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UNHEALTHY INSURANCE MARKETS:
SEARCH FRICTIONS AND THE COST AND QUALITY OF HEALTH INSURANCE

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ABSTRACT

We analyze the role of search frictions in the market for commercial health insurance. Frictions increase the cost of insurance by enabling insurers to set price above marginal cost, and by creating incentives for inefficiently high levels of marketing. Frictions also lead to price dispersion for identical products and, as a consequence, to increases in the rate of insurance turnover. Our empirical analysis indicates that frictions increase prices enough to transfer 13.2% of consumer surplus from employer groups to insurers (approximately $34.4 billion in 1997), and increase employer group turnover by 64% for the average insurance policy. This heightened turnover reduces insurer incentives to invest in the future health of their policy holders. Our analysis also suggests that a publicly-financed insurance option might improve private insurance markets by reducing distortions induced by search frictions.

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1. Introduction

In the United States, health insurance for those under age 65 is typically provided through group plans purchased by employers from commercial insurers. Health insurance is a complex multi-attribute service, so employers looking to buy insurance face a difficult shopping problem. Savvy purchasers must consider which of the many drugs their employees might use are in the insurer's formularies, which local physicians are part of the insurer's provider network, and what co-pays, fees, and deductibles apply to which pharmaceuticals, providers and services. Comparison shopping is made even more difficult by the fact that many aspects of insurance involve commitments to provide services under hard-to-anticipate contingencies. Medical underwriting by insurers and the great profusion of insurance products raises administrative costs and increases the complexity of an employer group's search for health insurance.[1]

Large and sophisticated employers can avoid many of these difficulties by "self insuring" and hiring insurers simply to administer their plans. Smaller and less sophisticated firms generally do not self insure. Instead they purchase products that provide both administrative services and insurance. These "fully insured" employers, who make up approximately half the market, face a particularly daunting search process.

In this paper we analyze the effects of search frictions on the functioning of health insurance markets. Our study, which focuses on frictions in the "fully insured" market, has both a theoretical and empirical dimension.

We begin our theoretical discussion in Section 2 by sketching a simple model of the search process for health insurance. Our analysis emphasizes three closely related results. First, the law of one price does not hold in frictional insurance markets. Instead there exists an equilibrium *distribution* of premiums (for identical policies and employer groups) and in this equilibrium all premiums exceed the marginal cost of insurance.[2] Second, equilibrium is

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1 Woolhandler, *et al.* (2003) note that Seattle alone had 757 distinct health insurance products. Our discussions with executives in the insurance industry suggest that this number is not atypical for metropolitan areas and may be conservative. Recent experience with the new market for pharmaceutical insurance under Medicare part D illustrates well the tendency for health insurance markets to proliferate vast numbers of products (Thaler and Sunstein, 2008).

2 The idea that search frictions lead to price dispersion is of course familiar, and empirical work has found such dispersion in many markets. One example in the insurance market is Brown and Goolsbee's (2002) study showing significant search frictions in the term life insurance market prior to

characterized by turnover in insurer-policy holder relationships. In an employer-based health insurance system some turnover is inevitable, of course, owing to individual job loss or change. The distinctive implication of our search framework is that there will be significant additional turnover in which entire groups of employees drop their current insurance because their employers seek (and find) less expensive plans. Third, because prices exceed marginal cost, insurers have powerful incentives to engage in marketing activities to attract new clients. Indeed, the competition for new clients can create a marketing arms race between insurers that leads to excessive spending.

The fact that frictions create powerful incentives for marketing is important because evidence suggests that these expenditures are quite high in the US commercial health insurance system. A recent McKinsey report, for example, finds that private insurers in the U.S. spend $60B/year more than other OECD countries after adjusting for GDP per capita. Of this excess spending, $34B is attributable to marketing and underwriting expenditures (Farrell, Jensen, Bob Kocher, Lovegrove, Melhem, Mendonca, and Parish, 2008, Exhibits 49 and 50, pages 74 and 75). Some of these expenditures are no doubt used for conventional types of product promotion, e.g. advertising campaigns, event sponsorships, and compensation of an internal sales force. In addition, marketing expenditures take the form of commissions to insurance brokers.[3] Evidence suggests that commission payments to brokers are quite substantial in the fully-insured market segment.[4] This matters because fully insured employer groups often rely on the experience and

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advent of internet-based comparison shopping. (Health insurance is, of course, a much more complex product than term life, making search all the more problematic.) Frank and Lamiraud (2008) report evidence of significant price dispersion for homogenous products in Swiss health insurance markets.

3 See Hall (2000a) for a careful discussion of these payment agreements in health insurance. Jackson (2008) offers an overview of the wide-spread use of side-payments to brokers in many financial services industries, including insurance. He observes that these payments often lead to poor outcomes for consumers, and he discusses different legal approaches taken to mitigate these adverse outcomes. Our analysis complements his by suggesting that the effect of these payments on markets will depend on the extent of search frictions.

4 Litow (2006)uses proprietary data from the actuarial and health care consultancy Milliman to analyze administrative expenses in private insurance plans. In the small group market (from which Litow excludes self-funded plans), he reports that administrative expenses total 21% of earned premiums. In contrast, the mostly self-insured large group market has administrative costs totaling 11.5% of earned premiums. Almost all this difference is due to commission payments – which are 8.5% of premiums in the small group segment compared to 1% in the large group segment. No other category of administrative expenses approaches the size of commissions in the small group market. For example,

contacts of insurance brokers to help them in their purchase decisions. To the extent that commissions and other direct payments cause brokers to act as insurers' external sales force, they introduce imperfections into the search process that are manifest as search frictions.[5]

In Section 3 we examine our model's empirical predictions about turnover and price dispersion using three data sources: the Household Survey component of the Community Tracking Study (CTS), proprietary information from the enrollment records of a large regional insurer, and the Robert Wood Johnson Foundation Employer Health Insurance Survey (EHIS). We observe high rates of health insurance turnover, roughly 20 percent per year on average, with markedly higher rates for fully insured employers. Importantly from the perspective of our theory, roughly half of this turnover is due to cancellations by entire employer groups.[6] As for the dispersion in premiums, a considerable amount of price dispersion remains after controlling for variation in product features and employer characteristics. We use this residual variation to estimate the extent of search frictions. Our estimates suggest that search frictions are sufficient to transfer approximately 13.5 percent of the consumer surplus from policy holders to insurers. This amounts to a transfer to insurers of approximately $35.8 billion dollars in 1997.

In Section 4 we employ our theoretical model to address two important policy issues—the *quality* of care financed by insurers and the effect of a *public insurance backstop option*. First, we note that chronic diseases such as diabetes account for a large fraction of health care costs, and effective disease management requires investments in the present to prevent or delay

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non-commission marketing expenses and underwriting expenses each account for only 1.5% of premiums in small groups (and each account for 1% of premiums in large groups). See Table 5 in Litow (2006).

5 Not all payments to brokers take the form of commissions. Sometimes additional direct payments are made to brokers to bring in new clients (Hall, 2000a). We found an example of these sorts of payments in a contract appended to a legal complaint. The contract obligated the insurer to pay brokers a fixed dollar amount above regular commissions for each new member they brought in and penalties were assessed for brokers who failed to keep 90% of the insurer's incumbent clients. It would be hard for employers to become aware of the conflicts of interest created by this payment because the contract required confidentiality as a "material condition" and breaching confidentiality would result in forfeiture of payments to the broker (Exhibit 3 in CSAHS/UHHS-Canton Inc vs Aultman Health Foundation, 2007).

6 High turnover rates between insurers and their policy holders are common knowledge among brokers and insurance companies, but this issue has received only limited attention from economists and health services researchers. For exceptions see Beaulieu, *et al.* (2007), Fang and Gavazza (2007), Herring (2006) and Cunningham and Kohn (2000).

complications in the future.[7] We find that the excess turnover induced by search frictions serves to reduce the private returns on these investments in future health, thereby reducing insurance quality along an important dimension.

Second, we examine the market impact of a government-financed public insurance option. We demonstrate that a public insurance option competing with private insurers can improve the efficiency of the market for private insurance. More specifically, a publicly subsidized backstop option reduces distortions created by frictions. These improvements stem from the fact that a moderately priced public option can displace the relatively small number of insurance policies located on the far right tail of the distribution of premiums. Eliminating this tail has a ripple effect that reduces prices throughout the rest of the market, scales back the incentives that lead to excessive marketing costs, and reduces policy turnover.

Section 5 provides concluding comments.

2. A Simple Model of Search Frictions in the Market for Insurance

Economic analyses of private sector health insurance markets frequently highlight market failures arising from moral hazard or adverse selection. In this analysis we take a different approach, focusing on problems that result from search frictions, i.e., on the consequences of imperfections in the process by which employer groups are matched to insurers.[8]

In setting out our model, we make two important simplifying assumptions. First, we restrict attention to two players—insurance companies that issue policies and employer groups who purchase them on behalf of employees.[9] Second, we assume that insurers offer a single homogeneous product.

It may seem incongruous to assume product homogeneity while appealing to search frictions resulting in part from product variety and complexity, but this approach is common to most theoretical analyses of search frictions.[10] Intuitively, frictions make it hard for employers

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[7] See Cebul, Rebitzer, Taylor and Votruba (2008) for a discussion of this issue.

[8] These three types of market failures are not mutually exclusive; indeed, adverse selection can itself be a cause of search frictions (Li, 2007).

[9] This starting point overlooks at least one other important player in the fully-insured commercial insurance market: the brokers who advise employers on which policies to purchase. As discussed above, side payments to brokers sustain imperfections in the search process and so not much is lost by leaving them out of the discussion.

[10] This assumption appears, for example, in Burdett and Mortensen's (1998) model, on which we base

to identify the available policy best suited to the needs and preferences of their workforce. The search problem is made additionally difficult because frictions give insurers limited market power and, as we will show, insurers use this power to adopt heterogeneous pricing policies: Some adopt high-price low-volume strategies while others adopt low-price high-volume strategies. Our empirical investigation in Section 4 uses within-segment variation in premiums to make inferences about the extent of frictions and so, for the purposes of this paper, product homogeneity is a reasonable simplifying assumption.

The objectives and behaviors of employer groups ("clients") and insurers are quite simple: There are n_c clients, who each seek to purchase insurance at the lowest possible price. We stipulate a reservation price, p^R, so at price p the current-period surplus is $p^R - p$. If the client is unsuccessful in fielding an offer, the surplus is normalized to 0.[11] Clients always accept the lowest price offered by competing insurers.

There are n_f firms offering insurance, each of which is small relative to the market.[12] The marginal cost of providing insurance is c. Each firm adopts a strategy of choosing some price $p \geq c$ and then maintaining that price indefinitely—for current clients and any future clients. The firm also chooses a level of marketing/sales effort, x. This effort is intended to promote one's products and increase market share; we give additional details below. Firms choose p and x so as to maximize profits. In equilibrium, price offers will differ across insurers, resulting in a price distribution whose cumulative density is designated $F(p)$. Because clients are more likely to accept low price insurance than high price policies, the distribution of accepted offers differs from the distribution of offers. We designate the cumulative distribution of *accepted* offers to be $G(p)$.

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our analysis below.

[11] One might think of the "no offer" outcome as going without insurance. Alternatively, employers with no offer in the preferred market segment condition might take up "limited benefit" policies that cover only a narrow subset of hospital or other expenses (Abelson, 2009). Finally firms without offers may ask employees to use backup coverage established by public policy, e.g., Medicare, health care at public clinics, or treatment at emergency departments as required by law for those with no demonstrated means of paying.

[12] Price dispersion can persist in friction oligopolistic markets as well (Stahl, 1989), but as this assumption makes clear, oligopoly is not necessary for the result.

All agents have the same discount rate, *r*, which we set to 0 for expositional ease. Agents are infinitely lived and the market unfolds in continuous time. To derive the equilibrium distribution *F*(*p*) we use Burdett and Mortensen's (1998) matching mechanism: All clients are assumed to receive offers drawn at random from the set of insurers, i.e., from *F*(*p*). If there were no cross-insurer variation in marketing, the arrival rate of offers would be the same from each insurer, say λ. Here, however, we allow for the possibility that λ varies, depending on insurer marketing efforts. Matches occur as clients choose the lowest offered price, and the matches persist until the client exits. Exits happen in one of two ways: (i) via an exogenous shock that occurs with probability, δ, or (ii) via a match with another insurance company offering a better deal.

Insurers maximizes profit, which in the steady state is given by

$$(1) \qquad \pi(p,x) = (p-c)n(p,F,x) - m(x).$$

The first term on the right-hand side gives the insurer's surplus per client times the number of clients, n, purchasing the product. The number of clients purchasing a policy depends on where the insurer's price, *p*, sits in the distribution of premiums, *F*, and on marketing efforts, *x*. Marketing is an important and costly activity in frictional markets and so we introduce the function, $m(x)$, representing "marketing and sales" expenses associated with marketing activity.

Ceteris paribus the optimal level of marketing might be expected to depend on the price the insurer has chosen, so we allow *x* to be a function of *p*. The *average* level of marketing activity for competing insurers in a market, *X*, is

$$(2) \qquad X = \int x(p)dF(p).$$

Following Manning (2003), we assume that the arrival rate of contacts for any individual insurer depends on *x*/*X*, the ratio of a firm's marketing activity to the marketing activity of the average firm. The aggregate rate at which offers arrive to clients in the market, λ, is assumed to be an increasing, concave function of the average marketing level chosen by insurers, *X*.[13]

In this framework the *arrival* of clients to an insurer charging premium p is

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[13] See Chapter 3 of Manning (2003). Like Burdett and Mortensen, his application is labor markets; he considers firms' efforts to recruit employees.

(3) $$A(p,x) = \lambda(X)N\left[\frac{x}{X}\right]\big[u+(1-u)[1-G(p)]\big],$$

where N is the ratio of clients per insurer (n_c/n_f), u is the proportion of clients who receive no offers, and $G(p)$ is the distribution of accepted insurance premiums.[14] Similarly, the fraction of clients *departing* from an insurer charging premium, p, is $\delta + \lambda(X)F(p)$, the exogenous rate plus the arrival rate of offers multiplied by the fraction of such offers that are less than one's own price. So the number of departures is

(4) $$D(p) = [\delta + \lambda(X)F(p)]n(p,F,x).$$

In steady state, the arrival of clients equals the departure of clients, so we can easily solve for $n(p,F,x)$ from (3) and (4):

(5) $$n(p,F,x) = \frac{\lambda(X)N\left[\frac{x}{X}\right]\big[u+(1-u)[1-G(p)]\big]}{\delta + \lambda(X)F(p)}.$$

Given (5), the firm's profits (1) can be written

(6) $$\pi(p,x) = \frac{x}{X}\left[\frac{\lambda(X)N\big[u+(1-u)[1-G(p)]\big](p-c)}{\delta + \lambda(X)F(p)}\right] - m(x).$$

We note for future reference that $m(x)$ must be convex, else profit increases in x without bound. Also, we note that (6) can be written

(7) $$\pi(p,x) = \frac{x}{X}\Pi(p) - m(x),$$

where $\Pi(p)$ is the term in brackets from (6). Expression $\Pi(p)$ is independent of an insurer's choice of x, so (7) implies that the optimal marketing expenditures, x^*, is an increasing function of $\Pi(p)$.

Equilibrium requires that expected profits in (7) be the same for all price and marketing strategies adopted by insurers. Because x^* is an increasing function of $\Pi(p)$, equal profits

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[14] Equation (3) assumes that all individuals who are outside of the desired insurance market segment, i.e. those who are uninsured or underinsured, will accept any offer of insurance that comes their way so long as it is priced below the reservation premium. Those who already have insurance will accept only offers with premiums lower than their current premium. This happens with probability *1-G(p).*

occur only if $\Pi(p)$ is the same for all offered prices.[15] But if $\Pi(p)$ is invariant to price, so then is an insurer's optimal level of marketing activity, x^*. Thus in equilibrium each insurer chooses the same level of marketing $x^* = X$ (which in turn also means that marketing costs *per client* are higher in high-price firms than in low-price firms).

We turn, finally, to the determination of equilibrium pricing. In the insurance context, as in the Burdett and Mortensen's (1998) original labor market analysis, equilibrium requires that the distribution of offered prices, *F(p)* is shaped so that insurers located anywhere on the distribution earn equal expected profits. Intuitively, if there were "too many" insurers offering a price below a given *p*, the offer at *p* would not attract enough clients and so expected profits would be "too low." Conversely, if too many other insurers are offering a price above *p*, then the offered price would generate excess profits.

The detailed steps to deriving the equilibrium distributions of offered prices, *F(p)*, is presented elsewhere, so we omit algebraic steps.[16] We note, first, that the proportion of clients who fail to secure an offer, *u*, will be

$$(8) \qquad u = \frac{\delta}{\delta + \lambda}.$$

Next, it is easy to show that

$$(9) \qquad G(p) = 1 - \frac{\delta\left(1 - F(p)\right)}{\delta + \lambda F(p)} = \frac{F(p)(\lambda + \delta)}{\delta + \lambda F(p)}.$$

Substituting (8) and (9) into (6), one can solve for the distribution *F(p)* that insures equal expected profits at any point on the distribution

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[15] Suppose, to the contrary, that two firms had differing levels of Π, say $\Pi_1 < \Pi_2$. Let x_1^* be the optimal level of x for firm 1. Clearly, firm 2 would earn more profit than firm 1 even if it also set x to x_1^*, and since x^* is increasing in Π, it can make more profit yet by setting x higher. In short, profit will be the same for the firms only if Π is the same for the firms.

[16] See Mortensen (2003) or Manning (2003) for clear expositions.

(10) $$F(p) = 1 - \frac{\delta + \lambda}{\lambda}\left[1 - \left(\frac{p - c}{p^R - c}\right)^{\frac{1}{2}}\right]$$

Substituting (10) into (9) we get a distribution of *accepted* offers,

(11) $$G(p) = 1 - \frac{\delta}{\lambda}\left[\left(\frac{p^R - c}{p - c}\right)^{\frac{1}{2}} - 1\right].$$

Using (11), we can show that the premium at any quantile, θ, of the *accepted* price distribution $G(p)$ is found to be a weighted sum of marginal cost c and the reservation value p^R:

(12) $$p_\theta = c + \alpha(\theta)[p^R - c],$$

with weights $\alpha(\theta) = (\gamma/(\gamma + 1 - \theta))^2$, where we have defined $\gamma = \delta/\lambda$. This last parameter is the "market friction parameter." *Ceteris paribus* the greater are the market frictions, i.e., the higher is γ, the larger the fraction of surplus accruing to insurers at every point on the distribution of accepted offers below p^R.

The maximum premium in the accepted distribution of prices is found by setting $\theta = 1$ in equation (12). Not surprisingly, the maximum accepted price equals the client's maximum willingness to pay, p^R. Similarly, the minimum price in the distribution occurs when $\theta = 0$. From (12) we see that this minimum premium exceeds c as long as there are some market frictions, i.e., as long as $\gamma > 0$. Thus even for insurers at the bottom of the price distribution, adding an additional client is always profitable.[17] Equation (12) also indicates that the entire distribution of prices depends on the highest prices clients will bear. This feature implies that prices and incentives throughout the market depend on the prices chosen in the far right tail of the distribution of prices. We will make use of this feature in the policy discussion in Section 4.2 below.

Using (11) we can also show that the average price observed in the market is

[17] Of course, a firm's profits might nonetheless be zero, given additional expenses for sales, marketing, arrangements for specialized contracts with clients, client screening costs, etc.

(13) $$\bar{p} = c + \frac{\gamma}{1+\gamma}(p^R - c).$$

Intuitively, at low values of γ offers arrive relatively quickly, so market prices move closer to marginal cost. Indeed, as γ approaches 0 the distribution of prices collapses to marginal cost *c*. Conversely, markets become increasingly frozen by frictions as γ moves towards infinity and, in the extreme case, the distribution collapses around the maximum willingness to pay for insurance, p^R.

Three important implications of the model merit emphasis:

First, the model leads us to expect price dispersion in a market characterized by search frictions. . Furthermore, comparing the median price (equation (12) with θ = 0.5) and the average in equation (13), we notice that the mean exceeds the average. This right skew makes sense. Competition pushes the mass of offered insurance prices towards marginal cost. Only relatively few sellers can profitably persist on the right tail of the offer distribution because there is only a relatively small chance that a buyer will have the misfortune that the high price is their best offer. The greater the friction, the thicker this right tail becomes.

A second implication concerns insurance turnover. Changing health insurers can entail significant costs. If market frictions were quite small (γ close to zero) or, for that matter, quite large (γ approaching infinity), the distribution of premiums would be narrow and gains from switching insurers would likely not exceed the switching costs. From this perspective, the observation of high rates of turnover in insurance relationships is itself evidence for intermediate levels of market frictions. Importantly, the churn predicted by the model is not merely a consequence of labor market turnover, which would be expected in any economy in which insurance is employer-provided. Rather, we expect to see movement of entire employer groups as clients exit after having found a better deal at a competing insurer.

Third, the model leads us to expect substantial marketing and sales expenditures. Indeed, the model predicts an inefficiently large level of such expenditures. To make this point we begin by substituting (8), (10), and (11) into (6) and write insurer profits as

$$\pi(p,x) = \frac{x}{X}\left[\frac{\lambda\delta N(p^R - c)}{(\delta+\lambda)^2}\right] - m(x). \tag{14}$$

Remembering that all insurers choose the same level of marketing activities, the profit maximizing marketing level, x^*, solves

$$\frac{\lambda\delta N(p^R - c)}{x^*(\delta+\lambda)^2} = m'(x^*), \tag{15}$$

Next, recall that our market has n_c clients and n_f insurers, and note that social surplus is $p^R - c$ for every client served minus the marketing and sales costs incurred by insurers:

$$S = \left[1 - \frac{\delta}{\delta+\lambda}\right] n_c (p^R - c) - n_f m(x). \tag{16}$$

where the term in brackets is the proportion of clients with insurance. Finally, then, we have surplus per client,

$$s = \frac{\lambda}{\delta+\lambda}(p^R - c) - (1/N)m(x). \tag{17}$$

The socially optimal level of marketing, x^e, maximizes (17), solves the following first order condition

$$\frac{\lambda_X \delta N(p^R - c)}{(\delta+\lambda)^2} = m'(x^e). \tag{18}$$

We have assumed that λ is concave in X, so $\lambda_X < \lambda / X$, and that $m(x)$ is convex, so $m'(x)$ is increasing in *x*. Thus the privately optimal level of marketing, x^* from (15), exceeds the socially optimal level, x^e from (18). In equilibrium, insurers spend more on marketing and sales than is socially optimal.

This finding has an intuitive interpretation. In a frictional market, prices exceed marginal cost so insurers profit by attracting new clients. Suppose that an insurer tries to attract new clients by increasing a marketing expenditure, such as side payments made to brokers. The advantage gained by this additional marketing expense is negated when other insurers decide to do the same thing. The result is an arms race in marketing. Social welfare would be improved if fewer resources were devoted to marketing, but no insurer will make this choice on its own because doing so would cede the advantage to others. What is needed is an intervention that encourages all insurers to simultaneously reduce marketing, a point to which we return to in our policy discussion in Section 4.2.

In short, our theory motivates an empirical assessment of commercial health insurance markets that focuses on three concerns: high policy turnover rates, the presence of price dispersion, and the existence of substantial marketing/sales costs. In Section 1 we mentioned evidence about the large levels of marketing costs in U.S. insurance markets. In the following section we turn to evidence about turnover and price dispersion.

3. Evidence Concerning Insurance Turnover and Price Dispersion

3.1. Turnover in Health Insurance Markets

To document the level of insurance policy turnover, we start with data from the Household Survey component of the Community Tracking Study (CTS) conducted in four waves (1996-97, 1998-99, 2000-01, and 2003) by the Center for Health System Change. Importantly for our purposes, the CTS Household Survey collects information on insurance coverage that we can use to estimate annual cancellation rates for a representative sample of consumers.[18]

One drawback of the CTS is that data on insurance changes is reported retrospectively. This raises the potential for recall errors and, more importantly, complicates our ability to identify persons who cancelled a private insurance plan in the year prior to the interview date. In practice, we identified a "cancellation" when (a) an individual reported a policy change or indicated the loss of insurance in the last year, and (b) reported "private plan" as their previous form of insurance. We cannot know with certainty that all these subjects had private coverage one year prior to interview, though it seems a reasonable assumption. "Non-cancellations" could be cleanly identified as those reporting current private coverage with no reported change in plans over the last year. The ratio of cancelling subjects to the sum of non-cancelling and cancelling subjects provides our estimate for the one-year cancellation rate in private health plans.

Two other limitations of the CTS are relevant. First, in characterizing prior insurance type, the broad category "private plan" includes both group plans and "direct purchase" plans (those purchased in the non-group market). As a result, we cannot specifically estimate the

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[18] In the implementation of the survey, selected communities were over-sampled but weights were provided to construct national averages.

cancellation rate for employer group health plans. Second, even for current insurance type, the CTS does not distinguish between fully insured (FI) and self insured (SI) group plans.

Our second source of data comes from the proprietary enrollment records of a large regional insurer. Using these data we can observe cancellations directly from 2001 through 2005. Our cancellation rates are calculated as the fraction of members enrolled with the insurer on July 1st of a given year who cancelled their policy by July 1st of the subsequent year. An important virtue of these data is that they allow us to distinguish between self insured and fully insured employer groups. Unfortunately we do not know how representative this insurer is of the entire market.

In Table 1 we present statistics on insurance cancellation rates. Column (1) provides an estimate of the one-year cancellation rate for private health plans based on the CTS sample. We find that 21% of respondents had private insurance within the previous 12 months and had cancelled that policy. Of this 21%, 87% had acquired a new private policy at the time of the CTS interview, while 10% were uninsured.

An alternative measure of insurance turnover, the one-year persistence rate, is presented in columns (2) and (3). Persistence rates are the fraction of current policyholders who report having the same plan for at least one year. The virtue of this measure is that the CTS distinguishes between group and non-group private plans for current insurance holdings. As expected, the measured persistence rate is roughly 1 minus the cancellation rate. More importantly, our measure of persistence is essentially unchanged when we exclude private policyholders in non-group plans, which suggests our CTS measure of the cancellation rate is not substantially affected by the inclusion of persons in non-group plans.

Column (4) of Table 1 presents the aggregate cancellation rate of our regional insurer for policyholders in employer groups containing at least 10 members. The one-year cancellation rate is nearly identical to that measured from the CTS. The aggregate cancellation rate, however, masks important heterogeneity among employer groups. As reported in columns (5) and (6), cancellation rates for the regional insurer are more than twice as high for policyholders in fully insured groups (31%) than for those in self insured groups (14%).

In Table 2 we provide estimates of the cancellation rate for various years. Cancellation rates calculated from the CTS hover between 20 and 21% for each of the four waves of the survey, while cancellation rates for our insurer are somewhat more variable over time. Again we note that FI employer groups have much higher cancellation rates than SI groups for each year.

Our analysis of insurance market frictions highlighted the exit of entire employer groups from insurance relationships. Table 3 presents estimates of the proportion of cancellations due to the exit of entire employer groups from one insurer to another. In the Community Tracking Study we identify a cancellation by the employer group if the respondent indicated that the reason for the insurance cancellation was a change in the health plan offerings of one's employer. In the data from the regional insurer, we identify employer group cancellations based on the aggregate cancellation rate for the group and the cancellation codes present in the administrative records.[19]

In the first column of Table 3 we provide information on the composition of cancellations in the CTS Household Survey. As reported in the first row of column (1), 35% of those identified as exiting a private plan over the prior year cited as their reason for cancelling a change in employer group offerings, while 40% reported job loss or job change as the reason for cancellation. These fractions are modestly lower than what we would expect if we could exclude persons in non-group plans, which comprise about 8% of all private policyholders in the CTS sample (based on the description of current policies). Adjusting for the presence of non-group policyholders (see rows titled "adjusted fraction"), we find that about 38% of cancellations among group policyholders is due to employer group cancellations, while about 43% are due to employer groups changing their insurance offerings. The remaining cancellations are primarily due to employees changing the plan they select among the employer's menu of insurance options or employees switching to policies available through a spouse's employer.

The remaining columns of Table 3 report estimates based on data from our regional insurer. In column (2), we estimate that roughly half of all cancellations are the result of

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[19] Specifically, we defined employer cancellations as occurring when at least 90% of the group's members were observed to cancel in a year or if at least 80% of members cancelled with at least one "group cancellation code" recorded in the insurance company's enrollment files. Representatives of the insurer assisted in determining our rule for identifying group cancellations. We could not rely on the reason for cancellation coded in the insurers' records because most of these codes were non-informative. We likely failed to identify some group cancellations in cases where a large fraction of a cancelling group's members took advantage of COBRA to continue their coverage. Thus, our results are likely to under-estimate turnover.

employer groups discontinuing their relationships with the regional insurer, a figure that is higher than the 38% found in the CTS Household Survey. Some of this discrepancy may be due to the differences in the definition of "employer group cancellations" across the two data sets and the potential misreporting of cancellation reasons in the CTS. Some of this difference, however, might also be due to particular pricing policies of our regional insurance company. In a frictional insurance market, if the insurer offered policies with above average premiums, it would also experience higher than average employer group cancellation rates. Columns (3) and (4) demonstrate that group cancellations are especially common among fully insured groups, comprising 59% of all cancellations compared with 38% for self insured groups.

The results reported in Tables 1 though 3 indicate that annual cancellation rates are non-trivial and, consistent with our model of insurance market frictions, a substantial fraction of this turnover is the result of entire employer groups exiting plans. Turnover by entire employer groups is especially pronounced for fully insured groups, consistent with our premise that search frictions are mostly found in the fully insured market.

In Table 4 we take the analysis a step further, using the data from the regional insurer to compare cancellation rates by employer size and insurance status (FI or SI). Statistics in column 1 of Table 4 demonstrate that annual cancellation rates are highest among smaller employer groups. It is well known that worker turnover rates are higher among small employers (e.g., Brown and Medoff, 1989, and Rebitzer, 1986) but the results in column (2) suggest that this is not the primary cause of higher cancellation rates in smaller employer groups. Instead, the differences appear mostly due to differences in the cancellation rate of entire employer groups.

Columns (3) through (6) of Table 4 report similar statistics separately for SI and FI employer groups. The general pattern from columns (1) and (2) holds: cancellation rates fall as firm size increases and substantial portions of this turnover are due to employer group exits rather than labor market mobility. We also find that overall cancellation rates, as well as cancellations due to the exit of entire employer groups, are markedly higher among the FI groups within any given firm size category. Among groups with fewer than 1000 members, the difference in aggregate cancellation rates across SI and FI employer groups is driven primarily by the difference in group cancellation rates.

In Section 4 below we argue that high turnover rates reduce private incentives to invest in future health. Many of those investments, especially those relating to the management of chronic disease, are best made in middle age or later. In Table 5 we therefore present cancellation rates by age. For both the CTS sample and our regional insurer, cancellation rates are highest among younger policyholders, but even in the oldest age category, turnover rates are substantial—approximately 15% per year. For older policyholders, group cancellations account for a particularly large fraction of all cancellations. This is especially true among older members in fully insured groups. For our regional insurer, these policyholders have cancellation rates of almost 25%, two-thirds of which is attributable to employer group cancellations.

In sum, we find that there is substantial health insurance turnover, much of it due to group-level cancellations. Turnover is more than twice as high in fully insured (FI) group plans than in self insuring (SI) group plans. This latter difference is due almost entirely to higher rates of group-level turnover in FI plans. This pattern is what we would expect if the market for fully insured employer groups had significant search frictions while the market for self insured employer groups did not.

3.2. Price Dispersion in the Health Insurance Market

We turn now to evidence on price dispersion drawing on the 1997 Robert Wood Johnson Foundation Employer Health Insurance Survey (EHIS). In this section we compare the empirical distribution of group insurance premiums to features of the distribution predicted by our search model. Specifically, we investigate whether the FI market segment (where frictions are most important) has more unexplained premium variation than the SI segment and whether this "excess price dispersion" in FI plans has the expected right skew. In Section 3.3 we go further, making simple structural estimates of the underlying parameters of the search model.

Our analysis focuses on 5,261 establishments that offered a non-HMO plan as their dominant plan option when surveyed.[20] Table 6 provides a breakdown of these establishments by insurance type and FI/SI status. Within this sample, the strongest predictor of SI status is firm size (see Table 7). Among firms with 35 or fewer workers, only 2.5% of establishments offered SI plans, while SI plans dominate establishments within larger firms. Our variable of interest is

[20] See the Data Appendix for detail on data exclusions.

the "single monthly premium" recorded for the dominant plan at the surveyed establishment. For both FI and SI employers, the premium includes the contributions of employers and employers. For SI insurers, the premium figure is best understood as approximating the expected no-load cost of insurance.

In Table 8 we report the distribution of raw premiums within SI and FI group plans in our sample. Mean premiums are nearly the same across SI and FI group plans, but the distribution of FI group premiums shows substantially higher variance and a more pronounced right skew.[21]

The greater premium variance observed in FI group plans is plausibly the result of search frictions, but could also result from greater heterogeneity in the expected costs associated with FI plans. We therefore focus our attention on "residual premiums," i.e., on the premium that is left unexplained by a premium regression estimated using a large number of control variables. The premium prediction models were estimated via GLM using the log "link" function and gamma distributional family.[22] Separate regressions were run for FI and SI plans and both regressions included identical covariates measuring plan and establishment characteristics such as plan type (PPO/POS), deductible level, co-payment for typical office visit, the inclusion of prescription drug coverage; and establishment characteristics such as firm and establishment size, percent of workers who are full-time, percent female, age distribution of workers and mean payroll. Details on these premium regressions are presented in the Data Appendix.

Table 9 and Figure 1 present the distribution of premium residuals derived from premium prediction models estimated separately for FI and SI group plans. The patterns in the data are what we would expect if there are search frictions in the market for FI group plans. Even after conditioning on group and plan characteristics, the residual premium variance is much higher for

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[21] We also find that mean premiums across SI and FI plans are similar after we control for plan/group characteristics under a variety of specifications. *Ceteris paribus* our model leads us to expect higher premiums in FI plans, but in comparing FI with SI plans all else is probably *not* equal. Large employers, who tend to self insure, offer higher wages than smaller employers (Brown and Medoff, 1989). We would therefore expect SI plans to offer richer and more expensive insurance because health insurance is a normal good and because the tax breaks for health insurance are most valuable for high-income employees.

[22] Specification of the premium prediction model followed the advice presented in Manning and Mullahy (2001) for the modeling of skewed health care cost distributions. The link and distributional family assumptions were supported by the Box-Cox test and modified Part test. See the Data Appendix for additional details and estimate results.

FI plans than SI plans. The included covariates explain a much smaller fraction of the original variance in premiums in FI group plans (about 20%) than for SI group plans (about 54%). The distribution of residuals for FI group plans also has the predicted right skew not evident among SI group plans. Table 10 gives calculations of the mean premium residual in different quintiles of the residual distribution. Here again the results suggest that variation in premium residuals is larger for FI plans.

The sample of FI firms contains more small employers than does the sample of SI firms. Small firms are of particular interest to our analysis because they are likely to face especially high per-employee costs of search. It is nevertheless useful to see if our patterns persist for firms in size categories that are common to both the SI and FI samples. In Table 11 we present residual variation comparisons by firm size and confirm our central result. Residual variation is higher for FI than SI plans even among the medium-sized firms common to both the FI and SI samples.

3.3. Estimating the Magnitude of Market Frictions in the Fully-Insured Market Segment

As discussed above, the empirical distribution of premium residuals for FI and SI plans are consistent with the presence of search frictions in the FI segment of the market. In this section, we fit the estimated distribution of FI premium residuals to the distribution implied by our model of search frictions in order to uncover parameters of the model. Our estimate of search frictions will be exaggerated, however, if we fail to take into account the fact that the residual premiums in the FI market also include some "nuisance" variation of the sort found in most regression models. The challenge for our estimation procedure, then, is to appropriately adjust for the presence of "nuisance dispersion" in the distribution of estimated FI residuals.

We begin by assuming that the residual premium observed for plan i , which we note as r_i, is the sum of two underlying components: a frictional residual resulting from i's place in the θ distribution, and an independent nuisance residual. We model the nuisance residual as the result of draws from a mean zero normally distributed random variable with a standard deviation (σ), set to equal to the standard error of the premium residuals estimated for the self-insured plans. This approach is based on the reasonable assumptions that search frictions are negligible in the self-insured market segment and that the effect of unobservables in the SI market are similar to the FI market. Thus if E_i is plan i's position in the distribution of nuisance residuals, the value of the nuisance residual is given by

(19) $$e_i = e(E_i) = \Phi(E_i)\sigma^2.$$

Using equations (19) and (12) the distribution of adjusted premiums, $\bar{p} + r_i$, can be written as a function of θ_i and E_i:

(20) $$\tilde{p}(\theta_i, E_i) = \bar{p} + r(\theta_i, E_i) = c + (p^R - c)\left[\frac{\gamma}{\gamma + 1 - \theta_i}\right]^2 + e(E_i).$$

If E_i and θ_i were observed, we could simply search for the parameter values of c, γ, and p^R that allow equation (20) to best fit the data. Unfortunately, E_i and θ_i are not observed, so instead we employ an iterative simulation procedure that utilizes inferred values for E_i and θ_i.

Let κ denote each percentile point in the distribution of adjusted premiums. In the first iteration, we assume that $\kappa_i = E_i = \theta_i$. In other words, each plan is initially assumed to occupy the same place in the distribution of nuisance residuals and the distribution of friction-induced residuals. This assumption, while clearly false, allows us to get initial parameter estimates by fitting the following model via non linear least squares (NLLS): [23]

(21) $$\bar{p} + r_\kappa - e(\kappa) = c + (p^R - c)\left[\frac{\gamma}{\gamma + 1 - \theta_i}\right]^2.$$

Using these initial parameter estimates, we then create a simulated distribution of premiums by taking 100,000 independent draws of E_i and θ_i and applying eq (20). Ranking the simulated premiums by magnitude, we obtain values of E and θ at each percentile point in the distribution of simulated premiums, which we denote E_κ and θ_κ.

In the second iteration, we use the values for E_κ and θ_κ to fit the following model using NLLS:

(22) $$\bar{p} + r_\kappa - e(E_\kappa) = c + (p^R - c)\left[\frac{\gamma}{\gamma + 1 - \kappa}\right]^2.$$

[23] Our results are not sensitive to how we select starting values. For example we get nearly identical results if we initialize the starting value of the nuisance residual to zero.

The resulting parameter estimates are used to generate a new simulated distribution of premiums, and this new distribution yields new values for E_κ and θ_κ. We fit these to equation (22) and obtain refined parameter values. The parameter estimates presented below are based on 20 iterations of this procedure, though the estimates largely "converge" after the 10-15th iteration.[24]

Panel A of Table 12 presents the results of our structural estimation. The baseline results are found in column (1). The average cost of insurance, c, is estimated to be \$136.4 per month in 1997. The search friction parameter, γ, is 0.152. The maximum willingness to pay for insurance is estimated to be \$433.9 per month. Fully insured employers are typically smaller than self insured employers and if the premium determination process for small firms is inherently noisier than large firms, our use of the variance from the self-insured regression to estimate nuisance variation may understate the variance of e. For this reason we present in column (2) a second set of estimates in which the standard deviation of the nuisance distribution is the standard deviation of the self insured premium residuals after the SI sample is reweighted to match the distribution of firm sizes in the fully insured sample. This adjustment increases the variance of the nuisance residual by 11%. Our estimates are not greatly changed, but do suggest modestly smaller search frictions. Both sets of estimates predict a mean monthly premium of \$175.7 (see equation 13), quite close to the mean observed in our data (\$176.2).

Panel B of Table 12 examines how closely the estimated model fits the empirical distribution of residuals. Row one of this panel presents the average difference between the empirical distribution of residuals and a simulated distribution produced using the parameter estimates and assumed nuisance variance. For model 1, the mean absolute deviation is \$1.7 per month. The mean squared distribution is also small (<10), indicating a close fit between the observed and predicted distribution of residuals. For model 2, the mean absolute deviation is slightly higher (\$2.6 per month) while the mean squared deviation is barely changed. Figure 2 and 3 plot the simulated and empirical distribution of residuals from models 1 and model 2

[24] Due to randomness inherent in the simulations, parameter estimates do not strictly converge, but fluctuate within tight bounds after the 10-15th iteration. As a result, slightly different estimates are obtained each time the iterative simulation procedure is performed. Reported estimates are those reflecting the median estimate of the friction parameter, γ, from 21 runs of the procedure.

respectively. These plots confirm the close concordance between the observed residuals and those predicted by the fitted search friction models.

As a check on the plausibility of our results, we can compare our value of c to estimates derived from other data sources. In 1997, total private insurer spending on personal health care was \$320B, and 188 million persons were covered by private insurance at some point during the year (National Center for Health Statistics, 2002). These numbers imply that insurers spent about \$142 per member per month in 1997—within the 95% confidence intervals of each model's estimate.[25] We can similarly perform a rough check on our estimate of maximum willingness to pay, p^R. As Hornstein, Krusell and Violante (2007) note, in frictional markets the maximum willingness to pay will equal the maximum observed premium so long as the efficacy of search for insurance is unrelated to current insurance status.[26] From this perspective, our model 1 estimate of p^R = \$433.9 seems reasonable as it lies about 5% above the premium at the 99th percentile of the adjusted distribution (\$415.2).[27]

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25 This estimate of c suggests that average premiums exceed costs in FI plans by 27%. This seems reasonable. In 1997 total premium payments (\$359 billion) exceeded the total payouts of private insurers on enrollees' health care (\$320 billion) by about 12%, but this is aggregated over FI and SI plans (as well as non-group plans). Taking into consideration that approximately 60% of enrollees in group plans are in SI plans, and assuming minimal excess overhead for these plans, we would expect the excess overhead aggregated over all plans to be roughly half as large as the overhead for FI plans exclusively. These estimates are also not out of line with studies of other imperfectly competitive health-related insurance markets. Brown and Finkelstein (2007), for example, estimate that in the market for long-term care insurance, policy holders receive \$0.82 in benefits for every premium dollar spent. Their result implies that the ratio of the discounted present value of premiums to the discounted present value of expenditures by insurers is 1.22.

26 To understand this result, consider the Burdett-Mortensen model in its original labor market context. If it is more effective for workers to search when employed, then some employees will accept a wage less than their reservation wage in order to gain access to a more efficient search process. In this case, the lowest observed wage will be less than the reservation wage. Conversely, if it is more effective to search when one isn't employed, some employees will pass up jobs with wages above reservation wages in order to gain access to more efficient search processes. If job search is as efficient for employed and unemployed workers, the minimum observed wage is the reservation wage. The analysis holds in our insurance context: if the efficiency of insurance search is independent of insurance status, then the maximum observed price is equal to p^R.

27 Another check on our estimates is to compare the "frictional" uninsurance rate implied by our estimates with observed rates of uninsurance. In the Burdett-Mortensen framework, the distribution of prices is bounded from above by employers' maximum willingness to pay. In the real world, of course, many employer groups don't offer insurance because the price exceeds their reservation price. To the extent that "affordability" contributes uninsurance, we would expect our estimate to understate total rates of uninsurance – perhaps by substantial amounts. Consistent with this expectation, our

Our estimates suggest the presence of moderate search frictions, sufficient to create substantial distortions in insurance markets. Estimates in model 1, for example, suggest that the monthly consumer surplus created by a health insurance policy is $p^R - c$ = \$297.5 per member per month. This totals \$3570 per member over a year. From equation (13) we know that for the average group, the fraction of the surplus accruing to insurers in the form of higher prices is $\gamma/(\gamma+1)$ or 13.2%. Summing over the 73.1 million policy holders in the FI group health insurance market in 1997, the implied aggregate surplus transfer to insurers resulting from market frictions was \$34.4 billion in 1997.[28]

We can similarly use our parameter estimates to analyze the distortions that search frictions introduce into insurance turnover rates. Recall from section two that the endogenous group cancellation rate due to search is $\lambda F(p)$ where $F(p)$ is the rank of a firm's premium in the distribution of premiums. The exogenous cancellation rate is represented by parameter δ, so the fraction of group turnover due to endogenous separations is $\frac{\lambda F(p)}{\lambda F(p)+\delta} = \frac{F(p)}{F(p)+\gamma}$. Substituting our estimated parameter values and predicted mean premium into equation (10), we find that the average *accepted* offer sits at the 27[th] percentile of the distribution of *offers*.[29] If $F(\overline{p})$=0.27, and if γ takes the estimated value of 0.152, it follows that search frictions account for about 64% of group turnover for the average insurer in the fully insured market.

4. Implications for Health Policy

The empirical investigations reported in Section 3 indicate that search frictions in the fully insured segment of the health insurance market are sufficient to produce considerable

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estimate of γ implies a frictional uninsurance rate = 0.135, far less than the 41.7 percent of employers in the EHIS who report not offering health insurance in 1997.

[28] From Health, United States, 2002, we know the number of persons less than 65 who obtained health insurance through their workplace in 1997 was 155.6m (National Center for Health Statistics, 2002). We estimate that roughly 47% of covered workers were in fully insured plans in 1997 by averaging figures for 1996 and 1998 from The 1999 Annual Employer Health Benefits Survey (The Kaiser Family Foundation and Health Research Educational Trust, 1999). This implies approximately 73.1m persons were in fully insured plans in 1997.

[29] Because the distribution of accepted offers is right skewed, the mean of *accepted offers* sits at the 75[th] percentile of the distribution of *accepted offers.*

premium dispersion and insurance turnover. These features of the market have important implications for public policy interventions designed to make health insurance more efficient and less costly.

4.1. Investments in Future Health

Inadequate preventive care, especially for those with chronic disease, is one of the most important quality failures in the U.S. health care system (Institute of Medicine Committee on Quality of Health Care in America, 2001). McGlynn, *et al.* (2003) estimate that only 55% of adults receive recommended levels of preventive care, while adults with such chronic illnesses as diabetes, asthma, coronary artery disease, chronic obstructed pulmonary disorders, and hypertension receive only 56% of the chronic care recommended by clinical guidelines. The care of patients with chronic diseases accounts for 75% of annual health care expenditures (National Center for Chronic Disease Prevention and Health Promotion 2005). The complications associated with these conditions accumulate over time, so early interventions can improve patient care and reduce medical costs. Excess turnover induced by search frictions shortens the expected duration of insurance relationships and therefore undermines insurers' incentives to invest in preventive care and disease management.[30]

To understand the effects of heightened turnover, we return to the model outlined in Section 2. Now, however, suppose that at the time a client enrolls, an insurance company makes a one-time investment I that reduces future health care costs. Such investments might include any number of preventive measures.[31] We let the costs of providing insurance going forward be $c(I)$, a function that is increasing in I and convex.

To simplify we ignore potential improvements in patient health and welfare and focus attention only on cost savings accruing from investments in *I*. The efficient level of investment, I^e, will be that level at which the marginal return equals the discount rate $-c'(I^e) = r$. Consider, though, a firm operating in the frictional environment discussed in Section 2. In this case

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[30] High rates of turnover can also add to the administrative burden of commercial health insurance, a point discussed in Cebul, *et al.* (2008).

[31] In the case of diabetes, for instance, it might represent resources spent aiding patients to control hemoglobin A1c (HbA1c) and blood lipids. See Beulieu, *et al.* (2007) for a discussion and reference to further literature.

equilibrium price dispersion increases the chances that the insurance relationships will be severed and savings accrue to other insurers. Thus in a fictional setting the firm discounts future cost savings according to $r+\delta+\lambda F(p)$, and so will choose I^* such that $-c'(I^*)=r+\delta+\lambda F(p)$. This implies that $I^* < I^e$ and firms will under-invest in preventative care. [32] The extent of underinvestment will depend on that firm's place in the price distribution, $F(p)$. [33]

4.2. Public Insurance Competing in a Private Market

In this section we consider a policy intervention that could reduce the distortions resulting from search frictions while leaving untouched the basic structure of insurance relationships in the private market. The policy we analyze is a publicly financed insurance option that would act as a "backstop" for employer groups searching for insurance in the private sector.

Let us suppose that, like any insurance provider, the government can provide insurance at cost *c*, and suppose that all clients are aware of the availability of this product. The government, in this hypothesized intervention, will offer a very simple and easy to understand policy. This simplicity, combined with the private sector's superior skill and flexibility in tailoring policies to the needs of individual clients, reduces the utility of the government financed backstop product relative to that available in the private sector. We capture this feature by setting the maximum willingness to pay for the government insurance policy below the reservation premium for the private sector, i.e. $p^G < p^R$. [34] The surplus created by enrolling in the government financed option is $(p^G - c)$, which is obviously less than the surplus created by the private plan, $(p^R - c)$.

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[32] The hypothesis that insurance turnover reduces investments in future health receives empirical support in recent studies by Herring (2006) and Fang and Gavazza (2007). In addition to turnover, frictions reduce these investments by enabling insurers to capture some of the surplus from investments in future health made by other insurers. This rent transfer leads to underinvestment even when these investments are fully general and reduce costs at all insurers. (Acemoglu, 1997 makes the analogous point in his analysis of investments in general human capital.) Indeed, rent transfer can lead to underinvestment in future health even when investments are financed by the patient and the returns accrue to the patient in the form of improved health.

[33] That friction induced price dispersion generates variation along non-price dimensions has been discussed in the literature on labor market search (e.g., Acemoglu and Shimer, 2000, and Lang and Majumdar, 2004).

[34] Otherwise, it would make sense to simply have publicly-provided insurance to all clients.

Welfare analysis of this policy is quite easy. If the publicly financed insurance policy is taken up by those who do not find insurance in the private sector, surplus per client is

(19) $$s = \frac{\lambda}{\delta + \lambda}(p^R - c) + \frac{\delta}{\delta + \lambda}(p^G - c) - (1/N)m(X),$$

where $\frac{\lambda}{\delta + \lambda}$ is the steady state fraction of clients finding private sector insurance, $\frac{\delta}{\delta + \lambda}$ is the fraction taking up the government fallback policy, and $(1/N)m(X)$ is the per client cost of marketing.

From our analysis above, we already know that the market-driven level of X is inefficiently high; an arms race exits which leads to excessive marketing costs across all firms. With this in mind, consider the impact of changes in X on per client surplus:

(20) $$\frac{\partial s}{\partial X} = \frac{\delta \lambda_X}{(\delta + \lambda)^2}(p^R - p^G) - \frac{m'(X)}{N}.$$

The first term on the right hand side is the marginal benefit from increased marketing expenditures. These gains result from an increase in the number of clients who adopt private plans times the greater willingness to pay for these plans, $p^R - p^G$. These benefits must be evaluated against the marginal costs arising from increased marketing activity. These costs are expressed in the second term on the right hand side of (24). The socially optimal level of marketing occurs when (24) is 0, i.e., at the level X^e that solves

(21) $$\frac{\lambda_X \delta N(p^R - p^G)}{(\delta + \lambda)^2} = m'(X^e).$$

The government can influence X by the way it chooses to price the public insurance option. Suppose the government sells its insurance product at price p_G^* (which obviously must be less than maximum willingness to pay, p^G). Purchasers can then either buy insurance from the government and gain $p^G - p_G^*$, or accept a better offer from the private sector if they can find one. With the government policy as a backstop, the highest price that will now be offered in the private sector is p^H, with $p^H = p^R - (p^G - p_G^*) < p^R$. This reduction in maximum price reduces incentives to market for all insurers. This is easy to see from equation (15). Substituting p^H for p^R, we see that each insurer will choose an optimal level of marketing x^* that solves

(22) $$\frac{\lambda \delta N(p^H - c)}{x^*(\delta + \lambda)^2} = m'(x^*).$$

Policy makers choose p_G^* to maximize social surplus, so that the left hand side of (25) equals the left hand side of (26). This condition reduces to

(23) $$\frac{\lambda}{X}[(p^R - p^G) + (p_G^* - c)] = \lambda_X [p^R - p^G].$$

Since $\frac{\lambda}{X} > \lambda_X$ (by concavity), (24) implies that $p_G^* - c < 0$. The socially optimal government policy is to price the public insurance backstop option below cost! Note that this policy will *not* completely crowd out private insurance, as privately-provided insurance is more highly valued than government-provided insurance. Indeed the size of the optimal subsidy is limited by the welfare costs of attracting clients away from superior private options. Rather, the intervention displaces insurance offerings on the far right tail of the distribution, i.e., the highest-priced policies, and in so doing makes the market more efficient.

A subsidized government plan has ripple effects that alter incentives and prices throughout the market. A properly chosen backstop plan improves market efficiency by moderating the arms race in marketing. More precisely, equation (27) states that the subsidy reduces the payoff to marketing for all insurers; thus each insurer can spend less without ceding an advantage to competitors. The government subsidized insurance also makes private insurance more attractive to consumers by compressing the distribution of prices towards marginal cost.

5. Conclusion

We have argued that search frictions distort commercial health insurance markets in ways that both increase the cost of health care to consumers and reduce care quality along some important dimensions. Frictions increase the cost of insurance by enabling insurers to set price above marginal cost and by creating incentives for inefficiently high levels of marketing. Frictions also lead to price dispersion for identical products and to an increased rate of insurance turnover. Our empirical findings indicate that frictions are a problem for the fully insured health insurance market. We find evidence consistent with the presence of moderate frictions but these are nevertheless sufficient to create important market distortions. We estimate that frictions increase prices enough to transfer13.2% of consumer surplus from employer groups to insurers (approximate $34.4 billion in 1997), and to increase employer group turnover 64% for the average insurance plan. Heightened turnover likely reduces insurer incentives to manage chronic disease via investment in the future health of their policy holders.

Our analysis of search frictions also addresses an important question raised in the current debate on health care reform: What is the point of having a public insurance option? Proponents of a public option argue that it will serve to "discipline" the private market, but such discipline is unnecessary if insurance is sold in conventional competitive markets. Things are different, however, if insurance markets have significant frictions. In this case an appropriately subsidized public insurance option can improve efficiency by moderating incentives for excessive marketing expenditures. A public option can also make private markets more attractive by displacing the relatively small number of policies on the far right tail of the distribution of premiums. Eliminating this tail has ripple effects that can reduce insurance prices throughout the price distribution.

Our analysis of frictions further suggests that an effective public option would be a simple, well-marketed and subsidized backstop policy that employers can choose if they don't find something they like better. Of course these conclusions emerge from a very stylized model and care should be taken in using them as a guide for policy.[35]

Ours is the first paper to estimate the magnitude of search frictions in health insurance markets, and it is clearly important for future work to replicate our findings with premium data and turnover data taken from other sources and other years. There is also considerable variation across states and over time in the rules governing the rate setting practices of health insurers in the small group market (Hall, 2000b). Future work could exploit this variation to better understand the determinants of market frictions. Confidence in our results would also be increased by empirical tests of ancillary predictions of our model. The most important of these predictions is that investments in future health are influenced by the expected tenure of the relationship between the insurer and policyholder.

[35] A more complete policy analysis would also consider the distortions created by the taxes required to finance the public insurance subsidy as well as the policy's own marketing and administrative costs. Other political considerations, such as whether the government will indeed choose the subsidy level that maximizes surplus, lie outside our analysis.

Assessing the impact of search frictions in insurance requires a better understanding of their underlying causes. In our introduction we emphasize the limited ability of small and medium-sized employers to compare the price and quality of the bewildering variety of complex health insurance policies. This "information overload" mechanism matches nicely with some of the institutional features of the fully insured health insurance market (a very large number of complex competing insurance products, heavy reliance on brokers who receive payments from insurers, significant marketing costs for insurers, etc.) but it is not the only possible source of frictions consistent with our analysis. Frictions might also result from the various state-level regulations that limit entry into the market and also distort pricing and the provision of product variety in health insurance markets (Hall, 2000b).[36] Still a third source might be adverse selection that gives an employer group's incumbent insurers an advantage over outside rivals.

Each of these possible causes of frictions has distinct implications for improving the functioning of health insurance markets. If the primary cause of frictions lies with the cognitive limitations of purchasers, outcomes might be improved by implementing more effective ways to disseminate information about the true price and quality of health insurance.[37] A simple backstop public insurance option of the sort mentioned above might also be helpful in this regard because it reduces the number of high price options available and thus allows purchasers to use their limited "mental shelf-space" to seek out more desirable options.

If state regulations are an important source of frictions, improvements might be best achieved by thoughtful pruning of the thicket of state and Federal rules governing insurance markets—especially for small and medium-sized employers. Finally, if the ultimate source of frictions is adverse selection, attention must be devoted to new ways of creating risk pools so as

[36] For example, laws assuring guaranteed renewability of insurance can lead to excess product variety (and associated search frictions) because insurers are not permitted to close out an old product unless it is willing to transfer the existing subscribers into a new and similar product. Under these circumstances, insurers keep old products on the books even if they cover a small number of persons (Mark Hall, personal communication).

[37] Thaler and Sunstein (2008) describe a number of possible methods to reduce the information burden of searching for health insurance. Their discussion is in the context of Medicare Part D, but is applicable to many other health insurance settings.

to mitigate this problem. Specifically individuals might be placed into large pools in ways that are unrelated to health risk (Hall, 2008).[38]

Understanding the relative importance of various sources of frictions is also important because policies best suited to reduce one type of friction might worsen other types. Consider, for example, a policy to "open up" state insurance markets to nationwide competition. In principal this could increase the flow of offers to employers, thereby reducing the price of insurance. But in a search model, an increase in the number of insurers need *not* lead to lower prices if it does not reduce the cost to insurers of marketing and medical underwriting or reduce the cost to employer groups of evaluating offers.[39] Indeed, this sort of proposal might exacerbate frictions resulting from information overload.

Health insurance reform is among the most pressing policy issues in the United States today. A better understanding of the causes and consequences of search frictions will be important for formulating better policy and improving the efficiency of insurance markets.

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[38] Diamond (1992), and Emanual and Fuchs (2005), sketch ambitious and far-reaching reform proposals along these lines.

[39] Lang and Rosenthal (1991) provide a nice example that illustrates this point. In their model, contractors bid on a project (in much the same way insurers might bid to be the policy provider for an employer group). The winning bid in their zero-expected-profit equilibrium is *rising* in the number of bidders.

Table 1. Annual Cancellation Rates for Privately Insured Individuals

	Community Tracking Study All waves (1996-2003)			Regional Private Insurer Enrollment Data 2001-2005		
	Cancellation Rate	Persistence Rate	Persistence Rate	Cancellation Rates		
	(1) All Privately Insured	(2) All Privately Insured	(3) All Group Insured	(4) All Group Insured	(5) Self Insured Groups	(6) Fully Insured Groups
Rate	.209 (.002)	.778 (.003)	.780 (.003)	.208 (.0003)	.139 (.0004)	.306 (.0006)
Employer Group Plans Only	NO	NO	YES	YES	YES	YES
N	60,316	60,770	56,170	1,601,199	936,532	664,667

Note: Author calculations from the CTS and enrollment records of a private insurer.

The CTS sample includes household heads aged 23-65 at interview. *Cancellation Rate* is defined as the fraction of persons with private insurance 12 months prior to interview who cancelled that policy by the time of the interview. *Persistence Rate* is defined as the fraction of persons with a currently active private policy (at interview) with no reported change in insurance within the last 12 months. Column (3) restricts the sample to private policyholders (at interview) with insurance through their employer. Results are weighted to be nationally representative.

The sample for the regional private insurer is primary policyholders aged 22-64 with an active policy at July 1st of a given year (2001-2004). The sample is limited to members of employer groups having at least 10 members. *Cancellation Rate* is defined as the fraction who cancelled their policy by July 1st of the subsequent year. Individual members are potentially represented up to four times.

Standard errors are in parentheses.

Table 2. Annual Cancellation Rates over Time

Community Tracking Study		Regional Private Insurer			
	(1) Cancellation Rate		(2) Cancellation Rate	(3) Cancellation Rate	(4) Cancellation Rate
Period	All Privately Insured	Period	All Group Insured	Self-Insured Groups	Fully Insured Groups
2003 (wave 4)	.206 (.007)	2004-05	.189 (.0006)	.114 (.0006)	.302 (.0011)
2000-01 (wave 3)	.210 (.004)	2003-04	.194 (.0006)	.124 (.0007)	.303 (.0012)
1998-99 (wave 2)	.218 (.004)	2002-03	.240 (.0007)	.185 (.0008)	.320 (.0011)
1996-97 (wave 1)	.204 (.004)	2001-02	.210 (.0007)	.135 (.0007)	.298 (.0011)

Notes: Author calculations from CTS data and enrollment records of a private insurer. Samples are as defined as in Table 1. Standard errors are in parentheses.

Table 3. Fraction of Annual Cancellation Rate Attributable to Employer Group Cancellations

	Community Tracking Study All waves	Regional Private Insurer 2001-2005		
	(1) All Privately Insured	(2) All Group Insured	(3) Self Insured Groups	(4) Fully Insured Groups
Fraction of *Cancellation Rate* due to employer group cancellations	.351 (.006)	.508 (.0009)	.383 (.0013)	.588 (.0011)
Adjusted Fraction	.381	n/a	n/a	n/a
Fraction of *Cancellation Rate* due to job loss/change	.401 (.007)	n/a	n/a	n/a
Adjusted Fraction	.434	n/a	n/a	n/a

Notes: Author calculations from CTS data and enrollment records of a private insurer. See Table 1 for samples. Standard errors are presented in parentheses.

In the CTS results, we attribute cancellations to employer group if the respondent indicated that the reason for the cancellation was "employer group changed offerings" (for those insured at interview) or "employer stopped offering coverage" (for those uninsured at interview). We attribute cancellations to job loss/change if the respondent indicated that the reason for the cancellation was "own/spouse job change" (for those insured at interview) or "lost job/change employers," "spouse/parent lost/changed job," or "became part time/temporary" (for those uninsured at interview). In each case, the adjusted fraction provides an estimate of the fraction of cancellations attributed to each cause if the sample were restricted to those with employer group coverage, by dividing the unadjusted fraction by the (weighted) fraction of currently private-insured persons who receive insurance through their employer (.920).

For regional insurer results, we attribute cancellations to employer group if ≥90% of group members exited plan in year, or if ≥80% of group members exited plan in year with at least one member having an assigned cancel code indicative of group cancellation. (Strict reliance on the assigned cancellation codes was not feasible since most were system-generated and non-informative.) The fraction of cancellations attributed to employer group cancellation is not strictly comparable across samples because group cancellations resulting from an employer going out of business are attributed to job loss/change in the CTS results, but attributed to employer group cancellation in the regional insurer results.

Table 4. Annual Cancellation Rates by Employer Group Size for the Regional Private Insurer

	All Groups			Self Insured (SI) Groups			Fully Insured (FI) Groups		
Group Size (# members)	(1) Cancellation Rate	(2) Emp Group Cancellation Rate	N	(3) Cancellation Rate	(4) Emp. Group Cancellation Rate	N	(5) Cancellation Rate	(6) Emp. Group Cancellation Rate	N
10-50	.294 (.0007)	.157 (.0006)	403,218	.204 (.0013)	.075 (.0009)	92,110	.321 (.0008)	.182 (.0007)	31,108
50-200	.238 (.0007)	.134 (.0005)	385,897	.157 (.0008)	.062 (.0005)	194,787	.320 (.0011)	.207 (.0009)	191,110
200-1000	.181 (.0006)	.090 (.0004)	403,353	.140 (.0006)	.053 (.0004)	293,367	.291 (.0014)	.187 (.0012)	109,986
>1000	.123 (.0005)	.051 (.0003)	408,731	.113 (.0005)	.046 (.0003)	356,268	.195 (.0017)	.088 (.0012)	52,463
All sizes	.160 (.0003)	.107 (.0002)	1,601,199	.139 (.0004)	.054 (.0002)	936,532	.306 (.0006)	.183 (.0005)	664,667

Notes: Author calculations from enrollment records of a private insurer. *Employer Group Cancellation Rate* is defined as fraction of members (as of July 1st in a given year) in groups that cancelled coverage by July 1st of the subsequent year. Group cancellations are identified as in Table 3.

Table 5. Annual Cancellation Rates by Age

	CTS Household Survey All waves			Regional Private Insurer 2001-2005					
	All Privately Insured			All Groups		Self Insured (SI) Groups		Fully Insured (FI) Groups	
Age	(1) Cancellation Rate	(2) Emp Group Cancellation Rate	(3) Job Exit Cancellation Rate	(4) Cancellation Rate	(5) Emp Group Cancellation Rate	(6) Cancellation Rate	(7) Emp Group Cancellation Rate	(8) Cancellation Rate	(9) Emp Group Cancellation Rate
22-34	.285 (.006)	.082 (.003) [.088]	.137 (.004) [.149]	.302 (.0008)	.130 (.0006)	.222 (.0010)	.067 (.0006)	.385 (.0012)	.196 (.0010)
34-44	.212 (.005)	.073 (.003) [.078]	.083 (.003) [.089]	.223 (.0007)	.118 (.0005)	.152 (.0008)	.061 (.0005)	.310 (.0011)	.187 (.0009)
44-54	.180 (.004)	.075 (.003) [.080]	.060 (.003) [0.65]	.177 (.0005)	.103 (.0004)	.116 (.0006)	.053 (.0004)	.267 (.0010)	.177 (.0009)
54-64	.149 (.005)	.064 (.003) [.072]	.042 (.003) [.047]	.145 (.0006)	.080 (.0005)	.096 (.0006)	.040 (.0004)	.248 (.0013)	.165 (.0011)

Notes: Author calculations from CTS and private regional insurer. For the CTS, age reflects the person's age one year prior to interview (i.e., age at "baseline" from which cancellation rates are measured). In columns 2 and 3, bracketed term represents an adjusted estimate of cause-specific cancellation rates under hypothetical restriction to persons with employer group coverage (see Table 3). Group cancellations are identified as described in Table 3. Standard errors are in parentheses.

Table 6. Fully Insured (FI) and Self Insured (SI) Status by Plan Type

	Establishment Counts	
Plan Type	FI Plans	SI Plans
Indemnity	841	284
PPO/POS	3446	690

Note: Author calculations from EHIS data. See Data Appendix for details.

Table 7. Fully Insured (FI) and Self Insured (SI) Status by Firm Size

	Establishment Counts	
Firm Size	FI Plans	SI Plans
<10	1128	25
10-35	1429	40
35-250	1268	201
250-5000	374	453
≥5000	88	255

Notes: Author calculations from EHIS data.

Table 8. Raw Distribution of Single Monthly Premiums

Percentile	FI Group Plans	SI Group Plans
1%	$55.70	$60.00
5%	85.00	97.00
10%	100.00	107.80
25%	122.50	138.20
50%	158.00	163.00
75%	201.00	207.00
90%	275.00	250.00
95%	333.30	278.00
99%	452.00	350.00
Mean	176.2	177.7
Variance	6418.2	3741.4
Skew	1.67	0.87
N (count)	4287	974

Notes: Author calculations from EHIS data. Weights applied to provide nationally-representative estimates.

Table 9. Distribution of Premium Residuals

Percentile	FI Group Plans	SI Group Plans
1%	-134	-113
5%	-94	-72
10%	-72	-45
25%	-44	-18
50%	-11	-1
75%	28	18
90%	84	47
95%	138	59
99%	239	136
Mean	-.06	0.11
Variance	5156.1	1736.0
Skew	1.48	0.32
N (count)	4287	974

Notes: Author calculations from EHIS data. Residuals obtained from premium prediction models reported in Table A1 (columns 1 and 2). Weights applied to provide nationally-representative estimates.

Table 10. Mean Premium Residuals across the Residual Distribution, FI and SI Plans

	(1)	(2)
	Mean Residual	
Quintile Range	FI Group Plans	SI Group Plans
0-20%	-80.5 (3.0)	-54.4 (3.9)
20-40%	-36.5 (1.5)	-14.7 (2.1)
40-60%	-10.1 (1.2)	-1.8 (1.2)
60-80%	18.9 (1.3)	14.7 (2.6)
80-100%	107.6 (4.3)	55.6 (4.1)
95-100%	204.1 (10.6)	94.0 (6.8)

Note: Author calculations from EHIS data. These are the mean premium residuals over different ranges of the residual distribution, with premium residuals estimated from the GLM premium prediction models (estimated separately for FI and SI plans). Bootstrap standard errors, with 300 replications, are presented in parentheses.

Table 11. Mean Premium Residuals across the Residual Distribution, by Firm Size

	Mean Residual							
Firm size	*0-35*		*35-250*		*250-5000*		*5000+*	
Plan type	*FI Groups*	*SI Groups*	*FI Groups*	*SI Groups*	*FI Groups*	*SI Groups*	*FI Groups*	*SI Groups*
Quintile Range								
0-20%	-83.2 (3.7)	--	-65.2 (4.2)	-33.6 (4.1)	-51.8 (4.9)	-34.1 (3.9)	--	-31.8 (4.1)
20-40%	-39.2 (1.9)	--	-21.0 (2.5)	-3.3 (0.8)	-12.7 (2.3)	-4.9 (1.4)	--	-3.9 (0.7)
40-60%	-10.1 (1.3)	--	-2.8 (1.2)	-0.7 (0.3)	-1.2 (0.7)	-1.2 (0.5)	--	0.4 (0.4)
60-80%	20.4 (1.6)	--	11.8 (2.0)	1.7 (0.6)	6.1 (2.1)	3.1 (1.3)	--	4.2 (0.8)
80-100%	111.3 (5.5)	--	76.7 (5.6)	27.5 (3.7)	58.2 (5.4)	34.2 (4.0)	--	28.7 (3.5)
95-100%	212.3 (12.8)	--	157.8 (11.5)	74.9 (9.6)	107.8 (9.7)	69.9 (6.8)	--	57.8 (7.8)
N (sample)	2557	65	1268	201	374	453	88	255

Notes: Author calculations from EHIS data. Details are as in Table 10, but models were estimated (and mean residuals calculated) by firm size categories. Results omitted for categories with small sample sizes (N<100). Bootstrap standard errors, with 300 replications, are presented in parentheses.

Table 12. Estimates of Market Frictions and Insurance Cost for Fully Insured Employers

Panel A: Fitted Models		
Parameter Estimates	**model 1**	**model 2**
c	136.4 (3.8)	142.1 (3.2)
γ	.152 (.025)	.121 (.018)
p^R	433.9 (31.7)	453.6 (29.8)
Panel B: Goodness-of-fit Measures		
Mean Absolute Deviation	1.7	2.6
Mean Squared Deviation	9.6	9.5

Notes: Panel A reports parameter estimates from the procedure described in text. Estimates are based on 20 iterations. Model 1 assumes nuisance residuals follow the distribution $N(0,\sigma^2)$ where σ^2 = 1736.0, the variance in premium residuals estimated over self-insured plans (Table A1, Model 2). Model 2 assumes nuisance residuals follow the distribution $N(0,\sigma^2)$ where σ^2 =2140.8, the variance in premium residuals estimated over self-insured plans re-weighted so that the firm size distribution matches that of fully insured plans. Similar estimates are obtained if we drop the normality assumptions and assume that the nuisance residual follows the exact distribution of residual premiums estimated over the self-insured. Numbers in () are bootstrapped standard errors estimated over 200 iterations.

Panel B presents "goodness-of-fit" measures based on comparisons of the estimated distribution of FI premium residuals and a simulated distribution of 100,000 premiums reflecting the estimated parameters and model assumptions. These measures were calculated based on the deviations observed at each percentile point across the two distributions.

Data Appendix

1. Data Selection Criteria

The premium data are obtained from the 1997 Robert Wood Johnson Foundation Employer Health Insurance Survey (EHIS). The dataset consists of a stratified sample of establishments. Throughout our analysis, the "establishment" is treated as the unit of analysis. Sampling "establishment weights" provided in the EHIS dataset are used throughout the analysis to provide nationally representative estimates.

The following describes the selection criteria applied to construct the analytic sample:

- Private establishments offering at least one general medical plan (N=13,716).
- Restricted to establishments with at least 3 permanent employees (N=12,840). This was done because the characteristics of workers in the establishment were constructed over permanent employees only, and the characteristics of permanent employees were found to be strongly predictive premiums.
- Restricted to establishments with a single "dominant" health plan, that covered both inpatient and outpatient services (N=10,391). We defined a health plan as dominant when at least 90% of health plan enrollees from an establishment were enrolled in the same general medical plan. In the premium prediction models, the plan characteristics used as covariates were those associated with the dominant plan for that establishment.
- Restricted to establishments where funding of the dominant plan was recorded as either "fully insured" or "self insured" (N=10,329).
- Restricted to establishments where the single monthly premium recorded for the dominant plan was *not* imputed (N=7,578).
- Excluded establishments if the dominant plan was an HMO plan (N=5,261). HMO plans were excluded for two reasons. First, fewer than 5% of all HMO plans were self insured, compared with 17% of PPO/POS plans and 25% of indemnity plans. Second, premiums for HMO plans are expected to vary for reasons not well-captured by the recorded plan characteristics.

The application of these selection criteria yielded a sample of 5261 establishments offering a non-HMO plan as their dominant plan option. The variable of interest in the subsequent analysis was the single monthly premium recorded for the establishment's dominant plan. An alternative premium measure – the family monthly premium – was not recorded as frequently, specifically not in cases where a family plan was not offered by the employer.

2. Covariates Used in the Premium Prediction Models

The same covariates were included in the two premium prediction models, with the exception of three covariates that were not applicable to self insured establishments.

- Plan characteristics:
    - plan type is PPO/POS (indicator)
    - must enroll with gatekeeper (indicator, applies to PPO/POS plans only)
    - deductible level (quadratic)
    - copayment for typical office visit (quadratic, in some cases inferred by EHIS on basis of reported coinsurance level)
    - any catastrophic cap (indicator)
    - catastrophic cap level
    - includes prescription drug coverage (indicator)
    - includes mental health coverage (indicator)
    - includes vision care coverage (indicator)
    - includes dental coverage (indicator)
    - includes coverage for preventive dental care and orthodontics (indicator)
    - family coverage option available (indicator)
    - no exclusions for health reasons (indicator)
    - enrollees must report medical history (indicator)
    - no waiting period for enrollment (indictor)
    - contract includes guaranteed renewal (indictor)
    - contract include minimum participation requirement (indictor)

- Establishment characteristics:
    - establishment size (5 categories)
    - percent workers, permanent
    - percent workers, full-time
    - percent workers, female
    - percent workers, age 30-39
    - percent workers, age 40-49
    - percent workers, age 50+
    - mean payroll per worker (quadratic)
    - any union workers (indicator)
    - firm size (5 categories)
    - firm industry (7 categories, agriculture collapsed with construction due to small sample size)
    - firm years in business (4 categories)
    - establishment part of insurance purchasing coalition
    - premium source (4 categories)[40]
    - state dummies

[40] The source for the single monthly premium was identified as one of the following: (a) reported premium, (b) COBRA, (c) reported same premium for single and family premium, or (d) derived from aggregate paid premiums.

Appendix Table A1. Premium Prediction Models

	GLM		OLS	
	FI Plans (1)	SI Plans (2)	FI Plans (3)	SI Plans (4)
A. Establishment characteristics				
Employee characteristics				
fraction permanent	0.11	0.01	18.93	25.10
	(0.08)	(0.14)	(14.70)	(22.81)
fraction full-time	0.05	-0.02	4.08	0.47
	(0.04)	(0.07)	(7.76)	(12.70)
fraction female	0.07	0.03	10.35	0.18
	(0.04)	(0.08)	(7.70)	(13.71)
fraction age 30-39	0.04	0.06	5.52	4.10
	(0.05)	(0.07)	(9.84)	(12.10)
fraction age 40-49	0.25	0.15	45.27	23.13
	(0.07)**	(0.06)*	(12.96)**	(11.96)+
fraction age 50+	0.36	0.06	61.43	7.56
	(0.07)**	(0.09)	(12.56)**	(16.85)
mean annual pay ($/10^5$)	0.24	-0.17	39.53	-26.18
	(0.09)*	(0.10)+	(19.90)+	(20.31)
mean annual pay sqrd ($/10^{10}$)	-0.12	0.05	-19.16	4.04
	(0.05)**	(0.05)	(9.69)+	(10.42)
any union employees	0.18	0.05	36.26	7.82
	(0.04)**	(0.08)	(8.11)**	(14.48)
Establishment size[a]				
8-20	0.00	0.06	-0.25	13.55
	(0.02)	(0.04)	(3.82)	(8.24)
20-50	0.01	-0.13	-0.08	-26.25
	(0.03)	(0.05)*	(4.70)	(10.92)*
50-300	-0.03	-0.08	-3.55	-12.58
	(0.04)	(0.07)	(8.50)	(11.94)
300+	-0.04	0.17	-8.69	36.01
	(0.05)	(0.09)+	(9.27)	(20.62)+
Firm size[b]				
10-35	-0.03	0.22	-5.91	31.74
	(0.03)	(0.14)	(4.94)	(22.63)
35-250	-0.03	0.15	-6.07	19.18
	(0.03)	(0.11)	(5.34)	(20.10)
250-5000	-0.12	0.23	-24.10	35.74
	(0.04)**	(0.10)*	(7.86)**	(15.91)*
5000+	-0.03	0.19	-2.45	28.76
	(0.10)	(0.11)+	(17.13)	(17.44)
Industry category[c]				
mining and manufacturing	0.00	-0.05	-0.78	-19.88
	(0.04)	(0.08)	(7.16)	(16.35)
transportation/communications	-0.01	0.01	-3.77	-5.17
	(0.05)	(0.08)	(8.68)	(17.73)
wholesale trade	0.07	-0.15	15.87	-35.15

	(0.07)	(0.09)+	(15.23)	(21.09)+
retail trade	0.02	-0.12	4.46	-26.06
	(0.03)	(0.12)	(6.24)	(22.96)
finance/insurance/real estate	0.02	-0.09	2.56	-24.94
	(0.03)	(0.08)	(4.91)	(15.76)
professional services	0.05	0.01	8.09	-8.65
	(0.04)	(0.11)	(6.09)	(23.15)
other services	-0.02	0.05	-4.65	5.07
	(0.04)	(0.09)	(8.08)	(17.18)
Years in business[d]				
5-10 years	-0.03	-0.04	-4.03	-9.32
	(0.06)	(0.08)	(12.03)	(14.49)
10-20 years	-0.00	0.07	-0.91	8.57
	(0.04)	(0.07)	(6.97)	(12.20)
20-50 years	0.01	0.10	1.22	16.49
	(0.04)	(0.07)	(7.49)	(10.31)
50+ years	0.06	0.07	11.60	7.39
	(0.03)+	(0.08)	(6.89)+	(11.36)
Establishment involved in a purchasing arrangement to buy HI	0.04 (0.02)*	0.08 (0.06)	6.30 (3.37)+	17.70 (12.64)
B. Plan characteristics				
Plan type				
PPO plan	-0.02	0.07	-3.82	13.24
	(0.03)	(0.05)	(5.37)	(11.08)
PPO plan w/ gatekeeper	-0.04	-0.08	-6.70	-12.66
	(0.02)*	(0.07)	(3.85)+	(12.63)
Plan offers family coverage	0.06	-0.49	10.00	-121.18
	(0.05)	(0.11)**	(9.04)	(25.01)**
Cost sharing				
deductible ($/10^2$)	0.00	-0.04	1.16	-8.45
	(0.01)	(0.03)	(2.00)	(5.01)+
deductible sqrd ($/10^4$)	-0.00	0.00	-0.10	0.42
	(0.00)	(0.00)	(0.21)	(0.39)
copay level (/10)	-0.02	-0.02	-3.43	-4.77
	(0.04)	(0.07)	(7.40)	(13.61)
copay level sqrd ($/10^2$)	-0.02	-0.00	-3.14	-0.11
	(0.01)	(0.01)	(2.50)	(2.74)
plan has catastrophic cap	0.10	0.14	17.84	25.99
	(0.03)**	(0.06)*	(5.85)**	(10.88)*
catastrophic cap amount	-0.11	-0.01	-20.04	3.67
	(0.09)	(0.22)	(18.27)	(37.81)
Coverage included				
outpatient prescription drugs	0.08	-0.04	12.87	-6.81
	(0.03)*	(0.12)	(6.01)*	(20.80)
mental health services	-0.05	-0.18	-11.87	-24.27
	(0.07)	(0.12)	(15.63)	(18.77)

vision care	0.00	0.04	1.65	7.12
	(0.03)	(0.05)	(5.09)	(9.08)
any dental	0.05	-0.01	7.04	-0.96
	(0.03)+	(0.04)	(5.14)	(7.80)
premium dental[e]	0.11	0.09	22.39	15.25
	(0.04)**	(0.07)	(7.53)**	(12.75)
Coverage restrictions				
any employees excluded because of health conditions	0.01 (0.02)	0.04 (0.04)	2.59 (3.94)	6.05 (7.98)
employees required to provide medical history	-0.00 (0.02)	--	-0.43 (5.14)	--
no waiting period for coverage	0.01	-0.01	1.86	-2.10
	(0.02)	(0.03)	(4.51)	(6.21)
contract for plan is guaranteed renewal	-0.01 (0.03)	--	-1.12 (5.54)	--
contract includes minimum participation requirement	-0.00 (0.03)	--	-1.11 (5.16)	--
Basis for reported premium				
COBRA	-0.09	0.03	-15.12	6.37
	(0.07)	(0.03)	(13.88)	(6.59)
reported that single premium did not differ from family premium[f]	0.09 (0.03)**	0.16 (0.23)	16.89 (5.67)**	27.87 (43.14)
derived from aggregate paid premiums	-0.11 (0.05)*	-0.01 (0.12)	-15.97 (9.75)	-10.53 (19.62)
State Fixed Effects	YES	YES	YES	YES
R^2	--	--	.2015	.5304
Sample size	4287	974	4287	974
Premium mean	176.2	177.7	176.2	177.7
Premium variance	6418.2	3741.4	6418.2	3741.4
Residual premium variance	5156.1	1736.0	5124.8	1757.1

Notes: Data is drawn from the 1997 Robert Wood Johnson Foundation Employer Health Insurance Survey (EHIS). Sample consists of 5261 private establishments meeting the following criteria: at least 3 permanent employees at establishment; firm offers at least one general medical plan to employees at establishment; at least 90 percent of participating employees were enrolled in the same non-HMO plan (the establishment's "dominant" health plan); and single plan premium was not imputed.

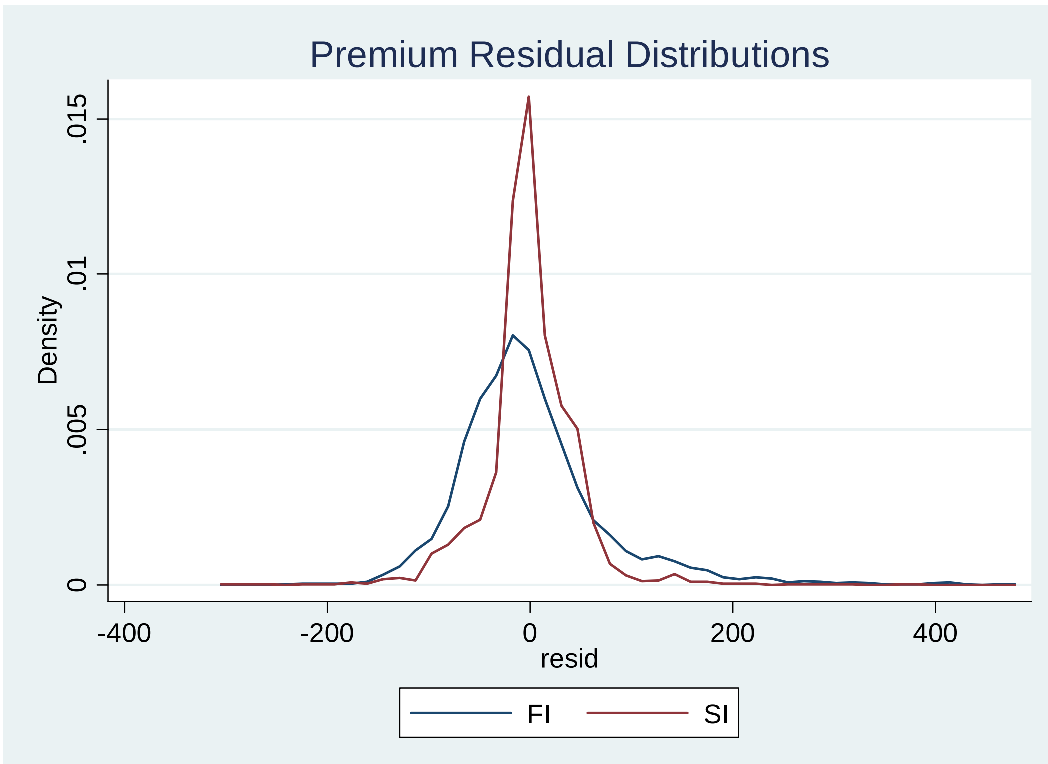
Dependent variable is single monthly premium recorded for establishment's dominant plan. Plan characteristics refer to establishment's dominant plan. Prediction model in columns 1 and 2 are estimated using generalized linear model (GLM) with log link and gamma distributional family. Coefficients are interpreted as changes in the log of predicted premium. The distributional family was determined by way of the modified Park Test. Prediction model in columns 3 and 4 are estimated using linear OLS.

Establishment-level weights applied to produce nationally representative estimates. Robust standard errors in parentheses, adjusted for clustering by sampling strata (+ significant at 10%; * significant at 5%; ** significant at 1%).

[a] omitted category: <8 employees
[b] omitted category: <10 employees

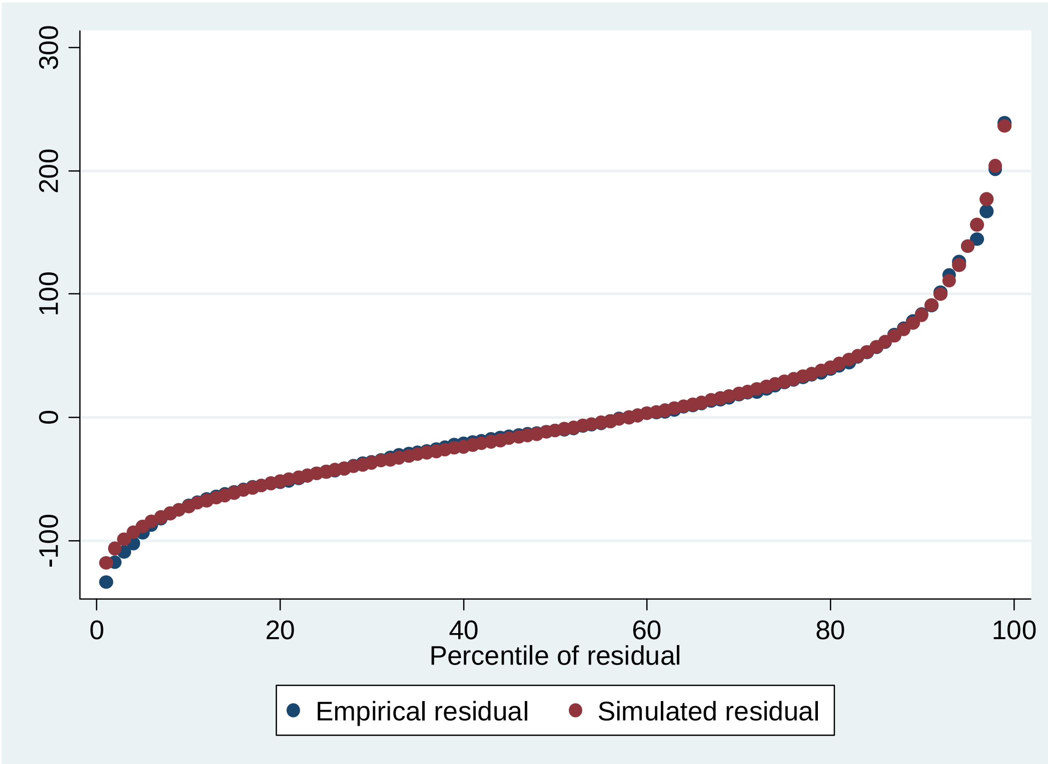
[c] omitted category: construction, plus agriculture/fishing/forestry (one establishment)
[d] omitted category: <5 years
[e] dental coverage that includes both preventive and orthodontic services
[f] omitted category: reported premium
[g] recorded single premium same as reported family premium in these cases

Figure 1.



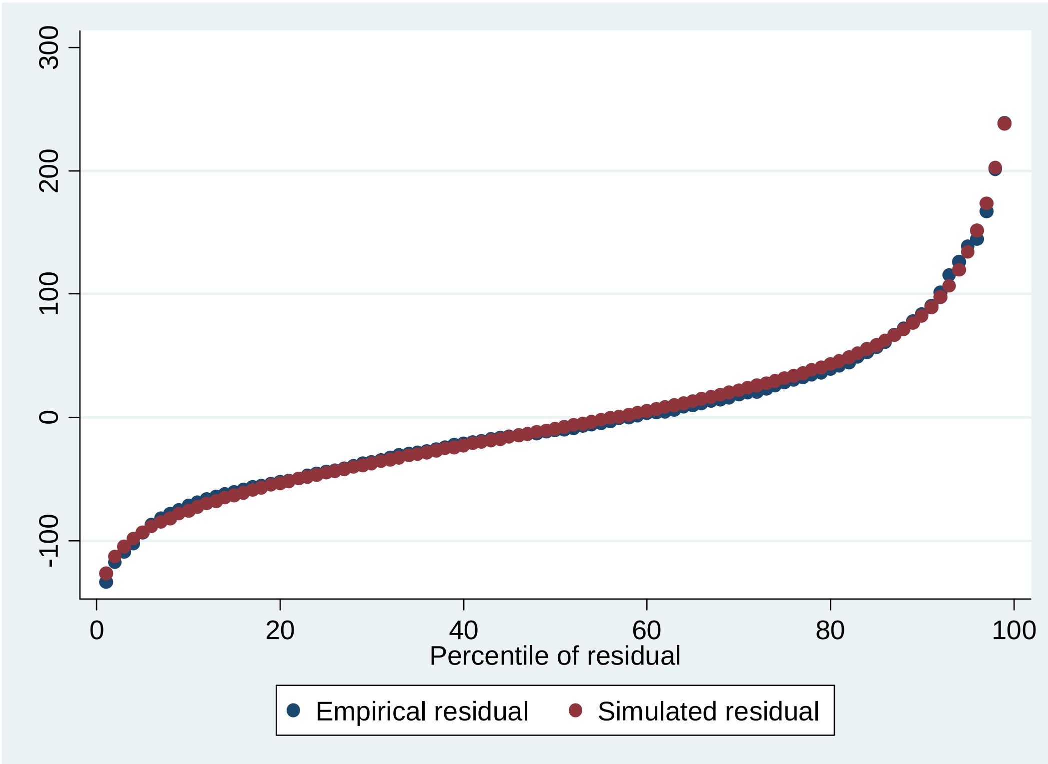
Notes: "FI" depicts the distribution of residuals from the premium prediction model estimated over fully-insured plans (Table A1, column 1). "SI" depicts the analogous set of residuals from the premium prediction model estimated over self-insured plans (Table A1, column 2).

Figure 2



Notes: "Estimated residuals" depict the empirical distribution of residual premiums at each percentile for fully insured employers. These were the residuals from the model estimated in Table A1, column 1. "Simulated residuals" depict a simulated distribution of residual premiums, plotted at each percentile, based on a simulation of 100,000 premiums under assumptions and parameters estimates from model 1 in Table 12.

Figure 3



Notes: "Estimated residuals" depict the empirical distribution of residual premiums at each percentile for fully insured employers. These were the residuals from the model estimated in Table A1, column 1. "Simulated residuals" depict a simulated distribution of residual premiums, plotted as each percentile, based on a simulation of 100,000 premiums under assumptions and parameters estimates from model 2 in Table 12.

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