Selection, Subsidies, and Welfare in Health Insurance: Employer Sponsored Health Insurance Versus the ACA Marketplaces*

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Abstract

The Affordable Care Act (ACA) changed incentives for purchasing private health insurance, potentially crowding out employer-sponsored insurance. We analyze the heterogeneous welfare gains across individuals in the Small Group Market (SGM) from alternative formulations of the ACA health insurance exchanges (HIX). We find that most consumers would benefit from moving to the HIX, with an average welfare gain of $2,188 when holding constant the number of plans. Accounting for the larger choice of plans in the HIX further increases these welfare gains. Subsidies are major driving force of the advantage of moving to the HIX for SGM consumers. Because less healthy and lower income individuals have larger gains from moving to the HIX, allowing HIX premiums to adjust in equilibrium partially mitigates consumer welfare gains. Finally, we evaluate the welfare effects of a Trump administration rule change that will allow individuals to purchase exchange plans on a pretax basis through the use of health savings accounts starting in 2020, essentially making a part of their premiums tax deductible. We find that this policy will increase the benefit of moving to the HIX for SGM consumers by $2,900 more on average, while increasing net government expenditures by about $1,500 per person.

Keywords: employer-sponsored health insurance, Affordable Care Act, adverse selection
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1 Introduction

The 2010 Affordable Care Act (ACA) ushered in some of the largest changes to U.S. healthcare policy over the past few decades. One of the main mechanisms of the ACA was to expand the sale of individual health insurance. This was done through a set of interrelated policies: subsidies to encourage moderate-income people to purchase insurance, penalties to incentivize the healthy to purchase, and the establishment of health insurance exchanges (HIXs), which are marketplaces that facilitate the sale of this product.

During the debate before its enactment in 2009-10, many observers feared that the ACA would result in an important disruption of the healthcare sector. To assuage these fears, President Obama famously said, "If you like your health insurance, you can keep it," a statement that was later widely criticized. Not coincidentally, the final version of the ACA contained provisions that disabled exchange plans relative to employer-sponsored health insurance. Most importantly, though the ACA subsidized exchange plans for moderate-income individuals, it did not make them tax deductible, while preserving the tax deductibility of employer-sponsored insurance.[1] It also established relatively modest penalties for not having health insurance, making it financially advantageous for many healthy individuals to pay the penalties instead of purchasing health insurance.[2]

Together, the ACA's policies regarding subsidies, tax deductibility, and penalties provided heterogeneous incentives across individuals for exchange plan take-up relative to employer-sponsored insurance. These incentives continue to be altered over time as different policymakers impose their visions for health insurance reform. A 2019 Trump administration rule change allows individuals to purchase exchange plans on a pre-tax basis through the use of health savings accounts starting in 2020, essentially making a part of their premiums tax deductible for employed individuals (Federal Register, 2019). This change, together with many other policy proposals, underscores the policy relevance of understanding the impact of health insurance policy on take-up and welfare.

The purpose of this paper is to understand the impact of policy design on health insurance take-up and welfare. We focus on individuals who are offered employer-sponsored insurance through the small group market. We estimate their preferences for insurance take-up as a function of individual

[1] The ACA did establish a "Cadillac Tax" on expensive employer-sponsored insurance but the implementation of this tax has already been delayed twice, currently until 2022.

[2] The penalties for not purchasing health insurance were ultimately repealed in the 2017 Tax Cut and Jobs Act.

characteristics, plan characteristics, and premiums.[3] We then evaluate how counterfactual policy design would affect take-up and welfare from exchange plans relative to employer-sponsored insurance. Our counterfactuals focus on changes in subsidies, tax deductibility, and penalties and allow premiums to adjust in equilibrium based on enrollee selection.

The small group market (SGM) insures employers with 2-50 covered lives. We focus on substitution between employer-sponsored insurance from the small group market and exchange plans because the small group market is the sector where the ACA was most expected to disrupt existing health insurance. Specifically, while large employers provide natural risk pools, the small group market has a potential for substantial reclassification risk, which would limit the welfare of its participants (Fleitas et al., 2018). Moreover, while the ACA established employer penalties for large employers that did not provide sufficient employee health insurance coverage, it did not implement any penalties for non-offer or non-coverage in the small group market. Last, the Kaiser Family Foundation Employer Health Benefits Survey found that only 69% of firms offered health benefits in 2010 and that this number is dropping over time. Recognizing this, the recent rule change that makes exchange plans partially tax deductible specifically targeted the small group market (Keith, 2019).

Our estimation primarily uses unique proprietary data from a large insurance company that offers plans on the small group market, over the period 2012-15. We refer to the insurer by a pseudonym, United States Insurance Company (USIC). USIC has provided us with claims, enrollment, and premiums data for its small group market plans in 10 states. We estimate choice models for individuals' offered plans in the small group market, using whether they chose an employer-sponsored insurance plan—and which plan they chose for those offered multiple plans.[4] Our choice model specifies that individual utility for each option is a function of plan characteristics such as the deductible and copay, the after-tax plan premium, and individual characteristics, notably expected health care costs, age, gender, and disposable income. We use after-tax prices and disposable income in order to be able to compute counterfactuals where we alter the tax deductibility of premiums.[5] We calculate the expected health care costs, which we denote as the individual's risk score, using USIC claims data.[6]

Our data are unique in that they allow us to link individuals' claims, take-up decisions, and pre-

[3] For employees who elect family coverage, we estimate their choice decision as a function of their characteristics and their family's characteristics.

[4] Almost all employers on the small group market contract with only one insurer.

[5] We calculate tax rates using the NBER *TAXSIM* program.

[6] We use the ACG risk score methodology developed by Johns Hopkins University.

miums across alternatives. The claims data allow us to compute detailed models of health plan choice that include the individual's health risk as a predictor of take-up. Moreover, by observing health risk, we can evaluate the costs of providing insurance under alternate scenarios, which we use to compute premiums in our equilibrium counterfactuals.

A limitation of our data is that we do not observe the characteristics for individuals who were offered employer-sponsored health insurance but declined coverage, though we do observe the number of individuals who did not take up coverage for each employer. We need these characteristics to estimate an accurate model of insurance take-up. We address this limitation with auxiliary data from the Medical Expenditure Panel Survey (MEPS). We use MEPS to simulate the distribution of individuals who were offered but declined coverage from USIC. We match individuals to MEPS using information on firm size, sector, and the employer-sponsored insurance offer/take-up decision. We then simulate health conditions (which allows us to estimate expected risk), age, and income for these individuals. The MEPS data also allow us to simulate income for individuals who take-up employer-sponsored insurance from USIC.

Using our combined USIC and MEPS data, we estimate nested logit and conditional logit choice models with multiple dimensions of heterogeneity. We then use our estimated models to simulate the welfare impact of a number of counterfactual policies. First, we simulate moving all individuals in the USIC small group market to the exchange market, using 2014 and 2015 exchange plan characteristics. Different individuals may select into insurance in counterfactual environments, leading to changes in premiums and further selection. Our counterfactuals calculate these equilibrium changes in premiums using a fixed-point approach and imposing the ACA medical-loss ratio standards.[7] We characterize the heterogeneity in the welfare impact of this counterfactual and also evaluate how its impact would vary based on the fraction of premiums that are paid by the employer. We also consider the impact of counterfactual policies that similarly move all enrollees in this market to the exchange market, but vary penalties for non-purchase of insurance, the tax deductibility of exchange plans, and subsidies for these plans.

Summary of results. First, we consider the effects of moving individuals from the small group market to the health insurance exchanges. We find that, even when holding the number of plans offered constant, 72% are better off in the HIX. Consumer welfare increases but take-up decreases when con-

[7]The ACA mandates caps on price-cost margins for insurance plans, which it denotes medical-loss ratio standards. We calculate equilibrium counterfactual premiums imposing these caps using expected costs determined from the risk scores. As a comparison, we also present counterfactuals that leave premiums the same as in the baseline.

sumers are moved to the HIX, where premiums are paid with post-tax dollars and eligible individuals receive subsidies for the purchase of insurance, relative to the SGM where premiums are paid with pre-tax dollars. When we offer individuals more choice in the HIX, there are significantly higher welfare gains. However, the advantage of the HIX can be partially reduced by employer contributions to premiums in the SGM, helping to understand why individuals choose to stay in the SGM. Additionally, our equilibrium counterfactuals show that premiums in the HIX would increase as a result of sorting of high risk individuals, mitigating the welfare gains in the HIX market.

Second, we consider counterfactuals in which we compare the HIX under different tax-subsidy arrangements, allowing for equilibrium changes in premiums. In order to understand the role of subsidies, we first consider a counterfactual in which we compare the SGM to a configuration of the HIX without subsidies. The results underscore that subsidies have large effects on take-up and consumer welfare, as both consumer welfare gains and take-up increases are smaller compared to the scenario with the current configuration with subsidies of the HIX. We then consider a counterfactual that compares the SGM to the HIX with the tax-subsidy incentives it will have starting in 2020, after the Trump administration rule change takes effect. Allowing consumers to pay for HIX plans with pre-tax dollars, as well as having subsidies, increases the welfare gains from moving to the HIX. Average consumer welfare increases by $2,900 more with this policy than with the current configuration of the HIX. On the other hand, this policy comes at a higher cost for the government, which collects on average about $1,300 less in taxes and spends $200 more on subsidies per capita. Future versions of this paper will also evaluate counterfactual scenarios with the effects of mandates.

Finally, we study the driving forces behind the heterogeneity in welfare changes, by correlating welfare changes with individual and firm characteristics. We conclude four things from this exercise. First, these results imply that the HIX is adversely selected in relation to the SGM, since it is more attractive for higher risk individuals. Second, lower income individuals tend to benefit more from moving to the HIX. Tax deductibility in the SGM benefits higher income individuals while subsidies in the HIX are targeted to lower income individuals. Third, consumers working in larger firms always benefit relatively less from switching to the HIX. Fourth, in general, individuals with higher risk and lower income have relatively larger gains from the current design of the HIX compared with situations in which we remove subsidies or allow for purchase of HIX plans with pre-tax dollars.

Relation to literature. This paper builds on three literatures. First, we build on a literature that considers individuals choices of health plans, often with the goal of understanding health insurance policy reform (Dafny et al., 2010, 2013; Curto et al., 2014; Kim and Lyons, 2019). A number of papers in this literature specifically consider the design of the ACA and its impact on selection (Ericson and Starc, 2015; Saltzman, 2017; Tebaldi, 2017; Hackmann et al., 2015; Frean et al., 2017; Einav et al., 2019; Panhans, 2019; Finkelstein et al., 2019). We build on this literature by incorporating individual and plan heterogeneity and by considering the impact of plan design. Our focus on the interaction between the small group and individual markets is also new. Second, we build on a literature that examines employers' decisions of health plan offerings and the substitution between employer-paid health insurance coverage and wages (Gruber and Poterba, 1996; Currie and Madrian, 1999; Levy and Feldman, 2001; Olson, 2002; Gruber and Lettau, 2004; Lubotsky and Olson, 2015; Lurie et al., 2019). Our model and counterfactuals incorporate potentially incomplete pass-through between employer-paid health insurance premiums and wages. Finally, we build on a literature that considers the design of taxes in differentiated products markets (Dubois et al., 2017; Allcott et al., 2018; Griffith et al., 2018, 2019).

2 Model and Estimation

Before 2014, individuals who worked for an employer with fewer than 50 employees could purchase insurance for them and their families through the small group market (SGM), as well as through other options outside of their employer. Starting in 2014, the ACA created health insurance exchanges (HIX) and individuals and family members could also purchase insurance through this channel. In 2014, more than 70% of individuals working in small employers who were offered insurance chose insurance through their employer. In contrast, a very small fraction (2%) of these individuals took up insurance in the HIX.[8] The lack of purchase from the individual market was due, in large part, to two factors. First, employer-sponsored insurance was paid with pre-tax dollars while individual insurance was not. Second, employers potentially subsidize at least some part of employer-sponsored insurance (Currie and Madrian, 1999; Olson, 2002; DeVaro and Maxwell, 2014; Lubotsky and Olson, 2015). However, individuals earning 400% or less of the federal poverty level qualified for premium subsidies when purchasing a plan from the HIX, providing a new reason to purchase insurance in this market for employed individuals.

The ultimate goal of our study is to evaluate the distribution of consumer welfare, government

[8] Data from own tabulation of the Medical Expenditure Panel Survey (MEPS)

spending, and insurance take-up if we expose households who were in the small group market to the exchange market, under its present design, and under counterfactual designs that vary in tax deductibility, subsidies, and penalties. Accordingly, we develop a plan choice framework that explicitly models taxes, subsidies, and insurance take-up.

Employees and families In our model, each employee decides either to buy insurance for herself and her family. We assume that if an employee decides to buy insurance she does it for her and her family and that each individual purchases the same option for all members of her household. These decisions are a function of household income, health status, and other household characteristics, as well as plan characteristics. Modeling the decisions at the household level is important in our framework, given that the tax incentives change considerably across family statuses.

Consider a marketplace with a set of households, indexed $i = 1, \ldots, I$. Each household has access to a set of insurance plans, indexed $j = 1, \ldots, J_i$. Let $j = 0$ denote the "outside option" of non-purchase of insurance. Let the price of each plan—gross of subsidies or tax deductibility —be p_{ij}, where p_{ij} is the price for covering all members of the individual's household. We normalize $p_{i0} = 0$.

Income and income tax. We now define different measures of income and income tax. Define Y_i^G to be gross income of the household, which we assume is exogenous. Since health insurance may be paid with pre-tax dollars, taxable income depends on the insurance choice: $Y_{ij}^T = Y_i^G - d \times p_{ij}$, for $j = 0, \ldots, I_j$, where d is an indicator for whether insurance is paid with pre-tax dollars. We can then define the income tax payable to be a function of taxable income, $\tau\left(Y^T\right)$. Let s be an indicator for whether there are subsidies available and $\phi\left(Y_i^G, p_{ij}\right)$ be the amount of the ACA subsidy. Also, let f be an indicator for whether there is a mandate and $\pi(Y_i^G)$ be the proposed ACA penalty from non-purchase of insurance. Finally, we define disposable income, Y_{ij}^D to be income net of taxes and of the purchase cost of health insurance (in the case of purchase). Formally,

$$Y_{ij}^D = Y_i^G - \tau\left(Y_{ij}^T\right) - p_{ij} + s \times \phi(Y_i^G, p_{ij}) - \mathbb{1}\{j = 0\} \times f \times \pi(Y_i^G). \tag{1}$$

In (1), the first term is gross income, the second term is taxes, the third term is premiums, the fourth term is subsidies, and the final term is the penalty for non-purchase of insurance.

Equation (1) allows us to exploit the different regimes of tax deductibility, subsidies, and penalties present in the SGM and HIX. We discuss some particular cases. The first case is when $d = 1$, $f = 0$, and $s = 0$. Under these assumptions, (1) reduces to $Y_{ij}^D = Y_i^G - \tau(Y_{ij}^G - p_{ij}) - p_{ij}$. This is the situation of the SGM prior to the ACA regulations, where premiums (if health insurance is purchased) are paid with pre-tax dollars, there are no penalties for non-purchase, and no subsidies available to consumers. A second case is when $d = 0$, $f = 0$, and $s = 1$. In this case, $Y_{ij}^D = Y_i^G - \tau(Y_i^G) - p_{ij} + \phi(Y_i^G, p_{ij})$. This is the situation of the HIX in 2019, where the premiums are paid with post-tax dollars, there are no penalties for non-purchase, and subsidies are available. Finally, Equation (1) allows us to investigate the impact of counterfactual combinations of taxes and subsidies. For example, it allows for the possibility of having the set of plants from the SGM, premiums paid with pre-tax dollars, and subsidies as in the HIX, by setting $d = s = 1$ and calculating outcomes with the set of plans that is present in the small group market.

Choice model We model health plan choice with a discrete choice model of demand. We model multiple dimensions of heterogeneity. First, as above, households are heterogeneous in their disposable income. Second, individuals differ in their risk score—which indicates their expected health care costs. The risk score (r_i) is a function of the employee's age (a_i), gender (g_i), and her previous health conditions and health care utilization (H_i). Formally,

$$r_i = \chi(a_i, g_i, H_i). \tag{2}$$

where $\chi(\cdot)$ is a function that predicts the health care claims risk based on detailed information about employees. Third, plans are heterogeneous, with different coinsurance levels, copays, deductibles, out-of-pocket maxima, and premiums.

Households make a choice between purchasing one of the J_i insurance products or purchasing the outside option of no insurance, which we denote $j = 0$. We specify a nested logit demand model in the tradition of McFadden (1974) and Berry (1994). We model two groups, with group 0 containing the outside option and group 1 containing the J_i insurance products. Let $g_i(j)$ be the function that assigns option j to group g for individual i and let $\mathcal{G}_{ij}$ denote the options in the same group as option j for individual i.

The utility of each option, $j = 0, \ldots, J_i$ can be written as:

$$u_{ij} = \delta_{ij} + \nu_{ig_i(j)} + (1 - \sigma)\varepsilon_{ij},$$

where δ_{ij} is the mean utility of plan j for individual i (which we discuss further below); $0 < \sigma \leq 1$ is the nesting parameter; ν_{ig} is common to all products in group g and is distributed $C(1-\sigma)$; and ε_{ij} is distributed type 1 extreme value $i.i.d.$ across products. Cardell (1997) shows that, given our distributional assumptions on $\nu_{ig_i(j)}$ and ε_{ij}, $\nu_{ig} + (1-\sigma_j)\varepsilon_{ij}$ is also an extreme value random variable. Note that as σ approaches one, the within group correlation of utility levels goes to one, and that for $\sigma = 0$, the within group correlation goes to zero and we return to the standard logit model.

We estimate a nested logit model rather than a richer random coefficients model because our data include many dimensions of observable heterogeneity, which enter into δ_{ij}. In our main specification, we define δ_{ij} to include disposable income of the household, in-network out-of-pocket costs, coinsurance rate and deductible, and out-of-network deductible and out-of-pocket maximum, all interacted with r_i,[9] a binary variable indicating married status (m_i), and number of kids (h), as a way to reflect the different effects of these plan characteristics for different types of individuals. For $j = 1, \ldots J$, we write:

$$
\begin{aligned}
\delta_{ij} \;=\;& \alpha_1 \times \log(Y_{ij}^D) + \alpha_2 \times \log(Y_{ij}^D) \times r_i + \alpha_3 \times \log(Y_{ij}^D) \times m_i + \alpha_4 \times \log(Y_{ij}^D) \times h_i \\
+\;& \beta_1 \times oopm_j + \beta_2 \times coins_j + \beta_3 \times ded_j + \beta_4 \times copay_j + \beta_5 \times OONded_j + \beta_6 \times OONoopm_j \\
+\;& \theta_1 \times r_i \times oopm_j + \theta_2 \times r_i \times coins_j + \theta_3 \times r_i \times ded_j \\
+\;& \theta_4 \times r_i \times copay_j + \theta_5 \times r_i \times OONded_j + \theta_6 \times r_i \times OONoopm_j \\
+\;& \theta_7 \times m_i \times oopm_j + \theta_8 \times m_i \times coins_j + \theta_9 \times m_i \times ded_j \\
+\;& \theta_{10} \times m_i \times copay_j + \theta_{11} \times m_i \times OONded_j + \theta_{12} \times m_i \times OONoopm_j \\
+\;& \theta_{13} \times h_i \times oopm_j + \theta_{14} \times h_i \times coins_j + \theta_{15} \times h_i \times ded_j \qquad (3) \\
+\;& \theta_{16} \times h_i \times copay_j + \theta_{17} \times h_i \times OONded_j + \theta_{18} \times h_i \times OONoopm_j \\
+\;& \omega_1 \times POS_j + \omega_2 \times PPO_j + \omega_3 \times EPO_j + \omega_4 \times HMO_j \\
+\;& \omega_5 \times POS_j \times r_i + \omega_6 \times PPO_j \times r_i + \omega_7 \times EPO_j \times r_i + \omega_8 \times HMO_j \times r_i \\
+\;& \omega_9 \times POS_j \times m_i + \omega_{10} \times PPO_j \times m_i + \omega_{11} \times EPO_j \times m_i + \omega_{12} \times HMO_j \times m_i \\
+\;& \omega_{13} \times POS_j \times h_i + \omega_{14} \times PPO_j \times h_i + \omega_{15} \times EPO_j \times h_i + \omega_{16} \times HMO_j \times h_i + \omega_{t(i)}
\end{aligned}
$$

where $oopm_j$ is the in-network out-of-pocket maximum, $coins_j$ is the in-network coinsurance, ded_j is the in-network deductible, $copay_j$ is the in-network copay, $OONded_j$ is the out-of-network deductible, $OONoopm_j$ is the out-of-network maximum, and HMO, POS, PPO, and EPO are plan types (with

[9]In our empirical model, r_i indicates the risk score of the enrollee, though we could also add in risk scores of other family members.

the category other plan types excluded). The α, β, θ, and ω terms are parameters to be estimated. Correspondingly to Equation (3), for $j = 0$, we can write:

$$\delta_{i0} = \alpha_1 \times \log(Y_{i0}^D) + \alpha_2 \times \log(Y_{i0}^D) \times r_i + \alpha_3 \times \log(Y_{i0}^D) \times m_i + \alpha_4 \times \log(Y_{i0}^D) \times h_i$$

Given the distributional assumption for the ε terms, the probability of individual i choosing plan j, Pr_{ij}, can be decomposed as the product of the probability of picking choice j conditional on choosing group g, $Pr_{ij|g}$, times the probability of choosing group g, $\overline{Pr}_{ig}$:

$$Pr_{ij} = Pr_{ij|g} \times \overline{Pr}_{ig} = \frac{\exp\left(\frac{\delta_{ij}}{1-\sigma}\right)}{\sum\limits_{k \in \mathcal{G}_{ij}} \exp\left(\frac{\delta_{ik}}{1-\sigma}\right)} \times \frac{\left(\sum\limits_{k \in \mathcal{G}_{ij}} \exp\left(\frac{\delta_{ik}}{1-\sigma}\right)\right)^{1-\sigma}}{1 + \left(\sum\limits_{k=1}^{J_i} \exp\left(\frac{\delta_{ik}}{1-\sigma}\right)\right)^{1-\sigma}}.$$

Estimation If we observed δ_{ij}, estimation via maximum likelihood would be standard. In that case, the log-likelihood for individual i could be defined as:

$$\log \mathcal{L}_i(\alpha, \beta, \theta, \omega, \sigma) = \log \left(\sum_{j=0}^{J_i} \mathbb{1}\{D_i = j\} Pr_{ij} \right)$$

where D_i indexes the chosen option.

However, our main data have one central limitation. While we know the number of employees who are eligible for insurance, we do not observe individual characteristics of income (Y_i^G), health risk (r_i) and family composition (m_i and h_i) for individuals who choose $j = 0$. For individuals who chose $j \geq 1$, we observe claims data, age, and gender—which allows us to compute health risk— and we assume that the family composition is giving by the family member that take up insurance but we still do not know income.

To address this issue, we integrate over these characteristics using an auxiliary source of data, the MEPS data. With the auxiliary data, we simulate the distribution of individual characteristics conditional on employer characteristics and on the take-up decision. We then maximize a simulated likelihood function using these distributions.

Formally, define c_i be the observable employer characteristics of individual i that we can match to the auxiliary data. These include the industrial sector, the number of employees, and the fact that the employer offered health insurance to its employees. Let $F(Y_i^G, r_i, m_i, h_i | c_i, \mathbb{1}\{j > 0\})$ be the distribution functions of r_i, m_i, h_i and Y_i^G in the auxiliary data conditional on c_i and an indicator for insurance take-up. Then, we can express the log-likelihood by integrating over r_i, m_i, h_i and Y_i^G:

$$\log \mathcal{L}_i(\alpha, \beta, \theta, \omega, \sigma) = \mathbb{1}\{D_i = 0\} \log \left(\int Pr_{i0|Y_i^G, r_i, m_i, h_i} dF^A(Y_i^G, r_i, m_i, h_i | c_i, \mathbb{1}\{j = 0\}) \right) + \sum_{j=1}^{J_i} \mathbb{1}\{D_i = j\} \log \left(\int Pr_{ij|Y_i^G} dF^B(Y_i^G | c_i, \mathbb{1}\{j > 0\}) \right) \quad (4)$$

In Equation (4), we consider the log-likelihood for each employee who is eligible for insurance, whether or not that individual takes up insurance. If the employee chooses $D_i = 0$, we simulate her r_i, m_i, h_i and Y_i^G from the matched auxiliary data. If she chooses $D_i \neq 0$, we simulate her income from the matched auxiliary data.

Finally, note that the auxiliary data do not directly include the risk score r_i. Instead, the auxiliary data include information on age, gender, health conditions, and health care utilization that can be used to predict r_i as in Equation (2). Thus, we estimate our likelihood using a three step procedure. First, we match individuals in our small group data to our auxiliary data. Second, we use the simulated health conditions, age, and gender for each individual who did not take up insurance and use this information to predict r_i. We predict r_i by performing a flexible regression of r_i on conditions, age, and gender in the small group data and using the regression coefficients to predict the score in the auxiliary data. Finally, using the the simulated Y_i^G, r_i, m_i and h_i we perform a simulated maximum likelihood estimation using Equation (4).

Counterfactuals We use these consumer preferences to analyze counterfactuals in which we change the market characteristics from which consumers can access to health insurance. In particular, we analyze how much consumer welfare and insurance take-up change if we move all SGM consumers to the HIX, under different scenarios of subsidies, taxes, and penalties. These counterfactuals allow us to analyze the role of plan characteristics offered in the different markets and of tax, penalty, and subsidy incentives. Since our approach allows for heterogeneity, we can compute individual welfare gains. We also analyze who would benefit from switching or from different incentives, focusing on the effects of income and health status on welfare changes.

In all counterfactuals, we express per capita expected utility for household i in the SGM, EU_i^{SGM}, using the standard formula:

$$EU_i^{SGM} = E\left[\max_{j=0,\dots,J} u_{ij}\right] = \log\left(1 + \exp\left((1-\sigma)\log\left[\sum_{j=1}^{J}\exp\left(\frac{\delta_{ij}}{1-\sigma}\right)\right]\right)\right) + \gamma, \tag{5}$$

where γ is Euler's constant. To calculate the expected utility from the HIX market, EU_i^{HIX}, we recompute δ_{ij} with the characteristics of HIX plans and recompute utility with these plans using Equation (5). We then define a measure of the change in consumer surplus in dollars from the change in available plans as:

$$\Delta CS_i = \frac{EU_i^{HIX} - EU_i^{SGM}}{\frac{\partial EU_i^{SGM}}{\partial Y_i^G}}, \tag{6}$$

where ΔCS_i in Equation (6) is the change in utility divided by the marginal utility of income, which is $\frac{\partial EU_i^{SGM}}{\partial Y_i^G} = \sum_{j=0}^{J} Pr_{ij} \times \frac{1}{Y_{ij}^D} \times (\alpha_1 + \alpha_2 r_i + \alpha_3 m_i + \alpha_4 h_i) \times \left(1 - \frac{\partial \tau}{\partial Y_i^G}\right)$. As Petrin (2002) noticed, this is just an approximation because the marginal utility of income might vary because of the income effects assumed by the non-linear specification of the utility function [10].

In addition to welfare, we report insurance take-up and government expenditures under counterfactual policies. We calculate take-up using the choice probabilities, Pr_{ij}, computed from our model. We compute government revenues from individual i as penalties plus taxes minus subsidies:

$$GR_i = Pr_{i0} \times f \times \pi(Y_i^G) + \sum_{j=0}^{J_i} Pr_{ij}\left[\tau\left(Y_i^G - d \times p_{ij}\right) - s \times \phi(Y_i^G, p_{ij})\right].$$

We compute equilibrium and non-equilibrium counterfactuals. In the non-equilibrium counterfactuals we take the choice set of plans, the characteristics and the premiums from the HIX as given, and we compute the welfare of the individuals conditional on those characteristics. In our equilibrium counterfactuals, we simulate a market similar to the HIX in which individuals can buy insurance for themselves and their families. In this market, we take the offerings and the characteristics of the plans as given but we allow the premiums for HIX plans to vary based on health costs to the insurer and the probability of choosing a plan. We assume that the markup of plans follows the Medical Loss Ratio rule that was

[10] We are also currently implementing a different approach to compute welfare by calculating the compensating varition which is a exact solution for models which are non-linear in income (Dagsvik and Karlström, 2005)

implemented under the ACA. This rules forced health plans in the individual market to spend at least 80% of their premiums on claims costs, or rebate these premiums (Cicala et al., 2019). Given this, our equilibrium counterfactuals adopt the simplifying assumption that plans premiums would be exactly at the MLR margin.

In order to compute premiums for our equilibrium counterfactuals we solve for a fixed point where premium for each plan is equal to the inverse of the Medical Loss Ratio times the medical and pharmaceutical costs for the integral of the share of that plan over individuals given the premiums in the market. Formally,

$$p_j = \frac{1}{MLR} \times \frac{\sum_i H_i \times Pr_{ij}(p_1, \ldots, p_{J_i}) \times HS_i}{\sum_i Pr_{ij}(p_1, \ldots, p_{J_i}) \times HS_i} \tag{7}$$

where H_i are the total costs of the individual given individuals' risk score, family composition, and plan's metal tier, and where we now explicitly note that Pr_{ij} is a function of all plan premiums $(p_1, ..., p_{J_i})$ offered in the choice set that each household i faces (J_i). HS_i is the household size of individual i.

In the equilibrium counterfactuals, we start by predicting total health expenditures under each health plan. Using data from individuals who opt in to their employer-sponsored USIC insurance, we model total expenditure family health costs (medical and pharmaceutical) in a non-parametric hedonic model that takes into account flexible interactions of plan characteristics with individual characteristics (r_i, m_i, h_i). We then predict total expenditure for all households in the sample across the plans offered in the HIX. We compute the total expenditure by plan as the total expenditure by household multiplied by the coverage of the plan's metal tier. The choice set is determined by the plans each consumer had to choose from in the non-equilibrium scenario. Therefore, our equilibrium and non-equilibrium results show the welfare change from the same set of HIX plans, but the equilibrium results allow for premiums to update.[11]

3 Data

The primary data are from a large health insurance provider, which we refer to as the United States Insurance Company, or USIC. USIC provides health insurance coverage to employers in the small group market. The data cover the years of 2013 through 2015 in ten different states: Arkansas, Delaware,

[11] See Section B for more details on the computation of equilibrium counterfactuals.

Illinois, Missouri, Oklahoma, Pennsylvania, Tennessee, Texas, Wisconsin, and Wyoming. We have data at both the employer-year and the enrollee-year level.

The employer-year level data include the number of employees eligible for health insurance coverage, the number of employees enrolled, the number of plans offered by the employer, characteristics of each plan (including coinsurance, physician copay, in-network deductible, in-network out-of-pocket maximum, out-of-network deductible, and out-of-network out-of-pocket maximum), and the total premium paid to the insurer for each plan. Table 1 shows the characteristics of firms in our data. Firms in our sample offer an average of 1.19 health insurance plans in which 61% of employees enroll. The average employer has 19.34 eligible employees. There are 32,046 unique firms in our data.

The enrollee-year data include age, gender, and the choice of health plan from the firm's offerings. We also have claims-level data, both medical and pharmaceutical claims, providing diagnoses, procedures, and dates of service. There are about 236,000 employees covered each year. We calculate a per-enrollee premium by diving the total premium paid to USIC in a year for a plan by the number of enrollees (employees and dependents) at that employer and plan during that year. We calculate the premium paid by a household by multiplying the enrollee premium amount by the number of enrollees in each household. In terms of the family composition, we assume that if an employee decides to buy insurance she does it for her and her family so we infer household composition from the enrollee data.

We use ACG risk scores to measure the predicted health expenditure risk, r_i, for each enrollee. Developed at the Johns Hopkins Bloomberg School of Public Health, the ACG system software uses claims-level data to calculate an "ACG risk score" for each enrollee in a year. The scores are based on age, gender, medical and pharmaceutical expenditures, diagnoses, and prescription drug consumption in the previous year. The risk index indicates the predicted relative healthcare cost for an individual over the year, and has a mean of one in a reference group chosen by the ACG software.

There are two primary limitations to our data for our estimation strategy. First, we do not have individual characteristics (age, gender, ACG scores, income, married status, number of kids) for individuals who are offered USIC insurance through their employers but decline this insurance. Secondly, we do not have income for individuals enrolled in a USIC plan through their employer. We supplement the USIC data with the Medical Expenditure Panel Survey (MEPS) Household Component. The MEPS is a nationally representative sample of households and contains information on demographic characteristics, health conditions, health insurance coverage, income, and employment.

We use a sample from the MEPS to represent individuals who decline the USIC insurance offered to them by their employer. To match those individuals from the MEPS who select the outside option to employers in our USIC data, we use an iterative matching process. As there are few individuals in the MEPS who satisfy the criteria of being (a) employed at small firms, (b) offered health insurance by their employer, and (c) declining that offer, the iterative process sorts MEPS individuals into "buckets" based on their firm size and industry. For each firm size-industry cell in our primary data, we create a bucket of at least twenty individuals in the MEPS. We then randomly select twenty MEPS individuals from the bucket so that each individual who selects the outside option in our primary data is represented by twenty possible draws of characteristics from the MEPS.

The MEPS data do not contain ACG risk scores, but are rich in the information collected on reported health status and include a number of diagnoses. From the claims data and enrollment data in our primary data, we predict ACG scores. We use a flexible specification that interacts diagnoses, industry fixed effects, firm size, age, and gender. The following diagnoses are reported in the MEPS and coded from ICD-9 diagnosis codes in the claims data: attention deficit disorder and attention deficit hyperactivity disorder, angina, arthritis, asthma, cancer, coronary heart disease, high cholesterol, diabetes, emphysema, high blood pressure, heart attack, and stroke. We calculate ACG scores for individuals choosing $j = 0$ by predicting scores plus a random shock drawn from a normal distribution of the mean squared error. We use ten draws by individual of these ACG scores for outsiders.

The second limitation to our data is that we do not have income for individuals enrolled in a USIC plan. Using the sample of individuals from the MEPS employed at small firms who are offered and accept their employer-sponsored health insurance, we use an iterative matching process to create five draws of wage income for each of the individuals in our primary data. The matching procedure is similar to that used to match MEPS outsiders to firms, though takes into account family structure. We assume individuals from USIC to be married if their spouse is covered by USIC insurance and assume individuals have the number of children that are also covered by USIC insurance. We create iterative buckets of at least seventy individuals from the MEPS over firm size, industry, and marital status. These incomes are joined to the primary data on marital status and whether or not the individual has children. The five observations with the closest age to the individual in the USIC sample are kept.

Our mean utility specification incorporates the utility that comes from disposable income, described in Equation (1). We use *TAXSIM* to compute tax rates, τ_{ij}, under the scenario in which premiums are paid pre-tax and the scenario in which premiums are paid with after-tax dollars. We assume that individuals file taxes jointly if a spouse is also enrolled on the USIC insurance plan. We assume the number of dependents to be the number of children enrolled on the USIC plan. Y_i^G is the total wage income for the individual and their spouse and total premiums, p_{ij}, depend on the number of family members enrolled on the plan. Table 2 compares individual characteristics for individuals who select into the USIC data ("insiders") and individuals who choose the outside option ("outsiders"). Insiders are older, more likely to be male, healthier, less likely to be married or have children, and have higher incomes.

Beginning January 1, 2014, the Affordable Care Act (ACA) provides subsidies to individuals in the form of premium tax credits. The premium tax credits, or subsidies, are available to individuals who purchase coverage in the HIX and have income between 100% and 400% of the federal poverty level. Subsidies are determined by individual characteristics, including gross income, state, family size, marital status, and number of children.

We compute subsidies, ϕ_{ij}, by first assuming that Y_i^G, wage income, is the annual gross income. We assume the same family structure we used for the *TAXSIM* calculations. Based on individual income and state, we determine how much above or below the poverty level an individual is. Individuals below 100% and above 400% do not receive any subsidies. Individuals contribute to the purchase of their health insurance through a yearly contribution. This contribution is a percentage of income based on the individual's federal poverty level (FPL). Lower income individuals are required to contribute a lower percentage of their income toward health insurance premium. For example, individuals at 200% FPL have a yearly contribution that is 6.3% of income. Individuals with 300-400% FPL have a yearly contribution of 9.5% of income.[12] The maximum subsidy an individual can receive is equal to the premium of the second lowest cost Silver plan available in the individual's state HIX less the annual individual contribution amount.

We also compute the penalties, $\pi(Y_i^G)$, that individuals would face if they did not fulfill the individual mandate to hold health insurance under the ACA. In 2014, individuals were fined the higher of $95 or 1% of household income for not having insurance. The penalty increased to the higher of $325 or 2% of household income in 2015.

In the counterfactuals, we move individuals from the plan choice available to them in the SGM to the HIX. We use the Health Insurance Exchange Public Use Files made available by the Center for Consumer

[12]The individual contribution schedule is described in Table 2 the IRS Instructions for Premium Tax Credit 8962 (https://www.irs.gov/pub/irs-prior/i8962–2014.pdf).

Information and Insurance Oversight (CCIIO) at the Centers for Medicare and Medicaid Services (CMS) to construct HIX plans available in our ten states. We construct plan level data to match the data from the insurer, including coinsurance, physician copay, in-network deductible, in-network out-of-pocket maximum, out-of-network deductible, out-of-network out-of-pocket maximum, and individual annual premium.

Table 3 compares the plan characteristics for plans offered by firms in the SGM to the plans offered on the HIX. SGM plans have lower annual premiums, in-network-deductible, and in-network out-of-pocket maximums. However, HIX plans are more generous in having lower copays, higher coinsurance (as percent paid by the insurer), and lower out-of-network deductibles and out-of-pocket maximums.

4 Results

In this section, we present the results of our demand model comparing the price elasticities with estimates in the literature. We also discuss the heterogeneity implied in our results. Table 4 summarize the estimates of the demand model. In all specifications, we control for different values of the outside option for different years using year fixed effects. We also control by plan type (PPO, HMO, POS, EPO), allowing for different plan types to provide different mean utilities to individuals. Columns I and II present the specifications where there is no heterogeneity across individuals in observables. Because of this, these specifications only use the data available in the USIC sample and constitute a good starting point to examine individual heterogeneity. Column I presents the estimates of the logit model ($1 - \sigma = 1$). The mean coefficient for the log price variable is ($\frac{\partial \delta_{imjt}}{\partial p_{jmt}}$) is -0.0001 and the weighted average own-price elasticity is -0.37. We report the weighted elasticities to account for the model assigning high price elasticities to plans with small market shares. By not interacting the premium with any individual characteristic, this model restricts the price coefficient (and the price elasticity) to be the same across individuals.

Allowing for correlation among the utility shocks of the inside option plans is a way to account for different types of consumers with different valuation for the inside option plans. The nested logit model is equivalent to a random coefficient model where there is heterogeneity in the dummy for the plans that are not the outside option (Berry, 1994). Column II presents the results of estimating the same model but including a random coefficient for the inside option dummy, or the nested logit model. The mean price coefficient ($\frac{\partial \delta_{imjt}}{\partial p_{jmt}}$) is -0.0001. The estimate of $1 - \sigma$ is 0.59, which implies correlation between the plans in the inside option. In this setting without individual heterogeneity in observables, a random coefficient on the inside option helps to reflect the heterogeneity in substitution patterns across consumers.

We then introduce individual heterogeneity by including the income of households in our specification. In order to able to do this, we use not only the USIC sample but also the auxiliary data from MEPS. We compute the disposable income, as presented in Section 2, and include the log of the disposable income in the specification of the mean utility to allow for income effects. Columns III and IV present the results of these estimates. In both specifications, the mean price coefficient ($\frac{\partial \delta_{imjt}}{\partial p_{jmt}}$) is similar and around -0.0002, slightly higher than in the previous two specifications. The weighted average own-price elasticity are approximately -0.84 in both cases, larger than in the previous specifications. While Column III constraint $1-\sigma$ to be 1 (Logit model), Column IV presents the unconstrained coefficients with of $0,98$. The value of this parameter is statistically different from 0 and also statistically different from the value of 1, which is the maximum for $1-\sigma=1$ to make the estimates to be consistent with a random utility model. Thus, the model rejects the logit model showing some, but not very high, unobserved correlation among the inside option plans.

Finally, we introduce further heterogeneity by including the risk score of employees (r_i) and the family structure (m_i and h_i) in our specification. We interact these household characteristics with all the characteristics of the plans, including the plan type indicators, and the log of disposable income ($log(Y_{ij}^D)$). Note that risk scores are functions of age, gender and past consumption of health services, so we are effectively introducing heterogeneity in many dimensions in this model. The Logit model is presented in Column V, and the Nested Logit model in Column VI. In both specifications, the mean price coefficient is very similar as in the previous two specifications that include income effects ($\frac{\partial \delta_{imjt}}{\partial p_{jmt}} = -0.0002$). Weighted average own price elasticities are approximately -0.78 for both models, very similar to the case of the model without interactions. The estimate for $1-\sigma$ is 0.97, statistically different from both extreme cases but very close to the Logit Model. Overall, our preferred specification is that of Column VI.

The previous estimates highlight three important facts. First, the price coefficients and the unobserved heterogeneity patterns change when we incorporate individual characteristics, via the utilization of auxiliary data and simulation methods. In models without individual characteristics, we cannot incorporate income effects and tax effects. This omission makes consumers appear much more inelastic to premium changes than in models where these effects are included. Second, the estimates show the trade off between including unobserved heterogeneity via a random coefficient that induce correlation among plans in the inside option and adding more detail individual characteristics. When we incorporate the observable heterogeneity by using individual characteristics, the unobserved heterogeneity reflected in the nested logit parameters reduces significantly. Third, all specifications with observed individual heterogeneity yield similar mean price coefficients and weighted average own price elasticities, so the main difference across them is that they imply different types and extents of heterogeneity across individuals. Heterogeneity is a key factor in our setting, because in our counterfactuals we will find the welfare gains/losses of different individuals, and we will understand which individuals win and lose under the different settings.

The estimates of the elasticities are in the range of previous estimates in the literature for other health care settings. Dafny et al. (2013) estimate lower elasticities, which range between -0.08 and -0.45, using a database for a large employer. Their elasticities are with respect to pre-tax employee contributions, whereas our estimates are for post-tax dollars. Ho and Lee (2017) find elasticities in the range from -1.23 for single-person households for one provider to -2.95 for families with children for a different provider. Ho (2006) finds an own-price premium elasticity of -1.24. Cutler and Reber (1998) and Royalty and Solomon (1998) use panel data for the employer-sponsored large group and changes in observed premiums to estimate elasticities of -2 and between -1.02 and -3.5, respectively. Strombom et al. (2002) estimate elasticities in a range between -0.8 and -5.2, using ”insurer-perspective” elasticities, calculated using the plans' total premiums. Graph 3a presents the smoothed histogram of the estimates of the individual own premium elasticity by plan for Column VI. While the weighted average price own plan elasticity is -0.78, the graph reflects the existence of significant heterogeneity.

Graph 3b presents the smoothed histogram of the weighted average own price plan elasticity by individual. The elasticities also exhibit large heterogeneity, with a distribution that is skewed to the left. In our model that captures rich patterns of heterogeneity, these elasticities depend on the plans that consumer face but also on the characteristics of the individuals like the income and health status. Graph 4a presents the smoothed distribution of the average elasticities by individual by different quartiles of the risk score variable (r_i). The graph presents two interesting facts of the setting. First, individuals who have higher risk are more elastic, since the distributions move to the left for the quartiles with higher risk. Second, these distributions show that there is a significant amount of heterogeneity even in the same risk quartile.

Graph 4b presents the distribution of the average elasticities by individual by different quartiles of gross income per capita (Y_i^G). Again, the distributions by quartiles provide evidence of differences across quartiles. Higher income income individuals are more inelastic, though there is also a lot of heterogeneity within income quartiles groups. These different patterns of substitution are dependent on rich characteristics of individuals and play a fundamental role in the counterfactuals to understand who gains and who loses from the alternative policies.

In terms of the other covariates, individuals prefer smaller out-of-pocket maximum with a one percent increase in the out-of-pocket maximum creating a drop in the average probability of choosing a plan of 0.8 percentage points. Additionally, the estimated effect of the deductible is not statistically significant, but consumers seem to care about out-of-network deductible strongly, consistent with them considering the possibility of having to visit an out-of-network physician or hospital. Finally, we show that being and HMO or a PPO has a negative impact on the average utility that a plan reports across individuals, compared with the other options available.

5 Counterfactuals

In this section, we present different counterfactuals in which we move consumers from the SGM to the HIX. We evaluate consumer welfare and government revenues under different tax-subsidy-mandate schemes in HIX, which additionally has different numbers of available plans with varying plan characteristics. For these counterfactuals, we use the estimated coefficients from our demand model in the SGM to predict the monetary value of welfare changes by individual. For the HIX, we use the plan offerings during the years 2014 and 2015 for all the markets in which we have data for the SGM. We present non-equilibrium and equilibrium results. In the non-equilibrium results, we assume that the characteristics and the premiums of the HIX plans remain the same when we move people from one market to the other. In the equilibrium counterfactuals, we assume that the characteristics remain the same but we compute the premiums as in equation 7. We compute the taxes and subsidies using our dataset from USIC complemented with MEPS data, with the help of *TAXSIM* from NBER and other sources as explained in the data section.

We discuss welfare changes and risk selection in two groups of counterfactuals. First, we analyze counterfactuals in which we "move" all consumers from the SGM to the HIX under the current setting of tax-subsidy-mandate arrangements in both markets. Second, we analyze counterfactuals in which we "move" all consumers from the SGM to the HIX under different tax-subsidy-mandate arrangements. For each of these counterfactuals, we analyze the descriptive statistics of the welfare changes and their heterogeneity across the distribution of welfare gains, income, and health risk. We also discuss the average individual take-up probability.

Additionally, as discussed before, different counterfactuals generate changes in net government revenues. There are three potential changes in net revenues from moving people from the SGM to the HIX. First, there is an increase in net tax revenues if premiums are paid with pre-tax dollars in the SGM and with post-tax dollars in the HIX. Second, the government could collect some revenues from penalties if individuals have a mandate to enroll when they are moved to the HIX. Third, the government spends some resources giving qualifying individuals subsidies if they enroll in the HIX. The amount of the subsidies changes with changes in the take-up and prices of the plans chosen. For each counterfactual, we present the net change in government revenue and discuss its composition.

5.1 Health Insurance Exchanges vs. Small Group Market

In the first set of counterfactuals, we discuss the relative value of the Small Group Market compared to the HIX. We switch every individual in our sample from the SGM to the HIX, leaving the tax-subsidy-mandate designs as they currently are. Therefore, in this counterfactual, everyone pays the premiums with pre-tax dollars in the SGM and with post-tax dollars in the HIX, eligible individuals receive subsidies in the HIX, and individuals do not have to pay a fee if they are uninsured.

When we "move" people from the SGM to the HIX, their choice set is considerably expanded. One important limitation of this exercise is that, since the utility function includes a logit error term with unbounded support, expanding the choice set offered to individuals overestimates the value to consumers of increased choice. In order to avoid this problem, we follow a strategy similar to Dafny et al. (2013) and we investigate three counterfactual scenarios to bound the welfare gains.

In the first scenario, called *plan swap scenario*, we maintain the same number of plans in the choice set for each individual, but instead substitute the plans currently offered for the plans that give *each* individual the highest average utility from the available plans in the HIX. In a different scenario, called *all plans scenario*, we allow consumers to choose among all the plans offered in their geographical market in the HIX. This scenario increases the number of plans dramatically so they are especially affected by the logit error problem. Finally, we also allow for a scenario that increases the number of plans less dramatically, by considering the plans that provide the highest utility in each metal tier of the HIX. This provides individuals with a choice set of four plans—one plan from each metal tier of bronze, silver, gold, and platinum. Therefore, this scenario reflects that individuals have some more value for having more choice in the HIX market, but the choice set expansion is limited, so it is less affected by the logit error term problem. In this scenario, called *average top metal tier*, we average individual utility across the plans offered in each geographical market, and allow consumers to choose among the four plans that have the highest average utility.

Table 5 presents the results for this counterfactual under the different scenarios. These results allow us to extract three takeaways. The first takeaway is that the HIX generates a higher value than the SGM for 72% of the consumers even in scenarios where the number of plans is held constant. In the case of the plan swap scenario,[13] about 72% of individuals are better off in the HIX than in the SGM. The median welfare gain faced by an individual moving from the small group market to the HIX is $901 and the mean welfare gain is $2,188, showing a right skewed distribution. The heterogeneity reflected in our setting is noteworthy. The 10th percentile (ordered by the welfare change) loses $2,743 while the 90th gains $7,546 from moving. Although consumers gain on average, the average take-up probability by individuals decreases by 47 percentage points in the HIX with respect to the SGM.

Since the number of plans is fixed, here the welfare changes come from differences in the plan offerings and the fiscal treatment of individuals in each of these markets. Government revenue decreases by $1,119 when individuals are moved to the HIX in the plan swap scenario. On one hand, taxes increase by $606 on average per individual, since premiums in the HIX are paid with post-tax dollars. However, the government pays subsidies on average of $1,725, although these subsidies are only paid to eligible consumers. 56% of consumers receive subsidies, and conditional on receipt, have an average subsidy of $3,064. This is consistent with average subsidies reported in other studies and the press.[14]

Consumer welfare gains are larger under the average top metal tier scenario. Around 95% of individuals are better off in the HIX when they are offered the best plan by tier on average across individuals.

[13] An additional point about the implementation of the counterfactuals is that the *plan swap scenario* is subject to a statistical problem in which, when we swap plans that are estimated to be the most preferred for employees within the relevant market, the estimated utility gains are likely to include positive estimation errors on average. For robustness, we follow the approach of Dafny et al. (2013), which consists of taking a certain number of draws from the estimated parameter distribution and for each draw calculating the distribution of welfare gains from the plan-swapping scenario.

[14] Kaiser Family Foundation estimated an average subsidy of $2,890 per eligible individual. See https://www.kff.org/health-reform/issue-brief/how-much-financial-assistance-are-people-receiving-under-the-affordable-care-act/. The New York Times reported average annual subsidies of $3,165 for eligible individuals using HealthCare.gov in 2015. See https://nyti.ms/1ES0WLI.

In this scenario, the mean welfare gain for individuals if we move everyone to the HIX is $12,118 and the median is $7,204. Again, we observe a lot of heterogeneity in welfare changes, with the 10th percentile gaining $828 and the 90th percentile $23,187. Graph 5 shows the smoothed distribution of the gains from this counterfactual under the average top metal tier, showing that the distribution has a right tail, with some people experiencing losses from the HIX but most people having sizable gains from the move. The take up probability decreases by 17 percentage points relative to the SGM, less than in the plan swap scenario. Government revenue decreases by $1,441 when individuals are moved to the HIX, with an average gain of $606 per individual in taxes and a $2,017 loss in subsidies per individual. Around 64% of individuals receive subsidies. Conditional on receipt, the average subsidy is $3,175. Again in this scenario, these amounts are consistent with the subsidies reported in other studies and the press.

A second takeaway is that giving individuals more options by offering them all the plans available in the HIX (our all plans scenario) makes consumers better off, with 99% of individuals better off in HIX. For the reasons discussed before, this scenario is an upper bound of the value of this market. The mean gain from moving to the HIX in this scenario is $49,555, and although the median is lower ($23,531) it is still a very significant amount. Heterogeneity in welfare gains is still very large, with the 10th percentile being $7,323 and the 90th percentile $81,430. In this scenario, only 1% of consumers are still better off staying in the SGM than moving to the HIX. Take-up increases by 27 percentage points. Government revenue decreases by $3,029 when individuals are moved to the HIX, with an average increase of $606 per individual in taxes and average decrease of $3,634 in subsidies. Around 66% of individuals receive subsidies in our sample. The average subsidy, conditional on receipt, is $5,479. Since the all plans scenario allows for individuals to choose from all the plans available on the HIX, this increases the average subsidy amount.

The third takeaway is that if individuals do not fully face the compensation of benefits with lower wages, many individuals will still find the SGM optimal, even when they have all the plans in the HIX available from which to choose. In the SGM, employers contribute to employee premiums. However, in the paragraphs above, we assumed that individuals pay the total premium of their health insurance. In other words, we assume that any potential benefit employees receive at the firm, for example, employer contributions to premiums, are already compensated through lower wages. However, it is also possible that different frictions of the labor market and tax incentives for employers to offer health insurance cause employers to contribute to premiums (Currie and Madrian, 1999; Lubotsky and Olson, 2015). We cannot estimate from our data what is the trade-off between benefits and wages. However, and as a point of reference, these results indicate that if all the premiums were paid by employers, still in the average top metal tier scenario around 30% of consumers would find it beneficial to stay in the small group market.

The fourth takeaway is that equilibrium counterfactuals would make the HIX premiums increase because of sorting of high risk individuals, and therefore the welfare gains in the HIX market would be smaller. In all the scenarios, the welfare gains from the HIX are smaller than in the non-equilibrium scenario. Government revenues also decreases in all scenarios, with taxes decreasing but subsidies increasing more due to both the increase in the premium and the probabilities of individuals choosing the plans.

5.2 The effects of subsidies and taxes in equilibrium

In the following counterfactuals, we consider alternative designs of the HIX in terms of tax-subsidy-mandate arrangements, in order to analyze how different fiscal incentives impact the welfare changes from moving people to the HIX. For the counterfactuals that follow, we discuss the average top metal tier scenario, which includes the effects of offerings and tax incentives holding the choice set to four plans, one by tier, to reflect the greater choice that consumers have in the HIX.

Effects of subsidies In Column 1 of Table 6, we repeat the non-equilibrium comparison of the SGM and the HIX under the top metal tier scenario, as a benchmark. In Column 2, we show the same counterfactual but now with equilibrium prices. The first thing to notice is that the (unweighted) average per capita premium increases by more than 100% in this counterfactual. This increase in premiums leads to a reduction in the median (mean) welfare gain of moving to the exchanges from $7,204 ($12,118) to $3,907 ($7,954). Because of that, only 79% of people are better off than in the SGM, while for the non-equilibrium about 95% of people were. Additionally, and even when premiums increase, take up also increases by 10 percentage points. This is explained because subsidies are related to the premium of the silver plan, so average subsidies increase from $2,017 to $4,778. The percentage of people receiving subsidies remain relatively constant, changing from 64% to 66%. Because of all the changes, the net revenue of the government changes from $-1,441 to $-4,172.

In Counterfactual 2, in Column 3, we further examine the role of subsidies. We estimate a counterfactual in which we move everyone to the exchanges and allow for equilibrium changes in prices, but consumers are not eligible for subsidies. In this counterfactual, the effect of subsidies on welfare is highlighted by the fact that the median welfare gain for individuals in only $303, although the mean welfare gain is $ 2,350. Take-up increases by one point compared with the SGM, which is much smaller than the 10 points increase in take-up observed in the counterfactual with subsidies. Government revenue increases by $606 compared to the SGM, due to the increase in taxes that is not upset by subsides in this case. Note that premiums are slightly higher than in the equilibrium counterfactual with subsidies, reflecting the sorting of high cost patients into plans.

Policy reform Counterfactual 3 in Column 4 of table 6 has the configurations of the exchanges that will rule from January 1, 2020. In this counterfactual, consumers will be able to buy health insurance plans in the exchanges with pre-tax dollars and still receive subsidies. The gains in consumer surplus are higher in this scenario than in the scenario in Column 2 with the current configuration of taxes and subsidies in the HIX and the SGM. The median (mean) welfare gain is $5,410 ($10,819), compared to $3,907 ($7,954) without the policy change. In other words, the median (mean) consumer has an increase of welfare of about $1,500 ($2,900). The heterogeneity in welfare gains also increases, with a distribution of gains that is even more skewed. Note that in this scenario, premiums will further increase because of the sorting of high cost consumers. The welfare gains are coming from the intensive margin (consumers having more welfare) rather than from the extensive margin, since take up only increases by three percentage points more than in the situation with the current tax/subsidy incentives. Note that, on the other hand, government revenues per capita decrease by about $1,500, mostly driven by forgone taxes rather than by subsidies, which remain similar to the scenario with the current tax incentives.

Overall, these counterfactuals allow us to understand the value of different tax-subsidy designs in the HIX and the effects of the new policy change. In general, subsidies are the main driving force behind the welfare gains from moving individuals from the HIX to the exchanges in scenarios with equilibrium prices. Allowing consumers to pay premiums with pre-tax dollars as in the policy reform makes the median consumer better off by about $1,500 dollars, which originates from a higher tax deduction in the HIX than in the SGM. Furthermore, these changes in tax/subsidy incentives have important distributive implications. Graph 5 shows the large heterogeneity of welfare changes from moving to the HIX from the SGM with the different configurations of the HIX. Finally, future versions of the paper will evaluate counterfactual scenarios with the effects of mandates.

Heterogeneity in welfare changes The relative welfare gains from moving to the HIX from the SGM are generally larger for healthier and higher income individuals and those working in larger firms. There are no significant differences across people working on different industries. Panel A of Table 7 presents the correlations between the welfare gains in the non-equilibrium plan swap, average top metal tier, and all plans scenarios and health condition, income, and firm size. For the average top metal tier scenario, the coefficients imply that a one standard deviation increase in income or firm size decreases the welfare gains from moving to the HIX by $731 and $1,013, respectively, while an increase of one standard deviation in risk increases the welfare gains by $4,060.[15] Panel B shows the correlations between welfare gains and individual and firm characteristics for the equilibrium baseline counterfactual. Finally, Panel C shows the correlations when we remove subsidies from the HIX and allow HIX premiums to be paid with pre-tax dollars.

We conclude four things from this exercise. First, these results imply that the SGM is advantageously selected in relation with the HIX since it is more attractive for lower risk individuals. Second, higher income individuals tend to benefit more from staying in the SGM than the HIX. Tax deductibility in the SGM benefits higher income individuals while subsidies in the HIX are targeted to low income individuals. Third, consumers working in larger firms always benefit relatively more from being in the SGM. Fourth, in general, individuals with higher risk and lower income have relatively larger gains from the current design of the HIX compared with situations in which we remove subsidies or allow for purchase of HIX plans with pre-tax dollars.

Figure 6 shows the heterogeneity in welfare changes graphically. In Figure 6a, we plot the average welfare change by per-capita income percentile. Individuals all along the income distribution benefit more from moving to the HIX, but in general, low income individuals benefit more from moving to the HIX. We observe lower income individuals benefiting from subsidy eligibility until the blue and orange lines converge. Allowing for HIX premiums to be paid with pre-tax dollars and for subsidies imposes the largest welfare gain across the distribution in equilibrium. Similarly, Figure 6b plots the average welfare change by health risk percentile. The patterns along the distribution of health risk are similar for all four formulations of welfare changes, though the ability to purchase premiums with pre-tax dollars has the lowest decrease in welfare. Individuals with very low health risk experience the greatest losses from moving to the HIX. This shows that the SGM is advantageously selected as it is more attractive for

[15]We obtain similar results also if we also condition on age and gender. Regressions are not presented but are available from the authors by request.

healthier individuals.

6 Conclusions

In this paper, we analyze the interplay between employer-sponsored insurance for the small group market and the ACA marketplaces. Specifically, we evaluate who benefits from being able to purchase insurance in the small group market relative to having this market eliminated and being faced with exchange plans. We develop a simple model of demand for insurance that accommodates the different designs of the tax incentives in the Small Group Market and the health insurance exchanges. We start by modeling the disposable income of individuals in a flexible way that describes the current rules in the SGM and the HIX. From this disposable income, we model the demand for health insurance plans in the SGM to recover the preferences of individuals.

To estimate the model, we use a unique dataset from a large U.S. health insurer, "United States Insurance Company" (USIC), with premium information on over 32,000 employers and more than 700,000 enrollees at these employers in the SGM. This dataset contains detailed data on plan offerings, plan characteristics and premiums, and individual characteristics and medical and pharmaceutical claims on individuals that purchase insurance through this insurance company. Since this dataset does not include information about income or individuals characteristics from those choosing the outside option, we complement these data by estimating the distribution of individual characteristics and income from the MEPS. We estimate the model via simulated maximum likelihood, where we integrate over the distributions of characteristics and income of individuals in order to get the choice probabilities of the individuals. Fundamentally in our setting, our estimates recover individual heterogeneity in price coefficients and elasticities of substitution in terms of health conditions, income, age and gender.

Finally, we simulate counterfactuals to evaluate the question of what value the small group market provides and what would occur if it were simply eliminated. We extract four main conclusions. First, we show that, even when holding the number of options fixed, most individuals tend to prefer the HIX, especially those individuals who are less healthy, have lower incomes, and work at smaller firms. Second, we show that offering individuals more choice leads them to have significant welfare gains from moving to the HIX. Third, subsidies are the main factor contributing to the advantage of the HIX. The policy reform of allowing individuals to buy health plans with pre-tax dollars in the exchanges will increase the median welfare gain for consumers by about $1,500 but will reduce government revenues by about the same amount. Additionally, there is heterogeneity in the welfare gains from different designs, with higher income individuals benefiting from paying premiums with pre-tax dollars in the SGM and lower income households benefiting from subsidies.

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A Tables and Figures

Figure 1: States in our estimation sample

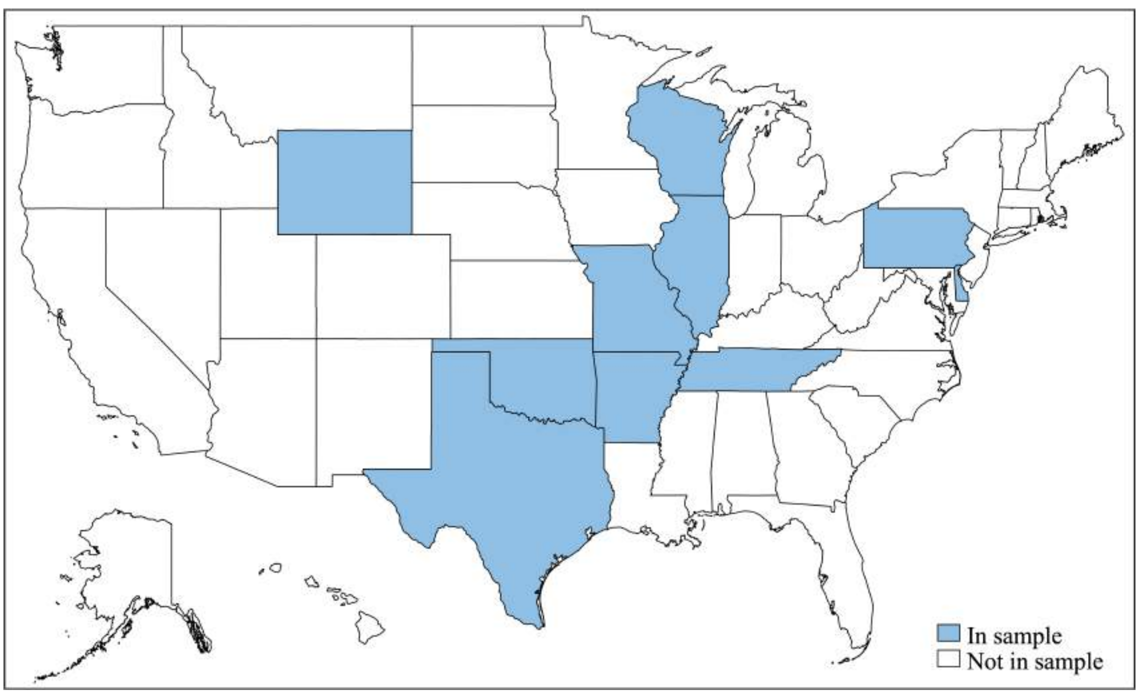


Figure 2: Distribution of plans offered by employers in SGM

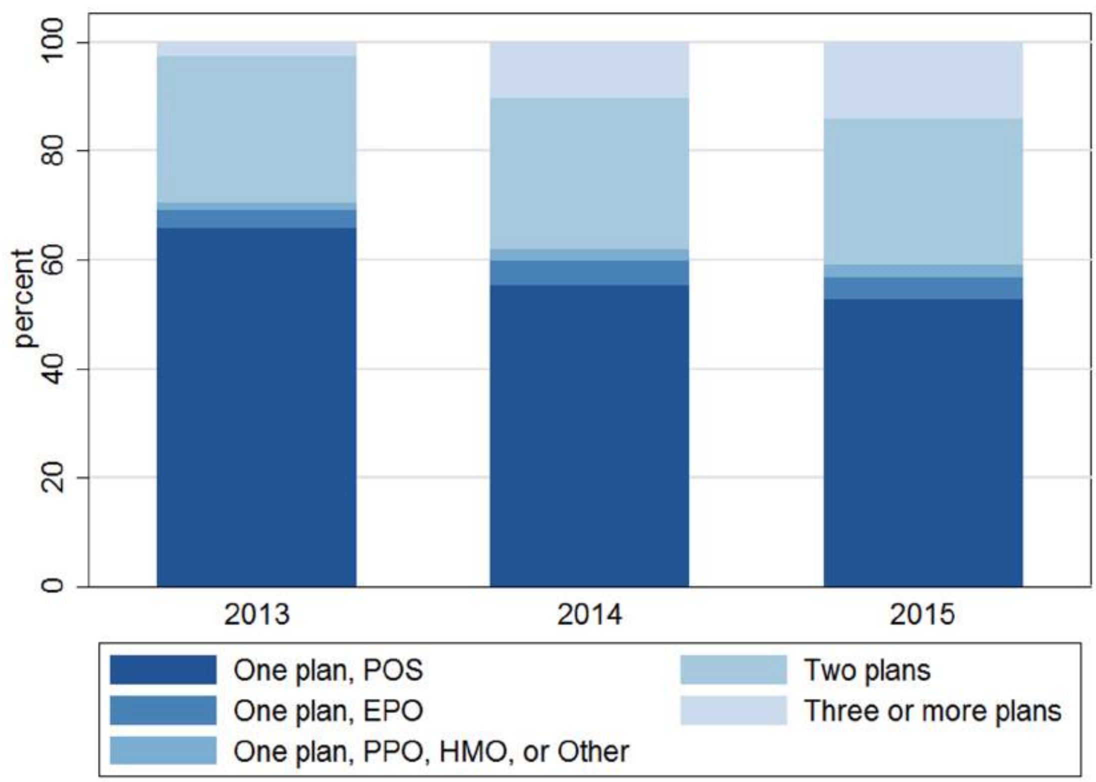
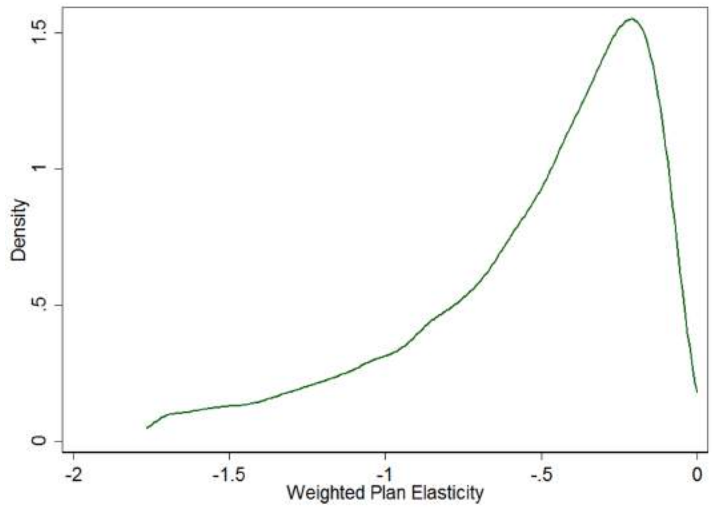
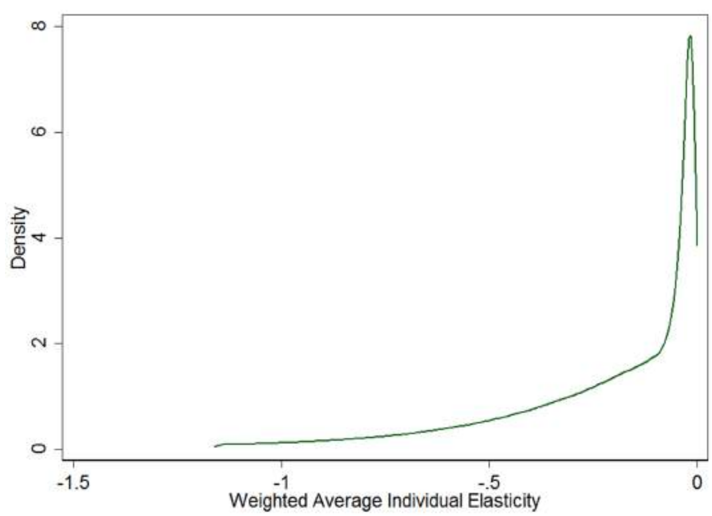


Figure 3: Plan Own Price Elasticity and Individual Elasticity

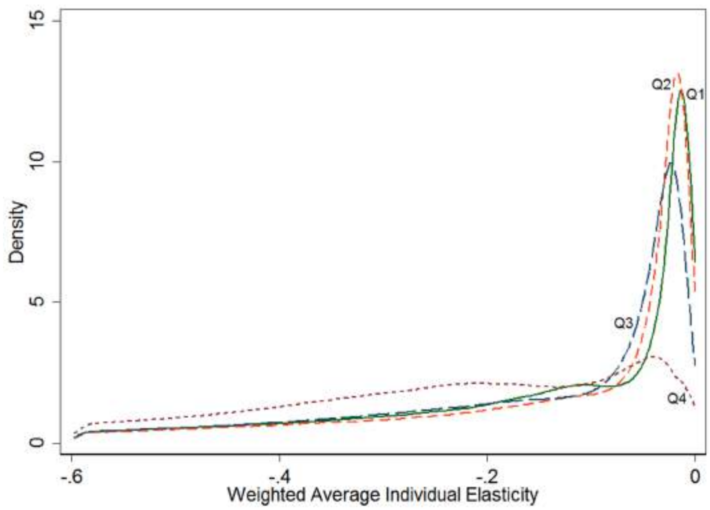


(a) Weigheted Average Plan Own-Price Elasticity

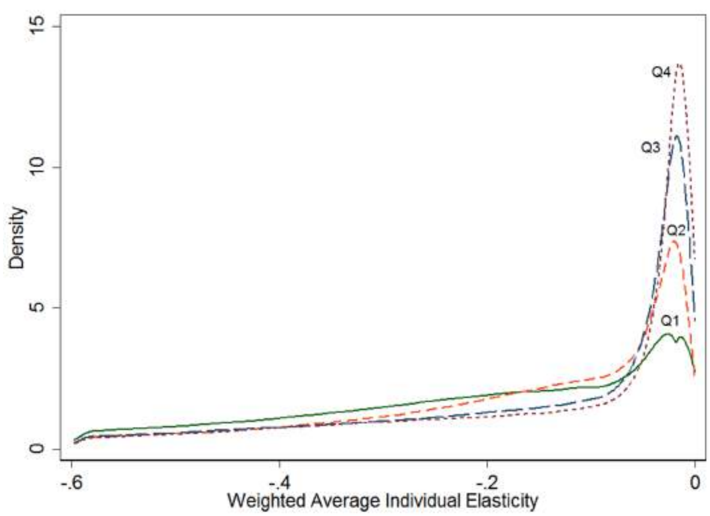


(b) Average Individual Own-Price Elasticity

Figure 4: Heterogeneity in Elasticities



(a) Heterogeneity by r_i quartile



(b) Heterogeneity by Y_i^D quartile

Figure 5: *Counterfactuals* Heterogeneity of Welfare Gains in Counterfactuals

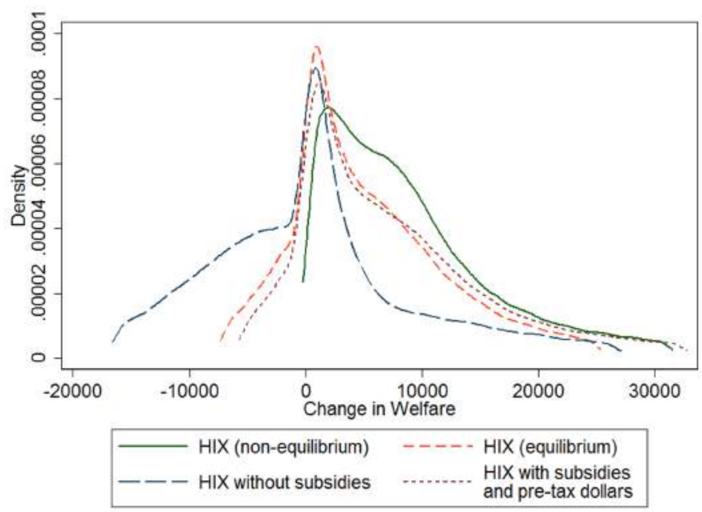
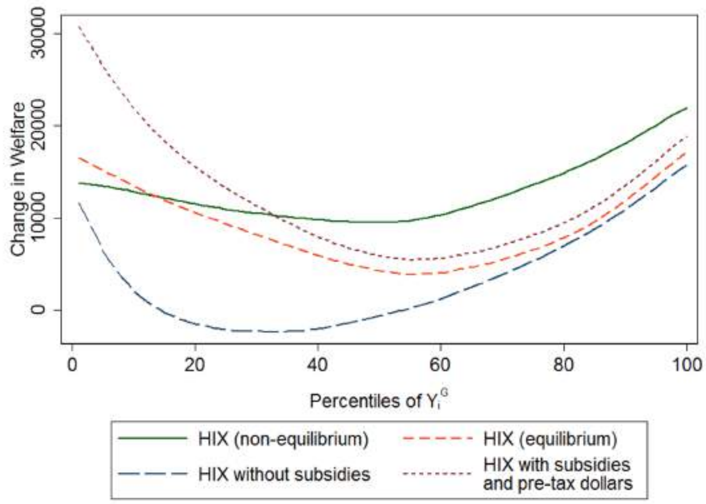
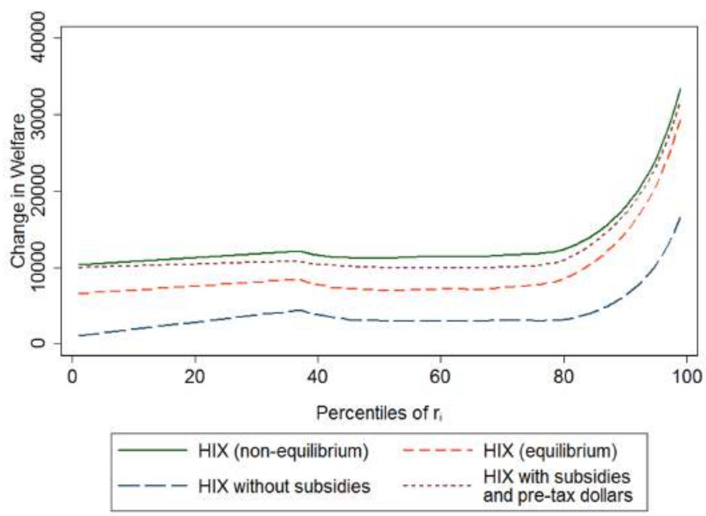


Figure 6: *Counterfactuals* Heterogeneity of Welfare Gains in Counterfactuals



(a) Welfare gains of scenarios HIX vs. SGM by income distribution



(b) Welfare gains of scenarios HIX vs. SGM by health risk distribution

Table 1: Firm Characteristics

Firm size	19.34
	(19.10)
Employee take-up	0.61
	(0.22)
Number of plans offered	1.19
	(0.49)
Industry Groupings	
Natural Resources, Mining, Construction, and Manufacturing	0.26
Transportation, Utilities, and Communications	0.04
Wholesale and Retail Trade	0.20
Finance, Insurance, Real Estate, and Professional and Business Services	0.08
Services	0.41
Public Administration and Military	0.01
Observations (firm-years)	59,187

Note: Each observation is one firm during one year, 2013-2015. Table reports mean values with standard deviations in parentheses.

Table 2: Individual Characteristics

	Overall	Insiders	Outsiders
Age (a_i)	42.64	44.96	38.47
	(9.73)	(11.36)	(2.39)
Female (g_i)	0.41	0.37	0.50
	(0.41)	(0.48)	(0.21)
Married (m_i)	0.37	0.27	0.55
	(0.38)	(0.44)	(0.09)
Number of Children (h_i)	0.54	0.43	0.72
	(0.64)	(0.76)	(0.18)
Risk Score (r_i)	0.88	0.69	1.21
	(0.79)	(0.90)	(0.31)
Household Income (Y_i^G)	54,903	54,841	55,016
	(19,768)	(23,506)	(9,613)
Observations (individual-year)	1,101,519	707,933	393,586
Individuals			
2013	389,250	244,190	145,060
2014	374,723	242,611	132,112
2015	337,546	221,132	116,414

Note: Each observation is one individual during one year, 2013-2015. Table reports mean values with standard deviations in parentheses. Insiders are individuals who choose a USIC insurance plan offered by their employer. Outsiders are individuals who declined the USIC plan offer and represented by individuals from the MEPS who (a) work at small firms, (b) were offered health insurance by their employer, and (c) declined the offer. Outsiders are matched to firms based on industry and firm size. Outsiders' r_i is predicted. Insiders are matched with income from the MEPS from individuals who a) work at small firms, (b) were offered health insurance by their employer, and (c) accepted the offer. Insiders' marital status and number of children is based on individuals covered on the employees USIC insurance plan, whereas marital status and number of children is from the MEPS. Income is averaged over 5 draws for insiders, and demographics are averaged over 20 draws for outsiders.

Table 3: Plan Characteristics

	SGM	HIX
Annual household premium	6,114	9,154
	(4,483)	(2,871)
In-network deductible	2,170	3,283
	(1,438)	(2,097)
Copay	24	0.01
	(10)	(0.75)
Coinsurance	0.86	0.91
	(0.17)	(0.16)
In-network out-of-pocket maximum	3,492	5,355
	(2,038)	(1,552)
Out-of-network deductible	4,140	3,977
	(2,856)	(4,760)
Out-of-network out-of-pocket maximum	8,244	6,293
	(4,410)	(7,576)
Observations (plan-year)	70,251	2,839
Average number of plans by state		
Arkansas		71.5
Delaware		23
Illinois		205
Missouri		68
Oklahoma		91.5
Pennsylvania		215.5
Tennessee		109.5
Texas		267
Wisconsin		338
Wyoming		30.5

Note: Each observation is one plan during one year, 2013-2015 for the case of the SGM and 2014-2015 for the case of the HIX. Table reports means with standard deviations in parentheses. Coinsurance is defined as the percentage paid by the insurer. The average number of plans by state is the average number of plans across 2014 and 2015 available on the exchanges.

Table 4: Specifications

	(I)	(II)	(III)	(IV)	(V)	(VI)
$\log(p_{ij})$	-0.29	-0.23				
	(0.005)	(0.004)				
$\log(Y_{ij}^D)$			3.96	3.94	5.72	5.64
			(0.02)	(0.03)	(0.04)	(0.05)
$\log(Y_{ij}^D) \times r_i$					-2.48	-2.45
					(0.12)	(0.12)
$\log(Y_{ij}^D) \times m_i$					-4.44	-4.39
					(0.04)	(0.05)
$\log(Y_{ij}^D) \times h_i$					-0.22	-0.20
					(0.02)	(0.02)
$1-\sigma$	1	0.59	1	0.98	1	0.97
		(0.006)		(0.007)		(0.007)
Plan Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Plan $\times$ Indiv. Char.	No	No	No	No	Yes	Yes
Plan Type FE	Yes	Yes	Yes	Yes	Yes	Yes
Plan Type $\times$ Indiv. Char	No	No	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Model	Logit	Nested Logit	Logit	Nested Logit	Logit	Nested Logit
Mean $\frac{\partial \delta_{imjt}}{\partial p_{jmt}}$	-0.0001	-0.0001	-0.0002	-0.0002	-0.0002	-0.0002
Wgt. avg. own-price elast.	-0.37	-0.34	-0.84	-0.84	-0.78	-0.78
Likelihood	-870,488	-868,081	-758,577	-758,574	-722,899	-722,885
Observations	25,958,225	25,958,225	25,958,225	25,958,225	25,958,225	25,958,225
Individuals	1,101,579	1,101,579	1,101,579	1,101,579	1,101,579	1,101,579

Note: Standard errors are in parentheses.

Table 5: Health Insurance Exchanges versus Small Group Market

Panel A: Non-equilibrium counterfactuals			
$\Delta\, WS = HIX - SGM$	Plan Swap	Average Top Metal Tier	All Plans
Mean welfare	2,188	12,118	49,555
10th percentile welfare	-2,743	828	7,323
Median welfare	901	7,204	23,531
90th percentile welfare	7,546	23,187	81,430
% Positive or equal	72%	95%	99%
Percentage point change in take-up	-47	-17	27
Net change in gov't. revenue	-1,119	-1,441	-3,029
Net change in taxes	606	606	606
Average subsidy amount	1,725	2,017	3,634
Percent receiving subsidy	56%	64%	66%
Average subsidy amount conditional on receipt	3,064	3,175	5,479
Premium (per capita)	2,456	3,706	4,761
Panel B: Equilibrium counterfactuals			
Mean welfare	-619	7,954	45,641
10th percentile welfare	-11,368	-3,775	4,748
Median welfare	73	3,907	21,395
90th percentile welfare	6,441	18,155	73,072
% Positive or equal	63%	79%	97%
Percentage point change in take-up	-2	10	25
Net change in gov't. revenue	-5,177	-4,172	-4,604
Net change in taxes	606	606	606
Average subsidy amount	4,035	4,778	5,210
Percent receiving subsidy	50%	66%	66%
Average subsidy amount conditional on receipt	8,073	7,283	7,926
Equilibrium premium (per capita)	7,000	7,652	10,942
Average expected spending (per capita)	5,603	6,121	8,751

Note: 138,313 observations (individual-years) in 2014 and 2015. Change in take-up is the average change in the probability of take-up when moving from the SGM to the HIX. Net change in government revenue is the average individual change. Welfare, premiums, and expected spending are at the per capita level.

Table 6: Health Insurance Exchanges versus Small Group Market with Different Tax Incentives (Average Top Metal Tier Scenario)

	CF1 HIX v SGM (non equilibrium)	CF1 HIX v SGM (equilibrium)	CF2 HIX without subsidies v SGM (equilibrium)	CF3 HIX with subsidies and pre-tax dollars v SGM (equilibrium)
Mean welfare	12,118	7,954	2,350	10,819
10th percentile welfare	828	-3,775	-12,376	-2,271
Median welfare	7,204	3,907	303	5,410
90th percentile welfare	23,187	18,155	17,815	23,344
% Positive or equal	95%	79%	53%	83%
Percentage point change in take-up	-17	10	1	13
Net change in gov't. revenue	-1,441	-4,172	606	-5,666
Net change in taxes	606	606	606	-714
Average subsidy amount	2,017	4,778	0	4,952
Percent receiving subsidy	64%	66%	0%	66%
Average subsidy amount conditional on receipt	3,175	7,283	0	7,538
Premium (per capita)	3,706	7,652	7,803	9,375

Note: 138,313 observations (individual-years) in 2014 and 2015. Change in take-up is the average change in the probability of take-up between the two scenarios. Net change in government revenue is the average individual change.

Table 7: Impact of Individual and Firm Characteristics on Welfare Change

	r_i	Y_i^G	Firm Size
Panel A: Non-Equilibrium HIX			
Plan Swap	1,374* (666)	1,754*** (64)	-398 (255)
Average Top Metal Tier	4,060 (2,767)	-731*** (204)	-1,013 (987)
All Plans	36,169 (20,860)	663 (672)	-5,213 (7,442)
Panel B: Equilibrium HIX			
Plan Swap	2,031** (734)	-3,625*** (90)	-719* (335)
Average Top Metal Tier	4,184 (2,561)	-2,044*** (179)	-1,240 (914)
All Plans	35,948 (20,663)	108 (656)	-5,282 (7,371)
Panel C: Counterfactual HIX, Average Top Metal Tier			
CF1: HIX v SGM (non-equilibrium)	4,060 (2,767)	-731*** (204)	-1,013 (987)
CF1: HIX v SGM (equilibrium)	4,184 (2,561)	-2,044*** (179)	-1,240 (914)
CF2: HIX without subsidies v SGM	3,155 (2,025)	-853*** (236)	-1,770* (736)
CF3: HIX with subsidies and pre-tax dollars v SGM	3,866 (2,591)	-2,937*** (243)	-1,237 (927)

Note: All regressions contain industry, state, and year fixed effects. 138,313 observations (individual-years) in 2014 and 2015. r_i, per capita Y_i^G, and firm size are standardized to have a mean of zero and a standard deviation of one. Standard errors in parentheses.

B Appendix: Equilibrium Counterfactuals

In the equilibrium counterfactuals, we allow for the premium in the HIX plans to vary based on health costs to the insurer and the probability that individuals choose a plan.

We first assume that the markup of plan premiums over total medical expenditures follows the Medical Loss Ratio (MLR) rule implemented under the ACA. The ACA requires insurers to spend at least 80% of premiums on medical care. We assume that plans' premiums would be at the MLR margin, and so premiums are set to be no more than 125% of expenditures.

We begin by predicting total health expenditures under each health plan. Using data from individuals who opt in to their employer-sponsored USIC insurance, we model USIC's annual expenditure for family health costs in a non-parametric, hedonic model. We predict annual expenditure by performing a flexible regression of expenditure on plan characteristics and their interaction with individual characteristics of r_i, m_i, and h_i. We use the regression coefficients to predict insurer expenditure for each of the health plans available in the HIX.

We compute the total expenditure by plan as the total expenditure by household multiplied by the coverage of the plan's metal tier. The choice set is determined by the plans each consumer had to choose from in the non-equilibrium scenario. Therefore, our equilibrium and non-equilibrium results show the welfare change from the same set of HIX plans, but the equilibrium results allow for premiums to update.

For our main analysis, we limit the plans available to the *average top metal tier* plans. Based on welfare from non-equilibrium counterfactuals, we select the plans that provide the highest average utility plan across individuals in each metal tier offered in each geographical market.

We then allow for premiums to update based on the individuals who select into a plan and their annual expenditure (weighted by the probability of choosing a plan), times the markup. We solve for a fixed point where premium for each plan is equal to the inverse MLR times total expenditure for the integral of the share of that plan over individuals given the current premiums in the market. This is formalized by:

$$p_j = \frac{1}{MLR} \times \frac{\sum_i H_i \times Pr_{ij}(p_1, \ldots, p_{J_i}) \times HS_i}{\sum_i Pr_{ij}(p_1, \ldots, p_{J_i}) \times HS_i}, \tag{8}$$

where $\frac{\sum_i H_i \times Pr_{ij}(p_1,\ldots,p_{J_i}) \times householdsize}{\sum_i Pr_{ij}(p_1,\ldots,p_{J_i}) \times householdsize}$ is the average individual expected plan cost. H_i is individual cost scaled by the actuarial value of the metal tier, where the insurer pays 60% of medical costs for a Bronze plan, 70% of costs for a Silver plan, 80% for a Gold plan, and 90% for a Platinum health plan. HS_i is the household size of individual i. Since households pay different premiums for the same plans based on household size, we calculate an individual-level premium. As the premium changes, individuals then update the plans they choose from the choice set. We hold other plan characteristics constant. We set a tolerance of 1 and iterate until the difference between new individual premiums and old individual premiums is below the tolerance level.