The Welfare Effects of Banning Risk-Rated Pricing in Health Insurance Markets: Evidence From Chile

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Abstract

We study the welfare consequences of a switch from risk-rated premiums to community-rated premiums using a two stage model of health insurance demand and detailed claims data from Chilean health insurers. Our results suggest that if insurers are not allowed to scale premiums based on age and sex (in accordance with a recent court ruling), a significant fraction of young, healthy individuals will opt out of the private insurance market, raising the average cost of insuring those who remain. Chilean consumers in aggregate are likely to be worse off under community-rated premiums, with declines in total surplus of 9%.

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1 Introduction

Many countries have recently implemented health reforms that involve regulating how health insurance is priced. Most of these reforms prohibit pricing based on pre-existing health conditions; some do not allow differential pricing based on other risk factors such as age and sex. These limitations are often motivated by fairness concerns and by a desire to protect consumers from reclassification risk. However, such policies introduce or amplify the problem of adverse selection. Adverse selection occurs when consumers have private or unpriced information about their risk factors leading those consumers who are higher risk to purchase more generous insurance plans. It can result in complete or partial market failures since low-risk consumers who value insurance more than their expected costs may not be fully insured.

In this paper, we study the private market for health insurance in Chile, where pricing based on age and sex was recently ruled unconstitutional by Chile's Constitutional Tribunal.[1] We use detailed individual-level administrative data on plan enrollment and claims that cover all consumers in the private health insurance market in Chile to estimate how this restriction in insurer ability to price will affect consumer welfare.

The key to understanding the welfare consequences of disallowing risk-rated premiums is in establishing whether after conditioning on priced observables consumers still have private information. Total welfare will decrease if individuals do not have additional private information because banning risk-rating induces adverse selection where there previously was none. Otherwise, welfare could increase or decrease depending on the shape and position of the demand and cost curves (discussed further in Einav & Finkelstein 2011). We show that in this market, consuumers with more generous plans tend to have higher total expenditures on health care services and that this correlation is substantially larger when we do not control for gender and age. We then use the data to estimate a model of insurance choice and analyze the potential consequences of the ban on risk-rated pricing. Specifically, we use our model to predict the extent to which low-risk individuals will opt out of the more generous private insurance plans, thereby increasing the average cost of those plans.

Chile is a particularly interesting case for study because in addition to the legality of risk-rated pricing, the purchase of insurance is mandated and a robust private health insurance market coexists with a large public sector plan. Mandates and risk-rated pricing are thought to ameliorate the welfare effects of adverse selection, but empirical evidence on their effectiveness is lacking in the literature. Our results are directly policy relevant for Chile,

[1] In 2010 the Constitutional Tribunal, a court that rules specifically on issues of constitutionality, found such pricing rules to be unconstitutional. The decision was subsequently affirmed by the Supreme Court, although implementation of a ban has not yet occurred.

and are also relevant for the United States, which bans some forms of risk-rating under the Affordable Care Act.[2]

We estimate a structural model of consumer demand for insurance and health care services, which is essential for the counterfactual simulations because it allows us to predict individual choices under alternative pricing policies. Futher, the model allows us to empirically differentiate between moral hazard and adverse selection, which is important because we explore the implications of removing the parts of the consumer decision that depend on private information. The framework is a two stage model similar to the one used in existing empirical models of demand and medical spending (Cardon and Hendel, 2001; Bajari et al., 2010; Carlin and Town, 2010; Einav et al., 2011). In the first stage, the consumer chooses the insurance policy that yields the highest expected utility using all the available information regarding his or her future health status. In the second stage, health status is realized and the consumer decides on optimal health care utilization given the policy chosen. Estimation of the model parameters shows that private information accounts for approximately 29% of the variance in predicted total annual expenditures in this market.

With the estimated model parameters, we study a community-rated pricing counterfactual to explore the effects of disallowing age and sex based price discrimination. The counterfactual allows consumers to switch from the private sector to the public sector. We also compare this to a version of the counterfactual in which we eliminate the consumer's private information. When consumers have private information, we find that total surplus declines by 8.6% under community-rated prices compared to under risk-rating, with the majority of the decline (77%) coming from a decrease in consumer surplus. Removing the possibility that consumers have private information about their health risk magnifies the effect of banning risk-rated premiums: total surplus decreases by 12.24%, with the majority of the decrease coming from a decrease in consumer surplus.

Our simulations also suggest that uniform premiums induce healthy people to opt for lower generosity plans to avoid the higher premiums that are a consequence of subsidizing sicker people enrolled in the same plan. The most generous plan types lose almost 12 percentage points in market share, and the lowest generosity plan type sees a 44% increase in its market share. An important fraction of enrollees also leave the private sector for the public sector, increasing the public sector's market share to almost 4%. The underlying dynamic in our results suggests that the risk of observing a 'death spiral' among high generosity private sector health insurance plans is real.

[2]In particular, plans sold on the small-group and non-group market must charge the same premium to all within an age group, regardless of gender or health conditions. Risk-rating on age is still allowed within certain limits–a standard formula that applies to all insurers.

The rest of the paper is organized as follows. We describe the institutional background in section 2. Section 3 details the data and construction of the sample and plan generosity measures. The structural model and estimation results are in section 4, while the counterfactual analysis is in section 5. Section 6 concludes.

2 Institutional Background

Both the private and public sectors play important roles in the health insurance market in Chile, although the public sector covers many more people. Thirteen private health insurance firms firms, called Instituciones de Salud Previsional (ISAPREs), serve approximately 13% of the population, i.e. 2.3 million individuals. The federal agency Fondo Nacional de Salud (FONASA), provides insurance to approximately 79% of the population. The remaining 8% of the population are either enlisted in the Chilean Army or do not belong to any particular system.[3] Several papers describe the system in greater depth than we do here, including Duarte (2012), Henriquez (2006), Sanhueza and Ruiz-Tagle (2002), and Sapelli (2004). Fischer, Gonzalez, and Serra (2005) provide a history of the system's development in the context of Chile's broader market reforms.

Health insurance in Chile is mandatory for salaried workers and retirees. They must spend 7% of their taxable income each year on a health insurance plan up to a cap of approximately $US 2,600, and are allowed to spend more than the 7% if desired. The 7% payment goes either to the public system as a tax to support it, or to the private system directly as a premium payment. Table 1 provides a comparative summary of the features of the private and public sectors.

Individuals can switch from public to private insurance at any time. Within the private sector, switching from one firm's plan to another is only allowed once per year. The market features a large number of potential plans: in 2009, there were 11,216 individual and group plans available across all ISAPREs. The number of plans arises because individual contribution to health insurance depends on income, and firms have responded by creating similar plans with slightly different features that yield marginally different expected out-of-pocket expenditures and offer them at a marginally different premium.

Insurance agents present summaries of each ISAPRE's plans, called 'Prestaciones Valorizadas', when visiting potential clients. The premium broadly determines the set of potential plans. The summaries consist of the plan coinsurance rate for outpatient health care services and for inpatient services and a list including 40 health care services with their coinsurance rate and cap on expenditures per service. The list of 40 services was required in

[3]CASEN and Superintendencia de Salud, 2009

1997 by the government in order to improve comparability between plans. The services on the list were chosen because of their frequency of usage and cost.

Sapelli and Vial (2003) use national survey data from Chile to study selection and moral hazard comparatively between the public and private sectors in Chile, with the idea that the public sector should be more negatively selected than the private sector since it serves as an insurer of last resort and for those whose observable risk factors are such that they cannot afford private insurance. They use a two equation selection model and find evidence of both adverse selection and moral hazard consistent with their hypothesis. They find no evidence that adverse selection is present within the private insurance sector, but have no data on prices or plans across sectors.

In general, the private sector offers access to higher quality providers. The private sector is also able to exclude the highest-risk individuals, since they are allowed to screen for pre-existing health conditions and may deny such applicants. As might be expected and is shown in Sapelli and Vial (2003), the rate of participation in the private sector is higher for higher-income individuals (since the 7% premium buys relatively more in the private sector) and for lower observable risk (since premiums are partially based on this).

Each private sector plan has a baseline premium which is adjusted according to legally specified observable risk factors (age of policyholder, sex of policyholder, number of dependents, and the age and sex of dependents). In order to reduce the ability of firms to price discriminate, in 2005 firms were required to provide risk tables that specify exactly how they price adjust. An example of one such table is shown in Table 1. The table is required to show the cost of the premium for each of 18 groups defined by age and sex, relative to the reference group, 30 year old males. For example, if the baseline price of plan k is \$1, then a 60 year old male would pay \$3.26 and a 30 year old female would pay \$2.53 to purchase plan k. Firms may set their own risk tables, but are allowed to have a maximum of two, and one of these tables must apply to each plan that the firm provides. Firms may revise the risk tables every five years.

There are three general types of plans in the private sector, with varying rates of coverage generosity. Under a 'free choice' plan, coverage is not tied to the use of a particular clinic or health care system, similar to a traditional fee for service indemnity plan in the United States. Also similar to the United States, there are plans with dual pricing systems tied to a 'preferred provider', but enrollees can use providers outside the system at a different price. Finally, in 'closed' plans, enrollees can only use the services of the plan providers or must pay full price (the equivalent of the U.S. HMO).

3 Data

We use individual-level enrollment and claims data on consumers of all 13 firms in the private sector of Chilean health insurance market. The enrollment data contain sex, age, income, family composition with number of dependents and their sex and age, insurance plan choice and enrollment dates, and characteristics of the insurance plan. The claims data are aggregated by service, plan, sex, and age groups for the 2002-2006 period. From 2007 to 2009, the claims data are at the individual level. Each claim includes, among many other details regarding diagnosis and services provided, the amount charged for the service and how the cost of service is shared between the individual and the insurer. The total number of claims is approximately 40 million each year. For most of the analysis, we focus on the individual-level claims data and use the earlier data to supplement the data on plans when necessary.

3.1 Sample construction

In order to construct the sample for analysis, we impose a set of restrictions on both plans and individuals. We limit the sample to individuals with no dependents. We do this because the premium is a function of the age and sex of both the individual and his or her dependents, and we want to link an individual's risk directly to the price he or she pays. We exclude children, defined as those less than 18 years of age, and the elderly, defined as those older than 65. We also exclude those who have incomes below the minimum wage, which we do to remove much of the question of the private versus public sector choice.[4] Finally, we require the individual to have 12 months of continuous enrollment in the private sector.

The set of available contracts for a given person to choose from is an important piece of the structural estimation. In this market, a potential policyholder reports to the insurance company two pieces of information: taxable income and demographics (age and sex of policyholder).[5] Recall that salaried workers and retirees are mandated to spend at least 7% of their taxable income each year on a health insurance plan. The individual's final premium equals a baseline premium (common to all enrollees) plus an adjustment which depends on sex and age. After learning about the individual's demographics and income, the insurer typically offers at least two plans to the potential policyholder; one plan priced at exactly

[4]The private sector should strictly dominate the public sector in the quality dimension, so while we do choose a higher-income sample, we otherwise abstract from the issue of public versus private choice selection until the counterfactual analysis.

[5]Applicants are also required to fill out a 'health declaration' which identifies any pre-existing conditions. Firms are not allowed to price discriminate based on pre-existing conditions, but the firm might restrict coverage for it or deny the applicant entirely.

7% of the individual's taxable income and one plan with a higher premium.

Since we do not directly observe the choice set for any one person, which could in theory be the entire set of plans priced at or above the 7% income threshold, we must restrict the set of possible plans. This ensures that the plans in our sample were actual options in the market for anyone with a similar premium. We first employ a set of restrictions that are intended to ensure that only plans that were actually being traded in the market (and were not, for example, created for one specific individual) are in the sample. We do this by choosing only plans launching after July 2005 which have positive enrollment, and impose the restriction that at least one other person in the sample of enrollees was enrolled in that plan within a six month window (three months before or after). We also exclude a few plans which were only offered at a single employer and not to the whole market.

In addition to the restrictions on individuals and plans, we have cross-restrictions. We do not include any individuals whose actual plan choice was an excluded plan, and we do not include any plans that were not purchased by at least one person in the sample. We are left with a total of 485,214 individuals. The total number of plans purchased by the enrollees in the sample as restricted is 17,237 plans of which 3,808 were being actively traded at the time.

A large fraction (53%) of enrollees are enrolled in free choice plans. Another 40% have preferred provider plans; the remaining 7% are in closed plans. Thirty percent of enrollees are in plans with restrictions on maternity coverage while the remaining 70% have general coverage plans.

Table 2 describes the sample of individuals analyzed in this paper. In the table, all monetary amounts are in US dollars converted from Unidad de Fomento (UF), an inflation-adjusted unit of account commonly used in Chile for pricing in contracts. The average annual premium in the sample is $1,209.44, whereas the average legal required premium is $1,016.84 (calculated based on reported income). Forty-seven percent of the sample pays a premium higher than legally required. Average income in the sample is $14,652 annually. The average enrollee age is 35.5 years, and 60% of the sample is male. In the sample, enrollees average 13.5 claims per year with an average total cost of $564.36. Just eleven percent of the sample made use of what are categorized as preventive services, with an average cost of $1.19 per person.[6]

[6]For reference, in 2007, 1 UF was on average equivalent to 18,789 Chilean pesos, which at an average of 523 Chilean pesos to the dollar comes out to roughly 36 US dollars to the UF.

3.2 Generosity measure

Plans are numerous and cannot be easily ordered. We need a measure of plan generosity in order to compare across plans and perform the empirical analysis. Here, we define a more generous plan as one which will require lower out of pocket expenditures for a given set of health services. This method is consistent the structural model, in which the main determinant of the consumers' choice of optimal health care services within plan is out of pocket expenditures (conditional on the premium).

In Chile, the cost to the patient for any specific health care service depends on the coinsurance rate and the per-service cap on the amount that the insurance company will pay. The formula for the out of pocket expenditure for individual i for service s is:

$$OOP_{s,i} = fee_{s,i} - minimum([fee_{s,i}(1 - coinsurance_{s,i})], cap_{s,i})$$

The effective coinsurance rate for this particular service is the ratio of out of pocket expenditure to total fees. Figure 4 shows an example of the relationship between the effective coinsurance rate and the price for a specific service. The important feature is that once the product of the percent covered and the fee hits the cap, the effective coinsurance rate increases monotonically and so do the out-of-pocket expenditures (see Figure 4).[7] These caps and coinsurance rates differ for each covered service, making clear the difficulty in describing the plans' many dimensions and the necessity of creating a summary measure.

The actuarial value of the plan is a measure of the percentage of the expected health care costs that a health plan will cover. It is calculated using the medical claims from a standard population, along with a plan's cost-sharing provisions. In our context, the standard population is defined by the same risk factors used for premium setting, the sex and age of the policy holder, combinations of which we call a risk group. We include all of the 40 services included in the list of 'Prestaciones Valorizadas' which represent approximately 45% of total health spending in the sample.

Then, the measure of actuarial value for plan k and population group g, is defined as:

$$AV_{k,g} = (\frac{1}{N_g} \sum_{i \in f} \frac{invoice_i - C_k(invoice_i)}{invoice_i}) \tag{1}$$

where $AV_{k,g}$ is the actuarial value of plan k for the group g, C_k denotes the cost-sharing rule for plan k and *invoice* is the plan's average price for the health care service. For each enrollee we calculate how much plan k would have paid on his or her behalf, based on current

[7] Plans do have an out of pocket maximum threshold, but we are only able to observe whether or not this threshold is reached and not the actual threshold itself. In the sample, only a handful of people reach their threshold, so we assume that it is not relevant.

utilization, and then we average across the relevant population. It varies at the plan level k for each risk group r. Table 2 shows the mean and standard deviation of the actuarial value measure. It varies from 20 percent coverage to 98 percent coverage with a mean of 67 percent coverage. Actuarial value is a standard way of measuring insurance plan generosity which does not rely on the demand for health services of plan enrollees but of the reference population. However, it does not capture differences in quality or provider networks.

3.3 Correlation between generosity and costs

Table 3 shows the results of simple regressions of plan generosity on total (ex-post) costs, conditional on variables the companies observe and price on, including income and risk group, and plan fixed-effects. As measures of generosity, we separately include an indicator for whether the individual spent more on his or her insurance premium than was legally required, and an indicator for whether the actuarial value of the plan purchased was higher than the minimum available actuarial value at that legal premium. These indicators provide a way of looking at whether, conditional on his or her choice set, the consumer self-identified as higher than the minimally possible risk.

The coefficient on the coverage generosity variable is positive and statistically significant at the 95% level or higher for all specifications, illustrating that consumers who use their plans more tend to have more generous plans. Purchasing more than the minimum plan is associated with a higher level of total costs ($59-$61) regardless of whether the minimum plan is defined by premium or by actuarial value.

Excluding controls for observable risk characteristics (risk group, which is the interaction of sex and age) changes the estimated coefficients so that purchasing more than the minimum plan is associated with a higher level of total costs ($220-$231). The estimated coefficient when we exclude controls for observable risk characteristics are almost four times larger than the estimated coefficient when we include those controls. The differences in these coefficients are statistically significant. Together, these simple regression results suggest that observable risk characteristics account for an important part of the variation in coverage decisions in the private sector of the Chilean market for health insurance.

4 Model

In this section we present a model of coverage choice and health care utilization which we estimate and use to perform the counterfactual analysis. We first introduce the model, which adapts the Cardon & Hendel (2001) model to the Chilean context. We then explain the variation in the data underlying the identification and describe the estimation procedure and results.

4.1 Model of insurance and health care choice

In the first stage, a consumer maximizes expected utility by choosing health insurance coverage, using all the available information about his or her uncertain future health state. In the second stage, once the uncertainty is resolved, the consumer chooses a level of health care services conditional on the observed health state and the previously selected insurance coverage. Generally speaking, the model predicts how individuals with the same observable characteristics but different private information about their subsequent health states pick an insurance plan and the levels of health care expenditures they will choose after learning about their health state.

Utility is described by $\mu(m_i, x_i - s_i)$, which is an increasing function of two arguments a composite good, m_i, and health consumption, $x_i - s_i$. Health consumption has two components: health care services x_i and a random health state s_i. Health can be improved either by increasing health care services (x_i) or drawing a better health state (s_i). Note that health care utilization and the health state are perfect substitutes.

An insurance policy $k = [p_k, C_k]$ is characterized by a premium p_k and out of pocket responsibility C_k. We discuss the model by first explaining the consumer's second stage decision conditional on insurance choice and realized health state, and then the first stage decision based on expected health state.

Utilization Choice: In the second stage, an individual observes the realization of their health state. Given the realized health state, s_i, and the first stage insurance coverage decision, policy k, an individual's health care utilization decision is made to maximize the trade off between the composite good and health consumption. Individuals solve the following problem:

$$\begin{aligned} \mu^*_{ik} = \mu^*(y_i, s_i, k) &= \max_{x_i \geq 0} \mu(m_i, x_i - s_i) \\ s.t.\ m_i + C_k(x_i) &= y_i - p_i \end{aligned} \tag{2}$$

where μ^* is indirect utility of individual i with policy j and y_i is income.

Coverage Choice: In the first stage, individuals observe a private signal ω_i which is correlated with their health state, and ϵ_{ik} which is an i.i.d. individual specific taste shock for policy k. In this context, individual i's valuation of a policy k is

$$V_{ik}(\omega_i, \epsilon_{ik}) \equiv E(\mu^*_{ik}(s_i)|\omega_i) + \epsilon_{ik} = \int \mu^*(y_i, z_i, k) dF_z(z|\omega_i) + \epsilon_{ik}$$

where V_{ij} is the expected utility from policy k given individual's belief about his subsequent health state, ω_i, and $dF_z(z|\omega_i)$ is the conditional distribution of the health state s_i.

Under this specification, individual i chooses the policy $k \iff V_{ik}(\omega_i, \epsilon_{ik}) \geq V_{il}(\omega_i, \epsilon_{il})$ for all $l \in \Omega_i$, i's choice set.

4.2 Parameterization

We now specify the econometric model that is based on the model of the previous section and add the Chilean-specific modifications. This allows us to jointly estimate plan choice and health care utilization.

First, we assume that the utility function is quadratic:

$$\mu(m_i, x_i - s_i) = \phi_1 m_i + \phi_2(x_i - s_i) + \phi_3 m_i(x_i - s_i) + \phi_4 m_i^2 + \phi_5(x_i - s_i)^2$$

where $m_i = y_i - p_{kg} - C_{kg}(x_i)$. In the specific context of the Chilean market we define:

- p_{kg}: as the plan k's premium for risk group g. Plan premiums are a function of two components: baseline premium and risk group as defined in the risk factor table.

- $C_{kg}(x_i)$: as out-of-pocket expenditures. We assume this is a linear function of the total expenditure, $C_{kg}(x_i) = (1 - AV_{kg})x_i = c_{kg}x_i$, where AV_{kg} is a summary of the coverage of plan k for risk group g as defined in section 3.2.

Under these assumptions we can compute the second stage optimal health care consumption as the solution to the first order condition of the individual's optimization problem. In particular, the optimal health care consumption at the interior solution is:

$$x_{ik} = \frac{\phi_2 - c_{kg}\phi_1 + (\phi_3 - 2c_{kg}\phi_4)(y_i - P_k) - (2\phi_5 - c_{kg}\phi_3)s_i}{2(c_{kg}\phi_3 - c_{kg}^2\phi_4 - \phi_5)}$$

Optimal health care consumption results from comparing utility at the interior solution and corner solutions among those that satisfy the budget constraint.

Second, since the distribution of total annual expenditures is highly skewed we assume that the health state is log-normally distributed

$$\log(s_i) = \kappa(Di) + \omega_i + \upsilon_i$$

where $\kappa(.)$ is a linear function of demographics, $\omega_i \sim N(0, \sigma_\omega)$ is the individual's belief about the subsequent health state (or the individual's private signal) and $\upsilon_i \sim N(0, \sigma_\upsilon)$ is the error prediction or unforeseen health shock.

Finally, we assume that the policy-specific shocks ϵ_{ik} are i.i.d. distributed Type I Extreme value random variables. This is a convenient assumption because it yields a closed form solution for the choice probabilities and reduces the number of dimensions of integration to two variables, ω and υ.

4.3 Identification

The most important econometric challenge in estimating models of asymmetric information in health insurance markets is to separately identify adverse selection from moral hazard. For our purposes, this separation is necessary so that we can examine the consequences of shutting down different channels of variation within the model on the choices that consumers make. Identifying adverse selection requires that similar consumers face different trade-offs between plan characteristics during the contracting stage, while identifying moral hazard requires exogenous variation in the cost sharing rules that consumers face after the contracting stage (Starc, 2010).

In a general sense, the key to identification in the model is the heterogeneity in choice sets across individuals. When choice sets differ across individuals, we observe similar individuals facing similar policies (for example, the same actuarial values) but with different premiums, and we observe similar individuals facing similar premiums with different policies. Price sensitivity (moral hazard) is identified from variation in coinsurance rates across individuals. Adverse selection is identified using differences in plan choices made by similar individuals who face similar choice sets.

In the specific context of this paper, the institutional environment is such that insurers typically offer one plan equivalent to the required premium as a function of income and one plan with a higher premium but lower expected cost. Variation in income across individuals changes the minimum possible plan, giving us variation in the set of available plans that is due only to an exogenous source, allowing identification of price sensitivity to plans, while variation in selected plans for individuals of similar incomes indicates a difference in expected costs, allowing us to identify adverse selection. The minimum required premium will be correlated with coinsurance, since a higher premium will purchase a more generous plan, but should be uncorrelated with the individual's future health state (as long as future health state does not itself determine income).

However, since health insurance and health care services are likely normal goods with positive income elasticities, we also note another type of variation in our data. The variation comes from each plan's baseline premium which is adjusted according to observable risk.

This means that regardless of their individual risk, otherwise similar individuals with just a small difference in age will face different premiums for the same plan, providing the type of variation needed to identify adverse selection.

4.4 Estimation

We estimate the model using the Generalized Method of Moments. This method is useful because it allows us to estimate a mixture of discrete (plan choice) and continuous choices (health care expenditures) as in Dubin & McFadden (1984). In the first stage, the model predicts how individuals with the same demographics (in particular income, sex, and age) but different private information behave. Therefore, our first set of moment conditions comes from individual plan choices. From the data we observe the individual's current plan choice and potential choice set. Then, for each individual i we define:

$$P_{ik}(\theta, D_i) - I_{ik} \tag{3}$$

where I_{ik} is a vector of indicator variables equal to 1 for the chosen option, and 0 otherwise; and $P_{ik}(\theta, D_i)$ is the probability that i chooses plan k, conditional on demographics D_i.

In the second stage, the model predicts how much an individual spends on health care conditional on having picked an specific plan. In the data, we observe the individual's actual expenditures, x_{ij}, under the chosen option. Using the first and second stage we build the following moment condition:

$$P_{ik}(\theta, D_i)E(x_{ik}|I_{ik} = 1) - I_{ik}x_{ik} \tag{4}$$

where $E(x_{ik}|I_{ik} = 1)$ is the model-predicted health care consumption conditional on plan k being the optimal decision, and x_{ij} is the actual expenditure.

Using the model's theoretical predictions, we build moment conditions for each type of plan (free choice, preferred provider, and closed plans). We aggregate the moment conditions at plan type level for tractability reasons. Since each individual choice set contains all plans that are at or above his legal premium, and choice sets differs across individuals, working with the moment conditions as defined in 3 and 4 requires operating with large matrices when computing the conditional choice probabilities.[8] Then, we minimize the objective function to find the parameters which give us the smallest differences between the population moments,

[8] The size of the matrices equals the number of enrollees multiplied by the total number of plans

which come from the model's assumptions, and the sample moments, which come from the data.

Given an initial set of parameters, the estimation algorithm then follows these steps:

1. Simulate the distribution of s_i. Take draws (realizations) of ω_i. Then for each ω_i, take draws of υ_i to get utility and health care consumption for each health realization;

2. Integrate over υ to obtain the expected utility for each plan k for each realization of the health state, i.e. $E(\mu^*_{ik}(s_i)|\omega_i)$;

3. Integrate with respect to the extreme value variable, ϵ_{ik}, to obtain probability of choosing plan k conditional on ω_i, $P_{ik}(\omega_i)$;

4. Integrate with respect to ω to obtain the probability of choosing plan k, P_{ik};

5. Then, compute the expected consumption under plan k by adding over all ω_is weighting them by the probability that k was the optimal choice, i.e. $E(x_{ik}|I_{ik} = 1) = \int_\omega P_{ik}(\omega)x_{ik}(\omega)dF_\omega(\omega)$; and

6. Build the prediction errors for each type of plan. The probability of choosing plan type t equals to the sum of probabilities of choosing plan type t in the individual's choice set. Expenditures are a probability weighted average.

7. Build the moment conditions using the prediction errors as defined along with a set of instruments.

4.5 Estimation results

In this section, we report estimates of the model's parameters. Preferences are represented by the coefficients of the utility function, the effect of demographics on the health care expenditure by the coefficients of the linear equation $\kappa(D_i)$ and the effect of private information on health care utilization through the coefficient σ_ω.

Table 4 presents parameter estimates from two different specifications of the model. The first specification is a baseline model where the health state does not include any demographics as controls. Since the model is capable of separately identifying the fraction of the variance of total expenditures that is due to private information and the fraction that is due to an unforeseen shock in health status, this specification provides an upper bound for the the variance of the signal. The second specification allows us to know whether after controlling for all information available to the insurer, individuals still have some residual private information.

The results suggest that private information about health risk plays an important role in plan choice. We estimate with high precision that the standard deviation of the signal is 1.586 in the baseline specification. The parameter estimate means that private information accounts for 46.3% of the variance of the predicted total annual expenditure. Results are similar in the second specification: even after including all the information that insurers are allowed to use to predict an individual's health state, we are able to confirm adverse selection. In this second specification the standard deviation of the signal is 0.879, meaning that private information still accounts for 29% of the variance of the predicted total annual expenditure. The parameter estimate for the standard deviation of the signal is statistically significant and it is estimated very precisely.

We also compute the effect of demographics on health care consumption through their effect on the health state. Our results show that women spend on average 100.6% more than men, and adding 5 years to age yields a 10.1% increase in health care expenditures. Our results underestimate the risk factor tables underlying values which show that women spend on average 120% more than men, and that adding 5 years to age yields a 16% increase in health care expenditures. The gap in total annual expenditures between women and men shrinks over time, and at advanced ages women eventually have lower expenditures than men.

4.6 Model performance

We judge the fit of the model by comparing the predicted and observed behavior shown in Tables 5 and 6 and Figure 1.

Table 5 shows that the model predicts the correct health insurance choice in 64% of the cases. The accuracy of prediction varies across plan types. Closed type plans are underestimated, with the model predicting the correct health insurance choice in just 10.7%.

Figure 1 compares the observed and predicted total annual expenditures. Although the shape of the distribution is similar, the model does poorly at predicting the right long tail observed in the data and the probability of observing an individual with a total annual expenditure of zero. As a consequence the model's predicted total annual expenditure is 23% larger that the observed total annual expenditure 6). However, while the model underestimates the probability of observing zero expenditures, it does a good job predicting a high fraction of individuals with low total annual expenditures (see 1). Both the observed and the predicted total annual expenditure distributions show 70% of the enrollees spending less that $200 annually.

5 Counterfactual Policy Analysis: Banning Risk-Rated Pricing

We now use the estimated structural model to quantify the potential welfare consequences of adverse selection through counterfactual analysis. We compare different market allocations and welfare under two scenarios: a benchmark scenario where firms are allowed to charge risk-rated premiums, and a counterfactual scenario where firms are only able to charge uniform premiums.

5.1 Measuring welfare

For a given set of plan prices, we can use the model estimates to compute individual choice probabilities and expected total annual expenditures conditional on ω_i. As we do not observe ω_i, we integrate over its distribution by taking draws from its estimated distribution for each individual, and then we average across draws. The final element necessary for conducting the counterfactual analysis is a way to measure the changes in consumer and producer welfare. We compute the change in the expected consumer surplus using the formula derived by Rosen & Small (1981); that is, we define the expected change in the money metric utility of individual i as results of a price change from p_k to p'_k as follows:

$$\Delta\mu_i(p_k, p'_k) = \int \{ln(\sum_{k\in\Omega_i} exp(\upsilon_k(\omega_i, p'_k))) - ln(\sum_{k\in\Omega_i} exp(\upsilon_k(\omega_i, p_k)))\}dF_\omega(\omega_i) \tag{5}$$

In the same way, the change in the producer surplus resulting from choices made by individual i is:

$$\Delta\pi_i(p_k, p'_k) = \int \{\sum_{k\in\Omega_i} Pr_k(\omega_i, p'_k)(p'_k - c'_{i,k}) - \sum_{k\in\Omega_i} Pr_k(\omega_i, p_k)(p_k - c_{i,k})\}dF_\omega(\omega_i) \tag{6}$$

The expected change in social welfare is the sum of both changes,

$$\Delta S_i(p_k, p'_k) = \Delta\mu_i(p_k, p'_k) + \Delta\pi_i(p_k, p'_k) \tag{7}$$

In order to obtain a meaningful measure of the change in welfare we divide this change by the total cost of coverage in the same period.

5.2 Supply side of the market

We do not model the supply side of the market. Instead, we use a very simple counterfactual pricing policy. We assume that firms update plan premiums naively to reflect the risk of enrollees in each different plan. Firms set premiums for each plan option as the average plan cost for the previous year's enrollees in that group, ac_k, plus the historical markup for the same plan δ_k, that is:

$$p'_k = ac_k + \delta_k \tag{8}$$

Although this rule is unlikely to result in optimal premium setting for the firms, it is commonly used to adjust premiums in health insurance markets (Einav & Finkelstein, 2011).

Additionally, in the counterfactual scenario we expand the individual's choice set to account for the possibility of opting for public health insurance. The relevant characteristics of the public health insurance options are: first, the public option is of lower quality, with average generosity of 43% compared to 67% in the private sector; second, public health insurance premiums depend only on an individual's taxable income (premiums are not risk-rated), and are not adjusted to reflect the risk of enrollees; third, public health insurance generosity is almost uniform across enrollees and is unrelated to premiums; and finally, choice of providers is allowed, but this search is limited to a relatively small list of providers who have signed an agreement with the system for this purpose.

5.3 Welfare Effects of Banning Risk-Rated Pricing

A central issue in assessing the welfare change of banning risk-rated premiums is whether after controlling by sex and gender, consumers still have private information. Welfare will decrease unambiguously if individuals do not have private information because banning risk-rated premiums creates adverse selection where it previously did not exist. Otherwise, if individuals do have some residual information, as we find in the Chilean case, the welfare change can go in either direction depending on the shape and position of gender-age-specific demand and cost curves relative to the pooled solution. The direction of the change in total welfare is an empirical question. For this reason, we present a counterfactual that bans risk-rated premiums and allows consumers to change plans based on their private risk as well as an additional counterfactual in which we simulate the welfare consequences of banning risk-rate pricing abstracting from the effect of private information.

We are also interested in whether when risk-rated premiums are disallowed, the market for high generosity coverage will unravel completely. Under risk-rated premiums (the benchmark scenario) there is a market for each risk type defined by the regulation. Conditional on plan generosity, enrollees classified as high risk pay higher premiums than low risk individuals. Moving to uniform premiums implies that observably low risk individuals will subsidize observably high risk individuals and therefore the former will face higher premiums than in the benchmark scenario. After observing the new prices, low risk types will seek to purchase an alternative that represents a better trade off between premiums and out-of-pocket expenditures. On the other hand, higher risk types might see an opportunity to increase their plan generosity at a premium equal or lower than the premium they faced in the benchmark scenario. In consequence, we expect to observe that enrollees whose expected risk is lower than the average expected risk for the plan opt out for a lower coverage option which increases the average expected risk for the plan (at least among relatively high generosity plans). If firms set premiums naively to reflect the average cost from the previous period cost, this dynamic could shrink the high coverage plan until it completely disappears.

Before proceeding with the counterfactual simulations, we illustrate how premiums would change as a result of banning risk-rated premiums under some restrictive assumptions. The purpose of this exercise is not to compute the exact change in premiums, but to provide some insight on its direction and help identifying which risk groups (as defined by the risk factor tables) will be most affected by the policy change. For this reason, we compute premiums under the counterfactual scenario as the vector of uniform premiums that delivers the same plan profit as with risk-rated premiums under the assumption that enrollees decide to stay in the same plan. Figure 2 shows that the risk groups that face large increases in premiums are males up to 40 years old and those facing the biggest decreases in premiums are females at their most fertile ages (around 25 years old).

Table 7 shows the results of the counterfactual simulations. It displays the percentage change in the consumer, insurer, and social surplus and also these changes measured as a percentage of the total cost of coverage. The top panel of Table 7 shows that banning risk-rated premiums decreases overall welfare by 8.6% as a percentage of the predicted total cost of coverage due to declines in both consumer and insurer surplus. Consumer surplus accounts for almost 77% of the welfare losses. In addition, we find that the predicted total cost of coverage of the system increases by 12.7%. Removing the possibility that consumers have private risk information magnifies the effect of banning risk-rated premiums (see the bottom panel of Table 7). In this case, welfare decreases by 12.24% as a percentage of the predicted total cost of coverage due to declines in both consumer (9.4%) and insurer (2.8%) surplus. The intuition is that selection on unobservables dampens the negative welfare effects of banning risk-rated premiums.

Recall that banning risk-rated premiums implies that high-risk consumers will face lower premiums and low-risk consumers will face higher premiums, potentially leading to a reallocation of enrollees. Table 8 shows the change in market shares and predicted average cost for each type of plan and across different risk groups when this reallocation process takes place.

Looking at the first row of the top panel we observe that Free Choice Plans lose almost 12 percentage points of market share which are reallocated between the Preferred Provider Plans, Closed Plans, and the Public Option. It is interesting to note that Closed Plans' market share increases by 44% and the Public Option, which has by definition no market share before requiring uniform premiums, captures 3.6% of the market. The next rows of the top panel decompose the sample into four intervals ordered increasingly in risk type, where Rf is defined by Table 1. Moving to uniform premiums induces low and moderate risk individual to switch toward less expensive (lower coverage) options like Closed and the Public Option plans. For example, the Public Option shows a zero-market share for the lowest risk group, $Rf <= 1$, in the benchmark scenario and its market share increases to 8.8% in the counterfactual scenario. High risk enrollees move in the opposite direction.

The reallocation of market shares across plan type might not be as informative as the change in the average cost if, for example, Closed Plans only attract low risk enrollees. The bottom panel of Table 8 shows both that riskier enrollees are more likely to stay in their previous choice (yielding a higher predicted average cost in the counterfactual scenario) and that the lowest risk enrollees prefer the Closed or the Public Option Plans over the Free Choice and Preferred Provider options. For example, note that, on average, enrollees with $Rf <= 1$ that opt to leave the private market show a predicted average cost lower than the enrollees that opt to stay in the private market. The predicted average cost for the Public Option is 94 dollars compare to 608, 500, and 259 dollars for the Free Choice, Preferred Provider, and Closed Plans respectively.

The previous simulations show that in the counterfactual analysis, low risk individuals opt for the Closed or the Public Option plans. These types of plans offer on average a lower generosity and lower baseline premium than their counterparts, and also present barriers discouraging the discretionary use of health care services such as primary care physician and referral systems. Finally, the public option premiums do not depend on the risk of the current or previous period enrollees.

An alternative way to present these results is to show the risk profile of the group of individuals who opt for the same plan versus who opt for a low generosity plan. Figure 3 shows the predicted average cost (benchmark) and the plan choice under uniform prices. This information is displayed for each decile of the population ranked from the highest to the lowest plan generosity (so that ten percent of the population is within each generosity band). With the exception of decile IV, enrollees that switch to a lower generosity plan are of lower predicted average cost than those who decide to stay in the same plan.

Finally, the bottom panel of 7 and Table 9 presents the simulation where we assume there is no private information, i.e. we set the standard deviation of the signal to zero. Banning risk-rated premiums decreases overall welfare by 12.24% and the predicted total cost of coverage increases by 24.23% as a percentage of the predicted total cost of coverage in the benchmark scenario (see the bottom panel of Table 7). Assuming no private information stretches the welfare losses by inducing a clear pattern of selection: individuals who presented high observable risk in the benchmark scenario self-select into high generosity plans while low observable risk self-select into low generosity plans. The top panel of Table 9 shows that in this case low risk individuals switch more frequently to the public sector, with the market share of private insurers declining by almost 17% in this segment, while the market share of private insurers declines by almost 9% when adverse selection is present. The observed pattern of selection affects inversely the predicted average cost of coverage (see the bottom panel of Table 9. In other words, adverse selection dampens the negative effects of banning risk-rated premiums when individuals who present low observable risk select high generosity plans and their realized risks are lower than the chosen plan's average.

6 Conclusion

In this paper, we study the Chilean health insurance market under risk-rated and uniform premiums. We estimate of a model of consumer demand for insurance and health care using administrative data that covers all of Chile's private insurers. The results confirm the existence of adverse selection, even under a mandate and with risk-rated premiums on age and sex. Private information explains almost 29% of the variation in health care expenditures.

We then perform counterfactual exercises in order to study the consequences of a likely policy change: a switch from risk-rated premiums to community-rated premiums. We show that market will begin to unravel in absence of risk-rated premiums. The market share of high generosity plans decreases 10.4% while their average cost increases 16.7%, and the market share of low generosity plans increases 42.5% while their average cost decreases by 12.6%. Healthier people opt for lower coverage plans and the public option. Consumers are worse off under uniform prices, and total surplus declines by 8.5% measured as apercentage of the total cost of coverage. While consumers may perceive uniform prices as more equitable, they are less efficient in this market.

References

Akerlof, George, 1970. "The Market for 'Lemons': Quality Uncertainty and The Market Mechanism." *Quarterly Journal of Economics,* 84: 488-500.

Bajari, Patrick, Han Hong, Ahmed Khwaja, and Christina Marsh. 2011. "Moral Hazard, Adverse Selection and Health Expenditures: A Semiparametric Analysis," Unpublished manuscript.

Brown, Jeffrey, and Amy Finkelstein, 2007. "Why Is the Market for Long Term Care Insurance so Small?" *Journal of Public Economics,* 91(10), 1967-1991,

Bundorf, Kate M., Jonathan Levin, and Neale Mahoney, 2008. "Pricing, Matching and Efficiency in Health Plan Choice," Mimeo, Stanford University, available at http://www.stanford.edu/ jdlevin/research.htm.

Cardon, James H., and Igal Hendel. 2001. "Asymmetric Information in Health Insurance: Evidence from the National Health Expenditure Survey." *RAND Journal of Economics*, 32, 408427.

Cawley, John, and Tomas Philipson. 1999, "An Empirical Examination of Information Barriers to Trade in Insurance." *American Economic Review*, 89, 827846.

Chiappori, Pierre-Andr, and Bernard Salani, 2000. "Testing for Asymmetric Information in Insurance Markets." *Journal of Political Economy* 108, 56-78.

Chiappori, Pierre-Andr, Bruno Jullien, Bernard Salani, and Franois Salani, 2006. "Asymmetric Information in Insurance: General Testable Implications." *Rand Journal of Economics* 37, 783-798.

ohen, Alma. 2005. "Asymmetric Information and Learning in the Automobile Insurance Market." *The Review of Economics and Statistics*, 87, 197207.

Cohen, Alma, and Liran Einav, 2007. "Estimating Risk Preferences from Deductible Choice." *American Economic Review* 97(3), 745-788.

Cohen, Alma, and Peter Siegelman, 2010. "Testing for Adverse Selection in Insurance Markets." *Journal of Risk and Insurance* 77(1), 39-84.

Cutler, D.M., and S.J. Reber. 1998. "Paying for Health Insurance-the Trade-off Between Competition and Adverse Selection." *Quarterly Journal of Economics*, 433-466.

Davidoff, Thomas, and Gerd Welke, 2007. "Selection and Moral Hazard in the Reverse Mortgage Market." Mimeo, University of British Columbia.

De Meza, David, and David C. Webb. 2001. "Advantageous Selection in Insurance Markets." *Rand Journal of Economics* 32(2), 249-262.

Duarte, Fabian. 2012. "'Price elasticity of expenditure across health care services." *Journal of Health Economics*, 31(6): 824-841.

Einav, Liran, and Amy Finkelstein. 2011. "Selection in Insurance Markets: Theory and Empirics in Pictures." *Journal of Economic Perspectives*, 25(1): 11538.

Einav, Liran, Amy Finkelstein, and Jonathan Levin. 2010. "Beyond Testing: Empirical Models of Insurance Markets." *Annual Review of Economics* 2, 311-336.

Einav, Liran, Amy Finkelstein, and Mark R. Cullen, 2010. "Estimating Welfare in Insurance Markets using Variation in Prices." *Quarterly Journal of Economics* 125(3), 877-921.

Fang, Hanming, Michael Keane, and Dan Silverman, 2008. "Sources of Advantageous Selection: Evidence from the Medigap Insurance Market." *Journal of Political Economy* 116, 303-350.

Finkelstein, Amy, and James Poterba, 2002. "Selection Effects in the Market for Individual Annuities: New Evidence from the United Kingdom." *Economic Journal* 112, 28-50

Finkelstein, Amy, and Kathleen McGarry, 2006. "Multiple Dimensions of Private Information: Evidence from The Long-Term Care Insurance Market." *American Economic Review* 96, 938-958.

Fischer, Ronald, Pablo Gonzalez, and Pablo Serra. 2006. "Does Competition in Privatized Social Services Work? The Chilean Experience." *World Development*, 34(4): 647-664.

Friedman, Benjamin M., and Mark Warshawsky, 1990. "The Cost of Annuities: Implications for Saving Behavior and Bequests." *NBER Working Paper* No. 1682.

Geruso, Mike, 2012. "Selection in Employer Health Plans: Homogeneous Prices and Heterogeneous Preferences," Unpublished manuscript.

Handel, Ben, 2011. "Adverse Selection and Switching Costs in Health Insurance Markets: When Nudging Hurts. Unpublished manuscript.

Henriquez Hofter, Ricardo. 2006. "Private Health Insurance and Utilization of Health Services in Chile." *Applied Economics*, 38(4): 423-439.

Hemenway David, 1990. "Propitious selection." *Quarterly Journal of Economics* 105, 1063-1069.

Lustig Josh, 2008. "The Welfare Effects of Adverse Selection in Privatized Medicare" Work. Pap., Boston University.

Mitchell, Olivia. S., James Poterba, Mark Warshawsky, and Jeffrey R. Brown, 1999. "New Evidence on the Money's Worth of Individual Annuities." *American Economic Review* 89, 1299-1318.

Newhouse, Joseph, 2002. *Pricing the Priceless: A Health Care Conundrum.* MIT Press. Cambridge, MA.

Pauly, Mark V. 1968. "The Economics of Moral Hazard: Comment." *American Economic Review*, 58(3): 531-37.

Puelz, Robert, and Arthur Snow. 1994. "Evidence on Adverse Selection: Equilibrium Signaling and Cross-Subsidization in the Insurance Market." *Journal of Political Economy*, 102, 236257.

Rothschild, Michael, and Joseph E. Stiglitz. 1976. "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information." *Quarterly Journal of Economics*, 90(4): 63049.

Sanhueza, R. and J. Ruiz-Tagle. 2002. "Choosing Health Insurance in a Dual Health Care System: The Chilean Case." *Journal of Applied Economics*, V(l), 157-184.

Sapelli, Claudio. 2004. "Risk segmentation and equity in the Chilean mandatory health insurance system." *Social Science & Medicine*, 58(2): 259-265.

Sapelli, C. and A. Torche. 2001. "The Mandatory Health Insurance System in Chile: Explainig the Choice between Public and Private Insurance." *International Journal of Health Care Finance and Economics*, 1(2), 97-110.

7 Tables and Figures

Figure 1: Observed *vs.* Predicted Total Annual Expenditure

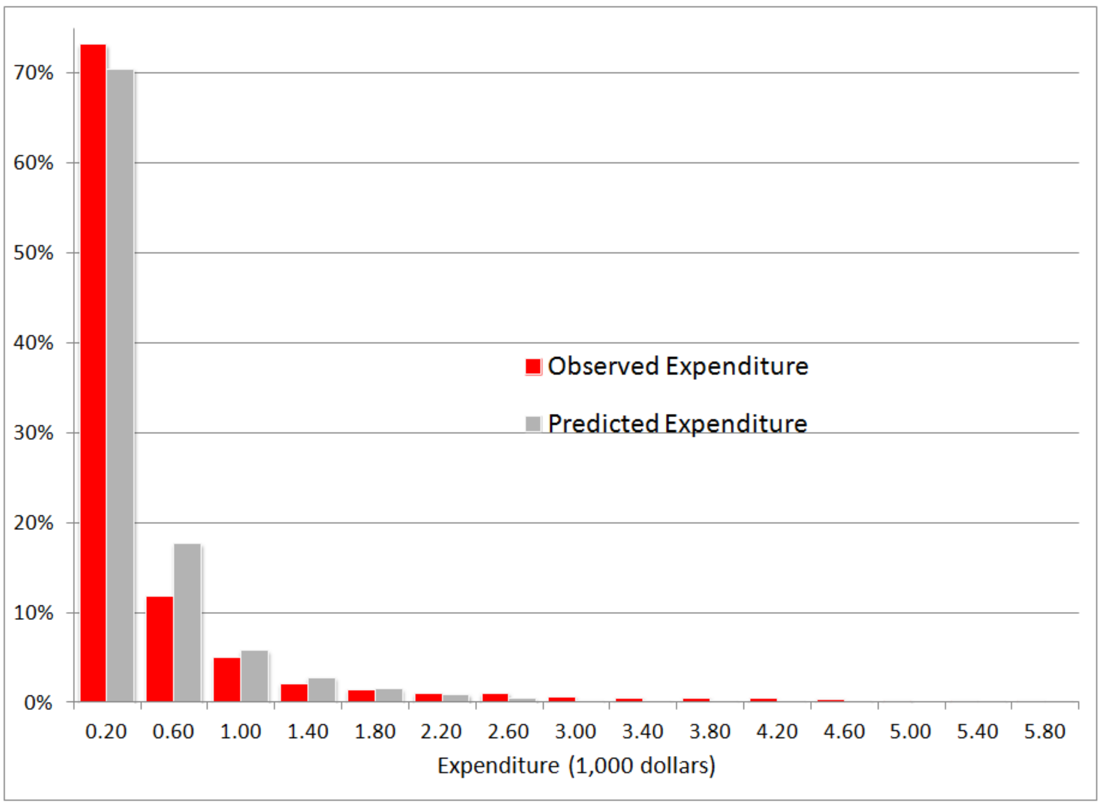


Figure 2: Premium Changes: Moving from Risk-Rated to Uniform Premiums

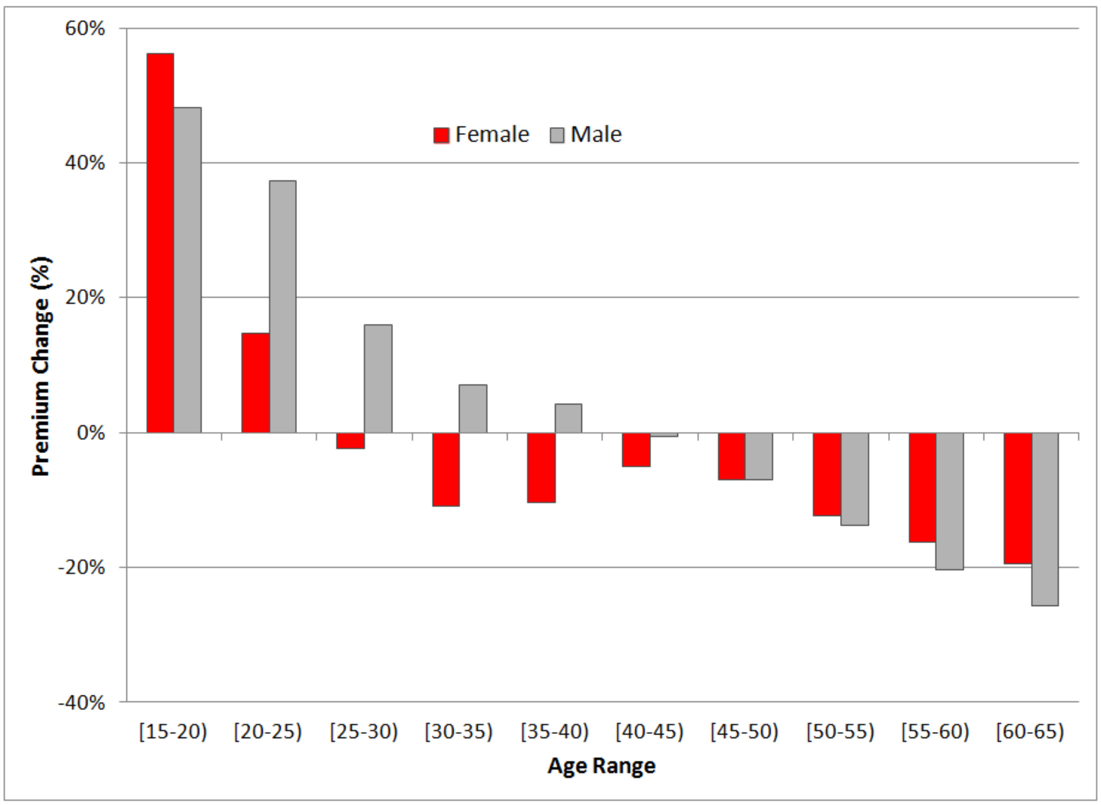


Figure 3: Predicted AC Under the Benchmark Decomposed by Counterfactual Plan Choice

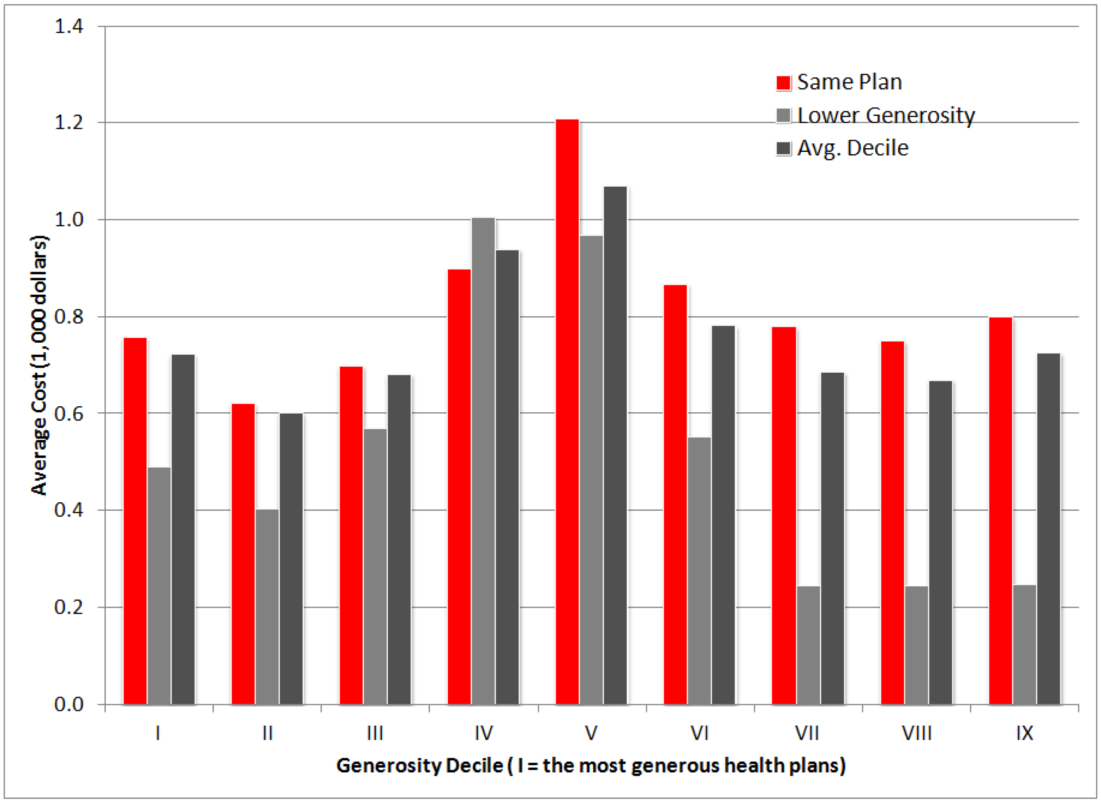
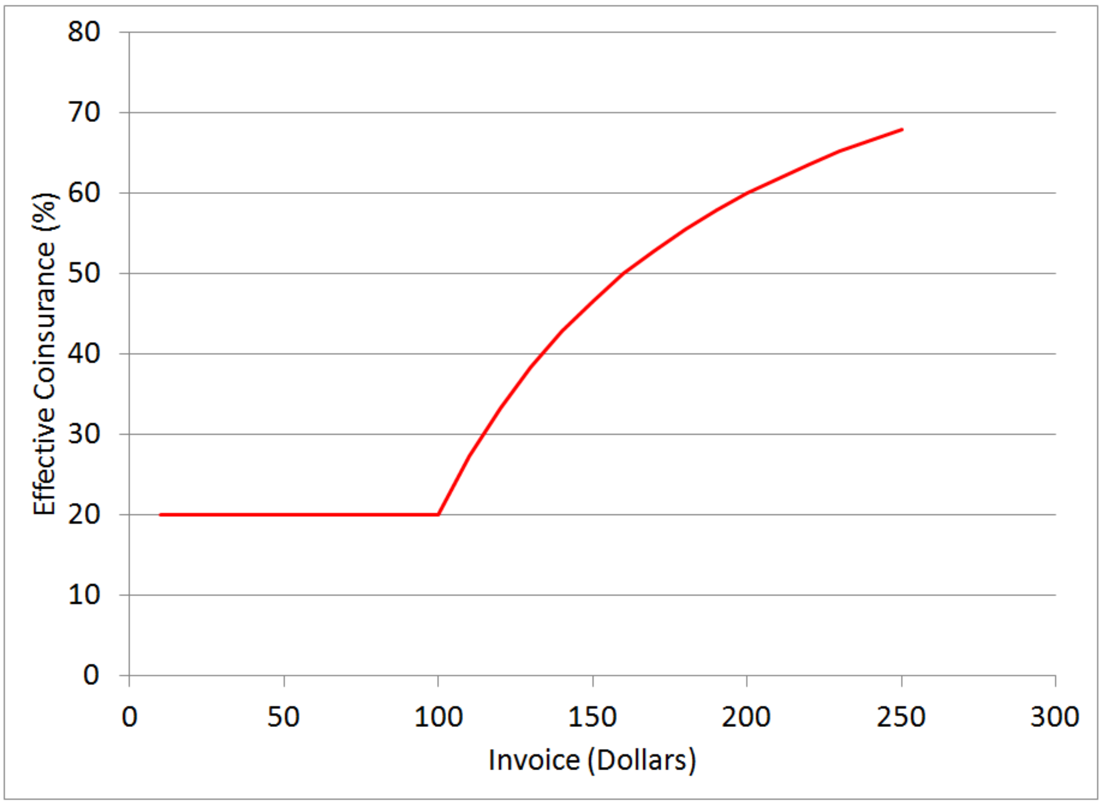


Figure 4: Appendix: Effective Coinsurance for one service (coverage = 80% and cap=$90)



[a]

[a]For example, suppose the enrollee needs to visit a primary care provider. The coinsurance rate is 20%, and the insurer payment cap for the provider is $90. If the provider's price is $50, using the previous formula we can calculate that the out of pocket expenditure will be $10. Therefore the effective coinsurance will be 20%. If instead the price for the visit is $200, she would pay $110 and the effective coinsurance increases to 55%.

Table 1: Risk Factor Table for Policyholder

Age range	*Observed*[a]		*Predicted*[b]	
	Male	Female	Male	Female
[15 – 20)	0.70	1.06	0.25	0.82
[20 – 25)	0.76	1.61	0.49	1.42
[25 – 30)	0.90	2.15	0.93	2.02
[30 – 35)	1.00	2.53	1.00	2.51
[35 – 40)	1.07	2.44	1.11	2.37
[40 – 45)	1.22	2.23	1.23	2.22
[45 – 50)	1.42	2.29	1.30	2.26
[50 – 55)	1.67	2.46	1.58	2.36
[55 – 60)	2.35	2.66	2.22	2.60
[60 – 65)	3.26	3.00	3.12	3.18

(a) Average of risk factor tables across firms. (b) Predicted value of a regression that includes cost as dependent variable and risk group dummy variables as independent variables.

Table 2: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Individual Characteristics				
Income	14,652	8,165	3,456	176,016
Age	35.24	11.29	18	64
Sex	0.60	0.49	0	1
Enrollee	0.50	0.50	0	1
New enrollee	0.27	0.44	0	1
Enrollee switching plan	0.13	0.34	0	1
Enrollee switching firm	0.10	0.30	0	1
Use of health care services				
Total cost	564.36	2,397	0	494,735
Frequency of claims	13.47	29.37	0	8,656
Ever used preventive care	0.11	0.31	0	1
Choice Attributes				
Premium	1,209	708	242	15,914
Legal Premium	1,017	548	242	2,116
Paying more than legal premium	0.47	0.50	0	1
Generosity (at plan prices)	0.67	0.12	0.20	0.98
Genesority greater than the legal premium generosity	0.30	0.46	0	1
Excess of generosity	0.04	0.08	0	0.60
Closed plan (HMO)	0.07	0.25	0	1
Preferred provider plan (PPO)	0.40	0.49	0	1
Free choice plan (Indemnity)	0.53	0.50	0	1
General coverage	0.70	0.46	0	1
Yearly cap	0.89	0.32	0	2
Number of Enrollees	485,214			
Total Number of Plan Being Traded	3,808			

Notes: Table shows selected descriptive statistics from Chilean administrative data sample. Details of sample construction are available in text.

Table 3: Correlation between generosity and risk

Variable	Dependent Variable: Cost			
	1.a	1.b	2.a	2.b
$P > P_{Legal}$	0.0592***	0.220***		
	(0.00805)	(0.00739)		
$G > G_{Legal}$			0.0609***	0.231***
			(0.00841)	(0.00770)
Observations	485,214	485,214	485,214	485,214
R-squared	0.246	0.241	0.246	0.241

Robust standard errors in parentheses. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$.

Notes: Each regression includes the following controls: taxable income, indicator variable for individuals being above the income threshold, and plan fixed-effects. Columns 1.a and 2.a also control for risk group; columns 1.b and 2.b do not.

Table 4: Parameter Estimates

Parameter	Model 1	Model 2
Utility Function		
ϕ_1	1	1
	-	-
ϕ_2	-0.402	-0.702
	(6.08)	(8.522)
ϕ_3	0.600	0.617
	(0.648)	(4.388)
ϕ_4	-0.010	-0.005
	(4.019)	(22.231)
ϕ_5	-2.324	-3.998
	(0.902)	(4.106)
Health State Distribution		
Constant	-2.828	-1.679
	(0.601)	(0.858)
Age		5.214
		(0.586)
Age-squared		-5.435
		(0.684)
Male		-1.403
		(0.549)
Male x Age		2.002
		(0.648)
σ_ω	1.586	0.879
	(0.347)	(0.448)
σ_υ	1.712	1.384
	(0.291)	(0.271)

Standard errors in parentheses. Standard errors are estimated using the variance-covariance matrix of parameter estimates computed using numerical gradient for a 1% increase in each parameter.

Table 5: Model Fit: Demand for Health Insurance

	Type of Plan			Total
	Free Choice	Pref. Provider	Closed	
Predicted Choices	708	1,504	33	2,245
Observed Choices	1,069	2,123	308	3,500
Correct Predictions	66.2%	70.8%	10.7%	64.1%

Table 6: Model Fit: Demand for Health Care

	Mean Exp.	Zeros Dist.
Observed	0.613	25%
Predicted	0.754	0%

Table 7: Welfare Under Uniform Plan Premium & Public Option (%)

Panel A: Allowing for Private Information

	Welfare			
	Consumer Surplus	Insurer Surplus	Social Surplus	Change in Total Cost
ChangeVar/Var	-0.272	-2.062	-0.343	
ChangeVar/TCC	-6.571	-1.987	-8.559	12.669

Panel B: Assuming no Private Information

	Welfare			
	Consumer Surplus	Insurer Surplus	Social Surplus	Change in Total Cost
ChangeVar/Var	-0.228	-1.607	-0.286	
ChangeVar/TCC	-9.409	-2.839	-12.248	24.243

Table 8: Market Shares and AC Under Uniform Plan Premiums & Public Option. Allowing for Private Information

Scenario	Risk factor (Rf)	*Type of Plan* Free Choice	Pref. Prov.	Closed	Public Option
		Market Shares			
Benchmark	*All Rf*	0.425	0.520	0.054	0.001
Change		-0.118	0.058	0.024	0.036
Benchmark	$Rf \in [0,1]$	0.351	0.610	0.039	n.e.
Change		-0.040	-0.038	-0.011	0.088(1)
Benchmark	$Rf \in (1,2)$	0.311	0.629	0.060	0.001
Change		-0.038	-0.010	0.037	0.011
Benchmark	$Rf \in (2,3]$	0.585	0.341	0.072	0.002
Change		-0.257	0.204	0.054	-0.001
Benchmark	$Rf > 3$	0.344	0.624	0.013	0.019
Change		-0.133	0.134	0.006	-0.007
		Average Cost (1,000 of dollars)			
Benchmark	*All Rf*	0.875	0.644	0.695	0.170
Change		0.102	0.191	-0.022	-0.073
Benchmark	$Rf \in [0,1]$	0.488	0.387	0.165	n.e.
Change		0.120	0.113	0.094	0.094(1)
Benchmark	$Rf \in (1,2)$	0.741	0.688	0.663	0.081
Change		0.165	0.112	-0.098	0.022
Benchmark	$Rf \in (2,3]$	1.168	1.031	1.008	0.139
Change		0.233	0.155	-0.196	-0.011
Benchmark	$Rf > 3$	1.185	1.084	0.958	0.271
Change		0.310	0.228	-0.036	0.006

n.e.: no enrollment in the benchmark scenario. (1) Since this particular combination of risk group and plan type does not present enrollment in the benchmark scenario, this value corresponds to the level of the variable in the counterfactual scenario.
Distribution of population across risk intervals: $Rf \in [0,1] = 39.7\%$; $Rf \in (1,2) = 21.4\%$; $Rf \in (2,3] = 35.5\%$; and $Rf > 3 = 3.5\%$.

Table 9: Market Shares and AC Under Uniform Plan Premiums & Public Option. Assuming no Private Information

Scenario	Risk factor (Rf)	*Type of Plan* Free Choice	Pref. Prov	Closed	Public Option
			Market Shares		
Benchmark	*All Rf*	0.411	0.528	0.052	0.009
Change		-0.153	0.030	0.049	0.074
Benchmark	$Rf \in [0,1]$	0.328	0.611	0.061	n.e.
Change		-0.056	-0.096	-0.017	0.168$^{(1)}$
Benchmark	$Rf \in (1,2)$	0.303	0.646	0.045	0.006
Change		-0.055	-0.064	0.074	0.045
Benchmark	$Rf \in (2,3]$	0.579	0.356	0.051	0.013
Change		-0.321	0.215	0.112	-0.006
Benchmark	$Rf > 3$	0.303	0.609	0.008	0.079
Change		-0.155	0.164	0.016	-0.025
			Average Cost (1,000 of dollars)		
Benchmark	*All Rf*	0.550	0.395	0.317	0.176
Change		0.115	0.225	0.046	-0.078
Benchmark	$Rf \in [0,1]$	0.373	0.277	0.123	n.e.
Change		0.122	0.117	0.078	0.092$^{(1)}$
Benchmark	$Rf \in (1,2)$	0.464	0.431	0.357	0.096
Change		0.171	0.120	-0.052	0.009
Benchmark	$Rf \in (2,3]$	0.680	0.535	0.549	0.164
Change		0.180	0.315	-0.113	-0.022
Benchmark	$Rf > 3$	0.735	0.666	0.538	0.235
Change		0.324	0.251	-0.046	-0.009

n.e.: no enrollment in the benchmark scenario. (1) Since this particular combination of risk group and plan type does not present enrollment in the benchmark scenario, this value corresponds to the level of the variable in the counterfactual scenario.

Table 10: Appendix: Fonasa vs. ISAPREs

	FONASA	ISAPREs
Beneficiary	Anyone who pays 7% of taxable income and their legal or medical dependents. Also, indigents.	Anyone who pays 7% of taxable income and their legal or medical dependents.
Premium	7% of taxable income. Premium does not depend on age, sex, number of household or demographic characteristics.	At least 7% of monthly taxable income. Premium depends on the chosen plan. Each plan has a baseline price which is adjusted according to beneficiary's gender and age.
Enrollment process	Automatic for dependent workers. Enrollees are grouped based on taxable income. Group A involves indigents. Group B takes in people whose income is below the legal minimum. Groups C & D include people with salaries greater than the legal minimum.	Contract subscription.
Rejection/Denial	Does not reject potential members. Benefits independent of individual contribution, except for certain copayments that must be paid by those with higher income.	Have right to deny applicants. Can establish waiting periods for preexisting illnesses. Consumers are required to report all pre-existing illnesses.
Providers & Institutional	Group A enrollees must use public health care providers; those in Group B, C, or D may choose private providers (free choice).	Depends on plan type. Free choice: enrollees can use public or private providers. Closed plan: enrollees can only use pre-specified providers. Preferred provider: plan associated with well-known clinics or hospitals.
Coinsurance (%)	None for Groups A and B and people older than 60. Group C, 10% coinsurance. Group D, 20% coinsurance. Coverage rates under free choice (private providers) are much lower.	Two coinsurance rates in each plan, one for ambulatory health care services (outpatient) and one for hospitalization-related health care services (inpatient).
Coinsurance (Cap)	Provides an annual list of caps for all health services provided by the government called Arancel FONASA.	Each ISAPRE has its own list of caps, called 'Aranceles', which are used to calculate the out-of-pocket payment for each service and plan. Required by law to be at least as high as the FONASA caps.
Emergency	Emergency services must be provided by public institutions.	Emergency services must be provided by the plan network.

Fonasa vs. ISAPREs, cont.

	FONASA	ISAPREs
Catastrophic coverage	Provides catastrophic insurance that covers certain illnesses (when diagnosed). In this case, the coverage is 100% (only public providers).	Some firms offer coverage for catastrophic diseases (CAEC). The coverage is 100% above the deductible.
AUGE/GES (Required services)	AUGE/GES does not imply additional payments for enrollees.	Each ISAPRE charges a uniform fee to all its plans for the provision of AUGE/GES.
Additional benefits	Free of charge preventive care examination. Loans to pay for vital emergency services.	Free of charge preventive care examination. Credits to pay for vital emergency services.
Contract modifications	Not applicable	Isapres are allow to unilaterally end the contract in the following cases: (1) enrollee provides false information in the health declaration; (2) non-payment; (3) enrollee becomes unemployed. Additionally, Isapres can unilaterally modify baseline prices of each plan each year up to 1.3 times the average increase in the other plans it offers.