The Effects of Health Insurance Loading Fees on Employment Choice

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Peter F. Graven

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Dedication

This is dedicated to my dad, Lloyd Graven. It was our ongoing conversations about healthcare that initiated this pursuit—and they will continue to guide me.

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Chapter 1. Introduction

This dissertation examines the impact of health insurance loading fees on the employment choices of individuals. Large firms are more likely to offer health insurance benefits and may be able to offer lower these benefits at a lower cost, or loading fee, to workers based on premium pricing practices. Individuals' sensitivity to these prices in their employment choice is largely unknown. The U.S. is undertaking significant and substantial reforms to the health insurance system including multiple reforms impacting loading fees, such as establishing federal medical loss ratio minimums and creating health insurance exchanges for the individual and employment markets. The Patient Protection and Affordable Care Act (PPACA) of 2010 introduces new options for the purchase of health insurance coverage that are not tied to employment. Using geographic variation in health insurance loading fees and individual variation in demand for healthcare, this study estimates an individual choice model between employment in large versus small firms to determine the impact of loading fees on employment decisions. It is hypothesized that individuals with greater healthcare demand may differentially prefer employment in larger firms due to the loading fees to which they are exposed.

This chapter provides an overview of (A) the role of employers in providing health insurance coverage, (B) the relevance of individual employment decisions, (C) background on health insurance pricing and the implications of the PPACA, and (D) a summary of how the study will contribute to understanding current and future policy questions.

1.1 Role of Employers in Providing Health Insurance Coverage

Employer sponsored health insurance (ESI) is the largest form of group health insurance in the US health care system covering 60% of the nonelderly population (SHADAC 2013). This level reflects an 8% drop in coverage from a level of 65% in 1995. Of those with ESI, 61% are in a plan that is self-insured, primarily at large firms (Kaiser 2013). Annual premiums in ESI coverage for single coverage are $5,884 and $16,351 for family coverage (Kaiser 2013). On average, employers contribute 82% of this amount for single coverage and 71% of the amount for family coverage. Compared to wages, this employer contribution to premiums represents approximately 14% of their combined value for individuals and 23% for families (Blewett 2009).

Employers provide coverage for many reasons. During the 1930s, employers represented a stable risk pool to which hospitals and physicians could offer premium-based access to their services. Adverse selection, where sicker individuals join a risk pool to get lower than expected premiums, was mitigated since individuals were unlikely to change jobs when they got sick. Additionally, wage and price controls during World War II, created incentives for employers to attract employees by offering fringe benefits, like health insurance, that were not considered wages. An administrative rule in 1943, and expanded by legislation in 1954, allowed the premiums paid by employers to be tax deductible as an expense (Thomasson 2002). Furthermore, throughout the mid-twentieth century, as medical technology increased the cost of health care relative to incomes, insurance became more important to employees' ability to afford both common and rare treatments.

The Patient Protection and Affordable Care Act (PPACA) of 2010 authorized the creation of the health insurance exchanges for individuals and small groups (defined as employers with less than 50 full-time employees). Each of these markets had experienced various signs of malfunction due to market power (Gaynor and Haas-Wilson ,1999; Dafny 2010), adverse selection (Simon 2005, Cutler 1994), absence of long term contracts (Dowd and Feldman, 1992) and policy attempts to mitigate the problem through community rating or other regulations (Lo Sasso and Lurie, 2009). The ACA also sought to create a marketplace to facilitate competition and more affordable options. In addition to standardizing insurance products to meet specific actuarial value levels and requiring coverage of "essential health benefits", health insurers are also required to use modified community rating with risk adjustment, and have their medical loss ratios exceed minimum standards-80% for individual and small group coverage and 85% for large group coverage (Federal Register 2011). An individual mandate was added to mitigate adverse selection. These changes create a potentially attractive new option for individuals and small employers who had difficulty obtaining these features in the past. The impact on labor outcomes requires research, to which this study can contribute, on the sensitivity of labor decisions to the various features.

1.2 Employment Choice

Individuals often face an employment decision between jobs for which they are qualified. The jobs may vary in the amount of wages, benefits and other amenities they offer. Theory suggests (Rosen 1986), with somewhat mixed empirical findings (Pauly 2001; Lehrer and Pereira, 2007), that health benefits are purchased at the expense of the employee's wages. If the premiums of a plan increase, the firm would need to decrease wages (or wage growth) for the employee or suffer financial consequences to their operations.

As health benefits represent a large portion of compensation and can potentially expose individuals to large out of pocket expenses, access to and generosity of health benefits are likely to be important considerations in any job choice. Information about an employer's health benefits is not as straightforward as salary since plan features have many components that constitute the value of the plan. However, existing employees may have experience with the plan and will express preferences on an ongoing basis to increase the plan value as much as possible. Thus, the value of the health plan at the firm may be dependent on consistent factors relating to employee preferences and the prices the plans obtain in the market.

Individuals are also keen to consider the health benefits of the employer because the alternatives in the individual market are significantly less appealing. In many states individual coverage could be denied based on pre-existing medical conditions or have greatly increased premiums making it unaffordable for the very people who needed insurance the most. A variety of reforms during the 1990s addressed these issues after the market was unable to solve some of the egregious policy problems (Cutler 1994).

A good deal of research has explored the mobility of individuals between jobs to assess the impact of insurance being tied to employment. Studies of “job lock”, the notion that ESI affects the frequency of employment decisions are somewhat mixed, with some studies showing ESI causes decreased mobility and some showing no effect or increased mobility according to a review by Gruber and Madrian (2002). Despite the intuitive logic of “job lock,” a price effect, as investigated in this study, would impact the choice itself rather than just the velocity of the choices. Thus, if large firms are more attractive due to price advantages, even under scenarios with high mobility, individual choice is still impacted.

PPACA changes the incentives for how individuals get insurance by including a penalty for individuals who do not obtain health insurance, subsidizing exchange purchased coverage for lower income individuals and families, banning pre-existing condition exclusions, and implementing modified community rating—restricting adjustments to age, region, and smoking status. By changing the product and incentives the PPACA impacts the choices available to individuals and therefore .

1.3 Health Insurance Pricing

Health insurance premiums can be represented as the sum of the actuarial value of the plan, or its expected health expenditures, plus a loading fee. Expected expenditures can be calculated from actuarial tables of historical trends based on the age and sex composition of the group or from medical underwriting standards that consider costs from reported health conditions. Expectations can also be adjusted to account for historical trends for the particular group or individual under, what is called, experience rating. The loading fee includes marketing costs, broker commissions, reserve requirements, administrative costs, and profits of the insurer. These components can add value to the plan and thus reflect both quality, as noted in Feldman (2007), but are generally sought to be minimized.

The loading fees the employer pays for the health benefits are substantially greater for small firms than large firms. Karaca-Mandic, Abraham, and Phelps (2011) find small firms (less than 100 employees) pay 28% more for the actuarially equivalent health insurance product compared to what a large firm (over 10,000 employees) pays. All else constant, with higher loading fees constraining what a small firm can offer in compensation, fewer people may be expected to work in small firms than would be the case if the prices were the same.

Loading fees are only known to have been constructed as explanatory variables in two studies-one to explain demand for supplementary health insurance (Marquis et al., 1985) and one to explain plan choice in the individual market (Marquis et al., 2007). If the premium is known they can be calculated by knowing the actuarial value of the plan. Marquis et al. (1985) constructed loading fee estimates for the RAND Health Insurance Experiment data to test the impact on purchase of supplementary insurance. Later, in 2007, Marquis et al. (2007) used an actuarial value calculator to look at the impacts of the loading fee on plan choice.

In general, the sensitivity of individuals to price is thought to be based on factors such as: availability of substitutes; the percent of income that health benefits represent; the necessity of health benefits; and how directly a person pays for the health benefits (Parkin, Powell and

Mathews, 2002). While many of these factors are difficult to observe, this study tries to capture the necessity of health benefits by using observed health care demand.

The sensitivity, or elasticity, of the individual's employment decision to these prices, as measured by loading fees, is not known. Some research finds positive effects of health insurance rating reforms on self-employment decisions (Fairlie et al. 2010, Nikpay 2013) and another is less certain (Holz-Eakin, 1996). But these studies do not directly examine the price issue. In a study closely related to this one, Kapur et al. (2008) finds that individuals with high demand for health care services are more likely to work at large firms, but is not able to conclude if it was due to sorting of employees or screening by employers.

Developing an estimate of a health benefit price elasticity of employment choice is important for theoretical reasons. There are many policies that can be thought to impact the price of health benefits and having an accurately measured parameter estimate can apply to these other situations. In particular, it is valuable for policymakers because the PPACA legislation has created health insurance marketplaces (or exchanges) that will allow individuals and small firms to potentially have access to prices for health insurance that are more similar to large firms. Furthermore, PPACA essentially limits the medical loss ratio of insurance plans in the individual and small group markets (Kirchhoff and Mulvey, 2012) by requiring costs above the threshold to be returned to consumers.

1.4 Summary

To understand the impact of loading fees on employment choice, this study draws on theory of price effects, develops a conceptual model of factors affecting the firm size decision, and estimates an econometric model of the impact. The study makes several contributions. First, it is the first study that uses the loading fee as a primary explanatory variable in an employment choice model. Second, it implements a novel method for estimating loading fees in the Medical Expenditure Panel Survey Household Component-Insurance Component (MEPS-HC-IC) Linked File through the use of an external actuarial value calculator. Third, it provides a theoretical structure to understand the economic impacts of loading fees. Finally, it contributes an econometric model structure well-suited to estimating and predicting incremental changes in loading fees.

The study shows that individuals with high health demand are influenced by the loading fees in the market. The estimated loading fee gradient between small and large firms in a market area has an average marginal effect of 10.8 percentage points on the relationship between health demand and the probability of working at a large firm. This result suggests that policies that reduce the loading fee gradients between small and large firms, should expect to increase employment in small firms as a result of those with greater demands responding to the price changes. A policy simulation suggests that changes in the medical loss ratio observed in the individual market could lead to as much as 4 percentage point increase in small firm employment from 72.5% percent to 68.2% percent.

Chapter 2. Literature Review

The research question deals with complex policy and economic issues and is thus draws upon a large literature. This review will cover the relevant topics to understand the decisions made for the study. Understanding the impact of loading fees motivates the research, and prior work in this area is discussed. The primary outcome of the study is the firm size choice of an individual and the research into the factors that affect this outcome are discussed. The role of health care demand by employees is discussed as another principle factor affecting individual choices. Due to its use in the theoretical motivation, a discussion of the work on compensating wage differentials for health insurance is included. The behavioral process of employment choice is discussed under the topics of job mobility, employee sorting, and labor force dynamics. Each of these topics addresses some of the issues that arise in understanding the context for employee behavior. Finally, the review considers research that pertains to the Patient Protection and Affordable Care Act (PPACA) and summarizes with the contribution of the current research to this literature.

2.1 Loading Fees

The loading fee is defined as the dollars of the premium over and above the expected amount paid on medical costs. Standard theory takes the loading fee to represent the price of the health insurance coverage (Kronick, 1997; Phelps, 2012)[1]. As described in Karaca-Mandic, Abraham, and Phelps (2011), the earliest estimates of loading fees (Phelps, 1973) showed that loading fees are between 35-40% for small firms (less than 10 employees) and between 5-8% for large firms. This results in a price for large firms that are approximately 27 percent cheaper than

[1] Many studies of plan choice within a firm have used out of pocket, net, or effective premiums, as the relevant price (Royalty, 1999; Cutler and Reber, 1998; Feldman and Dowd, 1993; Feldman et. al. 1989).

for firms of size 1-10 employees[2]. The Hay/Huggins Company provided estimates for the House Committee on Education and Labor in 1988 that suggested large firms had 25 percent lower prices for the same level of benefit (Reinhardt, 1991)[3]. These estimates are also similar to the administrative costs (28% for small firms and 5.6% for large firms[4]) found by Cutler (1994) in examination of premium data submitted to the Health Insurance Association of America (HIAA) in 1991.

The source of the price difference by firm size is thought to derive from differences in administrative costs, reserve requirements, and profits (Feldstein and Wickizer, 1995). Each of these pieces reflects a different underlying cause. It is easy to imagine efficiencies related to group size in underwriting costs when the variation allows for calculations at the group rather than individual level. However, some of these savings may be overstated for large group plans if some cost is shifted to an employer's human resources staff. Reserve requirements present a cost that shrinks relative to the expected medical costs as the pool size increases due to the law of large numbers. However, because the groups are independent and insurance companies may calculate the reserve requirement for the whole product line, per insurance regulations, they may not pass on the marginal cost of the reserve requirements to small firms. The profitability is a potential source of the difference since markets that are not perfectly competitive will involve some negotiation on price which would benefit larger firms.

This study investigates the potential impact of loading fees on employment choice. As traditionally defined, loading fees capture the costs of the health insurance plan beyond the

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[2] This calculation is based on the published loading fees of 30-40% for firms with 1-10 employees and loading fees of 5-8% for firms with more than 1,000 employees.
[3] Again, the relative prices are calculated from a 40% loading fee for large firms and 12% loading fee for small firms.
[4] Reported in Cutler (1994) as 40% and 6% of claims respectively. These are converted to percent of premium using Pct_of_Premium=1/((1/percent_of_claims)+1)

expected payments made to health care providers. They can be considered the relevant price of health insurance when comparing plans. Loading fees represent the price of health insurance since it can be defined as the dollars of premium paid per dollar of insurance coverage. It is inversely related to the medical loss ratio which indicates the percent of the premium spent on medical care. For example, a plan that spends 80 percent of the premium on medical care would have a loading fee of 1.25 (1/0.8=1.25). While the loading fee has a fairly straight-forward economic concept, they are not observed by individuals and are not readily available in data about health insurance plans.

Loading fees have been constructed for analysis in a few studies. Marquis and Phelps (1985) construct loading fees by comparing the premium to the expected expenditures of the plan for plans in the RAND Health Insurance Experiment. The analysis revealed the expected negative elasticity between price and demand for health insurance. In a study of plan choice, Marquis et al. (2007) construct the "price" of health insurance by dividing the premium by the actuarial value of the plan. Product choice was found to be quite sensitive to this price. In the context of plan choice this construction was debated as to whether it would bias impacts of quality (Feldman 2007, Marquis et al. 2007b).

2.2 Firm Size Distribution

The question of employment choice between large and small firms can lead to questions about the firm size distribution in general. Economists have long speculated about the causes of the firm size distribution and their models help to inform the choice model proposed. Early theory (Viner, 1932) suggested that each properly defined industry had a size associated with the lowest average cost of the technology and this is what drives the observed sizes. Later, Lucas (1978) proposed that the firm size distribution is based on an underlying distribution of managerial talent. Managerial talent restricted how large a firm could be and the talent was limited in the population. Other models have suggested, similarly, that there are random differences in the productivity of the firm that determine sizes (Jovanovic, 1982; Hopenhayn, 1992). More recently Holmes and Stevens (2014) hypothesize that the firm size distribution, in some industries, relates to niche roles that allow for greater productivity in certain types of production processes. This theory implies that although two firms are in the same industry, one is smaller not because it is less productive but because it is actually in a slightly different market which produces a niche item and therefore has a smaller optimal size.

Institutions and policies can affect the theoretical firm size distribution in many ways. Garciano et al. (2013) use the Lucas model to show the impact of a tax on wages imposed on firms above a certain threshold. This produces the expected results of reducing wages, reducing firm size to the threshold for firms near the threshold, and reducing firm size generally for larger firms[5]. Davis and Henrekson (1999) argue that the tax structure, credit market regulations, national pension systems, employment security provisions, wage setting institutions and public sector expansion all impact the firm size distribution. Leung et al. (2008) considers other institutional factors affecting the firm size distribution between the US and Canada in various industries. These estimates show that across all industries, 15.8 percent of workers are in small firms (0-10 employees) in the US while that proportion is 23.9 percent in Canada. Conversely, 36.9 percent of employment is in firms are over 500 in Canada while 51.2 percent of employment in the US is in firms with over 500 employees. Leung suggests the larger sizes in the US are more efficient than the smaller sizes in Canada. However, the lack of a loading fee differential may also be consistent with the smaller sizes in Canada.

[5] Garciano et al. (2013) also find the less intuitive result of increasing firm size for small firms due to the lower wages resulting from less demand for workers.

2.3 Health Status and Firm Size

The relationship between health status of employees and firm size has two sides. On the one hand, sicker individuals will be attracted to larger firms for their better health benefits. On the other hand, sicker workers may be inherently less productive and therefore less likely to naturally work a large firm. Finally, large firms may find ways, during the hiring process, to discourage sicker employees (or their households) from working and obtaining coverage. These effects suggest an ambiguous effect on health status by firm size. Results from Monheit and Vistnes (1994) showed that was the case in 1987 and recent work by Kapur et al. (2008) shows the relationship is similarly ambiguous.

2.4 Mobility

Studies of job mobility are the most prevalent research with respect to the relationship between ESI and job choice. The idea is that because insurance is not portable between jobs, an individual may remain in a job despite having more productive alternatives for fear of lack of coverage or inadequate coverage. Of course, estimating the relation of ESI and rates of turnover is prone to problems because ESI is also associated with other factors which reduce turnover. Therefore, researchers have needed to be creative in finding ways to isolate just the effect of ESI. In work published before the focus on identification, Mitchell (1982) considered the effect of ESI amongst other fringe benefits as a factor in turnover. The results could not isolate significant results for ESI.

As indicated in Gruber’s 2002 review of the topic, most researchers have chosen to identify job lock by finding variables that can explain when a person has a higher propensity for valuing health insurance but are not otherwise related to turnover. Examples of these types of variables have included: preexisting conditions (e.g. pregnancy), health status, disability of self or child, work limitation, body mass index (BMI) and hospital utilization (Gruber and Madrian, 2002). Also, he notes that there is a large gap in the ability to link reduced job turnover rates to economic welfare. The exception is the structural models which calculate it implicitly.

Madrian (1994) is one of the first authors credited with empirically estimating the magnitude of job lock. The analysis uses a simple identification strategy for job lock by looking at a difference-in-difference estimate between people with and without preexisting conditions and between those with and without ESI. She finds a 25-30% reduction in turnover using National Medical Expenditure Survey (NMES) data. Results of similar magnitude had been obtained by Cooper and Monheit (1993) using the Quality of Employment Survey (QES). They find a reduction of 23-39 percent in job turnover for those likely to lose health insurance (e.g. someone who has a chronic preexisting condition). Interestingly, for those likely to gain health insurance job turnover increased by 28-52 percent. Kapur (1998) attempted to replicate the findings of Madrian (1994) and applied corrections which did not result in significant findings.

Anderson (1997) also notices that some individuals may become in more need of health insurance and would be more likely to switch jobs to get it. Anderson considers this positive effect on mobility as “job push” in comparison to “job lock”. The circumstance of interest is the job switching behavior of a man with a pregnant wife. Job lock would be evidenced by reduced mobility during pregnancy when the pre-existing condition would discourage a new insurance policy. Job push would be evidenced by increased job mobility to obtain better insurance for the new dependent. Anderson reports that prior to birth mobility was reduced by 35 percent and after birth it increased by 18 percent. Anderson notes that although the 35 percent reduction estimate of job lock is not significant, conservative estimates are typically around 25 percent. Therefore, the 18 percent increase in mobility due to job push is of similar magnitude.

The first attempt to explicitly model worker decisions is from Gilleskie and Lutz (2002). Their work integrates the compensating differentials discussion into the job lock literature. They comment that, indeed, some individuals remain in jobs because of the risk of losing insurance while in between jobs. But they also note that even for those with little fear of gaps in coverage *and* without high demand for health insurance due to illness or dependence, if wages do not offset the valuation of health insurance, the individual may still be reluctant to switch to a more productive job. Gilleskie and Lutz indicate the potential for negative economic welfare consequences from any of these effects. They develop a partial equilibrium model which allows dynamic behavior on the individual's side, but where firm action is considered exogenous (but stochastic).

The most recent and sophisticated analysis comes in *Econometrica* from Dey and Flinn (2005). Their model is the first to incorporate the Nash bargaining framework explicitly into the job matching process. They showed that "worker differences in demand for health insurance could not produce situations in which lower match values were preferred to higher ones; rather, firm heterogeneity in the costs of providing insurance was crucial." They estimated job mobility reductions from ESI to be around 2 percent.

Dey's work, which has been republished with similar titles between 2000-2005, uses a framework, collectively developed with Flinn that has been applied to many other problems (minimum wage (Flinn, 2006), income inequality, (Flinn, 2002), and job mobility (Flinn, 1986)). Although this gives credence to the overall flexibility of the model, it implies the need for a precise specification for each problem.

The authors make a number of assumptions to incorporate health insurance into search-matching-bargaining framework. Related to job lock, the primary reason for job lock in the model is the reduction in mobility due to a worker becoming unable to perform the task from health related cause. As they say, “the role of health insurance in reducing the rate of separations into unemployment is presumed to result from covered employees more intensively utilizing medical services than non-covered employees. As a result, the rate of separations due to an inability to perform the job task associated with the match (theta) will be lower among covered employees. (Dey and Flinn, 2005)” Critically, this explanation does not accommodate the notion that individuals would separate due to their preference for health benefits, irrespective of the effects on job performance.

Gruber and Madrian (2002) criticized Dey’s attempt at a structural model in a number of ways. First, they questioned whether job lock had been properly identified. Second, they note the study only used individuals that had been unemployed. Third, there is concern the estimates from the model will depend more heavily, than non-structural models, on assumptions about parameters such as time discount rates, risk aversion, and disutility of labor. Unless these parameters are well understood additional error is added. Gruber and Madrian also note the model’s inability to account for “spillover” whereby one person’s match may improve another person’s match.

Despite the criticism the model has clear advantages. Since it specifically incorporates utility functions, the calculation of aggregate welfare changes are possible. Also, the structure may allow for continuous measure of health benefits. Although Dey uses a binary indicator of whether the individual is insured or not, this could be modified to estimate the amount of coverage. Likewise for the classification of firm characteristics Dey uses a binary variable of high cost or low cost firms. With a continuous range of firm costs more precise estimate may be possible. Also, if the effect of EHI is heterogeneous across firm cost levels, the estimates may vary substantially from those in the binary categorization. Another clear disadvantage of the Dey model is its inability to handle changing worker preferences. For instance, if the demand for insurance goes up, the Dey model allows renegotiation of wages which would eliminate these time-variant effects job lock.

Recently, Fairlie, Kapur, and Gates (2011) use spousal coverage as an instrument for an individual's coverage decision to identify an "entrepreneurial lock. This paper suggests spousal coverage can be used further to isolate the price effect from coverage overall. Gumus and Regan (2014) uses changes in taxes due to the 1986 Tax Reform Act which allowed the deduction of premiums for self-employed, as an instrument for changes in the after-tax health insurance premium. This change in the relative price of insurance did not have a significant impact on entry or exit. They do however identify reductions in likelihood of entry, of 18-25%, and exit, of 3-13%, due to the presence of individual health insurance. Zissimopolous (2007) uses panel data of near retirement individuals to understand transitions to self-employment and retirement. They include health insurance in the model and show that it reduces the likelihood of becoming self-employed. Heim and Lurie (2013b) find a statistically significant of reduction of the tax price on the decision to be self-employed. They also find that state rating reforms did not increase self-employment (Heim and Lurie, 2013).

2.5 Labor Force Dynamics

Health insurance is just one factor in all of labor force dynamics. Understanding this process is critical to estimating effects due to ESI. The process by which workers find jobs is described by the concepts of searching and matching. One of the first authors to consider an equilibrium model for these concepts was Jovanovic (1979). The work was motivated by the need to explain job turnover. In their model, each worker has a range of productivities across different jobs. Likewise, the employer can experience a range of productivities for its job. Employers can raise or lower the worker's pay depending on the worker's productivity both at meeting and during the course of employment Information improves over time about a worker's optimal job and about an employer's optimal worker.

In 1982, Flinn and Heckman synthesized common elements of Jovanovic and other modeling techniques to create an econometric framework for the type of equilibrium models (Flinn, 1982). These models were specifically designed to accommodate longitudinal datasets that became available at the time. With the ability to model the time element, these models can walk through the relevant components of job matching. An additional feature of this model is that the workers encounter jobs through time at a certain rate and either accept the job or continue searching. In the paper, Flinn and Heckman estimate the base parameters for this type of model.

Another early version of the labor force equilibrium model is developed by Diamond (1982). This model adds the Nash bargaining framework to divide the surplus of the productivity from a match. The surplus itself will be split 50-50, but the wage will be based on the time the worker and firm expect to find another match. A greater wait time will raise the wage offer of the firm and lower the reservation wage of the worker.

The application of these models has become more prolific. Elements of the Flinn modeling technique are also incorporated into Gottschalk and Maloney's (1985) analysis of whether the probability of finding a preferable job match is higher if a person searches while unemployed or employed. Their results suggest the probabilities are equivalent between the two, but worse for those coming from involuntary unemployment. In 1995, Eckstein and Wolpin (1995) used the equilibrium approach to understand how recent graduates find employment. They add the same Nash bargaining framework Diamond introduced into Flinn's specification of the model[6].

More recently, Flinn uses an equilibrium model to estimate the welfare effects from minimum wage changes (Flinn, 2006). His results show that increases in the minimum wage can be welfare increasing if the worker has low bargaining power relative to the employer, as in a monopsony situation.

The only model discovered in this search to apply equilibrium techniques to ESI effects was conducted by Dey, originally cited in 2000 as an unpublished paper, and finally published in Econometrica in 2005 (Dey and Flinn, 2005). These models are important because of their ability to measure productivity estimates within the model.

2.6 Sorting

The concept of sorting in the health insurance arena was first introduced by Goldstein and Pauly (1976) by describing workers with similar preferences grouping together at firms. Similarly, Pauly (1986) found there could be grouping based on tax rates due to the tax incentive of health insurance. This implies that higher income workers would tend to find companies with higher concentrations of higher income workers as described by (Scott, Berger, and Black, 1989). This concept has been built into modeling of firm behavior such as understanding a small business decision to offer health insurance (Feldman, Dowd, Leitz, and Blewett, 1997).

Empirical studies for the existence of sorting have been rare. Monheit and Vistnes (1999) used survey questions describing one's taste for health insurance and responses such as "healthy enough and not in need of health insurance" and "health insurance is not worth the cost"

[6] Despite Diamond's previous use of the Nash bargaining solution, the authors did not know of any work that was "devoted to structurally implementing bargaining models".

to identify people with low demand for health benefits. Their results do find evidence of sorting, that is, people with these responses are more likely to be at firms without insurance. Hirth et al. (2007) showed approximately 80 percent of workers are in jobs that are consistent with their preferences for health insurance benefits (offers for some, no offers for others). This result does not imply perfect sorting but does imply that individuals are considering benefits when choosing where to work. This study requires, to some extent, that individuals are choosing between jobs on the basis of benefits. It will test further if the price rather than just the existence of a health insurance plan is driving the sorting behavior observed.

Taken to its logical extreme, with perfect sorting, a firm would tailor its benefit package to its workforce which was homogenous in their preferences towards the different benefits (health, retirement, etc.). Recognizing the unlikelihood of this effect, others have suggested that sorting could operate within a firm as well. This would require the firm to allow different workers with different preferences to obtain different health benefits, such as with cafeteria plans. However, given existing tax laws regarding benefit offers, and the difficulty of having employees forego wages based on their health plan, it is unlikely for this to occur in a comprehensive way (Chernew and Hirth, 2002). Adding to the difficulty of within-firm sorting are the fixed costs of offering different health plans (Moran, Chernew and Hirth, 2001) and federal tax laws that encourage nondiscriminatory provision of fringe benefit packages to full-time workers (Scott et al., 1989). Scott, Berger and Black indicate that this limitation on fringe benefits will increase worker segmentation but the authors do not provide results as to the effects. They also speculate about a deadweight loss associated with the segmentation.

2.7 Employment Choice Models

Evans (1989) builds a structural entrepreneurial choice model to estimate the impact of liquidity constraints separate from ability. While the parameters are viewed cautiously, it is suggestive that liquidity constraints do bind and both reduce the probability people will try entrepreneurship and reduce, from optimal, the level of capital in the endeavor. This provides some evidence that factor prices affect employment choice. However, the Evans result assumes the price is based on the individual as compared to the firm size. Ashcroft et al. (2009) presents the standard model of self-employment choice where individuals compare utility from wages in addition to personal characteristic preferences. It is estimated using a probit. They also present a sequential probit that assumes various reasons for not starting a business. Haan (2009) considers if child care policy encourages employment generally.

2.8 Compensating Wage Differentials

The notion of compensating differentials relates to the idea that if a job has a negative non-wage characteristic, the firm will need to pay the worker more to take that job. For health insurance premiums, this would mean a job that does not have health insurance will need to pay a worker more in wages. The theory of compensating differentials was originally conceived by Adam Smith and according to Smith's (1979) review has remained relatively unchanged since then. Rosen (1986) describes a formal model for how individuals have preferences for job attributes and employers have demand for individual productivity. Thus there is an implicit market for the characteristics of the job and the characteristics of the worker. One example given is the composition of pay packages including fringe benefits, such as health insurance. Despite its theoretical support, many researchers have tried to assess, empirically, whether there is a "full" compensating differential with regards to health insurance in the labor market. Morrisey (2001) notes that due to other conditions in the market, it is not clear if wage differentials create an incidence at the individual or group level. Group level incidence means that each individual receives a corresponding reduction in wages to cover his/her own health insurance cost but that the entire employee group may obtain an average differential.

Additional work by Jensen and Morrisey (2001) shows that for older Americans, there is a wage reduction of about $6,300 for those jobs with health insurance. With actual health premiums for this age group ranging from $5,800-$6,900, this result is consistent with a “full” compensating wage differential. Their results, however, were statistically insignificant. Therefore, in assessing this paper as evidence of compensating differentials, Pauly described it, in baseball terminology, as a “double”—as compared to a home-run (Pauly, 2001).

To answer the question of whether the reduction in firms offering HI was increasing the wage gap, Lehrer and Pereira (2007) needed to evaluate if there was a compensating differential. The notion was that if individuals received the value of their compensating differential after losing health insurance, then the total compensation “wage” gap would remain constant. Using the Displaced Workers Supplement to the CPS they confirmed the lack of a compensating wage differential for health insurance and concluded wage gaps were increasing.

Levy and Feldman (2001) suggest conventional measurement of the differential is likely not to recover a full effect. They note that although wage differentials are expected for some kind of amenities health insurance is unique in two ways. First, since health insurance costs are not distributed randomly, some individuals are more likely to have higher costs than others (perhaps due to age) but are unlikely to receive a commensurate reduction in wage. Second, since a portion of the total health insurance premium is paid for in fees by the worker, the full cost of health insurance would not be expected to show up as a wage differential. Their study goes on to ask whether high cost individuals are receiving lower wages or if the cost is being spread across the firm at the group level. Although the study cannot conclude whether the shift is at the individual level, it does suggest an exogenous change in insurance status is likely to be a necessary element for a reliable conclusion. In general, their work considers that the lack of a compensating differential for health insurance at the individual level may not mean there is market failure.

According to Lehrer and Pereira (2007) the following work was consistent with conventional theory: Gruber (1994) on childbirth coverage, Sheiner (1999) on older workers, and Pauly and Herring (1999) on job-insured wage tenures. In general, Pauly (2001) does not find conclusive evidence in his review of several relevant papers whether there is a full compensating differential, *or* if it is at the individual level. Pauly suggests that if compensating differentials are not found then "we probably need to toss out labor economics".

2.9 Applications to PPACA

PPACA is relevant in at least two ways to the study objectives. Medical loss ratio (MLR) minimums were implemented beginning in December of 2010. These were set at 80% for the small group and individual markets and 85% for the large group market. Abraham and Karaca-Mandic (2011) noted that in 21 states 50% of the health insurers were below the thresholds prior to the rule and anticipated the tension it would place on insurers. If an insurer exceeded the amount they were required to pay the difference in rebates to the customer. The medical loss ratio is the inverse of the loading fee and thus the policy effectively capped the loading fee on a given set of health benefits. As discussed previously, the loading fee covers administrative costs, marketing costs, and any profits. In follow-up work, Abraham, Karaca-Mandic and Simon (2014) found that indeed administrative expenses were cut, most significantly broker and agent fees and commissions, to achieve the goals, though $2.1 billion was paid in rebates nationally in 2012 (DHHS 2012). Similarly, McCue, Hall and Liu (2013) noted increases in the MLR for the individual market, and negligible changes in the small group market. Their analysis also identified administrative costs as the source of the change, though did not specify component costs. States were also required, for 2011 plans, to practice rate review, which most had in some form previously, assessing the justification of premium increases. While this process does not explicitly reduce the loading fees, its consumer orientation is likely to put additional pressure on administrative costs. Research on this topic is not available.

In addition to medical loss ratios, PPACA created health insurance exchanges with the goal of providing a competitive marketplace for individuals and small groups to obtain health insurance. Not only did the exchange decrease the search costs, and therefore the marketing costs for insurers, but it also implemented guaranteed issue, modified community rating, risk adjustment, and reinsurance (for the first two years after implementation), and premium rate review. Each of these factors can arguably decrease the overhead cost of insurance.

The launch of the exchanges was slow given technical challenges with the website but enrollment met first year targets of over 7 million individuals. This figure is noteworthy from a research perspective because many states have tried to create new purchasing groups on behalf of individuals or small groups (Long and Marquis, 2001) and these enrollment figures exceed them. However, the small group market is largely unchanged at this point due to very small enrollment in the exchange's SHOP program.

A regulation that explicitly caps the profits of a firm has strong potential to have unintended consequences given the explicit or implicit goal of maximizing profits at most insurance companies. The current structure is examined in Karaca-Mandic, et al. (2013) to monitor impacts of firm exit or other behavior. However, it is also possible that regulation was able to target insurers that were extracting rent through market power. From this optimistic perspective, the MLR minimums act as an additional bargaining tool of consumers and allow gains in consumer surplus.

2.10 Summary

This study deals with a complex question intersecting a diverse set of literatures relating to labor force dynamics. The direct effect of loading fees, or the price of health insurance, on employment choice has not been considered in the literature. This is largely due to the difficulty in measuring them in practice. A more general investigation of the impact of ESI on small firm employment is covered Kapur et al. (2008). However, it does not attempt to isolate the impact of loading fees themselves. The lone study that effectively measured actuarial values in this context (Marquis et al., 2007) looked at how it impacted health plan choice and not employment choice. The recent policy changes of PPACA suggest the possibility that the loading fees have changed and could continue to change. The individual market has experienced increases in its medical loss ratio (the inverse of the loading fee) of about 5 points. This study provides a contribution to the field by explicitly testing the impact on employment choice.

Chapter 3. Theory

This chapter describes the basic economic theory underlying the research. Later, in the methodology section, additional factors will come into play. However, it is instructive to clearly identify the underlying theory that lays the foundation for this research. The economic model is presented which considers the choice between various employment types in a utility maximization model of employees choosing between job offers. In addition, this chapter discusses some equilibrium effects since the offers are constrained by the employer's production model.

3.1 Utility Maximization Model

The notion of health benefit prices and their impact on firm size choice is explored using a basic utility maximization model. In the model, individuals maximize utility by choosing between job offers composed wages (W), health benefits (H) and amenities (A)[7]. The total cost of the employer offer is constrained by the marginal revenue product (MRP) of the job (j) for the individual (i).

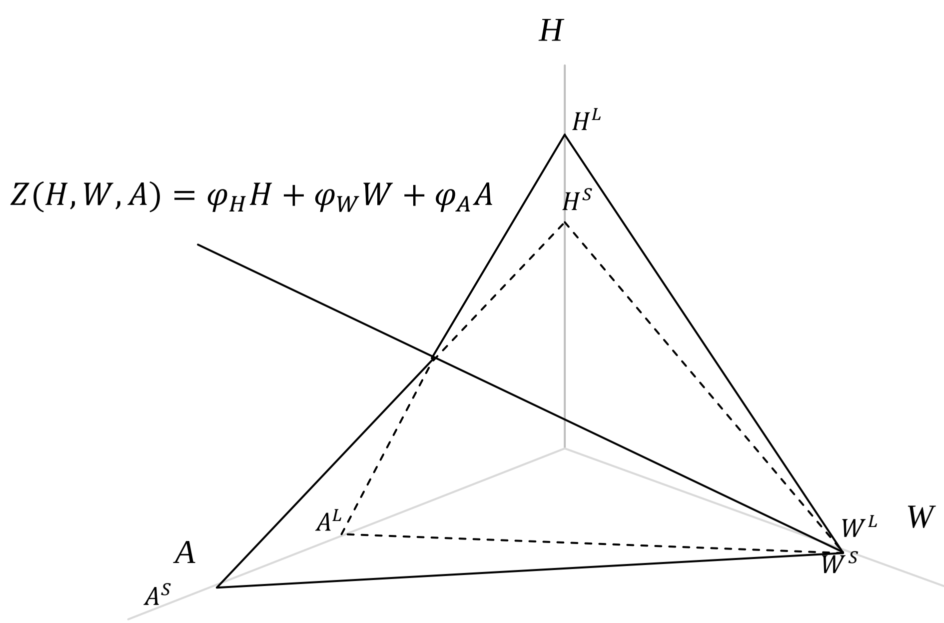
To simplify the problem, the firm size is categorized into two types; small and large. To observe the effect of firm level pricing into the constraint, we introduce two prices: P_H^L is the price for a large firm, which is defined to be less, by *g*, than the small firm price P_H^S. Additionally, the amenity price for small firms, P_A^S, is defined to be *h* less than the large firm price for amenities P_A^L. While large firms have been shown to be less than small firm prices, the amenity price difference is only used as illustration because it allows a tension between choices of small

[7] A job offer is not literal in the sense of applying and being offered a job but abstract in the sense of potential job offers should one had searched and pursued them completely.

and large firms that does not result in the same dominant choice in all situations. Alternatively, the underlying technology of the firm may be such that smaller firms are advantageous, relative to large firms, and health insurance pricing favors large firms over small firms. This would imply that jobs based around that technology would have a lower total compensation when found at large firms.

The exhibition of the effect will assume productivity levels are equivalent but that large and small firms vary in the price of health benefits and amenities. In this framework, the price of wages in the model is 1. As shown in Figure 3-1, the budget constructed by these sets of prices creates two intersecting planes, a large firm plane and a small firm plane, defined by vertices (H^L, W^L, A^L) and (H^S, W^S, A^S) respectively.

Figure 3-1. Offer budget by firm size with a fixed MRP and price constraints



If only the frontier of the budget is considered, the large and small firm sets of prices can be generalized into a generic set of prices (P_H', 1, P_A') where P_H' and P_A' vary depending on the values of H, W and A. When the planes are not parallel, such that one firm size does not dominate all offers of the other firm size, the frontier of this budget will include a kink along a vector (Z). The Z-vector is given by equating the two budget planes given different health and amenity prices and slopes, $\varphi_H, \varphi_W, \varphi_A$. The equation for the z-vector is shown in equation (3.1).

$$\begin{aligned} Z(H, W, A) &= \left(P_A^S - P_A^L\right)H + \left(MRP + P_A^L P_H^S - P_H^L P_A^S\right)W + \left(P_H^L - P_H^S\right)A \\ &= \varphi_H H + \varphi_W W + \varphi_A A \end{aligned} \quad (3.1)$$

Individuals will theoretically observe job offers along both planes, but given a strict decision rule will only pick those along the frontier that maximize their utility.

With these conditions, the maximization problem for each individual choosing a job (j) can be written:

$$\max U\left(W_j, H_j, A_j\right)$$

$$s.t. W_j + P_H' H_j + P_A' A_j = MRP_j$$

where;

$$P_H' = \begin{cases} P_H, & when\ FS = L \\ P_H + g, & when\ FS = S \end{cases}$$

$$P_A' = \begin{cases} P_A + h, & when\ FS = L \\ P_A, & when\ FS = S \end{cases}$$

The generic first order conditions are given as:

$$U_w + U_H H_W + U_A A_W - \lambda = 0$$

$$U_H + U_W W_H + U_A A_H - \lambda P_H' = 0$$

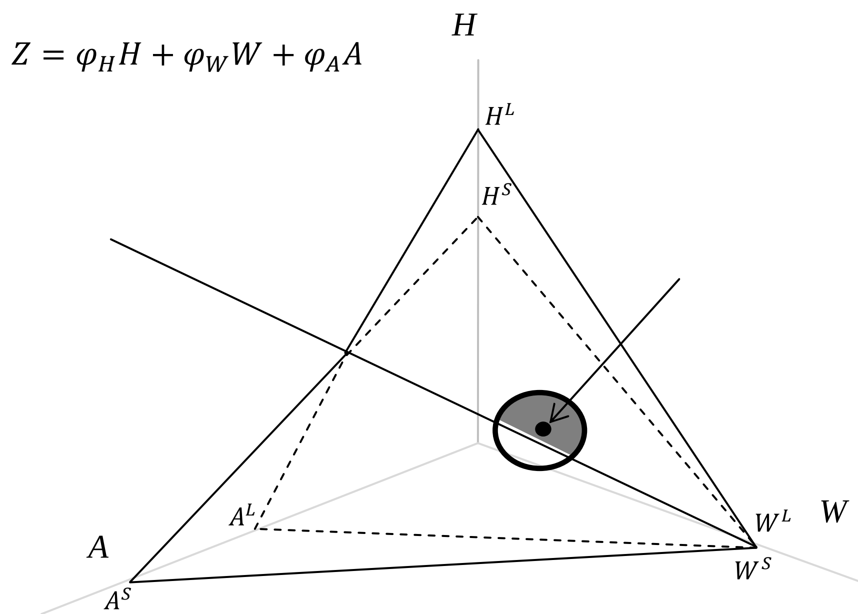
$$U_A + U_W W_A + U_H H_A - \lambda P_A' = 0$$

$$MRP - W - P_H' H - P_A' A = 0$$

The optimal X* (W*, H*, A*) is obtained from solving the first order conditions. Predictably, the first-order conditions state that wages, health benefits, and amenities should be increased until their marginal utilities divided by their price are equivalent. Thus, lower prices for health benefits would be expected to increase the amount of health benefits at the expense of amenities and wages.

To see the impact of individuals with varying health demands, a distribution of preferences is added. Graphically, this can be shown as a density function of the expansion paths, or Engel curves, for each individual utility function over all budgets projects from the origin. While the solution for the optimal allocation of any MRP, X*, is a point, the density of preferences will intersect with the budget frontier to define a probability distribution. The probability distribution around the point will correspond to the preferences of the population. Individuals with greater demand for health benefits are expected to prefer more health benefits and thus be more likely to be on the large firm plane.

Figure 3-2. Offer budget by firm size with preference distribution



The effect of interest is the change in the probability of choosing a particular employment type due to a change in the price of health benefits. This could be called the health benefit price elasticity of employment choice.

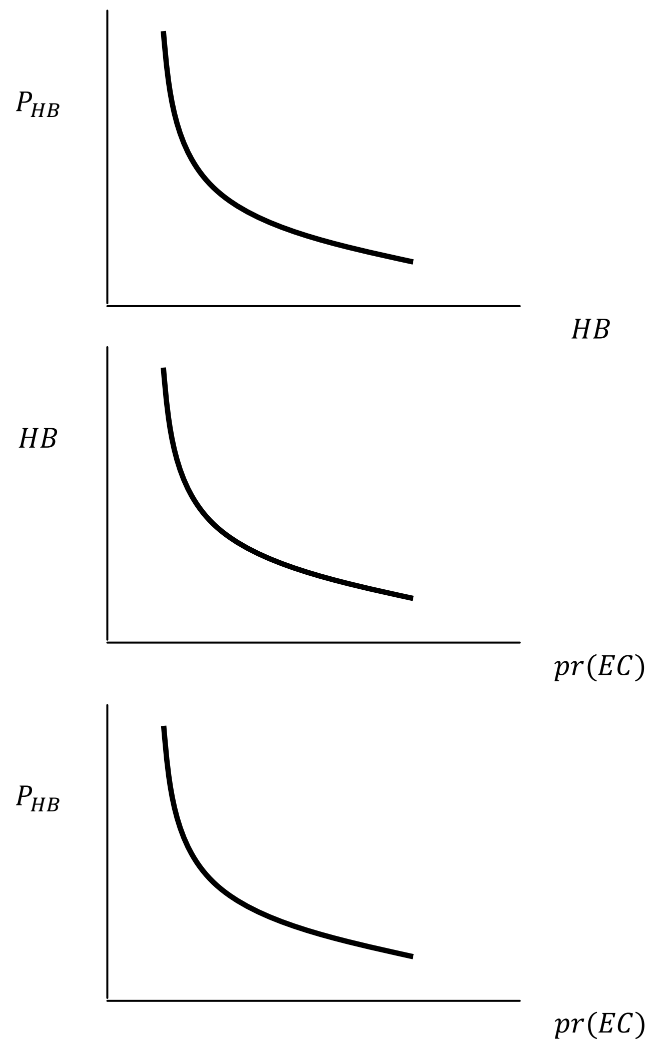
The elasticity is essentially the product of two elasticities, shown in (3.2)-the change in compensation package (X*) due to the change in health benefit price, and the change in employment choice due to the change in compensation package.

$$\frac{\partial EC}{\partial P_H} = \frac{\partial X^*}{\partial P_H} \times \frac{\partial EC}{\partial X^*} \tag{3.2}$$

Another way to think of this is in terms of the two elasticities that drive the overall impact. The first term, $\frac{\partial X^*}{\partial P_H}$ can be simplified by only considering the change of health benefits due to price, rather than the three dimensional vector of health benefits, wages, and amenities

(X*). The second term, $\frac{\partial EC}{\partial X^*}$, considers whether these changes in health benefits lead to changes in employment type.

Figure 3-3. Demand Curve Composition



Elasticities are typically shown in reference to a demand curve. In Figure 3-3(a), a demand curve is shown between the price of health benefits and the quantity of health benefits. In Figure 3-3(b), a similar curve is shown between how the probability of a particular employment choice (pr(EC)), such as choosing a large firm or a self-insured firm, is impacted by the health benefits offered. Finally, it is the third demand curve shown in Figure 3-3(c) that captures the effect of this study, the product of the two component elasticities. The elasticity describes the percentage change in the probability of an employment choice due to the percentage change in the price of health benefits. Individuals may show a highly elasticity to the price of health benefits in terms demanding more health benefits when prices are lower, but may not be elastic to choosing different jobs based on changes in the health benefits offered. While this study does not seek to decompose the overall effect, future work could isolate these effects more directly.

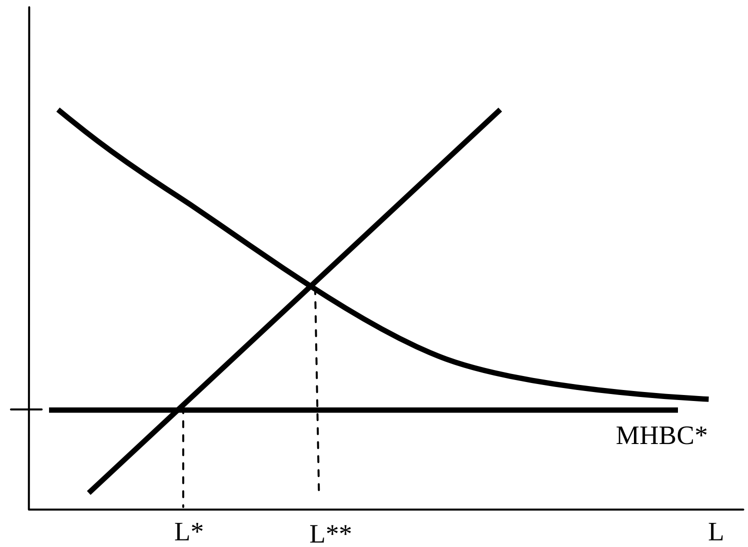
This elasticity amounts to estimating whether changes in price easily move individuals from one plane to the other due the shape of their preferences. The planes themselves are defined by these prices, so reductions in both prices simultaneously would have an ambiguous result and are not meaningful. Thus, it is more relevant if the *difference* in the prices (or its gradient) causes changes in the employment choice. Note that this elasticity is specifically calculating how sensitive individuals are to the price gradient which is a function of how close the individual's optimal package is to the Z-vector. For instance, if large firms were only firms with over 1 million employees, it may be the case that many individuals are not exposed to job offers from firms of this size. In that case, the elasticity would be small or perhaps zero. Likewise, even with a firm size threshold of 50 employees, some individuals may possess skills that are only used in much larger firms. Therefore, individuals may be quite sensitive to the prices generally, but no change in employment type may be observed. Moreover, firm size itself could be generalized not just to two planes but represent its own continuous dimension for which a precise optimal size could be shown. This, however, would not highlight the fundamental dynamic between health benefit prices and employment choice, nor be practical in estimation.

The basic theoretical model described above is not instructive about which other factors that may be affecting their choice. Here, it is only shown that an individual has many offers that have the same marginal revenue product (MRP). It is likely that the jobs for which an individual has the same MRP are clustered in an industry, such as manufacturing. The technology involved in the industry would drive the optimal firm size from the production side. Therefore, it would be expected that different types of skills, possessed by individuals, would have different elasticities based on the dominant industries they are found in. Not tested in this study due to lack of data about skillsets, it represents a complementary research question.

3.2 Equilibrium Considerations

While this theoretical model does not include equilibrium effects, it is worthwhile to consider what impact they may have on the expected result shown above. Individuals with greater health demand may differentially prefer employment in larger firms due to the health benefit price gradient, but the firms could not indefinitely accommodate this preference given their own technological constraints. A simple model of production, shown in the appendix, suggests firms can only deviate in size up to the point where the change in size effect on productivity is equal to the change in size effect on the cost of health benefits. This will occur where the marginal cost of the health benefits with respect to size are greater than or equal to the marginal average cost with respect to size. A stylized version of this trade-off is shown in Figure 3-4.

Figure 3-4. Production Side Constraint on Individual Choice



The graph shows optimal labor (L) given the results of firm cost minimization under two prices for health benefits. When prices do not vary by size, the marginal health benefit cost is flat (MHBC*) and marginal average cost (excluding health benefits) is increasing (MAC*). When the price of health benefits decreases with the size of L (as is found in the empirical literature on loading fees), the marginal cost of health benefits (MHBC**) is downward sloping.

The change in price function then leads to a change in optimal L from L* to L**[8]. The gap between L* and L** is then constrained by the slopes of the marginal benefit curves. More intuitively, a firm would not achieve net savings from increased size if the savings in health benefits were less than the increase in cost from being slightly less productive.

This perspective shows the production side, or supplier side, of how health benefits affect firm size. Employees may have demand for larger firm sizes but any particular firm is constrained

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[8] Since firms would actually be setting the sum of these marginal costs equal to 0, the true L* would be less. L** is accurate since the MHB** is 0.

in how much larger it could be due to the cost differences. A fully structural model could uncover the precise constraint of the supply side; this model will estimate a reduced form model that provides an upper bound on impacts of

3.3 Summary

The theory shows two important dynamics. First, it shows that there will be variation in the choice of firm size based on preferences of individuals. If individuals prefer health benefits to other types of compensation and large firms are have lower prices for health benefits, they should be more likely to work at larger firms. Second, it shows that difference in the planes is dependent on the difference, or gradient, in health benefit prices. Therefore, the correlation of individuals with higher health demands should be greater when the health benefit price gradient is larger. These predictions will be tested in the econometric model.

Overall, this framework is theoretical and other practical and measurement issues will be discussed in the following section. Nonetheless, it reflects the underlying mechanism for how health benefit prices can impact the choices observed by individuals.

Chapter 4. Methodology

4.1 Conceptual Model

The research question investigates the impact of loading fees on employment choice. The previous chapter described the theoretical motivation behind the question. In practice, the situation is more complicated. This chapter will map out the conceptual model and additional factors to consider for reduced form estimation. The primary theoretical concept is that loading fees represent prices which potentially provide an advantage to large firms in providing larger compensation packages, all things being equal. Of course, many things are not equal in observational data and the conceptual model below seeks to address the primary factors that need to be accounted for when looking at whether those with high demand are responding to largely unobserved, but potentially significant, prices.

The diagram in Figure 4-1 represents the conceptual model of factors affecting employment choice and specifically how the loading fee impacts the choice. As is shown, the firm size choice of an individual is the ultimate outcome of interest. Many factors will affect this choice by individuals, including the compensation package and other attributes of the job options. This compensation package includes wages as well as premiums and other amenities, shown in the figure. An effect, shown by a double-headed arrow, is shown between wages and premiums and retirement benefits. This relationship between the terms is supported by theoretical considerations from the compensating wage differential literature that these items can be traded for one another. Other amenities of the compensation package-paid vacation, paid sick leave, life insurance, and disability insurance-are grouped separately in the diagram.

The total compensation, in terms of cost to the employer is tied to the employee’s marginal revenue product, which is unobserved. In general, employers are able to pay out approximately what the person is worth in terms of revenue. This factor represents the basic productivity of the individual and could be predicted based on factors like experience, education, and ambition. The diagram excludes the marginal revenue product as it is not measured, but it influences the sum of the premiums, wages, retirement benefits, and other amenity costs attributable to an employee.

The amount of health benefits dictates the amount of premiums, conditional on the loading fee. This relationship of an interaction, sometimes called a modifier, is shown in the diagram using intersecting arrows[9]. In addition, the loading fee creates a substitution effect on the amount of health benefits offered. Depending on the aggregate health demand at the firm, it may use a lower (higher) loading fee for an increased (decreased) level of health benefits.

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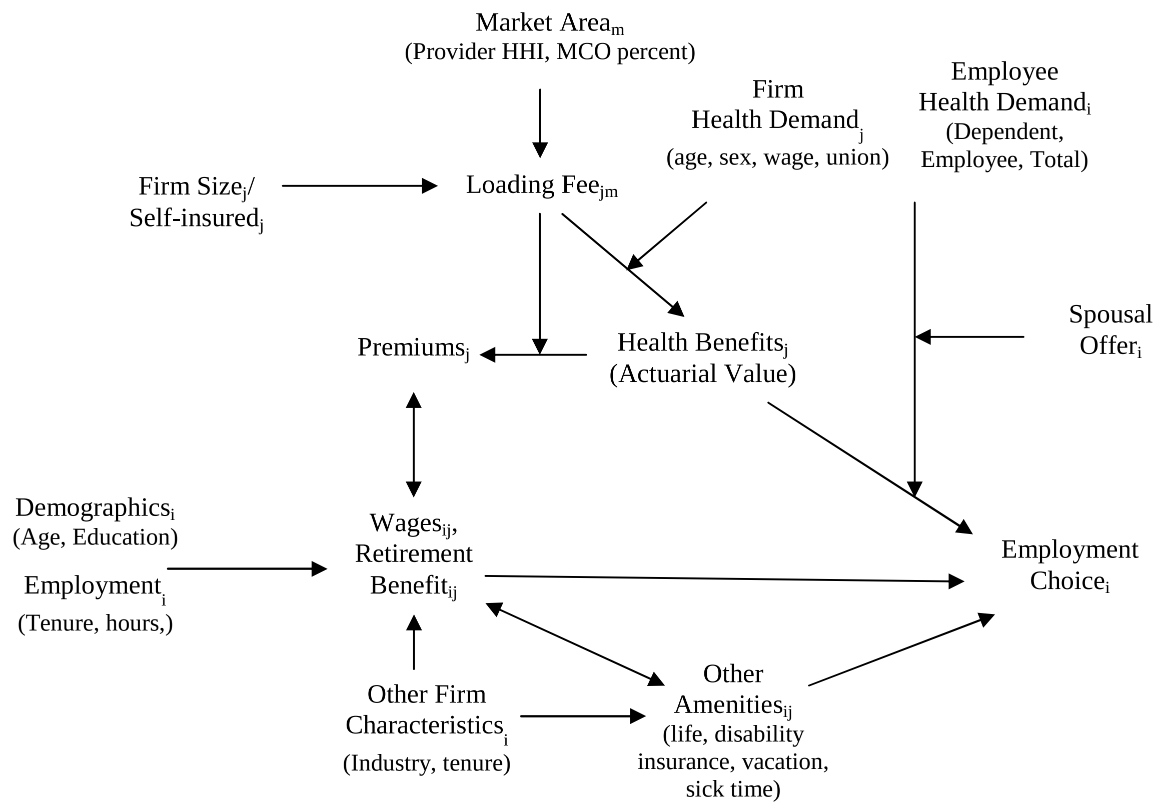
[9] The application of Directed Acyclic Graphs (DAGs) to causal models developed by Judea Pearl does not formally specify how to indicate the interaction. However, intersecting arrows have been considered by practitioners. Absent a special indication, both factors would simply point to the decedent and the more specific function which combines the effect would be unknown.

Figure 4-1. Conceptual Model



The loading fee is defined exactly as the premiums divided by the actuarial value of the health benefits, minus 1, and can be thought of as a percentage[10]. The loading fee is known to vary by firm size. In addition, the diagram shows that self-insured status impacts how firm size affects the loading fee. This is mostly a measurement issue in that we know some of the loading fee accounts for claims administration costs, which self-insured firms also pay, but some is related to the risk premium, for avoiding financial risk, which self-insured firms do not pay (except in the case of reinsurance).

[10] While this will be modeled linearly, it is possible that the loading fee reflects both fixed aspects like the costs associated with the enrollment process itself which does not increase with premiums and variable aspects, such as commissions paid to brokers or insurance agents.

The health benefits of a plan are not typically known unless an actuarial value has been generated for the plan. The actuarial value is essentially the predicted medical expenses the plan would be expected to pay out in an average year of risk. This amount will depend on the predicted utilization of services, their prices, and how much is covered by the plan features, as opposed to the individual.

Spousal offers are an important part of this model as shown in the diagram. A spousal offer would decrease the responsiveness to the loading fee because the spouse's offer means the individual has more than one way to acquire the health benefits they demand. Indeed, spousal coverage is shown to negatively impact the probability of being offered insurance (Royalty & Abraham, 2006). Moreover, if the other source of coverage is from a large firm, then it may explain why an employee with high dependent health demand works at a small firm. Conversely, if the other source is a small firm then the employee may be more likely to work at large firm.

4.2 Econometric Model

The impact of loading fees on employment choice is estimated using variation in the loading fee gradient across geographies and individual variation in health demand. The approach requires the derivation of the loading fee gradient, wage gradient, and retirement benefit gradients. These inputs are included with measures of health demand in an employment choice model of firm size and self-insurance status. The sections below describe how each of the terms is derived and how they are included in the final estimating equation.

4.2.1 Loading Fee Model

The premium model seeks to identify the loading fee paid by the employer (j) for a plan (p). The basic model starts with premium defined as the actuarial value of the benefit multiplied by a loading fee.

$$Premiums = (1 + LoadingFee)ActuarialValue \quad (4.1)$$

To decompose the impact of the loading fee from the actuarial value the natural log of both sides is applied.

$$ln(Premiums) = ln(1 + LoadingFee) + ln(ActuarialValue) \quad (4.2)$$

Next, actuarial values are estimated for each selected plan. Actuarial values are estimated using the publicly available 2015 CMS actuarial value calculator (DHHS 2013). This is similar to the approach used in Marquis et al. (2007) to estimate the impact of price on plan choice. The calculator allows many inputs to determine the actuarial value of the plan given a standard population and their observed use of services. While many of the inputs are not included in the MEPS plan files, the three largest drivers are available-annual deductible, coinsurance rate, and out-of-pocket maximum. To obtain the actuarial values from the spreadsheet, an algorithm was designed to iteratively input various combinations of these variables at observed levels in the data inflated to 2015 price levels. This dataset was imported into the RDC. Next a basic interaction model was fit to the AVs using the input values. This model was predicted into the plan dataset to provide estimates of the actuarial value for each plan.

The actuarial value from the calculator is inserted into the general model in (4.2). A linear regression framework is applied to the model.

$$ln\left(Premiums_j\right) = \beta_0 + \beta_1 ln\left(ActuarialValue_j\right) + ln\left(1 + LoadingFee_j\right) \quad (4.3)$$

Constraining the coefficient on the actuarial value β_1 to 1, subtracting on both sides of the equation, adding a vector of market area effects, and adding the modeling error term v_{jk} , distributed $N(0, \sigma)$, is shown in (4.3).

$$ln\left(Premiums_j\right) - ln\left(ActuarialValue_j\right)$$
$$= \beta_0 + MarketArea_j\beta_M + FirmHealthDemand\beta_F + ln\left(1 + LoadingFee_j\right) + v_j \quad (4.4)$$

Explanatory variables for this preliminary loading fee estimate include market area characteristics and firm health demand characteristics that captures the demand across all employees the firm covers. The market characteristics include conditions that may affect premiums such as the hospital concentration and HMO penetration rate. The firm health demand includes profit status, industry, and the percent of employees over age 50, the percent of employees that are female, the percent of employees that are low/medium/high wage, and the percent of employees that are unionized.

This model is estimated for each firm size k=1, 2 where 1=small and 2=large and produces the loading fee estimates defined in (4.5).

$$\left(LoadingFee_j^* | k = i\right) = ln\left(1 + LoadingFee_j | l = h\right) + v_{jk} \quad (4.5)$$

The difference in these loading fees, shown in (4.6) is the market specific loading fee gradient labeled as $\Delta LoadingFee_j$.

$$\Delta LoadingFee_j = \left(LoadingFee_j^* | k = 2\right) - \left(LoadingFee_j^* | k = 1\right) \quad (4.6)$$

4.2.2 Wage model

Wage differentials between large and small firms vary across market areas. A model of wages can capture this variation and allow its inclusion in the firm size choice model. The model shown in equation (4.7) considers individual characteristics that predict wages. In addition, the compensating wage differential implies that premiums and measured amenities of the individual will impact wages for similarly skilled workers. Similarly, firm characteristics, like business tenure, industry, and profit status may also affect the observed wage level. In order to isolate the relative differences in wages for an individual, firm size is interacted with individual characteristics using a vector of coefficients, β_{IF}. This allows individuals with different characteristics to have different wage gradients between large firms and small firms.

$$\begin{aligned} Wages_{ij} = \beta_0 + \beta_1 Premium_j + \beta_2 Amenities_j \\ + \beta_3 FirmCharacteristics_j \\ + \left(IndividualCharacteristics_{ij} \times FirmSize_j\right)\beta_{IF} \end{aligned} \quad (4.7)$$

The individual characteristics include age, sex, education, marital status, race, region, and metropolitan statistical area (MSA) status. Employment characteristics of the individual like occupation, hours of work, and tenure at the firm, are also included. Amenities include fringe benefits like paid vacation, paid sick leave, life insurance, and disability insurance. Each of these has some monetary cost to the firm and could therefore decrease wages. Amenities also includes flexible work schedule. This variable has an important theoretical connection such that it is believed small firms may be able to provide it at a lower cost than large firms.

A wage gradient for each individual is calculated by predicting the wage model conditional on the individual working at a large firm $\left(Wages_j^* | k = 2\right)$ and predicting the wage model conditional on the individual working at a small firm $\left(Wages_j^* | k = 1\right)$. These predictions are subtracted to create the wage gradient in equation (4.6).

$$\Delta Wage_{ij} = \left(Wages_{ij}^* | k = 2\right) - \left(Wages_{ij}^* | k = 1\right) \quad (4.8)$$

4.2.3 Retirement Benefit Model

Retirement benefits also may vary for large and small firms based on individual characteristics. This model builds on the same notion of the wage model and identifies the predicted difference in the probability of employers offering a retirement benefit. As with wages the model needs to account for premiums, amenities and other firm characteristics influencing retirement benefits. Individual characteristics are, similarly, interacted with firm size, using the vector of coefficients, β_{IF}, to allow predictions of the gradient in retirement benefits between large and small firms at an individual level.

$$pr(RetireBenefit = 1) = f\big(\beta_0 + \beta_1 Premium_j + \beta_2 Amenities_j + \beta_3 FirmCharacteristics_j + \big(IndividualCharacteristics_{ij} \times FirmSize_j\big)\beta_{IF}\big) \tag{4.9}$$

A retirement benefit gradient for each individual is calculated by predicting the probability of a retirement benefit conditional on the individual working at large firm $\left(RetireBenefit_j^* | k = 2\right)$ and predicting the retirement benefit model conditional on the individual working at a small firm $\left(RetireBenefit_j^* | k = 1\right)$. These predictions are subtracted to create the retirement benefit gradient in equation (4.10).

$$\Delta RetireBenefit_{ij} = \left(RetireBenefit_{ij}^* | k = 2\right) - \left(RetireBenefit_{ij}^* | k = 1\right) \tag{4.10}$$

4.2.4 Employment Choice Model

The employment choice model, tests whether the loading fee gradient estimated in equation (4.6) interacts with the health demand of the individual to increase the chance of working at firms with more than 50 employees. The wage and retirement benefit gradients predicted in (4.8) and (4.10) are included to capture other differences in the market areas. The sample for the model is limited to individuals in households that do not have a spousal offer of health insurance. An additional analysis will show if this decreases any observed effect. The model is fit using the logit function indicated by *f*.

$$pr\big(FirmSize_{ij} = 2\big) = f\big(\beta_0 + \beta_1 \Delta Wage_{ij} + \beta_2 \Delta RetireBenefit_{ij} + \beta 3 \Delta LoadingFeej + \beta 4 HealthDemandij + \beta 5 \Delta LoadingFeej * HealthDemandij + IndividualCharacteristics \beta 6 \tag{4.11}$$

This model tests the hypothesis that individuals with higher health demand will be more likely to work in large firms in areas with a larger gradient in the loading fees between large firms and small firms. The primary specification is for predicted dependent health expenditures. Additional measures of health demand are discussed as sensitivity analyses in section 4.5.

4.3 Estimation Details

Effects in the model will be interpreted using the average marginal effect (AME) rather than simply interpreting β_5. Since the model uses a non-linear link function, the logit, interaction coefficients do not represent the effect of interest (Ai and Norton, 2003). The equation for the computation of the interaction of two continuous variables is given in Norton, Wang and Ai (2004) and shown in (4.12).

$$\frac{\partial^2 F(u)}{\partial HealthDemand\ \partial \Delta LoadingFee_j} = \beta_5 \left(F(u)\big(1 - F(u)\big)\right) + (\beta_3 + \beta_5 * HealthDemand) * (\beta_4 + \beta_5 \Delta LoadingFee) * \left[F(u)\big(1 - F(u)\big)\big(1 - 2F(u)\big)\right] \tag{4.12}$$

$where$:

$$F(u) = \frac{1}{1 + e^{-(XB)}}$$

The variance is given, in equation (4.13), by:

$$\frac{\partial}{\partial \beta'}\left\{\frac{\partial^2 F(u)}{\partial HealthDemand\ \partial \Delta LoadingFee_j}\right\}\widehat{\Omega}_\beta \times \frac{\partial}{\partial \beta}\left\{\frac{\partial^2 F(u)}{\partial HealthDemand\ \partial \Delta LoadingFee_j}\right\} \tag{4.13}$$

Implementation of this formula for testing in Stata is described by Karaca-Mandic, Norton, and Dowd (2012) using the `predictnl` command and more conveniently with the `inteff` command. Non-interacted variables are produced as coefficients.

4.4 Identification

This model uses geographic variation in the difference between loading fees for small and large firms to identify the potential impact of loading fee differences on employment choice. While the loading fee gradient could impact *any* individual's employment choices and not just those with higher health demand, identification would be weaker, and rely on geographic patterns alone. Instead, this model uses variation in health demand in addition to variation in loading fee gradients to create a more robust estimate of the effect.

The basic threat to validity of the approach requires two conditions:

(a) The loading fee gradient to be correlated with individual's firm's size at the geographic level.

(b) The correlation in (a) is correlated with individual health demand in those areas.

Condition (a) has some potential for endogeneity because the model used to construct loading fees estimates has different models for large firms and small firms. Therefore, the loading fees estimated using area market characteristics could be related to the firm size distribution in the area (and thus disproportionately observing individuals of that firm size). However, to introduce bias into the effect in question, this correlation, as stated in (b), also needs to be correlated with the individual health demands in the area. The literature review of loading fees, health status, and firm size reveals no particular concerns of this type. Despite the lack of specific threats, various sensitivity analyses are included to contextualize the result.

4.5 Sensitivity Analysis

The consistency of the result is tested with various sensitivity analyses. The primary outcome is altered by using alternative firm size thresholds. This examines if the effect varies at firm size thresholds such as 25, 100, and 1000. Additionally, self-insurance status is tested as an outcome because it may also confer cost advantages for employers in a way similar to larger firm sizes. Next, an alternative measure of the loading fee, described in 4.2.1, is used to see if the construction of the loading fee gradient impacts the results.

$$ActuarialValue_j = \frac{Premium_j}{\left(1 + (LoadingFee|l = h)\right)} \tag{4.14}$$

For the plan at each employer, the actuarial value is calculated, shown in (4.14), using the l to indicate the 6 different firm size specific loading fees estimated from Karaca-Mandic et al. (2011), and the plan's observed premium. The loading fees from the paper are shown in Table 4-1.

Table 4-1. Loading Fees by Firm Size as estimated in Karaca-Mandic et al. (2011)

Firm Size	Loading Fee
0-50	0.42
51-100	0.25
101-500	0.17
501-1,000	0.12
1,001-10,000	0.16
>10,000	0.04

These actuarial values are used in place of the ones calculated using the actuarial value calculator. They are then inserted into equation (4.2) and the remainder of the estimation is the same.

Finally, variations in the health demand measure are evaluated. This includes using employee spending, as opposed to just their dependents. Also, observed spending is tested, as opposed to predicted spending. These measures of health demand are not supported due to theoretical concerns about decision making on behalf of the employee and employer.

Chapter 5. Data and Variables

This chapter describes the data the model will be using and the variables constructed using the data. The data are from the 1997-1999, 2001 Medical Expenditure Panel Survey Household Component-Insurance Component (MEPS-HC-IC) Linked File. This dataset is noteworthy because it not only includes information about a person and their household's health expenditures, but it also includes information about a person's employer and up to four health insurance plans if they offer them. The dataset was created by linking the listed employers from the Household Ccomponent (MEPS-HC) to the sample of employers in the Insurance Component (MEPS-IC). The relevant variables from these datasets and other data merged in are described. Additionally, as discussed in the Methodology chapter, certain variables are constructed from models. The results from those models are included in this chapter as they represent inputs to main estimating equation.

5.1 Data

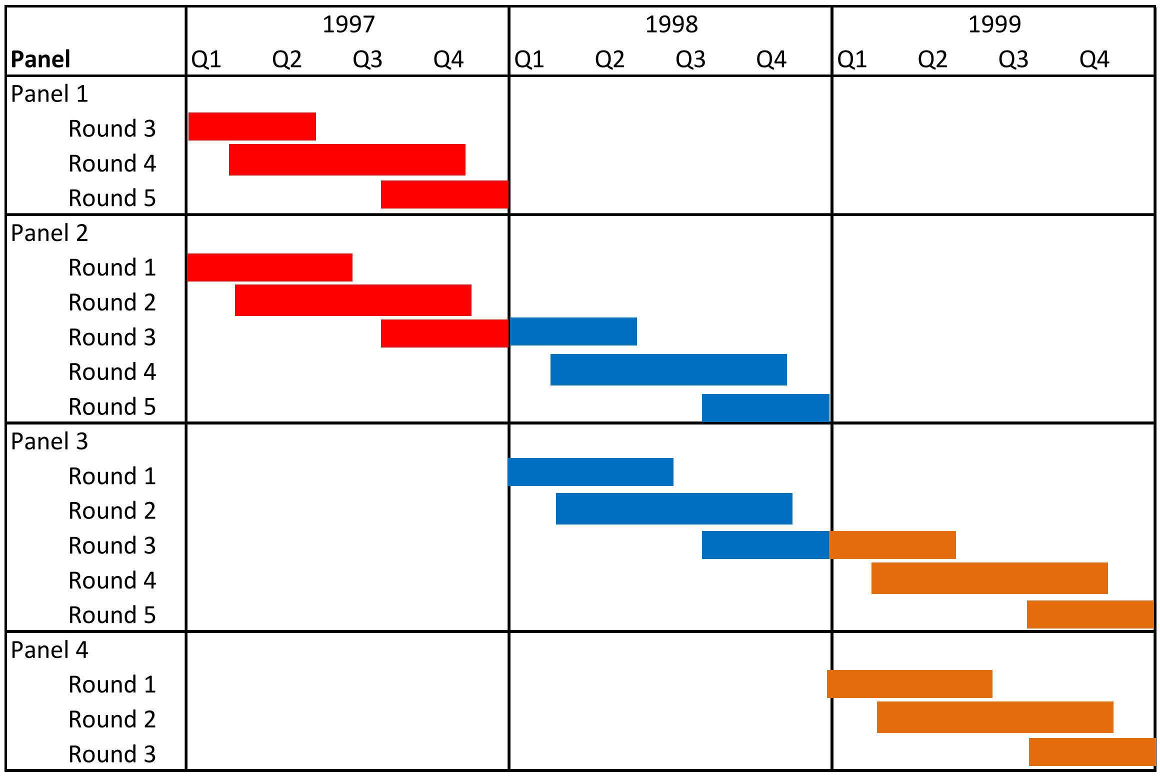
5.1.1 MEPS-HC

The MEPS-HC is a household survey that collects nationally representative information about healthcare utilization and cost. Each household in the MEPS-HC is interviewed 5 times, in "rounds", over a two-year period. The survey introduces a new panel of households each year. The sample of households comes from a subset of participants in the National Health Interview Survey (NHIS). Shown in Figure 5-1 is a diagram of the panel structure of the MEPS-HC adapted from the survey design methodology[11]. The diagram exhibits the longitudinal aspect of

[11] MEPS-HC Sample Design and Collection Process. Agency for Healthcare Research and Quality, Rockville, Md. http://www.meps.ahrq.gov/survey_comp/hc_data_collection.jsp

the data since each panel of individuals is being interviewed in 5 rounds that take place over a span of 2 years.

Figure 5-1. MEPS-HC Panel Design-1997-1999



The survey is noteworthy because it attempts to validate the expenditures reported by individuals by contacting the medical providers. While it is known to undercount total expenditures by approximately 21% (Sing et al., 2006), it still provides excellent relative spending amounts and their source of payment. In addition to consistent set of measures collected in each round, some round have additional modules of questions included. This study uses the person round plan files (PRPL), medical condition files, as well as the consolidated full-year files.

5.1.2 MEPS-IC

The MEPS-IC is a nationally representative survey of establishments. The primary purpose is to collect information about the health insurance benefits if the establishment offers health insurance. Because data include information about the wages and other benefits of the employer that may be competitive in nature, the record data are kept confidential and only produced publicly as summary tables by state, firm size, industry, and other establishment characteristics.

5.1.3 MEPS-HC-IC Linked File

The data are from the Medical Expenditure Panel Survey (MEPS) household and insurance component linked data (MEPS-HC-IC). The data are only available to researchers through one of the, currently, eighteen, Research Data Centers (RDC) operated by the US Census Bureau or through the Agency for Healthcare Research and Quality (AHRQ) directly. To create the analytic file, individuals employed in round 1 of the MEPS-HC are linked using employer contact information to establishment identifiers in the sample frame of the MEPS-IC. In addition to finding the employer of the household records, the selected plan of the individual is also matched. The quality of the match is recorded through multiple variables describing the process used to link records between surveys. For this study, individuals are included if the plan match was made automatically, manually, or through random assignment of offered plans. While this deviates somewhat from other approaches that only use automatics and manual matches (Karaca-Mandic et al., 2011), it is justified under the assumption that the plan information being used will tend to be of similar actuarial value across the plans that they offer. Therefore a random plan will approximate the actual plan with enough certainty to be used in the model. By including observations with random matches, the total sample of linked individuals increases from 8,245 to 9,946 over the 4 years of data.

Unfortunately, because not all households gave employer information and because not all of these employers completed the insurance survey, the estimates from the data do not have the same likelihood of being nationally representative as either survey individually. The impact on observed variables of this selection is discussed in the limitations section. While the MEPS-HC-IC data have many advantages—for questions of this variety in particular—the linked dataset was not created in years subsequent to 2001 due to issues of non-response.

5.1.4 Study Sample

Table 5-1 shows how the number of observations in the MEPS-HC, (116,797) compares to the number of observations with matched plan information from the MEPS-IC (9,946). In addition, the table shows how the plan link is split into three categories based on how the plan was identified: automatic (by name), manual (by staff), and random (from all plans offered). Finally, it shows that there were many other individual's with plans that were not matched to the MEPS-HC (44,384) out of the total records, at the plan level in the MEPS-IC (54,330).

Table 5-1. Data File Sizes

Sample	Count	Percent of Previous
HC All	116,797	
Working, Age 19-64	48,229	41%
IC Link	19,886	41%
Matched/Selected Plans	9,946	50%
Automatic	3,551	36%
Manual	4,694	47%
Random	1,701	17%
Unmatched/Unselected	44,384	
Total IC Plans	54,330	

From these data files there are multiple samples used in the study. The health expenditure model used data on all individuals, adults and children, in the MEPS-HC who had ESI at any point in time (n=66,927). The loading fee model is fit only on 7,157 observations (72%) in the MEPS-HC-IC with plan information linked and that had non-missing data in the plan information[12]. The wage and retirement benefit models are fit on working adults, age 18-64, with non-missing wage (n=9,416) and retirement benefit (n=6,876) information.

The employment choice model sample includes individuals that have employer sponsored insurance (ESI), as either a policyholder or a dependent, in the first round of their panel. The sample is restricted to those working adults age 18-64. These records are merged with the special MEPS-IC sample using the households' employers. While MEPS staff provide matches even when discrepancies exist, only records that exactly match plan information are used for the analysis. This step reduces the sample to 7,875. Finally, records missing key employer data such as firm size or plan characteristics are excluded giving a final sample size of 6,103. Summary statistics are shown in for variables in the MEPS-HC files over this period. Shown in

5.2 Variables

Several variables in the data are used in multiple models to construct the study measures. These input variables are described in this section. In general, due to the data construction of the linked file, all variables from the MEPS-HC use the round 3 or round 1 response from the individual. While many of the variables do not change much over time, these rounds align most accurately with the health insurance information observed in the MEPS-IC.

[12] The alternative loading fee model used 9,894 observations because it did not require the plan information about deductibles, coinsurance, and out-of-pocket maximums.

5.2.1 Outcomes

The primary outcome is measured in terms of the firm size of the selected job. Firm size is categorized into small and large using a threshold of 50 employees. The reason for this threshold value is based on a couple of factors. Historically, 50 employees has been the threshold in the definition of small firms for the purposes of rate regulation in states (though some states have used 100). Additionally, PPACA creates distinctly different rules for firms above and below the threshold of 50 employees and thus there is policy relevance to knowing the impact at that level. Other firm size thresholds are discussed in the sensitivity analysis.

Self-insurance is measured in the MEPS-IC at the plan level by asking employers if the plan was purchased from an insurance underwriter or it was self-insured such that the organization assumes risk for the enrollee’s medical expenses. This type of plan may charge employees a premium, be administered by a third party, and may employ supplemental stop-loss coverage (MEPS-HC 2001). It is relevant in the choice situation because self-insured firms have lower loading fees in similar way to large firms. And, because self-insured firms can be large or small (though much more likely to be large), it provides a different comparison of the potential impact.

5.2.2 Covariates

Premiums

The premiums are measured in the MEPS-IC using the premium for single person policies. While family policy premiums are given, it is more straightforward to only deal with the single policy due potential variations in family size between firms. All premiums are measured annually as reported by the employer. The premium includes the employer and employee contributions to best reflect the amount paid for the plan. As many firms are self-insured, their premiums are estimated as a monthly equivalent by the respondent after being asked to calculate the claims paid, administrative costs, and the cost of any stop-loss coverage[13].

Wages

Wages are measured annually in the MEPS-HC with the WAGEPX variable. Some wage data are only reported in broad ranges and are then imputed as an exact amount within the range using hot-deck imputation. In some cases, wages are constructed based on employment data about their hourly rate, number of hours per week, and number of weeks per year. Remaining wage imputations are based on employment status.

Retirement Benefit

The retirement benefit is included in both the MEPS-IC and MEPS-HC. The question from the MEPS-HC asks whether the establishment offered a pension a plan to its wage earners. While most employees would be part of these, it is only known if a plan is offered. Similarly, the MEPS-IC records whether the establishment offers a pension plan. There is some discrepancy between the measures and additional missing values in the MEPS-IC. Thus, the MEPS-HC measure, defined by the RETPLN31 variable, is coded as a binary indicator.

Individual Demographics

The standard demographic variables of age (0-18, 19-34, 35-54, 55-64, 65+), sex (male, female), race (White, Black, Hispanic, Other), education (Less than high school, High school, College or more), marital status (Married, Not married), and children under age 5 (Yes, No), are included as basic predictors in the models. In the health expenditure model, poverty is measured using the total income of the family defined using the Current Population Survey family

[13] The COBRA amount is used the premium equivalent is not known.

definition. Federal poverty guidelines using the size of the family are used to calculate the percent of the poverty for the family (Less than 150% of poverty, 150-200, 200-250, and 250-400).

One important variable used to define the sample for the wage, retirement benefit and employment choice models is employer sponsored insurance. This is measured on a monthly basis over the 2 years of the survey using the PEG[MM] variable series. To create an indicator for each person in the year of their IC link, ESI coverage in any month is allowed. While other measures are restricted to the round level of the link, the months do not align exactly with the rounds and thus, the broader definition is used. Individual employment characteristics are extracted from the MEPS-HC. These variables include occupation (10 categories), hours worked per week (0-14, 15-34, 35-44, 45-59, 60+) and years of job tenure (0-1, 2-4, 5-9, 10-19, 20+).

Individual Health

The MEPS-HC contains a separate module on medical conditions. This file lists all conditions for an individual (the employee and dependents) using ICD9 codes. Commonly coded variables are given indicators in the data. The list of conditions used includes indications of: cancer, diabetes, emphysema, high cholesterol, hypertension, heart disease, stroke, arthritis, asthma, gall bladder, ulcer, back problem, pregnancy or delivery, depression or anxiety. Self-reported health status and mental health status are both included as health characteristics. Also, functional limitations and the use of an assistive device are used to predict health expenditures.

Firm Characteristics

The basic characteristics of the firm include its profit status and its industry (11 categories) shown in Table 5-7. Job amenities are measured using paid vacation, paid sick leave, life insurance, and disability insurance as indicators. These other fringe benefits are shown in Lluis and Abraham (2011) to be significant factors in understanding total compensation. At the establishment level, the MEPS-IC records the percent of the employees over age 50, the percent female, the percent with low, medium, and high wages (the level of wage varies by year[14]). These variables are classified as measures of the firm's demand for health benefits.

Plan Characteristics

The health plan measures include: the deductible, the coinsurance rate, and the out-of-pocket maximum. Additional variables that are available but not specifically incorporated in the current set of include the provider referral requirements, provider network exclusivity, health maintenance organization (HMO) status, and specific covered items. The covered items include routine mammograms, adult preventive care, well-baby/well-child care, chiropractic care, outpatient prescriptions, routine vision care, routine dental care, orthodontic care, inpatient mental illness, outpatient mental illness, and alcohol/substance abuse treatment.

Market Area Characteristics

Median household income is measured at the county level in the area health resource file (AHRF). Also available through the AHRF, doctors per capita is measured through American Medical Association Masterfile tabulations and census population estimates by county. Hospitals per capita and admissions per capita are measured with numerators from the American Hospital Association (AHA) database. The HMO penetration rate for Medicare enrollees is used from AHRF.

Hospital competition is measured as the share of beds by the hospital system within the hospital referral region[15]. The count of beds is obtained from the publicly available hospital data used in the 2001-2005 hospital-specific datasets from the Dartmouth Atlas study of end of life

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[14] For 2001 the thresholds are $9.50 and $21.00 per hour. For 1997-1999 the thresholds are $6.50 and $15.00 per hour.
[15] Hospital Referral Regions can cross state lines.

care used in Wennberg et al. (2008)[16]. A standard Herfindahl-Hirschman Index (HHI) measure, the sum of squared markets shares, is created for each HRR. These are assigned to counties by applying a weighted average of the HRR scores based on the HRR share of the county[17]. The proportions used for the weights are calculated using a geographic information system (GIS) manipulation of HRR and county shapefiles to calculate the percent of the county's land area made up by each HRR[18]. The resulting measure is linked by the county of the household residence to the dataset.

5.3 Constructed Variables

5.3.1 Health expenditures

A key explanatory variable in the conceptual model is the expected health expenditure of the employee and their dependents. Health expenditures are notoriously difficult to model due to their non-normal distribution. A substantial number of individuals have no expenditures and the ones that do have expenditures, do not follow a normal distribution. While many approaches have been taken, Buntin (2004) provides a nice review of methods concluding that one or two part generalized linear models (GLM), with variance proportional to the mean, create the best fitting models for Medicare data. Furthermore, abstracting the GLM to alternative link functions, Glick (2008) advises to select a link function using the flexible power function (one value of which is the log link) using a summary fit measure derived from the Pearson, Pregibon, and Hosmer-Lemeshow fit statistics. More recently Hill and Miller (2010) look at optimal link functions for the MEPS data, specifically. They use the mean prediction error and a modified Hosmer-

[16] These data available online from http://www.dartmouthatlas.org/tools/downloads.aspx?tab=40
[17] The number of HRRs per state ranges from just one in Alaska to 29 in California.
[18] GIS calculations performed in ArcMAP 10.0 produced by ESRI.

Lemeshow test to test for overfitting and conclude that extended estimating equations (EEE) are better performing than the more restrictive GLM with log link. The Glick approach and the Hill and Miller selection criteria indicated 0.58 and 0.59, respectively, for the power function parameter. Next, the variance family is selected using the modified Park test. This procedure results in the gamma family variance structure (though the Poisson distribution was equally appropriate).

Therefore, the expected expenditure consists of a two-part GLM model with 0.58 power link and gamma variance. It is fit with covariates that include demographic characteristics and health status variables. The health status variables include a vector of health conditions, self-reported health status, functional limitations or use of assistive devices. Part 1 of the model, shown in (5.1), predicts expenditures (*Exp*) that are greater than zero with the logit as the link function, its inverse is indicated as g.

$$pr(Exp_i > 0) = g(\beta_0 + Demographics_i\beta_1 + HealthStatus_i\beta_2) + \sigma^2 \qquad (5.1)$$

The second part of the model, shown in equation (5.2), predicts expenditures, conditional on expenditures greater than zero. The power link function is set at 0.58 and its inverse is represented by *f*.

$$E(Exp|Exp > 0) = f(\beta_0 + Demographics_i\beta_1 + HealthStatus_i\beta_2) + \sigma^2 \qquad (5.2)$$

Additionally, the variance is specified as being proportional to mean squared as shown in equation (5.3).

$$(\sigma^2|X\beta) = \left(f(X\beta)\right)^2 \qquad (5.3)$$

The predictions are the product of the predicted probabilities from step 1 and the predicted expenditures in step 2 shown in equation (5.4).

$$E(Exp_i|X_i) = \Pr\left(Exp_i > 0\middle|X_i\right) E(Exp_i|X_i, Exp_i > 0) \qquad (5.4)$$

In later models this prediction is referred simply to health demand. It is calculated at the individual level for both the employee and their dependents. Thus it is aggregated as either the employees, that of just the dependents, or as the total of individuals on the same policy. To improve the precision of the model, it is fit not only on the linked cases, but the total sample of individuals with ESI coverage in the HC. This is approximately 60,000 records rather than just the 10,000 linked records. The summary statistics for the covariates are shown in Table 5-2.

Table 5-2. Expenditure Model Summary Statistics

	Logit	GLM
Health Spending >0 (%)	85.5	
Health Spending (mean)		$2,305.29
	Percent	Percent
Conditions		
Cancer	1.45	1.67
Diabetes	2.89	3.36
Emphysema	0.33	0.37
High cholesterol	2.51	2.92
Hypertension	7.40	8.60
Heart disease	2.55	2.95
Stroke	0.24	0.28
Arthritis	0.54	0.63
Asthma	2.59	2.96
Gall bladder	0.15	0.17
Ulcer	0.25	0.29
Back problem	3.48	3.90
Pregnancy or delivery	0.82	0.94
Depression or anxiety	4.76	5.45
Poverty as percent of HHS poverty guidelines		
Less than 150	10.8	9.7
150-200	8.3	7.8
200-250	9.5	9.1
250-400	27.1	27.2
Unknown/missing	44.3	46.2
Education		
Less than high school or unknown	8.9	8.1
High school/GED	38.7	38.3
College or more	23.8	25.3
Not Applicable (Age 0-18)	28.7	28.3
Marital Status		
Age 0-18	25.6	25.4

Not married	25.8	24.9
Married	48.6	49.8
Sex		
Male	48.9	46.4
Female	51.1	53.6
Age		
less than 1	1.0	1.0
1-18	27.1	26.8
19-34	21.5	19.8
35-54	34.1	34.5
55-64	9.2	10.0
65+	6.5	7.4
Unknown/missing	0.6	0.5
Race		
White	67.3	70.7
Black	12.4	11.2
Hispanic	16.8	14.9
Other	3.5	3.2
Health status		
Fair or poor	7.8	8.7
Excellent, very good, good	90.3	89.9
Unknown/missing	1.9	1.4
Mental health status		
Fair or poor	3.3	3.6
Excellent, very good, good	94.8	95.0
Unknown/missing	1.9	1.4
Limitation in physical functioning		
No	92.2	91.9
Yes	5.6	6.4
Unknown	2.2	1.7
Uses assistive devices		
No	96.6	96.8
Yes	1.6	1.8
Unknown	1.9	1.4

The expenditure model itself performed well. There were 66,927 observations in the sample, 57,216 of which had spending greater than zero and were included in the second part. The same set of covariates is used in both parts of the model and the results are shown in Table 5-3. While the impacts of these variables are not under examination directly, it is worth noting the strong significance of the predictors.

Table 5-3. Health Expenditure Model Results

	Logit Pr(Health Expenditures>0) Coefficient	SE	T-stat	GLM (power=0.58, var=gamma) Health Expenditures|>0 Coefficient	SE	T-stat
Conditions						
Cancer	2.05***	0.28	7.27	57.9***	7.68	7.54
Diabetes	2.743***	0.30	9.26	27.13***	4.22	6.44
Emphysema	0.418	0.44	0.95	13.18	13.62	0.97
High cholesterol	2.29***	0.32	7.12	19.68***	4.18	4.71
Hypertension	2.794***	0.19	14.71	16.06***	2.38	6.75
Heart disease	1.62***	0.24	6.90	41.63***	5.50	7.58
Stroke	1.16	0.80	1.45	31.79*	19.17	1.66
Arthritis	1.125**	0.46	2.43	34.5***	11.27	3.06
Asthma	1.905***	0.17	11.41	15.81***	2.86	5.53
Gall bladder	1.293**	0.55	2.37	52.08**	20.97	2.48
Ulcer	1.373***	0.47	2.93	27.76**	13.61	2.04
Back problem	0.946***	0.11	8.67	12.62***	2.94	4.29
Pregnancy or delivery	2.363***	0.34	6.94	84.12***	9.10	9.24
Depression or anxiety	1.516***	0.12	12.18	25.02***	2.87	8.73
Poverty as percent of HHS poverty guidelines						
Less than 150	[base]					
150-200	0.238***	0.05	5.06	-2.867*	1.67	-1.71
200-250	0.326***	0.05	7.08	-0.515	1.67	-0.31
250-400	0.564***	0.04	14.67	0.007	1.38	0.01
Unknown/missing	0.76***	0.04	19.85	3.665***	1.36	2.69
Education						
Less than high school or unknown						
High school/GED	0.315***	0.04	7.65	2.641	1.71	1.54
College or more	0.741***	0.05	15.44	2.167	1.82	1.19
Age 0-18	1.694***	0.20	8.59	14.24**	7.13	2.00
Marital Status						
Age 0-18						
Not married	-0.36***	0.06	-5.60	12.76***	2.21	5.78
Married	-0.152**	0.07	-2.14	13.65***	2.46	5.54
Sex						
Male						
Female	0.766***	0.02	31.50	6.925***	0.78	8.92
Age						

less than 1						
1-18	-2.052***	0.16	-12.66	-41.34***	6.11	-6.77
19-34	-1.067***	0.09	-11.59	-32.04***	2.83	-11.32
35-54	-0.895***	0.09	-9.79	-26.63***	2.76	-9.64
55-64	-0.602***	0.10	-5.87	-10.11***	3.18	-3.18
Unknown/missing	-3.945***	0.21	-18.91	96.85***	22.90	4.23
Race						
White						
Black	-0.835***	0.03	-25.18	-8.349***	1.15	-7.26
Hispanic	-0.728***	0.03	-24.31	-7.382***	1.00	-7.41
Other	-0.783***	0.06	-13.73	-11.69***	1.79	-6.52
Health status						
Fair or poor						
Excellent, very good, good	-0.696***	0.07	-9.48	-43.15***	2.88	-15.01
Unknown/missing	-2.481***	0.55	-4.53	-33.15	21.68	-1.53
Health status						
Fair or poor						
Excellent, very good, good	-0.185*	0.10	-1.88	-18.69***	3.64	-5.13
Unknown/missing	-0.545	0.51	-1.08	-4.394	21.15	-0.21
Limitation in physical functioning						
No						
Yes	0.88***	0.12	7.61	37.23***	3.74	9.95
Unknown	0.0963	0.19	0.52	32.85***	9.43	3.48
Uses assistive devices						
No						
Yes	0.446*	0.24	1.87	63.39***	9.63	6.59
Unknown	0.388	0.38	1.03	-48.73***	14.73	-3.31
Constant	2.5***	0.16	16.11	135.8***	5.75	23.61
Observations	66,927			57,216		
Chi value	8438			3244		
Chi (df)	40			40		

*** p<0.01, ** p<0.05, * p<0.1

5.3.2 Actuarial Value Calculator

Shown in Table 5-4 are the results of the actuarial value calculator imputation model which is fit on a dataset of actuarial value percentages. The model shows that the percentages are smoothly continuous predictors of the outcome. Due to the interactions, the direction of effects is counter-intuitive. That is, the larger deductibles appear to increase the actuarial value percentage but because they are strongly negatively related to the outcome when interacted with the coinsurance rate, the full effect is in the expected, negative, direction.

Table 5-4. Actuarial Value Calculator Imputation Model

	Coef	SE	T	Significance
Coinsurance	0.24405	0.029464	8.28	***
Deductible				
0-99	[Base]			
100-249	0.02231	0.023119	0.97	
250-499	0.056691	0.023119	2.45	**
500-999	0.116015	0.023119	5.02	***
1000-1999	0.156488	0.024294	6.44	***
2000+	0.212847	0.025788	8.25	***
Out-of-Pocket Maximum				
0-999	[Base]			
1000-1999	-0.1752	0.029282	-5.98	***
2000-2999	-0.27487	0.028417	-9.67	***
3000-3499	-0.3629	0.028417	-12.77	***
3500-3999	-0.42383	0.028417	-14.91	***
4000-4999	-0.4738	0.028417	-16.67	***
5000+	-0.50794	0.028417	-17.87	***
Coinsurance*Deductible				
Coinsurance*i.(100-249)	-0.0464	0.026354	-1.76	*
Coinsurance*i.(250-499)	-0.11405	0.026354	-4.33	***
Coinsurance*i.(500-999)	-0.22034	0.026354	-8.36	***
Coinsurance*i.(1000-1999)	-0.32849	0.027692	-11.86	***
Coinsurance*i.(2000+)	-0.44843	0.029395	-15.25	***
Coinsurance*Out-of-Pocket Maximum				
Coinsurance*i.(1000-1999)	0.173684	0.033378	5.2	***
Coinsurance*i.(2000-2999)	0.272806	0.032393	8.42	***
Coinsurance*i.(3000-3499)	0.359539	0.032393	11.1	***
Coinsurance*i.(3500-3999)	0.421001	0.032393	13	***
Coinsurance*i.(4000-4999)	0.47195	0.032393	14.57	***
Coinsurance*i.(5000+)	0.507002	0.032393	15.65	***
Constant	0.744325	0.025848	28.8	***

Note:
*** p<0.01, ** p<0.05, * p<0.1

This model is predicted into the MEPS-IC to provide estimates of the actuarial value of plans by multiplying the predicted percent by the single premium. As described in equation (4.4) the loading fee is calculated as the difference between the logged actuarial value and the logged premium.

5.3.3 Loading fee gradient

The loading fee gradient is derived econometrically as described in equation (4.6) . It is not observed directly and thus estimates are created that reflect its true value. The model uses area characteristics to explain variation in the calculated loading fees observed by employers in the sample. These are then predicted for large firms and small firms. The difference in these predictions constitutes the loading fee gradient to which individuals are exposed to. Two approaches are used to provide a robustness check of the impact of the measure construction.

The summary statistics for the loading fee model are shown in Table 5-5. The mean loading fee for small firms is estimated at 0.377 and 0.094 for large firms. Small firms make up 14% of the sample and large firms make up 86% of the sample.

Table 5-5. Loading Fee Model Summary Statistics

	Mean		
Continuous Variables	Small	Large	Total
Loading fee (Calculated)	0.377	0.094	0.132
SD	3.00E-08	0.065	0.114
MCO Penetration Percent	18.4	16.9	17.1
SD	16.2	16.0	16.1
Doctors (per 10,000 population)	25.9	24.1	24.3
SD	19.4	18.3	18.5
Median household income	44,950	43,676	43,846

SD	11,763	11,324	11,391
Hospitals (per 100,000 population)	2.0	2.2	2.1
SD	2.7	3.0	3.0
Admits (per 100 population)	12.5	12.6	12.6
SD	7.1	7.5	7.5

	Percent		
Categorical Variables	Small	Large	Total
Firm size (unweighted)	13.9	86.1	100.0
Hospital HRR HHI (beds)			
0-1,000	41.4	41.9	41.9
1,000-2,000	35.3	36.9	36.7
2,000-3,000	19.4	18.4	18.6
4,000+	2.5	2.2	2.2
Missing	1.4	0.5	0.6
Region			
Northeast	18.5	16.6	16.8
Midwest	26.5	23.1	23.5
South	29.6	38.6	37.4
West	25.4	21.7	22.2
Profit Status			
For profit	87.5	81.1	81.9
Not for profit	12.5	18.9	18.1
Industry			
Retail trade	7.5	6.3	6.4
Personal services	1.7	0.7	0.8
Business services	5.9	2.5	2.9
Other services	19.0	9.7	10.9
Manufacturing	7.8	15.0	14.0
Wholesale trade	4.9	2.5	2.9
Finance, insurance, or real estate	5.5	3.6	3.9
Transportation, communications and electric	2.9	3.5	3.4
Construction	8.5	1.2	2.2
Agriculture or forestry	1.4	0.3	0.4
Mining	0.2	0.4	0.3
Public administration	0.0	9.7	8.4
Missing/DK	34.6	44.7	43.3
Percent of employees-over age 50			
0-10	37.4	8.4	12.3
11-20	20.8	13.2	14.3

20-30	15.1	14.7	14.7
30-40	8.3	20.4	18.7
40+	15.7	7.3	8.4
Unknown	2.6	36.1	31.6
Percent of employees-female			
0-20	30.0	8.8	11.6
20-40	21.2	11.6	12.9
40-60	17.5	29.5	27.9
60-80	13.1	13.4	13.4
80-100	16.6	7.4	8.7
Unknown	1.5	29.2	25.5
Percent of employees-wage<$6.50/hour			
0-20	77.9	53.1	56.4
20-40	8.5	5.7	6.1
40-60	4.4	2.6	2.9
60-80	2.7	1.9	2.0
80-100	3.5	0.9	1.3
Unknown	3.1	35.7	31.3
Percent of employees-wage $6.50-$15/hour			
0-20	15.4	6.9	8.0
20-40	12.8	21.0	19.9
40-60	17.5	12.1	12.8
60-80	21.3	12.7	13.9
80-100	29.9	10.5	13.1
Unknown	3.2	36.9	32.3
Percent of employees-wage >$15/hour			
0-20	42.3	18.5	21.7
20-40	21.6	12.9	14.1
40-60	12.9	8.8	9.3
60-80	7.9	17.0	15.7
80-100	12.3	6.1	6.9
Unknown	2.9	36.8	32.2
Percent of employees-union			
0-20	92.8	52.8	58.1
20-40	0.6	3.9	3.5
40-60	0.8	4.0	3.6
60-80	1.3	6.7	5.9
80-100	2.3	10.1	9.1
Unknown	2.3	22.5	19.8

Year			
1997	18.8	18.9	18.9
1998	19.2	24.5	23.8
1999	27.9	29.6	29.4
2001	34.1	27.0	28.0

Note: All categorical column percentages sum to 100 percent

Table 5-6 shows the model output for direct effects in the loading fee model. The full model results include interactions of the listed variables with firm size. Additionally, not shown, state is included as a main and interacted effect with firm size. The model explained approximately 17% of the variation in the loading fee gradient and was fit with 7,157 observations. This sample size is limited to observations that included variables needed for calculating the actuarial value (deductible, coinsurance rate, and out-of-pocket maximum). The prediction from the loading fee model is applied to all 7,191 observations used in the employment choice model.

Table 5-6. Loading Fee Model Result

Variable	Coef	SE	T-Stat	Sig.
Doctors (per 10,000 population)	0.00029	0.0003	1.11	
Median household income ($10,000s)	0.00084	0.0035	0.24	
Hospitals (per 100,000 population)	0.00132	0.0012	1.06	
Admits (per 100 population)	-0.00053	0.0007	-0.74	
MCO Penetration (Percent)	-0.00075	0.0003	-2.23	
Hospital HRR HHI (beds)				
0-1,000	[Base]			
1,000-2,000	-0.00057	0.0085	-0.07	
2,000-3,000	0.00952	0.0109	0.87	
4,000+	-0.00642	0.0214	-0.30	
Missing	0.00769	0.0642	0.12	
Region				
Northeast				
Midwest	-0.04940	0.0708	-0.70	
South	0.03460	0.0692	0.50	
West	-0.10500	0.0753	-1.40	
Firm Size				
Small	[Base]			
Large	-0.00172	0.0597	-0.03	
Profit Status				
For profit	[Base]			
Not for profit	0.00405	0.0045	0.91	
Industry				
Retail trade	[Base]			
Personal services	0.00992	0.0147	0.68	
Business services	-0.00633	0.0086	-0.73	
Other services	0.01380	0.0067	2.08	*
Manufacturing	-0.01280	0.0060	-2.12	*
Wholesale trade	0.00509	0.0087	0.58	
Finance, insurance, or real estate	0.01550	0.0079	1.96	
Transportation, communications, electric	-0.00450	0.0086	-0.52	
Construction	0.00609	0.0095	0.64	
Agriculture or forestry	-0.02650	0.0171	-1.55	
Mining	0.01250	0.0196	0.64	**
Public administration	0.00269	0.0102	0.26	
Missing/DK	0.03150	0.0061	5.17	

Percent of employees-over age 50				
0-10	[Base]			
11-20	0.01760	0.0045	3.94	
20-30	0.01660	0.0045	3.68	
30-40	0.02670	0.0048	5.56	
40+	0.03730	0.0051	7.37	
Unknown	0.01610	0.0058	2.77	
Percent of employees-female				
0-20	[Base]			
20-40	-0.00028	0.0046	-0.06	
40-60	-0.00708	0.0044	-1.61	
60-80	0.00219	0.0048	0.46	
80-100	0.00561	0.0055	1.03	
Unknown	0.01280	0.0067	1.91	
Percent of employees-wage<$6.50/hour				
0-20	[Base]			*
20-40	0.00353	0.0059	0.60	*
40-60	0.00209	0.0094	0.22	
60-80	0.01470	0.0122	1.20	
80-100	0.03360	0.0150	2.25	
Unknown	-0.00333	0.0110	-0.30	
Percent of employees-wage $6.50-$15/hour				
0-20	[Base]			
20-40	0.00451	0.0080	0.57	
40-60	0.02130	0.0095	2.26	
60-80	0.02270	0.0110	2.08	
80-100	0.02320	0.0125	1.85	
Unknown	0.05220	0.0343	1.52	
Percent of employees-wage >$15/hour				
0-20	[Base]			
20-40	-0.00131	0.0050	-0.26	
40-60	0.00447	0.0079	0.56	
60-80	0.02370	0.0104	2.28	
80-100	0.03400	0.0127	2.68	
Unknown	-0.03320	0.0318	-1.04	*
Percent of employees-union				
0-20	[Base]			
20-40	-0.00884	0.0062	-1.42	
40-60	0.02520	0.0064	3.93	

60-80	0.01820	0.0053	3.46
80-100	0.03640	0.0046	7.85
Unknown	0.00873	0.0042	2.06
Year			
1997	[Base]		
1998	0.01740	0.0046	3.82
1999	0.02070	0.0042	4.91
2001	0.05250	0.0052	10.02
Constant	-0.03770	0.0511	-0.74
R-Squared	.1680		
F-Test	8.62		
Observations	7,157		

Note: Model contains full set of interactions between variables listed and firm size. In addition the full set of state by firm size interactions are included. Due to the large number of coefficients and lack of specific relevance the full model results are available upon request.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

5.3.4 Wage and Retirement Benefit Gradients

The wage and retirement benefit models are used to construct a measure that reflects the difference in wages and retirement benefits in the geographic area between large and small firms. These are used to protect against misinterpreting loading fee effects from wage and retirement benefit effects. The summary statistics for the model are shown in Table 5-7. The wages are very similar between small and large firms at $10.254 and $10.256 per hour respectively. The retirement benefit is substantially more common in the large firms, at 76%, compared to small firms, at 51%.

Table 5-7. Wage and Retirement Benefit Model Summary Statistics

	Wage Model		Retirement Benefit Model	
	Small	Large	Small	Large
Wage ($/hour)	10.2539	10.2562		
Retirement Benefit (percent)			50.5	76.4
	Percent	Percent	Percent	Percent
Amenities				
Paid Sick	38.5	44.5	56.0	59.1
Paid Vacation	57.8	51.2	83.6	67.7
Life Insurance	58.4	75.2	62.2	75.1
Disability Insurance	43.0	57.9	46.5	59.4
MSA Account	2.4	9.0	2.5	8.4
FSA Account	9.0	38.2	11.0	39.5
Café Plan	12.7	23.0	13.7	23.3
Non-Profit	12.2	18.3	13.8	17.0
Industry				
Agriculture, forestry, fisheries and mining	3.3	1.2	2.7	1.2
Construction	12.2	2.9	11.6	2.9
Manufacturing	14.1	21.0	14.9	21.2
Transportation, communications and utilities	5.5	9.9	5.2	9.8
Sales	16.4	12.0	16.8	11.9
Finance, insurance, or real estate	9.6	5.8	9.8	6.3
Repair services	9.9	3.5	10.0	3.5
Personal services	1.7	1.4	2.1	1.4
Entertainment and recreation	1.1	1.2	1.2	1.2
Professional services	24.4	27.7	24.2	28.1
Public administration	0.6	11.3	0.6	11.4
Other/Missing	1.2	2.0	0.9	1.2
Education				
Less than high school or unknown	9.8	8.9	10.9	8.6
High school/GED	52.7	52.2	55.1	51.9
College or more	37.5	38.9	34.0	39.5
Marital Status				
Not married	36.4	35.5	38.4	35.2
Married	63.6	64.5	61.6	64.8
Sex				
Male	62.8	52.8	60.3	52.4

Female	37.2	47.2	39.7	47.6
Age				
19-34	30.6	28.3	36.2	28.8
35-54	55.5	59.1	52.1	58.4
55-64	13.9	12.7	11.7	12.9
Race				
White	78.1	65.7	76.3	65.9
Black	6.8	14.9	6.7	14.8
Hispanic	12.4	15.7	14.2	15.5
Other	2.7	3.7	2.8	3.8
Children under 5				
Yes	18.2	19.6	18.9	19.8
Occupation				
Professional, technical and kindred	17.8	22.7	16.5	23.0
Managerial and administrative	23.8	15.4	20.5	15.8
Sales workers	9.3	6.9	9.0	6.8
Clerical and kindred workers	12.7	16.4	14.2	16.4
Craftsmen and foreman	15.7	9.8	17.6	10.1
Operatives	4.8	8.1	5.3	8.1
Transport operatives	5.6	4.3	6.0	4.3
Service workers	4.6	10.7	5.2	10.6
Laborers (not farming)	2.9	3.0	3.4	3.1
Other/unknown	2.9	2.8	2.2	1.8
Hours per week				
0-14	0.9	0.5	0.0	0.4
15-34	5.4	5.8	5.0	5.6
35-44	56.5	63.6	61.7	63.9
45-59	27.1	21.4	27.0	22.0
60+	9.2	6.8	5.5	6.9
Unknown	0.9	1.9	0.7	1.1
Job tenure (years)				
0-1	19.2	15.2	24.2	16.5
2-4	25.4	23.5	25.1	23.5
5-9	21.8	20.0	23.4	19.6
10-19	21.3	22.9	19.8	22.8
20+	10.4	16.0	5.9	16.2
Unknown	1.8	2.4	1.5	1.5

Note: All categorical column totals sum to 100 percent

The estimated coefficients show that many factors are able to predict the wages in an area and thus provide an estimate of what gradients may exist for wages and retirement benefits. The model output is shown in Table 5-8. The model achieves and r-squared of 30% for wages and 19% for retirement benefit.

Table 5-8. Wage and retirement benefit model result

	Wages			pr(Retirement Benefit)		
Variable	Coef	SE	T-test	Coef	SE	T-test
Premiums ($1000s)	0.0322***	0.006	5.41	0.0475	0.030	1.60
Amenities						
Paid Sick	0.0354*	0.020	1.76	0.953***	0.086	11.09
Paid Vacation	-0.00473	0.020	-0.24	0.831***	0.096	8.67
Life Insurance	-0.0502**	0.020	-2.51	-0.826***	0.107	-7.74
Disability Insurance	0.0442**	0.018	2.47	0.117	0.090	1.30
MSA Account	-0.0184	0.024	-0.77	0.0185	0.131	0.14
FSA Account	0.0649***	0.016	3.96	0.0343	0.084	0.41
Café Plan	-0.0178	0.016	-1.08	-0.196**	0.083	-2.37
Non-Profit	-0.00984	0.019	-0.52	-0.315***	0.097	-3.26
Industry						
Agriculture, forestry, fisheries and mining	[Base]					
Construction	0.028	0.064	0.44	-0.373	0.313	-1.19
Manufacturing	0.106*	0.058	1.85	0.313	0.287	1.09
Transportation, communications and utilities	0.227***	0.059	3.84	0.211	0.296	0.71
Sales	-0.0208	0.059	-0.35	-0.353	0.291	-1.21
Finance, insurance, or real estate	0.161***	0.062	2.63	0.499	0.310	1.61
Repair services	0.125**	0.063	1.98	-0.13	0.310	-0.42
Personal services	-0.00889	0.077	-0.12	-0.122	0.362	-0.34
Entertainment and recreation	0.0398	0.079	0.51	-0.605	0.375	-1.61
Professional services	-0.0211	0.058	-0.37	0.0324	0.289	0.11
Public administration	0.0989*	0.060	1.66	0.463	0.306	1.51
Other/Missing	-0.071	0.097	-0.73	0.0661	0.572	0.12
Education						
Less than high school or unknown	[Base]					

High school/GED	0.0466	0.065	0.71	0.707**	0.304	2.33
College or more	0.349***	0.073	4.81	1.398***	0.342	4.09
Marital Status						
Not married	[Base]					
Married	0.00153	0.039	0.04	0.151	0.178	0.85
Sex						
Male	[Base]					
Female	-0.191***	0.044	-4.39	-0.567***	0.203	-2.80
Age						
19-34	[Base]					
35-54	0.196***	0.043	4.55	0.251	0.189	1.33
55-64	0.0555	0.064	0.87	-0.39	0.303	-1.29
Race						
White	[Base]					
Black	-0.0971	0.070	-1.39	-0.0214	0.319	-0.07
Hispanic	0.0196	0.058	0.34	-0.154	0.249	-0.62
Other	-0.0212	0.107	-0.20	-0.602	0.488	-1.23
Children under 5						
No	[Base]					
Yes	0.0513	0.049	1.05	0.207	0.224	0.92
Occupation						
Professional, technical and kindred	[Base]					
Managerial and administrative	0.125**	0.056	2.25	0.447*	0.264	1.69
Sales workers	-0.161**	0.075	-2.16	0.795**	0.356	2.23
Clerical and kindred workers	-0.151**	0.068	-2.20	0.371	0.304	1.22
Craftsmen and foreman	-0.177***	0.067	-2.63	0.234	0.309	0.76
Operatives	-0.366***	0.095	-3.84	0.413	0.419	0.99
Transport operatives	-0.277***	0.090	-3.08	-0.196	0.419	-0.47
Service workers	-0.377***	0.093	-4.04	0.0425	0.413	0.10
Laborers (not farming)	-0.117	0.115	-1.02	0.516	0.520	0.99
Other/unknown	-0.41***	0.137	-3.00	-0.0846	0.717	-0.12
Hours per week						
0-14	[Base]					
15-34	0.0706	0.191	0.37	-1.115	1.848	-0.60
35-44	0.224	0.179	1.25	-0.912	1.805	-0.51
45-59	0.395**	0.182	2.18	-0.655	1.817	-0.36
60+	0.419**	0.187	2.24	-0.959	1.844	-0.52
Unknown	-0.142	0.344	-0.41	1.727**	0.735	2.35

Job tenure (years)						
0-1	[Base]					
2-4	0.0149	0.052	0.29	0.685***	0.223	3.07
5-9	0.0668	0.054	1.23	0.594**	0.232	2.56
10-19	0.0907	0.057	1.59	0.647***	0.249	2.59
20+	0.169**	0.072	2.36	2.022***	0.432	4.68
Unknown	0.185	0.189	0.98	1.033	0.937	1.10
R-Squared	.3060			0.195		
F-Test/Chi-sq	52.04			1560		
Observations	9,416			6,876		

Note: Model also includes the listed set of variables interacted with firm size. Due to the large number of coefficients and lack of specific relevance the full model results are available upon request.

Chapter 6. Results

This chapter describes the results of the health employment choice models and describes robustness checks where alternative specifications are tested. In order to simplify the descriptions of effects throughout, the term “employment choice elasticity” is sometimes used in place of the cumbersome, but more accurate phrase, “impact of the interaction of loading fee gradients with health demand on employment choice”.

6.1 Employment Choice Model

The firm size model described in equation (4.11) is estimated with 7,191 observations of individuals with linked premium records, predicted loading fee gradients, and no spousal offer. The overall model fit is weak with an R-squared of just 0.43 percent. The chi-square test, however, is significant. The average marginal effect (AME) of the employment choice elasticity is 0.108 and is significant at the 95 percent level of confidence with a T-statistic of 1.99. The AME values are extracted from the approach described in section 4.3. Other relevant coefficient estimates are shown in the second panel of Table 6-1 and are not significant.

Table 6-1. Employment Choice Model Result

	Pr(LargeFirm)		
Variables	AME	SE	T-stat
Loading fee gradient* Health demand	0.108**	0.054	1.992
	Coefficient	SE	T-stat
Loading fee gradient	1.201	1.057	1.14
Health demand	0.0153	0.015	1.00
Loading fee gradient*Health demand	0.848**	0.381	2.22
Retirement benefit gradient	-0.01	0.501	-0.02
Wage gradient	-0.281	2.432	-0.12
Constant	-0.256	1.205	-0.21
R-Squared	.0531		
LR Chi-square (38)	351.10		
Observations	7,191		

Note: Model includes set of individual covariates: education, marital status, sex, age, race, child under 5, occupation, hours of work, job tenure, and year. Large firms are defined as firms with 50 or greater number of employees. The loading fee gradient is the difference in estimated loading fees between small and large firms in the area. Health demand is measured as the expected dependent expenditures. Wage and retirement benefit gradients are the difference between small and large firms for each measure for the observation.
*** p<0.01, ** p<0.05, * p<0.1

The AME indicates a one unit increase in the interaction corresponds to 10.8 percentage point increase in the probability of working at large firms. Shown in Table 6-2, the mean value of the loading fee gradient is 0.24 and the mean value of health demand (in $1,000's) is 1.64. Therefore a decrease of 4 points in the loading fee gradient to 0.20 amounts to a decrease of 0.69 percentage points in the probability of working a large firm[19]. However, a full policy simulation

[19] 0.69=.04*1.64*10.8

of estimated changes in the loading fee gradient is conducted in Section 6.3 and reveals greater impacts when individual values of covariates are considered, rather than mean values in this interpretation exercise.

Table 6-2. Employment Choice Model Summary Statistics

	Mean	SD
Loading fee gradient	0.2362	0.0095
Health demand	1.6422	2.6404
Retirement benefit gradient	-0.2243	0.1894
Wage gradient	-0.0196	0.1341

Note: Full summary statistics of the employment choice model, including additional covariates, are available in the appendix.

The wage and retirement benefit gradients are both non-significant. This suggests that if firms are using price differences to make other changes in the compensation package, it is not detectable with these data. The loading fee gradient by itself is positive but not significant. It is theorized that with improved data, this value would be significant, though other explanation may indicate an ambiguous prediction.

6.2 Sensitivity Analysis

This section describes several sensitivity analyses conducted to provide broader understanding of the effect identified in the employment choice model. The analyses use alternative versions of the primary variables used in the analyses-the outcome, the loading fee gradient, and the health demand of the individual.

6.2.1 Alternative Firm Size Thresholds

The firm size threshold used in the outcome variable—and in constructing the gradients of loading fees, wages, and retirement benefits—is based on common definitions of small and large firms for health insurance purposes. However, the loading fee gradient is shown to decrease smoothly between 10 and 10,000 employees. Thus, it is likely that any effect is noticeable at other thresholds. Table 6-3 shows the average marginal effect of the loading fee gradient and health demand measure for various firm size thresholds.

Table 6-3. Employment Choice-Alternative Firm Size Thresholds

Firm Size Threshold	Health Demand* LoadingFeeGradient AME	T-stat	Health Demand coef	T-stat	Loading Fee Gradient coef	T-stat	Model Chi-sq
25	0.06	1.35	0.0069	0.40	1.664	1.34	329.9
50	**0.108****	**1.99**	**0.0153**	**1.00**	**1.201**	**1.14**	**351.1**
100	0.154**	2.55	0.0131	0.95	0.883	0.93	391.6
1000	0.086	1.31	0.0378***	3.11	3.146***	3.81	541.2

Note: Each Row is a separate model. The covariates for each model include: wage gradient, retirement benefit gradient, individual characteristics (education, marital status, sex, age, race, child under 5, occupation, hours of work, job tenure, year).
*** p<0.01, ** p<0.05, *
p<0.1

While the loading fee is known to relate to firm size due to the potential efficiencies of larger group, it also relates to self-insurance status because it removes a portion of the cost. These outcomes are largely correlated but it is worthwhile to test if the effect exists for this outcome as well.

Table 6-4. Employment Choice-Alternative Outcome

Outcome	Health Demand* Loading Fee Gradient AME	T-stat	Health Demand coef	T-stat	Loading Fee Gradient coef	T-stat	Model Chi-sq
Firm size (50+)	0.108**	1.99	0.0153	1.00	1.201	1.14	351.1
Self-insured	-0.041	-0.65	-0.0185	-1.58	-1.922**	-2.38	238.3

Note: Each Row is a separate model. The covariates for each model include: wage gradient,

retirement benefit gradient, individual characteristics (education, marital status, sex, age, race, child under 5, occupation, hours of work, job tenure, year).
*** p<0.01, ** p<0.05, * p<0.1

The self-insurance outcome also exhibits a positive employment choice elasticity. The model has 8,846 observations (fewer than the firm size model due to missing self-insurance information). This positive employment choice elasticity suggests that an individual's choice of employment, with respect to it self-insurance status, is responsive to the loading fee gradient when their health demands are different.

6.2.2 Alternative Loading Fee Gradient Approach

In this section an alternative approach is used to construct the loading fee gradient. Instead of using the AV calculator to estimate the actuarial value for each plan, loading fee estimates based on firm size are used. The outcome of the loading fee model is not based on the features of the plan but instead the size of the firm. Area market characteristics are still used to explain the difference between the AV and the premium. The model output is shown in the appendix. The results of both approaches are shown in Table 6-5.

Table 6-5. Firm Size Choice-Alternative Loading Fee Measures

	Health Demand* Loading Fee Gradient		Health Demand		Loading Fee Gradient		Model
Loading Fee Approach	AME	T-stat	Coef	T-stat	Coef	T-stat	Chi-sq
Calculated using Plan Features	**0.108****	**1.99**	**0.0153**	**1.00**	**1.201**	**1.14**	**351.1**
Estimated using Firm Size	0.468**	2.16	-0.816**	-2.30	2.408	0.60	350.0

Note: Each Row is a separate model. The covariates for each model include: wage gradient, retirement benefit gradient, and individual characteristics (education, marital status, sex, age, race, child under 5, occupation, hours of work, job tenure, year). Due to the large number of coefficients and lack of specific relevance the full model results are available upon request.

*** p<0.01, ** p<0.05, * p<0.1

These results are consistent with the primary specification for the sign and significance. The magnitude is much greater in the estimated using firm size approach. While the model fit is similar, the estimated using firm size approach finds a significant negative impact of health demand on the probability of choosing a large firm. Because it is expressed as a coefficient interpretation of the magnitude will be avoided, but it suggests that health demand may not be correlated with large firms after controlling for loading fee gradient impacts.

6.2.3 Alternative Health Demand Measure

Theoretical concerns have driven the primary specification for the health demand measure-predicted dependent spending. Other variants are explored, in Table 6-6 to see the impact of the measure on the estimate. First, predicted dependent expenditure are compared to observed dependent expenditures. Second, expenditures for the employee are examined both as predictions and as observations.

Table 6-6. Firm Size Choice-Alternative Health Demand Measures

	Health Demand* Loading Fee Gradient		Health Demand		Loading Fee Gradient		Model
Health Demand Measure	AME	T-stat	Coef	T-stat	Coef	T-stat	Chi-Sq
Dependent-predicted	**0.108****	**1.99**	**0.0153**	**1.00**	**1.201**	**1.14**	**351.1**
Dependent-observed	0.04	1.01	0.00978	0.99	2.032**	2.09	345.5
Employee-predicted	0.026	0.45	-0.00779	-0.37	1.985	1.55	341.9
Employee-observed	-0.012	-0.36	0.0122	-0.30	2.491**	2.49	344.4

Note: Each Row is a separate model. The covariates for each model include: wage gradient, retirement benefit gradient, individual characteristics (education, marital status, sex, age, race, child under 5, occupation, hours of work, job tenure, year).
*** p<0.01, ** p<0.05, * p<0.1

The impact of the health demand measure is fairly strong. While the predicted dependent spending is positive and significant, the observed dependent spending is not significant. These results are consistent with an explanation that individuals are using an expectation approach to the cost and are not responding to specific shocks to health expenditures.

The employee's own health is considered as a prediction and, separately as it is observed. This measure is avoided from a theoretical perspective because of the risk that employee health is correlated with employment outcomes due to productivity issues. The model suggests, indeed, that while employees with higher expected dependent spending are more likely to be affected by the loading fee gradient, employees who themselves have higher expected spending do not.

In models not presented here, a measure of risk aversion is developed to represent another form of health demand. Because the measure is only available for 2001, the model is weakly powered, but does not appear to be correlated in the same way as expected dependent expenditures. In addition, the restriction of the sample on only those without a spousal offer is explored but it also lacks the sample to adequately test the hypothesis. Each of these could be pursued more fully with better data.

6.3 Policy Simulation

In order to show the implications of the effect a policy simulation is constructed. The simulation uses observed changes in the medical loss ratio due to PPACA and converts them into changes in the loading fee gradient used in the model. This allows the effect of the model to be interpreted in terms of the probability of working at large and small firms. The parameters of the simulation are stylized approximations of the recent research about the impact of medical loss ratios. Specifically, PPACA created minimums for the medical loss ratio of 80% for the individual market and small group markets and 85% for the large group markets. Estimates from McCue, Hall and Liu (2013) show that between 2010 and 2011 the individual market average MLR increased by 5.5 points from 74.8 to 80.3, the small group market average MLR increased by 0.7 points from 80.3 to 81.0 and the large group market average MLR decreased by -0.7 points from 87.6 to 86.9. The MLRs for self-insured firms are not included in these estimates.

This study is focused on the loading fee gradient between large and small firms. The exact result from the study would not provide a particularly relevant change in the gradient since small firms go up by 0.7 points and large firms go down by 0.7 points. Thus, to make the change interesting and yet still plausible, the specification for the simulation is to consider a 5 point increase in the small group MLR from 75% to 80% (a similar increase as found in the individual market) and an unchanged large firm market MLR set at 90% (which is increased over estimates, to consider the higher MLRs of self-insured firms). These MLR changes are converted into a change in the loading fee gradient given that loading fees are equivalent to the inverse of the MLR minus 1. Subtracting the base loading fee gradient from the policy loading fee gradient gives a change of 0.08 points.

To simulate the change, the primary specification of the employment choice model is estimated. However, for the simulation one change is needed. In order for the change in loading fee gradient to be applicable, the estimated loading fees are re-scaled to be of the magnitude observed in the loading fee estimates in Karaca-Mandic, Abraham and Phelps (2011). These show that the maximum difference between large and small firms is approximately 43 points. Thus, the loading fee gradient was re-scaled such that 99% of the estimated loading fee would be observed within a 43 point spread[20]. Additionally, to make the results more policy relevant weights are constructed to match the existing firm size distribution of workers using summary tables from the 2012 MEPS-IC. Next, the model, described in equation (4.11) is fit with the re-scaled loading fee gradient. The prediction reflects the base probability of choosing large firms. Then, the loading fee gradient value is adjusted downward by 0.08 points and the predictions are obtained from the same model previously fit. Finally, these predictions are subtracted for each observation. The mean of the value represents the change in the probability of working at large firms due to the policy.

The results of the policy simulation show that the 0.08 point reduction in the loading fee gradient is associated with a 4.3 point reduction (from 72.5% percent to 68.2% percent) in the probability of choosing a large firm and an equivalent increase in the probability of working at a small firm. As stated in the theory section, this magnitude of change is dependent on firm technology constraints that may limit the number of job offers of the size. Thus, it represents the upper end of any expected policy change. It is also based on changes observed in the individual market which have not yet carried over into the small group market--and because the average small group market MLRs are above the minimum would not be expected to drive much additional increase, particularly in the context of eroding small group offer rates. However, current MLR thresholds are set at 80 percent for the small group market and 85 percent for the large group market. The policy simulation can therefore inform impacts from increasing the MLR to the large group level.

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[20] This is accomplished by taking the standard deviation of the estimated loading fees multiplying by 2 times the 99% confidence interval z-value of 2.54.

Chapter 7. Discussion

This study seeks to understand the impact of the largely unobserved health benefit price on the employment choice of individuals. In particular it builds on the observation of a difference in loading fees by firm size to predict that large firms have an advantage in offering compensation packages to those who have demand for health insurance and differentially to individuals with greater demand. This is the first study to use loading fees as an explanatory variable in the context of employment choice. While strictly absent from common datasets, loading fees may also have been neglected from research because they are largely unobserved in the marketplace. When individuals or groups purchase insurance they are not told the cost of the plan prior to the loading fee. And since plans vary greatly in what the actuarial value of the plan is, it is difficult for the consumer to separate what might be higher premiums due to higher loading fees, from higher premiums due to higher actuarial values. Nonetheless, efforts to understand loading fees have been made (Karaca-Mandic et al. 2011) and they have recently come under attention as part of medical loss ratio regulations in PPACA (Abraham, Karaca-Mandic and Simon, 2014; McCue, Hall and Liu, 2013). These developments underscore the need for further research into their impacts.

The research approach struggles with the typical issue of counterfactuals. It is not possible to see if the same person would choose the same job if it—only—had a different loading fee. Here, geographic variation in the loading fees is deemed to be exogenous from the employment choice elasticity and thus used for identification. Similar individuals exposed to different loading fee gradients in their market area are compared. The discussion will describe relevant limitations, opportunities for future research, and summarize the results.

7.1 Limitations

There are a few important limitations to the study. Because loading fees are not directly observed and can only be inferred from premiums and other measures, there is the ever present danger of unobserved confounding between the loading fee estimate and relationship between health demand and the firm size of the individual. The primary source of identification is from the variation of the loading fee estimate between market areas. This variation is based on county and hospital referral region variables such as hospital concentration, the number of admit and hospitals per capita, household income, and HMO penetration rate. They are assumed to be exogenous to the firm size choice of individuals in the area. But, if these variables are related to the choice the effects will be biased. This possibility has been mitigated by including controls as to whether the firm size distribution is related to wage and retirement benefit differences in the area. Nonetheless, the loading fee estimate has some risk of endogeneity.

The MEPS-HC-IC linked file presents some limitations due to its non-representative sample and non-response issues. A model is fit to assess how different the sample of linked cases is to the non-linked cases. The linked data had significantly higher proportions of individuals that were more likely to be: educated, unmarried, male, older, black, have children under age 5, work more hours per week, and longer work tenures. Despite these many significant individual differences from a more representative population, these variables are included in the model and thus only present interpretation risk if they are correlated with unobserved factors that influence the outcome. As this research area has not been examined heavily, there are no known particular factors to address.

7.2 Future Work

This study seeks to understand the impact of loading fees, or the price of health benefits, more generally, on employment choice. Loading fees are becoming more regulated in the context of the PPACA medical loss ratio minimum standards. If these prices could be measured in other contexts, they could explain other observed anomalies from the literature. For instance, individuals may make other choices to obtain lower health benefit prices. Dependent coverage provisions allow individuals who do not work at the employer to obtain access to the firm's price of the health benefits through marriage (moderated by the co-premium charged to the family). It is not inconceivable that if people are willing to differentially choose their workplace, that they may also differentially choose to marry. Given the marginally improved access to lower loading fees through an exchange, some individuals may choose to forgo marriage for this reason.

Another line of research would seek to clarify the issues imposed by the data. As indicated in the limitations section, more precise loading fee measures would decrease statistical modeling error from the estimation strategy. Similarly, additional measures explaining the loading fee gradient in each area would strengthen the identification method. Given the results of Abraham et al. (2014) it appears real changes have occurred for individual loading fees, if not small groups. These changes may be tested for the impact as an "outside option" on the employment choice in a pre-post identification strategy. While discussed only briefly, the dataset contains a plausible measure of a flexible work schedule. This measure could be tested to see if it exhibits the advantage to small firms hypothesized.

This study does not investigate the welfare implications of more transparent prices or even lower prices generally. However, all things being equal, it is safe to assume lower loading fees are welfare increasing. And, if it is true that individuals are adjusting their employment in response to loading fees, a natural question is to consider if it has implications on the economic output. The sensitivity of employment choice to this price could represent a distortion to economic performance, if firms are larger than they would otherwise be, absent the price differential. However, it is by no means straight-forward, or justified, to assume prices can simply decrease without additional effects. As has been documented, even the advent of the exchanges with community rating and risk adjustment has not made individual market loading fees equivalent to those of large firms. Thus, it is plausible that additional costs of insurance are being borne in some way by the employer (either by a human resources cost). An in-depth accounting of the costs at the firm level would inform the study of comparative changes in the price.

7.3 Implications

The results suggest there is a moderate but significant impact of the loading fee gradient on a person's employment choice. A 10 percentage point increase in the gradient, such as from the mean 0.23 to 0.25, equates to a 1.08 percentage point increase in the probability of working at a large firm. Conversely, a reduction in the gradient, as targeted by current PPACA policies, would decrease the probability of working at a large firm (and increase the probability of working at a small firm that offers health insurance). The sensitivity results, while not conclusive, suggest that this is most notable for dependent health care expenditures and not the employee's own health. This suggests that policies limiting dependent coverage may have similar impacts by decreasing the attractiveness of large firms.

The theoretical model used the concept of health benefit prices to predict the impact on employment choice. These prices, called loading fees, were noted to be unobserved in data and in the marketplace. But given the apparent impact, if the prices were observable to consumers—much like the expense ratio of mutual funds for investors—increased sensitivity may be expected. Moreover, the health insurance exchanges are providing many pieces of information to consumers about the plans including its general generosity (or metal tier), the provider network and list of covered benefits. This helps considerably in knowing what price consumers are paying for a plan, since it standardizes some elements and thus makes the premium more representative of the price. But it still does not provide the price directly in a numeric form that is easily to evaluate. Not only is it likely that consumers would be well-served by information about the loading fees, researchers would benefit as well. The intricate relationship between employers, employees and their household characteristics was only possible thanks to a federal data source that put in the effort to link independent surveys in a new way. This dataset was discontinued in 2001 and a new edition would prove highly valuable toward this kind of research.

Other elements of the PPACA interact with the findings in this study—showing individuals are responsive to changes in loading fee gradients in relationship to their demand for health care. The medical loss ratios minimums were described explicitly in the policy simulation because of their impact on prices. The essential health benefit rules will tend to increase the value of plans and thereby accentuate the cost of the price difference—thereby encouraging large firm enrollment. Similarly, community rating, guaranteed issue and the pre-existing condition prohibition each raise the cost of health plans and thereby encourage large firm enrollment. The Cadillac tax, set to be enforced in 2018, puts pressure on (mostly) large firms to decrease their amount of health benefits. This will therefore decrease the impact of the price difference and tend to encourage small firm employment. The individual mandate will increase demand for affordable insurance and thus provide some increased incentive for large firm employment, due to the price differential. Medicaid expansion will provide an additional low priced option for low income workers and thus increases the probability of working at small firms.

7.4 Summary

This study investigates the impact of loading fees on employment choice by individuals. It makes use of a unique dataset that combines detailed information about the individual, their household, their employer, and the health insurance plans at the employer. It is the first study to specifically study the impacts of loading fees on employment choice. While loading fees are discussed in theory and many times implicated as an explanation in other research, this study attempts to empirically estimate the loading fees and assess their impact. The results provide evidence that an individual's employment choice is affected by these loading fees. It is important because policy changes at the federal level have attempted to create markets for insurance that operate with lower loading fees. Researchers have speculated about impacts such as these in ESI and this study contributes to that understanding.

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Chapter 8. Appendix

8.1 Employment Choice Model (Full Output)

Table 8-1. Employment Choice Model Summary Statistics (Full Output)

	Percent
Education	
Less than high school or unknown	11.1
High school/GED	54.4
College or more	34.1
Age 0-18	0.4
Marital Status	
Age 0-18	0.4
Not married	38.7
Married	60.9
Sex	
Male	56.7
Female	43.3
Age	
19-34	29.6
35-54	55.2
55-64	12.1
65+	2.6
Unknown/missing	0.4
Race	
White	67.4
Black	13.7
Hispanic	15.4
Other	3.6
Children under age 5	
No	80.7
Yes	19.3
Occupation	
Professional, technical and kindred	17.0
Managerial and administrative	16.6
Sales workers	8.8
Clerical and kindred workers	15.3
Craftsmen and foreman	11.7
Operatives	9.4

Transport operatives		4.6
Service workers		7.7
Laborers (not farming)		3.6
Other/unknown		5.3
Hours per week		
0-14		0.5
15-34		5.5
35-44		59.2
45-59		23.1
60+		7.4
Unknown		4.3
Job tenure		
0-1		16.9
2-4		24.4
5-9		18.6
10-19		21.2
20+		14.0
Unknown		4.9
Year		
	1997	18.8
	1998	22.9
	1999	31.4
	2001	26.9

Note: All percentage totals sum to 100 percent.

Table 8-2. Employment Choice Model Results (Full Output)

	Coef	SE	T-stat	Significance
Loading fee gradient	1.2010	1.0570	1.1370	
Health demand	0.0153	0.0154	0.9950	
Loading fee gradient*Health demand	0.8480	0.3810	2.2230	**
Retirement benefit gradient	-0.0100	0.5010	-0.0201	
Wage gradient	-0.2810	2.4320	-0.1160	
Education				
Less than high school or unknown	0.0000	0.0000	0.0000	
High school/GED	0.1670	0.3110	0.5370	
College or more	0.2660	0.2350	1.1320	

Age 0-18	0.9880	0.6570	1.5040	
Marital Status				
Age 0-18	0.0000	0.0000	0.0000	
Not married	-0.0464	0.0772	-0.6010	
Married	0.0000	0.0000	0.0000	
Sex				
Male	0.0000	0.0000	0.0000	
Female	0.2940	0.1260	2.3250	**
Age				
0-18	0.0000	0.0000	0.0000	
19-34	0.5020	0.2180	2.2960	**
35-54	0.5060	0.2760	1.8350	*
55-64	0.2100	0.2690	0.7780	
Race				
White	0.0000	0.0000	0.0000	
Black	0.9300	0.1340	6.9400	***
Hispanic	0.3830	0.1710	2.2330	**
Other	0.4390	0.3200	1.3750	
Children under age 5				
No	0.0000	0.0000	0.0000	
Yes	0.1270	0.0991	1.2820	
Occupation				
Professional, technical and kindred	0.0000	0.0000	0.0000	
Managerial and administrative	-0.3670	0.2240	-1.6380	
Sales workers	0.0765	0.1600	0.4790	
Clerical and kindred workers	0.2560	0.2930	0.8740	
Craftsmen and foreman	-0.2080	0.1360	-1.5270	
Operatives	0.8350	0.1900	4.3940	***
Transport operatives	-0.0404	0.1930	-0.2100	
Service workers	0.4740	0.1970	2.4020	**
Laborers (not farming)	0.5720	0.7220	0.7920	
Other/unknown	-0.5170	0.2580	-2.0000	**
Hours per week				
0-14	0.0000	0.0000	0.0000	
15-34	0.5990	0.6210	0.9650	
35-44	0.6160	1.0060	0.6120	
45-59	0.5210	1.0540	0.4940	
60+	0.5160	1.1420	0.4520	
Unknown	2.2720	0.6800	3.3420	***

Job tenure				
0-1	0.0000	0.0000	0.0000	
2-4	0.0944	0.1310	0.7210	
5-9	0.0281	0.1890	0.1490	
10-19	0.1650	0.3310	0.5000	
20+	0.6130	0.4340	1.4140	
Unknown	0.0000	0.0000	0.0000	
Year				
1997	0.0000	0.0000	0.0000	
1998	0.1880	0.1030	1.8180	*
1999	0.1210	0.0951	1.2740	
2001	-0.2540	0.0938	-2.7130	***
Constant	-0.2560	1.2050	-0.2120	
R-Squared	.0000			
LR Chi-square ()	.00			
Observations	-			

Notes
*** p<0.01, ** p<0.05, * p<0.1

8.2 Production theory model of loading fee gradient

This model uses productive efficiency to derive the impact the increased loading fee (g) on the optimal quantity of labor. The model begins with a production function for output (Q) of only labor (L). Total factor productivity is constant and contained within the technology parameter (A).

$$Q = q(L) = AL^{\alpha} \tag{8.1}$$

Total cost (TC) is the sum of fixed and variable cost of production. We assume some fixed quantity of labor (ϕ), at wages W_{ϕ} plus the variable quantity labor (L) at wages W_L

$$TC = \begin{matrix} FC + (W_L)L & if\ L > c \\ FC + (W_L + g)L & if\ L < c \end{matrix} \tag{8.2}$$

Solving equation (8.1) for L and inserting into (8.2) puts the total cost in terms of the quantity of output.

$$TC = \begin{cases} FC + (W_L)\dfrac{1}{A}Q^{\frac{1}{\alpha}} & if\ L > c \\ FC + (W_L + g)\dfrac{1}{A}Q^{\frac{1}{\alpha}} & if\ L < c \end{cases} \tag{8.3}$$

The average cost function is given by.

$$AC = \begin{cases} \dfrac{FC + (W_L)\frac{1}{A}Q^{\frac{1}{\alpha}}}{Q} & if\ L > c \\ \dfrac{FC + (W_L + g)\frac{1}{A}Q^{\frac{1}{\alpha}}}{Q} & if\ L < c \end{cases} \tag{8.4}$$

The minimum of the average cost provides the productively efficient level of output. The productively efficient quantity is solved through minimization of (8.4) with respect to Q

$$\frac{\delta AC}{\delta Q} = \begin{cases} \dfrac{FC}{Q} + \left(\dfrac{1}{\alpha} - 1\right)(W_L)\dfrac{1}{A}Q^{\frac{1}{\alpha}-2} = 0 & if\ L > c \\ \dfrac{FC}{Q} + \left(\dfrac{1}{\alpha} - 1\right)(W_L + g)\dfrac{1}{A}Q^{\frac{1}{\alpha}-2} = 0 & if\ L < c \end{cases} \tag{8.5}$$

And solving for Q*

$$Q^* = \begin{cases} \left(\dfrac{-FC}{\left(\frac{1}{\alpha} - 1\right)(W_L)\left(\frac{1}{A}\right)}\right)^{\alpha-1} & if\ L > c \\ \left(\dfrac{-FC}{\left(\frac{1}{\alpha} - 1\right)(W_L + g)\left(\frac{1}{A}\right)}\right)^{\alpha-1} & if\ L < c \end{cases} \tag{8.6}$$

With just one factor, the productively efficient level of labor can be solved as from the optimal output by substituting (8.6) into (8.1) and solving for optimal labor.

$$L^* = \begin{cases} \dfrac{\left(\dfrac{-FC}{\left(\frac{1}{\alpha}-1\right)(W_L)\left(\frac{1}{A}\right)}\right)^{1-\frac{1}{\alpha}}}{A^{\frac{1}{\alpha}}} & if\ L > c \\ \dfrac{\left(\dfrac{-FC}{\left(\frac{1}{\alpha}-1\right)(W_L+g)\left(\frac{1}{A}\right)}\right)^{1-\frac{1}{\alpha}}}{A^{\frac{1}{\alpha}}} & if\ L < c \end{cases} \tag{8.7}$$

In the case when $L < c$ the top term decreases the expression, assuming α is less than 1,. With g in the denominator of that term, increases in g will lead to increases in L*. Thus, the loading fee will tend to increase the optimal size of labor for firms below the cut-off.

8.3 Variables Names and Sources

Description	Variable Code (if Available)	Source
Demographics		
Age	AGE31X	HC
Sex	SEX	HC
Race	RACETHNX	HC
Education	EDUCYEAR	HC
Marital Status	MARRY31X	HC
Family Size	FCSZ1231	HC
Wage	WAGEP99X	HC
Person Income	TTLP99X	HC
Family Income		Constructed
Number of kids		Constructed
Health Demand		
Expenditures	TOTEXP99	HC
Health status (self or proxy)	RTHLTH31	HC
Mental health status (self or proxy)	MNHLTH31	HC
Uses Assistive Devices	AIDHLP31,53	HC
Functional limitations (any)	WLKLIM31	HC
Conditions	CCCOXDC	HC-cond
Employment		

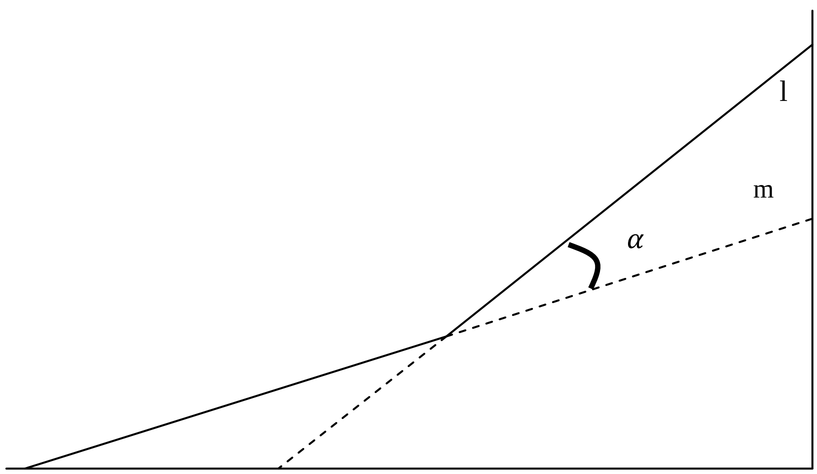
Ownership	C062	IC
Industry	C589	HC,IC
Occupation	COCCP31-53	HC
Percent female	C016	IC
Percent union	C018	IC
Percent Age over 50	C017	IC
Percent wage low	C022	IC
Percent wage medium	C023	IC
Percent wage high	C024	IC
Tenure of Business (years)	C064	IC
Usual start time of work	BGNWK31-53	HC
Usual End time	ENDWK31-53	HC
More than 1 job	MORJOB31	HC
Irregular work shift	SHFTWK31-53	HC
Missed work to care for others	OTHDYS31-53	HC

Description	Variable Code	Source
Market		
HMO penetration		ARF
Per Capita hospital spending		ARF
Per Capita MD spending		ARF
Other Benefits		
Paid vacation	C050	IC
Paid Sick Leave	C051	IC
Life insurance	C052	IC
Disability insurance	C053	IC
Pension plan	C054	IC
Health Benefits		
Total Premiums-Single	I130	IC-plan
Employer Contribution Premium-Single	I131	IC-plan
Total Premiums-Family	I134	IC-plan
Employee Premium-Family	I135	IC-plan
Self Insured plan	I105	IC-plan
Plan Quality		

Referral required	C104	IC-plan
Union operated	C113	IC-plan
Deductible	C146	IC-plan
Copayment for doctor visit	C156	IC-plan
Out-of-pocket maximum-Single	C161	IC-plan
Out-of-pocket maximum-Family	C162	IC-plan

8.4 Geometric Proof of Loading Fee Gradient Impacts

The following geometric proof shows the relationship between α and the loading fee gradient. While the movement of planes in relation to the prices is partially intuitive, this provides a mathematical relationship. Consider angles l and m, in the figure below.



It is known that α can be defined in terms of a triangle with three angles summing to 180 degrees, or π.

$$\alpha = \pi - l - m \tag{8.8}$$

Further, we know from the price ratios, the slopes of the lines that create angles m and l. The inverse tangent function gives the angle based on these slopes.

$$m = \pi - \tan^{-1}\left(\frac{P_H^S}{P_A^S}\right) \tag{8.9}$$

$$l = \tan^{-1}\left(\frac{P_H^L}{P_A^L}\right) \tag{8.10}$$

Substituting (8.9) and (8.10) into (8.8) gives:

$$\alpha = tan^{-1}\left(\frac{P_H^S}{P_A^S}\right) - tan^{-1}\left(\frac{P_H^L}{P_A^L}\right) \tag{8.11}$$

Since the inverse tangent function, or arctangent, is an increasing function, increases in P_H^S or decreases in P_H^L lead to increases in α. Thus, α is increasing in the difference between P_H^S-P_H^L, or the loading fee gradient.