Work Incentives of Medicaid Beneficiaries and The Role of Asset Testing *

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Abstract

Having low income is one of the requirements for Medicaid eligibility. Given that earning ability is unobservable, once an individual with high labor income stops working it is impossible to distinguish him from those whose potential labor income is low. This can affect the ability of Medicaid to target the most disadvantaged people given that a large fraction of its beneficiaries do not work. In this paper we ask two questions: 1) Does Medicaid significantly distort work incentives? 2) Can the insurance-incentives trade-off of Medicaid be improved without changing the size of the redistribution in the economy? Our tool is a general equilibrium model with heterogeneous agents calibrated using the Medical Expenditure Panel Survey Dataset to match the life-cycle patterns of employment and insurance take-up behavior as well as the key aggregate statistics. We find that around 20% of Medicaid enrollees do not work in order to be eligible. These distortions are costly for the economy: if Medicaid eligibility could be linked to (unobservable) productivity the resulting ex-ante welfare gains are equivalent to 1.5% of the annual consumption. We show that asset testing can achieve a similar outcome but only if asset limits are allowed to be different for workers and non-workers.

Keywords: health insurance, Medicaid, labor supply, asset testing, general equilibrium, life-cycle models

JEL Classification Codes: D52, D91, E21, H53, I13, I18

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1 Introduction

Medicaid is one of the largest means-tested programs in the US and it is an important source of health insurance coverage for the non-elderly poor. Having low income is one of the requirements for Medicaid eligibility: a Medicaid enrollee cannot earn more than a certain limit. This requirement prevents high-income *workers* from getting public transfers but it cannot guarantee that *non-workers* with potential income above the income limit do not enroll. Since earning ability is unobservable, once an individual with high labor income stops working he is indistinguishable from those whose potential labor income is low. This can affect the ability of Medicaid to target the most disadvantaged people given that a large fraction of its beneficiaries do not work. Indeed, the fraction of workers among Medicaid enrolles is substantially lower than this fraction among the rest of the population: on average only 53% of people on Medicaid work as compared to 94% among the uninsured and 98% among the privately insured.[1] Figure (1) shows that Medicaid beneficiaries tend to work significantly less than the other groups over the entire life-cycle. In this paper we ask two questions: 1) Does Medicaid significantly distort work incentives? 2) Can the insurance-incentives trade-off of Medicaid be improved without changing the size of the redistribution in the economy? More specifically, our goal in this paper is to quantify the distorting effects of Medicaid on work incentives, assess its welfare implications, and evaluate policies that can mitigate these distortions.

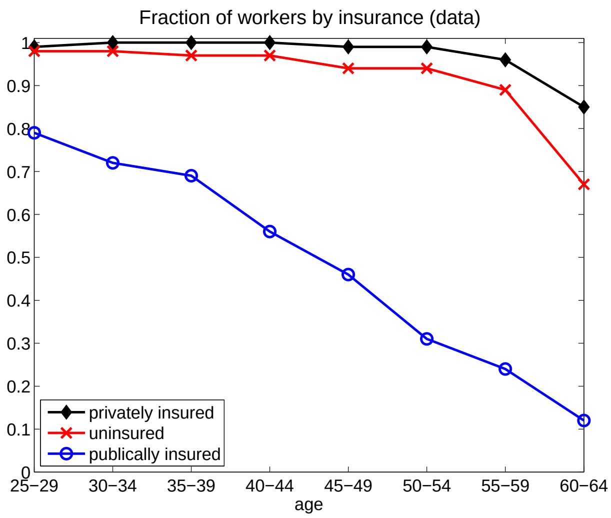


Figure 1: Fraction of workers by insurance status (source: MEPS). Each line shows the fraction of individuals who work in a corresponding age and insurance group.

[1]When constructing these statistics we define a person as a non-worker if he/she does not work for the whole year (which is the time period in our model). Our sample includes only the heads of the households where the head is defined as the highest earner in a household. Details on sample selection are reported in Section 4. Appendix B discusses in details the difference between the fraction of workers computed for our sample and the employment-population ratio computed based on the Current Population Survey (CPS).

To do this we construct a quantitative general equilibrium model with the following key features. First, we allow for heterogeneity of individuals along the dimensions of health, productivity and medical expense shocks. This allows us to capture the insurance role of Medicaid for people with bad health, large medical shocks and/or low productivity. Second, we let health affect productivity, available time and opportunity to access employer-based insurance which allows us to model the selection of people with low attachment to the labor force into Medicaid.[2] Third, people in our model have several options to insure against medical shocks: self-insurance, public health insurance and private health insurance (employer-based and individual). However, private health insurance is not easily accessible for two reasons. First, employer-based insurance is only available for a subset of population working in firms that offer this type of insurance. Second, the individual market is risk-rated meaning that unhealthy people face high premiums. People who want to obtain public insurance have to meet the income test and asset test. Since labor income is endogenous, Medicaid beneficiaries in our model include those who have low earnings ability, and those who have relatively high earning ability but choose not to work in order to be eligible. Finally, we model other non-Medicaid government means-tested programs to adequately represent the public safety net existing in the economy.

We calibrate the model using the Medical Expenditure Panel Survey (MEPS) dataset. More specifically, we require the model to reproduce the following key patterns of the data: i) the life-cycle profiles of insurance take-up by health, ii) the life-cycle profiles of employment by health and insurance status, iii) the average labor income profiles by health for all workers and for workers without employer-sponsored health insurance (ESHI). An essential feature of our calibration is that we use our model to estimate the potential labor income of people whom we do not observe working in the data and their chances to access ESHI. This is important for understanding how Medicaid affects labor supply decisions since almost half of Medicaid beneficiaries do not work.

Our findings are as follows. First, around 22% of the current Medicaid enrollees will not be eligible for Medicaid if they work because their potential earnings exceed the income test limit. Most of these people (or 20.3% of all Medicaid enrollees) will choose to work if they were able to keep their access to public insurance. The majority of this group is unhealthy, and has higher medical costs and higher assets than other Medicaid enrollees.

Second, these distortions are important in welfare terms. If we keep the budget of public transfers programs constant and link Medicaid eligibility to (unobservable)

[2] In the data, 43.7% of Medicaid beneficiaries are unhealthy whereas the unhealthy among the privately insured and the uninsured account for only 9.1% and 16.3% correspondingly. In addition, unhealthy people are less likely to access employer-based health insurance. Only 46% of the unhealthy are covered by the employer-based health insurance comparing to 69% among the healthy.

exogenous productivity as opposed to (observable) endogenous labor income, it will result in ex-ante welfare gains equivalent to 1.5% of the annual consumption.[3]

Third, we study if asset testing currently used in Medicaid eligibility rules can be modified in order to reduce the distortions when productivity is unobservable. We show that very strict asset testing (with the asset limit equal to $2,000) can completely eliminate non-workers with potential income above the income test limit from Medicaid beneficiaries. However, reduction in labor supply distortions comes at a cost of large saving distortions and this substantially decreases welfare gains of this policy. On the other hand, if asset limits are allowed to be different for workers and non-workers, asset testing can achieve an outcome that is very close to the "ideal" case of observable productivity. This happens because strict asset testing of non-workers prevents highly productive individuals from using the following strategy: stop working, claim Medicaid and then use their accumulated assets to smooth consumption. In contrast, loosening asset limits on working beneficiaries relieves saving distortions for individuals who do not "game" Medicaid rules by lowering their labor supply.[4]

The paper is organized as follows. Section 2 reviews the related literature. Section 3 introduces the model. Section 4 explains our calibration. Section 5 compares the performance of the model with the data. Section 6 presents the results. Section 7 discusses the role of asset testing. Section 8 concludes.

2 Related literature

Our paper is related to several strands of literature. Our positive analysis is motivated by the literature studying the labor supply effects of public means-tested programs (for an extensive review see Moffit, 2002). A subset of this literature focuses on the Medicaid program. Most of these studies use data prior to 1996 when adult eligibility for Medicaid was tied to eligibility for another welfare program, Aid for Families with Dependent Children (AFDC).[5,6] The close link between the two programs made it difficult to isolate the effect of Medicaid on labor supply and different identification strategies were used. Moffit and Wolfe (1992) exploit the variation in the valuation of Medicaid benefits and showed that Medicaid has a significant negative impact on labor force participation.

[3]Alternatively, the labor supply distortions of Medicaid can be eliminated by introducing universal public health insurance. However, this involves a sizeable increase in the redistribution in the economy which will also affect welfare. By fixing the budget of public transfers programs, we can isolate the welfare effects of the distortions created by Medicaid.

[4]The mechanism behind work-dependent asset-testing is analogous to the effect of earnings-dependent wealth taxation advocated in several studies of optimal taxation (see, for example, Kocherlakota (2005) and Albansei and Sleet (2006)).

[5]Currently this program is substituted by the Temporary Assistance for Needy Families (TANF).

[6]In the end of 1980s Medicaid was expanded to cover pregnant women regardless of their participation in welfare.

Blank (1989), Winkler (1991) and Montgomety and Navin (2000) use variations in the generosity of Medicaid by state to evaluate its effect on labor supply. The first study finds no effect while the last two studies find small effects on labor force participation. Yellowitz (1995) exploits delinking Medicaid from AFDC for children in the late 1980s and finds that this policy had a positive effect on labor force participation of mothers. Decker (1993) and Strumpf (2011) examine the effects of the introduction of the Medicaid program in the late 1960s and early 1970s on labor force participation, and both studies find no effect. Dave et al (2013) study the expansion of Medicaid to cover the costs of pregnancy and child birth that happened in the late 1980s and find that this policy had significantly decreased the probability that a woman who recently gave birth was employed. Overall, the literature based on pre-1996 data provides mixed evidence on the effects of Medicaid on labor supply. However, there is evidence that the decision to participate in welfare programs was noticeably affected by the availability of health insurance (Ellwood and Adams, 1990; Moffit and Wolfe, 1992; Decker, 1993).

After the welfare reform of 1996, Medicaid and AFDC were separated and states were allowed to determine their Medicaid eligibility criteria. To the best of our knowledge, only two studies examine the effects of Medicaid on labor supply using the data after the welfare reform of 1996. Garthwaite et al (2013) examine the consequences of a sharp reduction of the state Medicaid expansion program in Tennessee in 2005 when a large number of people was disenrolled within a period of less than a year. They find a significant increase in the employment among the group who lost coverage. Pohl (2011) estimates a structural model using variation in Medicaid policies across states and finds that some groups of population are significantly less likely to work in order to be eligible for Medicaid. Similar to the latter study, our paper addresses this question in a structural framework and using post-1996 data. Unlike Pohl (2011) our approach allows for the coexistence of self-insurance, several types of private health insurance and public insurance. We show that the interaction of self-insurance and labor supply distortions is important for our normative analysis.

The normative analysis of our paper is related to the literature studying how to efficiently provide insurance in dynamic economies with private information (this literature is often refereed to as New Dynamic Public Finance (NDPF))[7]. A primary focus of these studies is constrained-efficient allocations that solve the planning problem with incentive compatibility constraints arising from information asymmetry. These allocations imply that marginal decisions of agents should be distorted comparing to the case of full information. In particular, savings should be discouraged by creating a wedge between the intertemporal marginal rate of substitution and the aggregate return on capital. This is done to minimize the adverse effect of savings on work incentives. Studies that derive how

[7] Kocherlakota (2010) and Golosov, Tsyvinsky and Werning (2010) provide an extensive review.

optimal allocations can be implemented show that in certain environments the optimal wedge on saving decisions can be achieved by asset testing (Golosov and Tsyvinski, 2006) or by wealth taxes that negatively depend on labor income (Kocherlkota, 2005; Albanesi and Sleet, 2006). The former study shows that introducing asset testing to disability insurance results in substantial welfare gains. Based on the findings of these studies we provide a quantitative analysis of the effects of uniform asset testing and asset testing that depends on labor supply decisions.

Methodologically we relate to two groups of studies. First, we relate to models with incomplete labor markets augmented by health and medical expenses uncertainty and allowing for endogenous health insurance decisions (Kitao and Jeske, 2009, Hansen et al, 2011, Hsu, 2012, Pashchenko and Porapakkarm, 2013). Second, we relate to life-cycle structural models featuring health uncertainty (Capatina, 2011, De Nardi, French, Jones, 2010, French, 2005, Nakajima and Telyukova, 2011). Following the first group of studies we use a general equilibrium framework meaning that all aggregate variables (e.g. the ESHI premium, taxes) are endogenous. Similar to the second group of studies we allow for rich heterogeneity and impose a strict discipline on the model by requiring it to reproduce the behavior of each subgroup of agents as in the data.

3 Baseline Model

3.1 Households

3.1.1 Demographics and preferences

The economy is populated by overlapping generations of individuals. A model period is one year.[8] An individual lives to a maximum of N periods. During the first $R-1$ periods of life an individual can choose to work or not; and at age R all individuals retire.

At age t, an agent's health condition h_t can be either good ($h_t = 1$) or bad ($h_t = 0$). His health condition evolves according to an age-dependent Markov process, $\mathcal{H}_t(h_t|h_{t-1})$. Health affects the available time, productivity, survival probability and medical expenses.

An individual is endowed with one unit of time that can be used for either leisure or work.[9] Labor supply (l_t) is indivisible: $l_t \in \left\{0, \bar{l}\right\}$.[10] Work brings disutility modeled as

[8] We choose a period of the model to be one year because in most of the states in the US the renewal period for Medicaid is 12 months. A typical private health insurance contract also lasts one year.

[9] We assume that there are no labor market frictions in our model. Given that a model period is one year this is equivalent to assuming that an individual who wants to work can always find a job within a year. In our sample, only 4.1% of non-working Medicaid beneficiaries report they could not find a job at least in one interview round per year. This suggests that the majority of this group voluntarily chooses not to work.

[10] We assume indivisible labor supply since the evidence that low-income earners demonstrate significant response to public policies along the extensive margin is more prevalent than such evidence for the

a fixed costs of leisure ϕ_w. People in bad health incur time loss due to sickness, ϕ_t^{UH}, which is a non-decreasing function of age. We assume the Cobb-Douglas specification for preferences over consumption and leisure:

$$u(c_t, l_t, h_t) = \frac{\left(c_t^{\chi}\left(1 - l_t - \phi_w \mathbf{1}_{\{l_t>0\}} - \phi_t^{UH}\mathbf{1}_{\{h_t=0\}}\right)^{1-\chi}\right)^{1-\sigma}}{1-\sigma}.$$

where $\mathbf{1}_{\{.\}}$ is an indicator function mapping to one if its argument is true. Here χ is a parameter determining the relative weight of consumption, and σ is the risk-aversion over the consumption-leisure composite.

Agents discount the future at a rate β and survive till the next period with conditional probability ζ_t^h, which depends on age and health. We assume that the savings of households who do not survive are equally distributed among all survived agents. The population grows at a rate η.

3.1.2 Medical expenditures and health insurance

Each period an agent faces a stochastic medical expenditure shock x_t^h which depends on his age and health condition.[11] Medical expenditure shocks evolve according to a Markov process $\mathcal{G}_t(x_t^h|x_{t-1}^h)$. Every individual of working age can buy health insurance against medical shocks in the individual health insurance market. The price of health insurance in the individual market is a function of an individual's age, health condition and medical shock realized in the previous period. We denote the individual market price as $p_I\left(h_{t-1}, x_{t-1}^h, t\right)$.

Every period a working age individual gets an offer to buy employer-sponsored health insurance (ESHI) with probability $Prob_t$ that depends on age, income and health.[12] The variable g_t characterizes the status of the offer: $g_t = 1$ if an individual gets an offer, and $g_t = 0$ if he does not. All participants of the employer-based pool are charged the same premium p regardless of their health and age. Since an employer who offers ESHI pays fraction ψ of this premium, a worker who chooses to buy group insurance only pays $\overline{p}$ where:

$$\overline{p} = (1-\psi)\,p.$$

Low-income individuals of working age can obtain their health insurance from Medicaid for free. There are two pathways to qualify for Medicaid. First, an individual is

intensive margin response (Heckman, 1993, Kleven and Kreiner, 2005, Saez, 2002). In addition, in the data the difference in labor supply between the healthy and the unhealthy is more pronounced along the extensive margin.

[11]We assume medical expenses are exogenous, i.e. individuals do not choose the amount of their medical spending. We explain this modeling choice and its implications for our results in Appendix H.

[12]This assumption is used to replicate the empirical fact that healthy and high income people are much more likely to be covered by ESHI.

eligible if his total income is below the threshold y^{cat} and his assets are less than the limit k^{cat}. We call this pathway "categorial eligibility".[13] Second, an individual can become eligible through the Medically Needy program. This happens if his total income minus the out-of-pocket medical expenses is below the threshold y^{MN} and his assets are less than the limit k^{MN}. We call this pathway "eligibility based on medical need".

All types of insurance contracts - group, individual, and public - provide only partial insurance against medical expenditure shocks. We denote by $q\left(x_t^h, i_t\right)$ the fraction of medical expenditures covered by an insurance contract. This fraction is a function of medical expenditures and the insurance choice (i_t).

All retired households are enrolled in the Medicare program. The Medicare program charges a fixed premium p_{MCR} and covers a fraction q_{MCR} of medical costs.

3.1.3 Labor income

The household earning is equal to $\widetilde{w}z_t^h l_t$, where $\widetilde{w}$ is wage and z_t^h is the idiosyncratic productivity that depends on age (t). In addition, we allow a household's productivity to be affected by his health condition realized at the end of the previous period (h_{t-1}). This modeling assumption is motivated by the observation that in the data the average labor income of unhealthy workers is much lower than the average labor income of healthy workers.

3.1.4 Taxation and social transfers

All households pay an income tax $\mathcal{T}(y_t)$ which consists of two parts: a progressive tax and a proportional tax.[14] Taxable income y_t is based on both labor and capital income. Working households also pay payroll taxes: Medicare tax (τ_{MCR}) and Social

[13]Medicaid eligibility can also be linked to family status: the federal regulation requires states to cover at least certain categories of population - individuals with dependent children and low-income disabled individuals. We abstract from family status for two reasons. First, many states have additional eligibility pathways for non-disabled childless adults. In 2008, 23 states and the District of Columbia operated programs for low-income childless adults (Klein and Schwartz, 2008). The financing of these programs comes from state funding or through Medicaid §1115 waivers. In our sample, 20.6% of Medicaid beneficiaries do not have dependent children (defined as children younger than 18 years of age), and are not receiving disability benefits. Thus, introducing a tight link between Medicaid eligibility and family status can significantly underestimate the extent to which this program is available to some categories of population. Second, we abstract from modeling a family structure because of computational costs. Our model will be infeasible to compute and calibrate if we allow individuals to form families, have children, get separated, etc. An alternative and feasible strategy would be to introduce a stochastic family structure where individuals can move between several family states such as having or not having children according to a stochastic process calibrated from the data. Even though this approach allows for a more detailed representation of the Medicaid eligibility rules, it significantly increases the complexity of the model.

[14]The progressive part approximates the actual income tax schedule in the U.S., while the proportional tax represents all other taxes that we do not model explicitly. In this approach we follow Jeske and Kitao (2009).

Security tax (τ_{ss}). The Social Security tax rate for earnings above $\overline{y}_{ss}$ is zero. The U.S. tax code allows households to exclude out-of-pocket medical expenditures (including insurance premiums) that exceed 7.5% of their income when calculating their taxable income. In addition, the ESHI premium ($\overline{p}$) is tax-deductible in both income and payroll tax calculations. Consumption is taxed at a proportional rate of τ_c.

We also assume a public safety-net program, T_t^{SI}. This program guarantees each household a minimum consumption level equal to $\underline{c}$. This reflects the option available to U.S. households with a bad combination of income and medical shocks to rely on public transfer programs such as food stamps, Supplemental Security Income, disability insurance, and uncompensated care.[15] Retired households receive Social Security benefits ss.

3.1.5 Timing of the model

The timing of the model is as follows. At the beginning of the period a working-age individual learns his productivity and ESHI offer status. Based on this information an individual decides his labor supply (l_t) and insurance choice (i_t). If he is categorically eligible, he can choose to enroll in Medicaid (M). If he is not eligible or decides not to enroll in Medicaid, he can choose to buy individual insurance (I) , or employer-based group insurance (G) if offered, or to stay uninsured (U). At the end of the period the new health status (h_t) and medical expenses shock (x_t^h) are realized. At this point an uninsured household can become eligible for the Medically Needy (MN) program after he has spent down his income to pay his medical expenses until reaching the level of the Medically Needy eligibility threshold.[16] We use a variable i_t^{MN} to indicate whether an uninsured individual becomes eligible for the Medical Needy program after his medical shock is realized: $i_t^{MN} = 1$ if an individual becomes eligible, otherwise $i_t^{MN} = 0$. After paying the out-of-pocket medical expenses, an individual chooses his consumption (c_t) and savings (k_{t+1}). A retired household only chooses consumption and savings.

3.1.6 Optimization problem

Households of a working age ($t < R$) The state variables for a working-age household's optimization problem at the beginning of each period are capital ($k_t \in \mathbb{K} = R^+ \cup \{0\}$), health and medical cost shock realized at the end of the last period ($h_{t-1} \in \mathbb{H} = \{0, 1\}$; $x_{t-1}^h \in \mathbb{X} = R^+ \cup \{0\}$), idiosyncratic labor productivity $\left(z_t^h \in \mathbb{Z} = R^+\right)$, ESHI offer status ($g_t \in \mathbb{G} = \{0, 1\}$), and age ($t \in \mathbb{T} = \{1, 2, ..., R-1\}$).

[15] In 2004 85% of the uncompensated care were paid by the government. The major portion was from the disproportionate share hospital (DSH) payment (Kaiser Family Foundation, 2004).

[16] The Medically Needy program also allows insured people with high out-of-pocket medical expenses to be eligible. We rule out this case in our model since we allow only one type of insurance coverage in each period. This is consistent with the way we compute insurance statistics from the data.

The value function of a working-age individual can be written as follows:

$$V_t\left(k_t, h_{t-1}, x_{t-1,}^h z_t^h, g_t\right) = \max_{l_t, i_t} \sum_{h_t, x_t^h} \mathcal{H}_t\left(h_t | h_{t-1}\right) \mathcal{G}_t\left(x_t^h | x_{t-1}^h\right) W_t^{\{l_t, i_t\}}\left(k_t, h_{t-1}, x_{t-1}^h, z_t^h, g_t; h_t, x_t^h\right) \tag{1}$$

where

$$W_t^{\{l_t, i_t\}}\left(k_t, h_{t-1}, x_{t-1}^h, z_t^h, g_t; h_t, x_t^h\right) = \max_{c_t, k_{t+1}} u\left(c_t, l_t, h_t\right) + \beta \zeta_t^h E_t V_{t+1}\left(k_{t+1}, h_t, x_t^h, z_{t+1}^h, g_{t+1}\right) \tag{2}$$

subject to

$$\left(Beq + k_t\right)(1+r) + \widetilde{w} z_t^h l_t + T^{SI} = k_{t+1} + \left(1+\tau_c\right) c_t + Tax + P_t + X_t \tag{3}$$

$$\widetilde{w} = \left\{ \begin{array}{lll} w & ; & \text{if } g_t = 0 \\ (w - c_E) & ; & \text{if } g_t = 1 \end{array} \right\} \tag{4}$$

$$P_t = \begin{cases} 0 & ; \text{ if } i_t \in \{U, M\} \\ p_I\left(h_{t-1}, x_{t-1}^h, t\right) & ; \text{ if } i_t \in \{I\} \\ \overline{p} & ; \text{ if } i_t \in \{G\} \end{cases} \tag{5}$$

$$T_t^{SI} = \max\left(0, \left(1+\tau_c\right) \underline{c} + Tax + P_t + X_t - \left(Beq + k_t\right)(1+r) - \widetilde{w} z_t^h l_t\right) \tag{6}$$

$$Tax = \mathcal{T}\left(y_t\right) + \tau_{MCR}\big(\widetilde{w} z_t^h l_t - \overline{p}\mathbf{1}_{\{i_t = G\}}\big) + \tau_{ss} \min\big(\widetilde{w} z_t^h l_t - \overline{p}\mathbf{1}_{\{i_t = G\}}, \overline{y}_{ss}\big) \tag{7}$$

$$y_t = \max\left(0, k_t r + \widetilde{w} z_t^h l_t - \overline{p}\mathbf{1}_{\{i_t = G\}} - \max\big(0, X_t + p_I\left(h_{t-1}, x_{t-1}^h, t\right) \mathbf{1}_{\{i_t = I\}} - 0.075(k_t r + \widetilde{w} z_t^h l_t)\big)\right) \tag{8}$$

$$X_t = \begin{cases} x_t^h\left(1 - q\left(x_t^h, i_t\right)\right) & \text{if } i_t = \{M, I, G\} \\ x_t^h\left(1 - q\left(x_t^h, M\right)\right) + \max\big(0, k_t r + \widetilde{w} z_t^h l_t - y^{MN}\big) q\left(x_t^h, M\right) & \text{if } i_t = \{U\} \text{ and } i_t^{MN} = 1 \\ x_t^h & \text{if } i_t = \{U\} \text{ and } i_t^{MN} = 0 \end{cases} \tag{9}$$

An individual is eligible for Medicaid if:

$$\begin{array}{ll} k_t r + \widetilde{w}\ z_t^h l_t \leq y^{cat} \text{ and } k_t \leq k^{cat} & \text{for categorical eligibility,} \\ k_t r + \widetilde{w}\ z_t^h l_t - x_t^h \leq y^{MN} \text{ and } k_t \leq k^{MN} & \text{for the Medically Needy program.} \end{array} \tag{10}$$

The conditional expectation on the right-hand side of Eq (2) is over $\left\{z_{t+1}^h, g_{t+1}\right\}$. Eq (3) is the budget constraint. *Beq* is an accidental bequest. In Eq (4), w is wage per effective labor unit. If a household has an ESHI offer, his employer pays part of his insurance premium. We assume that the firm offering ESHI passes the costs of an employer's contribution on its workers by deducting an amount c_E from the wage per effective labor unit, as shown in Eq (4). In Eq (7), the first term is income tax and the last two terms are payroll taxes.[17] Eq (9) describes out-of-pocket medical expense X_t which depends on insurance status. It takes into account that an uninsured person who becomes eligible for the Medically Needy program has to spend down his resources first before public insurance starts paying for his medical expenses.

Retired households For a retired household ($t \geq R$) the state variables are capital (k_t), health (h_t), medical shock $\left(x_t^h\right)$, and age (t).[18] The value function of a retired household is:

$$V_t\left(k_t, h_{t-1}, x_{t-1}^h\right) = \sum_{h_t, x_t} \mathcal{H}_t\left(h_t | h_{t-1}\right) \mathcal{G}_t\left(x_t^h | x_{t-1}^h\right) W_t\left(k_t, h_t, x_t^h\right).$$

where

$$W_t\left(k_t, h_t, x_t^h\right) = \max_{c_t, k_{t+1}} u\left(c, 0, h_t\right) + \beta \zeta_t^h V_{t+1}\left(k_{t+1}, h_t, x_t^h\right) \tag{11}$$

subject to:

$$\left(Beq + k_t\right)(1+r) + ss + T^{SI} = k_{t+1} + \left(1 + \tau_c\right) c_t + \mathcal{T}\left(y_t\right) + p_{MCR} + x_t^h\left(1 - q_{MCR}\left(x_t^h\right)\right) \tag{12}$$

$$T_t^{SI} = \max\left(0, \left(1 + \tau_c\right) \underline{c} + \mathcal{T}\left(y_t\right) + p_{MCR} + x_t^h\left(1 - q_{MCR}\right) - \left(Beq + k_t\right)(1+r) - ss\right) \tag{13}$$

$$y_t = \left(Beq + k_t\right) r + ss - \max\left(0, x_t^h\left(1 - q_{MCR}\right) - 0.075\left(k_t r + ss\right)\right) \tag{14}$$

Distribution of households To simplify the notation, let $\mathbb{S}$ define the space of a household's state variables at the end of each period; $\mathbb{S} = \mathbb{K} \times \mathbb{H} \times \mathbb{X} \times \mathbb{Z} \times \mathbb{G} \times \mathbb{H} \times \mathbb{X} \times \mathbb{T}$ for working-age households and $\mathbb{S} = \mathbb{K} \times \mathbb{H} \times \mathbb{X} \times \mathbb{T}$ for retired households. Let $\mathbf{s} \in \mathbb{S}$, and denote by $\Gamma(\mathbf{s})$ the distribution of households over the state-space.

[17] In practice, employers contribute 50% of Medicare and Social Security taxes. For simplicity, we assume that employees pay 100% of payroll taxes.

[18] The Social Security payments depend on the highest 35 years of earnings. To minimize the number of state variables we allow ss to depend only on the fixed productivity type ξ (see Eq 22). More specifically, ss is determined by multiplying the Social Security replacement ratio by the average lifetime earnings over the highest 35 years of earning of an individual with a particular fixed productivity type. As a result, the fixed productivity type ξ is also part of the state variables for retired households but we omit it from the description of the optimization problem to simplify the notation.

3.2 Production sector

There are two stand-in firms which act competitively. Their production functions are Cobb-Douglas, $AK^{\alpha}L^{1-\alpha}$, where K and L are the aggregate capital and aggregate labor and A is the total factor productivity. The first stand-in firm offers ESHI to its workers but the second one does not. Under competitive behavior, the second firm pays each employee his marginal product of labor. Since capital is freely allocated between the two firms, the Cobb-Douglas production function implies that the capital-labor ratios of both firms are the same. Consequently, we have

$$w = (1-\alpha) AK^{\alpha}L^{-\alpha}, \quad (15)$$

$$r = \alpha AK^{\alpha-1}L^{1-\alpha} - \delta, \quad (16)$$

where δ is the depreciation rate.

The first firm has to partially finance the health insurance premium for its employees. These costs are fully passed on to its employees through a wage reduction. In specifying this wage reduction, we follow Jeske and Kitao (2009) . The first firm subtracts an amount c_E from the marginal product per effective labor unit. The zero profit condition implies

$$c_E = \frac{\psi p \left(\int \mathbf{1}_{\{i_t=G\}}\Gamma(\boldsymbol{s})\right)}{\int l_t z_t^h \mathbf{1}_{\{g_t=1\}}\Gamma(\boldsymbol{s})}. \quad (17)$$

The numerator is the total contributions towards the insurance premiums paid by the first firm. The denominator is the total effective labor in the first firm.

3.3 Insurance sector

Health insurance companies in both private and group markets act competitively but incur administrative costs when issuing an insurance contract. We assume that insurers can observe all state variables that determine the future medical expenses of individuals.[19] This assumption, together with the zero profit conditions, allows us to write insurance premiums as follows:

$$p_I\left(h_{t-1}, x_{t-1}^h, t\right) = \gamma^h EM_t\left(h_{t-1}, x_{t-1}^h\right) + \pi^h \quad (18)$$

for the non-group insurance market and

$$p = \frac{\gamma\left(\int \mathbf{1}_{\{i_t=G\}} EM_t\left(h_{t-1}, x_{t-1}^h\right)\Gamma(\boldsymbol{s})\right)}{\int \mathbf{1}_{\{i_t=G\}}\Gamma(\boldsymbol{s})} \quad (19)$$

[19]Currently most states allow insurance firms to medically underwrite applicants for health insurance.

for the group insurance market. Here, $EM_t\left(h_{t-1}, x^h_{t-1}\right)$ is the expected medical cost to an insurance company for an individual aged t whose last period health condition and medical expense shock are h_{t-1} and x^h_{t-1} respectively:

$$EM_t\left(h_{t-1}, x^h_{t-1}\right) = \sum_{h_t, x^h_t} x^h_t q\left(x^h_t, i_t\right) \mathcal{G}_t(x^h_t | x^h_{t-1}) \mathcal{H}_t\left(h_t | h_{t-1}\right); \quad i_t \in \{I, G\}$$

In Eq (19) γ is a markup on prices due to the administrative costs in the group market. In Eq (18) γ^h is a health-dependent markup in the individual market, whereas π^h is the health-dependent fixed cost of buying an individual policy.[20] The premium in the non-group insurance market is based on the discounted expected medical expenditure of an individual buyer. The premium for group insurance is based on the weighted average of the expected medical costs of those who buy group insurance.

3.4 Government constraint

We assume that the government runs a balanced budget. This implies that

$$\begin{aligned}
&\int_{t<R} \left(\tau_{MCR}\left(\widetilde{w} z^h_t l_t - \overline{p}\mathbf{1}_{\{i_t = G\}}\right) + \tau_{ss} \min\left(\widetilde{w} z^h_t l_t - \overline{p}\mathbf{1}_{\{i_t = G\}}, \overline{y}_{ss}\right)\right) \Gamma\left(\mathbf{s}\right) + \\
&\int \left(\tau_c c_t + \mathcal{T}\left(y_t\right)\right) \Gamma\left(\mathbf{s}\right) + \int_{t \geq R} p_{MCR} \Gamma\left(\mathbf{s}\right) - Gov = \qquad (20) \\
&\int T^{SI} \Gamma\left(\mathbf{s}\right) + \int_{t \geq R} \left(x^h_t q_{MCR} + ss\right) \Gamma\left(\mathbf{s}\right) + \int_{t<R} \left(x^h_t - X_t\right) \mathbf{1}_{\left\{i_t = M \text{ or } (i_t = U \text{ \& } i^{MN}_t = 1)\right\}} \Gamma\left(\mathbf{s}\right)
\end{aligned}$$

The left-hand side is the total tax revenue from all households net of the exogenous government expenditures (*Gov*). The first term on the right-hand side is the cost of guaranteeing the minimum consumption floor for households. The second term is the expenditures on Social Security and Medicare for retired households. The last term is the cost of Medicaid including the Medicaid Needy program for working-age households.

3.5 Definition of stationary competitive equilibrium

Given the government programs $\left\{\underline{c}, ss, q_{MCR}, p_{MCR}, y^{cat}, k^{cat}, y^{MN}, k^{MN}, Gov\right\}$, the fraction of medical costs covered by private insurers and Medicaid $\left\{q\left(x^h_t, i_t\right)\right\}$, and the

[20] The fixed cost captures the difference in overhead costs for individual and group policies. We allow fixed costs and markups to differ by health in order to reflect the fact that unhealthy individuals face additional frictions when buying insurance in the individual market. Alternatively, we can assume that unhealthy people are subject to a persistent pre-existent condition shock and people with this condition are denied insurance coverage in the individual market. This assumption will have similar results as the health-dependent markups: unhealthy people will be induced to self-select into Medicaid. However, the explicit modeling of the pre-existing conditions requires us to introduce an additional state variable.

employers' contribution (ψ), the competitive equilibrium of this economy consists of a set of time-invariant prices $\left\{w, r, p, p_I\left(h_{t-1}, x_{t-1}^h, t\right)\right\}$, wage reduction $\{c_E\}$, households' value functions $\{V_t(\boldsymbol{s})\}$, the decision rules for working-age households $\{k_{t+1}(\boldsymbol{s}), c_t(\boldsymbol{s}), l_t(\mathrm{s}), i_t(\boldsymbol{s})\}$ and retired households $\{c_t(\boldsymbol{s}), k_{t+1}(\boldsymbol{s})\}$ and the tax functions $\{\mathcal{T}(y), \tau_{med}, \tau_{ss}, \tau_c\}$ such that the following conditions are satisfied:

1. Given a set of prices and the tax functions, the decision rules solve the households' optimization problems in Eqs (1) and (11).

2. The bequest is derived from aggregating the assets of deceased households:

$$Beq = \frac{\int (1-\zeta_t^h) k_{t+1} \Gamma(\mathrm{s})}{1+\eta}$$

3. Wage (w) and rent (r) satisfy Eqs (15) and (16), where

$$\begin{aligned} K &= \int k_{t+1} \Gamma(\boldsymbol{s}), \\ L &= \int_{t<R} z_t^h l_t \Gamma(\boldsymbol{s}). \end{aligned}$$

4. c_E satisfies Eq (17), thus the firm offering ESHI earns zero profit.

5. The non-group insurance premiums $p_I\left(h_{t-1}, x_{t-1}^h, t\right)$ satisfy Eq (18), and the group insurance premium satisfies Eq (19), so health insurance companies earn zero profit.

6. The tax functions $\{\mathcal{T}(y), \tau_{MCR}, \tau_{ss}, \tau_c\}$ balance the government budget (20).

4 Data and calibration

We calibrate the model using the Medical Expenditure Panel Survey (MEPS) dataset. The MEPS collects detailed records on demographics, income, medical costs and insurance for a nationally representative sample of households. It consists of two-year overlapping panels and covers the period from 1996 to 2008. For each wave, each person is interviewed five rounds over the two years. We use nine waves of the MEPS (2000-2008). We use the cross-sectional weights and longitudinal weights provided by the MEPS for the cross-sectional and longtitudinal pools correspondingly. Since each wave is a representation of the population in that year, when pooling several years (or waves) together the weight of each individual was divided by the number of years (or waves). We use 2004 as the base year. All level variables were normalized to the base year using the Consumer Price Index (CPI).

4.1 Sample selection

The MEPS links people into one household based on eligibility for coverage under a typical family insurance plan. This Health Insurance Eligibility Unit (HIEU) defined in the MEPS dataset corresponds to our definition of a household. In our sample we include only the heads of the HIEU. We define the head as the person with the highest income in the HIEU.

In our sample we include all household heads who are at least 24 years old and have non-negative labor income (to be defined later). We exclude individuals who report receiving less than $3,000 per year from all possible income sources (labor, financial and other non-financial income including any private or public transfers) since these individuals are likely to have unreported sources of income.

Additionally, we drop 1,513 individuals who report their primary health insurance coverage to be through TriCare, a health insurance for military personnel and military retirees. We drop another 1,968 individuals, due to being younger than 65 years old and receiving Medicare but not receiving disability insurance payments, since Medicare covers non-elderly people only if they are on disability insurance.[21] We exclude an additional 607 individuals who report being covered by unspecified public health insurance (neither Medicaid nor Medicare), since the eligibility rules of these programs are unknown. The resulting sample size for each wave is presented in Table 1. In our sample, among the working-age population with public insurance, 86.05% receive only Medicaid, 10.7% receive both Medicaid and Medicare, and 3.25% receive only Medicare.

year	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08
no. of observations	4,140	8,417	6,184	6,325	6,248	6,069	6,519	4,930

Table 1: Number of observations in our sample in each wave of the MEPS (2000-2008)

4.2 Demographics, preferences and technology

In the model, agents are born at age 25 and can live to a maximum age of 99. Since the model period is one year the maximum lifespan N is 75. Agents retire at the age of 65, so R is 41. The population growth rate was set to 1.1% to match the fraction of people older than 65 in the data.

In the MEPS a person's self-reported health status is coded as 1 for excellent, 2 for very good, 3 for good, 4 for fair and 5 for poor. We define a person in bad health if his

[21] There are several exceptions from this rule. For example, individuals with end stage renal disease can obtain Medicare without being enrolled in the disability insurance program. However, these exceptions are relatively rare so this inconsistency is possibly due to misreporting.

average health score over that year is greater than 3. To construct the age-dependent health transition matrix, we start by computing the transition matrices for ages 30, 40,...70. In each case we use a sample in a 10-year age bracket. For example, to construct the transition matrix for age 40 we pool individuals aged 35-44. Then we construct the health transition matrix for all the remaining ages by using the polynomial degree two approximation. Figure (2) compares the fraction of the unhealthy in our model with the one observed in the data.

To adjust conditional survival probabilities ζ_t^h for the difference in health we follow Attanasio et al. (2011). In particular, we use the Health and Retirement Survey (HRS) to estimate the difference in survival probabilities for people in different health categories and use it to adjust the male life tables from the Social Security Administration. Appendix C explains in more detail how we adjust the survival probability.

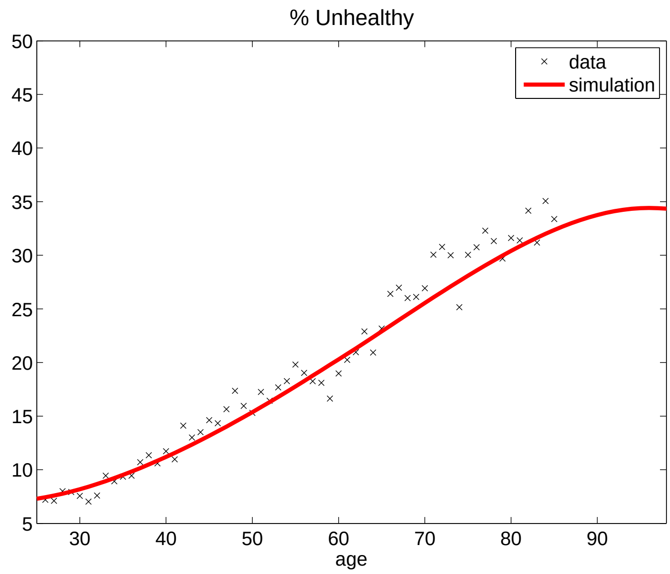


Figure 2: Fraction of the unhealthy by age

We set the consumption share in the utility function χ to 0.6 which is within the range estimated by French (2005).[22] The parameter σ is set to 3.35 in order to match the age profile of the fraction of people with individual insurance. This corresponds to the risk-aversion over consumption equal to 2.41.[23] The discount factor β is set to 0.9996 to match the aggregate capital output ratio of 2.7.[24] We set the labor supply of those who choose to work ($\bar{l}$) to 0.4

Fixed leisure costs of work ϕ_w are calibrated to match the employment profiles for

[22] Given that we have indivisible labor supply we cannot pin down this parameter using a moment in the data.

[23] The relative risk aversion over consumption is given by $-cu_{cc}/u_c = 1 - \chi(1-\sigma)$.

[24] From 2001 to 2011 the ratio of private fixed assets plus consumer durable to GDP ranged from 2.52 to 2.78 (Bureau of Economic Analysis).

healthy people.[25] The loss of time due to bad health ϕ_t^{UH} was calibrated to match the employment profile among the unhealthy.

The Cobb-Douglas function parameter α is set at 0.33, which corresponds to the capital income share in the US. The annual depreciation rate δ is calibrated to achieve an interest rate of 4% in the baseline economy. The total factor productivity A is set such that the total output equals one in the baseline model.

4.3 Government

In specifying the tax function $\mathcal{T}(y)$ we use a nonlinear functional form as specified by Gouveia and Strauss (1994), together with a linear income tax τ_y:

$$\mathcal{T}(y) = a_0 \left[y - \left(y^{-a_1} + a_2 \right)^{-1/a_1} \right] + \tau_y y$$

The first term captures progressive income tax and is commonly used in the quantitative macroeconomic literature (for example, Conesa and Krueger, 2006; Jeske and Kitao, 2009). In this functional form a_0 controls the marginal tax rate faced by the highest income group, a_1 determines the curvature of marginal taxes, and a_2 is a scaling parameter. We set a_0 and a_1 to 0.258 and 0.768 correspondingly, as in Gouveia and Strauss (1994). The parameter a_2 is used to balance the government budget in the baseline economy. We set proportional income tax τ_y to 6.77% to match the fact that around 65% of tax revenues comes from progressive income taxes. In all experimental cases we adjust the proportional tax τ_y to balance the government budget.

When calibrating the consumption minimum floor $\underline{c}$, we use the fact that this safety net has an important impact on labor supply decisions especially for the unhealthy and for people with low productivity. We set the minimum consumption floor to \$2,615 to match the employment rate among Medicaid beneficiaries.[26] This number is in line with other estimates based on the life-cycle model with medical expenses (see De Nardi et al., 2010). The Social Security replacement rate is set to 35%.

The income eligibility threshold for the general Medicaid program (y^{cat}) is set to 79.2% of FPL and its asset test is set to \$35,000 to match the life-cycle profile of the fraction of people covered by public health insurance. The income eligibility threshold for the Medically Needy program (y^{MN}) is set to be the same as the threshold for the

[25] We define a person as employed if he works at least 520 hours per year, earns at least \$2678 per year in base year dollars (this corresponds to working at least 10 hours per week and earning a minimum wage of \$5.15 per hour), and does not report having being retired or receiving Social Security benefits.

[26] The minimum consumption floor also affects the asset accumulation among poor people. Our model captures well the left tail of the wealth distribution. Among people aged 25-64 in our model, the fraction of people with zero assets, assets below \$2,000, \$5,000, \$10,000, \$20,000 are 7.6%, 11.8%, 16.9%, 21.5%, and 30.4% correspondingly. The same fractions in the data are 9.5%, 12.8%, 16.9%, 21.1%, and 27.1% respectively (Survey of Consumer Finance, 2001-2007).

general Medicaid program (y^{cat}), and the asset test for the Medically Needy program is taken from the data and is set to $2,000. This number is equal to the median asset test in 2009 in the states that have the Medically Needy program.[27]

The Medicare, Social Security and consumption tax rates were set to 2.9%, 12.4% and 5.67% correspondingly. The maximum taxable income for Social Security ($\overline{y}_{ss}$) is set to $84,900. The fraction of exogenous government expenses in GDP is 18%.

4.4 Insurance status

In the MEPS the question about the source of insurance coverage is asked retrospectively for each month of the year. We define a person as having employer-based insurance if he reports having ESHI for at least eight months during the year (variables PEGJA-PEGDE). The same criterion is used when defining a person as having individual insurance (variables PRIJA-PRIDE). For those few individuals who switch sources of private coverage during a year, we use the following definition of insurance status. If a person has both ESHI and individual insurance in one year, and each coverage lasts for eight months or less, but the total duration of coverage lasts for more than eight months, we classify this person as individually insured.[28] We define individuals who are not covered by private insurance as publicly insured if they report having public insurance (variables PUBJA-PUBDE) for at least one month.[29]

4.5 Medical expenditures and insurance coverage

Medical costs in our model correspond to the total paid medical expenditures in the MEPS dataset (variable TOTEXP). These include not only out-of-pocket medical expenses but also the costs covered by insurers. In our calibration medical expense shock is approximated by a 3-state discrete health- and age-dependent Markov process. For each age and health, these three states correspond to the average medical expenses of three groups: those with medical expenses below 50th, 50th to 95th, and above 95th percentiles respectively. To construct the transition matrix we measure the fraction of people who move from one bin to another between two consecutive years separately for people of working age (25-64) and for retirees (older than 64).

[27] We do not take the asset test for the general Medicaid program from the data because it significantly varies by state (some states do not have asset test and some states have a tight asset test). In contrast, the asset test for the Medically Needy program does not vary much by state. The goal of our calibration strategy is to capture the overall restrictiveness of the Medicaid eligibility and to reproduce the life-cycle profile of the enrollment in the program.

[28] The results do not significantly change if we change the cutoff point to 6 or 12 months.

[29] We classify individuals as publicly insured based on a shorter coverage period than private insurance because of the Medically Needy program.

We use MEPS to estimate the fraction of medical expenses covered by insurance policies $q(x_t, i_t)$. For retired households we set q to 0.5. In our model, the total medical expenses paid for by the Medicare program for people who are older than 64 amounts to 2.5% of GDP, comparing to 2.2% in the data (National Health Expenditure Data, 2004). More details on the estimation of medical shock process and the fraction of medical expenses covered by insurance are available in Appendix D.

4.6 Insurance sector

The share of health insurance premium paid by the firm (ψ) is set to 80% which is in the range of empirical employer's contribution rates (Kaiser Family Foundation, 2009). We set the proportional load for individual insurance policies (γ^h) to 1.079 for the healthy and 1.135 for the unhealthy. The fixed costs for an individual policy π_h is set to zero for the healthy and to $790 for the unhealthy. The fixed costs and proportional loads are set to match the life-cycle profile of individual insurance coverage among the healthy and the unhealthy. We set the proportional load of group insurance to be the same as the load of the healthy in the individual insurance market ($\gamma = \gamma^h$).

4.7 ESHI offer rate

We assume that probability of getting an offer of ESHI coverage is a logistic function:

$$Prob_t = \frac{\exp(u_t)}{1 + \exp(u_t)},$$

where the variable u_t is an odds ratio that takes the following form:

$$u_t = \eta_{0,t} + \eta_{1,t}\mathbf{1}_{\{h_{t-1}=0\}} + \eta_{2,t}\log(inc_t\ ) + \eta_{3,t}\log(inc_t\ )\mathbf{1}_{\{h_{t-1}=0\}} + \eta_4\mathbf{1}_{\{g_{t-1}=1\}}\mathbf{1}_{\{t>25\}} \quad (21)$$

Here $\eta_{0,t}, \eta_{1,t}, \eta_{2,t}, \eta_{3,t}$ are age-dependent coefficients, and inc_t is individual labor income. This specification allows for a positive relationship between labor income and opportunity to be covered by ESHI, as observed in the data. We include dummy coefficients for bad health to capture the lower opportunity to access ESHI for the unhealthy.

In general, it is possible to estimate Eq (21) directly from the data since in the MEPS the same person is observed for two years consecutively. However, there might be a selection bias problem because people with an ESHI offer are more likely to work than those without an ESHI offer.[30] Thus, a direct estimation from the data is likely to overstate the opportunity to get an ESHI offer among groups with low labor force

[30] See French and Jones (2011) for an investigation of the effect of the employer-based health insurance on decisions to work.

participation, such as the unhealthy or people at pre-retirement ages. To avoid this problem, we estimate this equation inside the model together with the labor income. This procedure is described in more detail in the following subsection.

4.8 Labor income

The productivity of individuals takes the following form:

$$z_t^h = \lambda_t^h \exp(v_t) \exp(\xi) \tag{22}$$

where λ_t^h is the deterministic function of age and health. The stochastic component of productivity consists of the persistent shock v_t and a fixed productivity type ξ:

$$v_t = \rho v_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_\varepsilon^2) \tag{23}$$

$$\xi \sim N(0, \sigma_\xi^2)$$

For the persistent shock v_t we set ρ to 0.98 and σ_ε^2 to 0.02 following the incomplete market literature (Storesletten et al, 2004; Hubbard et al, 1994; French, 2005). We set the variance of the fixed productivity type (σ_ξ^2) to 0.242, as in Storesletten et al (2004). In our computation we discretize v_t and ξ using the method in Floden (2008).[31] To construct the distribution of newborn individuals, we draw v_1 in Eq.(23) from $N(0, 0.352^2)$ distribution following Heathcote et al. (2010).

To estimate the deterministic part of productivity λ_t^h, we need to take into account the fact that in the data we only observe labor income of workers and we do not know the potential labor income of non-workers. In addition, as was mentioned in the previous subsection, people with an ESHI offer are more likely to work than people without an ESHI offer. To avoid the selection bias we adapt the method developed by French (2005). We start by estimating the labor income profiles from the MEPS dataset separately for all workers and for workers without ESHI coverage.[32] Then we guess λ_t^h in Eq.(22) and the coefficients $\eta_{0,t}, \eta_{1,t}, \eta_{2,t}, \eta_{3,t}, \eta_4$ in Eq.(21). Next, we feed the resulting productivity and the ESHI offer probability into our model. After solving and simulating the model we compute the average labor income profile of all workers and workers without ESHI as well as the ESHI coverage profile in our model and compare them with the profiles from the data. Then we update our guesses and reiterate until i) the labor income profiles generated by our model are the same as in the data for all workers as well as for workers

[31] We use 9 gridpoints for v_t and 2 gridpoints for ξ. The grid of v_t is expanding over ages to capture the increasing cross-sectional variance. Our discretized process for v_t generates the autocorrelation of 0.98 and the innovation variance of 0.0175.

[32] Household labor income is defined as the sum of wages (variable WAGEP) and 75% of the income from business (variable BUSNP).

not covered by ESHI for each health group; ii) the profiles of ESHI coverage in the model are the same as in the data for each health group, iii) the probability of being insured by ESHI in the current period conditioning on being insured by ESHI in the previous period is the same in the model and in the data.[33] The advantage of this approach is that we can reconstruct the productivity and the opportunity to access ESHI for individuals *whom we do not observe working in the data*, most of whom are Medicaid enrollees.

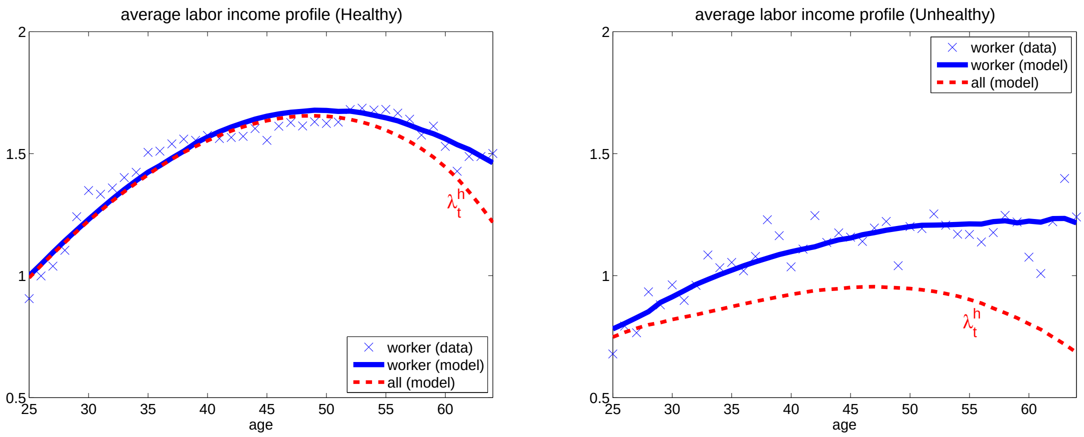


Figure 3: Average labor income of workers (data and model), and of everyone (model). The latter profile takes into account the unobserved productivity of those people who do not work.

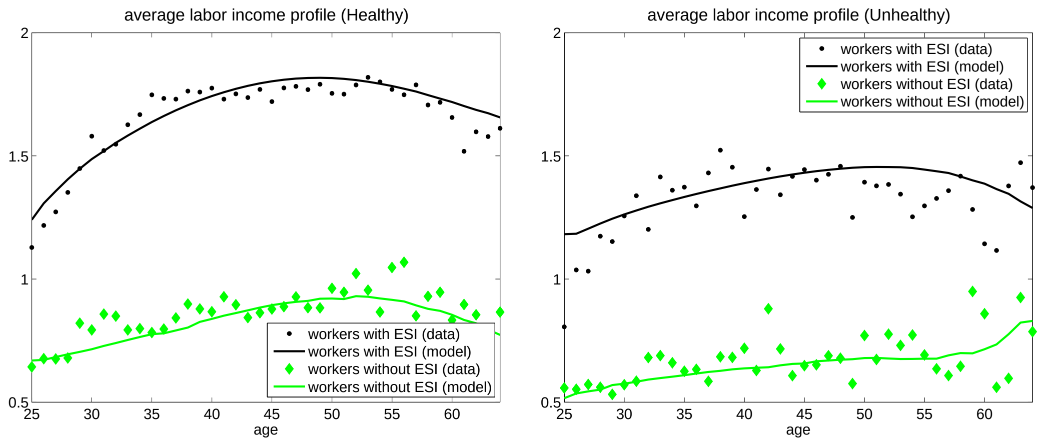


Figure 4: Average labor income of workers with and without ESHI coverage (data and model).

Figure (3) plots the labor income profiles of all *workers* observed in the data and simulated by the model, and compares them with the average potential labor income

[33]Based on our experiments, for a given set of model parameters there seems to be a unique set of coefficients defining λ_t^h and u_t that can match the profiles in the data. French (2005) provides a discussion of identification of λ_t^h. The identification of u_t is straightforward given that the ESHI take-up rate is 96% in the data (and 99% in our model). The coefficients $\eta_{0,t}, \eta_{1,t}, \eta_{2,t}$ and $\eta_{3,t}$ are pinned down by the profiles of ESHI coverage and the labor income profiles of workers without ESHI, η_4 is used to match the persistence of ESHI coverage.

computed for *everyone* in the model.[34] The latter profile takes into account the unobserved productivity of those people who do not work. The average labor income of workers is higher than the average labor income that includes potential income of non-workers because people with low productivity tend to drop out from the employment pool. Our estimates also show that unhealthy people are inherently less productive. The drop in productivity due to bad health depends on age but it can be as high as 40%.

Figure (4) compares the average labor income among workers with and without ESHI coverage by health. Our model can capture well the empirical fact that people who are not covered by ESHI have much lower income than those who have ESHI coverage. In addition, our calibration strategy captures the positive effect of the availability of ESHI on the probability to work, which is especially strong for low-income individuals. In particular, 24.3% of workers with labor income below 100% FPL and 45.9% of workers with labor income in the range 100-200% FPL receive an ESHI offer. In contrast, among non-workers with the same potential labor income only 7.7% and 11.6% respectively will receive an ESHI offer if they all choose to work.

The model parametrization is summarized in Table 12 in Appendix A.

5 Baseline model performance

	Data	Baseline model
by health status		
all	94.8	95.5
healthy	78.8	78.7
unhealthy	97.1	97.9
by insurance		
private insurance	98.1	99.3
uninsurance	94.5	96.1
public insurance	53.0	53.3

Table 2: Fraction of workers (data vs baseline model)

	Data				Baseline model			
	ESHI	individual	uninsured	public	ESHI	individual	uninsured	public
all	65.7	8.8	19.1	6.4	65.4	8.4	19.2	7.0
healthy	68.8	8.8	18.3	4.1	68.3	8.4	18.3	5.0
unhealthy	46.0	9.3	23.6	21.1	45.5	8.7	24.9	21.0
% unhealthy by insurance	9.1	13.8	16.3	43.7	8.9	13.2	16.6	38.0

Table 3: Insurance coverage (data vs baseline model)

[34] To obtain the age profile of labor income among workers (and workers without ESHI) in Figures (3) and (4) we regress labor income of workers (and workers without ESHI) on dummy variables of age and year, separately for the healthy and for the unhealthy. The average labor income of each age is the resulting coefficient on the dummy variable of the corresponding age.

Tables 2 and 3 compare the fraction of workers and the aggregate health insurance statistics generated by the model with those observed in the data. Our model closely tracks all the aggregate statistics including the fraction of the unhealthy in different insurance categories. In addition, our calibration strategy allows the model to match the targeted age profiles of employment by health (top panel of Figure (5)), and the targeted insurance coverage by health (Figures (6)-(7)). The bottom panel of Figure (5) shows the fraction of workers among people with different health insurance types, including the fraction of workers among healthy and unhealthy Medicaid enrollees. These profiles are not targeted in our calibration but our model can closely replicate them.

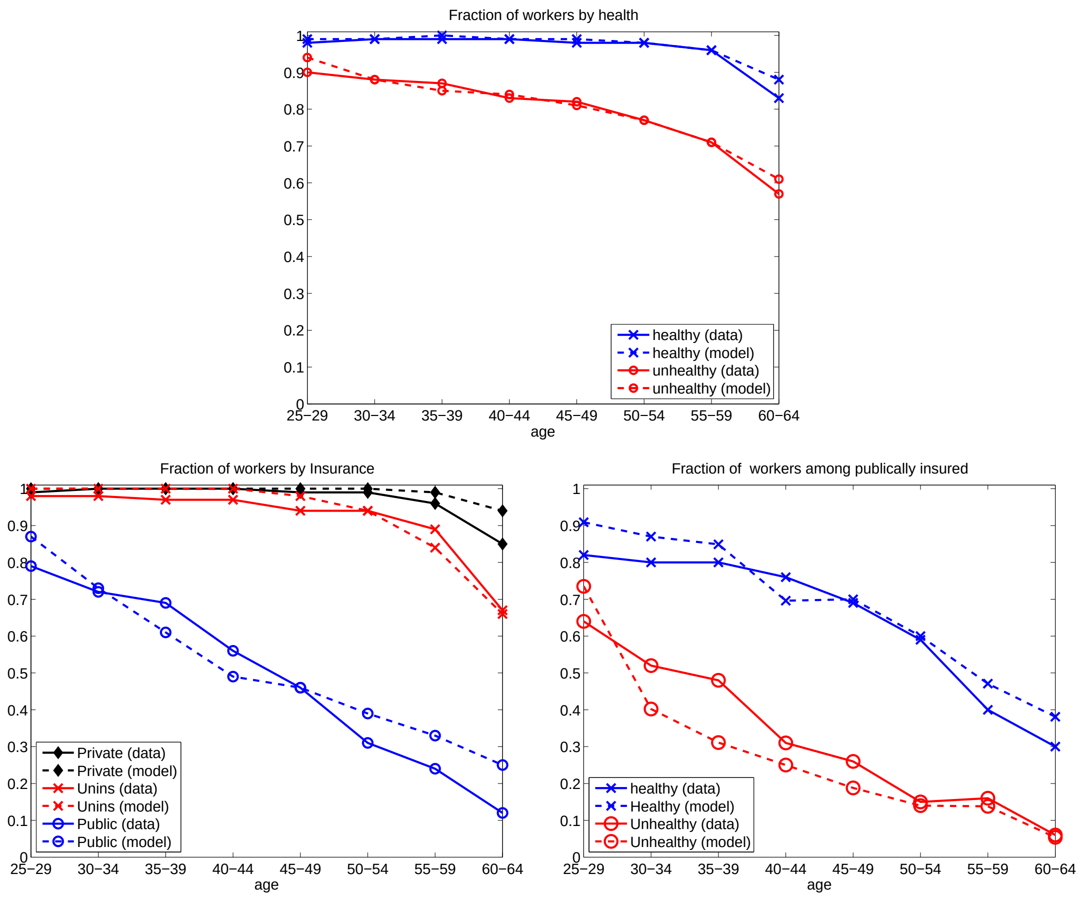


Figure 5: Employment profile (data vs baseline model). Top panel: employment by health. Bottom left panel: employment by insurance status. Bottom right panel: employment by health among those with public insurance

Note that our quantitative analysis in the next section depends on the extensive margin elasticity of labor supply in our model. To calculate the elasticity, we compute the percentage change in the fraction of workers in response to a one percent permanent increase in labor productivity in the partial equilibrium environment. The resulting extensive margin elasticity is 0.18 for the entire working-age population with unhealthy

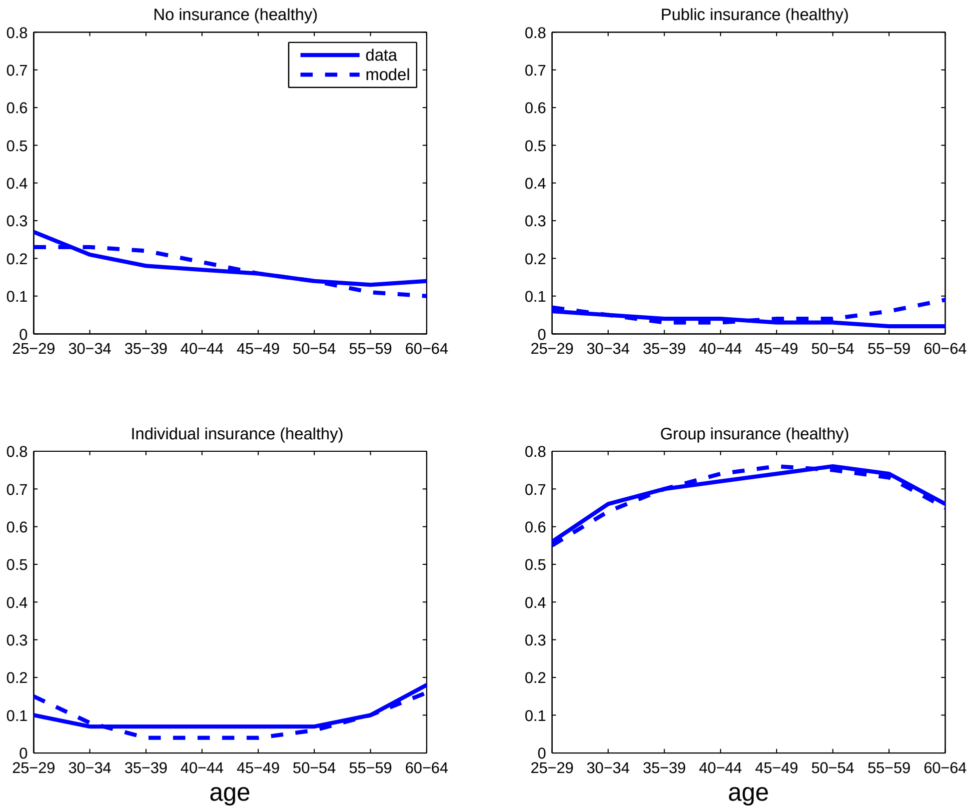


Figure 6: Insurance status among the healthy (data vs baseline model))

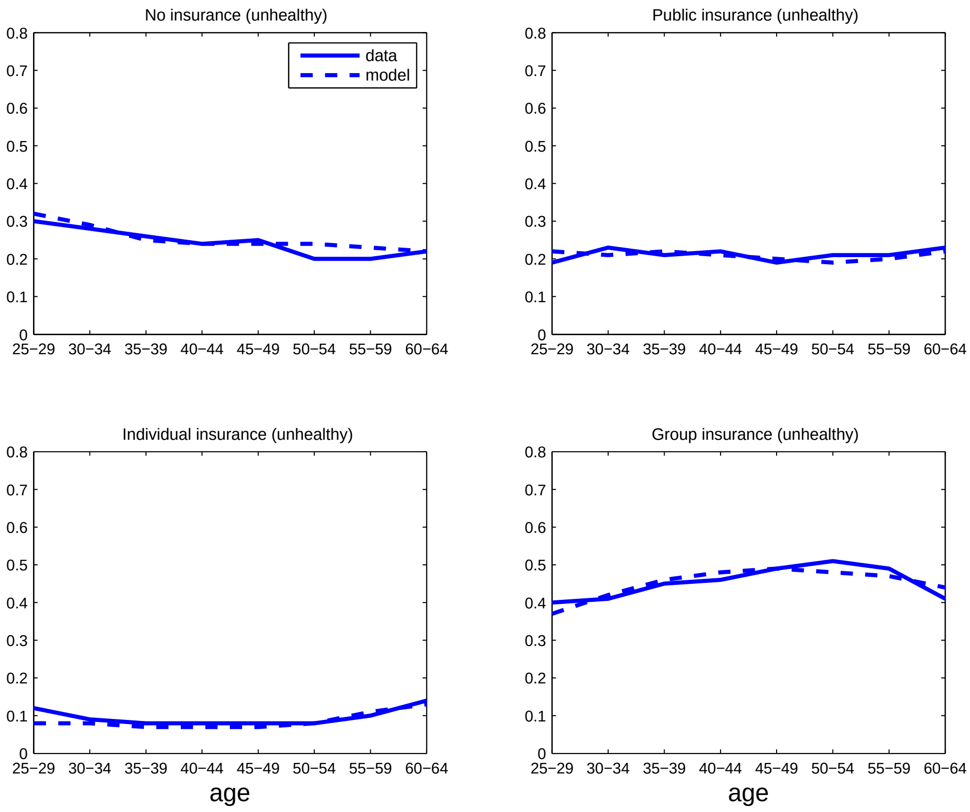


Figure 7: Insurance status among the unhealthy (data vs baseline model))

people demonstrating higher elasticity than the healthy: 0.36 for the former group compared with 0.16 for the latter. Our elasticities are in line with estimates in the empirical literature: quasi-experimental studies usually find that elasticities for different subgroups of population lie within the range of 0.13-0.43.[35]

6 Results

6.1 Characteristics of non-working Medicaid beneficiaries

To understand if the Medicaid program significantly distorts labor supply decisions we start by analyzing the productivity of those Medicaid enrollees who do not work. Using our estimates of the unobserved productivity among non-workers we can measure the fraction of Medicaid beneficiaries whose potential labor income is above the income test limit, i.e. if these people work they will lose Medicaid eligibility. The second row of Table 4 shows that 22% of *all* Medicaid beneficiaries will lose eligibility if they start working, and this constitutes around 47% of *non-working* Medicaid beneficiaries. Figure (8) plots age profiles of the fraction of non-working Medicaid enrollees (solid line) and non-working enrollees with potential income above the income test limit (dashed line) for each health status. Two observations can be made from Figure (8) and Table 4. First, the fraction of Medicaid beneficiaries who can keep eligibility only while not working increases quickly with age: for the unhealthy it goes up from 5.7% for the 25-29 age group to around 50% among the over 40 age group. Second, the fraction of people whose potential income is above the income test limit is noticeably higher among the unhealthy: while only 10.5% of healthy enrollees will lose their eligibility if they start working, this figure is 40.8% among the unhealthy.

	% of all enrollees	% of healthy enrollees	% of unhealthy enrollees
non-workers (baseline)	47.0	29.5	74.7
enrollees losing eligibility if working	22.0	10.5	40.8
non-workers $\Rightarrow$ workers if not losing eligibility	20.3	9.8	37.4

Table 4: Decomposition of Medicaid beneficiaries

Given that a substantial fraction of Medicaid beneficiaries will lose eligibility if they work, an important question is whether Medicaid actually induced them to stop work-

[35]See Chetty et al (2012) for an extensive review and discussion about the empirical estimates of extensive margin elasticity.

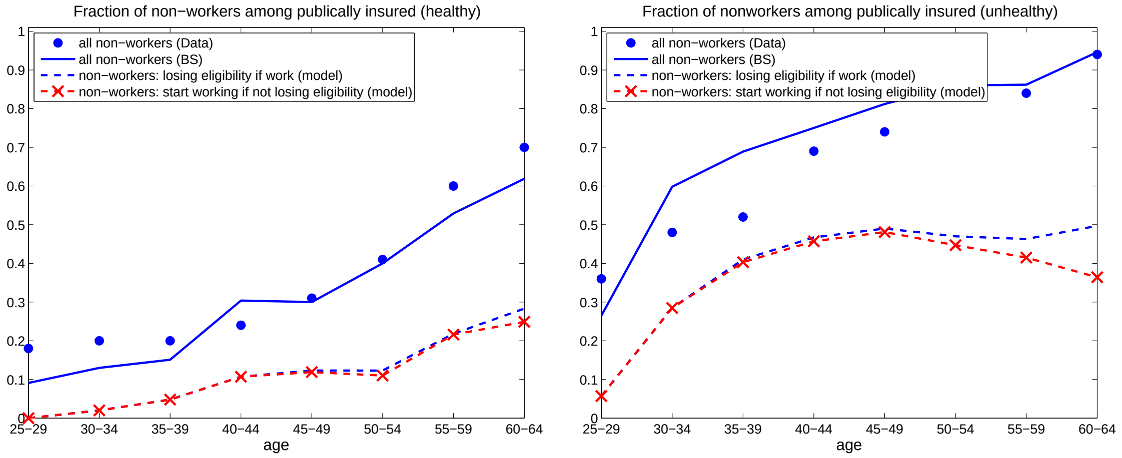


Figure 8: Decomposition of non-workers among Medicaid beneficiaries. The solid lines (dots) are the fraction of non-workers among Medicaid beneficiaries in the baseline model (in the data). The dashed lines are the fraction of Medicaid beneficiaries who will lose eligibility if they start working. In the bottom panel the dashed lines with crosses show the fraction of non-workers who will choose to work if they can keep their current Medicaid eligibility.

ing. On the one hand, these people are mostly unhealthy, so they value access to free insurance.[36] On the other hand, unhealthy people incur higher disutility from work; so they may decide to leave the employment even if there is no Medicaid. To understand to what extent the decision not to work of people with relatively high productivity is affected by Medicaid, we run the following experiment. We consider a partial equilibrium environment where we allow people who are currently on Medicaid to keep their eligibility for one period regardless of their income. In other words, people who are enrolled in Medicaid in the baseline economy become "vested" for one period - they cannot lose their eligibility even if their income exceeds the income test. The change in the labor supply behavior of Medicaid enrollees in this experiment allows us to evaluate to what extent the possibility of losing Medicaid eligibility affects their decisions in the baseline case.

The last row of Table 4 shows that more than 90% of non-working enrollees with potential income above the income test limit (or 20.3% of *all* Medicaid enrollees) will choose to work in this experiment.[37] The crossed dashed line in the bottom panel of

[36]In our model, only 1.3% of unhealthy non-working Medicaid enrollees would get an ESHI offer if they choose to work. This number is 15.5% for healthy non-working Medicaid enrollees.

[37]Our results suggest that the size of the moral hazard problem in Medicaid is around 20%: this is the percentage of people who are not supposed to be insured but they get insurance because of the asymmetric information. One can compare this number with the size of the moral hazard problem in the disability insurance program. Even though the disability insurance program is different from Medicaid, it also suffers from the problem of asymmetric information, since disability status is unobservable. Studies of the disability insurance program find that from 20 to 50% of people receiving disability benefits are not truly work-limited (see, for example, Nagi, 1969, Benitez-Silva et al, 2006, Low and Pistaferri, 2012).

Figure (8) shows how this number varies by age and health.

To better understand the difference between Medicaid beneficiaries who stop working in order to gain eligibility and the other Medicaid beneficiaries, Table 5 compares their medical expenses, potential labor income and assets. The average medical expenses of people who choose not to work in order to become eligible for Medicaid are noticeably higher than the average medical expenses of the rest of Medicaid beneficiaries ($7,578 vs. $5,136). At the same time, the former group is significantly more productive - their potential labor income is around 50% higher than the potential labor income of the latter group. Importantly, the group of beneficiaries who do not work in order to meet the eligibility criteria, on average, holds much more assets than the rest of Medicaid beneficiaries ($18,523 vs. $2,378). As a result, the former group is better self-insured: the average share of their medical expenses in total potential resources (assets plus potential labor income) is much lower than this share for the rest of Medicaid beneficiaries (32.8% vs. 65.1%). To sum up, Medicaid beneficiaries who do not work to get access to public insurance are mostly unhealthy people above middle age with high medical expenses but who have relatively high potential labor income and more assets compared with other Medicaid enrollees.

	medical expenses	potential earning	asset	$\frac{\text{medical expense}}{\text{potential cash-on-hand}}$
non-workers ⇒ workers if not losing eligibility	$7,578	$10,604	$18,523	32.8%
other Medicaid beneficiaries	$5,136	$7,133	$2,378	65.1%
all Medicaid	$5,634	$7,838	$5,659	58.5%

Table 5: Medicaid enrollees who would work if they can keep Medicaid eligibility vs. other Medicaid enrollees

6.2 Welfare effects

The previous section shows that Medicaid substantially distorts labor supply decisions especially among older and unhealthy people. These distortions can negatively affect welfare for several reasons. First, some people with relatively high productivity do not work. Second, some people receiving public transfers have good opportunities to self-insure. At the same time, the size of public transfers received by this group is large because of their high medical expenses. This section evaluates the welfare costs of these distortions. An important observation is that the labor supply distortions happen because Medicaid eligibility depends on labor income which is endogenous. People who want to obtain public insurance but whose labor income is too high have the option to stop working. This type of behavior can be eliminated if Medicaid eligibility is based on exogenous productivity. Thus, to evaluate welfare effects of the distortions we modify the Medicaid eligibility as follows:

$$\begin{aligned} &k_t r + \widetilde{w}\ z_t^h \bar{l} \leq y^{cat} \text{ and } k_t \leq k^{cat} && \text{for categorical eligibility,} \\ &k_t r + \widetilde{w}\ z_t^h \bar{l} - x_t^h \leq y^{MN} \text{ and } k_t \leq k^{MN} && \text{for the Medically Needy program.} \end{aligned} \tag{24}$$

Thus, Medicaid eligibility depends on the *potential* labor income of an individual but not on his *current* labor income. This means that even if an individual has zero labor income because he does not work, he will not be eligible if his productivity allows him to earn more than the income test limit. To be consistent, we also set eligibility for the Medically Needy program based on the potential labor income. We refer to this experiment as the *observable* productivity case and it will be a benchmark for our policy discussions in the next section.

To evaluate welfare effects from implementing this new eligibility criteria we maintain the total budget of the government transfers as in the baseline. To do this, we adjust the income eligibility thresholds $\widetilde{y}^{cat}$ and $\widetilde{y}^{MN}$ until the total spending on Medicaid and the minimum consumption guarantee for the working age population in the experimental case is the same as in the baseline economy. This way our welfare analysis measures welfare effects from removing distortions and reallocating the fixed public transfers rather than changing the size of the redistribution in the economy.[38]

	Baseline	Observable productivity
Income test: y^{cat}, y^{MN} (%FPL)	79.2%	100.5%
Income tax: τ_y	6.77%	6.57%
Employment rate (%)		
all	95.5	97.2
healthy	97.9	98.7
unhealthy	78.7	86.9
%Δ aggregate labor productivity	–	0.49
%Δ aggregate capital	–	0.75
%Δ aggregate output	–	0.58
Ex-ante consumption equivalent (%)	–	1.51

Table 6: The effects of removing Medicaid distortions on labor supply

[38]Since households change their labor supply and saving decisions, we also slightly adjust the proportional income tax τ_y to balance the government budget. In Appendix E we consider an alternative setup where, instead of adjusting the income eligibility threshold to maintain the size of the public transfers program, we only adjust τ_y to balance the government budget. The qualitative conclusions in this case stay the same.

	Baseline				observable productivity			
	ESHI	individual	uninsured	public	ESHI	individual	uninsured	public
all	65.4	8.4	19.2	7.1	64.6	7.7	18.3	9.4
healthy	68.3	8.4	18.3	5.0	67.5	7.9	17.2	7.9
unhealthy	45.5	8.7	24.9	21.0	45.3	9.5	26.0	19.3

Table 7: Change in insurance coverage

Tables 6 and 7 compare an economy where eligibility is based on productivity with the baseline. After implementing the new eligibility criteria, non-workers with relatively high potential labor income can no longer enroll in the Medicaid program. Given that many of these people have relatively high medical expenses, this significantly decreases Medicaid spending. To maintain the same level of public transfers, this free-up budget is used to cover more people with truly low productivity: the income test goes up from 79.2% to 100.5% of FPL and the percentage of people enrolled in Medicaid increases from 7.1% to 9.4%.

To measure welfare in this experiment, we use an ex-ante consumption equivalence that captures long-run welfare gains.[39] Eliminating the labor supply distortions results in sizeable welfare gains: a newborn individual in the baseline economy is willing to give up 1.51% of his annual consumption every period in order to be born in the economy where productivity is observable. Note that the increase in labor supply of people who lose eligibility only has a marginal contribution to these welfare gains. Even though the employment among the unhealthy increases from 78.7% to 86.9%, the aggregate labor productivity, aggregate employment, aggregate output and capital only slightly increase. Most of the welfare gains come from the more efficient use of Medicaid spending. As shown in the previous subsection, people who lose eligibility if their potential labor income is observable are relatively well self-insured due to high earning capacity and the ability to accumulate relatively high assets. On the other hand, the new enrollees have fewer opportunities to self-insure, and private insurance premiums and medical costs constitute a large fraction of their resources. Thus, reallocating public transfers from the former group to the latter improves welfare.[40]

[39]The ex-ante welfare criteria is commonly used in the NDPF literature. Let V^B and V^E denote the value function of a newborn in the baseline and the experimental economy correspondingly. The welfare gains x can be defined as:

$$x = 100 * \left[1 - \left(\frac{V^B}{V^E}\right)^{\frac{1}{\chi(1-\sigma)}}\right]$$

The resulting number represents the percentage of the annual consumption a newborn in the experimental economy is willing to give up in order to be indifferent between the baseline and experimental economies. The positive number implies welfare gains.

[40]In Appendix E we show that in the alternative setup when we only adjust τ_y the welfare gains are equal to 0.32% of the annual consumption. The gains are smaller because the savings from withdrawing public transfers from people with high potential income are allocated to the whole population in terms of reduced taxes as opposed to the relatively poor people in the benchmark case.

7 Policy discussion

The previous section shows that if productivity is observable Medicaid can provide insurance to people with truly low productivity without distorting incentives and this can substantially improve welfare. An important question is how to improve the trade-off between insurance and incentives in an environment where productivity is unobservable. The efficient provision of insurance in dynamic economies with private information has been extensively studied by the New Dynamic Public Finance literature. One important result from this literature is that in order to correct the incentive problem when stochastic productivity is unobservable, the saving decisions should be distorted. Golosov and Tsyvinski (2006) show that in the case of disability insurance, the optimal wedge on savings can be achieved by asset testing. The intuition behind this result is that individuals who falsely claim disability accumulate assets beforehand to smooth their consumption when not working and receiving disability transfers. Asset testing makes this strategy unattractive because able individuals with low assets are better off by working. Medicaid has an insurance-incentives trade-off similar to the disability insurance. It provides transfers to low-income people but it cannot separate truly low-productive individuals from non-workers with high productivity. In this section we explore whether asset testing can be an efficient tool to correct incentives in the case of the Medicaid program.

We start by investigating the effects of changing the existing asset limit in Section 7.1. We show that asset testing creates a trade-off between lower distortions on labor supply and higher saving distortions, which does not allow it to achieve the same welfare gains as the benchmark case of observable productivity. In Section 7.2 we take this analysis one step further by exploring the possibility of using different asset limits for workers and non-workers. We show that this policy is as effective in reducing labor supply distortions as the uniform asset testing but it does not create unnecessary saving distortions. As a result, the welfare gains of this policy are almost equivalent to the benchmark case of observable productivity.

7.1 Asset testing

To understand the role of asset testing in reducing labor supply distortions, we start by considering the effects of the complete asset test removal in two economies: i) with unobservable productivity, ii) with observable productivity. In other words, in the first economy the eligibility for Medicaid is determined according to the following rule:

$$k_t r + \widetilde{w}\ z_t^h l_t \leq y^{cat} \qquad \text{for categorical eligibility,}$$
$$k_t r + \widetilde{w}\ z_t^h l_t - x_t^h \leq y^{MN} \text{ and } k_t \leq k^{MN} \qquad \text{for the Medically Needy program;}$$

while in the second economy the eligibility criteria looks as follows:

$$k_t r + \widetilde{w}\ z_t^h \bar{l} \leq y^{cat} \qquad \text{for categorical eligibility,}$$
$$k_t r + \widetilde{w}\ z_t^h \bar{l} - x_t^h \leq y^{MN} \text{ and } k_t \leq k^{MN} \qquad \text{for the Medically Needy program.}$$

In both cases we keep the asset test for the Medically Needy program as in the baseline to maintain the role of this program as an ex-post insurance for impoverished people with no resources to pay for their medical costs. As in the previous section we fix the welfare budget by adjusting the income test (y^{cat} and y^{MN}). The results of these experiments are illustrated in Rows 1 and 3 in Tables 8 and 9.

Removing asset testing has very different effects depending on whether productivity is observable or not. In an economy where productivity is observable, removing asset testing increases welfare gains from 1.51% (the economy with observable productivity and asset testing) to 1.84%. This happens because asset testing creates distortions on saving decisions which are not needed in the full information case. The removal of asset testing increases wealth accumulation among people with low productivity (see Figure (9)).[41] In contrast, if productivity is unobservable, eliminating asset testing leads to welfare losses equivalent to -1.28% of the annual consumption. This happens because the distortions on labor supply created by Medicaid become more severe. More people with relatively high productivity and high medical costs who previously could not enroll in Medicaid because of their high assets now stop working and become eligible for the program. Given their high medical expenses, the strain on public spending increases and since we keep the welfare budget fixed, the income eligibility threshold decreases from 79.2% to 13.1% of FPL. The Medicaid coverage decreases from 7.1% to 5.6% while the fraction of beneficiaries who would start working if they could keep eligibility increases more than three times (to 64.7%). This experiment illustrates the important role that asset testing plays in preventing people who are highly productive and well self-insured from getting free public insurance by not working.

In the next set of experiments we gradually decrease the asset limit in the baseline economy from \$35,000 to \$2,000 to understand if this can reduce the labor supply distortions and move the economy closer to the benchmark case of observable productivity. As before, in each experiment we fix the size of the welfare budget by adjusting the income eligibility threshold for Medicaid. Tables 8 and 9 show the results of the tighter asset testing. Reducing the asset limit from \$35,000 (baseline level) to \$2,000 almost completely eliminates the moral hazard problem: the percentage of Medicaid enrollees who choose not to work in order to get eligibility drops to 0.4%. At the same time, the

[41] Gruber and Yelowitz (1999) also find that asset testing has a sizeable, negative effect on the savings of Medicaid enrollees.

Asset test (k^{CAT})	% enrollees losing eligibility if working	% non-worker⇒worker if not losing eligibility	Ex-ante CEV (%)		
			all	low ξ	high ξ
Productivity is observable					
1. No asset test	–	–	1.845	2.212	0.295
2. $35000	–	–	1.509	1.807	0.251
Productivity is unobservable					
3. No asset test	97.9	64.7	-1.276	-1.488	-0.379
4. $35000 (baseline)	22.0	20.3	–	–	–
5. $25000	12.8	11.8	0.276	0.333	0.036
6. $15000	5.6	5.3	0.708	0.853	0.095
7. $5000	1.3	1.2	0.588	0.710	0.074
8. $2000	0.5	0.4	0.322	0.391	0.033

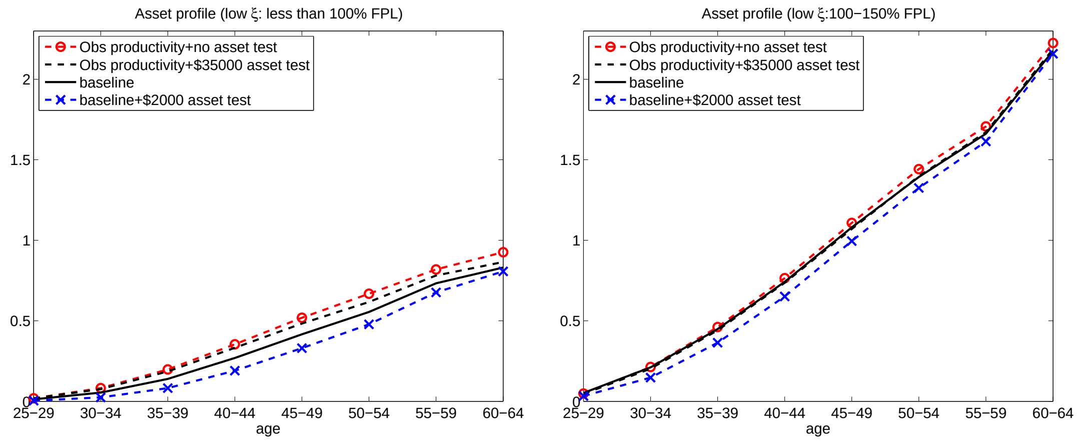
Table 8: Welfare effects of the uniform asset test: The percentage in the second and third columns is among all Medicaid beneficiaries.

Asset test (k^{CAT})	Income Test ($\%FPL$)	employment (%)		insurance (%)			
		unhealthy	healthy	unins	pub	Ind	ESHI
Productivity is observed							
1. No asset test	100.6	86.9	98.7	18.3	9.4	7.7	64.6
2. $35,000	100.5	86.9	98.7	18.3	9.3	7.7	64.7
Productivity is unobserved							
3. No asset test	13.1	74.1	96.2	19.0	5.6	9.5	65.9
4. $35,000 (baseline)	79.2	78.7	97.9	19.2	7.1	8.4	65.4
5. $25,000	84.9	81.0	98.1	18.7	7.9	8.2	65.2
6. $15,000	92.7	83.6	98.4	18.1	8.6	8.4	64.9
7. $5,000	95.8	85.1	98.4	18.0	8.6	8.6	64.9
8. $2,000	93.7	84.2	98.3	19.0	8.3	7.9	64.9

Table 9: Effects of the uniform asset test

employment rate among the unhealthy increases from 78.7% to 84.2%, which is closer to the benchmark economy where productivity is observable (86.9%). However, even though in terms of employment the economy with $2,000 asset limit is close to the benchmark economy with observable productivity, it brings much lower welfare gains: 0.32% of the annual consumption compared with 1.51% in the benchmark economy. This is because the positive effect of eliminating labor supply distortions is partially offset by the negative effect of large saving distortions created by the tight asset test: many low-income people accumulate fewer assets in order to meet the eligibility requirements. The percentage of people with assets below $2,000 increases from 11.8% in the baseline economy to 15.4% in the economy with a very tight asset test. Figure (9) illustrates this point further by showing age profiles of asset holdings for people with low fixed productivity type. For people with total potential labor income below 150% of FPL, the tight asset test results in a noticeable decline in wealth accumulation.

The trade-off between labor supply and saving distortions results in non-linear welfare



(a) Potential labor income: less than %100FPL (b) Potential labor income: %100-%150FPL

Figure 9: Asset profile of people whose fixed productivity (ξ) is low. The solid lines are for the baseline economy. The dashed lines are for the benchmark experiment with observable productivity and $35,000 asset limit, while the dashed lines with circles are for the economy with observable productivity and no asset testing. The solid lines with crosses are for the baseline economy and $2,000 uniform asset testing.

changes when tightening asset testing, as reported in the last three columns of Table 8.[42] The best results in welfare terms are obtained if asset limit is equal to $15,000. In this case the distortions on labor supply are lower compared to the baseline case and the distortions on saving decisions are much smaller than in the case of $2,000 asset limit. As a result, the welfare gains are higher than in both the baseline and in the $2,000 asset limit economy (0.71% of the annual consumption) but still much smaller than in the case of observable productivity.

7.2 Differentiated asset testing

The previous section shows that strict asset testing can eliminate distortions on the labor supply of Medicaid beneficiaries but at a cost of substantially distorting saving decisions. In this section we consider a more flexible asset testing policy which allows asset limits to depend on labor supply decisions. The rationale for this policy is based on the finding in the NDPF literature that one way to reduce the adverse effect of savings on work incentives is to introduce state-dependent wealth taxes (Kocherlakota, 2005, Albanesi and Sleet, 2006). The intuition here is as follows. Highly productive individuals can always mimic low productive individuals by working less. The attractiveness of this strategy increases with asset holding since wealth can substitute for forgone labor income. To make this behavior less attractive, an individual who reports low income should face higher marginal taxes on wealth. In our case individuals with high and

[42]Notice that the non-linear pattern of welfare gains is more pronounced among people with low fixed productivity. Since people in this group are more likely to rely on public health insurance, their saving decisions are affected more by asset testing.

low productivity are observationally identical only when they do not work. Thus, asset testing (which is equivalent to wealth tax) should be stricter for non-workers. In the next set of experiments we allow asset limits to be different for working and non-working Medicaid enrollees.[43] Tables 10 and 11 show the effects of policies that tighten the asset limit for non-workers from \$35,000 (baseline) to \$2,000, while keeping the asset limit for workers unchanged at the baseline level. As before, stricter asset testing is effective in reducing the moral hazard behavior among Medicaid beneficiaries: when asset limit is set to \$2,000, only 0.20% of enrollees would choose to work if they could keep their eligibility. Moreover, the welfare gains of a policy that sets the asset limit for non-workers at \$2,000 is close to welfare gains in the benchmark case of observable productivity (1.42% in the former case vs. 1.51% in the latter). Because the asset limit for workers is unchanged, this policy results in significantly smaller savings distortions compared to the case in which asset testing is tightened for everyone.[44] Thus, by allowing working and non-working Medicaid enrollees to face different asset limits we can achieve almost the same outcome that in the "ideal" case of linking Medicaid eligibility to unobservable productivity.

Asset test (k^{CAT}) for non-workers	% enrollees losing eligibility if working	% non-worker⇒worker if not losing eligibility	Ex-ante CEV (%)		
			all	low ξ	high ξ
1. \$35000 (baseline)	22.0	20.3	–	–	–
2. \$25000	12.3	11.3	0.384	0.462	0.055
3. \$15000	4.6	4.4	1.023	1.228	0.157
4. \$5000	0.7	0.7	1.390	1.661	0.242
5. \$2000	0.2	0.2	1.420	1.697	0.253

Table 10: Welfare effects of tightening asset testing only for non-working enrollees. The percentage in the second and third columns is among all Medicaid beneficiaries. In all experiments the asset limit for working beneficiaries is fixed at \$35,000 as in the baseline.

Asset test (k^{CAT}) for non-workers	Income Test ($\%FPL$)	employment (%)		insurance (%)			
		unhealthy	healthy	unins	pub	Ind	ESHI
1. \$35,000 (baseline)	79.2	78.7	97.9	19.2	7.1	8.4	65.4
2. \$25,000	85.9	81.6	98.5	18.7	7.9	8.1	65.2
3. \$15,000	94.2	85.1	98.7	18.3	8.6	7.9	64.8
4. \$5,000	99.4	88.2	98.7	18.3	8.6	7.8	64.7
5. \$2,000	99.9	88.6	98.8	18.3	8.3	7.8	64.7

Table 11: Effects of tightening asset testing only for non-working enrollees.

[43]In Appendix G we discuss how the differentiated asset testing policy would look if individuals were allowed to adjust their labor supply along the intensive margin.

[44]In Appendix F we show that completely removing asset testing of workers results in welfare gains that are slightly higher and close to the welfare gains in an economy with observable productivity and no asset testing.

8 Conclusion

In this paper we evaluate quantitative importance of the distortions that Medicaid creates for labor supply decisions and discuss policies that can reduce these distortions. The fraction of workers among Medicaid enrollees is two times less than the fraction of workers among the rest of the population, and this difference to a significant extent is accounted for by the design of the public insurance program. Medicaid eligibility depends on endogenous labor income, meaning that people who do not work can become eligible even if their productivity is relatively high. We find that 22% of Medicaid enrollees will lose eligibility if they start working and most of them would choose to work if they could keep public insurance. These distortions result in large welfare losses: if the participation in Medicaid could be based on (unobservable) exogenous productivity the ex-ante gains would be equivalent to 1.5% of the annual consumption. These gains arise from the improved allocation of limited public resources: public transfers get reallocated from non-working Medicaid enrollees with relatively high potential earnings to people with truly low productivity. We show that strict uniform asset testing can eliminate labor supply distortions created by Medicaid but at a cost of distorting saving decisions. In order to achieve an outcome close to the "ideal" case of observable productivity, asset limits should be different for workers and non-workers. This happens because imposing strict asset testing on Medicaid beneficiaries who work is redundant and just distorts their saving decisions.

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Appendix

A Summary of the parametrization of the baseline model

Parameter name	Notation	Value	Source
Parameters set outside the model			
Consumption share	$\varkappa$	0.6	French (2005)
Cobb-Douglas parameter	α	0.33	capital share in output
Labor supply	$\bar{l}$	0.4	
Tax function parameters	a_0	0.258	Gouveia and Strauss (1994)
	a_1	0.768	"
Social Security replacement rates	$-$	35%	
Medicare premium	p^{med}	\$1,055	total premiums =2.11% of Y
Asset test for Medically Needy	k^{MN}	\$2,000	Data
Employer contribution	ψ	80.0%	......
Labor productivity			
- Persistence parameter	ρ	0.98	Storesletten, et al (2000)
- Variance of innovations	σ_ε^2	0.02	"
- Fixed effect	σ_ξ^2	0.24	"
Parameters used to match some targets			
Discount factor	β	0.9996	$\frac{K}{Y} = 2.7$
Depreciation rate	δ	0.082	$r = 4\%$
Risk aversion	σ	3.35	age-profile of individually insured
Consumption floor	$\underline{c}$	\$2,615	% employment among public insurance
Population growth	η	1.1%	% people older than 65
Tax function parameter	a_2	0.616	balanced government budget
Proportional tax	τ_y	6.77%	composition of tax revenue
Insurance proportional loads			
- Individual market	γ^h	1.079, 1.135	% individually insured profile
- Group market	γ	1.079	assumed to be the same as γ^h for healthy
Insurance fixed load (unhealthy)	π^h	\$790	% individually insured (unhealthy)
Public insurance program			
- Income test	y^{CAT}, y^{MN}	$0.792FPL$	% publicly insured
- Categorial asset test	k^{CAT}	\$35,000	publicly insured profile
Fixed costs of work	ϕ_w	0.21	employment profiles (healthy)
Time loss due to unhealthy			
- age 25-40	ϕ_t^{UH}	0.02	employment profiles (unhealthy)
- age 64	ϕ_t^{UH}	0.0725	"

Table 12: Parameters in baseline model

B A comparison of employment statistics in the MEPS and the CPS

The purpose of this section is to compare the employment-population ratio derived from the Current Population Survey (CPS) and the fraction of workers computed for our sample from the MEPS. In 2003 the employment-population ratio among people aged

25-64 was 75.3% according to the CPS, while the fraction of workers in our sample is 94.8%. This discrepancy arises for two reasons. First, we use a different definition of an employed/working person. The CPS is a monthly survey and each individual is counted as employed if he is employed in a reference week. However, the MEPS has at most three rounds of interviews per year and each person reports average hours worked per week over the period of several months which we aggregate into total hours worked per year. We define an individual as a worker if his total hours worked over the entire year are greater than 520 and his total earnings are greater than $2,678 (using 2004 as a base year). Thus, the employment figure from the CPS reflects a snapshot in a particular period, while our figure is based on the aggregation over the entire year. As a result, non-workers in our sample are long-term non-participants in the labor market. The second reason for the discrepancy between our number and the one in the CPS is the sample selection. We consider only the heads of households (where the head is defined as the highest earner) while the calculation from the CPS includes all adults. If we compute the fraction of workers among *all* adults in the MEPS in one interview round (i.e. without aggregating hours over the entire year) the resulting number is 75.5% which is the same as the one in the CPS.

C Estimation of survival probabilities

To construct the survival probability by health, we use the HRS data to estimate the survival probability as a function of cubic polynomial of age and gender using a probit model for each health status. Then we compute the *survival premium* - the difference between the estimated survival probabilities of healthy and unhealthy males for each age. From the Social Security Administration life table we know the average survival probability of males. From the MEPS we can construct the fraction of people in the two health categories for each age. Using this information, we can recover the survival probabilities of healthy and unhealthy people for each age. Figure (10) plots the survival probability by health status.

D Medical expenses and insurance coverage

To calibrate medical expenses we separate our sample into 12 age groups (20-24, 25-29, 30-34, ..., 75+). We assign the age of each group to the mid-point of the corresponding age interval. For example, 22 for 20-24, 27 for 25-29, 32 for 30-34, etc. For each year,we divide medical expenditures into 3 bins, corresponding to the bottom 50th, 50-95th, and top 5th percentiles for each health status and age group. To get a value of medical expenses in each bin we run a regression of medical expenses on a set of age-group and year dummies.

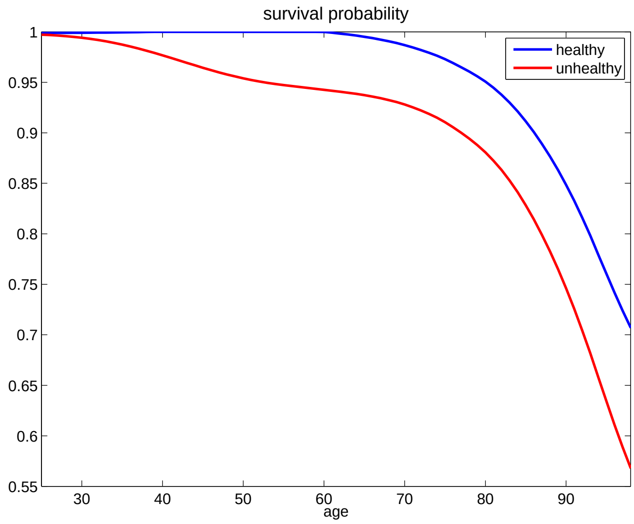

Figure 10: Survival probability (ζ_t)

The coefficients on age dummies in this regression are the average medical expenses for the corresponding age in a particular bin. Then we fit our estimated coefficients with a quadratic function of age. The MEPS tends to underestimate the aggregate medical expenditures (Sing et al, 2002). To account for this, we multiply our estimated medical expenses by 1.31. This adjustment allows us to match the share of total medical expenses of people of a working-age and elderly people in GDP (11.2%) as in the National Health Expenditure Account (2004).

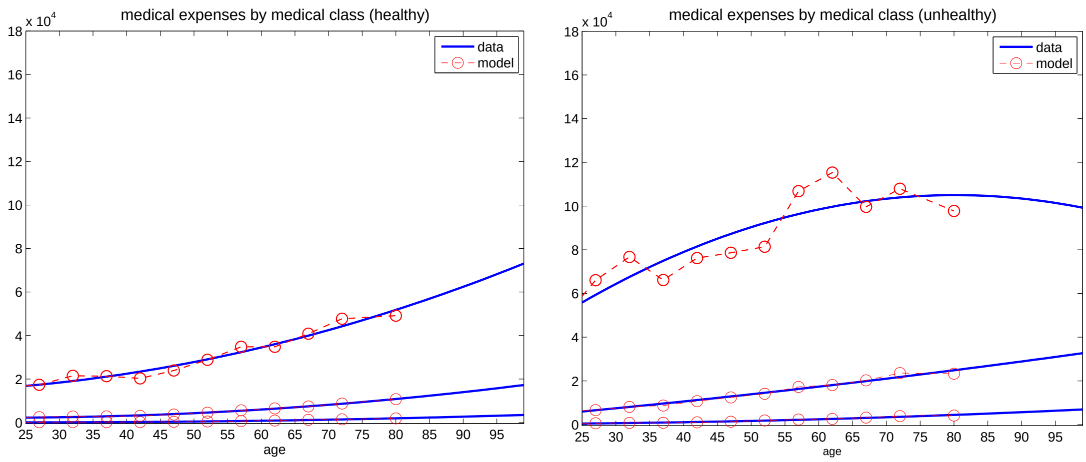

Figure 11: Medical expense grids by health status, x_t^h

To determine the fraction of medical expenses covered by private insurance and Medicaid $q(x_t, i_t)$, we do the following. For working age households we estimate medical expenditures paid by private insurers (variable TOTPRV) and Medicaid (variable TOTMCD)

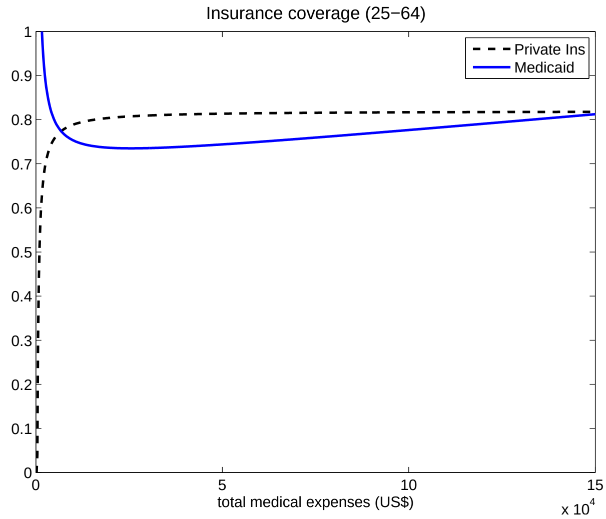

Figure 12: Fraction of medical costs covered by private insurance and Medicaid, $q(x_t^h, i_t)$

as a function of total medical expenditures and year dummy variables. We use a linear function of total medical expenditure for private insurance and a quadratic function for Medicaid.[45] Then we convert our estimates into the fraction of expenditures covered by insurers. Figure (12) plots the fraction of medical expenses covered by private insurance and Medicaid.

E Economy with observable productivity when welfare budget is not fixed

In this section, we reevaluate the welfare effects of linking Medicaid eligibility to exogenous productivity as in Section 6.2 (Eq 24) but when total spending on welfare programs (Medicaid and consumption floor) are not held constant. Unlike in Section 6.2, we do not adjust the income eligibility threshold to keep the welfare budget unchanged, but only adjust τ_y to balance the government budget. Table 13 and 14 report the results from this experiment.

As before, there is a welfare gain from implementing this experiment but the size of gains is much smaller: 0.32% of the annual consumption compared with 1.51% in Section 6.2. This happens because the size of the public transfers through Medicaid decreases. In the experiment in Section 6.2 the free-up budget from disenrolled Medicaid beneficiaries with relatively high productivity is used to enroll more low income people. Now, this budget is proportionately distributed to everyone through lower taxes. As a result, the income tax τ_y decreases from 6.77% to 6.41% but the Medicaid program shrinks: its coverage goes down from 7.1% (baseline) to 5.7%.

[45]For both regressions, R^2 is 0.88.

	Baseline	Observable productivity
Income test: y^{cat}, y^{MN} (%FPL)	79.2%	79.2%
Income tax: τ_y	6.77%	6.41%
Employment rate (%)		
all	95.5	96.8
healthy	97.9	98.5
unhealthy	78.7	85.1
%Δ aggregate labor productivity	–	0.43
%Δ aggregate capital	–	1.51
%Δ aggregate output	–	0.78
Ex-ante consumption equivalent (%)	–	0.32

Table 13: The effect of removing Medicaid distortions on labor supply (fixed income test)

	Baseline				observable productivity			
	ESHI	individual	uninsured	public	ESHI	individual	uninsured	public
all	65.4	8.4	19.2	7.0	65.4	8.5	20.4	5.7
healthy	68.3	8.4	18.3	5.0	68.3	8.3	18.9	4.5
unhealthy	45.5	8.7	24.9	21.0	45.6	10.3	30.3	23.8

Table 14: Change in insurance coverage (fixed income test)

F Removing asset testing of workers

In Section 7.2 we show that tight asset testing of non-workers can eliminate moral hazard behavior among Medicaid beneficiaries. In this section we consider the effects of the complete elimination of asset testing of workers while maintaining the strict asset testing ($2,000) of non-workers. Rows 3 of Tables 15 and 16 report the results of this experiment. For comparison, we also report in Row 2 the results for an economy where productivity is observable and there is no asset testing. In both experiments we fix the total budget of the welfare programs as in the baseline.

Compared with the results in Table 10, the welfare gains are higher. This is because for working beneficiaries there is no need to use asset testing to induce them to work. Instead, asset testing of working beneficiaries creates unnecessary savings distortions that reduce welfare. Moreover, removing asset testing of workers can achieve welfare gains close to the economy with observable productivity and no asset testing (1.71% vs 1.84%).

Experiment	% enrollees losing eligibility if working	% non-worker⇒worker if not losing eligibility	Ex-ante CEV (%)		
			all	low ξ	high ξ
1. Baseline	22.0	11.2	–	–	–
2. Obs productivity, no asset test	–	–	1.845	2.212	0.295
3. Asset test ($2,000) only for non-workers	0.22	0.18	1.715	2.049	0.307

Table 15: Welfare effects of complete removal of asset testing (Row 2) or removal of asset testing for workers (Row 3)

	Income Test	employment (%)		insurance (%)			
	(%FPL)	unhealthy	healthy	unins	pub	Ind	ESHI
1. Baseline	79.2	78.7	97.9	19.2	7.1	8.4	64.3
2. Obs productivity, no asset test	100.6	87.0	98.7	18.3	9.4	7.7	64.6
3. Asset test ($2,000) only for non-workers	99.8	89.5	98.8	18.3	9.3	7.8	64.6

Table 16: Employment and insurance effects of complete removal of asset testing (Row 2) or removal of asset testing for workers (Row 3)

G Differentiated asset testing with intensive margin of labor supply

In this paper we assume that individuals adjust their labor supply only along the extensive margin. We show that the distortions of Medicaid can be substantially reduced if Medicaid eligibility includes asset testing which imposes different asset limits on workers and non-workers. In this section we discuss how this policy would look if individuals can also adjust their labor supply along the intensive margin.

When individuals can choose how much to work, Medicaid can distort not only participation decisions but also decisions about hours worked. This happens if it is impossible to infer productivity from observing labor income and hours of working individuals.[46] In this case the asset limits can be linked to labor income in the following way: the lower the labor income is, the tighter the asset test. The intuition here is the same as in the case of our baseline model. When only extensive margin adjustment is possible, highly productive individuals can pretend to be low productive by not working. If intensive margin can also be adjusted, highly productive individuals can decrease their working hours, which results in low labor income. As before, the strategy of mimicking low productivity is only attractive for individuals who have enough assets to substitute forgone labor income when decreasing their labor supply. Thus, tighter asset limits on individuals

[46]This is the usual assumption in the NDPF literature. It can happen either because hours are observed imprecisely, or because individuals can also adjust their efforts.

with low labor income can prevent individuals with high productivity from enrolling into Medicaid.[47]

H Discussion of the assumption of exogenous medical expenses

Currently, two approaches exist for the modeling of medical expenses in macroeconomic and structural studies. The first approach takes a stand that medical expenses are exogenous shocks that result in monetary losses (see for example, Jeske and Kitao (2009), Hansen et al (2012), French and Jones (2011), Kopecky and Koreshkova (2011)). The second approach assumes that people can choose the amount of their medical spending (Fonseca et al (2010), Ozkan (2011), Scholz and Seshadri (2010)). It is well know that in reality medical spending has both discretionary and non-discretionary part. However, to the best of our knowledge the literature lacks a model that can unite the two approaches described above and reproduce the empirical patterns of discretionary vs. non-discretionary spending.

Our choice of the model of exogenous medical spending is determined by the focus of our study. We evaluate how much Medicaid distorts labor supply incentives. An important mechanism in our model is that some individuals value health insurance provided by Medicaid and they stop working in order to obtain this insurance. Hence, it is important for our quantitative analysis to gauge the value of health insurance for individuals. As Rust and Phelan (1997) emphasize, the value of health insurance to a large extent depends on the variance and skewness of medical expenses. In addition, the value of health insurance (and especially means-tested health insurance) depends on the correlation of medical and labor income shocks. To adequately measure the value of publicly provided health insurance, we need to carefully represent the joint distribution of medical expenses and labor income. To the best of our knowledge, none of the existing models of endogenous medical expenses can simultaneously reproduce the empirical variance and skewness of medical spending and its correlation with labor income.

If we were able to incorporate in our model the adjustments in medical spending resulting from people's optimal decision-making, we can expect the following changes in our welfare estimates. On the one hand, removing the distortions of Medicaid can result in higher welfare gains because more people get access to health insurance (see Table 7). Since health insurance can improve health outcomes, this creates additional positive

[47] Note that earnings-dependent asset limits are analogous to earnings-dependent wealth taxation, as discussed in the NDPF literature. Albanesi and Sleet (2005) find that optimal tax on wealth is a non-linear function of labor income which increases steeply when labor income is close to zero. So it is possible that in our case, asset limits can be a complicated non-linear function of the labor income.

effects on welfare. However, we expect these effects to be small based on the study of Baicker et al (2011). This study examines the effects of the first year of the Oregon health insurance experiment when a group of low income adults was randomly selected to be given a chance to apply for Medicaid. They find that Medicaid coverage did not significantly improve health outcomes.

On the other hand, our welfare estimates can decrease if the new enrollees into Medicaid will increase their medical spending once they obtain coverage. Baicker and Finkelstein (2013) estimate that the Oregon health insurance experiment resulted in 25% increase in the total annual medical expenditures. If we allow for this adjustment, our experiment of linking Medicaid eligibility to unobservable productivity will result in smaller expansion of Medicaid. This will happen because the welfare budget is fixed, and an increase in medical spending of the new enrollees will use part of this budget. As a result, fewer truly low productive individuals can be enrolled in place of disenrolled individuals with high potential labor income. However, our finding that removing Medicaid distortions results in positive welfare gains will still hold even in this case. As Appendix E shows, linking Medicaid eligibility to (unobservable) productivity is welfare improving even if we do not enroll any new people into Medicaid but only eliminate those enrollees whose potential income exceed the income test limit. Moreover, our policy analysis will remain valid in this case. Our calculations (not reported) show that when the welfare budget is not fixed (i.e. there are no new enrollees in Medicaid), work-dependent asset testing still achieves almost the same outcome in terms of welfare (0.30%) as linking Medicaid eligibility to unobservable productivity (0.32%).

I Computational algorithm

In our computation, we discretize all continuous state variables. Since the value function and policy functions are non-linear along the dimension of k_t when k_t is close to zero, we use a much finer grid for small values of k_t. We solved for the steady state equilibrium of the baseline model as follows.

1. Guess an initial interest rate r, price in the group insurance market p, the amount the firm offering ESHI subtracts from the wage of their workers c_E, tax parameter a_2, and bequest Beq.[48]

2. Solve for the households' decision rules using backward induction. We evaluate the value function for points outside the state space grid using a Piecewise Cubic Hermite Interpolating Polynomial (PCHIP).

[48] In general, insurance markets where firms are not allowed to risk-adjust premiums, as in the group market, can have multiple equilibriums. However, because the major part of the premium is contributed by the employer, people are less sensitive to the price of insurance and thus the multiplicity of equilibriums becomes less of an issue. In particular, our equilibrium price tends to be invariant to the initial guess.

3. Given policy functions simulate the households distribution using a non-stochastic method as in Young (2010).

4. Using the distribution of households and policy functions, check if market clearing conditions and zero profit conditions for insurance firms hold, and government budget balances. If not, update r, p, c_E, a_2, and Beq, and repeat Steps 1-3.

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