

The financial economics of a health reform: A structural econometrics approach to analyze equity versus efficiency

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Abstract

Following a structural econometrics approach in household finance, I estimate a static heterogeneous agent model of consumption and savings with a binary insurance decision. In this paper I conduct an ex-ante evaluation of the coexistence of a private insurance sector that offers actuarially fair insurance policies (efficiency), and a public insurance plan under a health reform that mandates non-discriminatory prices based on observables (equity). In the model I can generate an endogenous shock to health insurance premiums, in order to analyze different outcomes at micro and macro level: health-risk taking, consumption-saving and welfare. My main result is related to the coexistence of private and public health insurance plans under a reform that has equity as its main objective. Moreover, I find an average positive although mixed welfare effect of the reform. I see these results as an example of a non-discriminating policy that a society would pursue by an average welfare maximization rule that affects negatively low-income households, crowding out its participation in the private health insurance sector.

Key words:

JEL: D14, D15, H51, C54, I13

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1 Introduction

As Merton (1998) defined, financial economics is about “the allocation and deployment of economic resources, both spatially and across time, in an uncertain environment”. While historically the literature has tended to focus in corporate decisions and asset pricing - abstracting from underlying households’ preferences - a third strand of the literature interested in how households use financial instruments to attain their objectives is gaining relevance among the finance profession, Campbell (2006); Tufano (2009). In this respect, household risk-management with respect to health is a central component of households’ financial planning problem.¹ Nevertheless, the nature of health demand makes the risk-management problem particularly complex. First, health is not a commodity that can be traded in the market, only financial health risk is tradable. Second, health is a function of genetic factors that cannot be altered. Third, market imperfections emerge naturally in healthcare markets. All these problems have been extensively analyzed in the health economic literature (Arrow (2004)) and they are usually used to justify government intervention in healthcare markets.^{2 3} Consistent with such market failures a wide variety of institutional designs exist around the world. Some countries rely on a national insurance, mostly funded by taxes, other countries have systems where households bear more of their own healthcare costs. In this paper I focus specifically on semi-private systems where medical expenses are an important variable in households financial planning problem.

The United States is an example of a semi-private system, the private sector contributes 51% of the total per capita expenditure in healthcare compared with an average 27% in the OECD-ex USA at 2016. In the US, since 1942, private health insurance plans

¹Empirically, The Report on the Economic Well-Being of U.S. Households 2016 show that health problems are the most frequently hardship that households face. Theoretically, Cohen et al. (1986); Palumbo (1999); French and Jones (2004, 2011a), argue that health risk as an important ‘background risk’, defined as certain type of risks that cannot be avoided or insured against.

²Classical market failures in the health economics literature are: i) Ex-ante and ex-post moral hazard, caused by health insurance coverage, as insured individuals behave less “responsible”, or “overspend” on healthcare. ii) Adverse selection, where high cost individuals purchase more generous plans; iii) Information asymmetries and uncertainty about effective treatments create complications in the bargaining process.

³As is well known from the welfare economics literature, the degree of market failures’ factor into policy choices Greenwald and Stiglitz (1986).

have been tied to employment. In addition, the public sector covers the low-income and disabled by Medicaid, and the older population through Medicare. In this context, roughly 17% of the population lived uninsured (Kaiser Foundation, 1995-2013).⁴ In this context, in 2010 the Federal Government passed the Patient Protection and Affordable Care Act (ACA) that intended to expand health insurance coverage with the objective to reduce out-of-pocket health expenditure. The reform relaxed restrictions to access the public insurance, increasing the income eligibility thresholds and eliminating the asset-tests that affected the ability to qualify for Medicaid.⁵ However, one of the novelties of this reform was the creation of insurance exchanges (Marketplace) that allow households to buy standardized health plans. In this market, a scheme of subsidies based on income to purchase health plans was established. Importantly, the law required that insurers accept all applicants, cover a specific conditions, and charge flat premiums regardless of pre-existing conditions age or sex. On the other hand, a quasi-universal enrolling mandate (i.e. tax penalties) was imposed to disincentivize households' decisions to be uninsured.^{6,7}

After three years of the Marketplace implementation, the academic community has seen this as a massive experiment of 'managed competition' in health insurance with uniform and risk-independent insurance premiums.⁸ While non-discriminatory premiums have been associated with fairness and equity, it has also been criticized for the inefficiencies that create in terms of adverse selection. The efficiency critics rely on the predictions illustrated by Cutler and Reber (1998). That is, insured pools concentrate more costly individuals over time, premiums increase and potentially the market collapse, the so-called

⁴This number that has been mainly associated with a lack of affordability, defined as the degree of financial access to health services and prioritization according to clinical needs, Schoen et al. (2013).

⁵On the other hand, allowed children to stay in their parents' health plan until age 26, and encouraged employers to provide health coverage.

⁶The Kaiser Foundation calculates that roughly 46% of employers offer health insurance to their employees.

⁷The World Health Organization cites affordability and equity as one of the metrics to evaluate countries' health policies. In addition to: i) Access, defined as the availability of professionals, instrumental and infrastructure throughout the country; ii) Quality, defined by the degree of compliance with clinical standards generally accepted at the time exercised by practicing professionals; iii) Results, determined by the degree of treatment success; iv) ; v) Transparency, determined by the availability of data and publication of performance indicators; vi) Efficiency, determined by the health benefits per resource costs.

⁸Other reforms that have implemented non-discriminatory pricing in insurance markets are the European Court of Justice ruling out gender-specific insurance premiums (2011), and the US Supreme Court ruling that pensions payments in life annuities' markets have to be equal for both sexes, and independent of the different mortality probabilities (1980s).

‘death spiral’. However, as has been shown, Hackmann et al. (2015), tax penalties can increase health insurance coverage reducing the adverse selection problem and consequently premium costs. As is well known in the political economy literature, the competition between equity and market efficiency will be at the center of the political debate in all health reforms, Ferraz (2015). In the advent of a new reform in the US, and taking as given that political economy motivations toward undiscriminating pricing by age or gender are important across societies, this paper aboard a type of health insurance policy that affects households’ trough their budget and risk-taking decisions. Specifically, this paper examines how the mandate of non-discriminatory insurance premiums can affect households’ ability to hedge idiosyncratic health risk, the coexistence of public and private health insurance plans, and the direct (or indirect) effects on households’ saving decisions and welfare.

In order to understand the effect of a policy that regulate premiums in private health insurance markets I follow a structural econometrics approach. Firstly, I propose a static life-cycle model with heterogeneous agents that face a consumption-saving problem, and a binary health insurance choice. This model incorporates exogenous health shocks that are a function of individuals’ observables (age and gender). In addition to the household sector, I include a competitive private insurance sector, and a subsidized public option. Secondly, the model is structurally estimated to match the observed consumption-saving and health insurance decisions. I exploit microdata from Chile, a health system based on ‘managed competition’ that has been working since the 1980s. Which, as has been argued, Vargas Bustamante and Méndez (2016), shares similarities with the U.S. health system under the ACA, and is also considered one of the longest ‘managed competition’ health systems in the world.⁹ Finally, I apply the estimated model to perform an ex-ante evaluation of a health reform that has equity as its main objective, which is implemented through a mandate towards private insurance companies to charge a unique premium regardless of age or gender.

This paper intends to contribute to three strands of the literature. First, the struc-

⁹The debate with respect to equity versus efficiency in healthcare systems is one important aspect of the health economics literature Wolfe and Goddeeris (1991); Culyer and Wagstaff (1993); Boadway et al. (2006).

tural econometrics literature that performs ex-ante evaluation, Heckman and Vytlačil (2007); Todd and Wolpin (2008), as well as, the new efforts to combine the experimental and quasi-experimental research with structural evaluation, Heckman (2010). Second, this study contributes to the literature on household decision making under health risk, Palumbo (1999); French and Jones (2011b), including a binary health insurance choice, in the spirit of Carroll (2006); Iskhakov et al. (2015), and links it with the health insurance pricing regulation, Carlin and Town (2009) Einav et al. (2010) Lustig (2010) Bundorf et al. (2012) Handel et al. (2013) Ericson and Starc (2015) French et al. (2016). Third, the literature with respect to Chilean health system which has focused on income (Sapelli and Torche (2001)) and risk segmentation (Sapelli (2004)), self-selection in the case of independent workers (Sapelli and Vial (2003)), ex-post moral hazard in outpatient health services (Höfner (2006)), and pre-existing conditions lock-in (Atal (2015)).

My main findings can be summarized as follow. I find that if we abstract from information asymmetries or financial constraints, a private health insurance sector can coexist with a public insurance provider under non-discriminatory pricing regulation. Nevertheless, a reform that imposes a unique pooled premium for the private sector can have a significant effect on households' budgets in the short-term (liquid effect) even when they can experience a reduction in their discounted cost of private health insurance (wealth effect). On the other hand, the reform can have effects in households' health risk taking (health coverage) as it can crowd-out the participation of low-income younger households in the private health plan (precautionary saving effect). Finally, I show that the reform can be welfare-enhancing on average, however, the group of households negatively affected by the reform are more concentrated in the low-income population.

The paper proceeds as follows: Section 2 provides background information about the Chilean health system, which informs the empirical scenario used to estimate the model. In Section 3, we review previous studies on: i) counterfactual analysis, ex-ante evaluation, and how the experimental and structural econometric research can be combined to evaluate social programs; ii) the literature on household decision making under health risk and health insurance pricing regulation; iii) the Chilean health system. Section 4 methodology used to ex-ante evaluate the proposed health reform. This section also explains the

structurally-based tests for the different outcomes analyzed. Section 5 describes the constructed dataset, and presents summary statistics. Section 7 presents the results. Section 8 concludes.

2 Institutional Framework

The Chilean health system is mixed, existing public and private players that compete in the provision of healthcare services, as well as, health insurance plans. The current system was created in 1981, establishing that for-profit private institutions (Isapres) will compete for the 7% mandatory contributions that workers paid from their monthly pay checks. The private players operate in a regulated competition framework with risk-adjusted premiums, with no regulation of pre-existing conditions. As prices are independent of the 7% contribution, in some cases individuals pay extra for the plans that they purchase or accumulate 'excedents' that can be used to pay future health related costs. The private insurance companies are regulated by the Health Superintendence. Alternatively, the government offers a public health plan called Fonasa. The public insurance (Fonasa) differentiates beneficiaries based on income.¹⁰

Since the creation of the mixed system in the 80s, two important events are mentioned to understand the evolution and the current state of the system. In 2004 a reform was passed that created a special benefit package called Regime of Explicit Guarantees in Health (GES). This special package currently mandates that 56 catastrophic health conditions have to be included in all private plans and the public insurance plan. This reform imposed a partial universal plan system for specific health treatments. In addition, established specific time limits for diagnosis and treatment, technical requirement standards, and maximum copayments (20% or one month of family's income). More recently, the debate with respect to gender/age pricing has been at the center of the health policy de-

¹⁰There are four income groups: (A) Mainly composed by workers with no income, or living in extreme poverty measured by the extreme poverty line, currently fixed in US\$ 1,888 equivalent person annually; (B) Workers with income below \$4,927 annually; (C) Workers making between \$4,927-7,193 annually; (D) Workers with income higher than \$7,193 annually. The A group will face no premiums or copayments. Nevertheless, they have access to the public hospital network only. All the other groups have to contribute a 7% of their income, paying copayments equal to 0% (B), 10% (C) and 20% (D) in public hospitals or 50% in private providers.

bate since 2010, when the Constitutional Court questioned the utilization of pricing tables based on age and gender. While the law allows premiums to be linked to 'reasonable' adjustments related to the cost of offering an insurance policy, the legal uncertainty with respect to a 'justified cost adjustment' has been associated with an increasing number of lawsuits against health insurance companies (Isapres). For example, the courts analyzed 185,310 cases in 2016, a number that would be equivalent to roughly a 10% of the households enrolled in the private system. Consequently, several regulations have been proposed. In 2011 a proposal to reform the system was submitted to the Congress, consisting in a minimum regulated plan that included a set of catastrophic and non-catastrophic treatment that would be funded by individuals using its 7% contribution. At the same time that prices will be adjusted by a special health price index that would track the costs that Isapres face. However, this proposal wasn't approved by Congress.

3 Related Literature

There are three strands of literature that are related to our study. The methodological papers that discuss counterfactual analysis of public policies, the literature on decision under uncertainty with health insurance, and the papers that analyze the case of the Chilean health system.

This is a paper that follows the tradition of counterfactual analysis literature in economics. The counterfactual concept refers to a state of nature that is not observed but it could happen (or have happened) if other events occur (had occurred). This concept is used for the first time in Goodman (1947), which through philosophical analysis addresses causality, however it was not until Fogel (1966), who analyzed the long-term economic growth in the US if the train had not appeared, when it became popular among economists. As is well known, much of the problem of public policy analysis can be reduced to the proper estimation of what would happen if some political intervention takes place. However, the difficulty of this is its high sensitivity to the choice of empirical evidence available, as well as, the methodology used to estimate the theoretical scenario. In ex-ante evaluation, biases can imply erroneous conclusions about the examined policy.

In this regard, Heckman and Vytlacil (2007); Heckman (2010); Todd and Wolpin (2008) compares two methods for policy analysis, structural analysis and reduced form impact assessment. The methodology for impact assessment, also known as reduced form program evaluation, is mainly based on experimentation and statistics. It was popularized by Rubin (1974) and Holland et al. (1985). Rubin and Holland advocated for the idea of causal measurement as an experiment that would allow to identify causal effects. Currently, experimental or quasi-experimental designs dominate the empirical research, the so-called “credibility revolution”, however authors such as Deaton (2009); Heckman and Urzua (2010) criticize the ability to extrapolate these results to reality.¹¹ Interestingly, a new area of empirical research is trying to combine experimental designs and the structural approach. Notable examples are Nevo and Whinston (2010); Keane (2010, 2011). This paper intends to contribute to this literature.

This paper is also related to the traditional microeconomic literature on health insurance demand. A first branch of this literature is mainly related to the role of precautionary savings and debt as substitutes of health insurance Kotlikoff (1986); Levin (1995); Gollier (2003). These models have a clear prediction, *ceteris paribus*, an individual with a higher health insurance coverage maintains a lower buffer stock of wealth, as she faces lower uncertainty with respect to out-of-pocket health expenditure. On the other hand, our model is also related with the adverse selection literature, started by the classical informational asymmetry problem described by Akerlof (1970) and extended by Rothschild and Stiglitz (1976). These papers analyze the market equilibrium of a competitive insurance sector in presence of adverse selection. Empirical evidence from Cutler and Reber (1998), show that adverse selection in health insurance markets can lead to “death spirals”. That is, an insured pool concentrates risk over time, premiums increase, and consequently less costly individuals drop-out of the health insurance market. More recently, structural models with adverse selection have been used to analyze the market equilibrium in the Marketplace, implemented by the ACA, such as Ericson and Starc (2015) and Handel et al. (2013). Ericson and Starc (2015) have a model of imperfect competition that shows that

¹¹These critics motivated Imbens (2010) to defend the importance and benefits of the experimental and quasi-experimental approach in economics.

stricter pricing regulations transfer resources from low-cost individuals to riskier consumers, reduce industry profits, and increase overall consumer surplus. Handel et al. (2013) estimate a structural model with adverse selection to conduct welfare analysis. A third branch are the life cycle models that analyze household decisions. For example, Cochrane (1995) proposes a model to analyze the welfare gains of long-term health insurance. Zabinski et al. (1999); Cardon and Showalter (2007) have microfounded models to analyze the introduction of health saving accounts. Pelgrin and St-Amour (2016) use a structural model to analyze the effect of exogenous changes in health insurance coverage in the dynamic allocation of consumption, leisure and health expenditure. Hugonnier et al. (2012) estimates a dynamic model to analyze the joint determination of consumption, portfolio holdings, health investment, and health insurance.

Finally, this paper is related to the economic literature that analyze the Chilean health system, a regulated competition system with an individual mandate for universal health-care that started in 1980s. In one of the first papers that analyzed the decision between the private and public insurance in Chile, Sapelli and Torche (2001), the authors find that earnings are a key factor in the private versus public insurance choice. In addition, they show that worse health individuals tend to be enrolled in the public sector, suggesting an adverse selection against the public health insurance system that would be caused by the lack of risk adjustment in health insurance's premium. Sapelli and Vial (2003) document evidence of self-selection against private insurance companies in the case of independent workers, and against the public insurance for dependent workers. In addition, they suggest that moral hazard is negligible in the case of hospitalization but quantitatively important for medical visits. Similarly, Höfter (2006) also finds evidence of ex-post moral hazard in outpatient health services. Sapelli (2004) analyzes the risk segmentation between the public and private health insurance sector. More recently, Atal (2015) analyzes the welfare benefits of offering long-term health insurance that hedge households risk against health status changes. Applying a structural model the author shows a positive welfare effect of solving the problem of a lock-in due to pre-existence conditions. A problem that has been described by Pardo and Schott (2013).

4 Methodology

4.1 Model

In this section, I outline a life cycle model of consumption and savings with a health insurance decision that is able to explain the main mechanisms behind health insurance choices in the Chilean health system. I propose a four period model, young, middle-age, old, and retirement, such that households decide consumption and health insurance maximizing their expected lifetime expected recursive utility Kreps and Porteus (1978); Epstein and Zin (1991). The model has three features that capture the trade-off that households face when they decide between the private and the public health insurance. First, the model has a discrete nature in the health insurance decision, combined with a continuous decision on consumption. Second, health risk is composed by a Bernoulli process, with probability of being sick depending on age and gender, and with an ex-ante known negative shock that depends on the same demographics. Third, the public sector insurance (Fonasa) charges a premium that is equal to a 7% of income, while the private sector (Isapre) charges a premium that is actuarially fair, calculated on actual households' health risk. As a simplifying assumptions we have, deterministic income and mortality. Within this set-up, the individual maximization problem subject to its intertemporal budget constraint can be written as:

$$\begin{aligned} \max_{C_{t_0} \geq 0; \theta_{t_0} = \{I, F\}} \quad & U(C_{t_0}) + \sum_{j=t_0+1}^T \beta^{(j-t_0)} E[U(C_j) - \gamma U(C_{j-1})] \\ \text{s.t.} \quad & W_{t+1} = (W_t - C_t - \Delta_{\theta,t} + y_t)(1 + r) - \varepsilon_{\theta,t+1} + y_{t+1}, W_{t_0} \end{aligned} \quad (1)$$

where C_t is individual's consumption at time t , β_i represent the subjective discount factor, γ is an internal habit formation parameter, W_t is individual's net-worth at time t , r is the market interest rate, Δ_{θ} is the premium cost of health insurance that individual faces at time t if she chooses the insurance θ , $\varepsilon_{\theta,t+1}$ is the negative shock that the individual will face at time $t + 1$ if he is sick, event that occurs with probability p_t .

We assume insurance premiums are determined in each case as actuarially fair in the case of the private plan (Isapre I), or fixed at χ percent of current income in the case of the public plan (Fonasa F):

$$\Delta_{\theta,t} = \begin{cases} p_t \vartheta_I \varepsilon_{t+1} & \text{if } \theta_t = I \\ \chi y_t & \text{if } \theta_t = F \end{cases} \quad (2)$$

Health insurances plans will provide partial coverage (ϑ) against the health shock (ε). Conditionally on facing the health shock, individuals will pay a fraction of it.

$$\varepsilon_{\theta,t+1} = \begin{cases} (1 - \vartheta_I) \varepsilon_{t+1} & \text{if } \theta_t = I \\ (1 - \vartheta_F) \varepsilon_{t+1} & \text{if } \theta_t = F \end{cases} \quad (3)$$

where $\vartheta_I > \vartheta_F$, in other words, the private insurance offers a higher coverage.

Given that pre-existing conditions are not regulated, households that decide to stay in the public plan at time t are constrained to choose the private plan at time $t + 1$ if they faced a health shock.

We assume that individuals have standard log-utility preferences over its consumption:

$$U(C_t) = \log(C_t)$$

This assumption implies standard properties of a von Neumann-Morgenstern utility function.¹²

As is well, known we can rewrite the stochastic dynamic optimization (1) as follows:

$$v(W_t, \Delta_{\theta,t}, \varepsilon_{\theta,t+1}) = \max_{C_t \geq 0; \theta_t = \{I, F\}} U(C_t) + \sum_{j=t+1}^T \beta^{(j-t_0)} E [U(C_j) - \gamma U(C_{j-1})] \quad (4)$$

$$\Rightarrow v(W_t, \Delta_{\theta,t}, \varepsilon_{\theta,t+1}) = \max_{C_t \geq 0; \theta_t = \{I, F\}} U(C_t) + \beta E [[v(W_{t+1}, \Delta_{\theta,t+1}, \varepsilon_{\theta,t+2})]$$

$$s.t. \quad W_{t+1} = (W_t - C_t - \Delta_{\theta,t} + y_t)(1 + r) - \varepsilon_{\theta,t+1} + y_{t+1}$$

The above problem can be solved recursively starting from $T - 1$:

¹²In Appendix XX the analysis of the implications of log Epstein-Zin preferences for health insurance choices is presented.

$$\{C_{T-1}^*, \theta_{T-1}^*\} = \max_{C_{T-1} \geq 0; \theta_{T-1} = \{I, F\}} \log(C_{T-1}) + \beta E [\log(C_T) - \gamma \log(C_{T-1})] \quad (5)$$

$$s.t. \quad W_T = C_T$$

$$W_T = (W_{T-1} - C_{T-1} - \Delta_{\theta, T-1} + y_{T-1})(1 + r) - \varepsilon_{\theta, T} + y_T$$

At time $T - 2$:

$$\{C_{T-2}^*, \theta_{T-2}^*\} = \max_{C_{T-2} \geq 0; \theta_{T-2} = \{I, F\}} \log(C_{T-2}) + \beta E [\log(C_{T-1}^*(W_{T-1})) - \gamma \log(C_{T-2})] \quad (6)$$

$$s.t. \quad W_T = (W_{T-2} - C_{T-2} - \Delta_{\theta, t} + y_t)(1 + r) - \varepsilon_{\theta, t+1} + y_{t+1}$$

We iterate the same procedure until the initial time period.

Having calculated the optimal state-contingent consumption plan for both types of insurance options, it is possible to compare the value function in the case of private insurance $v(W_t, \Delta_{I,t}, \varepsilon_{I,t+1})$ and public insurance $v(W_t, \Delta_{F,t}, \varepsilon_{F,t+1})$. Therefore, households decide insurance at time t maximizing their lifetime expected utility.

4.2 Estimation

The estimation of structural parameters for the proposed life cycle model is performed using an exactly identified generalized method of moments. The model is estimated to match two moments, the observed average consumption and market share of the private insurance sector by educational group j , defined as:

$$M_{1,j} = \frac{\sum f_1(C_{i,j}, C_i^*(W_i, \Delta_{i,\theta}, \varepsilon_{i,\theta}, \gamma_j, \beta_j))}{N_j} = \frac{\sum (C_{i,j} - C_i^*(W_i, \Delta_{i,\theta}, \varepsilon_{i,\theta}, \gamma_j, \beta_j))}{N_j} \quad (7)$$

$$M_{2,j} = M_{1,j} = \frac{\sum f_2(\theta_{i,j,I}, \theta_{i,I}^*(W_i, \Delta_{i,\theta}, \varepsilon_{i,\theta}, \gamma_j, \beta_j))}{N_j} = \frac{\sum (\theta_{i,I}^*(W_i, \Delta_{i,\theta}, \varepsilon_{i,\theta}, \gamma_j, \beta_j) - \theta_{i,j,I})}{N_j} \quad (8)$$

where $C_{i,j}$ and $\theta_{i,j,I}$ are the observed consumption and private health insurance decision of the household i in the educational group j ; C_i^* and $\theta_{i,I}^*$ are the predicted consumption and the private health insurance decision of the household i given the structural (γ_j, β_j) and calibrated parameters $(W_i, \Delta_i, \varepsilon_{i,\theta})$.

The estimation follows the standard two-step approach of Hansen (1982). In the first-step we start from the identity matrix, and we specify a two dimensional grid search for the structural parameters (γ_0, β_0) , in order to find the pair of parameters that minimize:

$$\min_{(\gamma_0, \beta_0)} \left\{ \begin{bmatrix} M_{1,j} & M_{2,j} \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} M_{1,j} \\ M_{2,j} \end{bmatrix} \right\} \quad (9)$$

Given the first estimation of (γ_0, β_0) we can estimate the asymptotic covariance of the sample moments normalized by the root of the sample size as:

$$\hat{F}_j = \frac{1}{N_j} \sum \begin{bmatrix} f_1(C_{i,j}, C_i^*(W_i, \Delta_{i,\theta}, \varepsilon_{i,\theta}, \gamma_j, \beta_j)) \\ f_2(\theta_{i,j,I}, \theta_{i,I}^*(W_i, \Delta_{i,\theta}, \varepsilon_{i,\theta}, \gamma_j, \beta_j)) \end{bmatrix} \begin{bmatrix} f_1(C_{i,j}, C_i^*(W_i, \Delta_{i,\theta}, \varepsilon_{i,\theta}, \gamma_j, \beta_j)) \\ f_2(\theta_{i,j,I}, \theta_{i,I}^*(W_i, \Delta_{i,\theta}, \varepsilon_{i,\theta}, \gamma_j, \beta_j)) \end{bmatrix}^T \quad (10)$$

Therefore, we can calculate the optimal weighting matrix, $\omega = \hat{F}_j^{-1}$, that allows us to get the most information out of our moments conditions, and estimate (γ, β) efficiently in the second-step.

$$\min_{(\gamma, \beta)} \left\{ \begin{bmatrix} M_{1,j} & M_{2,j} \end{bmatrix} \omega \begin{bmatrix} M_{1,j} \\ M_{2,j} \end{bmatrix} \right\} \quad (11)$$

In order to estimate the standard error of the estimated structural parameters we calculate the value of the Jacobian ($G(\gamma, \beta)$) of the sample function moments (f) evaluated at the parameters (γ, β) , such that:

$$G(\gamma, \beta) = \begin{bmatrix} \frac{\partial f_1(C_{i,j}, C_i^*(W_i, \Delta_{i,\theta}, \varepsilon_{i,\theta}, \gamma_j, \beta_j))}{\partial \gamma_j} & \frac{\partial f_1(C_{i,j}, C_i^*(W_i, \Delta_{i,\theta}, \varepsilon_{i,\theta}, \gamma_j, \beta_j))}{\partial \beta_j} \\ \frac{\partial f_2(\theta_{i,j,I}, \theta_{i,I}^*(W_i, \Delta_{i,\theta}, \varepsilon_{i,\theta}, \gamma_j, \beta_j))}{\partial \gamma_j} & \frac{\partial f_2(\theta_{i,j,I}, \theta_{i,I}^*(W_i, \Delta_{i,\theta}, \varepsilon_{i,\theta}, \gamma_j, \beta_j))}{\partial \beta_j} \end{bmatrix} \quad (12)$$

Finally, we can compute the estimated variance of (γ, β) as:

$$\hat{V}(\gamma, \beta) = \frac{1}{N_j} \left[G(\gamma, \beta) \omega G(\gamma, \beta)^T \right]^{-1} \quad (13)$$

4.3 Counterfactual Scenario

The model is applied, conducting an ex-ante evaluation of a reform in the private health insurance market which is based on the imposition of flat premiums instead of actuarially fair premiums. Under this reform, premiums in the private sector for each individual j are calculated as the average actuarially fair price of the observed pool of individuals (J_t) that were enrolled in the private sector.

$$\Delta_{j,I,t}^* = \sum_j p_{j,t-1} \vartheta \varepsilon_{j,t} / J_{t-1} \quad (14)$$

As a consequence of the reform, the premium that an individual j face in the private sector changes to $\Delta_{j,I,t}^*$ at time t , instead of $\Delta_{j,I,t}$. This imply that individuals with a higher (lower) health risk will see a reduction (increase) in their premiums. Therefore, as individuals make their health insurance choice in this new scenario, the pool changes, and consequently the premiums are updated. Finally, iterating we can calculate the counterfactual equilibrium decisions under this alternative policy design.

4.4 Counterfactual Analysis

Under this counterfactual equilibrium three outcomes are analyzed in the following way:

a) Market share of the private health plan: Under the counterfactual scenario household health insurance decisions can be compared by individual, observing their decisions before (θ_t) and after the reform (θ_t). Therefore, market share measures by socio-demographic groups can be calculated, as well as, statistics with respect to the proportion of individuals that stay or switch from the private to the public plan or vice versa.

b) Current budget effect: The effect on current households' expenditure in health insurance depends on the premiums that households face, and consequently their health insurance decisions before and after the reform. The effect can be calculated at individ-

ual level, i , comparing their pre-reform current health insurance expenditure ($\Delta_{i,\theta,t}$) and their post-reform health insurance expenditure ($\Delta_{i,\theta,t}^*$). Therefore, the analysis can be conducted by socio-demographic groups or by changes in health insurance decisions.

c) Current consumption effect: The effect on current consumption-saving decisions depends on a wealth effect (lifetime expected cost of enrolling in the private health plan) and a precautionary saving (health insurance coverage). The estimation is calculated at individual level, i , using a linear regression of changes in current consumption, under the pre and post-reform, on the change in their individual lifetime expected cost of enrolling in the private health plan and their endogenous change in health insurance coverage, as follows:

$$C_{i,t_0}^*/C_{i,t_0} - 1 = \alpha + \beta_1 (PV(\Delta_{i,I,t_0}^*)/PV(\Delta_{i,I,t_0}) - 1) + \beta_2 (\vartheta_{i,\theta,t_0}^* - \vartheta_{i,\theta,t_0}) \quad (15)$$

where:

$$PV(\Delta_{i,I,t_0}^*)/PV(\Delta_{i,I,t_0}) = \left(\sum_{t=t_0+1}^{T-1} \beta_i^{(t-t_0)} \Delta_{i,I,t}^* \right) / \left(\sum_{t=t_0+1}^{T-1} \beta_i^{(t-t_0)} p_{i,t} \vartheta_{I\varepsilon_{i,t+1}} \right)$$

d) Welfare analysis: We calculate the effect of the reform by individual, i , based on certainty equivalents. The certainty equivalents are computed at individual level as the constant consumption stream that equals the optimal discounted utility pre (v^*) and post-reform (v), solving the fixed point problem:

$$v^*(W_{t_0}, \Delta_{\theta,t_0}^*, \varepsilon_{\theta,t_0+1}) = \sum_{j=t_0}^T \beta^{(j-t_0)} U(CEQ_i^*)$$

$$v(W_{t_0}, \Delta_{\theta,t_0}, \varepsilon_{\theta,t_0+1}) = \sum_{j=t_0}^T \beta^{(j-t_0)} U(CEQ_i)$$

Finally, the effect at individual level is calculated as the change in certainty equivalents before and after the reform.

5 Data

Our study exploit different data sources. We take as our main dataset the VII Household Budget Survey, this database includes information about different income sources and spending in products and services by households in Chile during November 2011 and October 2012. This cross-sectional sample has 35,669 observations, and is representative at national level. In this dataset, each observation represents an individual that can be

linked to an specific household. In addition to income and consumption households' information, this database includes variables related to educational attainment, age, gender, household size, and health system decisions (Isapre or Fonasa). We restrict our analysis to head of households in their pre-retirement stage of life, aged between 25 and 65 for men (60 for women). We classify individuals in three age groups, young (25-34), mid-age (35-44) and pre-legal retirement age (male 45-65/ female 45-60). This restrictions reduce the number of observations to a set of 5,567 households. For the estimation of the structural parameters we focus in three groups, classified by educational attainment, a high-education group composed by individuals with college or higher education, a mid-education group that has technical education, and a low-education group that has elementary or high school education. In Table 2 we document descriptive statistics for the most relevant variables that will be used in our model for each of the indentified groups.

In addition to the observed decisions that we fit to the model, we calibrate other parameters using information from different sources. Firstly, as future income expectations are unobservable, we calibrate a deterministic growth factor to the observed per capita income from the Survey on Employment in Greater Santiago carried out by the University of Chile (1998-2016), methodology documented in Apendix 11.1. As we can see in Table 2, the imputed income expectations for youg individuals with high education will be a 27% on average for the most inmediate future ($t+1$), a 45% increase for their pre-retirement age ($t+2$), and only 5% higher than their current income during retirement ($t+3$).¹³

The estimated negative health income shocks are also imputed from a different data source, the master files provided by the Health Superintendency, that contain the total expenditure by all beneficiaries in the private health insurance sector during the 2009-2010 period. The health shock imputed to our main dataset is equal to the median health expenditure by age and gender documented in Figure 3.

The coverage that offers the private plan is calibrated from the copayment and total expenditure per treatment that is observed in the master files provided by the Health Superintendency. The average copayment rate that beneficiaries face is 32.5% of the to-

¹³Imputed income growth expectations are estimated from pooled cross sections of the Survey on Employment in Greater Santiago carried out by the University of Chile for the period 1998-2016. The estimation is described in the Appendix.

tal amount charged by hospitals, implying a coverage of 67.5% of the health shock. On the contrary, for the public insurance we take the 50% copayment that provides Fonasa for their Free Choice Modality, that allows beneficiaries to pay for treatments in private hospitals.

The health shock probabilities are calibrated from the Chile National Socioeconomic Characterization Survey 2015. The estimated probabilities are obtained as the fraction of individuals that answer positively the question phrased as follows: “Did you have any health problem or accident during the last three months?”. The smoothed future probabilities that are imputed in this case are also calculated by age and gender, and they are documented in Figure 4. Combining the information of health shocks of Figure 3 and probabilities in Figure 4, we document the actuarially fair premiums in the first panel of Figure 5, that will be the prices that households face in the current scenario. Alternatively, in the second panel, we show the pooled premiums that will be consistent with an equally-weighted premium by men, women or both.

Finally, for each individual in our dataset we calibrate the initial level of savings based on the average liquid savings to income calculated by gender, educational and age group, obtained from the Survey of Household Finances 2014.

In summary, the main stylized facts that can be observed in our data, and consequently that we will be interested to fit with our model are the positive correlation between health risk and income with the decision to enroll in a insurance plan from Isapre, as well as, the relatively stable consumption to income ratio across educational levels and age groups.

6 Comparative Statics

In this section I present the results of a numerical analysis to compute different aggregated comparative statics of consumption and private insurance participation by calibrated educational groups. This section documents how the model behave when the structural parameters (γ_j, β_j) change. In Figures 6 we document how average consumption to income changes as the internal habit formation parameter changes for different levels of

impatience. As we can see, consumption is negatively related to habit formation and patience.

In Figures 7 similar comparative statics for the fraction of households that decide to enroll in the private insurance option are documented. In the model, less patient individuals are more willing to purchase private health insurance. While the effect of habit formation is increasing the propensity to enroll in the private insurance option. As can be seen, for the relevant range of structural parameters, the capacity of the model to explain health insurance participation is more restrictive than for the consumption case. As we can see, the nature of premiums based on income of the public option explains the positive correlation between education and private insurance participation.

An interesting feature of the model is that each structural parameter help us to identify current aspects of the current observed equilibrium. While the internal habit formation parameter is more important identifying the health insurance decisions, the subjective discount factor is more relevant identifying the average level of consumption in the educational group.

7 Results

7.1 Parameter Estimation

The estimated internal habit formation parameter, and the subjective discount factor are obtained from a grid search of $\beta = [0.6 - 1]$ and $\gamma = [0 - 1]$ with 14x14 evenly spaced points. In Table 4 we document our estimates for the risk aversion and the subjective discount factor for the different educational groups. This estimation procedure suggests similar levels of patience for households with different levels of education. While the internal habit formation is increasing with the educational level of individuals.

The estimation procedure can be evaluate from its capacity to fit the observed decisions with respect to health insurance and consumption-savings. In Table 5 the fitted consumption and private insurance market share are reported for each educational group, as we can see, for the low education group the model is able to match consumption decision

but underestimates the fraction of the population enrolled in the private insurance plan by 7 percentage points. In the case of households with technical education, the model overestimate the consumption share by 2 percentage points, and underestimate the fraction of households enrolled in the private insurance by 15 percentage points. In the most educated group, the model can match perfectly the consumption share but it also underestimate the fraction of households enrolled in the private health insurance plan by 12 percentage points. As we can see, the estimated model can succesfully explain the observed pattern of consumption of households with different levels of education, at the same time that fits an increasing participation of the private health insurance plan by educational level. However it tends to underestimate the the fraction within each educational group.

7.2 Counterfactual Analysis

Given the estimated parameters for each group, in this section the equilibrium under the counterfactual scenario of a health reform that has equity as its main objective is calculated. Specifically, we start calculating individual optimal decisions in the counterfactual scenario, where the health insurance premium in the private sector depends on the average risk of the private insurance's pool. Therefore, under the regulated enviroment, the pooled premium is equal to the average premium of the existing pool (pre-reform). As households face a different premium in the private sector, they change their consumption and insurance decisions. As the private insurance pool change, the pooled premium is updated. The model is iterated until the market share of the private sector reach convergence. In Figure 8 we can see how the market share, and the pooled premium change by iteration. The model predicts that the reform leads to an increase in the participation of private health insurance providers (Isapres) of roughly 9-10 percentage points. In Figure 9, a decomposition of the change in Isapres' market share by educational group, gender and age category, is documented. Notably, the market share of the less educated young and mid aged households headed by males decrease by 4.8 and 2 percentage points respectively. All other socioeconomic groups experience an increase in their participation in the private health insurance plan. Being the households headed by females the ones

that experience an increase in their participation in the private sector the most.

In order to study the effect of the reform on households' current budgets, in Figure 8 the equilibrium of the pooled premium is presented. The convergence occurs at US\$ 890 (11% of the average income per capita) which compares higher than the average actuarially fair premium of households currently enrolled in Isapres. Given the estimated insurance decisions in the counterfactual scenario, I estimate the effect on households' budgets that are directly affected by the reform. The results presented in Figure 10 shows the effect of the reform in current households' budgets by age, gender and educational group. On average, households spend 9.6% more in health insurance premiums. The groups that face a higher increase in their current health insurance expenditure are young and mid aged men college educated households, 50.6% and 31% respectively. On the other hand, women's households with technical education, and older households, face an increase of 0.2%, 0.3% (male) and 1.7% (female) respectively. In Figure 11 these results are analyzed from the counterfactual health insurance decision dimension. As we can see, the results show that households that switch from the public to the private plan are willing to spend 50% more on average in premiums. Households that stay in the private sector face an increase in the health insurance premium expenditure of 20% on average. On the contrary, households that switched from Isapre to Fonasa reduce their expenditure in health insurance premiums by 24%.

A third effect of the reform which is analyzed is households' consumption-saving decisions. In Figure 12 the consumption effect is measured by age, gender and educational group. The results show young and least educated households decrease their current consumption by 1.4% (male) and female (2.6%). On the contrary, young and most educated households increase their consumption by 3.3% (male) and 3.8% (female). The consumption effect is explained by a wealth and precautionary effect. We measure the wealth effect as the change in the expected discounted lifetime cost of being enrolled in the private health plan that each household face before and after the reform. On the other hand, the precautionary effect is measured by the change in health insurance coverage. In Table 6, the decomposed effect of consumption is presented. The results show that a 10% increase in the expected discounted cost of having private health insurance that a

household face reduces current consumption by 0.35%. While a 1 percentage point reduction in health insurance coverage reduces current consumption by 0.12%. As we can see, the model suggest an increase in precautionary savings of households that switch from Isapre to Fonasa. This is in line with a substitution effect between insurance and savings. In other words, households that are not willing to pay for insurance that offers higher coverage at the pooled price increase their saving to compensate higher expected out-of-pocket health expenditure.

Finally, in Figure 14 welfare gains/losses are calculated from changes in certainty equivalents by individuals before and after the reform. The results suggest that on average the reform has a positive effect equal to 0.29% of permanent consumption. However, the welfare effect is highly heterogenous, the standard deviation of the individual welfare effect is 0.98%, while young least educated households see a reduction in welfare equal to 1% (female) or 0.5% (male) in term of certainty equivalents, young and most educated households see gains of 2% (female) and 1.8% (male) respectively. On average, the negatively affected households are either households that are crowded out of the private insurance plan at the new higher premiums, while the positively affected households are the ones that were staying in the private health insurance before the reform during their lifetime, and after the reform they face a reduction in the expected discounted cost of being in the private plan.

8 Conclusion

This study structurally tests whether a mixed private and public health insurance system can be viable under a regulation change that has equity as its main objective. The analyzed health reform consists in the regulation of premiums in the private sector, mandating a unique pooled premium independent of individuals' observable risk factors (age or gender). Methodologically, this study propose a microfounded two-sector model of consumption-saving with a discrete health insurance choice. The structural parameters of heterogenous agents are estimated to match the observed cross-section of health insurance and consumption decisions. I use microdata from Chile, a health system with insur-

ance mandate which is segmented by private plans offered in a competitive market with actuarially fair premiums, and a public insurance plan that charge premiums that depend on households' income. The main finding of this study is that abstracting from information asymmetry or financial constraints a private health insurance sector can coexist with a public insurance provider under risk-independence pricing regulation. Nevertheless, a reform that imposes a unique pooled premium in the private insurance in the private sector can have a significant effect on households' budgets in the short-term even when they can experience a reduction in their expected discounted cost of the private health insurance (wealth effect). On the other hand, the reform can have effects in households' health risk taking (health coverage) as it can crowd-out the participation of low-income younger households in the private health plan (precautionary saving effect). Taking into account these two indirect effects of the reform, we show that a reduction (increase) in the lifetime cost of purchasing the private plan would increase (decrease) current consumption, at the same time that an increase (decrease) in households' contracted insurance coverage reduces (increases) savings. Finally, as the reform can be welfare-enhancing on average, the distribution of the households negatively affected by the reform is more concentrated in the low-income population. In conclusion, this paper can shed light, under standard microeconomic assumptions, on the effects of regulations that have distributional considerations on 'managed competition' health insurance designs. As health risk are one of the most important idiosyncratic risks that households face, understanding the viability of a financial market that provides hedging opportunities to households is important from a public policy perspective.

9 Appendix

9.1 Preferences

In this section I present the implications of assuming log Epstein-Zin preferences for the case of consumption and health insurance decisions. In a two-period setting household's preferences can be reduced to:

$$U(C_0, C_1) = \log(C_0) + \log(C_0 - \gamma C_1)$$

Focusing in the cases where the natural logarithm function is defined, future consumption is strictly larger than agent's habit ($C_1 - \gamma C_0 > 0$), and the subjective discount factor and the parameter of internal habit are in the [0-1] range. The Arrow-Pratt relative risk aversion measure is defined on current consumption as follows:

$$R(C_0, C_1) = -\frac{C_0 \partial^2 U(C_0, C_1)}{\partial C_0^2} / \frac{\partial U(C_0, C_1)}{\partial C_0} = \frac{C_0(1-2\gamma) + \gamma^2(1+C_0)}{C_0^2(1-\gamma-\beta\gamma)}$$

9.2 Income growth expectations

The imputed income expectations are obtained from a traditional Mincer equation with year-fixed effects, estimated on pooled cross sections of the Survey on Employment in Greater Santiago carried out by the University of Chile for the period 1998-2016. We estimate the following equation for each of the educational groups that we have indentified, including gender, age and year of schooling as controls:

$$\log(y_{i,t}) = \beta_0 + \delta_1 \text{Years of schooling}_i + \delta_2 \text{Age}_i + \delta_3 \text{Age}_i^2 + \delta_4 \text{Female}_i + \sum \beta_i \text{Year}_i + \xi_{s,t} \quad (16)$$

The estimated coefficients are presented in Table 3. The imputed income growth factor for an individual is estimated by Age-Gender-Education. First, we calculate the expected income that an individual in our main dataset would have given the estimated Mincer equation for its educational group, $\hat{y}(\text{Age}, \text{Gender}, \text{Education})$. Second, for each individual with age (x), we estimate its expected income in t years more as $\hat{y}(x + t, \text{Gender}, \text{Education})$. Third, we aggregate individuals' expected income by age groups (mid-age; pre-retirement; retirement). Finally, for the retirement period we assume that expected income will be given by the product of the average expected income for the last three yearss pre-retirement (63-65 for males and 58-60 for females) and the replacement rate estimated for this educational groups by Bernstein et al. (2013). Consequently, a female young of age x will be have an expected income growth for its mid-age, pre-retirement and retirement period obtained as follows:

$$Growth\ Mid - Age(x, Female, Education) = \frac{\sum_{t=35}^{44} \hat{y}(t, Female, Education) / (44 - 35)}{\hat{y}(x, Female, Education)}$$

$$Growth\ Pre - retirement(x, Female, Education) = \frac{\sum_{t=45}^{60} \hat{y}(t, Female, Education) / (60 - 45)}{\sum_{t=35}^{44} \hat{y}(t, Female, Education) / (44 - 35)}$$

$$Growth\ Retirement(x, Female, Education) = \sum_{t=58}^{60} \hat{y}(t, Female, Education) / 3 * Replacement\ Rate$$

The replacement rates for each educational groups used to estimate expected income growths are the following:

	Male	Female
Technical/College	102	35
School	77	60

Table 1: Average replacement rate by educational level estimated by Bernstein et al. (2013)

9.3 Initial wealth

The imputed initial saving are obtained from a cross-sectional regression from the Survey of Household Finances 2014. We estimate the following cross-sectional model of the natural logarithm liquid saving ($\log(1 + W)$) constructed as deposits plus other liquid securities plus cash holdings on sociodemographic controls:

$$\log(1 + W_i) = \log(1 + LiqSaving_i / Income_i) = \beta_0 + \delta_1 Income_i + \delta_2 Age_i + \delta_3 Age_i^2 + \delta_4 Female_i + \delta_5 Education_i \quad (17)$$

where Female is a dummy variable that takes 1 for females, and Education are dummies by educational group.

Based on the estimated coefficients, I transform the predicted liquid savings to income by each individual i in the dataset as follows:

$$\hat{W}_i = \exp(\log(1 + LiqSaving_i / Income_i)) - 1$$

Finally, for each group I calculate the mean predicted savings to income: gender, age, and education group. In Figure 1 the calibrated liquid savings to income by each group.

Figure 1: Liquid savings to income

These figures present the estimated liquid to saving income predicted by the regression model (17).

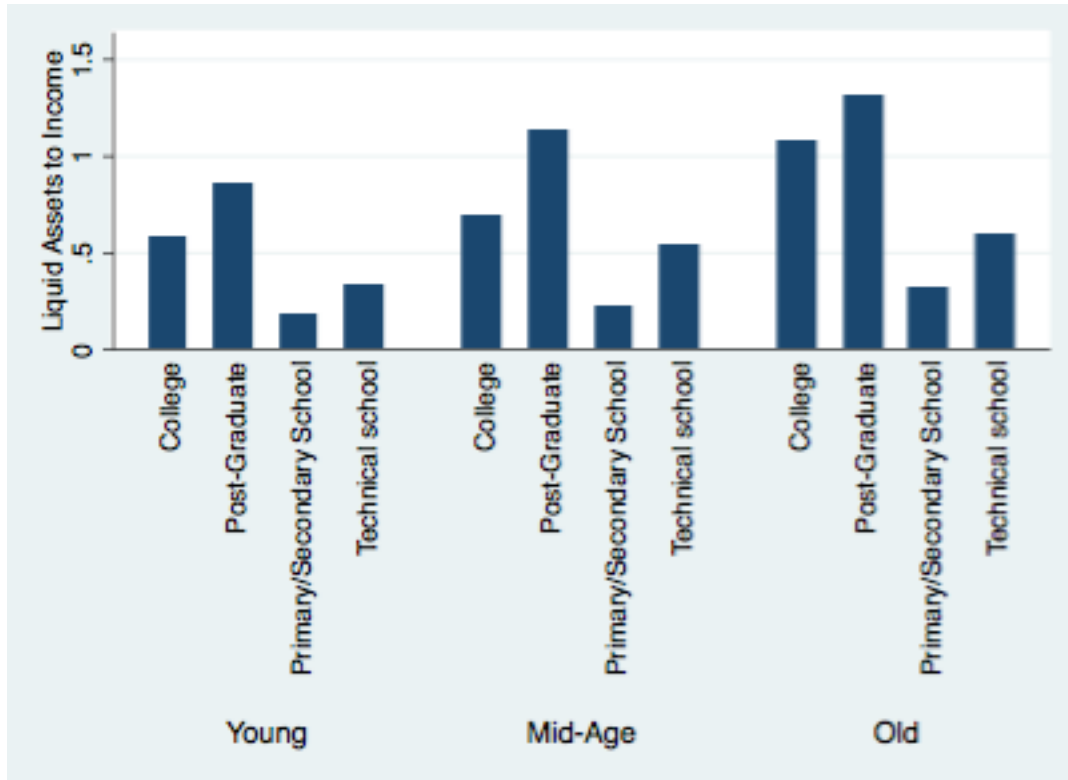


Table 2: Summary Statistics

This table presents summary statistics for the key variables in our analysis divided by age and education groups. For each variable we present the mean and the standard deviation (in parentheses). In the last row we report the relative size of each group..

	Age Group (25-34)			Age Group (35-44)			Age Group (45-65 / F:45-60)		
	Primary/Secondary	Technical Education	College	Primary/Secondary	Technical Education	College	Primary/Secondary	Technical Education	College
Age	30.3 (2.7)	30.2 (2.7)	29.6 (2.7)	39.2 (2.8)	39.9 (2.7)	39.5 (2.9)	53.0 (5.4)	53.8 (5.5)	52.6 (5.0)
Per capita income (US\$)	472 (1521)	738 (451)	1657 (642)	438 (1807)	725 (303)	1571 (471)	541 (1379)	1015 (692)	1617 (1119)
Normalized income	0.58 (0.46)	0.75 (0.54)	1.38 (1.12)	0.61 (0.40)	0.90 (0.51)	1.69 (1.37)	0.66 (0.53)	1.11 (0.89)	1.87 (1.72)
Income growth factor (t+1)	1.27 (0.12)	1.00 (0.08)	1.23 (0.08)	1.15 (0.08)	0.96 (0.06)	1.14 (0.05)	0.77 (0.30)	0.59 (0.06)	0.74 (0.32)
Income growth factor (t+2)	1.45 (0.13)	1.17 (0.10)	1.41 (0.09)	0.89 (0.32)	0.68 (0.07)	0.87 (0.40)	-	-	-
Income growth factor (t+3)	1.05 (0.43)	0.84 (0.09)	1.11 (0.45)	-	-	-	-	-	-
Prob. Health Shock	50.0% (4.8%)	49.8% (4.7%)	50.4% (4.6%)	57.6% (4.6%)	57.3% (4.7%)	56.2% (5.1%)	65.4% (4.0%)	65.5% (4.0%)	64.7% (4.2%)
Health Shock (US\$)	186 (19)	186 (19)	188 (19)	214 (14)	213 (14)	210 (15)	272 (29)	265 (30)	267 (25)
Health Shock / Income	19.7% (15.1%)	54.9% (25.2%)	41.5% (25.4%)	24.7% (20.5%)	64.0% (27.8%)	41.3% (24.4%)	29.3% (23.3%)	71.4% (33.5%)	43.5% (28.3%)
Consumption Share	1.20 (0.67)	1.12 (0.76)	1.22 (0.71)	1.19 (0.85)	1.17 (0.74)	1.20 (0.48)	1.28 (0.79)	1.17 (1.04)	1.19 (0.83)
% Isapre	13.9% (45.7%)	30.4% (34.6%)	70.5% (46.2%)	13.5% (46.4%)	42.5% (34.2%)	68.8% (49.7%)	10.7% (47.5%)	39.9% (30.9%)	65.8% (49.1%)
% Male	62.9% (48.4%)	67.1% (47.1%)	64.7% (48.0%)	69.9% (45.9%)	59.8% (49.1%)	59.3% (49.3%)	69.4% (46.1%)	64.3% (47.9%)	54.8% (49.9%)
% of Sample	7%	2%	8%	14%	2%	10%	39%	4%	14%

Table 3: Income Profile Regressions

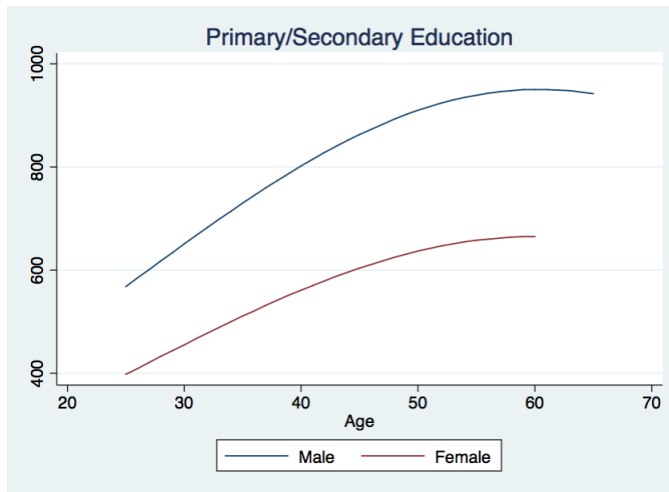
This table presents OLS estimations of Mincer regressions by education groups. The dependent variable in the regressions is observed income, and the independent variables socio-demographic controls.

Dependent:	<i>Log(Income)</i>		
	Primary /Secondary Education	Technical Education	College Education
<i>Years of schooling</i>	0.08 (0.00)	0.12 (0.03)	0.27 (0.01)
<i>Age</i>	0.05 (0.00)	0.05 (0.01)	0.07 (0.00)
<i>Age</i> ²	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
<i>Female</i>	-0.36 (0.01)	-0.44 (0.03)	-0.52 (0.02)
<i>Constant</i>	6.32 (0.04)	5.91 (0.37)	3.23 (0.15)
N	37,313	3,390	10,227
Year Fixed Effects		Yes	

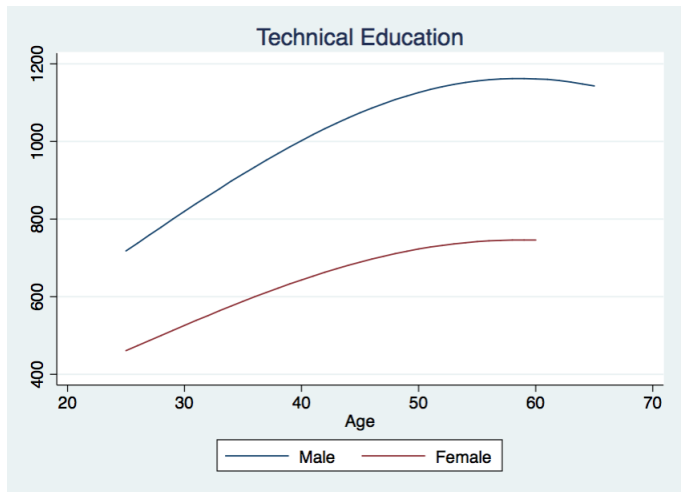
Figure 2: Per capita income profiles

These figures present the estimated income by age and gender obtained from the OLS estimations of Mincer regressions by education groups.

(a) Income Profile: Primary/Secondary Education



(b) Income Profile: Technical Education



(c) Income Profile: College Education

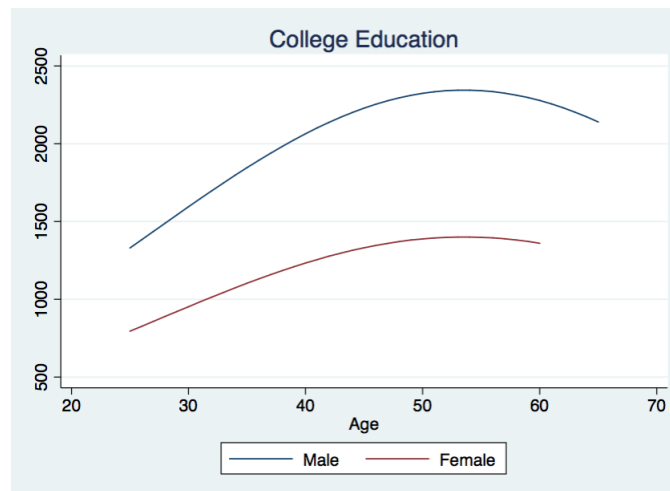


Figure 3: Health consumption profile

These figures documents the total health consumption per beneficiary by age and gender in the private sector (Isapres) for the period 2009-2010. The estimations are presented in US\$.

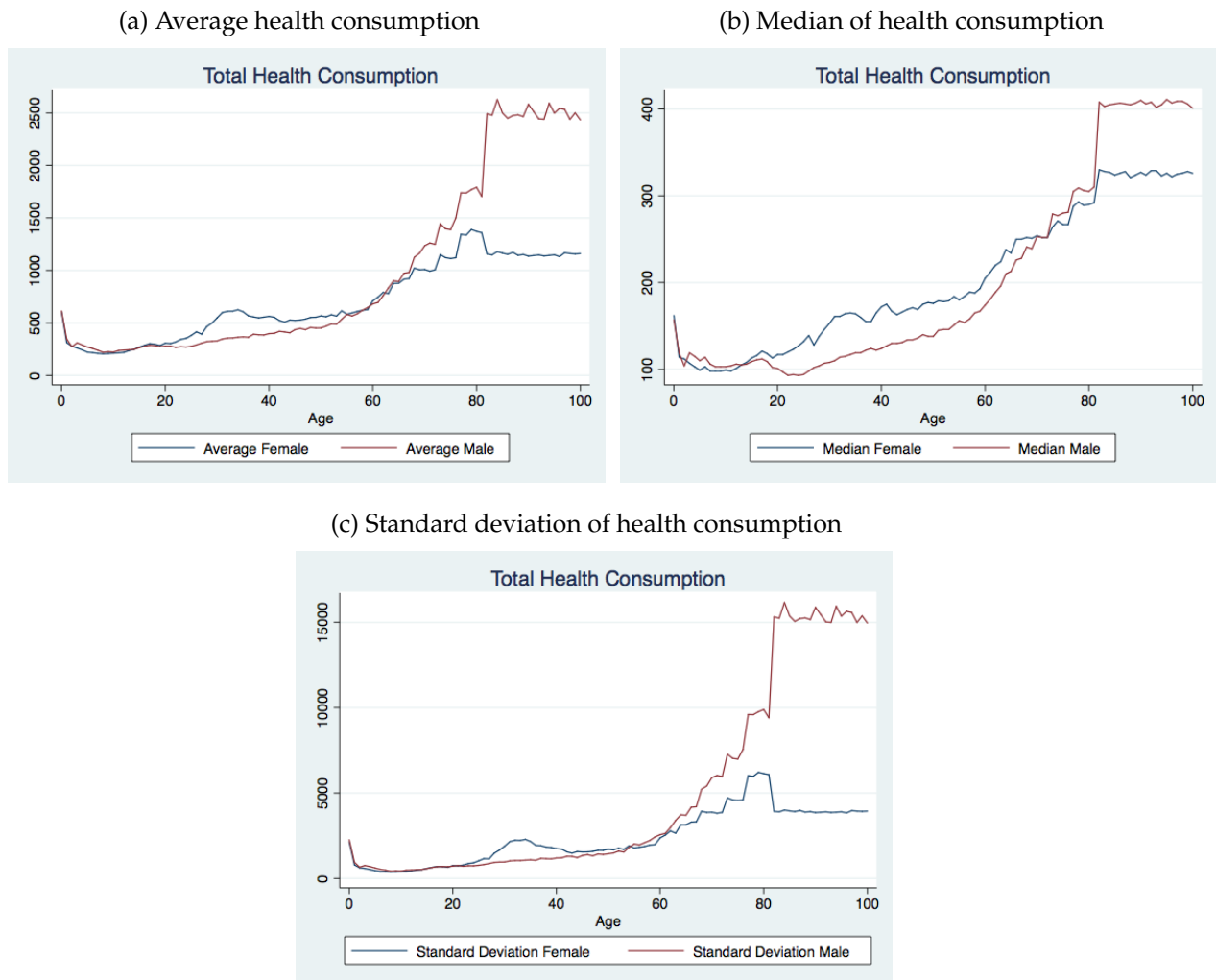


Figure 4: Health shock probability profile

These figures documents the estimated health shock probabilities obtained from the smoothed fraction of households that experience a health problem by age and gender.

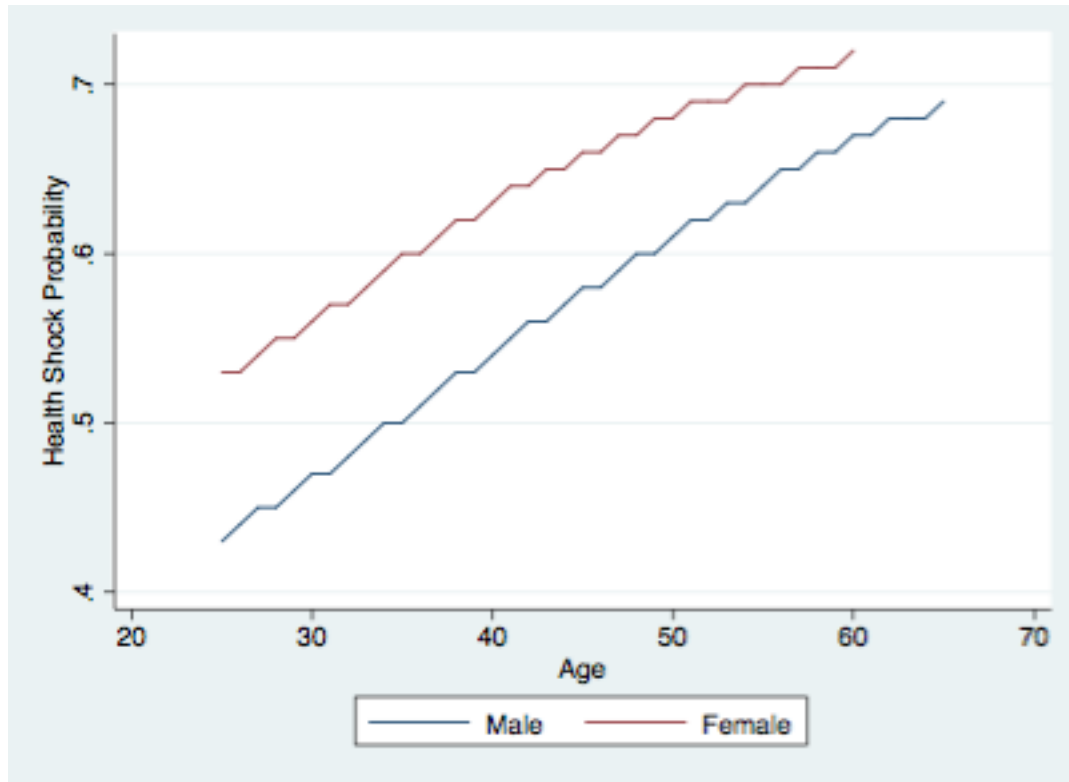


Figure 5: Estimated Health Premiums

These figures documents the estimated actuarially fair premium by age and gender that are constructed from the estimated health shock size (Figure) and probability. In panel (a) the plotted actuarially fair premium are the calibrated counterpart of $p_t \theta_I \varepsilon_{t+1}$. In panel (b) I show an example of a pooled premium obtained with the actuarially fair premiums.

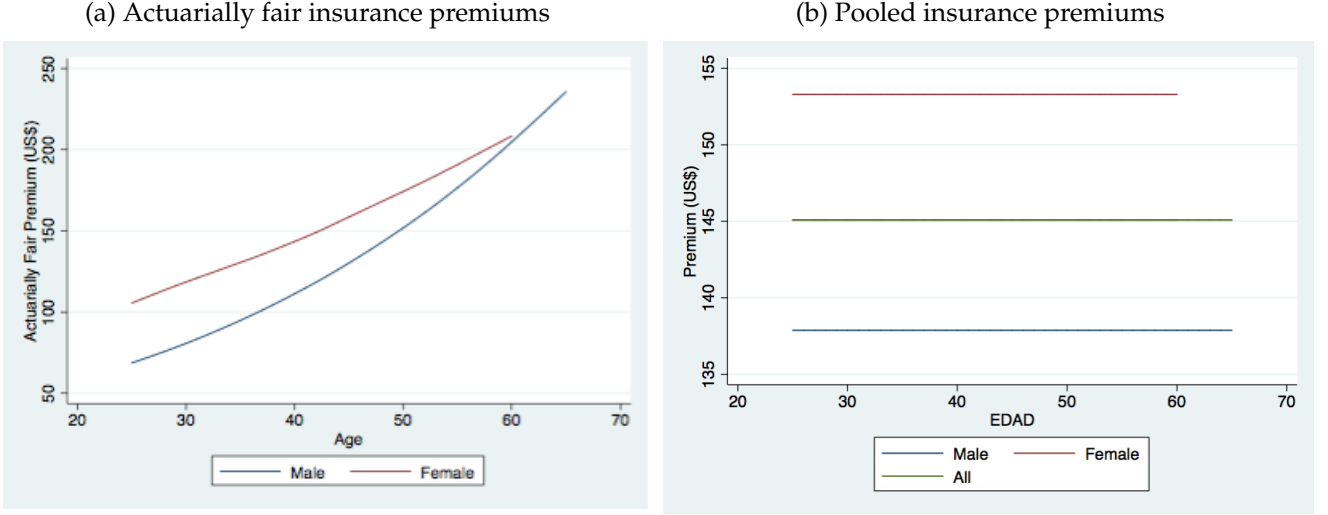


Figure 6: Comparative Statics: Consumption

These figures documents the main comparative statics of the model with respecto to consumption-saving by educational level. These figures show how the mean of aggregated optimal consumption to income decisions change as the structural parameters change.

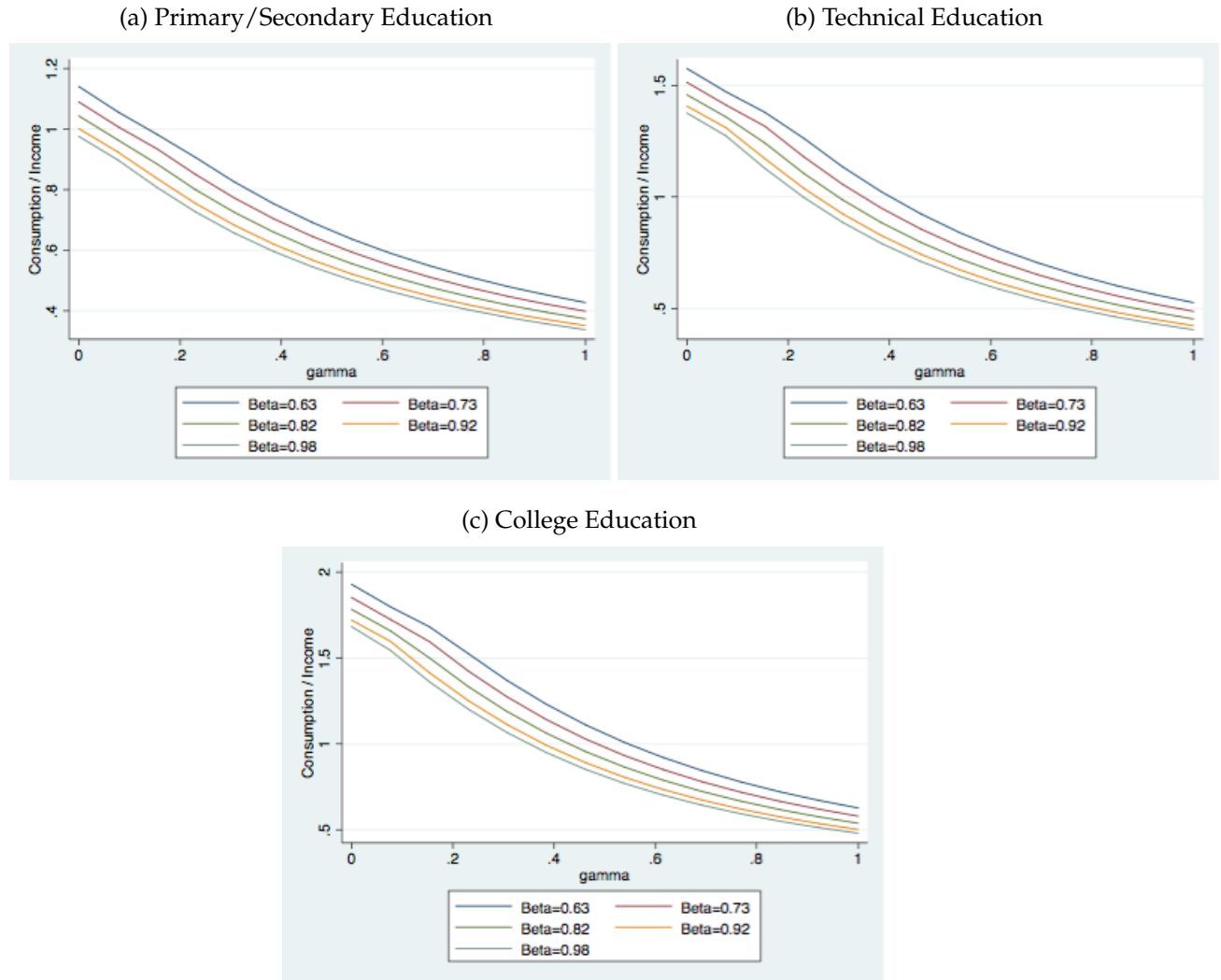


Figure 7: Comparative Statics: Private Insurance Share

These figures documents the main comparative statics of the model with respect to insurance decisions by educational level. These figures show how the fraction of households that choose th private insurance option change as the structural parameters change.

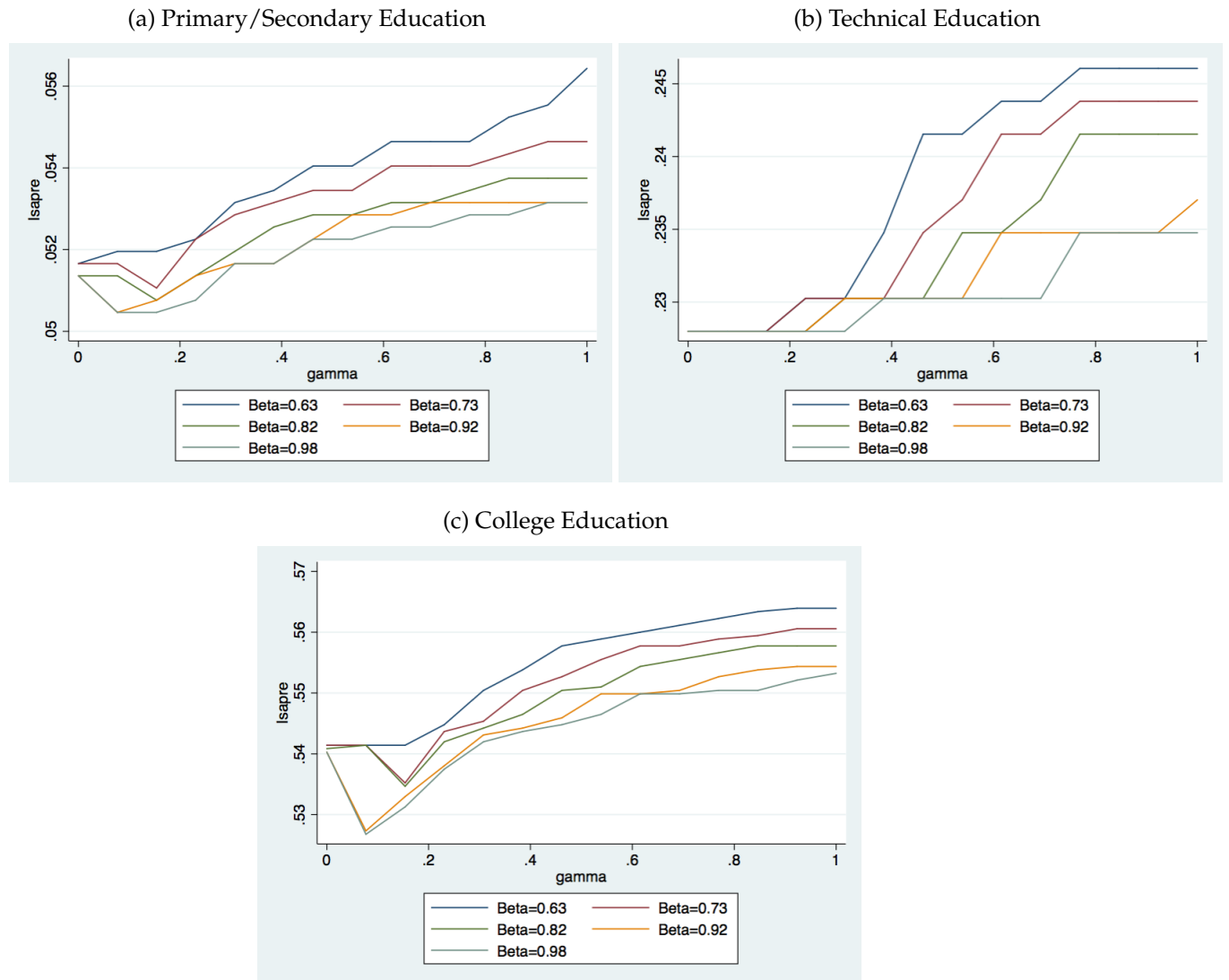


Table 4: GMM Estimates of Parameters

This table presents GMM estimated parameters by education groups.

	Primary/Secondary Education		Technical Education		College Education	
	β	γ	β	γ	β	γ
Estimate	0.60	0.15	0.60	0.38	0.63	0.54
Std. Err.	1.10	0.60	0.27	0.16	0.22	0.15

Table 5: Model Fitting

This table presents a comparison between model estimated moments and empirically observed moments. In the table average consumption to income and private insurance fraction are reported by educational group.

	Primary/Secondary Education		Technical Education		College Education	
	Model	Empirical	Model	Empirical	Model	Empirical
Consumption Share	1.02	1.02	1.05	1.07	1.04	1.04
Private Insurance	0.05	0.12	0.23	0.38	0.56	0.68

Figure 8: Long-run equilibrium: Market share of Private Health Insurance Sector

This figure presents the iterations of the model under the counterfactual scenario. In panel (a) the fraction of households that choose the private insurance in each iteration is reported, and in panel (b) the pooled premium that prevails at each iteration is documented.

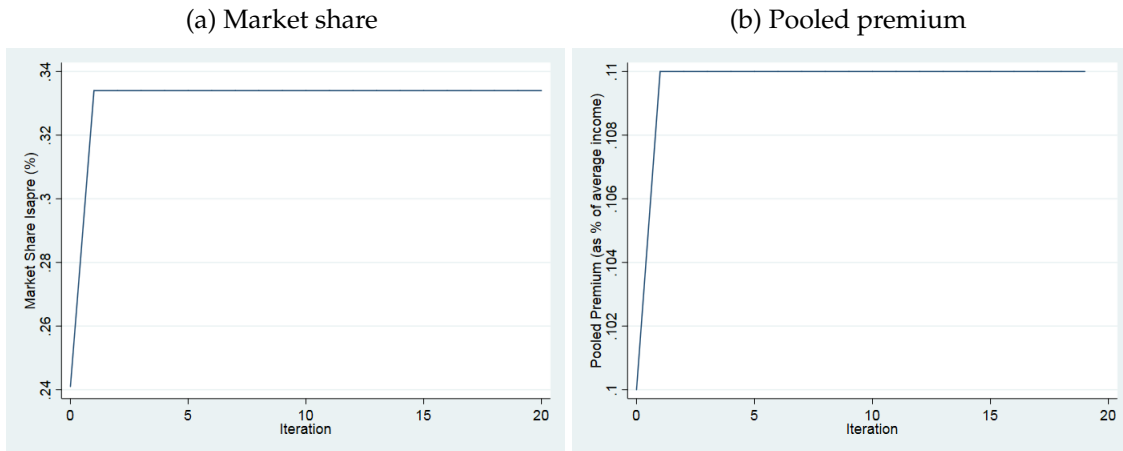
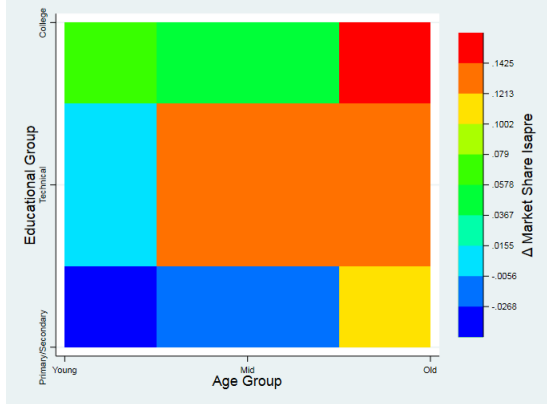


Figure 9: Market share decomposition by age and educational group

These figures documents the participation of the private health insurance plan by age, gender and educational group. In panel (a) I report the change between the constructed counterfactual and the fitted current scenario for the male, and female population.

(a) Estimated Change in the Market share of the private insurance plan by age and educational group (Male)



(b) Estimated Change in the Market share of the private insurance plan by age and educational group (Female)

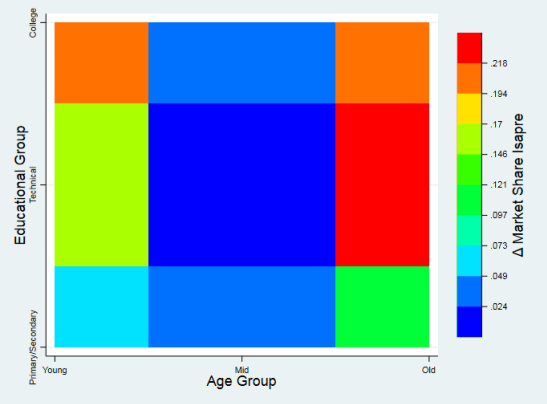
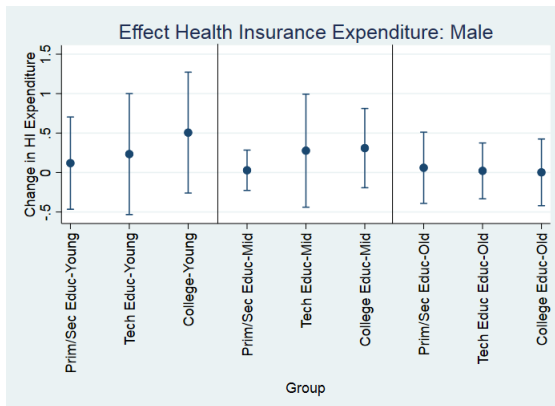


Figure 10: Policy treatment effect: Health insurance expenditure by age and educational group

These figure documents the confidence of interval of the change in housholds' current health expenditure by age and educational group. In panel (a) I report the statistics of the individual current health insurance expenditure for male, and in (b) the results for the female population are presented.

(a) Male



(b) Female

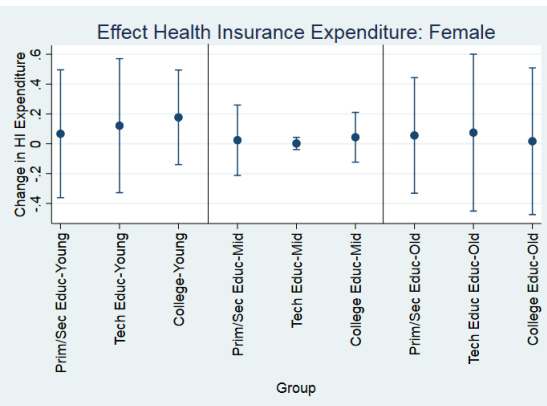


Figure 11: Policy treatment effect: Health insurance expenditure by counterfactual insurance decision

These figure documents the confidence of interval of the change in households' current health expenditure by changes in insurance decisions. In panel (a) I report the statistics of the individual current health insurance expenditure for male, and in (b) the results for the female population are presented.

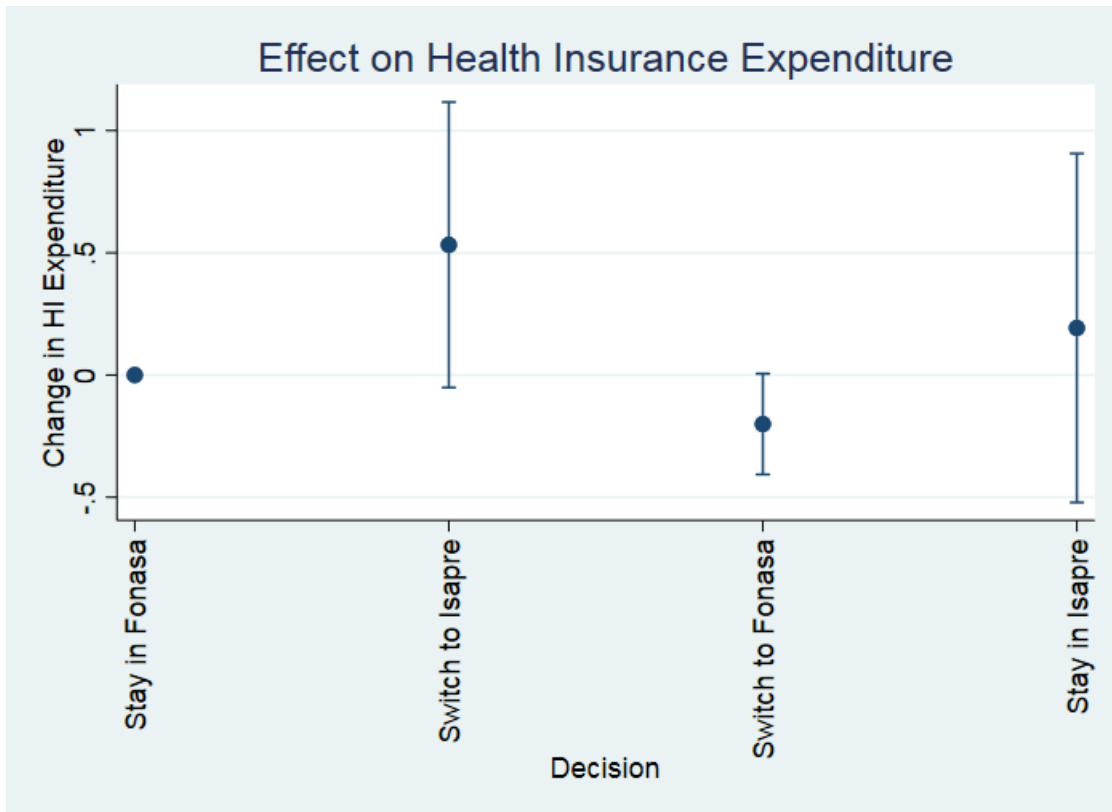


Figure 12: Policy treatment effect: Consumption by age and educational group

These figure documents the confidence of interval of the change in housholds' current consumption by age and educational group. In panel (a) I report the statistics of the individual current health insurance expenditure for male, and in (b) the results for the female population are presented.

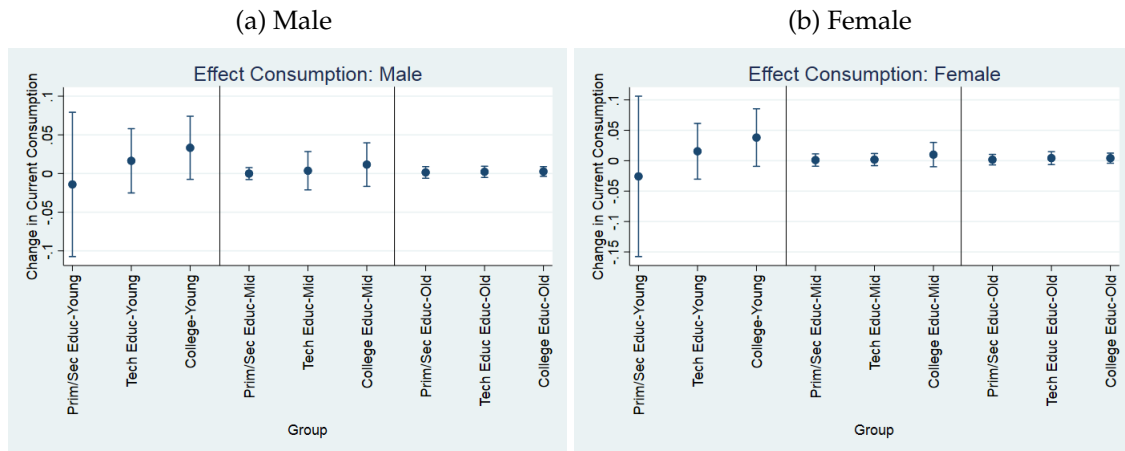


Figure 13: Policy treatment effect: Consumption by counterfactual insurance decision

These figure documents the confidence of interval of the change in households' current consumption by changes in insurance decisions. In panel (a) I report the statistics of the individual current health insurance expenditure for male, and in (b) the results for the female population are presented.

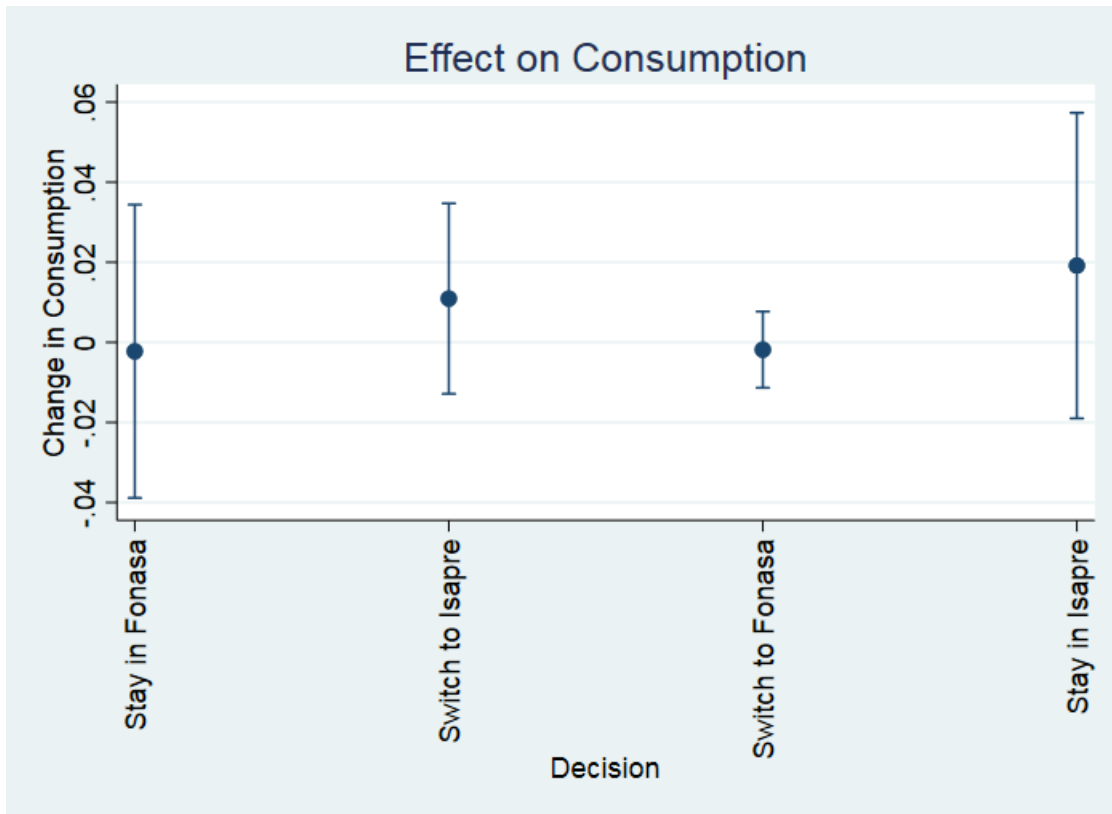


Table 6: Decomposition of consumption effect

This table shows regression estimates from a linear decomposition of the change in household consumption on the change in the lifetime cost of private health insurance and the change in insurance coverage.

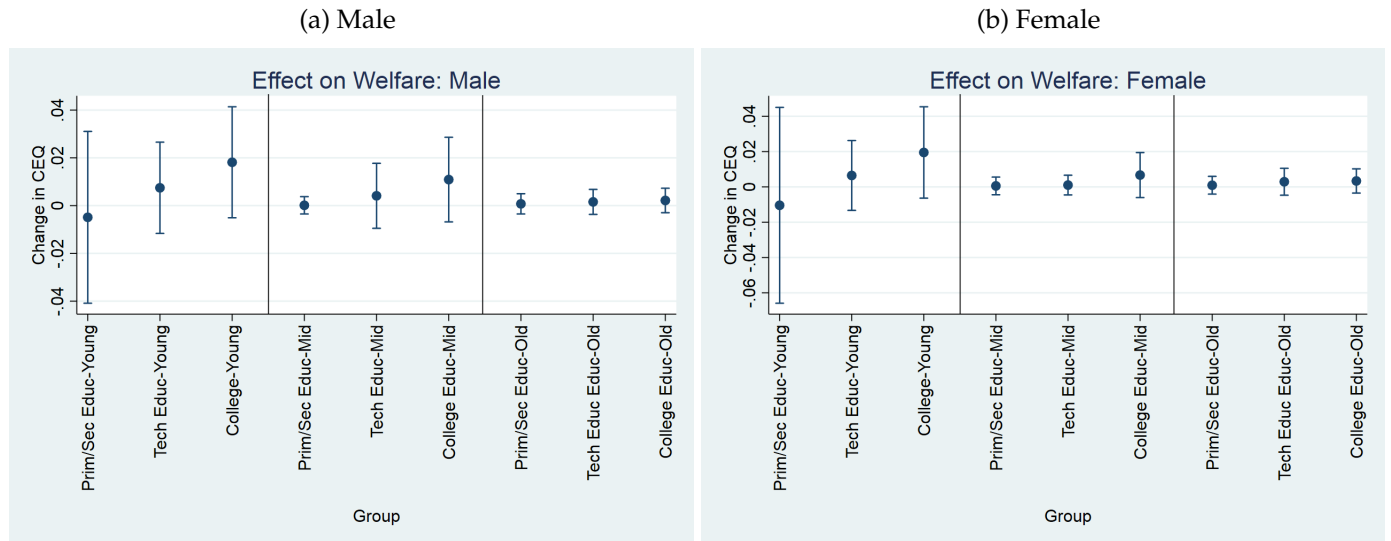
$$C_{i,t_0}^*/C_{i,t_0} - 1 = \alpha + \beta_1 \left(PV(\Delta_{i,I,t_0}^*)/PV(\Delta_{i,I,t_0}) - 1 \right) + \beta_2 \left(\vartheta_{i,\theta,t_0}^* - \vartheta_{i,\theta,t_0} \right).$$

The dependent variable is the relative change in consumption before and after the reform ($\frac{C^* - C}{C}$). The independent variables are the relative change in lifetime cost of private health insurance ($\frac{\Delta^* - \Delta}{\Delta}$) and the change in health insurance coverage ($\vartheta^* - \vartheta$).

	Consumption Effect	Consumption Effect
Current Expenditure in PV PHI	-0.0396*** (-24.05)	-0.0346*** (-19.66)
Health Converage Change	0.137*** (17.65)	0.120*** (15.49)
Constant	0.000433 (1.51)	0.000918 (0.57)
N	5,567	5,567
Adjusted R^2	0.216	0.230
Controls	N	Y

Figure 14: Welfare analysis

These figure documents the confidence of interval of the change in housholds' certainty equivalents by age and educational group. In panel (a) I report the statistics of the individual certainly equivalent effects for male, and in (b) the results for the female population are presented.



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