Medical Debt, Self-Insurance, and the Value of Health Insurance for the Non-Elderly *

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Abstract

In the US, about 60% of non-elderly workers are insured through employer-sponsored health insurance (ESHI). This paper studies how non-elderly workers manage various forms of insurance to cope with medical expenditure shocks and how their coping strategies affect job search decisions. Specifically, I examine the role of self-insurance through saving/borrowing and delaying medical bill payments. To that end, I develop and estimate a job search model in which individuals can insure themselves against medical expenditure shocks in three ways: (1) by enrolling in ESHI, (2) by saving and borrowing, and (3) by accumulating medical debt and repaying them over time. The findings reveal substantial variation in the value of ESHI, with higher valuations among two specific worker profiles: (i) workers with limited to moderate net liquid assets but not close to the borrowing limit and (ii) workers with higher levels of medical debt, with the valuation peaking at approximately $40,000 and remaining relatively stable thereafter. Such uninsured (insured) workers who value ESHI more are more likely to accept jobs with (without) ESHI at lower (higher) wages and transition to a job with (without) ESHI more (less) frequently.

Keywords: Medical debt, employer-sponsored health insurance, job search

JEL Codes: I13, J32, J60, G51, D14

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1 Introduction

In the United States, health insurance is closely linked to employment. About 60% of non-elderly workers rely on employer-sponsored health insurance (ESHI) as their primary means of coverage KFF's State Health Facts (2022). ESHI, however, can lead to welfare loss via inefficient matches of employers and workers through job push and job lock. Job push effects arise when uninsured employees accept a job offer providing health insurance, even if they will be less productive in the new job than in their current one. Conversely, job lock effects occur when insured employees are reluctant to accept a job offer that lacks ESHI despite the new job assuring them of higher productivity.

Such distorted job mobility decisions could occur because workers value ESHI as a way to deal with medical expenditure shocks. However, ESHI is not the only option. Individuals can resort to alternative forms of insurance as well. First, they can save money while they are healthy and then use the savings to cover medical expenditures. Alternatively, they can borrow to pay medical bills, subsequently paying off the debt after they recover. Second, patients can also resort to delaying payments by incurring medical debt owed to hospitals, thereby smoothing consumption when facing medical expenditure shocks. In fact, both alternatives are frequently used, with 41% of working-age adults in some form of debt caused by medical bills Lopes et al. (2022).

In this paper, I study how non-elderly workers manage the three ways of insurance: health insurance, self-insurance, and medical debt, to cope with medical expenditure shocks, which in turn affect job search decisions. Specifically, I address two questions: (1) How does the value of ESHI vary based on one's net liquid assets and medical debt? (2) How do job-to-job transition rates change with different net liquid assets and medical debt?

This paper's main contribution is to model the role of the two alternative forms of insurance, especially delayed payments by incurring medical debt. Medical debt is unique in terms of its benefits and costs for patients. Medical debt is usually interest-free, unlike regular debt such as credit card loans. However, people with medical debt suffer from other costs. For example, they might face difficulties accessing non-emergency care due to limited payment capacity Lopes et al. (2022). In addition, their credit scores could also be damaged Brevoort et al. (2020). Despite its prevalence and the pros and cons for patients, the role of medical debt in coping with medical expense shocks remains under-studied in the literature.

To address the questions above, I develop a partial equilibrium on-the-job search model augmented with four main features: (1) a stochastic process of health status, (2) enrollment in ESHI through job search decisions, (3) saving and borrowing decisions to capture self-insurance, and (4) accumulation and repayment decisions of medical debt. I estimate the model using the Survey of Income and Program Participation (SIPP) and the Medical Expenditure Panel Survey (MEPS), covering the period from 2017 to 2019. The structural parameters are estimated with Simulated Method of Moments (SMM) to match data moments from the joint distribution and the evolution of state variables. These variables consist of health insurance status, net liquid assets, medical debt, employment status, wage, health status, and flow medical expenditure.

Using the estimated parameters, I first quantify the Willingness-to-Pay (WTP) for ESHI among uninsured individuals and the Willingness-to-Accept (WTA) for ESHI among the insured. WTP is expressed as the maximum reduction in wage that an uninsured individual would be willing to accept to reach a state of indifference between remaining uninsured and obtaining ESHI. On the other hand, WTA represents the minimum increase in wage that an insured individual would require to achieve indifference between retaining ESHI and becoming uninsured. The results show non-neglible variation in the valuations of ESHI, particularly favoring it for two specific worker profiles: (i) workers with a limited to moderate amount of net liquid assets but not close to the borrowing limit and (ii) workers with higher levels of medical debt, where the valuation reaches a peak at approximately $\$40,000$, beyond which there is little change. Note that these variations in WTP and WTA are solely explained by differences in net liquid assets and medical debt, with other state variables such as wage and flow medical expenditure held constant. Secondly, I confirm that uninsured (insured) employees with a higher valuation for ESHI exhibit higher (lower) rates of transition to jobs with (without) ESHI.

Related Literature

This paper draws upon and contributes to four distinct strands of literature. In the first literature strand, research examines the interplay between health insurance and frictional labor markets.[1] Dey and Flinn (2008) are among the first paper estimating the value of health insurance for working-age individuals using a job search model. They construct a household search model and estimate the marginal willingness to pay for ESHI among both singles and married couples. Conti et al. (2020) examine the impact of the *Seguro Popular*, a significant health insurance expansion aimed at informal sector workers and the non-employed in Mexico. They utilize a household search model extended with informal and formal sectors to quantify the value of health insurance and the impact of the policy on labor market outcomes. Kim (2022) employs a search-matching-bargaining model, endogenizing medical care utilization decisions, to examine how ESHI can alleviate acute health costs, particularly by reducing absenteeism days. Additionally, there are studies analyzing the impact of the Affordable Care Act (ACA) on labor market outcomes, using a job search model. For instance, Aizawa and Fang (2020) develop an extended version of Bontemps et al. (2000)'s type equilibrium search model, capturing features of pre-ACA US health insurance systems. Then, they use it to quantitatively assess the impacts of the ACA reforms on the labor market equilibrium. Aizawa (2019) explores the optimal design of ACA health insurance exchanges, considering one's life-cycle decisions on job search, insurance choice, and medical care utilization. Fang and Shephard (2019) delve

1 For a broader set of studies on the interaction of health insurance and labor market (not limited to frictional labor market model), see Fang and Krueger (2022) for a survey of this literature.

into the impact of the ACA on firms' decisions to offer health insurance to the spouses of their employees using a household search model. They also find a significant fall in the value of ESHI after the introduction of the ACA. However, the existing literature fails to consider the role of net liquid assets and the burden of medical debt. It does so by presuming that workers neither save nor borrow, and that government transfers always ensure a minimum level of consumption, even in cases where out-of-pocket medical expenses surpass individuals' financial resources.

The second literature looks into the interaction between saving/borrowing decisions and frictional labor markets. It includes theoretical contributions by Lentz and Tranæs (2005) and empirical studies based on an individual search model by Rendon (2006), Lentz (2009)), and Lise (2012). A more recent study, García-Pérez and Rendon (2020), extends this line of framework to a household search model with saving decisions. They find that ignoring saving decisions leads to a significant underestimation of the coefficient of relative risk aversion. Flabbi and Tejada (2022) further explores the connection between labor market informality and access to formal financial institutions by estimating a job search model that incorporates portfolio allocation decisions between safe (formal) assets and risky (informal) assets. Although the papers mentioned do not focus on non-wage compensations such as health insurance, the model presented in this paper draws inspiration from the literature, particularly the work of Lise (2012).

The third strand of literature investigates the economic consequences of uncompensated care, medical debt, and default decisions as implicit insurance mechanisms for patients. Mahoney (2015) provides empirical evidence on the economic significance of uncompensated care by leveraging variations in asset exemption laws across states. Finkelstein et al. (2018) offers a conceptual framework for analyzing the implicit health insurance role of uncompensated care. Dobkin et al. (2018) shows that hospital admissions result in substantially larger unpaid bills for the uninsured than for the insured. Brevoort et al. (2020) studies the impact of unpaid medical bills on patients' credit scores, shedding light on the financial consequences of medical debt. Jang (2022) explores how default options on emergency medical bills and bankruptcy options shape households' behaviors concerning medical expenditures and their need for health insurance, while also considering preventative care. It develops and calibrates an extend version of Chatterjee et al. (2007)'s consumer bankruptcy model. Then the calibrated model is used to study the consequences of counterfactual eligibility rules of Medicaid.

The fourth literature is an extensive literature assessing the impact of job lock and job push on labor market dynamics. Numerous studies have attempted to examine the existence and the effect. Several studies have provided evidence of job lock or job push, including works by Madrian (1994), Gruber and Madrian (1994), Bansak and Raphael (2008), Garthwaite et al. (2014), Chatterji et al. (2016), Barkowski (2020), Hannah Bae, Katherine Meckel, and Maggie Shi (2023), and Aouad (2023). Some studies report limited size of impacts or find impacts specific to some demographic groups (e.g., Gilleskie and Lutz (2002), Hamersma and Kim (2009)). On the other hand, there are also studies finding little to no discernible impacts (e.g., Kapur (1998), Berger et al. (2004), Dey and Flinn (2005), Sanz-De-Galdeano (2006), Baicker et al. (2014), Bailey and Chorniy (2016)). The lack of consensus in the literature can be attributed to differences in testing settings, methodologies, and target populations.

Bringing together these various literature, this paper makes a contribution by exploring the roles of self-insurance and medical debt in the context of health insurance and labor market dynamics.

The remainder of this paper is organized as follows. Section 2 provides key facts that motivate the setup of the model, which is introduced in Section 3. In Section 4, I explain data and how the sample is constructed. Section 5 discusses identification and estimation procedure. Estimation results are reported in Section 6. Using the estimates, simulation exercises are performed to answer the research questions in Section 7. Lastly, Section 8 concludes the paper.

2 Empirical Facts

In this section, I present several empirical facts that provide the foundation for the model. The empirical analysis relies primarily on data from the Survey of Income and Program Participation (SIPP), covering years from 2017 to 2019. To ensure a homogeneous sample of workers, I focus on a specific demographic group: white males aged 26 to 55 who are high school graduates or higher, are not affiliated with the armed forces, are not currently enrolled in school, are not disabled, are not self-employed, and have never retired. Additionally, I restrict the sample to individuals residing in states that have already expanded Medicaid. Furthermore, I exclude individuals who have insurance coverage through Medigap, Medicare, military-related coverage, directly-purchased private health insurance, or employer-provided health insurance owned by someone else (e.g., spousal insurance). Consequently, the individuals within our sample fall into one of three categories: they are either uninsured, insured via their own ESHI, or insured through Medicaid. A comprehensive discussion of the sample restriction rules is presented later in Section 4.

Medical debt is prevalent and sizable Table 2 reveals that medical debt is prevalent and sizable in the sample. Approximately 8.7% of individuals have outstanding medical debt, with a median amount of around $\$20,000$ for those in debt. Additionally, medical debt is more prevalent and sizable among workers with fewer net liquid assets and those who are uninsured or insured through Medicaid. This finding is consistent with anecdotal evidence,[2] suggesting that individuals with limited financial resources or lacking insurance coverage often resort to medical debt as a means of coping with medical expenses.

Individuals pay off medical debt The next motivating pattern is the yearly changes in medical debt. Let $B_t < 0$ denote the stock of medical debt on the last day of year t

2 For more details, refer to Diagnosis: Debt by KFF Health News

measured in \$1,000. For example, if an individual has \$5,000 of medical debt in year t, B_t is -5. Table 3 shows the yearly changes in medical debt ($B_{t+1} - B_t$) among those who had medical debt in year t (i.e., $B_t < 0$). The table suggests that at least 77.2%) of those with medical debt in year t repay a part of medical debt, even though medical debt is typically interest-free. It suggests that medical debt has costs other than interest. While this paper remains agnostic about the specific sources of such costs, there are several types of possible costs. First, individuals with medical debt may face future restrictions on accessing non-emergency healthcare services due to past-due bills. A recent survey by Kaiser Family Foundation, Lopes et al. (2022), shows that 1 in 7 adults with medical debt have been denied care due to unpaid bills. Second, as demonstrated by Brevoort et al. (2020), medical debt can negatively affect an individual's credit score. Third, individuals with medical debt may be sued by hospitals, as observed by Cooper et al. (2021). They might also be subject to stigma or social embarrassment.

Many individuals with medical debt pay off medical debt gradually over time Furthermore, many individuals with medical debt opt for gradual repayment rather than a one-shot settlement. Lopes et al. (2022)[3] shows that about 24% of survey respondents currently have medical debt owed to medical providers, and about one in five (21%) of the survey respondents (i.e., around 88% = 0.21/0.24 of those with medical debt) have bills they are in the middle of paying off over time.

3 Model

Focusing on workers' decisions, I develop a partial equilibrium model of on-the-job search in which individuals manage the three forms of insurance: (1) enrollment in ESHI through job search decisions, in addition to exogenous enrollment in or dis-enrollment from Medicaid, (2) self-insurance through saving and borrowing, and (3) delaying payments by

3 see Figure 1 in Lopes et al. (2022)

incurring medical debt.

3.1 Environment

General environment The model is stationary, and the time is continuous. The economy is populated by a continuum of workers that are *ex-ante* identical. All workers are infinitely lived.

They have preferences over streams of consumption c_t and outstanding medical debt B_t. They incur a utility cost if they have medical debt (i.e., $B_t < 0$).

$$\mathbb{E}_0 \int_0^\infty e^{-\rho t} [u(c_t) - \mathbb{1}(B_t < 0)\chi(B_t, z_t)] dt \tag{1}$$

The utility function from consumption, $u(c)$, is assumed to be strictly increasing, strictly concave, and satisfy the Inada condition. The utility cost χ is assumed to be a function of outstanding medical debt B_t and flow repayment for it z_t. It is decreasing in flow repayment (i.e., $\chi_z < 0$), but the marginal return from repayment is diminishing (i.e., $\chi_{zz} > 0$). This specification is motivated by the observed repayment behavior that many individuals gradually pay off medical debt over time. Following suggestive evidence in section 2, I assume people who repay more today are less likely to incur the cost of medical debt (e.g., less likely to be denied their access to care), conditional on the amount of outstanding medical debt (B). Here, flow repayment z serves as a signal to hospitals on the patient's willingness or ability to pay off the debt.

Labor market environment Workers are either employed ($E = 1$) or unemployed ($E = 0$). While unemployed, individuals receive flow income $b > 0$. Job offers arrive as Poisson shocks at the rate of λ^U. A job is a pair (w, I), where w is the wage and $I \in \{0, 1\}$ indicates ESHI coverage. If the job provides ESHI, I takes on the value of 1. A job offer is a draw from an exogenous job offer distribution $F(w, I)$.

While employed, workers also engage in on-the-job search. Job offers arrive at a different rate λ^E. Upon arrival, a job offer is drawn from $F(w, I)$. An employed worker's current job can be terminated at the exogenous rate of η^0 for jobs without ESHI and η^1 for jobs with ESHI.

The transition of health status Individuals are healthy ($h = 1$) or unhealthy ($h = 0$). Health status h follows a Poisson process. When individuals are healthy, they are subject to negative health shocks occurring at a rate of ω^u. Conversely, when they are unhealthy, they recover by getting a positive health shock at a rate of ω^h. Upon encountering a negative health shock, individuals incur flow medical expenditures, m, drawn from the distribution F_m. The flow medical expense m is continuously charged until the arrival of a recovery shock. This m is assumed to be a non-discretionary medical total expenditure.

The transition of health insurance status Let I denote health insurance status, which can take on one of three values: uninsured ($I = 0$), insured via ESHI ($I = 1$), or insured via Medicaid ($I = 2$). When uninsured, workers enroll in ESHI if they accept a job offer that provides HI.[4] In addition to ESHI, I account for Medicaid for two reasons: First, Table (2) demonstrates a higher prevalence of medical debt among Medicaid recipients. Second, Medicaid's eligibility for lower-income individuals can influence their job search decisions. In the model, uninsured workers enroll in Medicaid at an exogenous rate ξ_{en}^U for the unemployed and $\xi_{en}^E(w)$ for the employed, dependent on wage w. Conversely, when they have Medicaid coverage, they dis-enroll from it at an exogenous rate ξ_{disen}^U for unemployed workers and $\xi_{disen}^E(w)$ for employees, dependent on wage w. They are also assumed to lose Medicaid coverage immediately if they enroll in ESHI. When individuals are insured via ESHI, their coverage is terminated when they transition to a job without ESHI or become unemployed. Following the literature, health insurance contracts are characterized by two parameters: the premium π^I and the insured fraction of medical

4 For simplicity, I do not allow workers to decline ESHI when offered, in line with the observation that most individuals (about 93% in my MEPS sample) enroll in ESHI when offered.

expenditure $q^I \in [0,1]$. Note that, when workers are uninsured (i.e., $I = 0$), there is no premium, $\pi^0 = 0$, and they have to pay their entire medical expenditure, $q^0 = 0$.

The taxation and the deduction of health insurance premium Following Pashchenko and Porapakkarm (2013), the tax schedule is modeled to account for the deduction of health insurance premiums, as specified in equation (2). Individuals pay taxes on labor income w net of the premium π^I, which is denoted by $T(w,I)$. In the specification, τ_0 and $\tau_1 \in (0,1)$ represent the level and the degree of progressivity of the income tax system, respectively. The tax function becomes more progressive as τ_1 increases, with $\tau_1 = 0$ indicating a proportional tax system. [5] In addition to the income tax, they also pay payroll taxes: Medicare tax and Social Security tax. The Medicare tax rate, τ_{med}, is 1.45% on the first \$200,000/year and 2.35% above \$200,000/year. The Social Security tax rate, τ_{ss}, is 6.2% on the first $\overline{y}_{ss} = \$130,000$/year wages paid. [6]

$$\begin{aligned} y &= w - \pi^I \\ T(w,I) &= T(y) = y - \tau_0 y^{1-\tau_1} \\ tax(w,I) &= T(y) + \tau_{med} y + \tau_{ss} \max\left\{y, \overline{y}_{ss}\right\} \end{aligned} \tag{2}$$

The evolution of net liquid assets and medical debt Individuals can have two types of assets: net liquid assets $A \gtreqless 0$ and medical debt $B \leq 0$. Concerning net liquid assets, they self-insure against income shocks by trading risk-free bonds with an interest rate of r. They are also subject to the borrowing limit $A \geq \underline{A}$. The lower bound $\underline{A}$ is allowed to be at least as restrictive as the natural borrowing limit.

In contrast to net liquid assets, medical debt is interest-free. I assume there exists a maximum amount of medical debt an individual can incur, denoted as $\overline{B} > 0$ satisfying

5 This specification is frequently used in public finance, such as Heathcote et al. (2020). Note that, for simplicity, I assume capital income is not taxed.

6 Strictly speaking, the maximum taxable income for the Social Security tax rate is \$127,200/year in 2017, \$128,400/year in 2018, and \$132,900/year in 2019.

$-B \leq \overline{B}$ where $-B \geq 0$ represents the amount of medical debt. This upper bound takes into account the fact that hospitals often partially write off unpaid bills to avoid bankruptcy filings (Mahoney (2015), Finkelstein et al. (2018)). This limit is a constraint for hospitals, above which any additional unpaid medical bills are written off as charity care or debt forgiveness.

To illustrate the evolution of assets and medical debt, consider workers who are employed ($E = 1$) and unhealthy ($h = 0$). See Appendix A for the other cases. In addition to job search, the worker makes three decisions: (i) how much to consume, c, (ii) how much to repay for an outstanding medical debt if any, $z \in [0, \overline{z}(B)]$,[7] and (iii) how much of the medical expenditure to pay today, $x \in \left[0, (1-q^I)m\right]$. Note that $(1-q^I)m$ is the amount of uninsured flow medical expense. Total disposable flow income, $rA + w - \pi^I - tax(w, I)$, is allocated to these three choices, with the remaining income being saved. Then, net liquid assets A and medical debt B evolve as follows:

$$\begin{cases} \dot{B} := \frac{dB}{dt} = z + \left\{x - (1-q^I)m\right\} \\ \dot{A} := \frac{dA}{dt} = rA + w - \pi^I - tax(w, I) - c - z - x \end{cases} \tag{3}$$

3.2 The value function

The set of state variables characterizing the decision problem is denoted as S and consists of seven variables $S = (A, B, E, w, I, h, m)$.

7 When numerically solving the model, $\overline{z}(B)$, the upper bound on z, is set to a very large value to alleviate the impact of this artificial bound on the flow repayment decision.

Table 1: The value functions

		uninsured ($I=0$)	ESHI ($I=1$)	Medicaid ($I=2$)
unemployed	healthy ($h=1$)	$V^{E=0,h=1,I=0}(A,B)$	-	$V^{E=0,h=1,I=2}(A,B)$
($E=0$)	unhealthy ($h=0$)	$V^{E=0,h=0,I=0}(A,B,m)$	-	$V^{E=0,h=0,I=2}(A,B,m)$
employed	healthy ($h=1$)	$V^{E=1,h=1,I=0}(A,B,w)$	$V^{E=1,h=1,I=1}(A,B,w)$	$V^{E=1,h=1,I=2}(A,B,w)$
($E=1$)	unhealthy ($h=0$)	$V^{E=1,h=0,I=0}(A,B,w,m)$	$V^{E=1,h=0,I=1}(A,B,w,m)$	$V^{E=1,h=0,I=2}(A,B,w,m)$

The value functions are the solution to the partial differential equation (Hamilon-Jacobi-Bellman equation) as in (4). Details about the derivation are described in Appendix B. In this section, I describe the value function for workers who are currently employed ($E=1$), unhealthy ($h=0$), and uninsured ($I=0$). See Appendix C for the value function of the other cases.

$$
\begin{aligned}
\rho V^{E=1,h=0,I=0}(A,B,w,m) = \max_{c,z,x} u(c) - & \underbrace{\mathbb{1}(B<0)\chi(B,z)}_{\text{the flow cost of incurring medical debt}} \\
& + \underbrace{V_A^{E=1,h=0,I=0}(A,B,w,m)\dot{A}}_{\text{(i) the value of accumulating } A} + \underbrace{V_B^{E=1,h=0,I=0}(A,B,w,m)\dot{B}}_{\text{(ii) the value of repaying } B} \\
& + \lambda^E \int \underbrace{\max\left\{V^{E=1,h=0,I=\tilde{I}}(A,B,\tilde{w},m) - V^{E=1,h=0,I=0}(A,B,w,m), 0\right\}}_{\text{(iii) the gain from switching to an offered job } (\tilde{w},\tilde{I})} dF(\tilde{w},\tilde{I}) \\
& + \xi_{en}^E(w)\underbrace{\left[\max\left\{V^{E=1,h=0,I=2}(A,B,w,m), V^{E=0,h=0,I=2}(A,B,m)\right\} - V^{E=1,h=0,I=0}(A,B,w,m)\right]}_{\text{(iv) the gain from Medicaid enrollment}} \\
& + \omega^h \underbrace{\left[\max\{V^{E=1,h=1,I=0}(A,B,w), V^{E=0,h=1,I=0}(A,B)\} - V^{E=1,h=0,I=0}(A,B,w,m)\right]}_{\text{(v) the gain from getting a positive health shock}} \\
& + \eta^0 \underbrace{\left\{V^{E=0,h=0,I=0}(A,B,m) - V^{E=1,h=0,I=0}(A,B,w,m)\right\}}_{\text{(vi) the loss from job termination}} \\
\text{s.t.} & \begin{cases} \dot{B} = z + \left\{x - (1-q^{I=0})m\right\} \;\; \& \;\; -B \leq \overline{B} \\ \dot{A} = rA + w - \pi^{I=0} - tax(w, I=0) - c - z - x \;\; \& \;\; A \geq \underline{A} \end{cases}
\end{aligned}
\tag{4}
$$

The left-hand side of (4) is the averaged discounted flow value. On the right-hand side, there are six components. The first line $u(c) - \mathbb{1}(B<0)\chi(B,z)$ represents flow utility. In the second and the subsequent lines, (i) pertains to the change in the value due to the evolution of net liquid assets, which is the marginal value of net liquid assets V_A multiplied by the change in assets, $\dot{A}$. The same argument is applied to the second term (ii), representing the value of repaying medical debt. (iii) corresponds to the gain achieved by switching to an offered job $(\tilde{w},\tilde{I})$ from the current job (w,I) when such job mobility is preferred. Note that they accept the job offer if $V^{E=1,h=0,I=\tilde{I}}(A,B,\tilde{w},m) > V^{E=1,h=0,I=0}(A,B,w,m)$ and reject it otherwise. (iv) represents the gain from enrolling in Medicaid. This term takes into account that workers newly enrolling in Medicaid may choose to remain in or quit their current job. If $V^{E=1,h=0,I=2}(A,B,w,m) > V^{E=0,h=0,I=2}(A,B,m)$ holds, then the worker opts to stay at their current job; otherwise, they quit. (v) captures the benefit of transitioning from being unhealthy to being healthy, considering the option to quit one's job upon experiencing a positive health shock. Lastly, (vi) represents the loss incurred from the termination of the current job.

3.3 The optimal solutions

Individuals have four types of decisions to make: (i) whether to accept a job offer and, (ii) how much to consume, denoted as c, (iii) how much to repay for outstanding medical debt, represented by $z \in [0, \overline{z}(B)]$, and (iv) how much of the medical expenditure to pay, denoted as $x \in [0, (1-q^I)m]$. In this section, I continue to use workers who are employed ($E = 1$), unhealthy ($h = 0$), and uninsured ($I = 0$) as an illustration. For the other cases, refer to Appendix C.

Regarding the first decision about job search, the optimal job offer acceptance decision follows the standard reservation wage rule. As mentioned in section 3.2, they accept a job offer $(\tilde{w}, \tilde{I})$ if $V^{E=1,h=0,I=\tilde{I}}(A,B,\tilde{w},m) \geq V^{E=1,h=0,I=0}(A,B,w,m)$ and reject it otherwise. Note that the reservation wages differ between jobs with and without ESHI. Whereas, here, the reservation wage for a job without ESHI is equal to the current wage w, the reservation wage for a job with ESHI is less than w when they have a positive valuation for ESHI.[8]

Equation (5) illustrates the optimal decisions for consumption, saving/borrowing, and the accumulation/repayment of medical debt. These solutions are derived by taking the first-order conditions of equations (4). The optimal consumption c is derived through the inter-temporal optimal condition: $u^{'}(c^*) = V_A$ where V_A denotes the partial derivative of the value function with respect to net liquid assets. The optimal flow repayment z

8 For uninsured workers who engage in on-the-job search, the reservation wage for a job with ESHI is also affected by the tax schedule and the rate of enrollment in Medicaid.

is determined by comparing the marginal benefit to the marginal cost. When they have medical debt (i.e., $B < 0$), the marginal benefit, $V_B - \chi_z(B, z^*)$, represents the total gain from paying off medical debt. The marginal cost, $V_A = u'(c^*)$, captures the loss from forgone consumption. Concerning the optimal payment for flow medical expenditure, they pay nothing (i.e., $x = 0$ if $V_A > V_B$ and pay the entire uninsured medical expenditure (i.e., $x = (1 - q^I)m = m$) otherwise. Note that the right-hand side of the equation (4) is a linear function of x.

$$
\begin{aligned}
&c^* = (u')^{-1}(V_A) \text{ where } V_A = \frac{\partial V}{\partial A} \\
&z^* = \begin{cases} 0 & \text{if } B = 0 \\ z^{\text{interior}} \text{ s.t. } -\chi_z(B, z^{\text{interior}}) = V_A - V_B & \text{if } B < 0 \ \& \ V_A > V_B \text{ (gradual repayment over time)} \\ \overline{z}(B) & \text{if } B < 0 \ \& \ V_A \leq V_B \text{ (almost one-shot settlement)} \end{cases} \\
&x^* = \begin{cases} 0 & \text{if } V_A > V_B \\ \left(1 - q^I\right) m & \text{otherwise} \end{cases}
\end{aligned} \tag{5}
$$

As noted by Achdou et al. (2021), the borrowing limit never binds today when net liquid asset is within the interior of the state space (i.e., $A > \underline{A}$) because assets will be strictly greater than the lower bound after an infinitesimal time has passed. If workers face the binding constraint (i.e., $A = \underline{A}$), the state constraint ($A \geq \underline{A}$) is imposed in the form of a boundary inequality for V_A as in (6), which is convenient when numerically solve the model.

$$
\begin{aligned}
& r\underline{A} + w - \pi^I - tax(w,I) - c - z - x \geq 0 \\
\Leftrightarrow & r\underline{A} + w - \pi^I - tax(w,I) \geq \\
& \underbrace{(u')^{-1}(V_A) + \mathbb{1}(B<0)\Big\{\mathbb{1}(V_A > V_B)z^{\text{interior}} + \mathbb{1}(V_A \leq V_B)\overline{z}(B)\Big\} + \mathbb{1}(V_A \leq V_B)\Big(1-q^I\Big)m}_{:= f(V_A) \quad \text{Note that } f \text{ is strictly decreasing in } V_A \text{ and } u \text{ satisfies the Inada conditons}} \qquad (6) \\
\Leftrightarrow & V_A \geq v^* \;\; \text{where } v^* \text{ satisfies } f(v^*) = r\underline{A} + w - \pi^I - tax(w,I)
\end{aligned}
$$

3.4 The evolution of the distribution of workers

Lastly, I derive the evolution of the distribution of workers. Let $g(S,t)$ denote the density of individual states $S = (A,B,E,w,I,h,m)$ at time t. Then, $\frac{\partial}{\partial t}g(S,t)$ is described by Kolmogorov Forward (KF) equations based on the optimal decision rules. The stationary worker distribution is determined to satisfy $\frac{\partial}{\partial t}g(S,t) = 0$. For details about the KF equations, see Appendix D.

3.5 The equilibrium

I focus on an equilibrium in which the distribution of workers over states is stationary. Given the focus on the decision problems of workers, several assumptions are made concerning the financial sector, hospitals, and employers. Specifically, the interest rate is fixed to $r < \rho$. The job offer distribution, $F(w,I)$, is exogenously given. Health insurance contracts, (π^I, q^I), are also taken as given. The model also takes the flow medical expenditure distribution, F_m, and the utility cost of medical debt, $\chi(B,z)$ as given. Under these assumptions, the stationary equilibrium is defined as below:

Definition 1. *The stationary equilibrium is defined by: (i) The value functions that solve the Hamiltonian-Jacobi-Bellman equations and (ii) the evolution equation of the distribution of workers that solve the Kolmogorov Forward equations.*

4 Data

The dataset for this study is derived from two sources. I use Survey of Income and Program Participation (SIPP2018-2020) as the primary data and complement it with the Medical Expenditure Panel Survey (MEPS2017-2019). These surveys cover a period from 2017 to 2019. Each SIPP survey wave provides monthly labor market outcomes and health insurance status. SIPP also collects data on assets and liabilities as of the last day in the reference years. On the other hand, the MEPS dataset supplies annual medical expenditure, monthly health insurance status, and monthly records of health events such as inpatient stays.

Sample selection As mentioned in section 2, I construct a relatively homogeneous sample well-described by the model. The sample is limited to observations that satisfy the following six conditions: (i) They fall within the age range of 26 to 55, are white, male, high school graduates, not in the armed forces, not enrolled in school, and not disabled. (ii) They are not self-employed and have never retired. (iii) They reside in a state that has expanded Medicaid. (iv) they are not insured through Medigap, Medicare, or military-related coverage. (v) they are not covered by directly-purchased private health insurance. It is worth noting that among those who meet the first four criteria, only 4% of them have directly-purchased health insurance from insurers. (vi) They are not covered by ESHI owned by another person (e.g., spouse).[9] Note that the restrictions (iii), (iv), and (v) limit their possible insurance status to being uninsured, insured by ESHI, or insured by Medicaid. The SIPP sample consists of $6,898$ person-years, while the MEPS sample includes $2,400$ person-years.

Descriptive Statistics This section provides descriptive statistics. I begin with the statistics related to net liquid assets, medical debt, employment status, and wage by in-

9 Among those who satisfy the first four criteria, 12% are covered by ESHI owned by someone else.

surance status. The data is sourced from SIPP2018-2020. Net liquid assets and medical debt are measured as of the last day of each reference year. Employment status, wage, and insurance status in the table are measured in December of each survey year. The reported values are derived based on pooled cross-sectional observations from 2017 to 2019.

Net liquid assets are defined as the sum of checking accounts, savings accounts, money market accounts or funds, and credit card debt and store bills.[10] The table clearly shows that those variables vary with health insurance status. On average, workers with ESHI possess assets four times larger than those who are uninsured or have Medicaid coverage. Medical debt is less prevalent and less significant (i.e., less negative) for workers with ESHI. In addition, workers with ESHI have significantly higher wages than uninsured workers or those with Medicaid. This finding is consistent with the fact that, under the Affordable Care Act (ACA), only small-sized firms (i.e., those without 50 full-time employees) - typically associated with lower wage levels - can offer jobs without ESHI.

The statistics of health status and annual out-of-pocket medical expenditures are summarized in Table 5, using data from MEPS2017-2019. Workers are considered healthy if they do not experience at least one of six types of health events in a given month: inpatient stays, emergency room visits, office-based visits, outpatient visits, dental visits, or home health visits. Approximately 78.3% of observations in the sample are classified as healthy, and the mean of total out-of-pocket payments for care provided during the year is $497.

Table 6 illustrates the transition of employment status over three months. Regarding the unemployment-to-employment transition, the first row indicates a higher rate for uninsured workers. The employment-to-unemployment rate also differs by insurance status, with uninsured workers and workers with Medicaid experiencing it more frequently. The job-to-job transition rate, which is more relevant to this paper, is higher for unin-

10 I follow a narrow definition of net liquid assets, as used in Boutros (2019).

sured workers than for workers with ESHI, even after controlling for wage levels. These findings are in line with the presence of job push/job lock effects. It is also observed that workers with Medicaid have higher rates than workers with ESHI, which is also consistent with the job lock story since Medicaid is not tied to employment, unlike ESHI.

Lastly, the transition rates of health status are reported in Table 7. Approximately 15% of healthy workers transition to unhealthy workers three months later, while 55% recover within three months.

Among those tables of describe statistics, Tables 4 and 6 demonstrate the association of insurance status with net liquid assets, medical debt, and labor market outcomes. As discussed in Section 3, the model in this paper explicitly considers decision problems related to job search, saving/borrowing, and the repayment/accumulation of medical debt, which can explain these dependencies. In the next section, I delve into how such associations between state variables can be used to identify structural parameters of the model.

5 Identification and Estimation Procedure

5.1 Empirical Specification

Several specification assumptions are made in empirical analysis. First, the flow utility from consumption, $u(c)$, adopts a CRRA form characterized by the coefficient of relative risk aversion, denoted as γ. Second, the utility cost of incurring medical debt, $\chi(B,z)$, is specified as a power function as equation (7). The scale of the cost is linear in the size of medical debt, $-B > 0$, and $\kappa_1 > 0$ represents the scale parameter. $\kappa_2 < 0$ captures the elasticity of the utility cost with respect to flow repayment z.

$$\begin{aligned} u(c) &= \frac{c^{1-\gamma}}{1-\gamma} \\ \chi(B,z) &= \kappa_1(-B_t)\frac{z_t^{\kappa_2}}{-\kappa_2} \end{aligned} \tag{7}$$

Under these specifications, the optimal solutions for consumption c and flow repayment z, as derived in equation (5), can be expressed as follows. Concerning the optimal flow repayment, the interior solution reflects the gradual repayment pattern over time, as discussed in section (2). On the other hand, the corner solution, $z^* = \overline{z}(B)$, represents (almost) one-shot settlement. Here, $\overline{z}(B)$, the upper bound on z, is set to a substantial value to mitigate the impact of this artificial boundary on the flow repayment decision.

$$
\begin{aligned}
c^* &= (V_A)^{-\frac{1}{\gamma}} \quad \text{where} \quad V_A = \frac{\partial V}{\partial A} \\
z^* &= \begin{cases} 0 & \text{if } B = 0 \\ \left(\frac{V_A - V_B}{\kappa_1(-B)}\right)^{\frac{1}{\kappa_2 - 1}} & \text{if } B < 0 \ \ \& \ \ V_A > V_B \text{ (gradual repayment over time)} \\ \overline{z}(B) & \text{if } B < 0 \ \ \& \ \ V_A \leq V_B \text{ (almost one-shot settlement)} \end{cases}
\end{aligned}
\tag{8}
$$

The job offer distribution, $F(w,I)$, can be decomposed into two components: the conditional distribution of wages given the provision of ESHI, $F(w \mid I)$, and the marginal distribution of ESHI provision, represented as $p(I)$. As in common in the literature, I assume that the conditional wage offer distributions are assumed to be log-normal, i.e., $w \mid I \sim log(\mu_w^I, \sigma_w^I)$. In addition, the distribution of flow medical expenditure is also assumed to follow a log-normal distribution, characterized by $m \sim log(\mu_m, \sigma_m)$.

Furthermore, Medicaid (dis-)enrollment shocks are specified as Poisson shocks. For the unemployed, the rates of enrollment and dis-enrollment are given by $\xi_{en}^U = \phi_0$ and $\xi_{disen}^U = \phi_1$, respectively. For the employed, the rates are specified as power functions dependent on wage w. Precisely, the rates of enrollment and dis-enrollment are specified as $\xi_{en}^E(w) = \phi_2 w^{\phi_3}$ and $\xi_{disen}^E(w) = \phi_4 w^{\phi_5}$, respectively.

5.2 Identification

This section provides a heuristic discussion on identification. Here, I explore which variations in the data are informative to identify the model parameters.

Some parameters are predetermined as outlined in Table 8. The discount rate, denoted as ρ, is fixed to yield an annual rate of 5%. The interest rate, represented as r, is set to match an annual rate of 3%. Health insurance contract parameters, (π^I, σ^I), are also predetermined. The premium of ESHI is set to the average yearly premium of single coverage from the sample in SIPP. The fraction of medical expenditure covered by ESHI is set at 80%, given that the average coinsurance rate for ESHI is around 20%, according to statistics from the MEPS-IC. As in Pashchenko and Porapakkarm (2013), Medicaid is specified as free insurance, so there is no premium or cost sharing for Medicaid.[11]

Next, I turn to the identification of preference parameters given the specification in equation (7). Following Aizawa and Fang (2020)), the coefficient of relative risk aversion, γ, is identified by the uninsured rate because γ significantly affects the value of health insurance. Additionally, the mean of net liquid assets is also informative to pin down γ, which determines the elasticity of inter-temporal substitution and, therefore, affects consumption growth and asset growth.

As for the utility cost associated with medical debt, it is parameterized by the scaling parameter κ_1 and the elasticity parameter κ_2 as in (7). Firstly, κ_1 is identified based on the prevalence of medical debt and the mean amount of medical debt since this parameter determines the scale of the cost. On the other hand, κ_2 is identified by the prevalence of medical debt conditional on net liquid assets. To see it, recall that κ_2 captures gradual repayment behavior as shown in equation (8). This equation reveals that the optimal repayment decision, z^*, is affected by the slope of the value function with respect to net liquid assets (i.e., V_A), which heavily depends on whether assets are close to the borrowing limit. Figure (1) displays how the interior solution for the flow repayment, $z^* = \left(\frac{V_A - V_B}{\kappa_1(-B)}\right)^{\frac{1}{\kappa_2 - 1}}$, varies with V_A. While an increase in κ_1 shifts the curve upward, a more negative κ_2 leads individuals closer to the borrowing limit (higher V_A) to repay more and

11 My specification of health insurance contracts is very close to one in the prototypical stylized framework of Fang and Krueger (2022).

workers with substantial assets (lower V_A) to reduce repayment. In this way, the level of net liquid assets determines the flow repayment decision, which directly affects the amount of outstanding medical debt. Therefore, the variation in the prevalence of medical debt across net liquid assets is informative to identify κ_2 separately from κ_1.

Concerning the labor market parameters, the arrival rates of a job offer are mainly identified by the transition probabilities between labor market states. The unemployment-to-employment transition rates are informative to identify the arrival rate for unemployed workers, λ^U. Similarly, the job-to-job transition rates are used to identify the rate for workers on-the-job search, λ^E. Given the arrival rates of a job offer, the rates of job separation conditional on the provision of ESHI, (η^0, η^1), are recovered by the employment-to-unemployment transition rates conditional on ESHI offerings and the steady-state proportion of unemployed workers. The conditional wage offer distributions, $F(w \mid I)$, are identified following Flinn and Heckman (1982). These distributions are identified from observed wage distributions conditional on the ESHI provision, if $F(w \mid I)$ satisfies the recoverability condition. In this context, recoverability means that knowledge of the observed wage distributions and the reservation wages (= truncation points) imply a unique distribution of $F(w \mid I)$. The log-normal distribution satisfies the recoverability and is known to achieve a good fit. The fraction of offered jobs providing ESHI is identified from the fraction of employed workers with ESHI. Unemployment income is identified by the bottom 5th percentile of accepted wage distributions, as it affects the decisions of unemployed job seekers on whether to accept lower-wage job offers.

Third, the rates of Medicaid (dis)enrollment, which are also Poisson intensity parameters, are recovered by the transition rates of health insurance status and the steady-state proportion of workers insured through Medicaid. For the unemployed, the enrollment rate, $\xi^U_{en} = \phi_0$, is identified based on the probability of transitioning from being uninsured to insured by Medicaid. The dis-enrollment rate, $\xi^U_{disen} = \phi_1$, is mainly determined by the share of workers insured by Medicaid among the unemployed. An analogous approach can be applied for the employed, considering that the enrollment rate $\xi^E_{en}(w) = \phi_2 w^{\phi_3}$ and the dis-enrollment rate $\xi^E_{disen}(w) = \phi_4 w^{\phi_5}$ are specified as functions of wage w. The scale parameters, (ϕ_2, ϕ_4), are determined based on the transition probability from being uninsured to being insured through Medicaid and the fraction of workers insured by Medicaid among the employed. For the elasticity parameters, (ϕ_3, ϕ_5), two specific data features are informative: (i) the median wage of employed workers who transition to being insured through Medicaid from being uninsured and (ii) the median wage of employed workers insured through Medicaid in the steady state.

Fourth, the borrowing limit, $\underline{A}$, is identified from the bottom 5th percentile of the liquid net asset distribution condition on having a negative amount of it. Similarly, the highest amount of medical debt that hospitals could impose on a patient, $-\overline{B} > 0$, is identified by the 95th percentile of the amount of medical debt conditional on having medical debt.

Lastly, the income tax schedule, $T(y)$, in equation (2) is recovered following the approach of Aizawa and Fang (2020). Using NBER's TAXSIM program, I first compute income tax $T(y)$ for each employee in my sample. Under the specification assumption, parameters τ_0 and τ_1 are directly recovered by running a regression after taking the logarithm of the equation.[12] Exogenous health shock transition rates, $(\omega^u,\ \omega^h)$, are also identified outside of the model by transition probabilities of health status. In my model, the transition rates of health status determines the duration of unhealthy periods. Thus, given $(\omega^u,\ \omega^h)$, the distribution of "flow" medical expenditure, F_m, is determined by the observed "annual" out-of-pocket medical spending conditional on having a positive amount. The mean of the flow distribution, μ_m,is identified from the mean of the annual out-of-pocket medical spending. Similarly, the standard deviation of F_m, σ_m, is recovered

12 Once I estimate these parameters, I adjust the scale of them to align with the unit of time (one quarter) and the unit of money (1,000USD).

from the standard deviation of the annual spending.

5.3 Estimation Procedure

The parameters are estimated using a two-step approach. In the first step, health status transition parameters and the income tax function parameters are estimated outside the model. After obtaining the first step estimates, the remaining parameters, θ, are estimated by Simulated Method of Moments (SMM). This involves finding a set of parameters that minimizes the weighted sum of the squared difference between simulated moments, $Q(\theta)$, and data moments, q. The selection of moments follows the identification discussion in Section (5.2).

$$\hat{\theta}_{SMM} = \arg\min_{\theta}(Q(\theta) - q)'W(Q(\theta) - q) \tag{9}$$

6 Estimation Results

First Stage Estimates The estimated health state transition rates are reported in Table (9). According to the estimates, healthy individuals get a negative health shock within one quarter of a year with the probability of 36%. Conversely, unhealthy individuals are hit by a positive (recovery) health shock within one quarter with the probability of 88%.[13] Regarding the income tax parameters, the degree of progressivity, τ_1, is estimated to be 0.180, which is very close to 0.181, the estimate in Heathcote et al. (2020).

Second Stage Estimates The remaining estimates are displayed in Table (10). As for the preference parameters, the estimated coefficient of relative risk aversion is around 3.982. Concerning the utility cost of medical debt, the estimated scale parameter is around

13 Given the rate of Poisson negative health shock $\omega^U = 0.448$, the probability is given by $1 - e^{-0.448\times 1} = 0.361$. The same argument is applied to the positive health shock. Note that the unit of time is one quarter here.

0.00003, and the elasticity parameter is estimated to be about −44. To interpret these estimates, consider an uninsured healthy worker with the state $(A, B, w) = (-10, 5, 4)$ as an example. Note that the unit of money is \$1,000. For this worker relatively close to the borrowing limit, a 1% increase in flow repayment (equivalent to \$9.8) results in a 44% reduction in the utility cost, which is equivalent to the dollar value of \$597. This observation highlights that even a small amount of flow repayment can alleviate the flow utility cost associated with outstanding medical debt. This result aligns with the frequently observed pattern of gradual repayment over time, as discussed in Section 2.

For the labor market parameters, unemployment income is around \$1,209 per quarter. The mean of offered wages is higher for jobs with ESHI, and the standard deviation of offered wages is also greater. These estimates are consistent with the fact that, under the ACA, all employers with 50 or more full-time employees are required to offer ESHI to their employees. Our estimate shows that 73% of job offers provide ESHI. The job offer arrival rate is 0.252 for the unemployed and 0.084 for the employed. On average, workers receive a job offer every 4.0 quarter when unemployed and every 11.9 quarter when employed. In addition, workers employed in jobs without ESHI are more likely to be exogenously separated from their current jobs than those in jobs with ESHI.

The third group of estimates represents the (dis-)enrollment shocks of Medicaid. The unemployed are much more likely to enroll in than dis-enroll from Medicaid. For the employed workers, the enrollment rate significantly decreases with wage. In contrast, the dis-enrollment rate substantially increases with wages. These estimates reflect the eligibility rule that permits individuals to enroll in Medicaid if their household income is below 138% of the federal poverty level in states that have expanded Medicaid under the ACA.

The estimated borrowing limit is \$ − 26,800. Additionally, the maximum amount of medical debt hospitals could impose on a patient is estimated to be \$200,800. Flow medical expenditure is estimated to have the mean of \$824 and the standard deviation of

$363,800. This large standard deviation is consistent with the well-known characteristic of medical expenditure, which follows a skewed distribution with a long right tail.

Fit of the Model This section examines the in-sample fit of the model by comparing the simulated and data moments. Table 11 shows the complete set of moments targeted by SMM and corresponding data moments.

The model performs well in capturing the moments relevant to individual preferences. The simulated proportion of those with medical debt, as well as the mean of medical debt and the prevalence conditional on net liquid assets, are close to their respective data values, indicating a good fit.

For the moments relevant to the job offer distribution, most moments are fitted well except for the standard deviation of net liquid assets. In the data, the distribution of net liquid wealth has a fat upper tail. To better fit with the tail, it will be necessary to extend the model, for example, by introducing risky assets with idiosyncratic investment risk. The moments on labor market shocks are also fitted well, excluding the employment-to-unemployment rate for jobs with ESHI. The observed transition rate is much lower than the simulated one. This lower estimate can be attributed to how the data moment is constructed. In the simulated data, the transition rate is computed based on two points in time. In contrast, in the data, workers are defined as unemployed if they do not work for any job throughout that month.

Concerning the moments for identifying Medicaid-related parameters, it is evident that the transition rates do not fit well, mainly due to the limited number of observations involving transitions in and out of Medicaid. In contrast, the simulated moments related to wage closely align with the data moments, providing confidence that the specified (dis-)enrollment shock effectively captures Medicaid's eligibility rule on income.

The percentile moments associated with the bounds on net liquid assets and medical debt exhibit a good fit. However, there is a deviation in the proportion of individuals with negative liquid assets compared to the data. This fitting issue can likely be attributed to the observed spike in the distribution of net liquid assets at 0. One possible explanation for this spike is a wedge between the interest rates on borrowing and saving, which is not accounted for in the model.

Lastly, the model successfully generates the standard deviation of annual out-of-pocket medical expenditure for individuals with positive amounts, as well as the standard deviation of medical debt for those with a positive amount. Although the mean of annual out-of-pocket medical expenditure conditional on having a positive amount of it is not far from the data moment, it is somewhat higher than the observed mean. This discrepancy might be due to the oversight of the intensive/extensive margin of healthcare utilization.

7 Simulation

This section addresses the two research questions based on the estimates derived in Section 5 and the model outlined in Section 3. Firstly, I compute the Willingness-to-Pay (WTP) for ESHI and the Willingness-to-Accept (WTA) for ESHI. These metrics measure the monetary value of ESHI. Note that WTP quantifies the value of ESHI for the uninsured, while WTA is relevant to insured employees. After obtaining WTPs/WTAs, I examine who have higher valuations for ESHI based on their net liquid assets and medical debt. Secondly, I simulate the reservation wage for jobs with and without ESHI. Lastly, I compute the probabilities of job-to-job transitions over one quarter, examining how workers' heterogeneous valuations are translated into their job mobility rates.

The value of ESHI For uninsured employees, the WTP for ESHI is defined in Equation (10). WTP is expressed as the maximum reduction in wage that an uninsured individual would be willing to accept to reach a state of indifference between remaining uninsured and obtaining ESHI.

$$\begin{cases} \underbrace{V^{E=1,I=0,h=1}(A,B,w)}_{\substack{\text{the value of being uninsured} \\ \text{with the wage } w}} = \underbrace{V^{E=1,I=1,h=1}(A,B,w-WTP)}_{\substack{\text{the value of being insured through ESHI} \\ \text{with the wage } w-WTP}} & \text{when healthy } (h=1) \\ V^{E=1,I=0,h=0}(A,B,w,m) = V^{E=1,I=1,h=1}(A,B,w-WTP,m) & \text{when unhealthy } (h=0) \end{cases} \tag{10}$$

The WTP depends on state variables (A,B,w,m). To explore how WTP varies across the (A,B) dimensions, I hold the other state variables (w,m) fixed. Wage w is set to a lower value (15.37) and a higher value (41.55), representing the first and the third quartiles of the accepted wage distributions among all employed workers, respectively. Flow medical expense m is fixed at $m = 1.00$. The unit of money is \$1,000, and the unit of time is one quarter of a year. Table 12 illustrates the estimated WTPs for four cases: (1) healthy low-wage uninsured workers, (2) healthy high-wage uninsured workers, (3) healthy low-wage uninsured workers, (4) healthy high-wage uninsured workers.

The figures underscore non-negligible heterogeneity in WTPs. For example, it ranges from $[4.624, 5.389]$ for healthy lower-wage workers, constituting $[30.1\%, 35.1\%]$ of their wage level. For healthy higher-wage individuals, the range extends from $[10.94, 19.11]$, representing $[26.3\%, 46.0\%]$ of their wage level. In addition, not surprisingly, WTPs are higher for unhealthy individuals.

Next, I examine patterns of heterogeneity across net liquid assets and medical debt. The figures reveal two worker profiles with a higher valuation for ESHI. First, concerning net liquid assets, workers with a limited to moderate amount of assets value ESHI more. This outcome is explicable through two competing forces: (1) Workers with substantial assets tend to value ESHI less, given their increased reliance on self-insurance. (2) Workers nearer the borrowing limit express a lower valuation for ESHI as the payment of the premium for ESHI becomes more costly. The simulation results suggest that these two competing forces shape the inverted U-shaped relationship between net liquid assets and

WTP.

Second, in relation to medical debt, those with more medical debt (i.e., more negative $B < 0$) value ESHI more up to around $\$40,000$ beyond which there is minimal change. This result can be interpreted based on two competing forces: (1) Workers with more medical debt might value health insurance more because it helps patients not to accumulate further medical debt, which brings disutility. (2) Workers with more medical debt might opt for an alternative channel of delaying payments because it is more likely to result in debt forgiveness by exceeding the upper bound $\overline{B}$ of the amount of medical debt. The simulation results suggest that, up to around $\$40,000$, the first effect outweighs the second, beyond which they nearly balance each other out.

Similarly, I explore WTA for ESHI among insured employees, as defined in Equation (11). WTA represents the minimum increase in wage that an insured individual would require to achieve indifference between retaining ESHI and becoming uninsured. I hold the other state variables (w, m) fixed at the same values as the case of WTP.

$$\begin{cases} \underbrace{V^{E=1,I=0,h=1}(A,B,w+WTA)}_{\substack{\text{the value of being uninsured} \\ \text{with the wage } w+WTA}} = \underbrace{V^{E=1,I=1,h=1}(A,B,w)}_{\substack{\text{the value of being insured through ESHI} \\ \text{with the wage } w}} & \text{when healthy } (h=1) \\ V^{E=1,I=0,h=0}(A,B,w+WTA,m) = V^{E=1,I=1,h=1}(A,B,w,m) & \text{when unhealthy } (h=0) \end{cases} \tag{11}$$

Figure 13 shows how the estimated WTAs vary with net liquid assets and medical debt, holding wage and health status fixed. The WTA spans from $[4.408, 7.524]$ for healthy lower-wage individuals and $[19.75, 45.71]$ for healthy higher-wage individuals. Similar to WTP, unhealthy workers generally exhibit higher WTAs than healthy workers. The observed patterns of heterogeneity in WTA across assets and medical debt mirror those found in WTP. In terms of net liquid assets, workers with moderate assets assign a higher value to ESHI. Concerning medical debt, consistent with findings of WTP, individuals with more medical debt (i.e., more negative $B < 0$) demonstrate higher WTA, peaking at around \$40,000, beyond which there is little change in WTAs.

The reservation wages There is a clear relationship between the WTPs/WTAs and the reservation wages. To see it, refer back to the equation (10). When an uninsured worker receives a wage of w, she is willing to accept a job with ESHI if the offered wage is greater than or equal to $w - WTP$. Since her reservation wage for a job without ESHI is the same as her current wage, w, WTP is the difference in the reservation wages for a job with and without ESHI (i.e., $w - (w - WTP)$). Thus, uninsured employees with higher WTPs have lower reservation wages for jobs with ESHI. Figure 14 depicts reservation wages for uninsured employees in jobs with ESHI. It indicates variations in reservation wages ranging between $[9.98, 10.7]$ for healthy lower-wage workers, $[22.4, 30.6]$ for healthy higher-wage workers. The ranges are not so different between healthy and unhealthy workers.

The same argument can be applied to insured workers as well. Referring to the equation (11), a worker who is insured through ESHI with a wage of w is willing to accept a job offer without ESHI if the offered wage is not less than $w + WTA$. Thus, WTA can be seen as the discrepancy between the reservation wages for a job with and without ESHI (i.e., $(w+wTA)-w$). In other words, insured employees with a higher WTA have a higher reservation wage for jobs without ESHI. Figure 15 displays the reservation wages for jobs without ESHI. They range between $[19.8, 22.9]$ for healthy lower-wage workers and $[61.3, 87.3]$ for healthy higher-wage workers. Similar ranges are observed for unhealthy workers.

The job-to-job transition probabilities Finally, I simulate job-to-job transition rates over one quarter and how they vary based on one's net liquid assets and medical debt. Figure 16 illustrates these rates for uninsured employees, showing heterogeneity ranging between $[0.0334, 0.0355]$ for healthy lower-wage workers and $[0.0081, 0.0140]$ for healthy higher-wage workers. Unhealthy workers display ranges similar to healthy ones. By comparing Figure 12 and Figure 16, it is obvious that uninsured workers valuing ESHI more have higher transition rates.

Figure 17 illustrates job-to-job transition rates for insured employees. The rates fall within the range of $[0.0016, 0.0022]$ for healthy lower-wage workers and $[0.00002, 0.00007]$ for healthy higher-wage workers, with similar ranges observed for unhealthy high-wage workers. Figures 13 and 17 provide a clear indication that insured employees who place a higher value on ESHI tend to experience lower rates of transition to jobs without ESHI.

Combining all the simulation results, it becomes clear that employees who are more likely to make job mobility decisions influenced by ESHI are those who (i) possess a limited to moderate amount of net liquid assets and are not close to the borrowing limit, and (ii) carry a larger amount of medical debt.

8 Conclusion

This paper develops and estimates a model of on-the-job search that captures the three ways of insurance to cope with medical expenditure shocks: enrollment in ESHI through job search decisions, saving/borrowing decisions, and accumulation/repayment decisions of medical debt.

Using the estimated parameters, we first quantify the WTP for ESHI among the uninsured and the WTA for ESHI among the insured. These values represent the monetary value individuals attribute to insurance coverage of ESHI. The results reveal non-neglible variation in the valuations of ESHI, favoring it for two specific worker profiles: (i) workers with a limited to moderate amount of net liquid assets but not close to the borrowing limit and (ii) workers with a higher amount of medical debt, with the valuation peaking at around $\$40,000$, beyond which there is minimal change. Since WTP and WTA capture the difference in reservation wages for jobs with and without ESHI, it is also confirmed that among the uninsured (insured), the reservation wages for a job with (without) ESHI substantially vary with net liquid assets and medical debt. Lastly, we simulate job-to-job transition rates and confirm that uninsured (insured) employees who place a higher value on ESHI have higher (lower) rates of transition to jobs with (without) ESHI. In conclusion, these findings shed light on the importance of considering net liquid assets and medical debt when assessing potential job match distortions.

There are several limitations in this paper. Firstly, focusing on a specific demographic group of white males is a necessary simplification to ensure a homogeneous and non-small sample. However, this choice may limit the generalizability of our findings. Notably, it is acknowledged that Black Americans, while not represented in our sample, are more likely to experience substantial medical debt (U.S. Census Bureau (2021)). Additionally, excluding those covered through spousal insurance or directly-purchased health insurance from the sample is another limitation, as these are alternative insurance options, especially for self-employed or female workers. Secondly, our sample restrictions may slightly skew my sample towards people with higher wages. The exclusion of workers insured through directly-purchased health insurance could lead to a subtle shift in our sample composition, even though they constitute a minority (below 8%) even in the lowest wage group. Thirdly, our analysis does not delve into the source of the cost associated with incurring medical debt. One possible improvement to our model is distinguishing between non-discretionary and discretionary health shocks. This extension would enable us to explore (1) the decision not to seek care when facing a discretionary negative health shock and (2) the cost associated with being denied access to care for discretionary health shocks due to outstanding medical debt. Addressing these limitations would expand the scope of future research in this area.[14]

14 For example, Adams et al. (2022) finds that financial assistance provided by hospitals increases health care utilization. This result implies that incorporating the decision to visit a medical provider is relevant.

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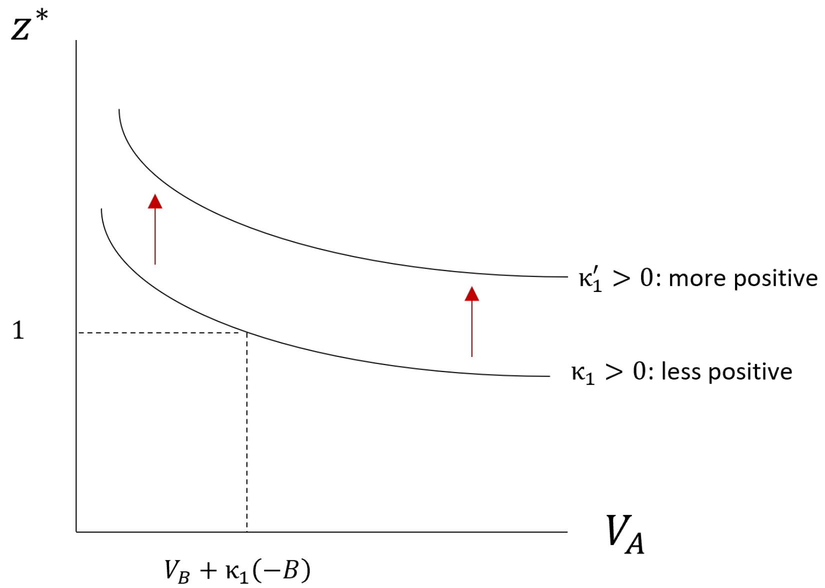
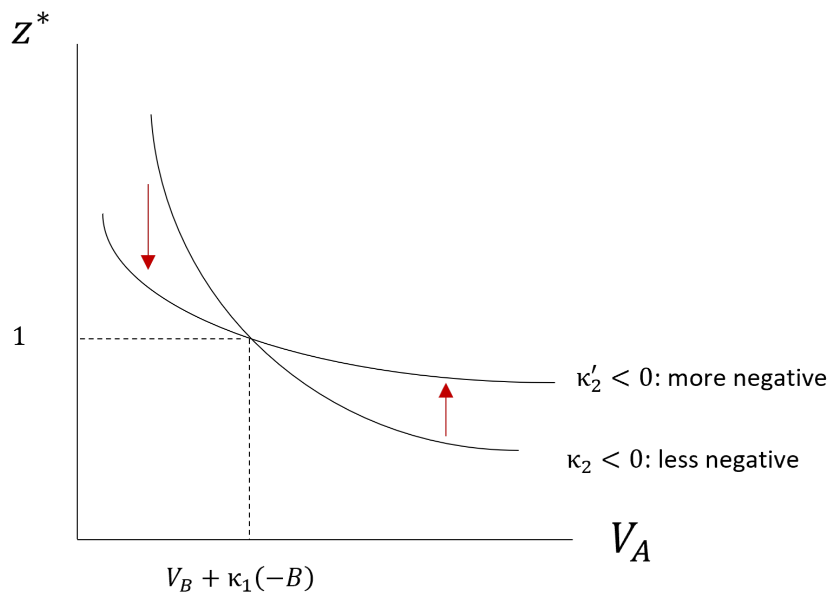
Figures

Figure 1: Separate identification of κ_1 and κ_2





Note: The figures show the curve of the interior solution for flow repayment $z = \left(\frac{V_A - V_B}{\kappa_1(-B)}\right)^{\frac{1}{\kappa_2 - 1}}$. The curve goes through a point $(V_B + \kappa_1(-B), 1$. The top figure corresponds to the case when the scale parameter of the cost of medical debt, $\kappa_1 > 0$, becomes more positive. The bottom figure shows the case where the elasticity of the cost with respect to flow repayment, $\kappa_2 < 0$, becomes more negative.

Tables

Table 2: The prevalence and size of medical debt by assets and insurance status

		Prevalence of medical debt	Median size of medical debt
All		0.09	2.00
Assets	1st Quintile (Least Wealthy)	0.16	2.00
	2nd Quintile	0.12	1.80
	3rd Quintile	0.09	1.60
	4th Quintile	0.04	1.50
	5th Quintile (Most Wealthy)	0.03	1.35
Insurance status	Uninsured	0.11	1.53
	ESHI	0.08	1.50
	Medicaid	0.12	2.30

Note: The unit of money is $\$1,000$. Data are taken from Survey of Income and Program Participation (SIPP2018-2020). The statistics are computed from the pooled cross-sectional observations. See section 4 for details about the sample selection rule.

Table 3: Yearly changes in medical debt

$B_{t+1} \leq B_t$ (rise in the amount of medical debt)	$B_{t+1} > B_t$ (drop in the amount of medical debt)
0.228	0.772

Note: Data are taken from Survey of Income and Program Participation (SIPP2018-2020). See section 4 for details about the sample selection rule.

Table 4: Descriptive statistics on net liquid assets, medical debt, labor market outcomes by insurance status

		Overall	1(uninsured)	1(ESHI)	1(Medicaid)
SIPP					
net liquid assets	median	1.75	0.200	3.00	0.05
	sd	(54.7)	(24.8)	(59.1)	(41.7)
1(any med. debt)	mean	0.09	0.11	0.08	0.12
	sd	(0.28)	(0.32)	(0.27)	(0.33)
med. debt	median	-1.80	-1.53	-1.50	-2.30
	sd	(106.7)	(86.1)	(117.6)	(54.9)
wage	mean	21.80	11.37	24.02	12.12
	sd	(28.01)	(16.30)	(28.24)	(33.78)
Observations		6898	895	5391	612

Note: The unit of money is \$1,000. Standard deviations are in parentheses. Data are taken from Survey of Income and Program Participation (SIPP2018-2020). The statistics are computed from the pooled cross-sectional observations. See section 4 for details about the sample selection rule.

Table 5: Descriptive statistics on health status and annual out-of-pocket medical expenditure by insurance status

	Overall	1(uninsured)	1(ESHI)	1(Medicaid)
1(healthy)	0.783	0.929	0.753	0.795
	(0.412)	(0.258)	(0.431)	(0.405)
annual out-of-pocket expenditure	0.497	0.267	0.592	0.110
	(1.406)	(0.893)	(1.550)	(0.414)
Observations	2398	350	1809	239

Note: The unit of money is \$1000. Standard deviations are in parentheses. Data are taken from Medical Expenditure Panel Survey (MEPS2017-2019). The statistics are computed from the pooled cross-sectional observations. See section 4 for details about the sample selection rule.

Table 6: Descriptive statistics on the transition of employment status by insurance status

	Overall	1(uninsured)	1(ESHI)	1(Medicaid)
$\mathbb{1}$(employed in month $t+3$ | unemployed in month t)	0.122	0.140	0.120	0.103
	(0.327)	(0.347)	(0.325)	(0.304)
$\mathbb{1}$(unemployed in month $t+3$ | employed in month t)	0.009	0.031	0.006	0.025
	(0.096)	(0.174)	(0.076)	(0.157)
$\mathbb{1}$(job $j^{'}$ in month $t+3$ | job j in month t)	0.018	0.036	0.014	0.035
	(0.131)	(0.186)	(0.119)	(0.183)
$\mathbb{1}$(job $j^{'}$ in month $t+3$ | job j and wage is in the 1st quartile group in month t)	0.033	0.040	0.029	0.037
	(0.179)	(0.196)	(0.168)	(0.190)
$\mathbb{1}$(job $j^{'}$ in month $t+3$ | job j and wage is in the 2nd quartile group in month t)	0.014	0.026	0.012	0.026
	(0.117)	(0.160)	(0.110)	(0.161)
$\mathbb{1}$(job $j^{'}$ in month $t+3$ | job j and wage is in the 3rd quartile group in month t)	0.012	0.017	0.011	0.041
	(0.107)	(0.131)	(0.103)	(0.198)
$\mathbb{1}$(job $j^{'}$ in month $t+3$ | job j and wage is in the 4th quartile group in month t)	0.012	0.046	0.011	0.016
	(0.108)	(0.209)	(0.105)	(0.126)
Observations	59342	6873	47651	4818

Note: Standard deviations are in parentheses. Data are taken from Survey of Income and Program Participation (SIPP2018-2020). The transition rates are computed one quarter (three months) apart. See section 4 for details about the sample selection rule.

Table 7: Descriptive Statistics on the transition of health status

$\mathbb{1}$(unhealthy in month $t+3 \mid$ healthy in month t)	0.154
	(0.361)
$\mathbb{1}$(healthy in month $t+3 \mid$ unhealthy in month t)	0.552
	(0.497)
Observations	23401

Note: Standard deviations are in parentheses. Data are taken from Medical Expenditure Panel Survey (MEPS2017-2019). The transition rates are computed one quarter (three months) apart. See section 4 for details about the sample selection rule.

Table 8: Predetermined parameters

parameters	description	values
ρ	the yearly discount rate	0.05
r	the yearly interest rate	0.03
$\pi^{I=1}$	the yearly premium of medical expenditure for ESHI ($I=1$)	1.932
$q^{I=1}$	the insured fraction of medical expenditure for ESHI ($I=1$)	0.80
$\pi^{I=2}$	the yearly premium of medical expenditure for Medicaid ($I=2$)	0
$q^{I=2}$	the insured fraction of medical expenditures for Medicaid ($I=2$)	1

Note: The unit of money is \$1,000. See section 5.2 for a discussion on how these parameter values are predetermined.

Table 9: First step estimation results

parameters	description	estimates
ω^u	the quarterly rate of receiving a negative health shock	0.448
ω^h	the quarterly rate of receiving a positive health shock	2.123
τ_0	the level parameter of the income tax function: $T(y) = y - \tau_0 y^{1-\tau 1}$	1.460
τ_1	the progressivity parameter of the income tax function: $T(y) = y - \tau_0 y^{1-\tau 1}$	0.180

Note: The unit of time is one quarter (three months).

Table 10: Second step estimation results

	parameters	description	estimates
Preference	γ	CRRA risk aversion parameter	3.982
	k_1	Preference cost of holding medical debt	2.816e-05
	k_2	Preference cost of holding medical debt	-44.25
Labor market	b	Unemployment income	1.209
	μ_{w0}	Mean of offered wages of jobs not providing HI	9.701
	μ_{w1}	Mean of offered wages of jobs providing HI	17.16
	σ_{w0}	SD of offered wages of jobs not providing HI	80.69
	σ_{w1}	SD of offered wages of jobs providing HI	297.0
	θ	Fraction of offered jobs providing HI	0.727
	λ^U	Arrival rate of job offers while unemployed	0.252
	λ^E	Arrival rate of job offers while employed	0.084
	η^0	Termination rate while employed in a job without ESHI	0.028
	η^1	Termination rate while employed in a job with ESHI	0.016
Medicaid	ϕ_0	Enrollment rate while unemployed	0.168
	ϕ_1	Disenrollment rate while unemployed	0.045
	ϕ_2	Enrollment rate while employed: $\phi_2 w^{\phi_3}$	0.280
	ϕ_3	Enrollment rate while employed: $\phi_2 w^{\phi_3}$	-4.899
	ϕ_4	Disenrollment rate while employed: $\phi_4 w^{\phi_5}$	6.342e-07
	ϕ_5	Disenrollment rate while employed: $\phi_4 w^{\phi_5}$	3.251
Portfolio	$\underline{A}$	The borrowing limit	-26.84
	$\overline{\overline{B}}$	The highest medical debt hospitals could impose on patients	200.8
Medical expenditure	μ_m	Mean of flow medical expenditure	0.824
	σ_m	SD of flow medical expenditure	363.8

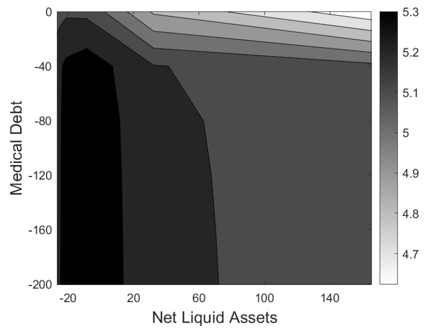
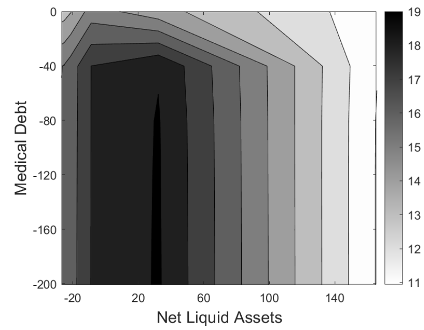
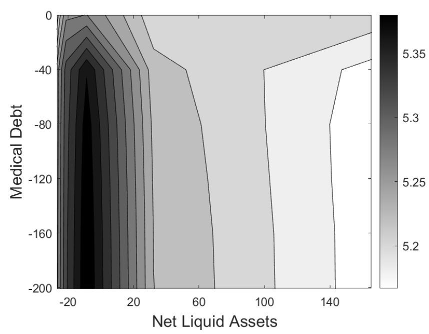
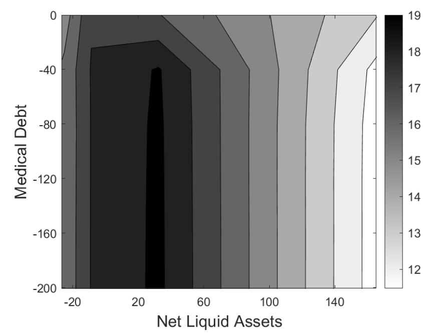
Note: The unit of money is \$1,000. The unit of time is one quarter (three months).

Table 11: Moments fit

Moments		model	data	weight
Proportion:	uninsured	0.1061	0.1293	61023
Mean:	net liquid assets	1.4207	1.3314	1464
Proportion:	those with medical debt	0.0951	0.0868	86514
Mean:	medical debt	0.0976	0.1383	17909
Proportion:	those with medical debt | negative net liquid assets	0.1775	0.1570	8650
Proportion:	those with medical debt | positive net liquid assets	0.0458	0.0667	87463
5th percentile	wage | employed in a job without ESHI	1.9745	1.847	1156
5th percentile	wage | employed in a job with ESHI	0.9747	0.7943	322
Mean	wage | employed in a job without ESHI	2.4682	2.0949	1461
Mean	wage | employed in a job with ESHI	3.2713	2.8925	9176
SD	wage | employed in a job without ESHI	0.8685	0.8187	478
SD	net liquid assets | employed in a job without ESHI	3.6196	1.8435	563
SD	wage | employed in a job with ESHI	0.7308	0.7352	3989
SD	net liquid assets | employed in a job with ESHI	3.5526	2.4214	1991
Proportion	insured through ESHI | employed	0.9027	0.820	47862
Transition rate	employed in month $m+3$ | unemployed in month m	0.2012	0.1394	13010
Transition rate	employed in a job $j' \neq j$ in month $m+3$ | employed in a job j in month m	0.0162	0.0186	1120381
Transition rate	unemployed in month $m+6$ | employed in a job without ESHI in month m	0.0403	0.0388	32535
Transition rate	unemployed in month $m+6$ | employed in a job with ESHI in month m	0.0224	0.00530	1628823
Proportion	unemployed	0.0635	0.0567	107059
Transition rate	insured through Medicaid in month $m+6$ | uninsured and unemployed in month m	0.164	0.0366	8290
Proportion	insured through Medicaid | unemployed	0.3879	0.4169	1948
Transition rate	insured through Medicaid in month $m+6$ | uninsured and employed in month m	0.00520	0.0118	131110
Median	wage in month m | employed, uninsured in month m, insured via Medicaid in month $m+6$	12.4319	12.136	0.157
Proportion	insured through Medicaid | employed	0.0255	0.0691	90428
Median	wage | employed and insured through Meidicad	8.267	8.082	13.81
5th percentile	net liquid assets | negative net liquid assets	-3.9833	-4.4408	9245
Proportion	those with negative liquid assets	0.3743	0.1986	41591
95th percentile	medical debt | having a positive amount of it	-4.2899	-3.9359	8.559
Mean	annual out-of-pocket medical expenditure | having positive amount of it	1.0313	0.8064	445
SD	annual out-of-pocket medical expenditure | having positive amount of it	1.6617	1.7501	12.77
SD	medical debt | having a positive amount of it	1.4861	1.3766	167.2

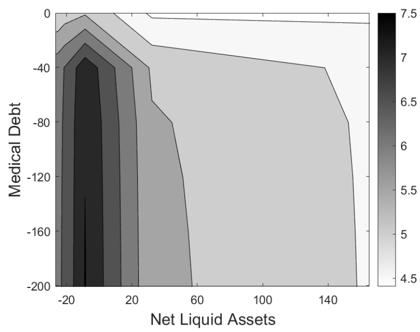
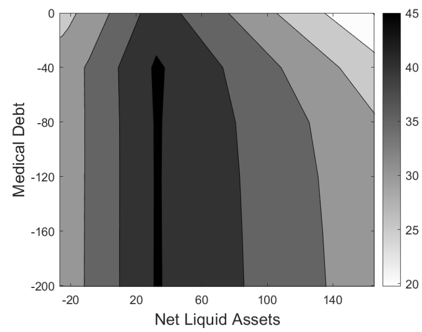
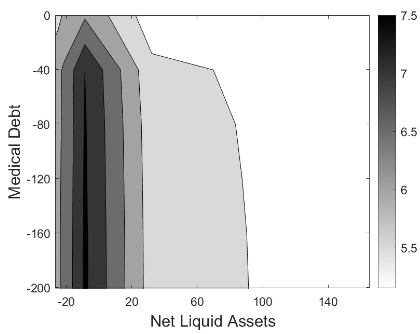
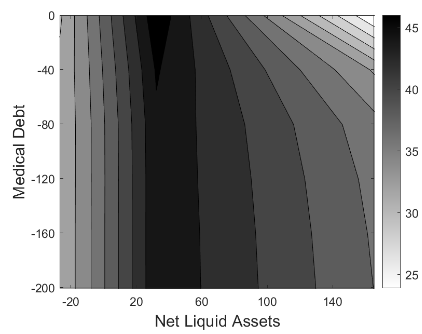
Note: SD stands for the standard deviation. The model moments are computed from the simulated steady state. Following Lise (2012), net liquid assets (A) and medical debt (B) are inverse-hyperbolic-sine-transformed. Wage w and annual out-of-pocket medical expenditures are log-transformed.

Table 12: The WTPs for uninsured employees

<table>
<tr><th></th><th>lower wage ($w = 15.37$)</th><th>higher wage ($w = 41.55$)</th></tr>
<tr><td>healthy</td><td>
</td><td>
</td></tr>
<tr><td>unhealthy
($m = 1.00$)</td><td>
</td><td>
</td></tr>
</table>

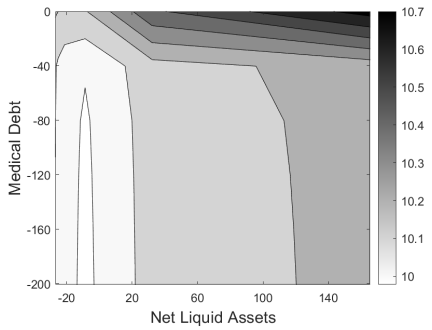
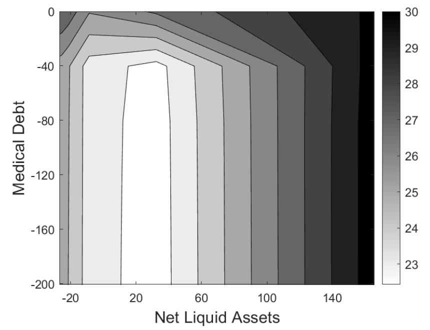
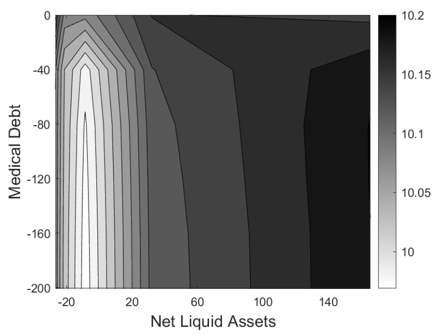
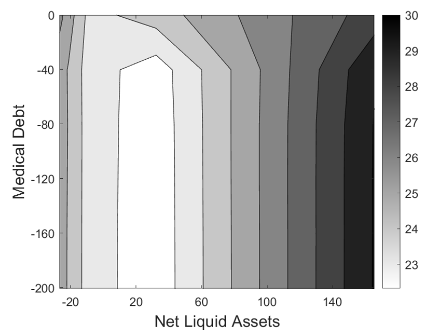
Note: Net liquid assets and medical debt are measured in \$1000. WTPs are measured in \$1000/quarter. The lower and higher wages are fixed to the first and the third quartile of the accepted wage distribution of all employed workers, respectively. Flow medical expenditure for the unhealthy is held fixed to $m = 1$.

Table 13: The WTAs for insured employees

<table>
<tr><th></th><th>lower wage ($w = 15.37$)</th><th>higher wage ($w = 41.55$)</th></tr>
<tr><td>healthy</td><td>
</td><td>
</td></tr>
<tr><td>unhealthy
($m = 1.00$)</td><td>
</td><td>
</td></tr>
</table>

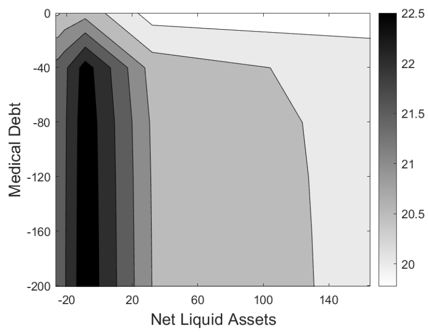
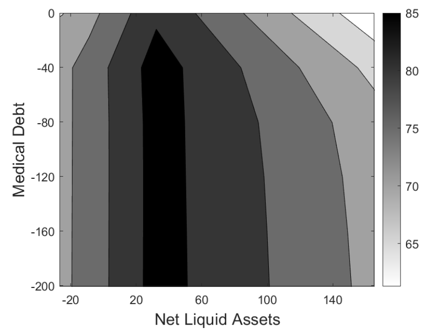
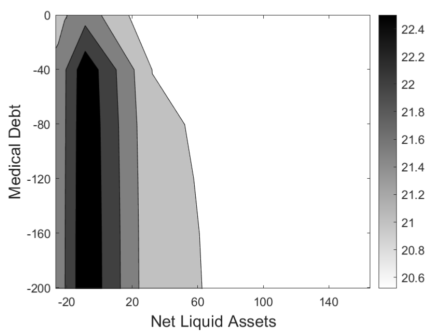
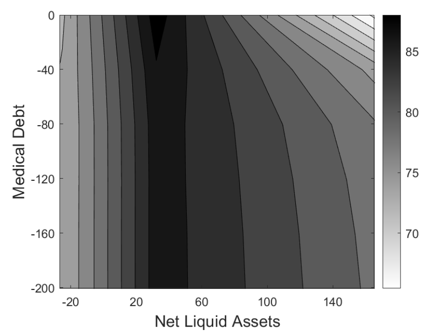
Note: Net liquid assets and medical debt are measured in \$1000. WTPs are measured in \$1000/quarter. The lower and higher wages are fixed to the first and the third quartile of the accepted wage distribution of all employed workers, respectively. Flow medical expenditure for the unhealthy is held fixed to $m = 1$.

Table 14: Reservation wages for jobs with ESHI for uninsured employees

	lower wage ($w = 15.37$)	higher wage ($w = 41.55$)
healthy		
unhealthy ($m = 1.00$)		

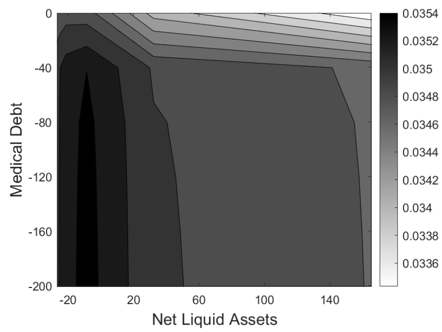
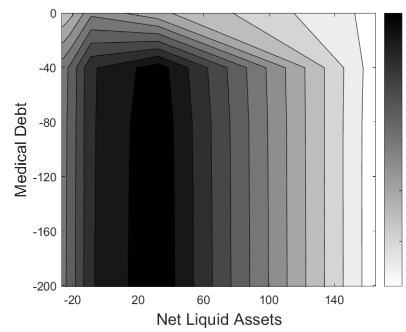
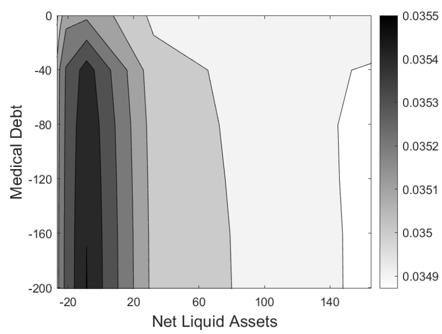
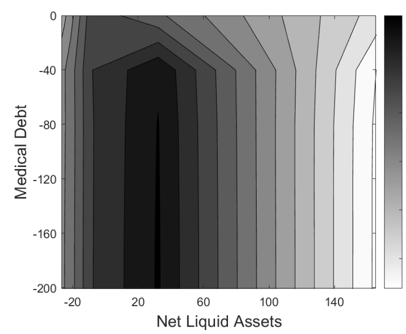
Note: Net liquid assets and medical debt are measured in \$1000. Reservation wages are measured in \$1000/quarter. The lower and higher wages are fixed to the first and the third quartile of the accepted wage distribution of all employed workers, respectively. Flow medical expenditure for the unhealthy is held fixed to $m = 1$.

Table 15: Reservation wages for jobs without ESHI for insured employees

<table>
<tr><th></th><th>lower wage ($w = 15.37$)</th><th>higher wage ($w = 41.55$)</th></tr>
<tr><td>healthy</td><td>
</td><td>
</td></tr>
<tr><td>unhealthy
($m = 1.00$)</td><td>
</td><td>
</td></tr>
</table>

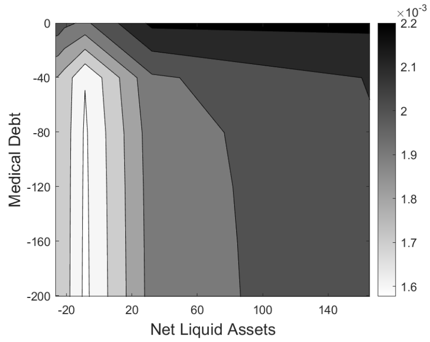
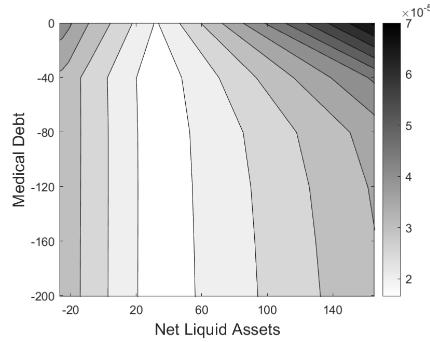
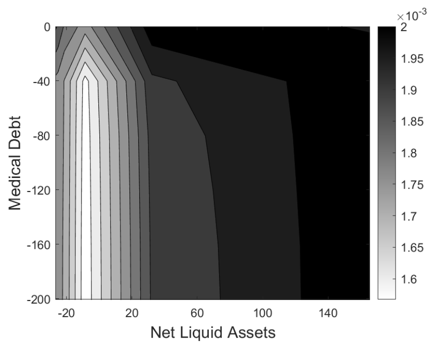
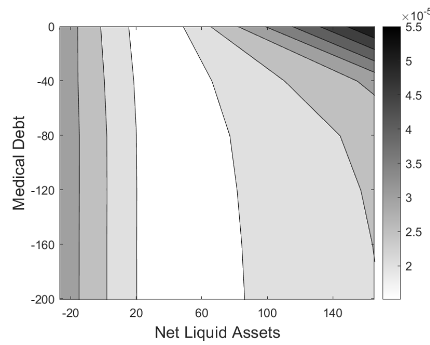
Note: Net liquid assets and medical debt are measured in \$1000. Reservation wages are measured in \$1000/quarter. The lower and higher wages are fixed to the first and the third quartile of the accepted wage distribution of all employed workers, respectively. Flow medical expenditure for the unhealthy is held fixed to $m = 1$.

Table 16: Job-to-job transition rates of uninsured employees to a job with ESHI

	lower wage ($w = 15.37$)	higher wage ($w = 41.55$)
healthy		
unhealthy ($m = 1.00$)		

Note: The unit of money is \$1000. The transition rates are computed over a period of one quarter. The lower and higher wages are fixed to the 1st and the 3rd quartile of the accepted wage distribution of all employed workers, respectively. Flow medical expenditure for the unhealthy is held fixed to $m = 1$.

Table 17: Job-to-job transition rates of insured employees to a job without ESHI

<table>
<tr><th></th><th>lower wage ($w = 15.37$)</th><th>higher wage ($w = 41.55$)</th></tr>
<tr><td>healthy</td><td>
</td><td>
</td></tr>
<tr><td>unhealthy ($m = 1.00$)</td><td>
</td><td>
</td></tr>
</table>

Note: The unit of money is \$1000. The transition rates are computed over a period of one quarter. The lower and higher wages are fixed to the 1st and the 3rd quartile of the accepted wage distribution among all employed workers, respectively. Flow medical expenditure for the unhealthy is held fixed to $m = 1$.

Appendices

A Evolution process of net liquid assets and medical debt

In section 3.1, I described the evolution equation of net liquid assets and medical debt for individuals who are employed ($E = 1$), uninsured ($I = 0$), and unhealthy ($h = 0$). This appendix section provides the equations for the other cases.

unemployed ($E = 0$) **and healthy** ($h = 1$)

$$\begin{cases} \dot{B} := \frac{dB}{dt} = z \geq 0 \\ \dot{A} := \frac{dA}{dt} = rA + b - \pi^I - c - z \ \ \& \ \ A \geq \underline{A} \end{cases} \tag{12}$$

unemployed ($E = 0$) **and unhealthy** ($h = 1$)

$$\begin{cases} \dot{B} = z + \{x - (1 - q^I)m\} \ \ \& \ \ -B \leq \overline{B} \\ \dot{A} = rA + b - \pi^I - c - z - x \ \ \& \ \ A \geq \underline{A} \end{cases} \tag{13}$$

employed $E = 1$ **and healthy** $h = 1$

$$\begin{cases} \dot{B} = z \geq 0 \\ \dot{A} = rA + w - \pi^I - tax(w, I) - c - z \ \ \& \ \ A \geq \underline{A} \end{cases} \tag{14}$$

employed $E = 1$ **and unhealthy** $h = 0$

$$\begin{cases} \dot{B} = z + \{x - (1 - q^I)m\} \ \ \& \ \ -B \leq \overline{B} \\ \dot{A} = rA + w - \pi^I - tax(w, I) - c - z - x \ \ \& \ \ A \geq \underline{A} \end{cases} \tag{15}$$

B Derivation of the steady-state value function

As in section 3, continue to focus on workers who are employed ($E = 1$), uninsured ($I = 0$), and unhealthy ($h = 0$). I derive the equation (4) in a heuristic way. I first set up a discrete time model where the length of a period is Δ.

$$
\begin{aligned}
&V^{E=1,I=0,h=0}(A_t, B_t, w_t = w, m_t = m) = \max_{c_t, z_t, x_t} (u(c_t) - \mathbb{1}(B_t < 0)\kappa(B_t, z_t))\Delta \\
&+ \frac{1}{1+\rho\Delta}\Bigg[\lambda^E \Delta \int \max\left\{V^{E=1,I=\tilde{I},h=0}(A_{t+\Delta}, B_{t+\Delta}, \tilde{w}, m), V^{E=1,I=0,h=0}(A_{t+\Delta}, B_{t+\Delta}, w, m)\right\} dF(\tilde{w}, \tilde{I}) \\
&+\xi^E_{en}(w_t)\Delta \max\left\{V^{E=1,I=2,h=0}(A_{t+\Delta}, B_{t+\Delta}, w, m), V^{E=0,I=2,h=0}(A_{t+\Delta}, B_{t+\Delta}, m)\right\} \\
&+\omega^h \Delta \max\left\{V^{E=1,I=0,h=1}(A_{t+\Delta}, B_{t+\Delta}, w), V^{E=0,I=0,h=1}(A_{t+\Delta}, B_{t+\Delta})\right\} \\
&+\eta^0 \Delta V^{E=0,I=0,h=0}(A_{t+\Delta}, B_{t+\Delta}, m) \\
&+\left(1 - \lambda^E\Delta - \xi^{en}(w)\Delta - \omega^h\Delta - \eta\Delta\right) V^{E=1,I=0,h=0}(A_{t+\Delta}, B_{t+\Delta}, w, m)\Bigg] + o(\Delta) \\
&\text{s.t.} \begin{cases} B_{t+\Delta} = B_t + (z_t + (x_t - m_t))\Delta \ \ \& \ \ -B_{t+\Delta} \leq \overline{B} \\ A_{t+\Delta} = (1 + r\Delta)A_t + (w_t - \pi^{I=0} - tax(w_t, I_t = 0) - c_t - z_t - x_t)\Delta \ \ \& \ \ A_{t+\Delta} \geq \underline{A} \end{cases}
\end{aligned} \tag{16}
$$

Multiplying both sides by $1 + \rho\Delta$, subtracting V from both sides, dividing both sides by Δ, and taking the limit $\Delta \to 0$ yield the HJB equation (4). The value function for the other cases can be derived analogously.

C The steady-state value functions and the solutions

C.1 When unemployed ($E = 0$) and healthy ($h = 1$)

The value function

$$
\begin{aligned}
&\rho V^{E=0,h=1,I}(A,B) = \max_{c,z} u(c) - \mathbb{1}(B<0)\chi(B,z) \\
&\quad + V_A^{E=0,h=1,I}(A,B)\dot{A} + V_B^{E=0,h=1,I}(A,B)\dot{B} \\
&\quad + \lambda^U \int \underbrace{\max\left\{V^{E=1,h=1,I=\mathbb{1}_{\{\tilde{I}=0,I=0\}}\cdot 0+\mathbb{1}_{\{\tilde{I}=0,I=2\}}\cdot 2+\mathbb{1}_{\{\tilde{I}=1\}}\cdot 1}(A,B,\tilde{w}) - V^{E=0,h=1,I}(A,B), 0\right\}}_{\text{the gain from accepting/rejecting an offered job } (\tilde{w},\tilde{I})} dF(\tilde{w},\tilde{I}) \\
&\quad + \mathbb{1}_{\{I=0\}}\xi_{en}^{U} \underbrace{\left\{V^{E=0,h=1,I=2}(A,B) - V^{E=0,h=1,I=0}(A,B)\right\}}_{\text{the gain from Medicaid enrollment}} \\
&\quad + \mathbb{1}_{\{I=2\}}\xi_{disen}^{U} \underbrace{\left\{V^{E=0,h=1,I=0}(A,B) - V^{E=0,h=1,I=2}(A,B)\right\}}_{\text{the loss from Medicaid dis-enrollment}} \\
&\quad + \omega^u \int \underbrace{\left\{V^{E=0,h=0,I}(A,B,m) - V^{E=0,h=1,I}(A,B)\right\}}_{\text{the loss from getting a negative health shock}} dF(m) \\
&\text{s.t.} \begin{cases} \dot{B} = z \;\;\&\;\; -B \le \overline{B} \\ \dot{A} = rA + b - \pi^I - c - z \;\;\&\;\; A \ge \underline{A} \end{cases}
\end{aligned}
\tag{17}
$$

The optimal solution

$$
\begin{aligned}
c^* &= (V_A)^{-\frac{1}{\gamma}} \\
z^* &= \begin{cases} 0 & \text{if } B = 0 \\ \left(\frac{V_A - V_B}{\kappa_1(-B)}\right)^{\frac{1}{\kappa_2 - 1}} & \text{if } B < 0 \;\;\&\;\; V_A > V_B \\ \overline{z}(B) & \text{if } B < 0 \;\;\&\;\; V_A \le V_B \end{cases}
\end{aligned}
\tag{18}
$$

The state constraint

When solving the model, the constraint is imposed as the inequality constraint for V_A:

$$
\begin{aligned}
& r\underline{A} + b - \pi^I - c - z \ge 0 \\
\Leftrightarrow & r\underline{A} + b - \pi^I \ge \underbrace{(V_A)^{-\frac{1}{\gamma}} + \mathbb{1}(B<0)\left\{\mathbb{1}(V_A > V_B)\left(\frac{V_A - V_B}{\kappa_1(-B)}\right)^{\frac{1}{\kappa_2-1}} + \mathbb{1}(V_A \le V_B)\overline{z}(B)\right\}}_{\text{strictly decreasing in } V_A} \qquad (19) \\
\Leftrightarrow & V_A \ge v^* \;\text{ where the equality holds at } V_A = v^* \text{ in the above inequality}
\end{aligned}
$$

C.2 When unemployed ($E = 0$) and unhealthy ($h = 0$)

The value function

$$
\begin{aligned}
&\rho V^{E=0,h=0,I}(A,B,m) = \max_{c,z,x} u(c) - \mathbb{1}(B<0)\chi(B,z) \\
&+ V_A^{E=0,h=0,I}(A,B,m)\dot{A} + V_B^{E=0,h=0,I}(A,B,m)\dot{B} \\
&+ \lambda^U \int \underbrace{\max\left\{V^{E=1,h=0,I=\mathbb{1}_{\{\tilde{I}=0,I=0\}}\cdot 0+\mathbb{1}_{\{\tilde{I}=0,I=2\}}\cdot 2+\mathbb{1}_{\{\tilde{I}=1\}}\cdot 1}(A,B,\tilde{w},m) - V^{E=0,h=0,I}(A,B,m), 0\right\}}_{\text{the gain from accepting/rejecting an offered job } (\tilde{w},\tilde{I})} dF(\tilde{w},\tilde{I}) \\
&+ \mathbb{1}_{\{I=0\}}\xi_{en}^U \underbrace{\left\{V^{E=0,h=0,I=2}(A,B,m) - V^{E=0,h=0,I=0}(A,B,m)\right\}}_{\text{the gain from Medicaid enrollment}} \\
&+ \mathbb{1}_{\{I=2\}}\xi_{disen}^U \underbrace{\left\{V^{E=0,h=0,I=0}(A,B,m) - V^{E=0,h=0,I=2}(A,B,m)\right\}}_{\text{the loss from Medicaid dis-enrollment}} \\
&+ \omega^h \underbrace{\left\{V^{E=0,h=1,I}(A,B) - V^{E=0,h=0,I}(A,B,m)\right\}}_{\text{the gain from getting recovered}} \\
&\text{s.t.} \begin{cases} \dot{B} = z + \left\{x - (1-q^I)m\right\} \ \ \& \ \ -B \le \overline{B} \\ \dot{A} = rA + b - \pi^I - c - z - x \ \ \& \ \ A \ge \underline{A} \end{cases}
\end{aligned}
\tag{20}
$$

The optimal solution

$$
\begin{aligned}
c^* &= (V_A)^{-\frac{1}{\gamma}} \\
z^* &= \begin{cases} 0 & \text{if } B = 0 \\ \left(\frac{V_A - V_B}{\kappa_1(-B)}\right)^{\frac{1}{\kappa_2 - 1}} & \text{if } B < 0 \ \ \& \ \ V_A > V_B \\ \overline{z}(B) & \text{if } B < 0 \ \ \& \ \ V_A \le V_B \end{cases} \\
x^* &= \begin{cases} 0 & \text{if } V_A > V_B \\ \left(1 - q^I\right)m & \text{otherwise} \end{cases}
\end{aligned}
\tag{21}
$$

The state constraint

$$
\begin{aligned}
& r\underline{A} + b - \pi^I - c - z - x \ge 0 \\
\Leftrightarrow & r\underline{A} + b - \pi^I \ge \\
& \underbrace{(V_A)^{-\frac{1}{\gamma}} + \mathbb{1}(B<0)\left\{\mathbb{1}(V_A > V_B)\left(\frac{V_A - V_B}{\kappa_1(-B)}\right)^{\frac{1}{\kappa_2-1}} + \mathbb{1}(V_A \le V_B)\overline{z}(B)\right\} + \mathbb{1}(V_A \le V_B)\left(1 - q^I\right)m}_{\text{strictly decreasing in } V_A} \\
\Leftrightarrow & V_A \ge v^* \ \text{ where the equality holds at } V_A = v^* \text{ in the above inequality}
\end{aligned}
\tag{22}
$$

C.3 When employed $(E = 1)$ and healthy $(h = 1)$

The value function

$$
\begin{aligned}
&\rho V^{E=1,h=1,I}(A,B,w) = \max_{c,z,x} u(c) - \mathbb{1}(B<0)\chi(B,z) \\
&\quad + V_A^{E=1,h=1,I}(A,B,w)\dot{A} + V_B^{E=1,h=1,I}(A,B,w)\dot{B} \\
&\quad + \lambda^E \int \underbrace{\max\left\{V^{E=1,h=1,I=\mathbb{1}_{\{\tilde{I}=0,I=0\}}\cdot 0+\mathbb{1}_{\{\tilde{I}=0,I=2\}}\cdot 2+\mathbb{1}_{\{\tilde{I}=1\}}\cdot 1}(A,B,\tilde{w}) - V^{E=1,h=1,I}(A,B,w), 0\right\}}_{\text{the gain from switching to an offered job } (\tilde{w},\tilde{I})} dF(\tilde{w},\tilde{I}) \\
&\quad + \mathbb{1}_{\{I=0\}}\xi_{en}^E(w)\underbrace{\left[\max\left\{V^{E=1,h=1,I=2}(A,B,w), V^{E=0,h=1,I=2}(A,B)\right\} - V^{E=1,h=1,I=0}(A,B,w)\right]}_{\text{the gain from Medicaid enrollment}} \\
&\quad + \mathbb{1}_{\{I=2\}}\xi_{disen}^E(w)\underbrace{\left[\max\left\{V^{E=1,h=1,I=0}(A,B,w), V^{E=0,h=1,I=0}(A,B)\right\} - V^{E=1,h=1,I=2}(A,B,w)\right]}_{\text{the loss from Medicaid dis-enrollment}} \\
&\quad + \omega^u \int \underbrace{\left[\max\{V^{E=1,h=0,I}(A,B,w,m), V^{E=0,h=0,I=2}(A,B,m)\} - V^{E=1,h=1,I}(A,B,w)\right]}_{\text{the loss from getting a negative health shock}} dF_m(m) \\
&\quad + \eta^{\mathbb{1}(I=1)}\underbrace{\left\{V^{E=0,h=1,I}(A,B) - V^{E=1,h=1,I}(A,B,w)\right\}}_{\text{the loss from job termination}} \\
&\quad \text{s.t.} \begin{cases} \dot{B} = z \ \ \& \ \ -B \le \overline{B} \\ \dot{A} = rA + w - \pi^I - tax(w,I) - c - z - x \ \ \& \ \ A \ge \underline{A} \end{cases}
\end{aligned} \tag{23}
$$

The optimal solution

$$
\begin{aligned}
c^* &= (V_A)^{-\frac{1}{\gamma}} \\
z^* &= \begin{cases} 0 & \text{if } B = 0 \\ \left(\frac{V_A - V_B}{\kappa_1(-B)}\right)^{\frac{1}{\kappa_2 - 1}} & \text{if } B < 0 \ \ \& \ \ V_A > V_B \\ \overline{z}(B) & \text{if } B < 0 \ \ \& \ \ V_A \le V_B \end{cases}
\end{aligned} \tag{24}
$$

The state constraint

$$
\begin{aligned}
& r\underline{A} + w - \pi^I - tax(w,I) - c - z \ge 0 \\
\Leftrightarrow\; & r\underline{A} + w - \pi^I - tax(w,I) \ge \underbrace{(V_A)^{-\frac{1}{\gamma}} + \mathbb{1}(B<0)\left\{\mathbb{1}(V_A > V_B)\left(\frac{V_A - V_B}{\kappa_1(-B)}\right)^{\frac{1}{\kappa_2 - 1}} + \mathbb{1}(V_A \le V_B)\overline{z}(B)\right\}}_{\text{strictly decreasing in } V_A} \\
\Leftrightarrow\; & V_A \ge v^* \ \text{ where the equality holds at } V_A = v^* \text{ in the above inequality}
\end{aligned} \tag{25}
$$

C.4 When employed $(E=1)$ and unhealthy $(h=0)$

The value function

$$
\begin{aligned}
&\rho V^{E=1,h=0,I}(A,B,w,m) = \max_{c,z,x} u(c) - \mathbb{1}(B<0)\chi(B,z) \\
&+ V_A^{E=1,h=0,I}(A,B,w,m)\dot{A} + V_B^{E=1,h=0,I}(A,B,w,m)\dot{B} \\
&+ \lambda^E \int \underbrace{\max\Big\{V^{E=1,h=0,I=\mathbb{1}_{\{\tilde{I}=0,I=0\}}\cdot 0+\mathbb{1}_{\{\tilde{I}=0,I=2\}}\cdot 2+\mathbb{1}_{\{\tilde{I}=1\}}\cdot 1}(A,B,\tilde{w},m) - V^{E=1,h=0,I}(A,B,w,m),0\Big\}}_{\text{the gain from switching to an offered job } (\tilde{w},\tilde{I})} dF(\tilde{w},\tilde{I}) \\
&+ \mathbb{1}_{\{I=0\}}\xi_{en}^E(w)\underbrace{\Big[\max\Big\{V^{E=1,h=0,I=2}(A,B,w,m), V^{E=0,h=0,I=2}(A,B,m)\Big\} - V^{E=1,h=0,I=0}(A,B,w,m)\Big]}_{\text{the gain from Medicaid enrollment}} \\
&+ \mathbb{1}_{\{I=2\}}\xi_{disen}^E(w)\underbrace{\Big[\max\Big\{V^{E=1,h=0,I=0}(A,B,w,m), V^{E=0,h=0,I=0}(A,B,m)\Big\} - V^{E=1,h=0,I=2}(A,B,w,m)\Big]}_{\text{the loss from Medicaid dis-enrollment}} \\
&+ \omega^h \underbrace{\Big[\max\{V^{E=1,h=1,I}(A,B,w), V^{E=0,h=1,I}(A,B)\} - V^{E=1,h=0,I}(A,B,w,m)\Big]}_{\text{the gain from getting a positive health shock}} \\
&+ \eta^{\mathbb{1}(I=1)} \underbrace{\Big\{V^{E=0,h=0,I}(A,B,m) - V^{E=1,h=0,I}(A,B,w,m)\Big\}}_{\text{the loss from job termination}} \\
&\text{s.t.} \begin{cases} \dot{B} = z + \Big\{x - (1-q^I)m\Big\} \ \ \& \ \ -B \le \overline{B} \\ \dot{A} = rA + w - \pi^I - tax(w,I) - c - z - x \ \ \& \ \ A \ge \underline{A} \end{cases}
\end{aligned} \tag{26}
$$

The optimal solution

$$
\begin{aligned}
c^* &= (V_A)^{-\frac{1}{\gamma}} \\
z^* &= \begin{cases} 0 & \text{if } B=0 \\ \left(\frac{V_A - V_B}{\kappa_1(-B)}\right)^{\frac{1}{\kappa_2 - 1}} & \text{if } B<0 \ \& \ V_A > V_B \\ \overline{z}(B) & \text{if } B<0 \ \& \ V_A \le V_B \end{cases} \\
x^* &= \begin{cases} 0 & \text{if } V_A > V_B \\ \left(1-q^I\right)m & \text{otherwise} \end{cases}
\end{aligned} \tag{27}
$$

The state constraint

$$
\begin{aligned}
& r\underline{A} + w - \pi^I - tax(w,I) - c - z - x \ge 0 \\
\Leftrightarrow & r\underline{A} + w - \pi^I - tax(w,I) \ge \\
& \underbrace{(V_A)^{-\frac{1}{\gamma}} + \mathbb{1}(B<0)\left\{\mathbb{1}(V_A > V_B)\left(\frac{V_A - V_B}{\kappa_1(-B)}\right)^{\frac{1}{\kappa_2-1}} + \mathbb{1}(V_A \le V_B)\overline{z}(B)\right\} + \mathbb{1}(V_A \le V_B)\left(1-q^I\right)m}_{\text{strictly decreasing in } V_A} \\
\Leftrightarrow & V_A \ge v^* \ \text{ where the equality holds at } V_A = v^* \text{ in the above inequality}
\end{aligned} \tag{28}
$$

D Kolmogorov forward equations

Take workers who are employed ($E = 1$), unhealthy ($h = 0$), and uninsured ($I = 0$) for example. The evolution equation of the density $g(A, B, E = 1, w, h = 0, m, I = 0, t)$ is determined as follows. For ease of exposition, I adopt the notation: $g^{E,h,I}(A, B, w, m, t) = g(A, B, E, w, h, m, I, t)$.

$$
\begin{aligned}
&\frac{\partial}{\partial t} g^{E=1,h=0,I=0}(A, B, t) = \\
&- \frac{\partial}{\partial A}\left[\dot{A}(A, B, E = 1, h = 0, I = 0) g^{E=1,h=0,I=0}(A, B, t)\right] \\
&- \frac{\partial}{\partial B}\left[\dot{B}(A, B, E = 1, h = 0, I = 0) g^{E=1,h=0,I=0}(A, B, t)\right] \\
&- \left[\lambda^E \int \mathbb{1}_{\{V^{E=1,h=0,I=\tilde{I}}(A,B,\tilde{w},m) > V^{E=1,h=0,I=0}(A,B,w,m)\}} dF(\tilde{w}, \tilde{I}) + \xi^E_{en} + \omega^h + \eta^0\right] g^{E=1,h=0,I=0}(A, B, w, m, t) \\
&+ \lambda^U \mathbb{1}_{\{V^{E=1,h=0,\tilde{I}=0}(A,B,\tilde{w}=w,m) > V^{E=0,h=0,I=0}(A,B,m)\}} f(\tilde{w} = w \mid \tilde{I} = 0) p(\tilde{I} = 0) \\
&+ \xi^E_{disen} g^{E=1,h=0,I=2}(A, B, w, m, t) \\
&+ \omega^u g^{E=1,h=1,I=0}(A, B, w, t) f_m(m)
\end{aligned}
\tag{29}
$$

In the RHS of the equation, the first and the second lines capture outflow from the current state, which occurs due to changes in net liquid assets and medical debt, respectively. The third line represents outflow caused by job mobility, enrollment in Medicaid, a positive health shock, and termination of the current job. The fourth line corresponds to inflow through accepting a job ($\tilde{w} = w, \tilde{I} = 0$) by workers who are unemployed, unhealthy, and uninsured with the three continuous state variables (A, B, m). The fifth line signifies inflow due to Medicaid dis-enrollment. The last line captures inflow resulting from a negative health shock, which incurs flow medical expense of m. Kolmogorov forward equation for the other cases can be determined analogously.