Log of contribution to HMO Plan				Log of contribution to PPO Plan			
	Tobit	FE	Tobit	FE	Tobit	FE	Tobit	FE
	1	2	3	4	5	6	7	8
Change in the log of monthly HMO premium	1.15**	1.207**	1.18**	1.337**	-0.876**	-0.523	-0.886**	-0.564
	(0.321)	(0.342)	(0.334)	(0.368)	(0.321)	(0.34)	(0.327)	(0.359)
Change in the log of monthly PPO premium	-0.872**	-0.206	-0.846**	-0.167	1.02**	1.602**	1.078**	1.668**
	(0.406)	(0.346)	(0.411)	(0.377)	(0.337)	(0.529)	(0.334)	(0.548)
Lagged log of monthly HMO premium	1.259**	1.32**	1.21**	1.403**	-1.223**	-0.384	-1.267**	-0.462
	(0.296)	(0.523)	(0.304)	(0.548)	(0.285)	(0.557)	(0.286)	(0.581)
Lagged log of monthly PPO premium	-1.378**	0.712†	-1.211**	0.821*	1.3**	2.161**	1.437**	2.226**
	(0.26)	(0.376)	(0.266)	(0.406)	(0.227)	(0.658)	(0.226)	(0.639)
Plan characteristics	No	No	Yes	Yes	No	No	Yes	Yes
R-squared/Pseudo R-squared	0.0569	0.1235	0.0632	0.1452	0.039	0.1113	0.0449	0.1276
Observations	1,247	1,247	1,186	1,186	1,247	1,247	1,186	1,186
Firms	591	591	576	576	591	591	576	576

Unless otherwise indicated, each model includes all the variables as in Table 5.
Clustered standard errors in parenthesis

Table 7: Robustness checks

	Consecutive Observations Only		Excluding Low-Income Employers[1]	
	HMO	PPO	HMO	PPO
Change in the log of monthly HMO premium	1.17**	-0.62†	1.113**	-0.697*
	(0.351)	(0.337)	(0.344)	(0.321)
Change in the log of monthly PPO premium	-0.291	1.469*	-0.414	1.466**
	(0.382)	(0.565)	(0.293)	(0.55)
Lagged log of monthly HMO premium	1.28*	-0.62	1.271*	-0.478
	(0.519)	(0.571)	(0.533)	(0.562)
Lagged log of monthly PPO premium	0.678†	2.161**	0.535	2.005**
	(0.387)	(0.715)	(0.341)	(0.684)
R-squared	0.1452	0.1146	0.1367	0.1063
Observations	1,133	1,133	1,177	1,177
Number of firms	548	548	566	566

All models control for industry and year fixed effects.
Clustered standard errors are in parentheses.
[1]Low-income employers are those where more than fity percent of the employees earn less than $20,000.

Table 8: Robustness check

	Log of contribution to HMO Plan			Log of contribution to PPO Plan		
	1	2	3	4	5	6
Change in the log of monthly HMO premium	1.337**	1.335**	1.094**	-0.564	-0.32*	
	(0.368)	(0.326)	(0.304)	(0.359)	(0.162)	
Change in the log of monthly PPO premium	-0.167	-0.613*		1.668**	1.517**	1.098**
	(0.377)	(0.286)		(0.548)	(0.517)	(0.448)
Lagged log of monthly HMO premium	1.403**	1.543**	1.198**	-0.462		0.0023
	(0.548)	(0.491)	(0.47)	(0.581)		(0.266)
Lagged log of monthly PPO premium	0.821*		0.911**	2.226**	2.027**	1.581**
	(0.406)		(0.319)	(0.639)	(0.632)	(0.532)
R-squared	0.1524	0.118	0.1129	0.1276	0.1115	0.0817
Observations	1,186	1,247	1,340	1,174	1,247	1,461
Firms	576	591	644	580	591	712

All models control for industry and year fixed effects.
Clustered standard errors are in parentheses.

Appendix A:

Note that equation (3) must hold with equality (otherwise the firm could always save money by offering a smaller wage). Hence we can solve for *w* in (3) and substitute it into the objective function. The firm's minimization problem becomes:

$$\min_{C_L, C_H} \left\{ \overline{w} + \frac{1}{(1-\tau)} [\Gamma(P_L, P_H) - \Gamma(C_L, C_H)] + [(1-p)(P_L - C_L) + p(P_H - C_H)] \right\}$$

Differentiating this function with respect to C_H and assuming that $C_L = 0$, we obtain:

$$-\frac{1}{(1-\tau)} \frac{\partial \Gamma}{\partial C_H} - \frac{\partial p}{\partial C_H} (P_L) + \frac{\partial p}{\partial C_H} (P_H - C_H) - p = 0,$$

Noting that $\frac{\partial \Gamma}{\partial C_H} = -p$ [i.e. when the employer increases the contribution toward high quality plans by \$1, the net benefit of a employees decreases by \$1 times the probability that he will choose a high quality plan], then we obtain:

$$\frac{\partial p}{\partial C_H} (P_H - C_H) = \frac{\partial p}{\partial C_H} (P_L) - \frac{1}{(1-\tau)} p + p$$

which can be rewritten as the expression given in the Lemma.

Appendix B:

It is trivial to show that, if the sticky wage constraint is not binding, the solution is similar to the solution to Lemma 1, i.e. $\hat{\mathrm{C}}_{\mathrm{L}}^{\mathrm{t+1}} = 0$ and a contribution toward the high quality plan:

$$\hat{\mathrm{C}}_{\mathrm{H}}^{\mathrm{t+1}} = \left((1+\beta_H)P_H^t - (1+\beta_L)\mathrm{P_L}\right) + \frac{\tau}{(1-\tau)}\hat{p}^{t+1} \Big/ \frac{\partial p^{t+1}}{\partial \mathrm{C}_{\mathrm{H}}^{\mathrm{t+1}}} \qquad \text{(i)}$$

Under this scenario, we can derive the wage offer for period t+1 from equation (3a) since it is assumed to be always binding:

$$\hat{w}^{t+1} = (1+\gamma)\bar{w} + \frac{1}{(1-\tau)}\left[\Gamma\left((1+\beta_L)P_L^t, (1+\beta_H)P_H^t\right) - \Gamma\left(0, \hat{C}_H^{t+1}\right)\right] \qquad \text{(ii)}$$

If the sticky wage constraint is binding, an employer would be indifferent between offering $\hat{w}^{t+1}$ and a contribution schedule $\left(0, \hat{\mathrm{C}}_{\mathrm{H}}^{\mathrm{t+1}}\right)$ or the previous higher wage ($\hat{w}^t$) and a contribution schedule ($\tilde{\mathrm{C}}_L^{t+1}, \tilde{\mathrm{C}}_H^{t+1}$) as long as the following relationship is satisfied:

$$\hat{w}^t + \left[(1-\tilde{p}^{t+1})\left((1+\beta_L)P_L^t - \tilde{\mathrm{C}}_{\mathrm{L}}^{\mathrm{t+1}}\right) + \tilde{p}^{t+1}\left((1+\beta_H)P_H^t - \tilde{\mathrm{C}}_H^{t+1}\right)\right] =$$

$$\hat{w}^{t+1} + \left[(1-\hat{p}^{t+1})(1+\beta_L)\mathrm{P_L} + \hat{p}^{t+1}\left((1+\beta_H)P_H^t - \hat{\mathrm{C}}_{\mathrm{H}}^{\mathrm{t+1}}\right)\right] \qquad \text{(iii)}$$

where $\tilde{p}^{t+1}$ represents the probability that a worker will choose the high quality plan when the sticky wage constraint is binding and $\hat{p}^{t+1}$ represents the probability that a worker will choose the high quality plan when the sticky wage is not binding.

The fixed subsidy hypothesis says that:

$$\tilde{\mathrm{C}}_H^{t+1} = \tilde{\mathrm{C}}_L^{t+1} + \left((1+\beta_H)P_H^t - (1+\beta_L)\mathrm{P_L}\right) + \frac{\tau}{(1-\tau)}\tilde{p}^{t+1} \Big/ \frac{\partial p^{t+1}}{\partial \mathrm{C}_{\mathrm{H}}^{\mathrm{t+1}}} \qquad \text{(iv)}$$

Plugging the equation for $\tilde{\mathrm{C}}_{\mathrm{H}}^{\mathrm{t+1}}$and $\hat{\mathrm{C}}_{\mathrm{H}}^{\mathrm{t+1}}$ into (iii) and solving for $\tilde{\mathrm{C}}_L^{t+1}$, we obtain

$$\tilde{\mathrm{C}}_L^{t+1} = \hat{w}^t - \hat{w}^{t+1} + [(\hat{p}^{t+1})^2 - (\tilde{p}^{t+1})^2]\frac{\tau}{(1-\tau)} \Big/ \frac{\partial p^{t+1}}{\partial C_H^{t+1}} \qquad \text{(v)}$$

Equation (v) says that if the wage offer at time t+1 consistent with a contribution schedule fixed to the previous year ($\widehat{w}^{t+1}$) is lower than the $\widehat{w}^{t}$, an employer will offer $\widehat{w}^{t}$ in period t+1 but require a higher contribution level towards the low quality plan equal to the difference between $\widehat{w}^{t}$ and $\widehat{w}^{t+1}$ adjusted for any possible effect due to preferred tax treatment of the employer's contribution.

Using equation (3) and the result in Lemma 1 we can derive an expression for $\widehat{w}^{t}$:

$$\widehat{w}^{t} = \overline{w}^{t} + \frac{1}{(1-\tau)}\left\{\Gamma[\mathrm{P_L^t},\ \mathrm{P_H^t}] - \Gamma\left[0, (\mathrm{P_H^t} - \mathrm{P_L^t}) + \frac{\tau}{(1-\tau)} p^{t} \Big/ \frac{\partial p^{t}}{\partial C_H}\right]\right\}. \tag{vi}$$

Plugging (i) and (vi) into (v) we obtain:

$$\tilde{\mathrm{C}}_L^{t+1} = -\gamma\overline{w} + \frac{1}{(1-\tau)}\{\Gamma[\mathrm{P_L^t},\ \mathrm{P_H^t}] - \Gamma[(1+\beta_L)\mathrm{P_L^t}, (1+\beta_H)\mathrm{P_H^t}]\}$$

$$-\frac{1}{(1-\tau)}\left\{\Gamma\left[0, \left(\mathrm{P_H^t} - \mathrm{P_{L_L}^t}\right) + \frac{\tau}{(1-\tau)} p^{t} \Big/ \frac{\partial p^{t}}{\partial C_H}\right] - \Gamma\left[0, (1+\beta_H)\mathrm{P_H^t} - (1+\beta_L)\mathrm{P_L^t} + \frac{\tau}{(1-\tau)} \hat{p}^{t+1} \Big/ \frac{\partial p^{t+1}}{\partial C_H^{t+1}}\right]\right\}$$

$$+ \left[(\hat{p}^{t+1})^2 - (\tilde{p}^{t+1})^2\right] \frac{\tau}{(1-\tau)} \Big/ \frac{\partial p^{t+1}}{\partial C_H^{t+1}} \tag{vii}$$