Health Care Reform or Labor Market Reform? A Quantitative Analysis of the Affordable Care Act*

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Abstract

The Patient Protection and Affordable Care Act (ACA) requires all individuals to have health insurance, and introduces penalties to large firms that do not offer affordable coverage to their employees. While the possible effects of the ACA on the insurance decision of individuals have been studied, what is less studied is how the ACA can affect labor demand. In particular, since the ACA does not require small firms to offer health insurance, and does not require firms to offer health insurance to part-time employees, there are concerns that employers will either stay small, or replace full-time workers with part-time workers in order to avoid offering health insurance to their employees. The main focus of this paper is to study the effects from the distortions caused by the ACA, modeling employer' decision on hiring part-time and full-time workers, as well as the decision to offer coverage. The aim is to quantify the effect of the possible changes in the size distribution of firms and the composition of the labor force on employment, aggregate output, and welfare.

Keywords: health insurance, health reform, inter-temporal consumer choice, inter-temporal firm choice
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1 Introduction

The Patient Protection and Affordable Care Act (ACA), which was signed into law in 2010, is the biggest reform in the U.S. health care system. The reform aims to provide near-universal coverage. There are three major components of the reform. The first one is the individual mandate which requires all individuals to obtain coverage or pay a penalty. The mandate is particularly important for individuals and families who do not have access to employer-sponsored health insurance, as the reform introduces the Health Insurance Marketplace that gathers health insurance options offered by private companies in the state. The second element is the penalty for large firms that employ more than 50 full-time equivalent workers, but do not offer affordable coverage to its employees. The reform also brings tax subsidies to small firms with less than 50 full-time equivalent workers when health insurance is offered. The third element is the expansion of Medicaid, which offers publicly-provided health insurance for individuals and families who are below 133 percent of the federal poverty line (FPL).

The ACA has generally adopted the model of the 2006 Massachusetts Health Care Reform. A major impact of the health reform in Massachusetts was to significantly lower the rate of uninsurance (Chan & Gruber (2010), Kolstad & Kowalski (2012), Hackmann et al. (2013)). Similarly, since the enactment of the ACA in 2010, the share of uninsured has started to decline. According to the White House, the share of Americans without health insurance declined by 0.3 percentage points, from 15.7 percent in 2011 to 15.4 percent in 2012. In total, the share of Americans without health insurance has declined by 0.9 percentage points since 2010.[1] The uninsured

[1] http://www.whitehouse.gov/blog/2013/09/17/america-s-uninsured-progress-and-prospects-

rate is expected to fall further as the individual mandate of the ACA gets fully implemented in 2014.

While the possible effects of the ACA on the insurance decision of individuals have been studied, what is less studied is how the ACA may affect the labor demand. In particular, since the ACA does not require small firms to offer health insurance, and does not require firms to offer health insurance to part-time employees, there are concerns that employers will either stay small, or replace full-time workers with part-time workers. As Restuccia & Rogerson (2008) and Guner et al. (2008) have shown, policies that distort the size distribution of firms could have sizable consequences for aggregate output, and welfare. Brügemann & Manovskii (2010) also study the effects from the distortions caused by the ACA, but they abstract from the margins between full-time and part-time employees, which is a main focus of this study.

The rest of the paper is organized as follows. Section 2 reviews the literature. Section 3 discusses the elements of the U.S. health care system pre- and post-ACA. Section 4 presents the key ingredients and an equilibrium of the theoretical model. Sections 5 lays out the calibration strategy. Section 6 discusses the policy experiments. Lastly, Section 7 concludes.

2 Related Literature

Our paper is related to several different strands of literature. The first one is on the macroeconomics of the health insurance system in the U.S. Among the important studies in this literature, Jeske & Kitao (2009) study the regressive tax policy on health insurance in the U.S. which subsidies workers who are offered employer-based

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insurance. The subsidy is in the form of tax deductions, and favors high-income earners. Jeske & Kitao (2009) construct a dynamic general equilibrium model with heterogenous agents and an endogenous demand for health insurance. Their results indicate that removing the tax subsidy would substantially decrease health insurance coverage and lead to a partial collapse of the group insurance market due to adverse selection.

Feng (2009) uses a dynamic general equilibrium model to study the macroeconomic effects of alternative reforms to the U.S. health insurance system: the expansion of Medicare to the entire population, the expansion of Medicaid, an individual mandate, the removal of the tax break to purchase group insurance and providing a refundable tax credit for insurance purchases. Using a stochastic OLG model with heterogenous agents facing uncertain health shocks, the study finds that the expansion of Medicare and an individual mandate are good candidates for achieving universal health care. However, a removal of the tax subsidy to purchase private insurance seems to cause a big reduction in the insurance market.

Hansen et al. (2011) evaluates the welfare consequences of a policy reform that would allow younger workers (aged 55-64) to purchase Medicare coverage from the government, Medicare buy-in. Using a calibrated life-cycle economy with incomplete markets and endogenous labor supply, they show that unless this program is subsidized by the government an equilibrium with an active market for the Medicare buy-in will not exist due to adverse selection. Even when there is a mandate requiring everyone to purchase some form of health insurance, the result continues to hold, since healthy individuals will choose alternatives to being pooled with less healthy individuals.

Fang & Gavazza (2011) investigate the effect of employment-based health insurance system in the U.S. on individuals' life cycle health care decisions. Defining health as a form of human capital, they show that employment-based health insurance system may lead to an inefficiently low level of individual health investment, which becomes more severe when workers' turnover rate is higher.

This paper is also related to the literature that studies the past health care reforms in the U.S. One such reform is the 2006 health care reform in Massachusetts, also known as the Romneycare. While the ACA is at the national level, it shares many similar elements with the Massachusetts Health Care Reform. Both reforms focus on expanding health insurance coverage to near-universal levels. Both reforms are mandate-based and are based on three key provisions to expand coverage: employers offer coverage or pay a penalty, individuals obtain coverage or pay a penalty, and public coverage gets expanded.

Kolstad & Kowalski (2012) assess the impact of Massachusetts Health Care Reform on welfare. They find that the compensating differential for employer-provided health insurance is only slightly smaller in magnitude than the average cost of it to employers. Moreover, mandate-based reform turns out to be substantially more efficient than a tax-based reform.

Hackmann et al. (2012) find that increased coverage due to the reform led to lower average hospital costs, and thus lower average premiums. According to their calculations, premiums in employer-sponsored plans followed the national trend, but premiums in the non-group market declined by 20% between 2006 and 2009.

Hackmann et al. (2013) focus on the individual mandate of the Massachusetts Health Care Reform, and show that the individual mandate reduced adverse selection

and increased annual welfare by $335 per person in the individual market, which translates into an overall annual welfare gain of $71 million.

The third strand of literature is the recent one that studies the consequences of the ACA. Janicki (2011) develops a heterogeneous agents incomplete markets model augmented with idiosyncratic medical expenditure shocks that are partially insurable through a private employer-sponsored health insurance market. His results show that with the reform the share of uninsured households declines from 22.6% to 1.1%. However, the reform is also associated with crowding-out of the private insurance market, because of increased cost of health insurance due to the individual mandate.

Similarly, Jung & Tran (2011) use a stochastic dynamic general equilibrium overlapping generations model with endogenous health capital and show that the reform lead to universal coverage of the working age population. However, spending on health care services will increase due to a moral hazard effect triggered by the newly insured. They conclude that the reform is socially efficient because it leads to welfare gains for generations born before (up to 25 years) and after the implementation of the reform.

More recently, Pashchenko & Porapakkarm (2012) quantify the welfare effects of the reform by decomposing it to its regulatory and redistributive components. Using a general equilibrium life-cycle model that incorporates both medical expenses and labor income risks, they show that the reform's welfare gains mostly come from the redistributive measures embedded in the reform, rather than changes in the regulation.

A common feature among papers in this newly emerging macro-literature is that the consequences of the health care reform are studied by focusing on its effect on

individuals' insurance decisions. These models do not take into account the possible effects of the health care reform on the firms' decisions to offer health insurance to their employees. There are two exceptions. The first one is Brügemann & Manovskii (2010) which constructs a model with discrete employer size, search and matching frictions, employer-provided health insurance, and government regulation, to study firms' health insurance coverage decision after the ACA. The authors conclude that penalties imposed on individuals and tax credits for small firms play important roles in increasing aggregate coverage.

A similar study is Aizawa & Fang (2013), where an equilibrium labor market search model with risk averse workers facing medical expenditure shocks are matched with firms making health insurance coverage decisions. They show the uninsurance rate gets reduced significantly with the ACA. Interestingly, they also argue that the uninsured rate could be lower if the ACA's employer penalty were eliminated.

Our paper follows Brügemann & Manovskii (2010) and Aizawa & Fang (2013) in modeling the employer's coverage decision before and after the implementation of the ACA. Different from these earlier studies we distinguish between part-time and full-time jobs. The reform gives the right incentives to employers with more than 50 full-time equivalent workers to offer health insurance to their full-time workers. However, the law is silent on the health insurance coverage for part-time workers. This has many to argue that the composition of the jobs in the U.S. labor market will be changing due to the health care reform, because employers will be shifting their workforce from full-time employment toward part-time employment. This will be to avoid paying health insurance premiums for their part-time workers, as well as to avoid paying penalties.

3 The Patient Protection and Affordable Care Act

3.1 U.S. Health Care System Pre-ACA

Healthcare spending in the U.S. corresponds to more than 17% of GDP. This share is the highest among the major industrialized nations. Despite spending so much on health care the U.S. is the only industrialized nation without a universal coverage.

Majority of the non-elderly population is covered by health insurance provided by employers. Employers that offer health insurance share the cost of the health insurance premium with the employee. This type of insurance is provided by private insurers in the group insurance market. Health insurance provided through employers is purchased with pre-tax earnings, while insurance provided outside the employment setting is purchased with post-tax earning. Therefore, for an employed individual the former is a better choice than the latter.

The U.S. also has Medicare and Medicaid programs that offer public insurance. The Medicare is the universal health insurance program for the elderly. The Medicaid is a program designed for the low-income families, especially those with children.

If an individual of working age, has too high of an income to qualify for Medicaid, and is not offered insurance through an employer, then her only option is to seek health insurance from the private non-group insurance market. A major problem with this market is the exclusions based on pre-existing health conditions. Private insurers in this market can deny coverage or offer only limited coverage with high premiums to those who have pre-existing conditions.

3.2 U.S. Health Care System Post-ACA

The ACA will affect all individuals and employers. The health care system will change in the following way.[2]

a. Individuals: As of January 2014, the individual mandate mandate requires all individuals to have health insurance that qualifies as minimum essential coverage.[3] There are several ways to obtain health insurance. The first one is going to the insurance market, called Health Insurance Marketplace, in each state. Each state's Health Insurance Marketplace is run by either the state itself, or the federal government, and gathers health insurance options offered by private companies in the state. Plans are presented in five categories, bronze, silver, gold, platinum, and catastrophic, which makes comparison easier. The second option obtaining coverage is through a job, where the employer offers health insurance by paying part of the premiums or by self-insurance. An employed individual covered through her employer may change to Marketplace coverage; however, they might not quality for lower premiums, since these rates are calculated based on the income of the individual. Also, in this case the employer does not contribute to the individual's premiums.

Unemployed individuals may qualify for Medicaid, the Children's Heath Insurance Program (CHIP), or lower premiums on Marketplace based on their income. Medi-

[2]More detailed information can be found at www.healthcare.gov

[3] Minimum essential coverage includes individual market policies, job-based coverage, Medicare, Medicaid, Children's Heath Insurance Program, TRICARE and certain other coverage. The essential health benefits include at least the following items and services: Ambulatory patient services (outpatient care you get without being admitted to a hospital); emergency services; hospitalization (such as surgery); maternity and newborn care (care before and after the baby is born); mental health and substance use disorder services, including behavioral health treatment (this includes counseling and psychotherapy); prescription drugs; rehabilitative and habilitative services and devices (services and devices to help people with injuries, disabilities, or chronic conditions gain or recover mental and physical skills); laboratory services; preventive and wellness services and chronic disease management; pediatric services.

caid offers coverage to individuals with limited incomes and disabilities. While each state has different Medicaid rules, many states are expanding Medicaid to cover more people. CHIP provides coverage for children and pregnant woman in families that cannot afford private insurance, but have income too high for Medicaid.

Starting in 2014, health insurance companies are not allowed to refuse coverage or charge more to individuals with pre-existing health conditions.[4]

If an individual chooses to not have health coverage, then she will be required to pay a fee of the greater of $95 per person or 1% of yearly income in 2014. The fee will increase every year. In 2016, the fee will be greater of $695 per person, or 2.5% of yearly income.[5] Also, the individual will be responsible for the cost of her medical care.

b. Employers: All firms covered by the Fair Labor Standards Act are required to notify their employees via a written notice about the Health Insurance Marketplace.

The new health care law has different requirements for small and large firms. A firm is considered a "large" firm if it has 50 full-time equivalent employees. All employees working more than 30 hours per week are considered full-time employees, while those working less than 30 hours per week are considered part-time. There is also a new concept of "full-time equivalent" that helps determine if the firm is a small or a large one.

Let's say a firm has 40 workers working more than 30 hours per week, and 20 workers working 15 hours per week. Those 40 workers are counted as full-time em-

[4]The only exception is for grandfathered individual health insurance plans which are not bought through an employer.

[5]There will be some exceptions for financial hardship, religious objections, American Indians, people who have been uninsured for less than three months.

ployees. 20 workers working 15 hours per week are equivalent of 10 full-timers in terms of hours, so they are counted as "full-time equivalent" employees. In total, the firm has 40+10=50 full-time or full-time equivalent employees. This firm is then considered as a large one, and is required to provide health insurance to its full-time employees or pay the "Employer Shared Responsibility Payment." Additionally, the plan offered by the employer has to meet the minimum value. A health plan meets minimum value if the plan's share of the total costs of covered services is at least 60%.[6]

The Employer Shared Responsibility Payment applies to large firms that don't offer insurance that meets certain minimum standards, or offers health insurance coverage that is not "affordable" for its employees. If an employee's share of the premium costs for employee-only coverage is more than 9.5% of their yearly household income, then the coverage is considered non-affordable.[7]

The amount of the annual Employer Shared Responsibility Payment is based partly on whether the firm offers health insurance or not. If no health insurance is provided, then the annual payment is $2000 per full-time employee (excluding the first 30 employees). If health insurance is provided, but the insurance doesn't meet the minimum requirements, the annual payment is $3000 per full-time employee who qualifies for premium savings in the Marketplace. Unlike employer contributions to employee premiums, the Employer Shared Responsibility Payment is not tax deductible.

A firm is considered "small" if it has less than 50 full-time equivalent employees.

[6] All plans offered in the Marketplace meet the minimum value.

[7] Since the firm will not know the household income of its employees, it will need to make sure the employee's share of the premium for employee-only coverage doesn't exceed 9.5% of their wages for that year in order to avoid paying the Employer Shared Responsibility Payment.

Small firms are exempt from the Employer Shared Responsibility Payment. Moreover, a small firm may qualify for employer health care tax credits if it has fewer than 25 full-time equivalent employees making an average of about $50,000 a year or less. In order to qualify for the Small Business Health Care Tax Credit, the firm needs to pay at least half of its full-time employees' premium costs. However, the firm is not required to offer coverage to its part-time employees or to dependents. There are higher benefits for smaller firms. The tax credit is highest for firms with fewer than 10 employees who are paid an average of $25,000 or less. The smaller the business is, the bigger the credit will be. Starting in 2014, the tax credit will be available only if the firm offers coverage through the Small Business Health Options Program (SHOP). This is a new program that simplifies the process of buying health insurance for your small business. Beginning in 2016, all SHOPs will be open to firms with up to 100 full-time equivalent employees.

Individual mandate has been in effect since January 2014. However, employer penalty won't be in effect until 2015 for firms with more than 100 full-time equivalent workers, and the date is pushed to 2016 for firms with less than 100 full-time equivalent workers.[8]

3.3 Health Insurance Provision by Firm Size

Health insurance provision by firm size is illustrated in Figure 1. The data come from the Medical Expenditure Panel Survey (MEPS). This survey is run by the Agency

[8]The provisions to Medicare include: Expanded prescription drug coverage; Improved low income subsidy for drug coverage; Expanded coverage of preventative services; Primary care improvements; Increased premiums for high income beneficiaries; Increased taxes for high income households; Reductions in payments and other requirements for medicare advantage; Reduction in growth of payments to providers; Special provisions for rural hospitals; Encouragements for innovations

for Healthcare Research and Quality, a subdivision of the U.S. Department of Health and Human Services. The dataset was obtained from a survey of employers about the health insurance provided at their establishments, based on the parent firm's size.

The definition of establishment is consistent with the one used by the BLS. An establishment is defined as a location where business is conducted, making the firm the entire set of establishments for one company that compose one company. The results presented in the MEPS are at the establishment level, categorized by the size of the parent firm. For example, in 2012 Company X employed 361,000 people (full-time and part-time), making the firm size more than 1000 employees. Company X had 1,778 stores in 2012, and each of those stores would count as an establishment in the more than 1000 employees category.

The table's first tier represents the number of full time employees who work at private establishments, sorted by the size of the firm/total number of employees at the firm. The second tier is the MEPS report on the percentage of establishments that offer health insurance to their employees, sorted by firm size and total number of employees.

3.4 Health Insurance Provision for Full-Time and Part-Time Workers

Health insurance coverage for full-time and part-time workers is very different in the U.S. labor market. Currently, around 80% of the labor force is working at full-time jobs. According to the ADP's 2012 Study of Large Employer Health Benefits - which surveyed firms with more than 1000 employees - 88% of the full-time workforce is

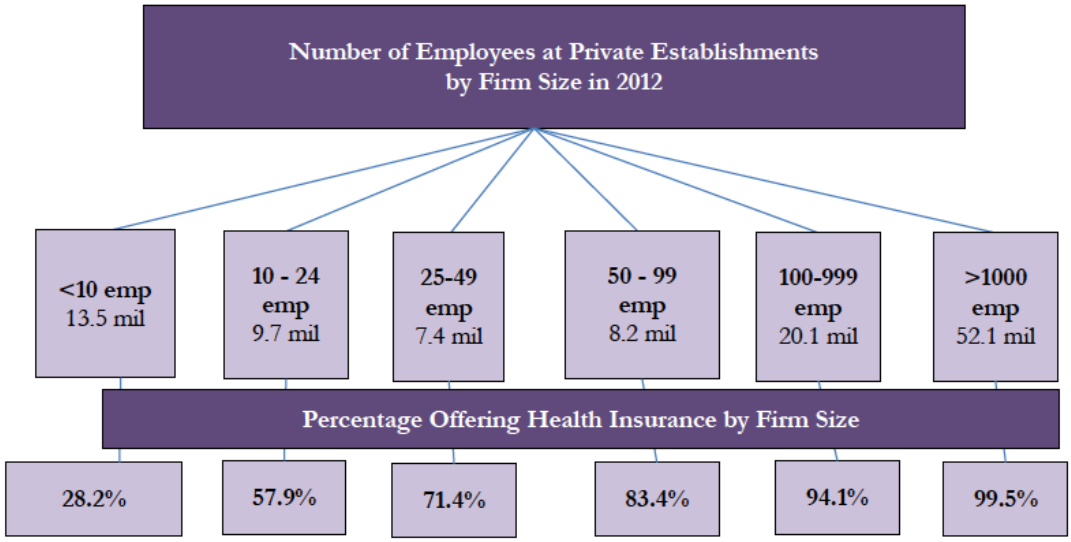

Figure 1: Health Insurance Provision at Private Establishments by Firm Size in 2012
Source: MEPS and authors's calculations.

eligible for health care benefits.[9] 77% of those eligible will select health coverage. The result is that 68% of the total full-time workforce is covered by their employers' health plan. This percentage is very small when it comes to part-time employees. Part-time employment corresponds to 20% of all jobs in the U.S. labor market. According to the same ADP Study, only 15% of these part-time employees are eligible for health coverage and the take rate for part-time employees is only 53%. Thus, about half of all eligible part-time employees (8%) participate in health coverage. When both full-time and part-time employees considered together, part-time employees represent less than 5% of the total population participating in their employers' health coverage.

A similar conclusion can be reached by looking at numbers from a different data

[9]http://www.adp.com/tools-and-resources/adp-research-institute/research-and-trends/research-item-detail.aspx?id=656665F4-5D63-47D1-8114-57D11D837F60

set. According to the MEPS data, 70% of private-sector part-time employees were working at at establishments that offer health insurance in 2012.[10] However, only 31% of them were eligible for health insurance at establishments that offer health insurance. 42% of private-sector part-time employees eligible for health insurance were enrolled in health insurance at establishments that offer health insurance. Total of 13% of private-sector part-time employees were enrolled in health insurance at establishments that offer health insurance.

To conclude, a very small share of workers at part-time jobs had coverage before the ACA. Moreover, the new law does not require employers to take any action to offer coverage to their part-time employees. It seems that uninsured rate will continue to be high among part-time workers.

4 Model

4.1 Firm

A firm is characterized by (a, z). a is the idiosyncratic fixed benefit (if positive) or cost (if negative) of providing health insurance to employees. z is the individual productivity. The type distribution of firms is denoted by $\chi_{a,z}$. Each period, a firm (a, z) decides whether to offer an insurance ($i = 2$) to its full-time workers or not ($i = 1$), and how many full-time workers (n) and part-time workers to hire. For simplicity, we assume that firms do not offer health insurance to part-time workers.

Current profits for a firm (a, z) that hires (n, m) but does not offer health insurance

[10] Data can be found at http://meps.ahrq.gov/mepsweb/

to full-time workers ($i = 1$), are as follows:

$$p(a, z, n, m; i = 1) = (1 - \tau_f) \left\{ z \left[\alpha (p_1 n)^{\epsilon} + (1 - \alpha)(\psi p_3 m)^{\epsilon} \right]^{\frac{\theta}{\epsilon}} - w_1 p_1 n - \psi w_3 p_3 m \right\} \tag{1}$$

τ_f is the proportional corporate income tax rate. $y = z \left[\alpha (p_1 n)^{\epsilon} + (1 - \alpha)(\psi p_3 m)^{\epsilon} \right]^{\frac{\theta}{\epsilon}}$ is the production technology. Notice that there is a constant elasticity of substitution (CES) between full-time labor and part-time labor. The elasticity of substitution between full-time and part-time workers is $\frac{1}{1-\epsilon}$. α is the share parameter of the CES aggregation function. $\theta < 1$ represents the decreasing returns to scale of the production technology. w_1 is the wage for a full-time worker without insurance. w_3 is the wage for a part-time worker. p_1 and p_3 are average productivity of full-time workers (without health insurance) and part-time workers, respectively. ψ is a parameter that represents the working hours of a part-time worker. Working hours of a full-time worker is normalized to one.

Similarly, current profits for a firm that offers health insurance ($i = 2$) are as follows:

$$p(a, z, n, m; i = 2) = (1 - \tau_f) \left\{ z \left[\alpha (p_2 n)^{\epsilon} + (1 - \alpha)(\psi p_3 m)^{\epsilon} \right]^{\frac{\theta}{\epsilon}} - w_2 p_2 n - \psi w_3 p_3 m - q_0 - \gamma q_2 n + a \right\} \tag{2}$$

Since a firms that offers health insurance to its full-time employees hire full-time workers from a different pool, p_2 represents the average productivity of workers, w_2 is the wage for those workers. q_0 is the fixed cost of providing health insurance to its full-time workers, and q_2 is variable cost, which is proportional to the number of full-time workers to be covered by health insurance. γ is the proportion of the

variable portion of the premium paid by the firm. a is the idiosyncratic benefit or cost of providing health insurance to full-time employees.

Since there is no dynamic aspect for the firm's decision problem, given prices, the decision of a firm of type (a, z) can be characterized as follows:

$$p(a,z) = \max\left\{\max_{n,m} p(a,z,n,m;i=1),\ \max_{n,m} p(a,z,n,m;i=2)\right\} \tag{3}$$

The optimal decision rules of firms can be denoted by $n = g_n(a,z)$, $m = g_m(a,z)$, and $i = g_i(a,z)$. Notice that the optimal combination of (n,m) is conditional to the choice of insurance coverage i. $p(a,z)$ is the optimal profits.

4.2 Worker

A worker is characterized by (d, x, s, e), where d is preference for leisure (disutility for work), x is the medical expenditure in the previous period, s is the individual productivity, and e denotes the *island* that the worker is currently in. We denote the type distribution of workers by $\mu_{d,x,s,e}$. For now, we assume $d \in^+$ is drawn once and does not change over time, but $s \in^+$ and $x \in^+$ changes over time with persistence. Both are assumed to follow a respective first-order Markov process. Because of the persistence of the medical expenditure, x in the previous period provides information about the medical expenditure of the current period, which is realized after the decision about insurance purchase is made.

A worker is in one of the four islands. $e \in \{0,1,2,3\}$ denotes the island that a worker is currently in. $e = 0$ means that the worker is in the unemployment island; i.e., the worker is currently unemployed. A worker in the island $e = 1$ are hired as

full-time by a firm that does not offer a health insurance. A worker in the $e = 2$ island is hired as full-time by a firm that offers an health insurance. A worker in the $e = 3$ island is hired by a firm as part-time. Part-time workers are not offered a health insurance by assumption.

Each period, with probability λ, a worker is separated from its job and has to leave the current island. When a worker leaves the current island, with probability $1 - \pi_e$, the worker arrives in the unemployment island ($e = 0$). With probability π_e, the worker arrives in one of the islands with employment opportunities. In particular, with probability $\pi_e \frac{N_1}{N_1+N_2+M}$, the worker arrives in the island of full-time jobs without insurance ($e = 1$). With probability $\pi_e \frac{N_2}{N_1+N_2+M}$, the worker arrives in the island of full-time jobs with health insurance ($e = 2$). With probability $\pi_e \frac{M}{N_1+N_2+M}$, the worker arrives in the island of part-time jobs ($e = 3$). Taken together, the expected value of leaving an island and moving to a different island randomly can be characterized as follows:

$$\tilde{V}(d, x, s) = (1-\pi_e)V(d, x, s, 0)+\pi_e \frac{(N_1 V(d, x, s, 1) + N_2 V(d, x, s, 2) + M V(d, x, s, 3))}{N_1 + N_2 + M} \tag{4}$$

With probability $(1 - \lambda)$, the worker is not forced to leave the current island. In this case, the worker can stay in the current island or moves to any island.

The period utility of a worker takes the following form:

$$u(d, c, \ell) = \frac{c^{1-\sigma}}{1-\sigma} - d\ell \tag{5}$$

where c is current consumption and ℓ denotes hours worked. Workers are risk-averse, which makes health insurance valuable for workers, but we also assume, for simplicity,

that workers cannot save. Workers are hand-to-mouth consumers. We also assume a discount factor β.

4.2.1 Unemployed Worker

A worker with $e = 0$ (unemployed) chooses whether to buy a private insurance $j = 1$ or not $j = 0$, and, if there is an option, which island to move to. The health insurance decision is made before the medical expenditure for the current period x' is drawn. After x' is drawn, the worker receives unemployment benefits and consumes, before the new productivity shock s' is drawn and the worker potentially moves to a different island. Consumption of a worker with $(x, x', s, e = 0)$, conditional on the insurance purchase decision j, is as follows:

$$c(x, x', s, e = 0; j = 0) = \max\{c, (1 - \tau_w)sw_1b - x'\} \tag{6}$$

$$c(x, x', s, e = 0; j = 1) = \max\{c, (1 - \tau_w)sw_1b - q_{1,x} - (1 - \phi_1)x'\} \tag{7}$$

where τ_w is the personal income tax rate, s in individual productivity, w_1 is the wage for full-time worker without insurance, b is the replacement rate for unemployment insurance benefits, and $q_{1,x}$ is the private health insurance premium for a worker with the medical expenditure in the previous period of x. ϕ_1 is the coverage ratio for private insurance. c is the lower bound for consumption, which is guaranteed by the government. For an unemployed worker, $\ell = 0$ by definition.

Now we can define the value for a worker in the unemployment island with type

$(d, x, s, e = 0)$ as follows:

$$V(d, x, s, 0) = \max\{V_0(d, x, s, 0), V_1(d, x, s, 0)\} \tag{8}$$

$$V_0(d, x, s, 0) = \sum_{x'} \sum_{s'} \pi_{x,x'} \pi_{s,s'} \left\{ u(d, c(x, x', s, 0; j = 0), 0) + \beta \left((1 - \lambda) \max_{e'} V(d, x', s', e') + \lambda \tilde{V}(d, x', s') \right) \right\} \tag{9}$$

$$V_1(d, x, s, 0) = \sum_{x'} \sum_{s'} \pi_{x,x'} \pi_{s,s'} \left\{ u(d, c(x, x', s, 0; j = 1), 0) + \beta \left((1 - \lambda) \max_{e'} V(d, x', s', e') + \lambda \tilde{V}(d, x', s') \right) \right\} \tag{10}$$

where equation (8) represents the optimal decision of purchasing private insurance or not. Equations (9) and (10) represent the values conditional on the decision of purchasing private insurance or not purchasing. $\pi_{x,x'}$ and $\pi_{s,s'}$ are the Markov transition probabilities of x and s, respectively. With probability $1 - \lambda$, the worker can choose which island to move to, or stay in the current island. The max operator with respect to e' captures such choice. With probability λ, the worker is forced to leave the current island and randomly move to a new island.

Let $h_e(d, x, s, e) \in \{0, 1, 2, 3\}$ denote the decision of a worker as to which island to move to. Also let $h_j(d, x, s, e) \in \{0, 1\}$ denote the purchasing decision of private health insurance. $h_j(d, x, s, e) = 1$ means purchasing private health insurance and $h_j(d, x, s, e) = 0$ means not purchasing.

4.2.2 Full-Time Worker without Employer-Provided Health Insurance

A worker with $e = 1$ (full-time employment without health insurance) first chooses whether to purchase private health insurance or not. After the current medical expenditure is realized, the worker works full-time, pays for the medical expenditure, and consumes. After the individual productivity in the next period, s', is realized, with probability $1 - \lambda$, the worker decides which island to move to or stay in the current island. With probability $1 - \lambda$, the worker leaves the current island and randomly moves to a a new island. Consumption of a worker with $(x, x', s, e = 1)$, conditional on the insurance purchase decision j, is as follows:

$$c(x, x', s, e = 1; j = 0) = \max\{c, (1 - \tau_w)sw_1 - x'\} \tag{11}$$

$$c(x, x', s, e = 1; j = 1) = \max\{c, (1 - \tau_w)sw_1 - q_{1,x} - (1 - \phi_1)x'\} \tag{12}$$

where w_1 is the wage for a full-time job without health insurance. Although there are firms of different types on the island, it is assumed that wage is determined to clear the labor market on the island. In other words, all firms offer the same wage. A worker on this island is assumed to work for 1 unit of time, which means full-time.

The value for a worker with type $(d, x, s, e = 1)$ can be similarly defined as follows:

$$V(d, x, s, 1) = \max\{V_0(d, x, s, 1), V_1(d, x, s, 1)\} \tag{13}$$

$$V_0(d,x,s,1) = \sum_{x'}\sum_{s'} \pi_{x,x'}\pi_{s,s'}$$
$$\left\{u(d, c(x,x',s,1;j=0),1) + \beta\left((1-\lambda)\max_{e'} V(d,x',s',e') + \lambda\tilde{V}(d,x',s')\right)\right\} \quad (14)$$

$$V_1(d,x,s,1) = \sum_{x'}\sum_{s'} \pi_{x,x'}\pi_{s,s'}$$
$$\left\{u(d, c(x,x',s,1;j=1),1) + \beta\left((1-\lambda)\max_{e'} V(d,x',s',e') + \lambda\tilde{V}(d,x',s')\right)\right\} \quad (15)$$

4.2.3 Full-Time Worker with Employer-Provided Health Insurance

A worker that works full-time for a firm that offers a health insurance does not need to purchase private insurance. Therefore, consumption of a worker with $(x, x', s, e = 2)$ does not depend on the health insurance decision, and thus can be characterized as follows:

$$c(x,x',s,e=2) = \max\{c, (1-\tau_w)(sw_2 - (1-\gamma)q_2) - (1-\phi_2)x'\} \quad (16)$$

where w_2 is the equilibrium wage for a full-time job with health insurance, q_2 is the variable part of the health insurance premium offered by an employer, $(1-\gamma)$ is the proportion of the health insurance premium paid by the employee, and ϕ_2 is the insurance coverage. One can see that health insurance premium is paid from pre-tax income, as in the current U.S. A worker on this island is assumed to work for 1 unit of time, which means full-time.

The value for a worker with type $(d, x, s, e = 2)$ is as follows:

$$V(d,x,s,2) = \sum_{x'}\sum_{s'} \pi_{x,x'}\pi_{s,s'} \left\{ u(d, c(x,x',s,2), 1) + \beta \left((1-\lambda) \max_{e'} V(d,x',s',e') + \lambda \tilde{V}(d,x',s') \right) \right\} \quad (17)$$

4.2.4 Part-Time Worker

A worker with $e = 3$ (part-time employment) first chooses whether to purchase private health insurance or not. After the current medical expenditure is realized, the worker works part-time, pays for the medical expenditure, and consumes. After the individual productivity in the next period, s', is realized, with probability $1 - \lambda$, the worker decides which island to move to or stay in the current island. With probability $1 - \lambda$, the worker leaves the current island and randomly moves to a a new island. Consumption of a worker with $(x, x', s, e = 3)$, conditional on the insurance purchase decision j, is as follows:

$$c(x,x',s,e=3;j=0) = \max\{c, (1-\tau_w)\psi s w_3 - x'\} \quad (18)$$

$$c(x,x',s,e=3;j=1) = \max\{c, (1-\tau_w)\psi s w_3 - q_{1,x} - (1-\phi_1)x'\} \quad (19)$$

where w_3 is the wage for a part-time job. ψ represents the hours that a part-time worker works for.

The value for a worker with type $(d, x, s, e = 3)$ can be defined as follows:

$$V(d,x,s,3) = \max\{V_0(d,x,s,3), V_1(d,x,s,3)\} \quad (20)$$

$$V_0(d,x,s,3) = \sum_{x'}\sum_{s'} \pi_{x,x'}\pi_{s,s'}$$
$$\left\{u(d,c(x,x',s,3;j=0),\psi) + \beta\left((1-\lambda)\max_{e'} V(d,x',s',e') + \lambda\tilde{V}(d,x',s')\right)\right\} \quad (21)$$

$$V_1(d,x,s,3) = \sum_{x'}\sum_{s'} \pi_{x,x'}\pi_{s,s'}$$
$$\left\{u(d,c(x,x',s,3;j=1),\psi) + \beta\left((1-\lambda)\max_{e'} V(d,x',s',e') + \lambda\tilde{V}(d,x',s')\right)\right\} \quad (22)$$

4.3 Health Insurance

We describe here the environment surrounding the health insurance industry *without the ACA*. First of all, in the private health insurance market, insurance premium can and does depend on the individual characteristics of each workers. We also assume a perfectly competitive market, which implies zero profit from health insurance for each type of workers. In other words, cross-subsidization across different types of workers is not possible. Therefore, the premium of the private health insurance for a worker with the medical expenditure in the last period x, $q_{1,x}$, can be characterized as follows.

$$q_{1,x} = \sum_{x'} \pi_{x,x'}\phi_1 x'(1+\kappa_1) \quad (23)$$

where κ_1 represents the operating cost. The premium in the private insurance market does not depend on other characteristics of workers, because x is uncorrelated with any other characteristics of workers by assumption.

On the other hand, when an employer offers health insurance to its full-time

employees, it cannot discriminate employees depending on the individual characteristics. In other words, all the employees are pooled in the employer-provided insurance. Since the composition of worker's type is the same across all firms regardless of the firm size, by assumption, insurance premium for workers can be characterized by the distribution of x among workers in the island of $e = 2$. Moreover, we assume that a fraction κ_2 of the total costs is covered by the fixed cost q_0 that each firm that provides health insurance has to pay. The remaining fraction $1 - \kappa_2$ is paid by by each employees working for the participating firms. The insurance premium per worker is q_2. Under these assumptions, the following equations characterizes the zero profit conditions of employer-provided insurance.

$$q_0 = \frac{\kappa_2 \sum_d \sum_x \sum_s \mu_{d,x,s,2} \sum_{x'} \pi_{x,x'} \phi_2 x'}{\sum_a \sum_z \chi_{a,z g_i(a,z)=2}} \tag{24}$$

$$q_2 = \frac{(1-\kappa_2) \sum_d \sum_x \sum_s \mu_{d,x,s,2} \sum_{x'} \pi_{x,x'} \phi_2 x'}{\sum_d \sum_x \sum_s \mu_{d,x,s,2}} \tag{25}$$

is an indicator function that takes the value 1 (0) if the condition attached is true (false). Notice that, because of the pooling, the premium is independent of x of an individual worker.

4.4 Equilibrium

The total demand for full-time labor with (N_2^d) and without (N_1^d) health insurance, as well as part-time labor (M^d) can be computed as follows:

$$N_1^d = \int_{g_i(a,z)=1} g_n(a,z) d\chi_{a,z} \tag{26}$$

$$N_2^d = \int_{g_i(a,z)=2} g_n(a,z) d\chi_{a,z} \tag{27}$$

$$M^d = \int g_m(a,z) d\chi_{a,z} \tag{28}$$

Meanwhile, the total supply of the three types of labor can be computed as follows:

$$N_1^s = \int s d\mu_{d,x,s,1} \tag{29}$$

$$N_2^s = \int s d\mu_{d,x,s,2} \tag{30}$$

$$M^s = \int s d\mu_{d,x,s,3} \tag{31}$$

[Steady-state equilibrium without ACA] A steady-state equilibrium without ACA consists of $\chi_{a,z}$, $\mu_{d,x,s,e}$, $g_i(a,z)$, $g_n(a,z)$, $g_m(a,z)$, $V(d,x,s,e)$, $h_e(d,x',s',e)$, $h_j(d,x,s,e)$, $q_{1,x}$, q_0, q_2, w_1, w_2, w_3, p_1, p_2, p_3, N_1, N_2, and M such that:

1. $g_i(a,z)$, $g_n(a,z)$, and $g_m(a,z)$ are the optimal decision of the firm.
2. $V(d,x,s,e)$ is the solution to the optimization problem of the worker. $h_e(d,x',s',e)$ and $h_j(d,x,s,e)$ are the associated optimal decision rules.
3. $\chi_{a,z}$ is time-invariant.
4. $\mu_{d,x,s,e}$ is time-invariant and consistent with the worker's optimal decision rules.

5. Insurance premium $q_{1,x}$, q_0, and q_2 are characterized by equations (23), (24), and (25), respectively.

6. w_1, w_2, and w_3 clear the labor market on islands of full-time jobs without and with insurance, and part-time jobs, respectively. N_1, N_2, and M are the market clearing supply of each type of labor.

7. p_1, p_2, and p_3 are the average productivity of workers on respective island.

5 Calibration

The model is calibrated to the U.S. economy before the ACA started being implemented. We put special emphasis on matching the firm size distribution, type distribution of firms offering employer-provided health insurance, and the composition of full-time and part-time workers in firms of difference sizes.

6 Experiments

The main experiment is to introduce stylized version of the ACA, as in Brügemann & Manovskii (2010), but with an emphasis on the distinction between full-time and part-time employment. With the ACA, the following features are introduced into our baseline model (without the ACA).

1. The existing tax deduction for premiums of employer-provided health insurance remains intact.

2. Premiums paid in the private health insurance market remains tax deductible.

3. Premiums for private health insurance is now community based, i.e., risks of all the participants are pooled.

4. An employer with more than 50 *full-time equivalent* employees is required to offer health insurance to its full-time employees, or it has to pay a penalty (Employer Shared Responsibility Payment). The number of full-time equivalent employees is computed by treating a part-time employee as 0.5 full-time equivalent. The penalty per full-time employee is $2,000$ dollars, excluding the first 30 employees. The penalty is not tax deductible.

5. An employer with less than 50 *full-time equivalent* employees is not required to offer health insurance. Moreover, a firm with less than 25 *full-time equivalent* employees is qualified for employer health care tax credits, which is 50 percent of the premiums paid by the firm. For a firm with less than 10 *full-time equivalent* employees is qualified for employer health care tax credits, which is 100 percent of the premiums paid by the firm.

6. If an individual does not purchase an insurance, a penalty of 2.5 percent to income is applied.

Some details, especially regarding the income of workers are abstracted, because the model does not generate a large heterogeneity in income by design.

7 Conclusion

TO BE ADDED

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