Employer-Provided Health Insurance in a Model with Labor Market Frictions

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Abstract

In this paper, I perform a quantitative analysis of the role of frictions in the market for employer-based health insurance on coverage and labor market outcomes. I incorporate frictions in the form of 1) enrollment restrictions due to waiting periods or preexisting conditions, and 2) limits in duration of continuation coverage into a model of indivisible labor supply with idiosyncratic productivity and medical expenditure shocks. I find that the model is able to account for key features of the distribution of employer-based health insurance coverage. Frictions in the health insurance market have important implications for health insurance coverage and the distribution of employment across productivity levels, but matter less for aggregate labor force outcomes.

1   Introduction

The majority of working-age individuals are covered by employment-based health insurance, either through their current employer, a former employer, or a spouse through dependent coverage. The link between employment and health insurance opportunities has led to a rich empirical literature on measurement of "job lock," the reduction in mobility in the labor market due to health insurance enrollment restrictions.[1] These restrictions usually take the form of waiting periods or exclusions due to pre-existing conditions. There are

[1]See Madrian (1994) for an example. Also see Gruber and Madrian (2004) for a thorough survey of this literature.

also limits to the duration of continuation coverage that reduce insurance opportunities outside the workplace.

Several policy proposals have been introduced over the last thirty years to weaken the link between employment and health insurance opportunities. Most notably, the 1985 Consolidated Omnibus Budget Reconciliation Act (COBRA) required employers to offer continuation coverage for 18 to 36 months after job separation depending on eligibility. The Health Insurance Portability and Accountability Act of 1996 (HIPAA) limited health insurance enrollment exclusions to a maximum of 12 months following start of employment. The more recent 2010 Patient Protection and Affordable Care Act (ACA) is designed to expand health insurance opportunities for those not eligible for employment-based health insurance. Nevertheless, despite much policy interest and empirical work, there does not exist a quantitative framework for evaluating the effects of public health policies on health insurance coverage and labor supply.

The purpose of this paper is to provide a quantitative model to study the interaction of employer-based health insurance coverge decisions and labor market turnover in the determination of employment. The root of the potential changes in labor mobility is the trade-off between improved risk-sharing provided through employment health insurance benefits and the decreased work incentives from the cost of insurance. To better understand this trade-off, I provide answers to the following questions. First, to what extent do enrollment restrictions in the market for health insurance impact health insurance enrollment and labor supply? Second, how does the presence and length of continuation coverage change incentives to insure and participate in the labor force? Third, to what extent do frictions in the health insurance market affect labor market transitions and the mobility of workers?

To formally study this trade-off, I construct an incomplete markets model with idiosyncratic shocks to labor productivity and medical expenditures. Agents face a discrete choice of labor supply and health insurance participation. Agent choices are subject to trading frictions. That is, there are frictions in the form of arrival of job offers and separations commonly used in the search-theoretic literature. Labor market frictions are key to capturing the reduction in health insurance coverage following the transition from employment to unemployment and exit from the labor force. In addition, I model restrictions to health insurance enrollment and continuation coverage as a trading friction defined by a two parameters. Exogenous variation of these parameters allows for measurement of the net effect of these frictions on health insurance coverage rates and labor force outcomes. The model is calibrated to longitudinal data from the Survey of Income and Program Par-

ticipation. The degree of frictions in the labor market and the market for health insurance generate the levels of insurance participation by labor force status as well as transitions between health insurance categories consistent with those observed in the data.

The calibrated model is then used to establish the role of frictions in equilibrium labor force outcomes and health insurance participation. I find that frictions in the health insurance market have important implications for health insurance coverage. Restrictions to health insurance enrollment opportunities mitigate selection of agents by severity of medical expenditure shocks. In particular, I find that a waiting period of six months maximizes the aggregate level of health insurance coverage in equilibrium at approximately 80 percent. However, I find relatively small effects of generosity of continuation coverage on aggregate insurance enrollment.

Both health insurance enrollment restrictions and continuation coverage have important implications for labor force outcomes. Employment-based health insurance with enrollment restrictions undoes disincentives to work provided by transfers that guarantee a minimum consumption level among agents with high realizations of medical expenditure shocks. While limits in the duration of continuation coverage have little effect on aggregate employment, the presence of continuation coverage benefits reduces employment among agent with low labor productivity. Put another way, continuation coverage reduces incentives to use employment as a mechanism to smooth consumption in times of low labor productivity and high medical expenditures.

This paper is related to several papers that introduce indivisible labor, frictions, and idiosyncratic labor shocks to capture flows of workers across employment, unemployment, and not in the labor force categories. Krusell et al. (2010) and Krusell et al. (2011) match labor flows across the three labor market states where workers face idiosyncratic wage shocks, but do not consider health expenditure shocks or employer-provision of insurance against these shocks.

Several studies have developed models to analyze the role of household health insurance choice in an incomplete markets framework with idiosyncratic productivity and medical expenditure shocks. This literature includes Jeske and Kitao (2009), Huang and Huffman (2010), Pashchenko and Porapakkarm (2010), and Janicki (2012a). The majority of the models in this literature abstract from labor market frictions that limit access to employment-based health insurance. One exception is Huang and Huffman (2010). They consider a richer general equilibrium model with endogenous health accumulation. However, their model is not consistent with higher frequency labor market or health insurance participation transitions.

Finally, other research explores the implications of the interactions between workers and employers for employment-based health insurance offer and participation rates (Dey and Flinn (2005), Brügemann and Manovskii (2010)). Dey and Flinn (2005) construct a search-theoretic model of health insurance provision and wage determination, but rely on bargaining between individual workers and firms over health insurance benefits. In contrast to this paper, Brügemann and Manovskii (2010) focus on the effects of the health insurance system on the firm size distribution.

The remainder of the paper is organized as follows. Section 2 describes some key summary statistics of the distribution of the population with and without employment-based health insurance coverage. Section 3 details the model. Section 4 outlines the calibration procedure. Section 5 presents an analysis of the role of health insurance frictions on health insurance enrollment and labor force participation. Section 6 concludes.

2   Data

Moments describing employment-based health insurance coverage and labor force participation come from the 2004 panel of the Survey of Income and Program Participation (SIPP). The SIPP is a longitudinal survey representing the civilian non-institutionalized population of the United States sponsored by the U.S. Census Bureau. The SIPP collects detailed information on demographic characteristics, labor force participation, and government program participation. The 2004 SIPP panel was fielded from February 2004 to September 2008. The SIPP panel is divided into four "rotation" groups, which are interviewed cyclically, one group per month, in a series of collections called "waves." The estimates presented in this paper are based on data taken from the entire longitudinal panel composed of waves 1 through 12.[2]

The data for this analysis are restricted to male respondents with ages between 25-54. I exclude respondents that reported themselves to be self-employed at any time during the reference period, since such respondents are not usually eligible for group health insurance coverage. Women are excluded from my analysis since spells of nonemployment due to fertility or childcare decision are outside the scope of the paper. In addition, I restrict my sample to prime-aged workers to minimize the effects of school attendance and retirement.

To begin the analysis, I divide the population by source of health insurance coverage for alternative definitions of duration of coverage. The participation rates for 2007 are

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[2]For a complete discussion of the SIPP sample selection, weighting procedures, and the source and accuracy of the estimates, see the technical documentation at:
http://www.census.gov/apsd/techdoc/sipp/sipp.html

Table 1: Health Insurance Coverage by Definition

Source of coverage	Entire year	Point-in-time	Anytime
Employer-based (self)	56.5	62.7	68.3
Employer-based (spouse)	5.0	7.6	11.6
Public	6.9	9.1	9.7
Direct-purchase	1.2	2.8	4.7
Other	2.0	3.7	4.9
No health insurance	19.1	22.0	26.0

presented in Table 1. While the majority of coverage is provided through employment-based sources regardless of the definition of coverage used, Table 1 illustrates that there are significant flows between these insurance categories throughout the year. The strongest measure restricts the definition of coverage for the entire 12 month period. The two weaker measures, that give progressively mixed estimates at a "point-in-time" and "any time" during the year allowing for substitution between sources of coverage.
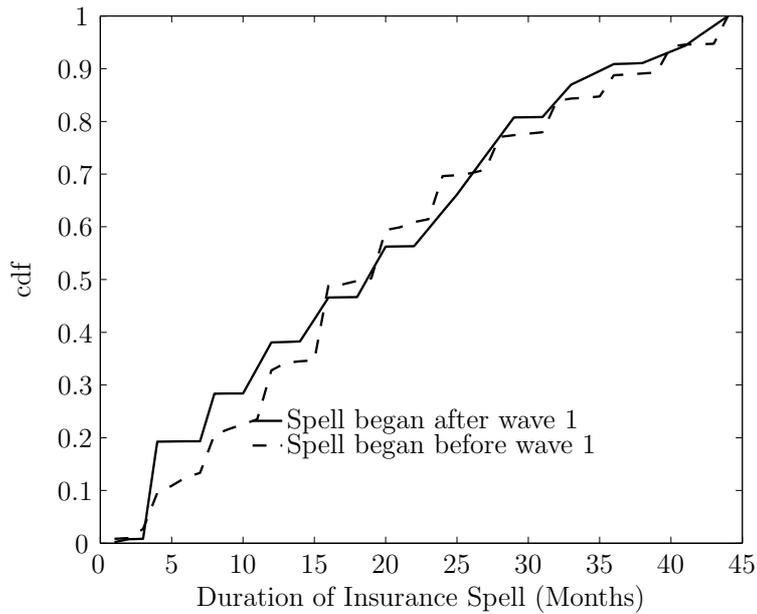

Figure 1: Duration of Employer-based Coverage

Differences in coverage rates by degree of coverage over the year in Table 1 suggest that spells of health insurance coverage can be transitory or persistent. Since this paper is focused on employer-based health insurance coverage, I divide health insurance by employer-based participation. That is, respondents with no coverage can be either unin-
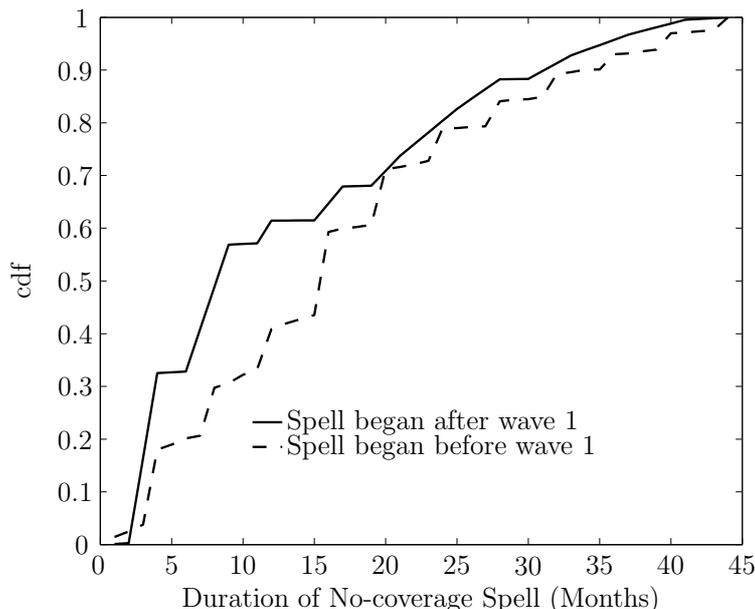
Figure 2: Duration of No-coverage Spells

sured or insured through a source other than employment. Figure 1 plots the empirical cumulative distribution function of employer-based health insurance coverage spells by duration. The figures illustrate that the majority of spells are quite long; 12 months or more. However, about 20 percent of spells are 4 months or less. Figure 2 details the time distribution of no-coverage spells by whether the spell began before or after the initial interview at wave 1. For spells that began during the interview period, it is clear that approximately half of these spells end within 5 months. Almost 90% end within 12 months. While about 10% of no-coverage spells last one year or more, the limited length of the panel fails to capture the length of the longer spells. To limit the effect of censoring, Figure 2 also outlines the time distribution of no-coverage spells conditional on a respondent not having employment-based health insurance at the initial interview. Among these respondents, the vast majority (70%) have no-coverage for longer than one year, and almost 40% have a length of a no-coverage spell of two years or longer.

To get a better sense of the effect of labor market participation on employer-based health insurance coverage, I detail monthly employer-based coverage as a function of labor market status for the period 2004-2007 in Table 2.[3] Focusing on monthly coverage

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[3]I define a respondent as employed if they claim to have a job and worked at least one week. Weeks not worked were not due to layoffs. Unemployed respondents included those with a job but on layoff or those without a job and looking for work. Those not in the labor force are defined by no job for the entire month and no time looking for work.

Table 2: Employer-based Coverage by Labor Force Status

	Employer-based Coverage
Aggregate	63.5
Employed	71.4
Unemployed	24.3
Not-in-labor-force	9.0

rates limits the effect of labor market transitions within a year. Broadly speaking, the likelihood of employer-based coverage is correlated with labor market attachment. Employed individuals are most likely to be insured at any month (80.2%), followed by the unemployed (34.1%), and those not participating the the labor force (20.7%).

While the levels of employer-based health insurance coverage vary by labor force status, it is worthwhile to document transitions across health insurance status by labor force status. Table 3 illustrates that health insurance flows exhibit a large degree of persistence when not accompanied by a simultaneous change in labor force status. Furthermore while levels of coverage vary by labor force status, flows between insurance categories are largely invariant between the employed, unemployed, and those not in the labor force.

3 Model

Consider an economy populated by a continuum of infinitely-lived agents with unit mass. Agents face idiosyncratic uncertainty in labor productivity and medical expenditures. Agents make a choice of employment and health insurance coverage that are subject to trading frictions. Conditional on eligibility, there exists a competitive health insurance market against household medical expenditure risk. The government guarantees a minimum consumption level.

3.1 Environment

Preferences. All agents have identical preferences over streams of consumption and leisure represented by:

$$\mathbb{E}\left\{\sum_{t=0}^{\infty}\beta^t\left[\ln(c_t)-\alpha h_t\right]\right\}$$

Table 3: Health Insurance Transitions by Labor Force Status

	Aggregate	
	To (t+1):	
From (t):	**Coverage**	**No Coverage**
Coverage	0.990	0.010
No Coverage	0.011	0.989

	Employed	
	To (t+1):	
From (t):	**Coverage**	**No Coverage**
Coverage	0.992	0.008
No Coverage	0.024	0.976

	Unemployed	
	To (t+1):	
From (t):	**Coverage**	**No Coverage**
Coverage	0.914	0.086
No Coverage	0.011	0.989

	Not-in-labor-force	
	To (t+1):	
From (t):	**Coverage**	**No Coverage**
Coverage	0.934	0.066
No Coverage	0.007	0.993

where β denotes the discount factor and α is the disutility from labor. The variables c_t and h_t are consumption and employment participation at time t. Employment is a choice denoted by $h_t \in \{0, 1\}$.

Endowments. Agents are subject to idiosyncratic shocks to productivity that are modeled as shocks to the return to working. Labor productivity of agent i at time t is denoted z_{it} where $z_{it} \in Z$ is a persistent shock follows a Markov chain represented by the transition matrix $\Pi(z, z')$. Agents are subject to idiosyncratic medical expenditure shocks. I follow Hubbard et al. (1995) in modeling medical expenditures as an exogenous stochastic process. Medical expenditures are defined as $m_{it} = Y \exp(\mu + s_{it})$, where $s_{it} \in S$, μ is a scaling parameter, and Y is average output in the economy. Let s_{it} be a persistent shock that follows a Markov chain represented by $\tilde{\Pi}(s, s')$. Realization of shocks are independently and identically distributed across agents.

To capture frictions in the labor market and the market for health insurance, I restrict agent access to both markets. I focus on two frictions in the labor market commonly used in search and marching models (for example Pissarides (2000)) to capture equilibrium labor market outcomes. The first friction is a probability of a job offer for nonemployed agents and the second friction is a probability of job separation for employed agents. I include labor market frictions since levels of employer-based health insurance coverage are significantly different by labor market outcomes. As such, it is important for the model to capture the incentives that motivate health insurance purchases across labor market categories.

The market for employment-based health insurance is characterized by time limits on enrollment opportunities, waiting periods due to pre-existing conditions, and restrictions on duration of coverage following termination of employment that are detailed in the following sections. The model captures these limits in a minimalist fashion by modeling two frictions that limit opportunities for purchase of health insurance. The first friction is a probability of an enrollment opportunity for employer-based health insurance. This opportunity allows employed agents to enroll or if currently insured, to drop health insurance coverage. The second friction is the probability that a continuation coverage ends for currently insured non-employed agents.

I incorporate these four frictions into my model within the island framework similar to Lucas and Prescott (1974) and more recently, Krusell et al. (2011). Consider four islands characterized by employment opportunities ("production" and "leisure" islands) and employment-based health insurance opportunities ("HI offer" or "No HI offer"). Agents cannot move freely between any island. Each period a worker loses his employment offer

with probability σ (job separation rate) regardless of health insurance status. Conversely, non-employed agents receive employment opportunities with probability λ (job arrival rate). Workers receive an opportunity to purchase health insurance coverage with probability γ. Meanwhile, non-employed and insured workers lose health insurance coverage with probability θ.

3.2 Assets

Following Aiyagari (1994) and Huggett (1993), agents can accumulate assets to insure against idiosyncratic risk. These assets provide one-period risk-free claims to consumption at interest rate r. Let k_{it} denote the asset holdings of household i at age t with $k_{it} \geq 0$, i.e. households face a no-borrowing constraint.

3.3 Health Insurance

While agents can use assets to insure consumption against both labor productivity and medical expenditure shocks, I model an explicit health insurance market against medical expenditures provided through employment. First, I focus on employer-based health insurance coverage. This is a key assumption as most non-elderly households currently obtain health insurance through their employer contingent on full-time employment (Janicki, 2012b). In addition to the provision of health insurance benefits through the current employer, I model extensions of employer coverage outside employment. This feature of the model represents a variety of state-specific continuation coverage mandates and federally mandated extensions of health insurance coverage provided through 1985 Consolidated Omnibus Budget Reconciliation Act (COBRA). Specifically, insured agents that transition from employment to nonemployment are eligible to continue enrollment in the employer-based plan.

Second, I assume that not all individuals face the same price for health insurance contracts. Currently, employment-based health insurance premiums are usually divided between an "employer contribution" and the "employee contribution". For working agents, I model the employee contribution as a constant fraction (ψ) of the total health insurance premium (π), denoted $\psi\pi$. For non-employed insured agents, the employee contribution is equal to the total health insurance premium, i.e. $\psi = 1$. This feature reflects the fact that COBRA continuation coverage makes no provision for employer contribution toward health insurance benefits of former employees.[4] The employer contribution is modeled

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[4]It is worth pointing out that the American Recovery and Reinvestment Act of 2009 mandated em-

as a proportional tax (ξ) on efficiency labor hours units imposed by the firm similar to Jeske and Kitao (2009). For an individual with gross labor earnings weh, the ξeh are collected by the firm to pay for the employer contribution. Finally, in reality premiums vary across firms of different sizes due to composition of medical expenditures by workers and employer contributions. I abstract from this dimension since I do not focus on the firm decision to offer health insurance benefits. See Dey and Flinn (2005) and Brügemann and Manovskii (2010) for recent work that explores this decision in more detail.

Third, I assume working agents have access to a single pooling health insurance contract. Currently, health insurers and employers are limited in their ability to "risk adjust" employer group health insurance plans by federal regulations such as 29 CFR Part 2590.702, IRS Section 125, and the 1996 Health Insurance Portability and Accountability Act. Furthermore, this assumption is consistent with evidence that suggests that households choose from a small set of health insurance contracts (Cardon and Hendel, 2001). I assume the contract takes the following form: households pay a premium and are reimbursed a fraction ϕ of medical expenses. Employee health insurance benefits are not subject to payroll taxes. This feature is key as it provides an incentive for households to purchase insurance instead of self-insuring by saving. In equilibrium, π is chosen so as to cover all medical payments out of the health insurance pool.

For ease of exposition, I summarize the net out-of-pocket medical expenditures as a function $\Omega(s,h,i,)$ of the medical expense shock s, employment status h, and insurance status i, where:

$$\Omega(s,h,i) = \begin{cases} \exp(\mu + s) & \text{if } i = 0 \\ \phi \exp(\mu + s) + \pi & \text{if } i = 1, h = 0 \\ \phi \exp(\mu + s) + \psi \cdot \pi \cdot (1 - \tau) & \text{if } i = 1, h = 1 \end{cases}$$

3.4 Tax and Transfer Programs

In a model with exogenous medical expenditure shocks and borrowing constraints, even insured households may not be able to finance their out-of-pocket medical expenses. Therefore, I introduce government-provided transfers that guarantee a minimum consumption level $\underline{c}$. Through this transfer program, the government also funds all medical expenditures net of household resources to mimic Medicaid program participation and "uncompensated

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ployer contributions to 65 percent of the total premium for employees upon involuntary termination of employment. Since the SIPP panel used in the calibration procedure ends in 2008, I disregard these recent changes to continuation coverage laws.

care" benefits such as emergency-room treatment.[5]

There is a tax on labor earnings denoted by τ that is set exogenously. Government revenues that are not spent on the minimum consumption floor detailed above are renumerated lump-sum to all agents. I denote total government transfers to the household by $T(\cdot)$ in the budget constraint.

3.5 Household Problem

I define the household problem recursively. Each period, agent decisions depend on employment status l, health insurance status i, capital stock k, and realizations of labor shocks z and medical expenditure shocks s. Let $E(k, s, z)$ and $V(k, s, z, i)$ be the value function of an agent with a job opportunity and with or without an opportunity to change health insurance status,

$$E(k, s, z) = \max\{W(k, s, z, 0), N(k, s, z, 0), W(k, s, z, 1), N(k, s, z, 1)\}$$

and

$$V(k, s, z, i) = \max\{W(k, s, z, i), N(k, s, z, i)\}$$

where $W(k, s, z, i)$ denotes the value of employment,

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\begin{aligned}
W(k, s, z, i) = \max_{c, k'} \Bigg\{ \log(c) - \alpha h + \beta \sum_{s' \in S, z' \in Z} \Pi(z, z') \tilde{\Pi}(s, s') \Big[\\
(1 - \sigma)[\gamma E(k, s, z) + (1 - \gamma) V(k, s, z, i)] + \\
\sigma[\theta N(k, s, z, 0) + (1 - \theta) M(k, s, z, i)] \Big] \Bigg\}
\end{aligned}
$$

subject to the following budget constraint,

$$c + k' + \Omega(s, h, i) = (1 - \tau)(w - \xi)zh + (1 + r)k + T(k, s, z, i)$$

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[5]By the 1986 Federal Emergency Medical Treatment and Labor Act (EMTALA) hospitals are required give emergency care regardless of insurance status, ability to pay, or citizenship. Furthermore, hospitals cannot discharge patients until they are stabilized or transferred to another facility. Hospitals and physicians are reimbursed for these services in part though Medicaid disproportional share hospital (DSH) payments. Note that "uncompensated care" in my model is not reflected in employer health insurance premiums due to hospital cost shifting. This is in line with evidence from Hadley et al. (2008) who calculate the majority (75 percent) of "uncompensated care" is paid for by the government.

where $c \geq 0$ and $k \geq 0$. Let $N(k, s, z, i)$ denotes the value of non-employment:

$$N(k, s, z, i) = \max_{c, k'} \left\{ \log(c) + \beta \sum_{s' \in S, z' \in Z} \Pi(z, z') \tilde{\Pi}(s, s') \Big[\right.$$

$$\lambda [\gamma E(k, s, z) + (1 - \gamma) V(k, s, z, i)] +$$

$$\left. (1 - \lambda)[\theta N(k, s, z, 0) + (1 - \theta) M(k, s, z, i)] \Big] \right\}$$

subject to the following budget constraint,

$$c + k' + \Omega(s, h, i) = (1 + r)k + T(k, s, z, i)$$

where $c \geq 0$ and $k \geq 0$. Let $M(k, s, z, i)$ denote the value of the optimal health insurance purchase decision when non-employed,

$$M(k, s, z, i) = \max\{N(k, s, z, 0), N(k, s, z, i)\}$$

Note that for agents without health insurance coverage, $M(k, s, z, 0) = N(k, s, z, 0)$. Finally, let $h(k, s, z, i)$ denote the optimal labor choice and $n(k, s, z, i, l)$ denote the optimal health insurance decision rule.

3.6 Equilibrium Definition

A stationary recursive competitive equilibrium is a list of functions $W(k, s, z, i)$, $N(k, s, z, i)$, $E(k, s, z)$, $V(k, s, z, i)$, and $M(k, s, z, i)$, $h(k, s, z, i)$, $n(k, s, z, i, l)$, $c(k, s, z, i, l)$, $k'(k, s, z, i, l)$, scalars π and b, and a distribution of agents $\Psi(k, s, z, i, l)$ such that:

1. Agents decision rules solve the household problem

2. Employer health insurance firms earn zero profits in equilibrium:

$$\int \pi \mathbf{I}[i = 1] d\Psi = \int \phi m \mathbf{I}[i = 1] d\Psi$$

3. Government budget is balanced:

$$\int \tau [zh(k, s, z, i) - n(k, s, z, i, 1)\pi] d\Psi = \int T(k, s, z, i) d\psi$$

4. Distribution of households Ψ is consistent with individual behavior:

5. Markets clear:

$$\int c(k, s, z, i, l)d\Psi + \int k'(k, s, z, i, l)d\Psi + M = Y$$

where $M = \int \exp(\mu + s)d\Psi$ and $Y = \int rk'(k, s, z, i, l)d\Psi + \int zh(k, s, z, i)d\Psi$.

4 Calibration

Each model period corresponds to one month. Final calibration parameters are presented in Table 4 for reference. I calibrate the labor disutility parameter α to match the employment-to-population rate of 86.3% among prime-age males from the SIPP dataset described earlier. The discount rate β is set to 0.9967 following Krusell et al. (2011). Capital return to investment (r) is set at 4 percent annual rate and wage rate is normalized to one. I follow the calibration strategy outlined in Krusell et al. (2011) to pick labor market friction parameters λ and σ. The job separation rate σ is set to match the flow of workers from employment to unemployment in equilibrium (1.08%). The job finding rate λ is set to match the unemployment rate in the economy (4.65%).

Table 4: Calibration Parameters

Name	Symbol	Value
Disutility from labor	α	0.345
Discount rate	β	0.9967
Interest rate (annual)	r	0.04
Wage rate	w	1.0
Job separation rate	σ	0.009
Job finding rate	λ	0.363
HI offer rate	γ	0.083
HI loss rate	θ	0.0567
Labor productivity	ρ, σ_ϵ	0.9931,0.1017
Medical expenditure	$\tilde{\rho}, \tilde{\sigma}_\epsilon$	0.9470,0.7277
Average medical expenditures	μ	0.01
Copayment	ϕ	0.3
Employee contribution	ψ	0.2
Employer contribution	ξ	0.062
Tax rate	τ	0.3
Consumption floor	$\bar{c}$	$0.1 \cdot Y$

Next, consider the health insurance friction parameters. The parameter γ determines

the frequency with which an agent has an opportunity to purchase employment-based health insurance conditional on working. I choose γ to match the equilibrium insurance participation rate among the employed population. Likewise, θ determines the frequency with which an agent loses continuation coverage following entrance into the nonemployment pool. I set θ to match the participation rate among the unemployed population.

4.1 Labor Productivity

There is a large literature that estimates the structure of the process for idiosyncratic shocks to labor earnings and wages. Notable examples include Floden and Lindé (2001), Chang and Kim (2006), and Heathcote et al. (2010). I use estimates of $\rho = 0.92$ and $\sigma_\epsilon = 0.21$ for the autoregressive productivity process $\log(z_{i,t+1}) = \rho \log(z_{i,t}) + \epsilon_{i,t+1}$ where $\epsilon_{ij} \sim N(0, \sigma_\epsilon^2)$ from Floden and Lindé (2001). These parameters are then converted to monthly frequencies. The transition matrix $\Pi(z, z')$ is created using the Tauchen (1986) method.

4.2 Medical Expenditures and Insurance Reimbursement

I use longitudinal data from the Medical Expenditure Panel Survey (MEPS) to estimate the process of medical expenditure shocks and insurance reimbursement by source. The MEPS contains detailed individual level data on household medical expenditures, insurance reimbursements, and out-of-pocket expenditures. Each individual is interviewed for two years. I use data from 1996-2008 (Panels 1-12) of the MEPS Household Component (HC) files. To ensure data correspond to the model, I restrict my sample to households with household heads between 25-54 with positive medical expenditures net of expenditures that were reimbursed by independently purchased health insurance.

Similar to Janicki (2012a), I consider an autogregressive process for medical expenditures relative to average income: $s_{i,t+1} = \tilde{\rho} s_{i,t} + \tilde{\epsilon}_{i,t+1}$, where the log of medical expenditures regresses to the age-specific mean in the sample. I set μ so that the aggregate medical expenditure to output ratio is 12 percent.[6] I use annual parameters $\rho = 0.512$ and $\tilde{\sigma}_\epsilon = 1.25$ that are converted to monthly frequencies. The transition matrix $\tilde{\Pi}(s, s')$ is created using the Tauchen (1986) process.

I estimate the reimbursement share by aggregating annual household expenditures in the data and taking the average over all households with employer-based coverage yielding

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[6]I define aggregate medical expenditures net of Medicare expenditures in 2008 as a fraction of GDP from National Health Expenditure data maintained by the Center for Medicare and Medicaid Services. This data is available from *http://www.cms.gov*.

$\phi = 0.3$.

4.3 Government

I model transfers that guarantee consumption floor $\underline{c}$ following Hubbard et al. (1995). Transfers are made net of labor income, wealth, medical expenditures, and lump-sum transfers b:

$$T(k, z, s, i) = b + \max\{0, \underline{c} - [(w - \xi)zh(1 - \tau) + (1 + r)k - \Omega(s, h, i) + b]\}$$

The value of the government-provided consumption floor is set to 10% of average earnings in the economy. This value is lower than Hubbard et al. (1995), but is similar to estimates obtained by De Nardi et al. (2010).

4.4 Baseline Fit

The purpose of this section is to evaluate the ability of the model to match key features of the labor market and the market for employment-based health insurance. I begin by showing the labor force status distribution in Table 5. Recall that the labor disutility parameter is set to match the aggregate employment level. The model comes close to replicating the employment-to-population rate of 86.3 percent at 86.1. Likewise, the aggregate levels of unemployment and those not-in-the-labor-force is similar to those found in the data at 4.2 percent vs. 3.4 percent for the unemployed, and 9.5 percent and 10.5 percent for those not in the labor force, respectively.

Table 5: Labor Force Status: Data and Model

	Data	Model
Employed	86.3	86.1
Unemployed	4.2	3.4
Not-in-labor-force	9.5	10.5

Table 6 demonstrates the ability of the model to match aggregate employment-based health insurance participation rate as well as health insurance coverage by labor force status. While aggregate health insurance coverage was not directly targeted in the calibration procedure, it is worth noting that the model manages to approximate it fairly well at 62.5 percent vs. 63.5 percent in the data. The model also replicates health insurance

coverage by labor force status. Among employed population, 71.0 percent have employer-based health insurance in the model compared to 71.4 percent in the data. Among the non-employed population the pattern is similar. For the unemployed, 24.3 percent are insure through a former-employer in the model compared with 24.3 percent in the data. The fact that the model does well along these dimensions should not be surprising, since these moments are targeted in the calibration. Finally, the model underestimates health insurance participation of those not in the labor force have employer-based health insurance at 9.0 percent versus 0.6 percent.

Table 6: Health Insurance by Labor Force Status: Data and Model

	Data	Model
Aggregate	63.5	62.5
Employed	71.4	71.0
Unemployed	24.3	24.3
Not-in-labor-force	9.0	0.6

Recall that labor market friction parameter σ was chosen to best match flows between employment and unemployment (1.1 percent). Note that the respective flow in the model is 1.1 percent, which compares favorably to the target. The transitions in the model and data are presented in Table 7. The calibrated baseline model does well at replicating the diagonal elements of the transition matrix. Specifically, duration of employment, unemployment, and not-in-labor-force are similar to those found in the data. The model does a reasonable job of matching flows in and out of the not-in-labor-force category. One weakness of the model is an overestimation of flows between unemployment and employment at 34.7 percent versus 11.2 percent in the data.

Table 8 shows transition probabilities between employer-based health insurance coverage in the data and those generated by the model. The spells of coverage and no coverage in the model exhibit a large degree of persistence that are consistent with the data.

5   Results

In this section, I report the effect of frictions in the health insurance market on agent allocations. I first focus on health insurance coverage and disaggregate the effects of frictions by labor force status and magnitude of medical expenditure shocks s. Second, I detail the effect of health insurance frictions on labor supply outcomes.

Table 7: Labor Force Transitions: Data and Model

	Data		
	To (t+1):		
From (t):	Employed	Unemployed	Not-in-labor-force
Employed	0.987	0.011	0.002
Unemployed	0.112	0.860	0.028
Not-in-labor-force	0.019	0.041	0.940

	Model		
	To (t+1):		
From (t):	Employed	Unemployed	Not-in-labor-force
Employed	0.982	0.010	0.008
Unemployed	0.347	0.602	0.052
Not-in-labor-force	0.037	0.055	0.908

Table 8: Health Insurance Transitions: Data and Model

	Data	
	To (t+1):	
From (t):	Coverage	No Coverage
Coverage	0.990	0.010
No Coverage	0.011	0.989

	Model	
	To (t+1):	
From (t):	Coverage	No Coverage
Coverage	0.982	0.018
No Coverage	0.030	0.970

5.1 Health Insurance Frictions and Coverage

What impact do health insurance frictions have on employment-based health insurance coverage? This question is important since limits on enrollment have been the subject of numerous health policies with contradictory goals. The Employee Retirement Income Security Act of 1974 removed state regulatory authority to exclude coverage of pre-existing conditions by large firms. In contrast, the 1996 HIPAA legislation imposed maximum time limits of exclusion from group health insurance.

I begin by exploring the impact of exogenous changes in the arrival rate of a health insurance insurance coverage opportunity, γ. The focus of this section is to compare the equilibrium health insurance participation rates by agent characteristics relative to exogenous changes in the parameter γ. Each exogenous change in γ implies a new equilibrium with a possibly distinct set of decision rules, premiums π, lump-sum transfers b, and value of the consumption floor $\bar{c}$. All remaining utility and friction parameters are held at their calibrated values in the benchmark economy. Figure 3 illustrates the effect of γ on health insurance participation.
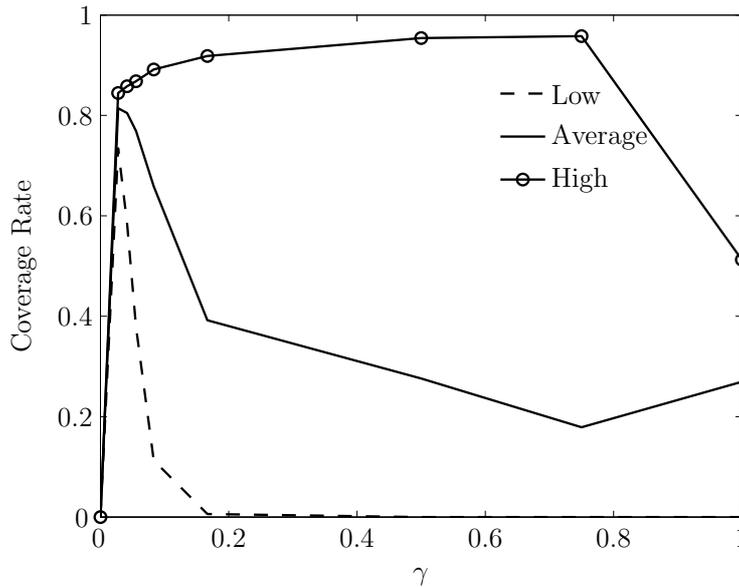
Figure 3: Health Insurance Offer Probability and Coverage

The solid line represents the aggregate (average) health insurance participation rate. As γ increases, agents make health insurance coverage decisions with greater frequency. A striking finding is that changes in γ have large effects on insurance participation. As γ increases, the aggregate participation rate falls. Greater frequency of coverage decisions

19

allows for selection in and out of insurance coverage. To illustrate this more clearly, the figure plots insurance participation rates for agents with high and low realizations of s that reflect the magnitude of medical expenditure shocks. The figure illustrates that as the frequency of insurance enrollment opportunities increases, agents with high values of s will choose to enroll, while those with low realizations of s will forgo coverage.

A key implication of this experiment is that abstracting from enrollment frictions, i.e. $\gamma = 1$, results in a model that underestimates the incentives to purchase health insurance among agents with low realizations of medical expense shocks s. Conversely, in the presence of enrollment frictions, low-s agents find it optimal to purchase health insurance only if frictions are "sufficiently" severe. To get a better sense of the magnitude of health insurance frictions introduced by γ, I express the the average length of the waiting period by $1/\gamma$. The baseline calibration implies average waiting periods of 19 months. Figure 3 illustrates that enrollment of 0.15 or 6 months or more are needed to limit the effect of selection out of the health insurance pool and attain a 80 percent enrollment rate in the aggregate. However, these enrollment limits differ by realization of medical expense shocks s. For example. low-s agents are likely to participate in their employer's health insurance plan if enrollment decisions are restricted to less than 12 months. In contrast, agents with high-s realizations are equally likely to purchase insurance coverage.
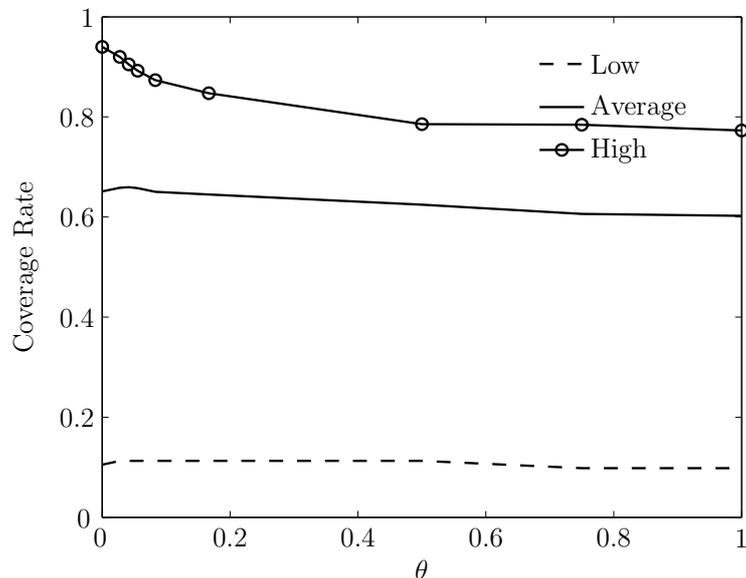

Figure 4: Health Insurance Loss Probability and Coverage

Another central friction introduced in this model is the health insurance separation rate of employer-based coverage provided by a former employer. As discussed earlier, this separation rate θ is a reduced-form representation of a variety of factors that might induce a termination of health insurance coverage such as limits to COBRA coverage, an employer decision to cancel provision of health insurance benefits to employees, or employer bankruptcy. As θ increases, the likelihood that an insured agent faces a loss of health insurance coverage from a former employer also increases. Figure 4 illustrates health insurance coverage by θ. From the figure, it is clear that changes in θ result in relatively small changes in aggregate health insurance enrollment. The effect of the separation friction is larger for high-s agents than low-s agents. One implication of this finding is that state and federal laws that mandate continued access to employer-provided health insurance have little effect on all but those agents with high expense shocks.
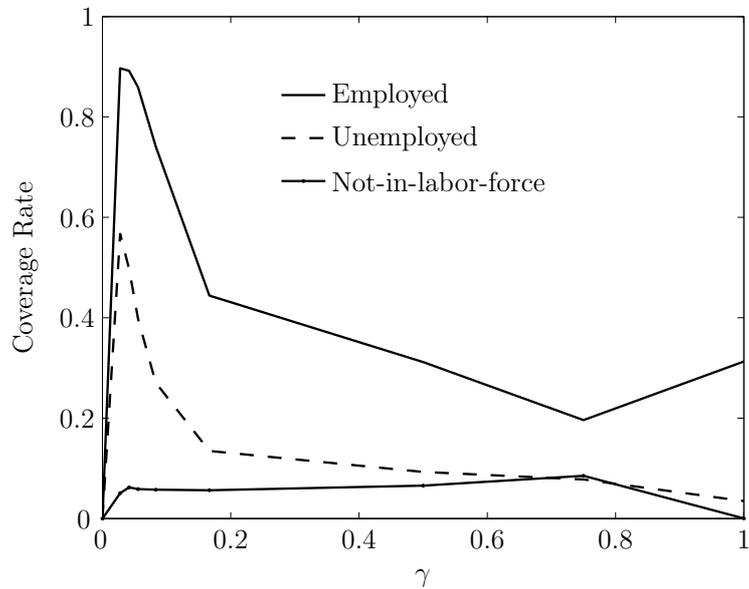

Figure 5: Health Insurance Offer Probability and Insurance by Labor Force Status

Figures 5 and 6 repeat the exercise, but disaggregate the response of changes in the frictions by labor status. I note that restrictions to health insurance enrollment among employed agents have differential effects on incentives to purchase health insurance among the unemployed and those not in the labor force. While health insurance coverage among the employed in Figure 5 follow aggregate health insurance purchases already discussed in Figure 3, plots of health insurance coverage among the non-employed suggest that non-employment dampens the effect of changes in γ. In particular, a decrease in enrollment
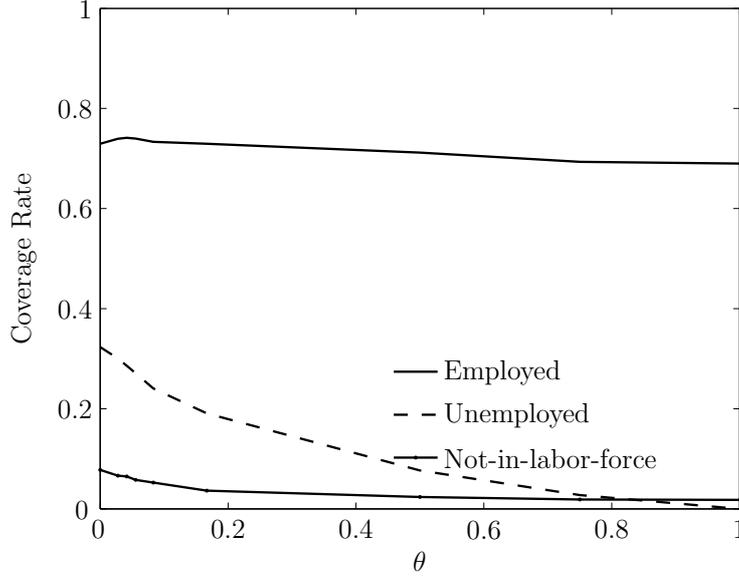
Figure 6: Health Insurance Loss Probability and Insurance by Labor Force Status

restrictions reduces health insurance coverage among the unemployed and has little effect on those out of the labor force. Note that γ determines the opportunities for self-selection of health insurance benefits. Since employer-based health insurance is only available to non-employed agents that participated in their employer's health insurance plan while employed, decreased incentives for purchase of health insurance while employed spill-over to the non-employed population. This effect is particularly strong among the unemployed, who are more likely to purchase health insurance through their former employer than those out of the labor force.

While the effect of health insurance separation friction θ on aggregate coverage is small relative to γ, Figure 6 shows that changes in θ have the largest effect on insurance coverage among the unemployed population.

5.2 Health Insurance Frictions and the Labor Market

What role do frictions in the health insurance market (γ, θ) have on employment? Figure 7 and 8 plot the aggregate employment level across exogenous changes in parameters γ and θ. For example, elimination of employer-based health insurance $(\gamma = 0)$ would decrease the aggregate employment rate from 86.1 percent in the baseline calibration to 82.1 percent. Meanwhile, elimination on duration limits on continuation coverage $(\theta = 0)$ would decrease the aggregate employment rate to 85.8 percent.
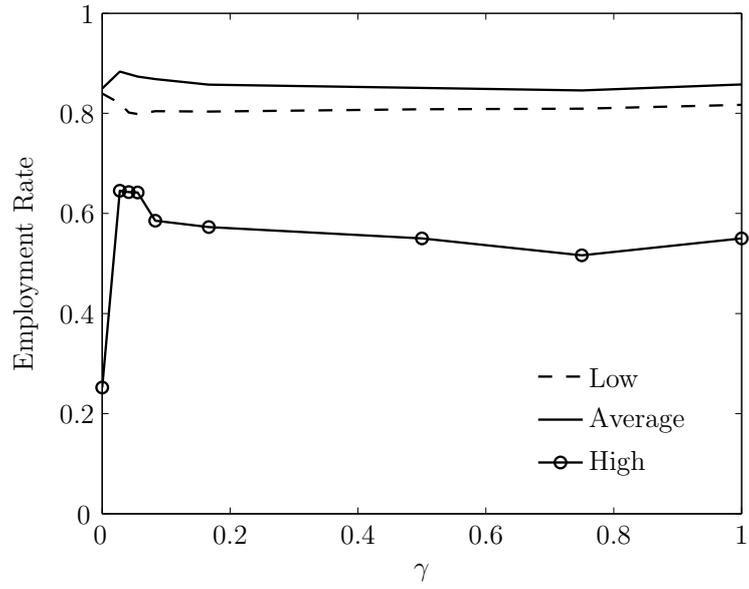
22

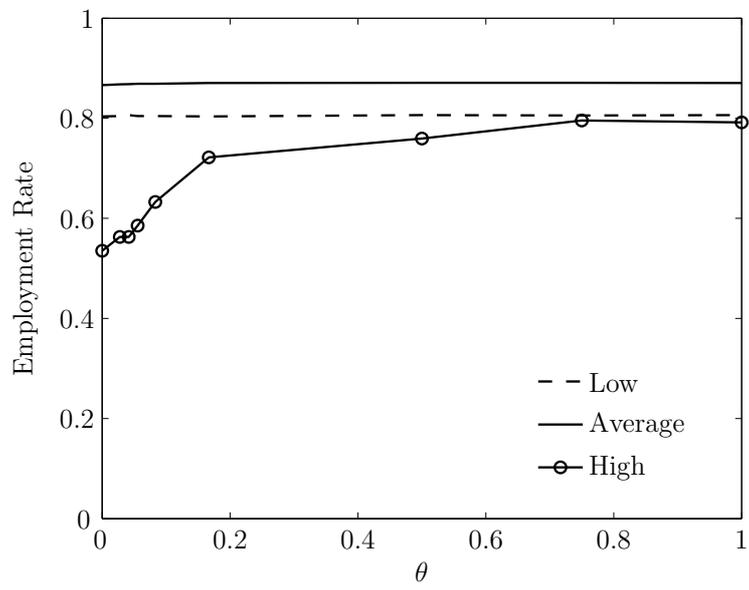Figure 7: Health Insurance Offer Probability and Employment

Figure 8: Health Insurance Loss Probability and Employment

23

The aggregate changes in employment level mask more substantial effects when decomposing the effects by magnitude of the expense shock s. In particular, the effect of changes in θ on the employment rate are larger for agents with high realizations of s than low realizations of s. In Figure 7, a decrease in γ from the baseline value to zero decreases employment among agents with high s from 58.4 percent to 24.6 percent. Agents with low-s values see an increase in employment from 80.8 percent to 81.2 percent. The elimination of employer-based health insurance is associated with a dramatic decline in employment among agents with the highest realizations of medical expense shocks. Why do agents with the highest medical expense shocks choose not to work in the absence of employer-based health insurance? Holding the level of assets fixed, a large medical expense shock can easily eliminate the majority of labor earnings for all but the most productive agents. This results in both employed and non-employed agents choosing to consume $\bar{c}$. Agents choose to substitute consumption for leisure by foregoing employment. Note that in the presence of employment-based insurance, regardless of the magnitude of health insurance frictions, employment by high-s agents is approximately constant.

To what extent do frictions in the market for health insurance affect agents of different productivity levels? In Figure 9 and 10, I show the distribution of employment across different productivity levels z for select values of γ for agents with low and high realizations of medical expense shocks s. From Alonso-Ortiz and Rogerson (2010), we know that an incomplete markets model with indivisible labor choice generates too much employment among low productivity agents relative to a complete markets model. That is, the inability of agents to move consumption from periods of high productivity to low productivity leads agents to smooth consumption using employment despite the high value of leisure in low productivity periods. The introduction of idiosyncratic medical expenditures that are insurable though employment substantially strengthens this motive. In Figure 10, the introduction of an employment-base health insurance market increases employment among low-z agents. This is seen in comparing employment rates when $\gamma = 0$ versus $\gamma = \gamma^b$.

While the introduction of an employment-based health insurance program distorts the employment incentives for leisure among low-z agents, the opposite is true for agents with higher productivity. Again, see Figure 10. Note that for agents with average productivity above the mean (grid 9), the introduction of employment-base health insurance increases employment incentives for agents with high medical expenditure shocks. The reason for this is the existence of the consumption floor. Agents with "catastrophic" medical expenditure shocks have little incentive to work, since their labor earnings will go to
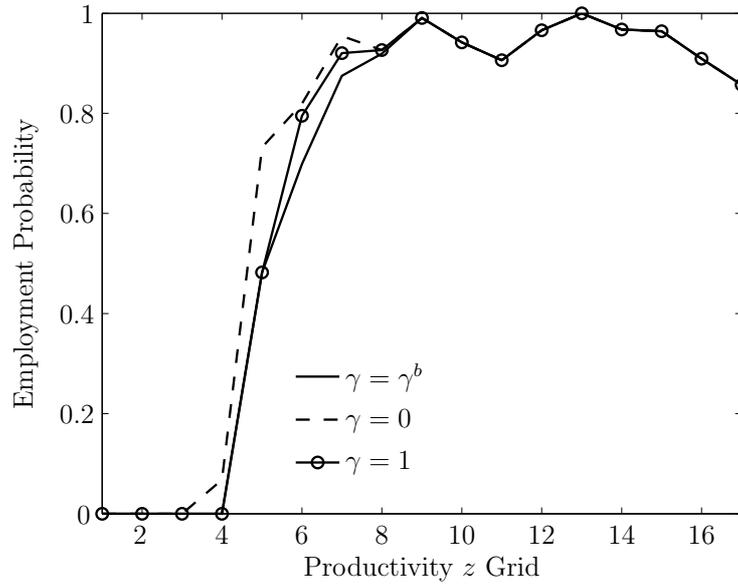
24

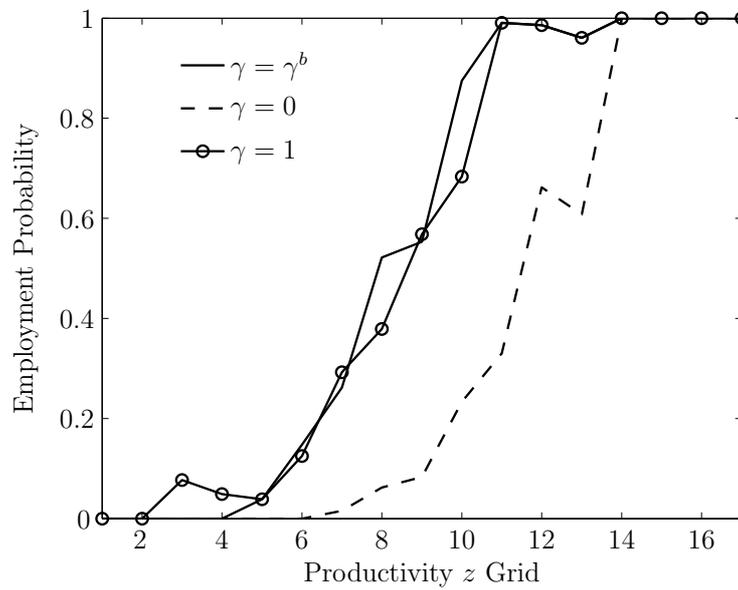Figure 9: Employment By Productivity and γ, Low Medical Expense Shock

Figure 10: Employment By Productivity and γ, High Medical Expense Shock

payment of medical bills rather than consumption. In this case, nonemployment provides those agents with utility from leisure and a minimum consumption level that is preferable to a consumption bundle net of disutility of labor. Loosely speaking, employment-based insurance undoes the incentive to nonemployment provided by the consumption floor by increasing the return to working.
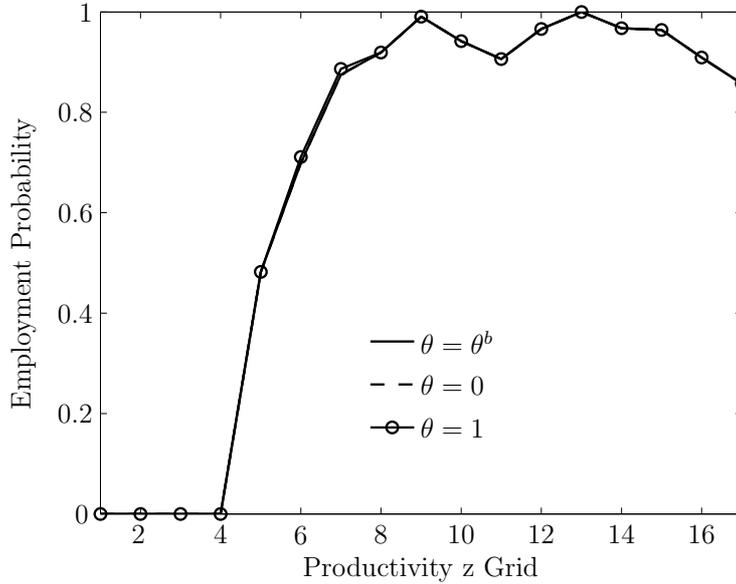

Figure 11: Employment By Productivity and θ, Low Medical Expense Shock

It is worth pointing out that the magnitude of this effect depends on the realization of the medical expense shock incurred by the agent. Figure 9 shows that employment incentives for low-z agents decline when accompanied by small realizations of medical expense shocks. Why does the introduction of employment-based health insurance reduce employment incentives for agents with low productivity and low medical expense shocks? Recall that the effective return to working in a model with health insurance is $(w - \xi)z$. The cost ξz is paid regardless of health insurance participation. This cost reduces the return to working relative to an equilibrium without health insurance ($\gamma = 0$) and reduces employment for low-z agents.

I repeat the exercise above but for θ rather than γ. The results are similar and are presented in Figure 11 and 12. For low values of s, continuation coverage has little effect on employment by productivity level. For higher values of s, the effect of continuation coverage is larger. Agents with low productivity are more likely to work when no continuation coverage is available. Furthermore, as the duration of continuation coverage is
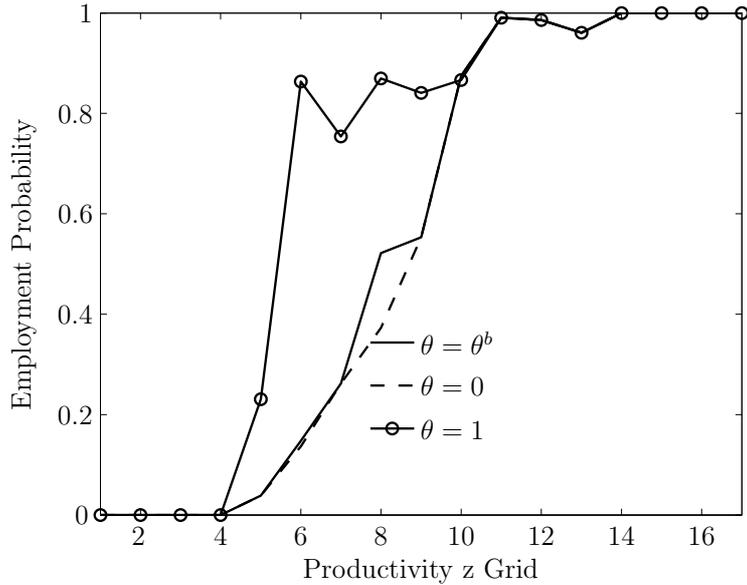
26

Figure 12: Employment By Productivity and θ, High Medical Expense Shock

expanded, the employment rate among unproductive agent declines. Note that there is little effect on employment among these agents when limits to duration of continuation coverage are eliminated. That is seen in Figure 12 by comparing the line corresponding to θ^b to the line corresponding to 0. The expected duration coverage at the benchmark value is approximately 10 months, while $\theta = 0$ implies unlimited duration for continuation coverage. This suggests that expansions of continuation coverage from the current benchmark θ^b have little effect among agents that are least likely to work, i.e. the most unproductive workers. However, the elimination of continuation coverage has a sizeable effect on employment among these workers. For example, for agents with a productivity realization of 6 are 8 times more likely to work when continuation coverage is eliminated relative to the baseline economy (80 percent vs. 10 percent).

Table 9: Labor Force Transitions by γ

	$\gamma = 0$	$\gamma = \gamma^b$	$\gamma = 1$
E-E	0.978	0.982	0.978
U-U	0.595	0.601	0.593
N-N	0.877	0.905	0.884

Lastly, I return to the effect of health insurance frictions on job mobility, known as "job lock." I perform the following experiment. I solve for the equilibrium implied by three

27

values of γ and calculate the diagonal elements of the labor supply transition matrix calculated earlier. I chose $\gamma = 0$ (no health insurance system), $\gamma = \gamma^b$ (baseline), and $\gamma = 1$ (no enrollment restrictions). The results are found in Table 9 and illustrate that the effect of frictions or waiting periods in the market for health insurance has little effect on aggregate measures of job mobility. The likelihood of transition from employment at month t to employment at month $t + 1$ (E-E) is approximately constant. The same is true for transitions across spells of unemployment (U-U). The biggest change is in the probability of remaining not-in-labor force. The elimination of employer-based insurance decreases persistence of non-participation in the labor force from 0.905 to 0.877. Contrary to the empirical findings of Madrian (1994), this result suggests that employment-provision of health insurance has little effect on the duration of employment or unemployment spells.

6   Conclusion

The purpose of this paper is to provide a quantitative model of employer-based health insurance coverage characterized by frictions in the market for health insurance. In particular, I construct an incomplete markets model with idiosyncratic shocks to labor productivity and medical expenditures. Agents face a discrete choice of labor supply and health insurance participation that are subject to frictions. The degree of frictions in the labor market and the market for health insurance generates the levels of insurance participation by labor force status as well as transitions between health insurance categories consistent those observed in the data.

I find that frictions in the health insurance market have important implications for health insurance coverage. Restrictions to health insurance enrollment opportunities play an important role in mitigating selection of agents by expected medical expenditures. However, I find relatively small effects of generosity of continuation coverage on aggregate insurance enrollment. Both health insurance enrollment restrictions and continuation coverage have important implications for labor force outcomes. In particular, employment-based health insurance with enrollment restrictions undoes disincentives to work provided by transfers that guarantee a minimum consumption level among agents with high realizations of medical expenditure shocks. While limits in the duration of continuation coverage have little effect on aggregate employment, the presence of continuation coverage benefits reduces employment among agent with low labor productivity.

There is considerable room for expansion of the model to answer related questions. For example, introduction of a "storage" technology for medical expense shocks could be used

to address the role of delays in treatment on health insurance coverage. Spousal health insurance coverage is an important source of insurance coverage. How does dependency coverage alter the household labor supply decision when health insurance is modeled as a benefit to employment? Finally, introduction of a Medicaid program and a Medicaid enrollment decision into the model could be used to address the reasons why eligible workers do not enroll in Medicaid coverage and the implications of the program on labor supply.

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