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INTERACTION OF THE LABOR MARKET AND THE HEALTH INSURANCE SYSTEM: EMPLOYER-SPONSORED, INDIVIDUAL, AND PUBLIC INSURANCE

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ABSTRACT

We study regulations on the health insurance system for working-age U.S. households, consisting of employer-sponsored health insurance (ESHI), individual health insurance exchange (HIX), and Medicaid. We develop and estimate an equilibrium model with rich heterogeneity across local markets, households, and firms, which highlights the inter-relationship between various components of the health insurance system as well as their relationship with the labor market. We estimate the model exploiting variations across states and policy environments before and after the Affordable Care Act. In counterfactual experiments, we consider policies to cross subsidize between ESHI and HIX, which include pure risk pooling between the two markets as a special case. We find such policies would benefit most households, improve average household welfare, and decrease government expenditure. Furthermore, the welfare gains are larger if the cross subsidization is interacted with Medicaid expansion.

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1 Introduction

For the vast majority of working-age households in the United States, health insurance is attainable via three channels: employer-sponsored health insurance (ESHI), private individual insurance markets, currently known as the health insurance exchange (HIX), and public insurance mainly via Medicaid. A theme of many past reforms and ongoing policy debates is how to simultaneously regulate all three components of the health insurance system.[1] The major goal of this paper is to contribute to this policy discussion.

To this end, one needs to account for several factors. First, the various components of the health insurance system are intrinsically inter-connected, as households sort into different insurance options (including non-insurance). Second, the health insurance system is closely connected to the labor market. Directly, 85% of the insured obtain insurance from their or their spouses' employers that offer ESHI as part of the compensation. Indirectly, household income is a key determinant of Medicaid eligibility and government subsidies for individual health insurance premiums. Therefore, a framework aimed at shedding light on the design of health insurance regulations should take such connections into account. Third, to the extent that impacts of health insurance regulations can be highly heterogeneous across households, employers (firms), and local markets, a framework incorporating such heterogeneity becomes necessary if policy makers are concerned about distributional effects.

In this paper, we provide such a framework. We develop and estimate an equilibrium model, where we treat each state in the U.S. as a market that consists of a labor market and two insurance markets: one for individual health insurance and another for ESHI. Markets are subject to various health insurance regulations, which may vary across states and policy eras. Each state consists of a distribution of firms and households. Households differ in their demographics (including health status), skill levels and tastes. Skills and tastes are unobservable to the researcher and may be distributed differently across states. A household chooses, for each adult member, among the options of full-time jobs with and without ESHI, part-time jobs with and without ESHI, and non-employment. It also makes decisions concerning Medicaid enrollment (if eligible) and individual health insurance purchases. Firms, which are endowed with heterogeneous production technologies, choose the number of workers to hire from each (skill, full/part time) category and whether or not to offer ESHI. Wages, premiums for individual health insurance, and ESHI clear the corresponding market in the equilibrium.

To estimate such a model, which allows for unobserved heterogeneity across households, firms and states, one needs data with rich variation. We utilize the opportunity provided by

[1] For example, the 2010 Affordable Care Act expanded the eligibility of Medicaid, provided premium subsidies for households on HIX, and imposed a tax penalty on large firms not offering ESHI.

the 2010 Affordable Care Act (ACA) and exploit 1) the change in policy environments before and after ACA, which involved a comprehensive re-design of various policy components; 2) the targeted nature of certain components of the ACA that created variation in policy doses received by different firms and/or households within the same market; and 3) the differential implementation across states with respect to Medicaid expansion, which leads to further policy variation across states under the same policy era. With data from both before and after the ACA, we estimate the model via indirect inference, where we choose auxiliary models to fully exploit the aforementioned variation under the assumption that the *state-specific* distribution of unobservables is the same pre and post ACA (conditional on observables).

Specifically, we use data from the American Community Survey, the Current Population Survey, Medical Expenditure Panel Survey, and the Kaiser Family Employer Health Insurance Benefit Survey. The first three data sets provide information on household characteristics, labor supply and health insurance choices, wages, and medical expenditure; while the fourth provides information on firm size, ESHI provision, and employee composition in terms of wage levels and full/part time status. For the purpose of model validation, we deliberately leave the post-ACA data for a non-random sample of states out of the estimation. The estimated model matches the patterns in the data, including in the hold-out sample.

Using our estimated model, we conduct two sets of counterfactual experiments that are largely motivated by the following observation. Our estimation results suggest a positive correlation between worker skill and their preferences for health insurance. In the equilibrium, high-skill workers are more likely to sort into firms offering ESHI, which are more likely to be endowed with more skill-biased technologies. Households who choose to be non-employed or earn wages low enough to be eligible for Medicaid are more likely to be at the lower end of the skill distribution. Under the current health insurance system, the high-skilled and the very low-skilled are largely separated from the risk pool on HIX. Unlike ESHI, HIX insurance is not bundled with one's job and hence may be more susceptible to adverse selection.

Various policies have been proposed to enlarge/improve the risk pool on HIX, mostly aimed at influencing households' choices between participating in HIX and staying uninsured.[2] We take a different perspective and examine the potential of a new alternative: subsidization *across* ESHI and HIX, which includes risk pooling across ESHI and HIX markets as a special case. We find that the average household welfare would increase by \$189 to \$340 (as measured by annual consumption equivalent variation), depending on the degree of cross subsidization, and that over 70% of households would gain in each case. These welfare gains are achieved simultaneously with savings in government expenditure in the health insurance system. The

[2]For an example of recent research on this issue, see Einav *et al.* (2019).

uninsured rate would decrease by 0.1 to 0.3 percentage point (ppt) from the baseline economy (the ACA environment in 2015), and full-time employment would increase by 0.1 ppt. To further illustrate the interaction across ESHI, HIX, and Medicaid, we contrast the impact of ESHI-HIX cross subsidization for the *same* state if it expanded Medicaid and if it did not expand Medicaid. The results imply that ESHI-HIX cross subsidization would lead to higher welfare gains when it is interacted with Medicaid expansion.

Our paper contributes to the broad literature that studies the link between the health insurance system and the labor market, especially those via the lens of labor market equilibrium models.[3] For example, Dey and Flinn (2005) estimate an equilibrium search model with endogenous ESHI to evaluate the extent to which ESHI affects job mobility and efficiency. Using a similar framework, Aizawa and Fang (2019), Aizawa (2019), and Fang and Shephard (2019) tailor their models to reflect features of the health insurance market before and after the ACA, which are estimated using pre-ACA data and used to study potential impacts of the ACA through counterfactual experiments.[4] Our paper well complements these studies. Instead of evaluating the ACA's impact via counterfactual simulations, we exploit policy variation associated with the ACA to estimate our model in order to study the effect of counterfactual policies with relatively less dependence on the model structure. Exploiting this data variation also allows us to incorporate rich heterogeneity across states, households, and firms in our analysis. A more substantial difference is the main focus of our paper, which is to provide an integrated framework that allows one to exploit new ways to regulate various parts of the health insurance system in a complementary manner.

Our paper also complements studies that examine the impact of public health insurance programs via the lens of individual decision models (e.g., Rust and Phelan (1997), French and Jones (2011), and De Nardi *et al.* (2016)). Particularly related to our paper, Pohl (2018) studies the effect of geographical heterogeneity of pre-ACA Medicaid policies in a static single agent labor supply model; French *et al.* (2018) estimate a life-cycle model of labor supply and consumption using pre-ACA data and simulate the potential impact of the ACA on retirement, savings, and welfare.

A different branch of the literature on health insurance reforms is more design-based, using experimental or quasi-experimental variation. For example, Finkelstein *et al.* (2012) and Baicker *et al.* (2014) study the impact of the Oregon Medicaid experiment on health and labor supply, Kolstad and Kowalski (2012) and Kolstad and Kowalski (2016) study the Massachusetts health care reform, Garthwaite *et al.* (2014) study the Tennessee Medicaid reform, Gooptu *et al.*

[3]See Currie and Madrian (1999) and Gruber (2000) for reviews of earlier work in this literature.

[4]Using macroeconomic tools, Pashchenko and Porapakkarm (2013), Hansen *et al.* (2014), Ozkan (2017), Nakajima and Tuzemen (2017), and Cole *et al.* (2018) study aggregate impacts of the ACA.

(2016), Frean *et al.* (2017), Kaestner *et al.* (2017), and Leung and Mas (2018) study the impact of ACA. More recently, Garthwaite *et al.* (2019) find significant heterogeneity across Medicaid-expansion states in the effects of the expansion on health care utilization, highlighting the need to consider geographical heterogeneity in evaluating the welfare incidence of health care polices.

A set of recent studies on ACA reforms have focused on the individual health insurance market. For example, Hackmann *et al.* (2015), Handel *et al.* (2015), and Tebaldi (2017) develop equilibrium models of ACA HIX markets and study impacts of various regulations on HIX. Kowalski (2014) uses variation before and after the ACA in regulations on individual health insurance markets to study the early impact of the ACA in different states. Diamond *et al.* (2018) study strategic take-up and drop-out behaviors by consumers on HIX. Our paper complements these studies well. While this set of papers incorporate HIX market structures in more details than we do, we focus on the interaction across HIX, ESHI, and Medicaid.

Finally, to the extent that health insurance subsidies are a particular type of in-kind transfer, our paper is also related to studies assessing the impact of government-provided in-kind benefits. For example, Keane and Moffitt (1998), Chan (2013), Blundell *et al.* (2016), and Low *et al.* (2018) study the impact of welfare programs on labor supply. In this context, our paper is most closely related with Gayle and Shephard (2019), who emphasize the importance of modeling equilibrium market responses for understanding the optimal design of tax and welfare programs.

The rest of the paper is organized as follows. Section 2 describes the policy background of the ACA; Section 3 describes the model; Section 4 describes the data; Section 5 explains our estimation strategy; Section 6 reports the estimation results; Section 7 conducts counterfactual experiments; and Section 8 concludes the paper. Additional details are in the appendix.

2 Background Information

We use sample periods both pre and post ACA (2012 and 2015) in order to exploit rich variation associated with the ACA, which consists mainly of five components. Below, we describe each component, highlighting ACA specifics that are applicable for our 2015 sample year.

Individual Mandate Since 2014, individuals are required to be covered by a health insurance plan that meets minimum standards or pay a tax penalty.[5] The amount of the tax penalty depends on household income and household size, increased between 2014 and 2016. In 2015, the penalty was the maximum of (a) 2.0% of household income in excess of the 2015 income tax filing thresholds and (b) \$325 per adult plus \$162.50 per child, up to a \$975 maximum for

[5]The individual mandate was abolished in 2019.

the family.

Employer Mandate Starting in 2015, every employer with more than N full-time-equivalent employees are required to provide a health insurance plan meeting minimum standards to full time employees and their dependent children or to pay a tax penalty, where full time is defined as average weekly hours of 30 or more. In 2015, $N = 100$, and from 2016 onwards, $N = 50$. The tax penalty is $2,000 (indexed for future years) for each full-time employee, with the first 30 employees excluded from the calculation.

Health Insurance Exchanges The *state-based* health insurance exchanges (HIX), or simply the marketplaces, were established in 2014. An individual can purchase a health insurance plan from insurers *only in his/her state.* The design of health insurance plans is government-regulated and categorized into four plans with different levels of generosity: bronze, silver, gold, and platinum. Insurers need to offer the same plans to every consumer. Insurance premiums are subject to modified community rating: premiums can vary *only* based on age and smoking status, with the degree of variation set by the government.[6]

Income-Based Subsides for Plans from HIX Individuals may obtain both premium and coinsurance subsidies from the government if they purchase health insurance from HIX. Individuals are eligible for the subsidies if (1) they are unable to get affordable coverage through an eligible employer plan that provides the minimum generosity; (2) they are not eligible for any other government health insurance program (e.g., Medicaid); (3) their household income is between 100% and 400% of Federal Poverty Line (FPL). The amount of subsidies varies by income, family size, and states of residence. In general, individuals and families whose household income for the year is between 100% and 400% of FPL for their family size may be eligible for the premium subsidies, and the subsidies decrease with income. If household income is around 100% of the FPL, subsidies are designed such that the maximum premium contribution of the household is equal to 2% of household income. If income is around 400% of the FPL, it is 9% of the household income.[7] In addition, individuals purchasing the silver plan can obtain an income-based tax credit, which serves as a cost-sharing subsidy.

[6] The regulations are set by the federal government, based on which, state governments can set further restrictions.

[7] If states offer Medicaid to individuals whose income is below 100%, then they are not eligible for these subsidies. For additional details, see https://www.irs.gov/Affordable-Care-Act/Individuals-and-Families/Questions-and-Answers-on-the-Premium-Tax-Credit

Medicaid The ACA specifies that Medicaid should expand to cover uninsured individuals with household income below 133% of FPL. However, it is *not* a mandate that states shall expand Medicaid. In 2015, 32 states (including Washington DC) expanded Medicaid to cover the sub-population as the ACA specifies. In particular, most states in the northeast expanded Medicaid, while half of the states in the south did not expand Medicaid.

3 Model

3.1 Environment

There are M isolated markets defined by state and policy era (pre-ACA and ACA), each consisting of a labor market, an individual health insurance market, and an ESHI insurance market. In each market m, there is a distribution of heterogeneous households, making decisions on labor supply and health insurance status, and a distribution of firms that produce homogeneous goods using labor inputs, but with heterogeneous technologies. A firm makes decisions on the quantities of different labor inputs and the provision of health insurance offered to its workers.

Each household is characterized by $(x, \mathbf{s}, \boldsymbol{\chi}, \epsilon)$, where x is a vector of observable characteristics while $(\mathbf{s}, \boldsymbol{\chi}, \epsilon)$ are unobservable to the researcher.[8] In particular, $\mathbf{s}$ and $\boldsymbol{\chi}$ are both two-dimensional vectors of discrete variables: $\mathbf{s}$ consists of each spouse's human capital level and $\boldsymbol{\chi}$ consists of their preference types; $\mathbf{s}$ and $\boldsymbol{\chi}$ may be correlated.[9] The distribution, $\Pr\left((\mathbf{s}, \boldsymbol{\chi})\,|x, state\right)$, varies with x and across states. ϵ is a vector of choice-specific taste shocks that are i.i.d. across households.

Each labor market is perfectly competitive with a vector of wages $\{w^m_{shz}\}$ for each worker-job category in m, where a category is characterized by human capital level s, part time or full time $h \in \{P, F\}$ and employer insurance coverage $z \in \{0, 1\}$. Exchanges on the labor market are based on (s, h, z) and blind to $(x, \boldsymbol{\chi}, \epsilon)$.

Remark 1 *We take the distribution of x directly from the data, which may differ for the same state across policy eras for reasons we abstract from, e.g., migration.*[10] *Via the correlation between x and unobservables, our model allows the distribution of $(\mathbf{s}, \boldsymbol{\chi})$ in a state to differ across policy eras. However, a key assumption is that the conditional distribution $\Pr\left((\mathbf{s}, \boldsymbol{\chi})\,|x, state\right)$ is constant across policy eras.*

[8] x includes marital status, number of young children, and each spouse's gender, age, education, and health status.

[9] In the case of singles, the second entry of the vector is irrelevant.

[10] Some studies have examined migration responses to ACA, e.g., Goodman (2017) finds no effect of the ACA Medicaid expansion on migration.

3.1.1 Insurance and Out-of-Pocket Health Expense

Each worker's health insurance status is described by a vector $INS \in \{0,1\}^4$, where $INS_1 = I(\text{ESHI})$, $INS_2 = I(\text{spousal ESHI})$, $INS_3 = I(\text{Medicaid})$, $INS_4 = I(\text{individual insurance})$. We assume that all four statuses are mutually exclusive, so that $\sum_{s=1}^{4} INS_s \in \{0,1\}$ with $\sum_{s=1}^{4} INS_s = 0$ indicating no insurance. Let $\mathbf{INS}$ be the 4×2 matrix of health insurance status of the couple.

A household's out-of-pocket health expense OOP varies with its characteristics x (including health statuses of household members), its insurance status, the market it belongs to, and the individual insurance premium (r). In addition, OOP is subject to medical expenditure shocks that are realized after the household makes its decisions.[11] The distribution of OOP is given by

$$OOP \sim F_{OOP}\left(x, \mathbf{INS}, m, r\right).$$

A major role of insurance is to make the OOP distribution less dispersed for a household.

3.1.2 Household Preference

A household's utility depends on consumption C, leisure, and health insurance status, the trade-offs among which may be viewed differently by households with different $(x, \boldsymbol{\chi})$, such that

$$u(C, \mathbf{h}, \mathbf{INS}; x, \boldsymbol{\chi}) = \frac{\left(\frac{C}{n_x}\right)^{1-\gamma_{\boldsymbol{\chi}}}}{1-\gamma_{\boldsymbol{\chi}}} + \varpi_{\mathbf{INS}} - D\left(\mathbf{h}, \boldsymbol{\chi}, x\right),$$

where n_x is an adult-equivalence factor that varies with family size.[12] $\gamma_{\boldsymbol{\chi}}$ is a risk-aversion parameter that may differ by household type. $\varpi_{\mathbf{INS}}$ captures non-pecuniary preferences for different types of insurance. $\mathbf{h} = [h, h']$ is the vector of labor supply status of the household and $D\left(\mathbf{h}, \boldsymbol{\chi}, x\right)$ is disutility from work.

3.1.3 Production Function

At each human capital *index/level* s, we denote k_s as the corresponding *amount* of human capital. Let n_{jsh} be the number of employees with human capital level s and working status h hired by Firm j. Let l_{jsh} be the Type-(s,h) labor input in Firm j, which is the total amount of k_s possessed by the n_{jsh} employees. Firm j's production is governed by the following modified

[11] Given the static nature of the model, we treat a health shock purely as an expenditure shock.

[12] We follow the literature and set $n_x = 1$ for singles without children, $n_x = 1.3$ for singles with children, $n_x = 1.5$ for couples without children, and $n_x = 1.8$ for couples with children.

CES function

$$Y_j = T_j \left[A_j \sum_{s \geq s^*} B_{sF} l_{jsF}^{\rho} + (1 - A_j) \left(\sum_{s < s^*} B_{sF} l_{jsF}^{\rho} + \sum_{s=1}^{S} B_{sP} l_{jsP}^{\rho} \right) \right]^{\frac{\theta}{\rho}}, \tag{1}$$
$$\text{where } l_{jsh} = k_s n_{jsh}.$$

The parameters θ, ρ and B are common across firms, with $\sum_{s,h} B_{sh} = 1$. Firms differ in (T_j, A_j) : T_j denotes Firm j's TFP, $A_j \in (0,1)$ measures the degree to Firm j's technology complements (biases toward) high skilled workers ($s \geq s^*$) who works full time, relative to other workers.[13] The two factors T_j and A_j may be correlated, which would help shape the equilibrium sorting between a firm's productivity and the skill composition of its employees.[14] Moreover, together with the correlation between a worker's skill and demand for health insurance, (T_j, A_j) correlation also underlies the correlation between firm productivity and ESHI provision.

3.2 Household's Problem

A household's problem can be solved in two steps. First, it chooses labor supply status $(\mathbf{h}, \mathbf{z})$, where each worker in the household can be non-employed or working in one job category, i.e., $(\mathbf{h}, \mathbf{z}) \in \{(0,0), \{P, F\} \times \{0,1\}\}^2$. Second, it chooses its health insurance status $\mathbf{INS}$ given $(\mathbf{h}, \mathbf{z})$. A household solves the following problem[15]

$$\max_{(\mathbf{h},\mathbf{z}) \in \{(0,0),\{P,F\}\times\{0,1\}\}^2} \left\{ V\left(x, m, \boldsymbol{\chi}, \mathbf{s}, \mathbf{h}, \mathbf{z}\right) + \epsilon_{\mathbf{h},\mathbf{z}} \right\}, \tag{2}$$

where $V(\cdot, \mathbf{h}, \mathbf{z})$ is the value function associated with the choice $(\mathbf{h}, \mathbf{z})$, as we specify below. The last term, $\epsilon_{\mathbf{h},\mathbf{z}}$, is household's taste shocks associated with choice $(\mathbf{h}, \mathbf{z})$, assumed to be drawn from a Type-I extreme value distribution. Let $(\mathbf{h}^*, \mathbf{z}^*)_{(x,m,\boldsymbol{\chi},\mathbf{s},\epsilon)}$ be the solution to (2).

$V(\cdot, \mathbf{h}, \mathbf{z})$ is the household's expected utility with its optimal $\mathbf{INS}$ choice given $(\mathbf{h}, \mathbf{z})$:

$$\begin{aligned} V\left(x, m, \boldsymbol{\chi}, \mathbf{s}, \mathbf{h}, \mathbf{z}\right) &= \max_{\mathbf{INS}} \left\{ \int u(C, \mathbf{h}, \mathbf{INS}; x, \boldsymbol{\chi}) dF_{OOP}\left(x, \mathbf{INS}, m, r\right) \right\} \qquad (3) \\ s.t. \qquad C &= \max\left\{y - OOP,\ \underline{c}\right\} \\ y &= w_{shz}^m + w_{s'h'z'}^m + b\left(x, m, r, w_{shz}^m + w_{s'h'z'}^m, \mathbf{INS}\right) \\ \mathbf{INS} &\in \Omega\left(x, y, m, \mathbf{z}\right), \end{aligned}$$

[13]Empirically, we allow for 5 skill levels and define the top 40% in the skill distribution as $s \geq s^*$, i.e., $s^* = 4$ in our application.

[14]See Eeckhout and Kircher (2018) for a theoretical study of a competitive labor market equilibrium with endogenous firm sizes and firm-worker sorting.

[15]We present the problem for a coupled household. The problem is simpler for singles, with $h' = z' = 0$.

where the expectation is taken over the distribution of OOP that reduces household consumption, but households are guaranteed a minimum consumption level $\underline{c}$.[16] Household total income y consists of the couple's labor earnings ($w^m_{shz} = 0$ if $h = 0$), and a net government transfer $b(\cdot)$. The function $b(\cdot)$ accounts for taxes, welfare programs and health-insurance-related transfers, such as insurance premium subsidies and penalties on the uninsured (see Section 2). As such, $b(\cdot)$ depends on market m, household characteristics x, earnings $(w^m_{shz} + w^m_{s'h'z'})$, premium r and insurance status **INS**. The last constraint in (3) specifies that **INS** can only be chosen from $\Omega(x, y, m, \mathbf{z})$, which reflects the link between a household's choices of **INS** and job status.

3.2.1 Health Insurance Choice Set $\Omega(\cdot)$

A household's health insurance choice set $\Omega(\cdot)$ is closely related to its job status $\mathbf{z}$, which is a micro-foundation for the intrinsic connection between the insurance system and labor market. For example, ESHI (INS_1) and spousal ESHI (INS'_2) are both directly governed by z.[17] If neither of the spouses are covered by ESHI, $(z, z') = 0$, the household may be eligible for Medicaid governed by function $MC(x, y, m)$. Therefore, via income y, a household's labor supply decision indirectly affects INS_3 and INS'_3 (Medicaid). In addition to these natural links and the assumption that all four INS statuses are mutually exclusive, we impose the following simplifying assumptions on $\Omega(\cdot)$, which are in line with the observed choices among most households.

1) If only one spouse works on a job with ESHI, the other spouse and children will be covered, e.g., $\mathbf{z} = [1, 0]$ implies $INS_1 = INS'_2 = 1$.

2) If both spouses are covered by ESHI $(z, z') = 1$, they are indifferent between whose employer covers their children. As such, in expectation, the burden of child health insurance will be split evenly between the two employers.

3) *Conditional on choosing* $(z, z') = 0$, if a household is eligible for Medicaid $(MC(x, y, m) = 1)$, it chooses between using Medicaid ($INS_3 = INS'_3 = 1$) or staying uninsured ($\mathbf{INS} = \mathbf{0}$).[18] If $MC(x, y, m) = 0$, it chooses between individual health insurance and staying uninsured, and $INS_4 = INS'_4$, so that individual health insurance purchase are made for the entire household.[19]

[16] As specified later, welfare programs such as SNAP are included in $b(\cdot)$; $\underline{c}$ is explicitly introduced as a buffer against extreme health expenditure shocks.

[17] $INS_1 = z \in \{0, 1\}$; and $INS'_2 = 0$ if $z = 0$.

[18] In the data, only 5.7% of households eligible for Medicaid chose individual insurance.

[19] In our empirical application, when $z = z' = 0$ and hence the household faces a non-degenerate choice set of health insurance status, we introduce additional preference shocks ε for Medicaid vs no insurance (if Medicaid eligible) and for individual insurance vs no insurance (if Medicaid ineligible). These shocks help explain some variation in observed choices and are assumed to be realized after the labor supply choice has been made. When

Therefore, the choice set $\Omega(\cdot)$ is given by

$$\begin{aligned}
\Omega(x,y,m,\mathbf{z}=[1,0]) &= \{([1,0,0,0],[0,1,0,0])\}, \\
\Omega(x,y,m,\mathbf{z}=[0,1]) &= \{([0,1,0,0],[1,0,0,0])\}, \\
\Omega(x,y,m,\mathbf{z}=[1,1]) &= \{[1,0,0,0]^2\}, \\
\Omega(x,y,m,\mathbf{z}=[0,0]) &= \left\{ \begin{array}{c} MC(x,y,m)\left\{[0,0,1,0]^2,[0,0,0,0]^2\right\} \\ (1-MC(x,y,m))\left\{[0,0,0,1]^2,[0,0,0,0]^2\right\} \end{array} \right\}.
\end{aligned} \tag{5}$$

3.3 Firm's Problem

Firm j chooses the quantity n_{jsh} of labor inputs in each (s,h) category, and whether or not to provide ESHI. For tractability and due to data limitation, we assume that a firm's health insurance provision is the same for all of its employees with the same working status h.[20]Consistent with the data, we also assume that ESHI is offered to part-time workers only if it is also offered to full-time workers. That is, $z_j = \{z_{jh}\}_{h\in\{P,F\}} \in \{(1,1),(0,1),(0,0)\}$. In the following, we describe a firm's problem without ESHI mandates. The case with ESHI mandates (see Section 2) is described in the online appendix.

Firm j solves the following problem,

$$\pi_j^* = \max_{\left\{z_{jh},\{n_{jsh}\}_s\right\}_h} \left\{ Y_j - \sum_{s,h} n_{jsh}\left[w_{shz}^m\left(1+\tau_w^m\right) + q^m z_{jh}\kappa_{sh}^m\right] - \delta I\left(z_j \neq (0,0)\right) + \eta_{z_j} \right\}, \tag{6}$$

where Y_j follows the technology (1), τ_w^m is a payroll tax, q^m is the price of ESHI on Market m, κ_{sh}^m is the expected demand for health insurance by a worker s. The cost of hiring a worker involves wage payments (plus payroll tax), and, if $z_{jh}=1$, the expected cost of ESHI. The latter involves expectation because households differ in demands for health insurance, which in turn leads to different labor supply decisions. A firm needs to infer the expected demand for health insurance from a worker with skill s for his/her family (κ_{sh}^m), conditional on the household's

$\mathbf{z}=(0,0)$, the value function (3) is modified to

$$\begin{aligned}
V(x,m,\boldsymbol{\chi},\mathbf{s},\mathbf{h},\mathbf{z}=(0,0)) &= E\max_{\mathbf{INS}}\left\{\int u(C,\mathbf{h},\mathbf{INS};x,\boldsymbol{\chi})dF_{OOP}(x,\mathbf{INS},m,r)+\varepsilon_{\mathbf{INS}}\right\} \\
s.t. \quad C &= \max\{y-OOP,\ \underline{c}\} \\
y &= w_{shz}^m + w_{s'h'z'}^m + b(x,m,r,w_{shz}^m+w_{s'h'z'}^m,\mathbf{h},\mathbf{INS}) \\
\mathbf{INS} &\in \Omega(x,y,m,\mathbf{z}=[0,0]).
\end{aligned} \tag{4}$$

[20]In Kaiser data we use for our estimation, we observe a firm's ESHI provision status only by worker's work status h, but not by wage levels.

endogenous decision to let him/her work h hours with ESHI.[21] δ is a fixed cost of providing ESHI, η_{z_j} is the an i.i.d. Type-I extreme-value distributed shock (with standard deviation σ_η) for choosing each z_j option. Notice that following the tax exemption treatment for ESHI, the firm does not pay payroll tax on ESHI, nor does the worker pay taxes on ESHI. Given the progressive income tax structure, this tax exemption provides a higher benefit for higher-skill workers.

Firm j's optimal decision $\left\{z^*_{jh}, \left\{n^*_{jsh}\right\}_s\right\}_h$ can be derived in two steps. First, given a particular vector z, Firm j chooses its optimal demand for each type of worker $\{n^*_{sh}(z)\}_{sh}$, which gives the maximum profit $\pi^*_j(z)$ conditional on z. Second, it chooses the z associated with the highest profit. For a researcher, who has no information about η_{z_j}, the probability that a particular z^* is chosen follows

$$\Pr(z_j = z^*) = \frac{\exp\left(\frac{\pi^*_j(z^*)}{\sigma_\eta}\right)}{\sum_{z\in\{(0,0),(1,0),(1,1)\}} \exp\left(\frac{\pi^*_j(z)}{\sigma_\eta}\right)}.$$

3.4 Insurance Premiums

We assume a single product on HIX as in Hackmann *et al.* (2015) and a single product on ESHI. Our counterfactual experiments are likely to change the risk pools on HIX and ESHI markets, and hence the health insurance premiums. Although it is beyond the scope of this paper to incorporate a full-blown model of health insurance markets into our setting, we endogenize equilibrium insurance premiums in our counterfactuals such that on both ESHI and HIX, insurers are break-even.[22] Break-even on market m and insurance type $k \in \{ESHI, HIX\}$ refers to the equalization of the total premium and the total reimbursement multiplied by the loading factor l^m_k on the (m, k) market.

For HIX, we incorporate its key feature that premiums are set according to a standard age-rating curve and are otherwise non-discriminatory.[23] Let r^m_b be the base premium on Market m, and $\Gamma(\cdot)$ be the exogenous age-rating curve, the premium faced by someone with characteristics

[21]
$$\kappa^m_{sh} = \int \kappa(x, m, \boldsymbol{\chi}, s, s', \epsilon)\, dF\left(x, \boldsymbol{\chi}, s', \epsilon | s, m, (h^*, z^*)_{(x,m,\boldsymbol{\chi},\mathbf{s},\epsilon)} = (h, 1)\right), \tag{7}$$

where $\kappa(x, m, \boldsymbol{\chi}, s, s', \epsilon)$ is the adult-equivalent measure of the unit of health insurance demanded by a household from one employer with characteristics $(x, m, \boldsymbol{\chi}, s, s', \epsilon)$. It depends on household size, and whether or not the spouse also works on an ESHI job.

[22]The pre-ACA individual health insurance premium structure was much more complex. We use the pre-ACA data only for estimating the model. The estimated model is used to conduct counterfactual experiments with premium regulations similar to HIX. For estimation, it suffices to take the observed equilibrium insurance premiums as given.

[23]We abstract from the premium variation based on one's smoking history, which we do not observe.

x (including age as one component) is given by

$$r^m(x) = \Gamma(r_b^m, age). \tag{8}$$

On each HIX market m, the premium r_b^m adjusts to satisfy the break-even condition (as in Handel *et al.* (2015)).

3.5 Equilibrium

Definition 1 *An equilibrium on Market m is a tuple*
$\left\{(\mathbf{h}^*, \mathbf{z}^*)_{(x,m,\boldsymbol{\chi},\mathbf{s},\epsilon)}, \left(\{z_h^*, \{n_{sh}^*\}_s\}_h\right)_{(T,A)}, \{w_{shz}^m\}_{shz}, r_b^m, q^m\right\}$ *that satisfies*
(1) Given $\{w_{shz}^m\}_{shz}$ *and* $r^m(x)$, $(\mathbf{h}^*, \mathbf{z}^*)_{(x,m,\boldsymbol{\chi},\mathbf{s},\epsilon)}$ *solves household optimization problem for each* $(x, m, \boldsymbol{\chi}, \mathbf{s}, \epsilon)$.
(2) Given $\{w_{shz}^m\}_{shz}$ *and* $r^m(x)$, $\left(\{z_h^*, \{n_{sh}^*\}_s\}_h\right)_{(T,A)}$ *solves firm optimization problem for each* (T, A).
(3) Equilibrium consistency:
1) wages $\{w_{shz}^m\}_{shz}$ *equate the aggregate demand and supply for each* (s, h, z) *category;*
2) the base premium r_b^m *and* $r^m(x)$ *implied by* (8) *satisfy the break-even condition on the HIX market;* q^m *satisfies the break-even condition on the ESHI market.*

Remark 2 *By focusing on the competitive equilibrium, we have assumed away some market imperfection such as search friction. However, due to the adverse selection problem on health insurance markets and the connection between the health insurance system and the labor market, the competitive equilibrium may no longer lead to efficient allocations.*

3.6 Further Empirical Specifications

To apply our model to the data, we make some further empirical specifications.

3.6.1 Household Unobservables

In the model, a worker's human capital level s is observed by both the worker and the firm. The researcher observes neither human capital nor household types, the distribution of which varies with x and states, given by

$$\Pr((\mathbf{s}, \boldsymbol{\chi})|x, state) = \Pr(\boldsymbol{\chi}|x, state)\Pr(\mathbf{s}|x, \boldsymbol{\chi}),$$

where $\mathbf{s} \in \{1, ...S\}^2$, $\boldsymbol{\chi} \in \{1, 2\}^2$.[24] We set the total number of skill levels $S = 5$, which leads to 20 categories of jobs defined by (s, h, z) , 10 unobserved types of singles defined by (s, χ) and 100 unobserved types of coupled households defined by $(\mathbf{s}, \boldsymbol{\chi})$.

Preference Type Denote the components in x such that the sub-vectors x_1 and x_2 refer to the individual characteristics of Spouse 1 and Spouse 2 and that x_0 refers to household level characteristics. We assume that types of a couple follow a bivariate Probit distribution, with the latent variables drawn from

$$N\left(\left[\begin{array}{c} x_0\beta_0 + x_1\beta + \xi_{state} \\ x_0\beta_0 + x_2\beta + \xi_{state} \end{array}\right], \left[\begin{array}{c} 1, \varrho \\ \varrho, 1 \end{array}\right]\right). \tag{9}$$

where ξ_{state} is a state-specific parameter that introduces state-level unobservables into the model, and ϱ allows for matching on unobservables between a couple.[25]

Skill The probability that a worker's skill is of level s follows a discretized log-normal distribution:

$$\Pr(s|x, \chi) = \begin{cases} \Phi(\ln(k_s) - x'\lambda - \alpha_\chi) - \Phi(\ln(k_{s-1}) - x'\lambda - \alpha_\chi) & \text{for } 1 < s < S, \\ \Phi(\ln(k_s) - x'\lambda - \alpha_\chi) & \text{for } s = 1, \\ 1 - \Phi(\ln(k_{s-1}) - x'\lambda - \alpha_\chi) & \text{for } s = S, \end{cases} \tag{10}$$

where α_χ is a type-specific parameter that allows for correlation between s and χ, with α_2 normalized to zero. The mass points of the amounts human capital (k_s) are assumed to be quantiles from $\ln N(\overline{x}'\lambda, 1)$, where $\overline{x}$ is the national average of x. That is, one's rank in the skill distribution is correlated with the distance of one's x from the national average.[26]
The distribution of a couple's skills is given by

$$\Pr(\mathbf{s}|x, \boldsymbol{\chi}) = \Pr(s|x, \chi) \Pr(s'|x, \chi').$$

Notice that a couple's skill levels are correlated because 1) household characteristics x enter the skill distributions for both, and 2) types χ and χ' are correlated between spouses and type enters the skill distribution via α_χ.

[24]For singles, only the first entry of $\mathbf{s}$ and that of $\boldsymbol{\chi}$ are relevant.
[25]For singles, $\Pr(\chi = 2) = \Phi(x_0\beta_0 + x_1\beta + \xi_{state})$.
[26]Worker's skill and firm's TFP (two unobservable levels) jointly map into one observable object, i.e., wage. Therefore, one of the two unobservables (skill, TFP) needs to be normalized. We use the quantiles of $\ln N(\overline{x}'\lambda, 1)$ as the mass points of k_s levels, which serves as a normalization.

Remark 3 *Our modeling of household unobservables is partly motivated by the following observations. First, in the data, the* ***distribution*** *of household outcomes conditional on x differ across states, which may arise partly from differences in state policies but presumably also from state-level unobservables. To account for the latter without imposing too much structure, we allow the distribution of unobservables conditional on x to differ across states via state-specific ξ.*

Second, for any given risk aversion coefficient, the CRRA utility function implies a negative relationship between the probability of being insured and income, ceteris paribus. As shown in the online appendix, this relationship is violated in the data. Without excluding other possible explanations, we rationalize this pattern by allowing for a correlation between preferences and skills conditional on x.[27] *Including α_χ in (10) is a parsimonious way to introduce such a correlation.*

3.6.2 Firm Technology

We allow T_j and A_j to be correlated within a firm, but $\{(T_j,\ A_j)\}_j$ are assumed to be independent across firms. Firm's TFP T_j follows a Pareto distribution,

$$T_j \sim Pareto\left(\underline{T}, \alpha_T\right),$$

where $\underline{T}$ is the scale parameter (the minimum value of T_j) and α_T is the shape parameter. As a convenient way to guarantee that $A_j \in (0,1)$, the weight A_j is assumed to follow a logit normal distribution, such that

$$\left[\ln\left(\frac{A_j}{1-A_j}\right)|T_j\right] \sim N\left(\ln\left(\frac{\mu_A}{1-\mu_A}\right) + \nu(\ln(T_j) - \ln(\mu_T))), \sigma_A^2\right),$$

where μ_A is the median of A for firms with $T = \mu_T \equiv E[T]$, and ν governs the correlation between T_j and A_j.

4 Data

For household-side information, we use three data sources: the American Community Survey (ACS), the Current Population Survey Annual Social and Economic Supplement (CPS), and the Medical Expenditure Panel Survey (MEPS). We focus on the population aged 22 to 64.

[27] For example, this data fact can also be rationalized via heterogeneous non-pecuniary preferences for insurance ($\varpi_{\mathbf{INS}}$), but both types of heterogeneity cannot be separately identified. Since heterogeneous risk aversion is commonly allowed for in the literature (e.g., Handel *et al.* (2015)), we assume a common $\varpi_{\mathbf{INS}}$.

For firm-side information, we use the Kaiser Family Employer Health Benefit Survey (Kaiser), supplemented with information from Statistics of U.S. Businesses (SUSB). To exploit policy variation, we use data from 2012 (pre-ACA era) and 2015 (ACA era).[28]

ACS and CPS both provide information on households' health insurance, labor market status, demographics and residential states. Given the inconsistency in the health insurance information in CPS arising from the re-design of relevant questions (Pascale (2016)), we rely mainly on ACS (a 5% random sample) and supplement it with information on household members' health status from CPS. We estimate a logistic probability function $\Psi(healthy|x, state)$ from CPS, which we use to simulate the health status for those in the ACS sample.[29] This CPS-supplemented ACS sample contains most of the information we need to estimate the model except for medical-expenditure-related information, for which we resort to MEPS.

MEPS is a set of large-scale surveys of families and individuals, their medical providers, and employers across the U.S. We use its Household Component, a panel survey that features several rounds of interviews covering two full calendar years. Key to our analyses, MEPS collects detailed information on each household member's demographic characteristics, health conditions, health status, use of medical services, charges and source of payments, health insurance coverage, income, and employment. We use the restricted MEPS data with geocode, which identifies 30 states with the remaining states encrypted. The 30 identified states account for 89% of households in the U.S., from which we exclude Massachusetts and Hawaii, the two states that already implemented state-wide (nearly) universal coverage before ACA. Of the remaining 28 states, 15 expanded Medicaid by 2015. We use MEPS to estimate the medical expenditure distribution for each of the 28 states and restrict our ACS and CPS sample to households in these 28 states as well.

Kaiser is a cross-sectional survey of firms representative of U.S. firms with at least 3 workers. Crucial to our analyses, it contains information on firm size and health insurance provision, as well as employee composition in terms of wage levels and full/part time status. We focus on private-sector employers. Our sample consists of all private employers for which the information on ESHI offering is not missing.[30] Firm locations are known up to the Census Region (Northeast, Midwest, South, and West), which allows us to estimate firm-side parameters separately for

[28] To reduce the computation burden, we use only two years of data, which nevertheless contain rich variation for identification.

[29] Health status is self-reported as one of the 5 categories: excellent, very good, good, fair or poor. We define the first 3 categories as being healthy. As shown in the online appendix, this variable is highly correlated with gross medical costs. In addition, self-reported measures are also highly correlated with labor market outcomes as shown in Blundell *et al.* (2017).

[30] The distribution of other firm-level variables in this sample is similar to that in the entire private-firm sample (e.g., MEPS IC components). Therefore, we assume that the ESHI offering information is missing at random and this sample is representative.

each region.[31] To supplement statistics from Kaiser, which only covers firms with at least 3 workers, we resort to SUSB for information on the overall distribution of firms of all sizes.

4.1 Summary Statistics

Table 1: Individual Level Summary Statistics

Residents in	Medicaid Expansion States		Non-Expansion States	
(%)	2012	2015	2012	2015
A. Demographics: ACS				
Edu Low (below high school)	12.13	11.49	13.10	12.13
Edu High (at least some college)	33.35	34.89	28.63	29.77
Single	42.09	42.82	42.80	44.24
Childless	61.62	62.31	61.34	62.21
B. Insurance Status: ACS				
Uninsured	19.20	10.76	26.28	19.42
ESHI	68.08	69.29	63.73	66.81
Medicaid	7.71	12.97	4.56	5.54
Ind. Insurance	5.01	6.98	5.43	8.23
C. Work Status: ACS				
Non-employment	22.16	20.00	22.59	21.18
Full-time	70.81	73.12	71.47	72.67
Number of Individuals (ACS)	27,140	27,465	18,927	19,734
D. % Unhealthy: CPS				
All	7.48	7.28	8.06	7.68
ESHI	5.42	5.22	5.92	5.88
Medicaid	18.43	17.45	22.99	20.56
Ind. Insurance	5.99	7.29	7.12	8.79
Number of Individuals (CPS)	31,866	25,325	19,977	19,933

Table 1 summarizes individual-level statistics from ACS (Panels A and C) and health information from CPS (Panel D), before and after the ACA and separately for ACA Medicaid expansion and non-expansion states.[32] Panel A shows that the demographic distribution in

[31] Ideally, we should focus on the same 28 states for both firm and household sides of the data, which is not feasible given that a firm's state ID is not available in Kaiser. We have compared, for each region, the distribution of firm characteristics (e.g., size) available in Statistics of U.S. Businesses (SUSB), using all states and using only the states included in the household sample. The distributions are extremely similar. See the online appendix for details.

[32] Table A1 in the appendix shows the joint distribution of characteristics and outcomes between spouses.

each group of states is largely stable before and after ACA, and that residents in expansion states tend to have more education than those in non-expansion states. Panel B shows that the uninsured rate declined significantly from 19.2% to 10.8% in expansion states, and from 26.3% to 19.4% in non-expansion states. In 2012, ESHI and Medicaid coverage rates were higher in expansion states (even before the expansion). After ACA, although shares in all three insurance status increased, the biggest share increase occurred in Medicaid for expansion states, but in individual insurance for non-expansion states. Panel C shows that the distribution of employment status was very similar across the two groups of states in 2012. From 2012 to 2015, there was a 2.2 percentage points (ppt) growth in employment in expansion states and a 1.4 ppt growth in non-expansion states. Panel D shows that Medicaid enrollees are disproportionally unhealthy. In addition, individual insurance enrollees are more likely to be unhealthy than ESHI enrollees, especially after the ACA. As shown in the online appendix, for any given health insurance status, the average medical expenditure among the unhealthy is over 3 times as large as that among the healthy.

For a closer look at the data, we run regressions of the following form:

$$y_{ist} = x_{ist}\alpha_1 + d_s + I(t = 2015)x_{ist}\left[MEP_s\alpha_2 + (1 - MEP_s)\,\alpha_3\right] + \epsilon_{ist}. \tag{11}$$

where y_{ist} is an outcome variable for individual i, with characteristics x_{ist} in state s and year t, d_s is a state fixed effect. $MEP_s \in \{0, 1\}$ indicates whether or not State s expanded Medicaid under the ACA. The vector of parameters α_2 reflects (2015 versus 2012) changes in outcomes among different demographic groups (x) in Medicaid expansion states; and α_3 reflects these changes in non-expansion states. ϵ_{ist} is an error term.

Each column of Table 2 shows the estimates from one outcome regression. The two panels report coefficient vectors on the post-ACA dummy in Medicaid expansion states (α_2) and non-expansion states (α_3) separately, which exhibits some noticeable differences across demographic groups and across the two groups of states. For example, after ACA, the uninsured rate decreased significantly among the low-educated and/or singles living in Medicaid expansion states, mostly via the increased Medicaid coverage. Relative to changes in insurance status, changes in work status are not as significant, which is in line with findings from other studies.[33]

The upper panel of Table 3 summarizes firm level statistics from Kaiser data (cross-firm standard deviations are in parentheses), which consists of about 1,900 firms in each of the two years. In the 2012 sample, 56% of firms provided ESHI. In the 2015 sample, 51% did so. For firm size and worker compositions, we present the statistics among all firms and among firms

[33] For example, Leung and Mas (2018) find that Medicaid expansion significantly increased Medicaid coverage but did not reduce "employment lock" among childless adults.

Table 2: Insurance and Work Status Regressions

	Uninsured	Medicaid	ESHI	Nonemployed	Full time
ACA*Medicaid Expansion States (α_2)					
α_{20}	-0.059	0.049	0.007	-0.014	0.015
	(0.011)	(0.013)	(0.012)	(0.007)	(0.008)
Edu Low (α_{21})	-0.055	0.064	-0.006	-0.005	0.015
	(0.015)	(0.014)	(0.012)	(0.013)	(0.015)
Edu High (α_{22})	0.071	-0.059	-0.013	0.022	-0.010
	(0.011)	(0.010)	(0.012)	(0.005)	(0.009)
Childless (α_{23})	0.003	-0.012	-0.004	-0.003	0.001
	(0.012)	(0.010)	(0.011)	(0.008)	(0.009)
Single (α_{24})	-0.104	0.060	0.025	-0.026	0.020
	(0.013)	(0.012)	(0.017)	(0.010)	(0.011)
ACA*Non-Expansion States (α_3)					
α_{30}	-0.058	-0.001	0.045	-0.027	0.022
	(0.011)	(0.008)	(0.017)	(0.012)	(0.011)
Edu Low (α_{31})	0.019	-0.025	-0.003	0.033	-0.020
	(0.015)	(0.014)	(0.013)	(0.020)	(0.020)
Edu High (α_{32})	0.012	0.012	-0.015	0.010	-0.001
	(0.017)	(0.006)	(0.013)	(0.008)	(0.007)
Childless (α_{33})	-0.013	0.023	-0.017	0.027	-0.023
	(0.015)	(0.007)	(0.013)	(0.009)	(0.009)
Single (α_{34})	-0.019	-0.008	0.005	-0.026	0.017
	(0.015)	(0.007)	(0.013)	(0.009)	(0.009)

Other control variables: state dummies, education, gender, I(childless), marital status, age and age^2 . Standard errors are clustered at the state level.

with ESHI. The average and standard deviation of sizes are subject to the caveat that firm sizes in Kaiser are top coded at 500, so we also present the fraction of firms of size$\geq$ 500.[34] With this caveat, we can see that compared to average firms, firms with ESHI are larger, have more full-time workers and more high-wage workers.[35] The lower panel of Table 4 shows the size distribution of all firms in SUSB.[36] Between the two years, we see a slight shift of the distribution to the right.

[34]The top-coding of firm sizes in Kaiser data is taken into account in our estimation, as we explain in Remark 4.

[35]Kaiser only specifies three crude division of wage levels: $\$24,000$ ($\$23,000$) is the upper bound for low earnings and $\$55,000$ ($\$58,000$) is the lower bound for high earnings in 2012 (2015) in real dollar terms.

[36]SUSB firm size is categorical, and size$\leq$ 4 is the first category, while Kaiser data only contains firms with size$\geq$ 3.

Table 3: Summary Statistics: Firms

Kaiser											
Year	Obs.	ESHI	Size[a]		Size≥500 (%)		% Full-time workers		% High-wage workers	
		%	All	ESHI	All	ESHI	All	ESHI	All	ESHI
2012	1,981	56.1	22.0	32.8	0.71	1.25	74.5	84.6	23.6	32.3
		-	(55.0)	(70.6)	-	-	(29.6)	(19.6)	(26.6)	(26.2)
2015	1,852	51.4	22.1	34.5	0.74	1.42	72.8	79.3	26.9	33.7
		-	(56.3)	(75.5)	-	-	(30.5)	(26.5)	(28.7)	(29.0)

[a]Firm sizes in Kaiser are top coded at 500, and treated so in this calculation. .

SUSB						
Year		All Firms	Size≤4	4<Size< 100	100≤Size< 500	Size≥ 500
2012	%Firms	100	61.43	36.71	1.26	0.60
	Size	19.5	1.7	15.9	151.4	1063.6
2015	%Firms	100	61.23	36.75	1.41	0.64
	Size	20.3	1.6	16.2	151.2	1082.4

5 Estimation

5.1 Parameters Estimated outside of the Model

To reduce computational burden, we estimate the following objects outside of the model: the out-of-pocket health expenditure distribution $F_{OOP}(\cdot)$, government health-care-related policies, and the net transfer function. We briefly describe each, with further details in the online appendix.

Out-of-pocket health expenditure consists of the health insurance premium $r^m(x)$ and out-of-pocket medical costs, which are estimated using data from MEPS. For $r^m(x)$ used in the estimation sample, we use the observed average premium among households with $r^m(x)$.[37] A household's out-of-pocket medical cost is the sum of its members' gross medical costs minus the total reimbursement based on the most common health insurance plan. We estimate each household member's gross medical cost as a stochastic function of one's own characteristics, household characteristics, and insurance status, where the distribution of the random component is market-specific.

Health-care-related government policies are parameterized as precisely as we can, including those implemented under the ACA. In particular, we specify the Medicaid eligibility and coverage rule $MC(x, y, m)$ as a market-specific function of household characteristics and in-

[37]Similarly, q^m is set at the average ESHI premiums reported by firms in Kaiser on each market m. Notice that the premium entering OOP and the ESHI premium q^m are both estimated directly from the data only for estimating the model. For counterfactual policy simulation, premiums on both HIX and ESHI will be equilibrium objects to be determined internally.

come, which varies before and after the ACA and across states. We parameterize $MC(x, y, m)$ using information from Kaiser Family Foundation.[38], [39]

Government net transfer function is broken down into its components including household income tax, welfare benefits (TANF), food stamps (SNAP), HIX premium subsidies, and tax penalties for the uninsured with ACA individual mandates. We parameterize each component. In particular, we follow Chan (2013) in specifying the eligibility and benefits of TANF and SNAP.

5.2 Structural Estimation: Overview

5.2.1 Estimation Sample and Validation Sample

We divide the household data into two samples: one for estimation and the other for model validation. The estimation sample, from which our auxiliary models are calculated, includes the pre-ACA data of all 28 states in our sample, and the post-ACA data of all but the 7 states with the lowest poverty rates. The post-ACA data for these 7 states are held out for model validation.[40]

We use the data in this fashion for the following reasons. First, information of a state in at least one policy era is necessary to identify state-specific parameters; and information of multiple states in both policy eras gives us the variation to identify policy-invariant household preference parameters without having to rely entirely on the model structure. Second, several major ACA components were targeted at low-income households, leading to potentially different impacts in states with different poverty rates. It will increase credibility of our model and its counterfactual policy implications if the model is able to fit the post-ACA patterns in this non-random hold-out sample. As shown in Table 4, the hold-out sample (lowest-poverty) states are indeed quite different from the other states: they are disproportionally more likely to have expanded Medicaid ($\frac{5}{7}$ vs $\frac{10}{21}$); and the population in these states are more educated.

[38]https://www.kff.org/state-category/medicaid-chip.

[39]We abstract from asset testing for Medicaid, which would require detailed asset data and non-trivial complication in our setting. See French et al. (2019) for a study of how asset testing for Medicaid affects individuals' retirement decisions.

[40]The hold-out model validation is limited to the household-side estimation. We use all of the firm data in the firm-side estimation, given the relatively small sample size and that firm locations are known only at the Census Region level.

Table 4: State Characteristics (Sample Split)

States Groups	#States	#Medicaid Exp States	Edu=high	Edu=low	Singles	Childless
Lowest Poverty States	7	5	38.5%	8.0%	40.7%	62.0%
Other States	21	10	30.9%	13.3 %	43.3%	61.8%

5.2.2 Equilibrium Prices in the Estimation

Taking the observed equilibrium as given, our estimation procedure does not require solving for the equilibrium. Households and firms take equilibrium prices as given in making their optimal decisions. Among equilibrium prices, health insurance premiums are directly observable in the data; while wages $\{w^m_{shz}\}$ are not, because skill s is unobservable (although we observe both the types of jobs (h, z) chosen and the wages earned by individuals with different characteristics x). However, since the realized equilibrium wages $\{w^m_{shz}\}$ are taken as given by households and firms, they can be treated as parameters to be estimated together with structural parameters.

To keep the estimation tractable, we assume that wages without ESHI $\{w^m_{sh0}\}$ can be approximated by a discretized log-normal distribution.[41] In particular, within each hour (h) category on Market m, the skill-specific log wages $\{\ln (w^m_{sh0})\}_{s=1}^{S}$ without ESHI are quantiles from

$$N\left(\omega^0_h + \omega^0_{state} + \omega^0_{year}, \sigma^2_{wh}\right),$$

where ω^0 is a vector of dummies for part/full time (h), state and year. To capture the idea of compensating wage differentials, we assume that wages with ESHI are proportional to their non-ESHI counterparts. The wage ratio, and hence the magnitude of compensating differentials, may vary with wage levels, as given by

$$\frac{w^m_{sh1}}{w^m_{sh0}} = \frac{1}{1 + \exp\left(\omega^1_0 + \omega^1_1 w^m_{sh0}\right)}.$$

We treat $\{\omega^0, \omega^1, \sigma_w\}$ as parameters to be estimated, which jointly imply $\{w^m_{shz}\}$. Notice that $\{\omega^0, \omega^1, \sigma_w\}$ are not structural parameters, which are used in the estimation *only*; in counterfactual policy simulations, wages and insurance premiums are all determined internally as equilibrium outcomes (Definition (1)).

[41] Similar approaches have been used in the literature to approximate equilibrium objects that are too complex to compute exactly, e.g., Lee and Wolpin (2006) and Meghir *et al.* (2015).

5.2.3 Two-Stage Estimation via Indirect Inference

Stage 1: Estimate household-side parameters $\left(\Theta^H\right)$ and $\{\omega^0, \omega^1, \sigma_w\}$ by matching model-predicted household decisions with the observed household choices, where Θ^H consists of the parameters governing household preferences and the conditional distribution of unobserved household skill and preference types $\Pr\left((\mathbf{s}, \boldsymbol{\chi})\,|x, state\right)$.
Stage 2: Given parameter estimates in Stage 1 (hence household decision rules and equilibrium wages), estimate firm-side parameters $\left(\Theta^F\right)$ by matching firms' optimal decisions with the observed firm choices.

In both stages, the estimation is via indirect inference, an approach that involves two steps: 1) compute from the data a set of "auxiliary models" that summarize the patterns in the data; and 2) repeatedly simulate data with the structural model, compute corresponding auxiliary models using the simulated data, and search for model parameters that match model-generated auxiliary models with those from the true data. In particular, let $\overline{\beta}$ denote our chosen set of auxiliary model parameters computed from data; let $\widehat{\beta}(\Theta)$ denote the corresponding auxiliary model parameters obtained from simulating a large dataset from the model (parameterized by a particular vector Θ) and computing the same estimators. The structural parameter estimator is then the solution

$$\widehat{\Theta} = \text{argmin}_{\Theta}\ [\widehat{\beta}(\Theta) - \overline{\beta}]' W [\widehat{\beta}(\Theta) - \overline{\beta}],$$

where W is a diagonal weighting matrix. We obtain standard errors for $\widehat{\beta}(\Theta)$ by numerically computing $\frac{\partial \widehat{\Theta}}{\partial \overline{\beta}}$ and applying the delta method to the variance-covariance matrix of $\overline{\beta}$.

5.3 Structural Estimation: Auxiliary Models

Our auxiliary models exploit the rich variation across states and policy eras, as well as the varying policy doses across different households and firms. We summarize how this directly *observable* variation (prices and known policy rules) is embedded in our model.[42]

Household Side: 1) Variation in the equilibrium premiums $r^m(x)$ for individual health insurance affect household out-of-pocket expenditure OOP if they choose to get individual insurance. 2) Medicaid eligibility rules $MC(\cdot)$, and hence the choice set of household insurance status $\Omega(\cdot)$, differ across states and across time in states that expanded Medicaid. 3) HIX premium subsidies and the individual mandate both affect household budget via the net government transfer function $b(\cdot)$ that depends on their insurance status.

Firm Side: The cost/incentive of ESHI provision is changed via 1) changes in the equilibrium

[42] Prices are endogenous. However, during the estimation, we only need to solve individual household/firm problems, who takes the observed equilibrium prices as given.

premiums q^m and 2) the employer mandate.[43]

We now describe our auxiliary models, followed by brief identification arguments that guide our choice of these auxiliary models.

5.3.1 Stage 1

We target the following auxiliary models, all of which are based on the estimation sample only.

1. Individual level targets from ACS

   (a) Regressions as reported in the data section for insurance status and work status, i.e.,

   $$y_{ist} = x_{ist}\alpha_1 + d_s + I(t = 2015)x_{ist}\left[MEP_s\alpha_2 + (1 - MEP_s)\,\alpha_3\right] + \epsilon_{ist}.$$

   (b) Wage regression of the following form:

   $$\ln(w_{ist}) = x_{ist}\alpha_1^w + d_s^w + I(t = 2015)\alpha_2^w + I(h_{ist} = F)\,\alpha_3^w + ESHI_{ist}\alpha_4^w + IND_{ist}\alpha_5^w + \epsilon_{ist}^w,$$

   where d_s^w is a state dummy, coefficients α_3^w to α_5^w capture the correlation between wage and full/part time status (h), ESHI status, and individual insurance purchase.[44]

   (c) $E\left[(\ln(w_{ist}))^2\right]$

   (d) Moments overall and by one-way demographics (marital status, presence of children, education, age groups).[45]

      i. Fractions of uninsured, insured via ESHI, and insured via Medicaid.

      ii. Fractions of non-employed and employed full time.

      iii. Fractions of uninsured×part time, uninsured×non-employed, Medicaid×part time, Medicaid×non-employed, and ESHI×full time

2. Individual level moments (by pre/post-ACA×Medicaid expansion/non-expansion states) from CPS that are informative of health-related utility parameters:

   (a) Fractions of uninsured×healthy, ESHI×healthy, and Medicaid×healthy

   (b) Fractions of non-employed×healthy and full time×healthy

[43] On average ESHI premiums increased by about 4% between 2012 and 2015.

[44] Coefficients in regression Targets 1(a) and 1(b) should not be viewed as causal, rather, they are a succinct way to summarize data patterns that are informative of our structural model parameters, as we discuss below.

[45] Since we target the unconditional moment $E(y)$, one subgroup is omitted in the target, e.g., $E(y|\text{low edu})$, $E(y|\text{high edu})$ are targeted, with $E(y|\text{middle edu})$ omitted.

3. Moments of joint outcomes between couples from ACS that are informative the correlation of types between spouses:

   (a) Covariance of earnings between two spouses.

   (b) Fractions of couples who both work, who both work full time.

The household-side model to be estimated in Stage 1 is essentially a generalized Roy model (Heckman and Vytlacil (2007)), with parameters governing (i) the wage offer distribution, (ii) household preferences and (iii) the conditional distribution of unobserved household skill and preference types $\Pr((\mathbf{s}, \boldsymbol{\chi})|x, state)$. As summarized in French and Taber (2011), identifying this class of models in a cross section requires exclusion restrictions that affect the payoff in the relevant sector, but not payoffs in other sectors. Although we also impose exclusion restrictions and functional form assumptions, identification of our model is greatly facilitated by the fact that our data, although not a panel, contain much more information than what is available in a cross section. We observe the distribution of household outcomes in each state *both before and after* the ACA. This data structure allows us to exploit ACA policies and their interactions with household characteristics, such as those reflected in Targets $1a$, to inform us of (policy-invariant) parameters in (ii) and (iii). For example, state dummies in $1a$ are informative of the state-specific shifter parameters in $\Pr((\mathbf{s}, \boldsymbol{\chi})|x, state)$, while cross-era comparison of household choices as captured by α_2 and α_3 are informative of household preferences.

Specifically, this policy variation is first exploited in the work status regressions in $1a$, which are targeted jointly with the wage regression and variance ($1b$ and $1c$). To correct the self selection problem that may affect correct inference for (i), we supplement policy variation with an exclusion restriction, where we exclude the presence of children from the skill distribution and thus from wage offers.[46] By itself, this variable increases the disutility of work and, via medical expenses, increases the value of ESHI jobs relative to non-ESHI jobs. Moreover, it interacts with policy changes. For example, although the ACA-induced change in equilibrium wages equally affected households of the same skill type within a state (which will be partly captured by α_2^w in Target $1b$), the ACA-induced change in individual insurance premiums affected these households differently depending on the presence of children. Moreover, some policy changes under ACA, such as insurance premium subsidies, for which ESHI-covered workers are not eligible, interact with the size of the households. As such, ACA premium subsidies directly increase the value of non-ESHI jobs and differentially so for households with and without children, which creates policy variation within the same unobservable type of households, given our exclusion restriction.

[46] The x entering $\Pr((\mathbf{s}, \boldsymbol{\chi})|x, state)$ includes education, age, gender and marrital status.

This policy variation is also exploited in the insurance status regressions in Target 1a. Because insurance premium subsidies and the individual mandate directly affected the monetary incentive to obtain insurance, and because Medicaid expansion directly changes households' choice set of insurance status, these regressions are informative of the non-pecuniary benefits/costs associated with insurance status (ϖ_{INS}) and risk aversion coefficients $\left(\gamma_{\chi}\right)$.

Moreover, it also helps that for the *same* household, we observe not only their labor market outcomes but also their choice of whether or not to get individual insurance/Medicaid if not covered by ESHI. Conditional on (x, state, year), the correlation between the latter choice and income is informative of how skill and preferences are correlated, as discussed in Remark 3. In particular, coefficients α_4^w and α_5^w in Target 1b capture how wages correlate with ESHI and individual insurance status (relative to Medicaid and uninsured), which, together with the set of regressions 1a, are informative of how skill and preference may be correlated.

5.3.2 Stage 2

Borrowing from the literature (e.g., Garicano *et al.* (2016)), we set parameter $\theta = 0.75$ in the production function (1), because it is neither the focus of our paper nor clearly identified. For each Census Region, we estimate $\{B_{sh}\}$, ρ, δ and parameters governing the distribution of (A_j, T_j) by targeting sets of moments that map closely to firm's optimal decisions and an additional set of moments that impose labor market equilibrium conditions. Specifically, for each region, we target the following region-specific auxiliary models:

1. Moments from Kaiser: (by policy era)
   (a) Mean and variance of firm size, fraction(full time employees), fraction(employees earning low/high wages)[47]
   (b) Fraction of firms with $ESHI = 1$
   (c) Cov($ESHI$, firm size), Cov($ESHI$, fraction of employees earning high wages), Cov($ESHI$, fraction of full time)
   (d) Cov(firm size, fraction of full time employees), Cov(firm size, fraction of employees earning low/high wages).
2. (by policy era): The aggregate supply of labor for each (s, h, z) category derived from Stage 1 estimates.

[47] See Footnote (35) for details.

3. Moments from SUSB (by policy era): Fraction of small firms.[48]

Given ESHI choices z_{jh}, firms' first order conditions with respect to labor inputs are given by[49]

$$w_{shz}^{m}+q^{m}z_{jh}\kappa_{sh}^{m}=\begin{cases}T_{j}L_{j}^{\frac{\theta}{\rho}-1}A_{j}B_{sh}k_{s}^{\rho}\left(n_{jsh}\right)^{\rho-1}\text{ if } s\geq s^{*}\text{ and } h=F,\\ T_{j}L_{j}^{\frac{\theta}{\rho}-1}\left(1-A_{j}\right)B_{sh}k_{s}^{\rho}\left(n_{jsh}\right)^{\rho-1}\text{ otherwise.}\end{cases}\tag{12}$$

The marginal cost of labor (the LHS of (12)) consists of wage and the expected cost of ESHI, both of which are known given estimates from Stage 1 and vary across markets m, i.e., state×policy era.[50] Given $\{k_s\}$ implied by the skill distribution parameters estimated in Stage 1, the marginal productivity of labor (the RHS of (12)) is known up to parameters $(A_j, T_j, \{B_{sh}\}, \rho)$. Via (12), these parameters govern firms' size and labor composition, as captured in Moments 1a.

Moments 1b and 1c focus on firm's choice of ESHI offering and its correlation with labor inputs. The relative profitability of different choices of ESHI offering depends on (1) wage differentials between ESHI and non-ESHI jobs, equilibrium ESHI premium (q^m) and household expected demand for ESHI (κ_{sh}^m), (2) the employer mandate, (3) the fixed cost of ESHI provision and (4) a firm's productivity (A_j, T_j). Among these, (1) is known from Stage 1 and varies across states and policy eras, (2) follows a known formula that is relevant only under ACA and only for bigger (more productive) firms. Given variation in (1) and (2), Moments 1b and 1c inform us of the policy-invariant parameters governing (3). Moreover, joint with 1a, 1b and 1c also inform us of the distribution of (A_j, T_j), where the identification benefits from the assumption that the fixed cost and the random shocks associated with ESHI offering are independent of (A_j, T_j).

Moments 1d are informative about the correlation between A_j and T_j for the following reason. As implied by Condition (12), given ESHI choice, the ratio of different types of labor is independent of T_j but dependent on A_j; TFP T_j, however, directly affects the size of a firm. As such, given ESHI choice, the correlation between labor ratio and firm size arises from the correlation between (A_j, T_j). Conditional on the correlation between firm size and worker composition that is associated with ESHI offering (i.e., Moments 1b and 1c), Moments 1d

[48] Firm size is known up to size groups in SUSB, with the first category being size $\in [1,4]$. We target the fraction of firms belonging to this group.

[49]
$$L_j = A_j \sum_{s\geq s^*} B_{sF} l_{jsF}^{\rho} + (1-A_j)\left(\sum_{s<s^*} B_{sF} l_{jsF}^{\rho} + \sum_{s} B_{sP} l_{jsP}^{\rho}\right).$$

[50] Wages are Stage-1 parameter estimates, ESHI price q^m is data and κ_{sh}^m is derived from household preference parameters.

provides direct information on the correlation between (A_j, T_j).

Moments 2 serve two purposes. First, they discipline the estimation algorithm to favor parameters that guarantee equilibrium consistency, which we deem as important for equilibrium counterfactual analyses. Second, Kaiser only includes crude measures of wages; skill-specific labor supply from Stage 1 supplements Moments 1 in pinning down the production technology parameters. Similarly, to overcome the limitation that only firms with more than 3 workers are represented in Kaiser, we target the fraction of small firms (Moments 3) from SUSB, which, together with Moments 1, provide a more complete picture of the distribution of firms.

Remark 4 *On a technical note, our model-simulated firms can be of any size. In calculating Moments 1 from our simulated data, we only use simulated firms with at 3 workers and top code their sizes at 500, as is the case in the data. For Moments 2 and 3, all simulated firms are included in the calculation and their sizes are not top coded.*[51]

6 Estimation Results

6.1 Parameter Estimates

We report a selected set of parameter estimates in this section and the others in the online appendix. The standard errors are reported in parentheses, which tend to be larger for firm-side parameters than household-side parameters. Panel A of Table 5 shows selected parameters governing household preferences. The left columns show that Type 1 singles and (Type 1, Type 1) couples have higher relative risk aversion $(\gamma_{\boldsymbol{\chi}})$ compared with their Type 2 counterparts; households with mixed types of spouses have $\gamma_{\boldsymbol{\chi}}$ closer to Type 1 households. These estimated γ's are in the range of the estimates in other studies (e.g., French and Jones 2011 and Cohen and Einav 2016). The annual consumption floor (against health expenditure shocks) is estimated at \$2,600, which is very close to the estimate in De Nardi *et al.* (2010). The nonpecuniary values of both Medicaid and individual insurance are negative, while that of ESHI is positive. These parameters help to explain household choices beyond what is explained by the pecuniary values of insurance per se, which may capture factors such as the inertia against taking up Medicaid and the psychic cost associated with applying for individual insurance. Based on our parameter estimates, we have calculated the elasticity of the demand and the willingness to pay for health insurance, both of which are comparable to those found in the literature (e.g., Finkelstein *et al.* (2019b) and Finkelstein *et al.* (2019a)).[52]

[51] Details are in the online appendix.

[52] Following Finkelstein *et al.* (2019b), who focus on the population faced with the choice between participating in HIX and staying uninsured, we find that among them, the HIX enrollment rate would be 49% if 75% of the

Table 5: Selected Parameter Estimates: Household

A. Preferences					
γ_{χ} : Type 1 singles or (Types 1, 1) couples	4.12	(0.003)	Disutility of Working		
γ_{χ} : Type 2 singles or (Types 2, 2) couples	2.11	(0.003)	Full-time job (unhealthy)	-3.29	(0.03)
γ_{χ} : (Types 1, 2) couples	3.29	(0.01)	Part-time job (unhealthy)	-3.16	(0.03)
Consumption floor ($10,000)	0.26	(0.001)	Full-time job (Type1)	-2.10	(0.004)
Nonpecuniary value: Medicaid	-0.40	(0.002)	Part-time job (Type 1)	-2.32	(0.01)
Nonpecuniary value: Individual insurance	-0.13	(0.001)	Full-time job (Type 2)	-3.36	(0.01)
Nonpecuniary value: ESHI	1.43	(0.003)	Part-time job (Type 2)	-4.23	(0.01)
B. Type and Skill Distribution*					
$\Pr(\chi = 2 \mid x, state)$			$\Pr(s \mid x, \chi)$		
Age	-0.42	(0.002)	Age	0.82	(0.001)
Education = middle	0.94	(0.01)	Education = middle	-2.64	(0.01)
Education = low	1.10	(0.01)	Education = low	-3.88	(0.01)
Married	0.40	(0.001)	Female	-0.92	(0.002)
Female	0.58	(0.002)	$\chi = 1$	1.51	(0.003)
ϱ : type correlation between a couple	0.77	(0.01)			
C. Simulated Type Distribution in the Sample: $\Pr(\chi = 1 \mid \cdot)$ (%)					
By Demographics			By State of Residence		
All		85.4	Expansion States	92.0	
Singles		79.1	Non-Expansion States	75.1	
Edu=low		75.6	State Poverty Rate (Lowest)	94.6	
Edu=high		95.3	State Poverty Rate (Q2)	93.8	
Age>40		93.1	State Poverty Rate (Q3)	85.2	
Childless		85.8	State Poverty Rate (Highest)	70.6	

The right columns of Panel A show that, compared to others, unhealthy individuals and those with children incur larger disutility from working. In general, Type 1 individuals incur lower disutility from working. In addition, we find that the disutility of working full time is lower than that of working part time, which may seem counter-intuitive. However, it should be noted that the "disutility of working" in this model is a composite of various factors that affect labor supply choices beyond contemporary pecuniary benefits. Without taking a stand on these factors, it is not clear that full-time jobs should be more costly than part-time jobs.

The left part of Panel B reports estimates relating x to type.[53] Individuals who are younger,

premium costs are subsidized and 61% if 90% of the costs are subsidized. The corresponding enrollment rates in Finkelstein *et al.* (2019b) are 49% and 79%, respectively. Similarly, our estimates imply that among those covered by Medicaid, the willingness to pay for Medicaid is $851 in terms of consumption equivalent variation, or 21% of the cost of Medicaid, which is close to but lower than the 22% to 46% range found in Finkelstein *et al.* (2019a).

[53]State-specific parameters in the type distribution are included but not reported in this table.

lower-educated, married and/or females are more likely to be Type 2 (the less risk averse type). Moreover, we do find that couples are more likely to be the same type, conditional on observables. The right columns of Panel B reports the skill distribution. In particular, we find that Type 1 (the more risk averse type) are more likely to have higher skills. For an easier illustration of the parameters, Panel C of Table 5 reports the percentage of Type 1 individuals by demographic groups and by state of residence. Overall, 85% of individuals are Type 1's, but this fraction is much higher in Medicaid expansion states and states with lower poverty rates, which arises both from the different distribution of observables across states and from the state-specific shifters in type distribution (Equation 9).

Table 6: Selected Firm-Side Parameter Estimates

Region	Northeast		Midwest		West		South	
A. TFP Distribution $T_j \sim Pareto\left(\underline{T}, \alpha_T\right)$								
Scale $\underline{T}$ (2012)	24.53	(3.52)	25.50	(4.71)	25.57	(1.58)	25.09	(4.09)
Scale $\underline{T}$ (2015)	25.11	(1.40)	25.95	(3.15)	26.41	(3.37)	25.50	(3.09)
Shape α_T	3.49	(0.26)	3.76	(0.51)	3.90	(0.21)	4.14	(0.19)
B. Skill Bias $\ln\left(\frac{A_j}{1-A_j}\right) \mid T_j \sim N\left(\ln\left(\frac{\mu_A}{1-\mu_A}\right) + \nu(\ln(T_j) - \ln(\mu_T))), \sigma_A^2\right)$								
μ_A	0.67	(0.122)	0.73	(0.04)	0.74	(0.04)	0.68	(0.02)
σ_A	1.41	(0.198)	1.61	(0.35)	2.19	(0.23)	1.27	(0.22)
ν	0.86	(0.661)	0.93	(0.19)	1.55	(0.85)	1.15	(0.04)
C. Other Selected Parameters								
ρ (CES power parameter)	0.42	(0.03)	0.41	(0.02)	0.40	(0.01)	0.45	(0.01)
Fixed cost of ESHI	3.57	(0.53)	3.07	(0.84)	2.99	(0.56)	5.09	(1.84)
σ_η (ESHI decision shock)	1.92	(0.43)	1.87	(1.02)	1.91	(0.77)	1.92	(1.19)

Table 6 reports firm-side parameters. In general, these parameters are similar across regions, although the fixed cost of ESHI appears higher in the South. One thing to notice is that the estimated ν's in Panel B, which govern the correlation between T_j and A_j, are positive. That is, higher TFP firms are also more likely to be more skill-biased, and hence have higher demand for high-skill workers ceteris paribus. As shown in Table 2, individuals with higher risk aversion are also more likely to have higher skill levels. As a result, in the equilibrium, higher TFP firms are more likely to offer ESHI, and high-skill workers are more likely to sort into these firms.

Given our estimated model, for each market m and insurance type $k \in \{ESHI, HIX\}$ we obtain the loading factor l_k^m from the baseline equilibrium in the post-ACA era, which is defined as the ratio between the total premium and the total reimbursement on each (m, k) market. We use these loading factors to compute new equilibrium premiums in our counterfactual policy experiments.

6.2 Model Fit

Table 7 and Table 8 report the household-side model fit within the estimation sample. Table 7 shows that the model fits well the distribution of insurance and work statuses by year, while the fit of wages is not as good. Table 8 shows that the model fit of the insurance status regressions in Target 1a is reasonably good. Table 9 report the out-of-sample model validation. In particular, we show that the model can reasonably replicate the patterns in the lowest-poverty-rate states in the post ACA era, both overall and in Medicaid expansion (MEP) states. Given that the hold-out sample is systematically different from the estimation sample, this validation exercise lends us some confidence of the model in conducting counterfactual policy experiment. Finally, Table 10 shows the firm-side model fit at the national level by year. The region-year-specific fits are reported Table A2. The overall fit is good, but the model over-predicts the fraction of high-wage employees and that of full-time employees.

Table 7. Within-Sample Fit: Status and Wage Moments

	Status (%)				ln(wage)			
	Data		Model		Data		Model	
Year	2012	2015	2012	2015	2012	2015	2012	2015
ESHI	66.30	67.06	67.91	67.49	8.14	8.13	8.44	8.44
Medicaid	6.41	10.03	5.46	9.39	6.94	6.88	6.80	6.70
Uninsured	22.11	15.20	21.94	15.37	7.25	7.26	7.56	7.79
Part time	6.58	6.53	6.81	6.70	6.66	6.58	6.30	6.29
Full time	71.08	72.18	73.20	73.42	8.05	8.04	8.41	8.41

Table 8.Within-Sample Fit: Status Regressions

	Uninsured		Medicaid		ESHI		Nonemployed		Full time	
Medi. Expand	Expand	No	Expand	No	Expand	No	Expand	No	Expand	No
					Data					
ACA	-0.067	-0.058	0.051	0.002	0.011	0.038	-0.014	-0.025	0.015	0.022
ACA*lowEdu	-0.061	0.023	0.066	-0.024	-0.004	-0.007	-0.001	0.035	0.015	-0.022
ACA*highEdu	0.073	0.006	-0.064	0.013	-0.015	-0.012	0.018	0.010	-0.003	-0.003
ACA*single	-0.101	-0.013	0.063	-0.010	0.019	0.003	-0.025	-0.028	0.018	0.017
ACA*childless	0.005	-0.016	-0.013	0.021	-0.002	-0.013	-0.004	0.026	0.001	-0.023
					Model					
ACA	-0.026	-0.087	0.026	0.008	-0.034	0.036	0.001	0.015	-0.002	-0.024
ACA*lowEdu	-0.131	-0.022	0.127	-0.047	-0.019	0.045	0.014	-0.014	-0.008	0.001
ACA*highEdu	0.097	0.015	-0.080	0.012	0.012	0.002	0.001	-0.008	-0.001	0.013
ACA*single	-0.145	0.024	0.105	0.010	0.016	-0.036	0.006	-0.002	-0.001	0.002
ACA*childless	-0.025	0.027	0.000	0.005	0.039	-0.024	-0.017	-0.014	0.013	0.025

Table 9. Holdout Sample Fit (Lowest Poverty States 2015)

%	Data		Model	
	All	MEP States	All	MEP. States
ESHI	74.44	72.72	72.58	72.21
Medicaid	8.92	10.19	8.32	10.09
Uninsured	10.18	10.51	10.57	10.19
Part time	6.80	6.69	7.29	7.38
Full time	76.81	76.55	74.33	73.25

Table 10: Model Fits: Firm-Side Moments

	Data		Model	
Year	2012	2015	2012	2015
Size	22.08	22.26	21.29	21.20
ESHI %	56.59	51.37	56.80	50.88
Fr(HighWage Workers) %	23.57	27.55	33.77	35.79
Fr(FullTime Workers) %	74.02	73.29	80.12	80.26
Size*ESHI	18.66	17.83	18.51	16.67
ESHI*Fr(HighWage Workers) %	17.61	17.81	22.56	22.19
ESHI*Fr(FullTime Workers) %	47.62	41.44	49.10	44.71

7 Counterfactual Experiments

Our framework explicitly accounts for the connection between various components of the health insurance system and their connection with the labor market, which allows us to consider counterfactual policies that jointly regulate ESHI, HIX and Medicaid in a complementary manner. We illustrate this idea with two sets of counterfactual policy experiments. The first set of policies subsidize across ESHI and HIX markets, which include pure risk pooling across the two markets as a special case. The second set of counterfactuals examine the interaction between such cross-subsidization policies with Medicaid expansion policies.

7.1 Subsidization across ESHI and HIX

7.1.1 Motivation

Our estimation results suggest that high-skill workers are more likely to sort into firms offering ESHI, which are more likely to be endowed with skill-biased technologies; and that households who choose to be non-employed and/or earn wages low enough to be eligible for Medicaid are more likely to be at the lower end of the skill distribution. Under the current health insurance system, these two types of households are largely "segregated" from the risk pool on HIX.[54] Unlike ESHI, HIX insurance is not bundled with one's job and hence may be more susceptible to adverse selection. Various policies have been proposed to enlarge/improve the risk pool on HIX, mostly aimed at influencing choices between participating in HIX and staying uninsured.[55] Given the aforementioned "segregation," we take a different perspective and exploit policy tools that essentially pool the risk on ESHI and HIX, which can be easily implemented via subsidization across the two markets. A special case of such policies is pure risk pooling, where quality-adjusted insurance premiums are equalized between these two markets in each state.

Remark 5 *Under the status quo, the pool on ESHI is of lower risk than that on HIX (Table 1), leading to a lower insurance premium on ESHI after adjusting for the difference in the quality of ESHI and HIX products. Pooling the risk across the two markets may decrease the insurance premium on HIX and hence enlarge/improve the risk pool on HIX, but at the cost of increasing the premium on ESHI and hence disturbing the labor market. The welfare implication of such risk pooling policies is therefore theoretically ambiguous; it depends on how different households would re-sort across different job and insurance statuses and how different firms would adjust their choices in terms of ESHI offering and the combination of labor inputs. These equilibrium responses in turn depend on the distribution of household preferences and firm technologies; our estimated model has equipped us with this knowledge to investigate this empirical question.*

7.1.2 Implementation

Let $\tilde{r}_b^m$ be the new base premium on HIX, which implies age-adjusted premiums $\widetilde{r}^m(x) = \Gamma(\tilde{r}_b^m, age)$ as in (8); let the premium on ESHI be $\widetilde{q}^m = \theta \tilde{r}_b^m$, where θ is a modifiable policy parameter that adjusts the degree of cross subsidization. For a given θ, we solve for the new equilibrium wages and insurance premiums, which would effectively pool ESHI and HIX. In particular, under $\tilde{r}_b^m(\theta)$ and its implied $\widetilde{r}^m(x)$ and $\widetilde{q}^m$, the break-even condition holds across ESHI and HIX, i.e., the sum of total expected cost for insurers on ESHI and HIX is equal to the sum of total premiums on these two markets.

Although these equilibrium prices essentially pool the risk across ESHI and HIX, the two markets need not be literally pooled as one market. Instead, the ESHI-HIX risk pooling equilibrium associated with any given $\tilde{r}_b^m$ can be achieved via policy interventions such as risk

[54] For example, the existing medical loss ratio regulation imposes that the premium in each Market $k \in$ {ESHI, HIX} should closely reflect the risk among those insured within Market k.

[55] The newly established employer health reimbursement arrangements give firms tax benefit if they reimburse their employees for HIX purchases.

adjustment transfers *across* ESHI and HIX, where insurers facing the riskier (healthier) pool are subsidized (taxed).[56] Specifically, for $k \in \{HIX, ESHI\}$ and Market m, let $\mu_k^m(x)$ be the measure of households with characteristics x who opt for k on m in the new equilibrium associated with $\tilde{r}_b^m$, $C_k^m(x)$ the average expected cost among these households for the insurer, where we have suppressed the dependence of $\mu_k^m(\cdot)$ and $C_k^m(\cdot)$ on $\tilde{r}_b^m$. The government can achieve the new pooling equilibrium by imposing taxes/subsidies τ_k^m as defined by

$$\begin{aligned}(1-\tau_{HIX}^m)\int \mu_{HIX}^m(x)\,\widetilde{r}^m(x)\,dF_m(x) &= \int \mu_{HIX}^m(x)\,C_{HIX}^m(x)\,dF_m(x),\\ (1-\tau_{ESHI}^m)\int \mu_{ESHI}^m(x)\,\widetilde{q}^m dF_m(x) &= \int \mu_{ESHI}^m(x)\,C_{ESHI}^m(x)\,dF_m(x).\end{aligned}$$

By construction, the total subsidy given to the riskier market is offset by the total tax imposed on the healthier market.

The Degree of Adjustment As a policy parameter, θ adjusts the degree of cross-subsidization between ESHI and HIX: a higher θ implies a larger subsidization flowing from ESHI to HIX. As a starting point, we consider a θ that is just enough to offset the difference between ESHI and HIX in their actuarially fair values and quality of care, which is denoted as θ^0 and calibrated at 1.4.[57] The equilibrium achieved under θ^0 is one that simply pools the risk across ESHI and HIX, without further adjustment. Then, we experiment with a series of θ's with increasing degrees of subsidization toward HIX, with the maximum being $2\theta^0$. Among these experiments, we find qualitatively consistent results; quantitatively, the welfare impact increases at first but levels off around $1.5\theta^0$. To save space, we report policy impacts under θ^0 and under $1.5\theta^0$.

7.1.3 Policy Impacts

In this section, we report the effect of ESHI-HIX cross subsidization imposed on the baseline economy, i.e., the equilibrium under the state-specific policies as implemented in 2015. The upper panel of Table 11 shows the percentage changes in premiums on HIX and ESHI markets, averaged across states. The lower panel shows the percentage point (ppt) changes in insurance

[56] Risk adjustment policies have been central policy components in many health insurance markets, including Medicare Advantage, Medicare Part D, as well as HIX, see, for example, Handel *et al.* (2015) for their analysis of risk adjustment within HIX. As far as we know, we are the first to consider risk adjustment transfers *across* ESHI and HIX.

[57] Specifically, $\theta^0 = \frac{g_{ESHI}}{g_{HIX}}\frac{ME_{ESHI}}{ME_{HIX}}$, where $\frac{g_{ESHI}}{g_{HIX}} = \frac{0.85}{0.7}$ is the ratio of generosity or actuarial values of ESHI relative to HIX, and $\frac{ME_{ESHI}}{ME_{HIX}}$ accounts for differences in the quality of care as proxied by the population level medical spending on $k \in \{ESHI, HIX\}$: ME_k is the average medical expenditure if everyone participates in k as predicted by our estimated medical expenditure process on k.

and work status across all individuals and by demographics. With pure risk pooling $\left(\theta=\theta^0\right)$, changes in premiums are small. With $\theta = 1.5\theta^0$, HIX premium decreases by 33.6% while ESHI premium increases only by 2.8%. This arises partly from the fact that ESHI is a much larger market than HIX and that the effect of adjustment transfers is more noticeable in a smaller market. Under both θ's, the cross-subsidization policy would increase the fraction of individuals covered by HIX and lower that covered by ESHI, leading to a very small reduction in the uninsured rate in all demographic groups. There is also a very small but *positive* effect on employment, in that the fraction of full-time workers is slightly larger while labor force participation rate is barely affected. The only exception is the lowest education group, where there appears to be a tiny work disincentive effect.

Result 1: ESHI-HIX cross subsidization has very small but positive effects on insurance and work status.

Table 11. Subsidization across ESHI and HIX: Premiums and Status

	$\theta=\theta^0$					$\theta=1.5\theta^0$				
	Change in Premiums (%)					Change in Premiums (%)				
HIX	-6.33					-33.61				
ESHI	0.59					2.81				
	Change in Status (ppt)					Change in Status (ppt)				
Group	Uninsured	HIX	ESHI	Nonwork	Fulltime	Uninsured	HIX	ESHI	Nonwork	Fulltime
All	-0.10	0.19	-0.12	0.01	0.07	-0.29	0.74	-0.58	-0.01	0.11
Low Edu	-0.02	0.17	-0.16	0.05	-0.03	-0.10	0.51	-0.44	0.06	-0.03
High Edu	-0.17	0.16	-0.09	-0.05	0.18	-0.42	0.75	-0.81	-0.17	0.38
Single	-0.14	0.16	0.02	-0.02	0.16	-0.38	0.71	-0.37	-0.02	0.13
Childless	-0.18	0.26	-0.11	0.02	0.06	-0.41	0.86	-0.53	0.02	0.04

Now we present policy effects on government budget and households' ex ante welfare, i.e., households' optimal values integrated over taste shocks.[58] For each household, we measure the change in its ex ante welfare by consumption equivalent variation (CEV), i.e., the expected dollar change in a household's baseline consumption that would make it equally well off as it would be in the new equilibrium (see the online appendix for the derivation of CEV). Table 12 reports the average CEV and the fraction of winners overall and within each subgroup of households. Overall, average household welfare increases by \$189 under the pure risk pooling case ($\theta=\theta^0$) and by \$340 under $\theta=1.5\theta^0$. In both cases, over 70% of households would win.

[58]Ex ante welfare is defined as $\mathbf{V}\left(x,m,\boldsymbol{\chi},\mathbf{s}\right)\equiv E\max_{(\mathbf{h},\mathbf{z})}\left\{V\left(x,m,\boldsymbol{\chi},\mathbf{s},\mathbf{h},\mathbf{z}\right)+\epsilon_{\mathbf{h},\mathbf{z}}\right\}.$

Welfare gains differ across households: households with high education are more likely to win and to win more, partly because they are less likely to be eligible for HIX subsidies and hence more likely to benefit from the decrease in HIX premiums. Type-1 households, those who are more risk averse, are also more likely to win. Government net spending in the health insurance system decreases by \$14 per household (hh) under $\theta = \theta^0$ and by \$41 per hh under $\theta = 1.5\theta^0$.[59] The savings come mostly from decreases in HIX premium subsidies since subsidies are directly linked to HIX premium levels (see Section 2).

Result 2: ESHI-HIX cross subsidization benefits most households, increases average household welfare, and lowers government expenditure.

Remark 6 *Relative to their impacts on the equilibrium distribution of insurance and work status, ESHI-HIX cross subsidization policies have larger impacts on households' ex ante welfare. This is because these policies would significantly reduce HIX premiums without significantly affecting ESHI premiums or wages on the labor market. As such, these policies smooth a household's consumption across different contingencies (e.g., shocks to labor supply decisions) it may face ex post, which improves the welfare of the risk-averse household.*

Table 12: Subsidization across ESHI and HIX : Household Welfare and Gov Spending

	$\theta = \theta^0$		$\theta = 1.5\theta^0$	
Welfare	CEV (\$)	Fr(Winners)	CEV (\$)	Fr(Winners)
Overall	189.4	0.71	340.3	0.73
Low Edu Singles or (Low, Low) Couples	81.4	0.63	125.1	0.61
High Edu Singles or (High, High) Couples	283.7	0.77	525.4	0.81
Single	194.5	0.69	372.9	0.72
Childless	211.6	0.71	398.0	0.75
Type 1 Singles or (Type 1, Type 1) Couples	221.3	0.74	395.0	0.77
Type 2 Singles or (Type 2, Type 2) Couples	43.5	0.52	52.6	0.55
Savings in Gov. expenditure per hh (\$)	14.5		40.9	
Savings in HIX subsidies per enrolled hh (\$)	229.0		759.1	

7.2 Interaction between ESHI-HIX Subsidization and Medicaid

Given the connection between the three components of the health insurance system, the effect of policies on ESHI and HIX markets may vary with Medicaid policies.[60] To see this point,

[59] The cross subsidization between ESHI and HIX per se is revenue neutral. Government net spending includes expenditures on Medicaid and HIX subsidies net of revenues from insurance mandate tax penalties.

[60] Chetty and Finkelstein (2013) point out that understanding how public insurance programs or policies affect the existence and nature of adverse selection in the residual private markets is an important area for further work.

we examine the impact of cross ESHI-HIX subsidization policies separately for the 15 ACA Medicaid expansion (MEP) complying states and 13 non-complying states under counterfactual scenarios with and without Medicaid expansion.[61] In doing so, we would like to highlight the impacts of ESHI-HIX subsidization on different groups of states given the same hypothetical Medicaid expansion status, and the impacts of ESHI-HIX subsidization on the same group of states under different hypothetical Medicaid expansion statuses.

Table 13 shows these effects under $\theta = \theta^0$ (the left panel) and $\theta = 1.5\theta^0$ (the right panel). Within each panel, the first two columns are for the 15 MEP complying states, with the first (second) column showing the effect of cross-ESHI-HIX subsidization without (with) Medicaid expansion.[62] The third and fourth columns show the same statistics for the 13 MEP non-complying states. For each group of states, the bold-faced **Yes/No** status is their observed Medicaid expansion status in 2015. Overall, cross subsidization between ESHI and HIX improves welfare, lowers the uninsured rate and saves on government expenditure in both groups of states, regardless of whether or not Medicaid were expanded; and the effect is larger when $\theta = 1.5\theta^0$.

Table 13: Effects of Cross-ESHI-HIX Subsidization by Medicaid Expansion Status

	$\theta = \theta^0$				$\theta = 1.5\theta^0$			
Group of States	MEP Compliers		Non-Compliers		MEP Compliers		Non-Compliers	
Medicaid Expansion	No	**Yes**	**No**	Yes	No	**Yes**	**No**	Yes
Change in Uninsured (ppt)	-0.01	-0.03	-0.20	-0.11	-0.18	-0.23	-0.38	-0.30
CEV ($)	73.7	169.9	216.1	234.2	170.5	338.0	343.4	451.7
Fr(winner)	0.58	0.75	0.64	0.69	0.77	0.72	0.75	0.76
Savings for Gov. per hh	12.4	11.3	18.8	14.1	44.0	27.9	58.8	51.8

Given the same Medicaid expansion status and the same degree of adjustment θ, the effect of cross-ESHI-HIX subsidization is larger in MEP non-complying states in terms of declines in uninsured rates, average welfare gains, fractions of winners and savings in government expenditure.[63] We also find some limited interaction between Medicaid expansion and ESHI-HIX cross

[61] For MEP complying states, we use their 2012 state-specific Medicaid eligibility rules in the counterfactual non-expansion scenario. Of all households in the sample, 57.8% live in MEP complying states.

[62] For example, to get the results shown in the first column, for each state, we compute the equilibrium if Medicaid were not expanded and there is no ESHI-HIX cross subsidization (E0), then, we compute the equilibrium if Medicaid were not expanded but ESHI-HIX cross subsidization were in place (E1), Column 1 shows the difference between E1 and E0.

[63] The two groups of states differ both in their population composition, state-specific unobservables and state-specific policies. For a given yes/no Medicaid expansion status, the uninsured rate is higher in MEP non-complying states before cross subsidization.

subsidization. Given θ and the same group of states, welfare gains from the cross subsidization, in terms of both CEV alone and CEV plus government savings, tend to be larger when Medicaid is expanded.

Result 3: ESHI-HIX cross subsidization leads to higher welfare gains when it is interacted with Medicaid expansion.

Remark 7 *It is theoretically ambiguous whether ESHI-HIX cross subsidization would be more effective with or without Medicaid expansion. For example, with Medicaid expansion, on the one hand, fewer people would be uninsured, which means fewer people would benefit from the decrease in HIX premiums due to the cross subsidization; on the other hand, the risk pool on HIX is relatively healthier to begin with, which means cross subsidization would be less distorting for ESHI premiums and labor market wages.*

8 Conclusion

We have developed and estimated an equilibrium model of labor market and health insurance markets, highlighting the interactions across various components of the health insurance system (employer-sponsored, individual, and public), and their relationship with the labor market. The model allows for rich heterogeneity across local markets, workers, and firms. We estimate the model exploiting policy variation associated with the Affordable Care Act. The estimated model well matches the data, including patterns in a non-random hold-out sample.

Via counterfactual policy experiments, we find that ESHI-HIX cross subsidization could simultaneously lower the uninsured rate, improve household welfare and lower government expenditure in the health insurance system. Moreover, the policy leads to higher welfare gains when it is interacted with Medicaid expansion. These findings have illustrated the value of a framework like ours, which allows one to explore policies that regulate different parts of the health insurance system in a complementary manner and thereby achieve higher efficiency. As such, this paper has made a modest step toward the goal of answering globally optimal social insurance design questions as pointed out by Chetty and Finkelstein (2013).

This paper has some important limitations. For example, without considering the funding regime (e.g., the tax system) underlying the health insurance system and the general equilibrium effect on health care costs, it is beyond the scope of this paper to properly study the effect of more drastic health insurance reforms, such as a switch to universal health insurance. In addition, we have left several challenging extensions for future work. One extension is to embed household dynamics into our framework, including savings and potential direct effects of health insurance on one's health and hence future productivity. Another is to consider health insurance regulations in the presence of other sources of inefficiency besides adverse selection in health insurance choice decisions, such as search friction on the labor market and/or non-competitive insurance markets.

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Appendix

A Functional Forms

We assume that household utility is separable in consumption, leisure and non-pecuniary preferences for health insurance. Let n_x be the adult equivalent measure of household x, utility function is given by

$$u(C, \mathbf{h}, \mathbf{INS}; x, \boldsymbol{\chi}) = \frac{(C/n_x)^{1-\gamma_{\boldsymbol{\chi}}}}{1-\gamma_{\boldsymbol{\chi}}} + \sum_{k=1,3,4} \varpi_k I\left(INS_k = 1\right) - D\left(\mathbf{h}, \boldsymbol{\chi}, x\right).$$

The utility from consumption is assumed to be governed by a CRRA function, with household-type-specific parameter $\gamma_{\boldsymbol{\chi}}$. $\{\varpi_k\}$ captures household's non-pecuniary preferences for ESHI, Medicaid and individual insurance coverage. $D(\cdot)$ is the disutility from working, taking the following form

$$D\left(\mathbf{h}, \boldsymbol{\chi}, x\right) =$$

$$\begin{cases} \sum_{l=P,F} I(h=l)\left(d_{\chi l} + \varphi_{1l} I\left(kid>0\right) + \varphi_{2l} I(unhealthy)\right) & \text{if single} \\ \upsilon \sum_{n=1}^{2} \sum_{l=P,F} I(h_n=l)\left(d_{\chi l} + \varphi_{1l} I\left(kid>0\right) + \varphi_{2l} I(unhealthy)\right) & \text{otherwise} \end{cases},$$

where $d_{\chi l}$ is a type-specific disutility of working with status $l = P, F$. φ_{1l} and φ_{2l} are the additional disutility from working in the presence of young children and in bad health, respectively. For a coupled household, the disutility is summed over each spouse's disutility, with a scale parameter υ to be estimated.[64]

[64] One could use vectors of disutility parameters separately for singles and for couples. We instead use a scale parameter to save on the total number of parameters.

B Additional Tables

Table A1: Within-Couple Correlation

Medicaid	Expansion States		Non-Expansion States	
	2012	2015	2012	2015
Education: %				
(Low, Low)	6.00	6.46	6.26	6.81
(Mid, Mid)	37.17	35.90	39.71	38.73
(High, High)	27.33	27.40	22.63	24.68
Work Status: %				
(Full time, Full time)	52.86	53.49	53.04	54.12
(Full time, Part time)	10.82	10.17	9.68	8.84
(Full time, Nonemp)	31.20	32.42	32.97	32.64
(Part time, Part time)	0.44	0.40	0.31	0.24
(Part time, Nonemp)	1.71	1.37	1.42	1.57
Wage Correlation|both working	0.25	0.26	0.22	0.22
Number of Coupled Households	7,745	6,233	5,296	4,829

Table A2: Model Fits: Firm-Side Moments By Region

Year	2012				2015			
Region	NE	M	W	S	NE	M	W	S
	Data							
Size	24.73	24.21	19.47	20.99	25.26	24.53	19.70	20.72
ESHI %	20.81	21.17	15.68	17.84	21.22	19.45	15.63	16.24
Fr(HighWage Workers) %	46.86	61.15	55.29	59.85	49.06	53.25	51.76	51.25
Fr(FullTime Workers) %	20.37	22.34	25.20	25.04	29.03	19.17	27.01	32.52
Size*ESHI	66.39	70.82	80.38	76.01	75.76	67.22	72.16	76.55
ESHI*Fr(HighWage Workers) %	16.36	16.50	21.16	16.59	15.86	13.10	17.80	22.06
ESHI*Fr(FullTime Workers) %	40.25	46.84	49.53	50.92	36.92	41.78	39.56	45.14
	Model							
Size	24.50	22.35	20.16	19.59	23.67	22.62	21.38	18.70
ESHI %	51.48	57.14	56.83	59.50	43.98	56.75	50.17	51.57
Fr(HighWage Workers) %	31.71	36.67	33.79	32.96	34.08	37.35	36.80	35.10
Fr(FullTime Workers) %	79.49	83.07	80.85	78.00	79.68	83.38	81.41	77.78
Size*ESHI	21.09	20.02	16.22	17.64	18.25	18.45	14.57	16.00
ESHI*Fr(HighWage Workers) %	19.18	24.73	23.60	22.28	18.14	24.81	23.55	21.94
ESHI*Fr(FullTime Workers) %	43.96	51.07	49.60	50.29	38.12	50.91	44.81	44.48