Welfare-enhancing public and private insurance arrangements for long-term care risk*

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Abstract

Long-term care is costly. About one in three Americans will experience a stay in a nursing home that exceeds 100 days during their lifetime, and about one in ten will incur out-of-pocket expenses of $200,000 or more. Surprisingly, only about 10% of retirees have private long-term care insurance. Private insurers incur high administrative costs and must contend with private information. Medicaid offers means-tested benefits for those with low assets. However, Medicaid is a secondary payer that only provides coverage after private insurance benefits have been exhausted. These two features crowd out demand for private insurance and retirees pay a large share of long-term care expenses out-of-pocket. We consider alternative strategies for reforming public and private insurance for long-term care risk in an optimal contracting model and find that making Medicaid a primary payer while retaining the means test performs best. This reform stimulates the private long-term care insurance market while preserving the safety net provided by public insurance to low-income individuals. Social welfare increases even though government expenditures fall.

Keywords: Long-Term Care Insurance; Medicaid; Adverse Selection; Insurance Rejections.

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1 Introduction

Long-term care risk is significant and costly. About one in three Americans will experience a stay in a nursing home that exceeds 100 days during their lifetime, and about one in ten will incur out-of-pocket expenses of $200,000 or more. Given the risk and cost of an adverse event, one would expect that the private market for long-term care insurance (LTCI) would be large and cover a large fraction of NH expenses. This is not the case. Premia are high, denials due to pre-existing conditions are common, and coverage of the insured is incomplete. Only about 10% of individuals ages 62 and over have LTCI, and the size of the private insurance market has been declining steadily over the past twenty years.

This project analyzes the properties of good LTCI arrangements in a general equilibrium model of the US long-term care insurance market. We assess alternative long-term care arrangements based on how they impact social welfare of different demographic groups, how they impact government expenditures, and how they affect takeup and profitability in the private LTCI market.

The specific policy reforms considered here are motivated by findings in Braun et al. (2019) who attribute high premia, denials, low takeup and incomplete coverage to the crowding out effects of public insurance, high administrative costs faced by private insurers, and adverse selection. Some Americans receive free public LTCI benefits provided by Medicaid. Medicaid benefits are only available to individuals with low personal resources. Still, Braun et al. (2019) find that Medicaid crowds out private LTCI and depresses profits of private insurers. In this paper, we model the fiscal costs of funding Medicaid and analyze the consequences of reducing its scale. Private insurance takeup among low- and middle-income households increases, but their welfare declines. They have higher exposure to LTCI risk and relatively inelastic demand for private insurance when Medicaid benefits are reduced. Consequently, profits from insuring these groups go up. Affluent households prefer a smaller Medicaid program. They benefit from lower taxes and they have the outside option of self-insuring LTC risk, which keeps their premiums low. The first effect is larger and welfare of a newborn declines.

Private LTCI is costly to produce. Brokerage costs can exceed 3 years of premium and underwriting costs are also larger than other life insurance product lines. These costs can be avoided and coverage against LTCI risk increased if there is a single public insurer of LTC risk. Other advanced economies such as Germany and Japan offer universal public LTC benefits, and Medicare already provides universal coverage of medical risks in the US. Consequently, we consider a reform in which Medicaid provides universal primary coverage against NH risk. The welfare effects of this reform are reversed from the previous one. Low- and middle-income individuals benefit, but the welfare of high-income individuals falls. The welfare gains of the first group are larger and welfare of a newborn increases.

The third scenario we consider is a partial reform of the Medicaid benefit formula. Medicaid benefits are means-tested and subject to a secondary payer provision. Holders of private insurance only qualify for Medicaid benefits once their private insurance benefits are exhausted. Under our reform, benefits continue to be means-tested, but Medicaid is the primary payer. This third scenario works best. Private LTCI takeup rates rise, the poor continue to receive free public insurance, and the welfare of all income groups increases.

A surprising property of the Medicaid primary scenario is that aggregate public expenditures on Medicaid are lower when Medicaid is a primary payer. We show that the secondary payer provision of the current Medicaid program depresses private LTCI takeup of middle-class individuals and also depresses their savings. When the secondary payer distortion is absent, middle-class individuals save more and purchase private insurance. Fewer individuals qualify for Medicaid benefits and aggregate Medicaid expenditures per recipient fall.

This paper fills a gap in the academic literature. The focus of the previous literature on LTCI has been on understanding why the private LTCI market is small: Brown and Finkelstein (2007), Finkelstein and McGarry (2006), Hendren (2013), Braun et al. (2019). Other research analyzes the effects of historical policy reforms on the private LTCI market. Aizawa and Ko (2023) analyze how a change in the private LTCI regulatory environment influenced welfare and the market's functioning. Lin and Prince (2013), Goda (2011), Bergquist et al. (2018) assess the impact of the Partnership Policy program on the market. This reform relaxed the Medicaid asset-test for individuals who purchase private LTCI. The results from both lines of research are negative. Aizawa and Ko (2023) find that transferring aggregate risk from LTCI policyholders to insurers has a small positive impact on welfare but lowers the profitability of private insurers while increasing concentration in the market. Most analyses of the Partnership Policy Program find that the impact on private LTCI has been small. Our structural general equilibrium framework accounts for many empirical properties of US LTCI arrangements and is a valuable laboratory for analyzing the impact of novel policies not yet implemented. Our results illustrate both the challenges and opportunities for reforming the US long-term care insurance market.

The remainder of our paper is organized in the following way. Section 2.1 provides a graphical analysis of the informational frictions that provide a rationale for public insurance, shows how administrative costs influence pricing and coverage of private insurance, and shows how the means-testing and secondary payer provisions of Medicaid influence pricing, coverage, and takeup of private LTCI. Section 2.2 describes our quantitative general equilibrium model and Section 3 provides an overview of how we parameterize the model. Our main results are reported in Section 4.

2 The Model

We present the model in two steps. First, we consider the contract design problem of an LTCI monopoly issuer that faces a single risk group. We use this framework to illustrate how the costs of providing private insurance and the availability of means-tested public insurance influence private LTCI takeup and coverage rates, as well as pricing, premiums, and profitability. We also use this framework to show how Medicaid's secondary-payer provision influences the private LTCI market. Then, we present our quantitative general equilibrium model. This model has multiple periods, multiple sources of uncertainty, and heterogeneous individuals who self-insure against LTC risk and other risks faced during retirement by saving.

2.1 The one-period model

Consider a continuum of individuals each with resources $w + a$ and private type $i \in \{L, H\}$.[1] The fraction of individuals with private type L is ψ and the fraction with private type H is $1 - \psi$. The risk of entering a nursing home (NH), θ^i, is lower for type-L individuals than type-H individuals, i.e., $0 < \theta^L < \theta^H < 1$. The simple model has two instants of time. At the beginning of the period, households decide whether to purchase an LTCI contract. Then the NH event is realized and $\eta \equiv \psi\theta^L + (1 - \psi)\theta^H$ individuals incur NH expenses m. LTCI contracts specify a premium and an indemnity and are type specific. The premium for type i is π^i and the net indemnity is $\iota^i - \pi^i$.

Individuals' problem. Risk-averse individuals maximize utility subject to participation and incentive compatibility constraints and have access to public insurance that resembles NH benefits provided by Medicaid. An individual of type i solves

$$\max_{c^i_{NH}, c^i, \pi^i, \iota^i} \theta^i u(c^i_{NH}) + (1 - \theta^i) u(c^i), \tag{1}$$

where

$$c^i = w + a - \pi^i, \tag{2}$$

$$c^i_{NH} = w + a - m + \iota^i - \pi^i + T^i, \tag{3}$$

$$T^i = \max\Big\{0, \underline{c}_{NH} - \big[w + a - m + \iota^i - \pi^i\big]\Big\}, \tag{4}$$

and $u(c) = c^{1-\sigma}/(1 - \sigma)$ with $\sigma > 0$. Public NH benefits, T^i, determined by equation (4), are just enough to provide their recipient with the level of consumption $\underline{c}_{NH}$. Even though equation (4) is a simplified version of how Medicaid NH benefits are determined in practice, it effectively captures the program's two key features. First, the transfer amount decreases as endowments increase—that is, benefits are means-tested. Second, Medicaid serves as a secondary payer, meaning that higher net benefits from private insurance, $\iota - \pi$, reduce public insurance transfers on a one-for-one basis.

The insurer's problem. The insurer cannot directly observe an individual's risk exposure type i and faces claims processing costs $(\lambda - 1 \geq 0)$ that are proportional to indemnities. He chooses a menu of contracts to offer that maximizes his expected profits subject to the participation and incentive compatibility constraints of each private type by solving

$$\max_{\{\pi^i, \iota^i\}_{i \in \{L,H\}}} \psi[\pi^L - \lambda\theta^L\iota^L] + (1 - \psi)[\pi^H - \lambda\theta^H\iota^H], \tag{5}$$

subject to

$$(PC_i) \quad U(\theta^i \pi^i, \iota^i) - U(\theta^i, 0, 0) \geq 0, \quad i \in \{L, H\}, \tag{6}$$

$$(IC_i) \quad U(\theta^i, \pi^i, \iota^i) - U(\theta^i, \pi^j, \iota^j) \geq 0, \quad i, j \in \{L, H\}, \tag{7}$$

[1] We give households two endowments here to facilitate comparison with our quantitative model which has

where $U(\theta^i, \pi^i, \iota^i) = \theta^i u(c^i_{NH}) + (1-\theta^i)u(c^i)$. Equation (6) states that each type $i \in \{L, H\}$ must be at least as well off with the contract designed for them as they would be if they did not purchase any private insurance. Equation (7) states that individuals must weakly prefer their own contract to the contract designed for the other private type. It will be helpful in the graphical analysis that follows to refer to the optimality conditions for the insurer's problem

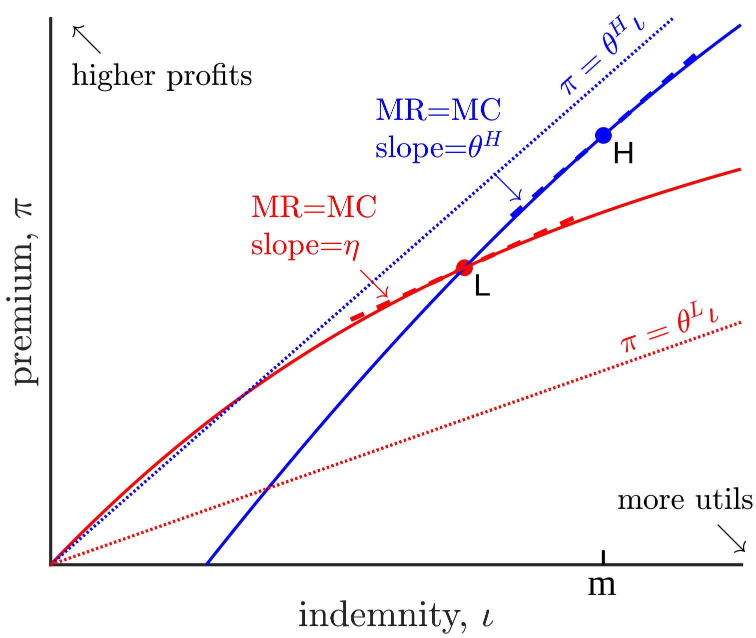
$$MRS(\theta^L, \pi^L, \iota^L) = \lambda\eta, \tag{8}$$
$$MRS(\theta^H, \pi^H, \iota^H) = \lambda\theta^H, \tag{9}$$
$$U(\theta^L\pi^L, \iota^L) - U(\theta^L, 0, 0) = 0, \tag{10}$$
$$U(\theta^H, \pi^H, \iota^H) - U(\theta^H, \pi^L, \iota^L) = 0, \tag{11}$$

where the marginal rate of substitution (MRS) of type i,

$$MRS(\theta^i, \pi^i, \iota^i) = -\frac{dU(\theta^i, \pi^i, \iota^i)/d\iota^i}{dU(\theta^i, \pi^i, \iota^i)/d\pi^i},$$

is the amount by which the indemnity ι^i must increase given a marginal increase in the premium π^i so as to keep type i's utility constant. Observe that at the optimal menu of contracts the participation constraint binds for type L and the incentive compatibility constraint binds for type H.

Figure 1: Optimal contracts with no administrative costs and no public insurance.



Note: Point H is the optimal contract for type-H individuals and point L is the optimal contract for type-L individuals. The parametrization used to create the figure is $\sigma = 1.1$, $\psi = 0.8$, $\theta^L = 0.2$, $\theta^H = 0.5$, $w + a = 1.0$, $m = 0.8.$, $\lambda = 1$, and $\underline{c}_{NH} = 0$.

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multiple periods and saving. In that model, w is the endowment and a is beginning-of-period asset holdings.

Optimal contracts with no public insurance or claims processing costs. When public insurance and claims processing (CP) costs are absent, our model is equivalent to the specification considered by Stiglitz (1977). We start with this case. Figure 1 illustrates the optimal contracts when $\theta^L < \theta^H < 1$, $\lambda = 1$, and $\underline{c}_{NH} = 0$. The solid curved lines are (indirect) indifference curves of types L and H with utility increasing to the southeast.[2] The slopes of the dashed lines are the marginal costs of insuring each given type. The contracts at points L and H satisfy the optimality equations (8)–(11). At point L, the MRS (marginal revenue) equals marginal cost for type L—equation (8). At point H, the same condition holds for type H—equation (9). Type L's participation constraint binds because his indifference curve passes through the origin indicating that he is indifferent between no insurance and contract L, in other words, equation (10) is satisfied. Equation (11) is satisfied too. The participation constraint of type H is binding because his indifference curve passes through point L indicating that he is indifferent between the two contracts.

Notice that the optimal contracts provide full coverage of the loss m for high-risk (H) types and partial coverage for low-risk (L) types. Figure 1 can be used to explain why the optimal contracts are always separating. Consider a pooling contract at point L. MRS is steeper than marginal cost for type H at this point. Contracts on the high-risk type's indifference curve to the right of point L are incentive compatible and provide high-risk types with the same level of utility as point L but reduce the losses from insuring them.

The optimal contracts also feature cross-subsidization from low-risk to high-risk types. To illustrate this point, the figure reports the actuarially-fair contract rays for each type. These are the dotted straight lines that pass through the origin. Along each ray expected indemnities equal premium revenue. Thus each ray depicts the set of contracts that the firm breaks even on within the given type. Notice that point H lies below the type-H zero profit ray indicating that the insurer loses money on the optimal contract for high-risk types. The opposite is true of the optimal contract for low-risk types. The firm earns profits on the type-L contract sufficient to offset the losses on the type-H contract, and total profits are positive. Cross-subsidization becomes more costly when either the relative risk of NH entry of type-H individuals increases or the share of type-H individuals in the risk group rises. When cross-subsidization is no longer profitable, the optimal contracts feature exclusion of the low-risk types. That is, the optimal menu consists of a full coverage contract for type H and a $(0, 0)$ contract for type L.

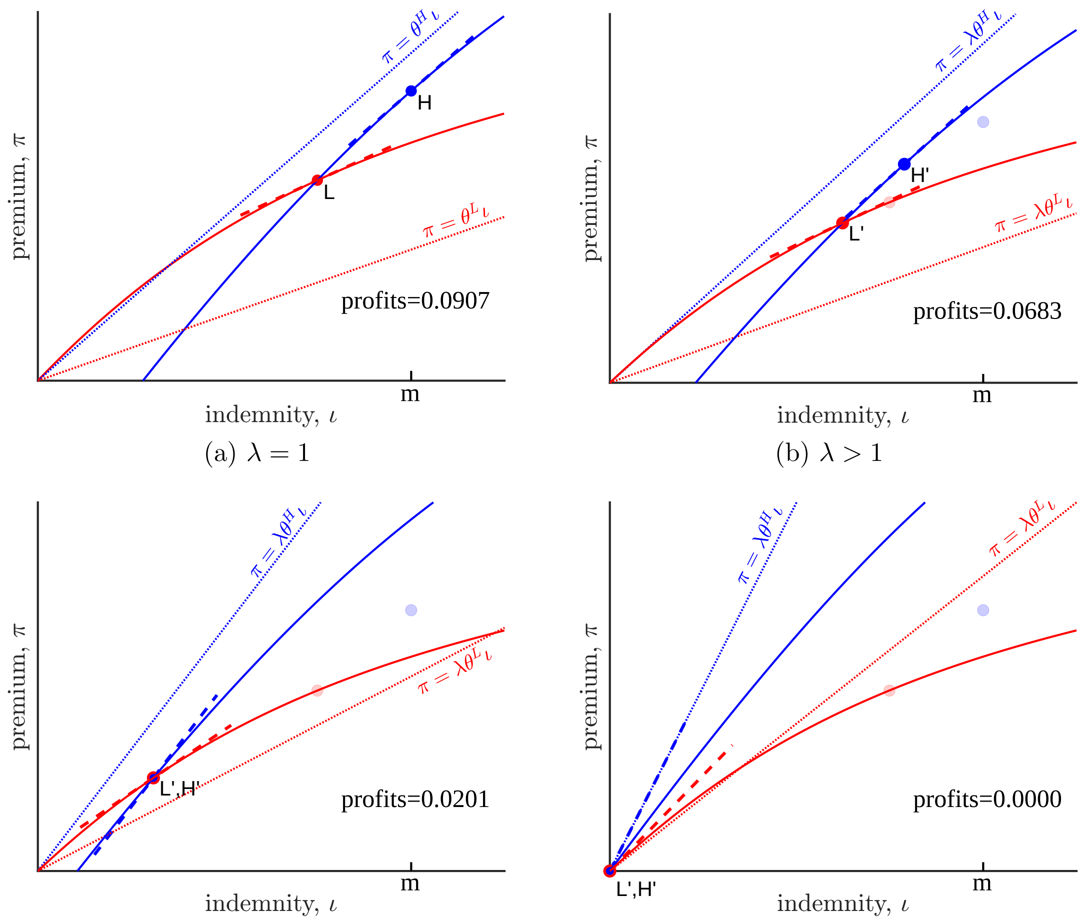
Optimal contracts with incomplete coverage of low-risk types and cross-subsidization arise because of asymmetric information. To see this, it is helpful to describe the properties of the optimal contracts under full information. When information frictions are absent, the insurer extracts the entire surplus and the participation constraint binds for both types. The optimal contracts for each type provide full coverage of the loss and lie along a vertical line passing through point $\mathbf{m}$. Utility of type H falls because he is now paying a higher premium for the same level of coverage. Type L also pays a higher premium but goes from partial coverage to a full coverage contract, and his utility is unchanged.[3]

[2] The indifference curves are implicit functions of consumption. Our objective is to illustrate how administrative costs and public insurance influence the pricing and coverage of private insurance contracts. It is easier to do this in the contract space than in the consumption space.

[3] Using the parameterization in Figure 1, the premium for type L rises from 0.24 to 0.29, while the premium for type H rises from 0.35 to 0.57.

Optimal contracts with administrative costs. Next we consider how administrative costs influence the profitability, pricing, and coverage of private insurance contracts. LTCI is harder to market than other life insurance products, and broker commissions can surpass three years of premiums. We capture these commissions by setting λ greater than its baseline value of 1 which introduces administrative costs that are proportional to indemnities. As equations (8) and (9) show, these administrative costs increase the marginal costs of providing insurance to each private type.

Figure 2: Optimal contracts with varying levels of administrative costs.



(a) $\lambda = 1$ (b) $\lambda > 1$ (c) $\lambda >> 1$ (d) $\lambda >>> 1$

Note: Panel (a) presents the baseline case where administrative costs are zero, $\lambda = 1$. In panel (b) $\lambda > 1$ and the optimal contract menu is separating. In panel (c) $\lambda >> 1$ and the optimal contract menu is a pooling non-zero contract. In panel (d) $\lambda >>> 1$ and the optimal contract menu is a pooling zero-zero contract. The faded dots in panels (b)-(d) are the optimal contracts with no administrative costs. The parameterization used to create this figure is: $\sigma = 1.1$, $\phi = 0.8$, $\theta^L = 0.2$, $\theta^H = 0.5$, $w + a = 1.0$, $m = 0.8$, $\lambda \in \{1, 1.15, 1.65, 2.5\}$, $\underline{c}_{NH} = 0$.

The four panels of Figure 2 illustrate the optimal contracts with increasingly larger values of λ starting from the baseline ($\lambda = 1$). As the slopes of the marginal cost lines increase, coverage ratios fall and the optimal contracts move down the agents' indifference curves towards the origin. The slopes of the break-even rays (the dotted lines) also increase and comparing the distances between these rays and the optimal contracts indicates that profits on type L fall and losses on type H rise.

When costs are moderate, the insurer continues to use separating contracts and cross-subsidization to confront asymmetric information. However, increasing proportional administrative costs reduces the profitability of lending to the high-risk group more rapidly than to the low-risk group, making cross-subsidization less profitable. Consequently, the optimal contracts get closer together. When costs are sufficiently high, as in panel 2c, there are no opportunities for cross-subsidization across types, and a pooling equilibrium arises. When pooling occurs, the optimal menu absent information frictions is downward sloping. At the pooling contract in panel 2c, notice that marginal cost exceeds MRS for type H. The insurer would prefer to offer type H lower coverage than type L but is constrained by incentive compatibility.

When λ is sufficiently large, coverage falls to zero as reported in panel 2d. In this panel, marginal cost exceeds MRS for both types at $(0,0)$. Consequently, the entire risk group is denied coverage because there are no profitable insurance opportunities available to the firm.[4]

Denials can occur in other ways when $\lambda > 1$. For instance, increasing the fraction of high-risk types, $1-\psi$, makes the overall cost of insuring the risk group larger, reducing profitability and increasing the likelihood that the entire risk group will be denied coverage. Claims processing costs increase the marginal cost of providing insurance. When $\lambda > 1$, if endowments are sufficiently high relative to the expected loss, marginal rates of substitution can be lower than marginal costs indicating that the entire risk group prefers to self-insure against LTC risk.

Optimal contracts with public insurance Medicaid benefits are means-tested, meaning the program's effects on private insurance coverage and pricing depend on individuals' income and wealth.[5] There may be little to no direct impact for the wealthiest individuals. But, for those with more moderate levels of income and wealth, the program's effects are more pronounced and will vary based on the generosity of Medicaid relative to their financial situation.

We now explore the variable effects of Medicaid NH benefits by considering two scenarios that differ in the size of the risk group's endowment relative to the size of the Medicaid NH consumption floor. The first panel of Figure 3 depicts the optimal contracts in the baseline case with no public NH insurance or claims processing costs. Optimal contracts with Medicaid NH benefits are illustrated in panels 3b and 3c.[6] Both panels depict risk groups in which, absent private LTCI, individuals who enter a NH would be eligible for Medicaid benefits, i.e., $\underline{c}_{NH} > w + a - m$. Panel 3b illustrates the optimal contracts when the risk group's endowment level, $w + a$, is low relative to the Medicaid guaranteed level of

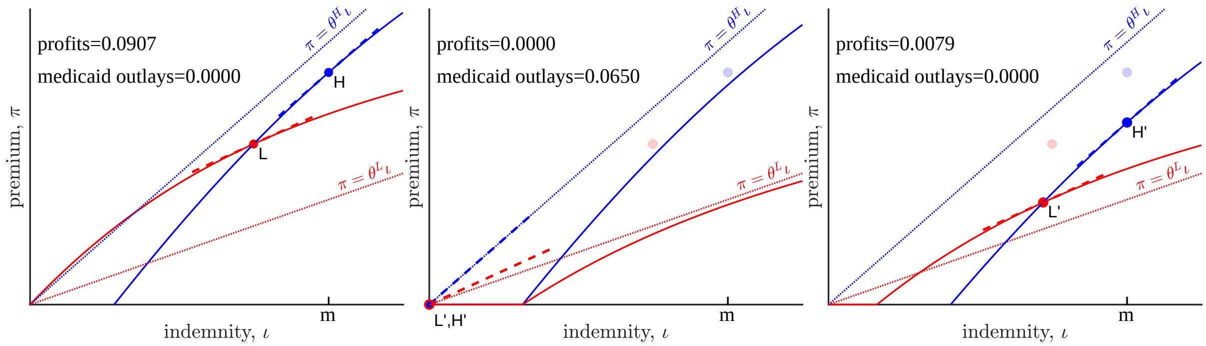
[4]While there are no profitable menus with private information, notice that the slope of the zero-profit ray is flatter than the slope of the low-risk type's indifference curve at $(0,0)$. The optimal menu with full information would feature positive insurance for low-risk types and no insurance for high-risk types at this value of λ.

[5]Asymmetric information and administrative costs are used to motivate public insurance in the public finance literature Gruber (2022). We will analyze the welfare value of policy reforms starting from a baseline where these frictions are present and public insurance is available through a program that captures the key features of Medicaid.

[6]Claims processing costs are absent in all of the Medicaid scenarios.

consumption $\underline{c}_{NH}$ and panel 3c illustrates the optimal menu when the risk group's endowment level is high relative to $\underline{c}_{NH}$.

Figure 3: Optimal contracts with varying levels of the NH consumption floor.



(a) $\underline{c}_{NH} = 0$ (b) $w + a$ low relative to $\underline{c}_{NH}$ (c) $w + a$ high relative to $\underline{c}_{NH}$

Note: Panel (a) presents the baseline case with no public NH insurance, $\underline{c}_{NH} = 0$. In panel (b) $w+a$ is low relative to $\underline{c}_{NH}$ and the optimal contract menu is a pooling zero-zero contract. In panel (c) $w+a$ is high relative to $\underline{c}_{NH}$ and the optimal contract menu is separating. The parameterization used to create this figure is: $\sigma = 1.1$, $\phi = 0.8$, $\theta^L = 0.2$, $\theta^H = 0.5$, $w + a = 1.0$, $m = 0.8$, $\lambda = 1$, $\underline{c}_{NH} \in \{0, 0.45, 0.33\}$.

In addition to being means-tested, Medicaid is a secondary payer, and this second provision of Medicaid is readily discernible in Figure 3. The secondary payer provision is responsible for the kinks and downward shifts in the indifference curves in panels 3b and 3c.[7] The changes arise because free Medicaid benefits improve individuals' outside option—tightening their participation constraint. Consequently, individuals are unwilling to pay for levels of ι to the left of the kinks because they offer less coverage than they can get for free from Medicaid. To the right of the kinks, willingness-to-pay (WTP) for a given level of private LTCI is positive but reduced relative to the baseline. In this region, private insurance provides more coverage of the loss than Medicaid, but because individuals can get free Medicaid benefits if they don't purchase private LTCI, WTP for that coverage declines. If the consumption floor is high enough relative to the size of the endowment, there may be no menu of contracts that are both attractive to individuals and profitable to the insurer. This is the situation in Figure 3b. In Figure 3c the endowment is relatively higher and WTP, while lower than in the baseline, is higher than in Figure 3b. As in the baseline, the optimal contracts feature full insurance for Type H but the insurer has to give individuals a better deal, and premia and profits are significantly lower.

Figure 3 shows that the secondary payer provision of Medicaid crowds out private insurance by both reducing the number of risk groups that are profitable to insure and the profits on insurable risk groups. We will consider reforms that relax the secondary payer provision of Medicaid in our quantitative model and we can illustrate some of the impacts of these reforms here by retaining Medicaid's means-test but making it a primary payer. In particular, consider a scenario where equation (4) is replaced with

$$T = \max\left\{0, \underline{c}_{NH} - \left[w + a - m\right]\right\}. \tag{12}$$

[7]Recall that these indifference curves are over contracts and not consumption.

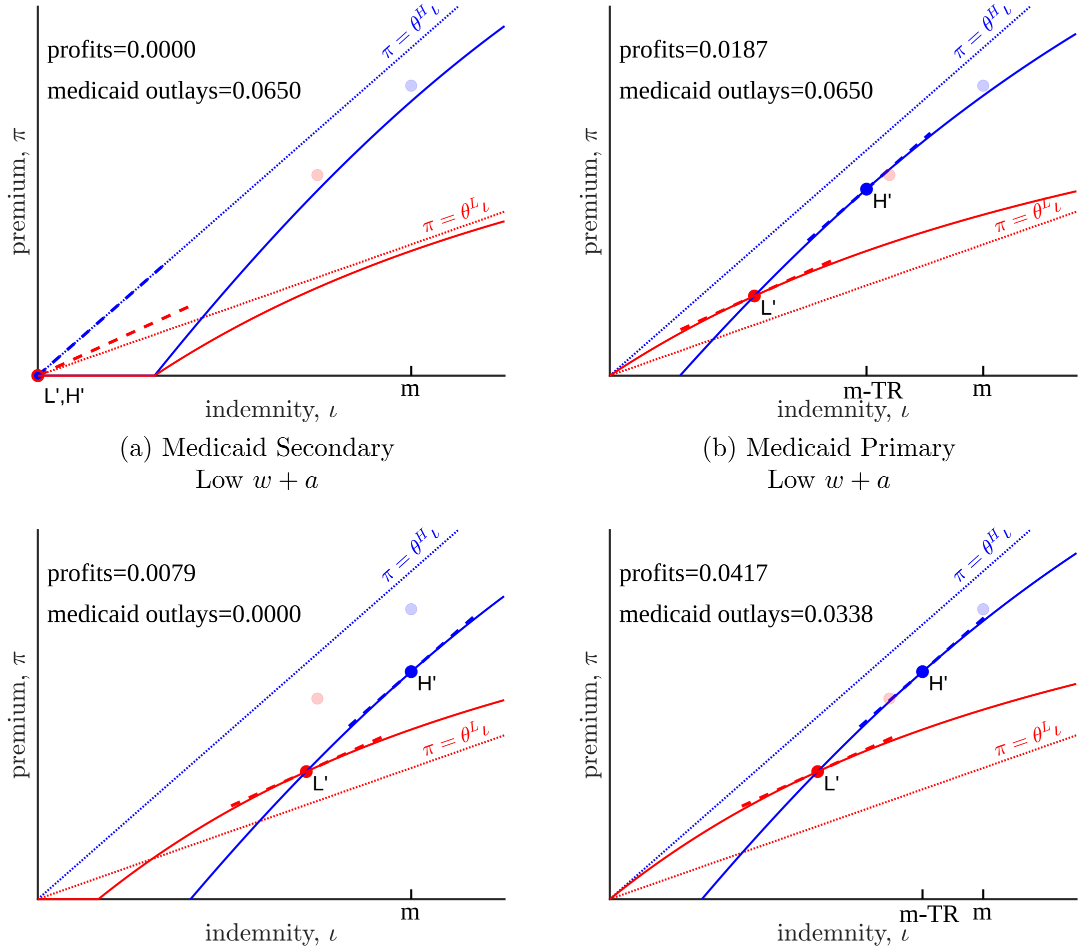
Public insurance is still means-tested in equation (12) because individuals with a high endowment relative to $\underline{c}_{NH}$ do not receive benefits. However, individuals who may qualify for Medicaid have a stronger incentive to purchase additional insurance. They receive public benefits of T and can insure part or all of the residual $m - T$ with private insurance. While their WTP to pay for a given level of private insurance is now higher, their marginal WTP for an increase in private insurance has declined because the effective size of the loss they face has declined. In other words, when Medicaid is a secondary payer it tightens individuals' participation constraint, but when Medicaid is a primary payer it instead reduces their MRS.

Figure 4 displays the Medicaid secondary and Medicaid primary payer scenarios for the same two risk groups considered in Figure 3. Consider first the risk group with low endowments, $w + a$, relative to $\underline{c}_{NH}$. In the baseline Medicaid scenario, this group is uninsurable, and the private insurer earns zero profits. However, when Medicaid serves as the primary payer and WTP for a fixed level of private insurance is higher, both members of the risk group choose to purchase private coverage. Removing the secondary payer provision does not have an impact on Medicaid outlays for this group, but increases private insurance takeup and total coverage against the loss.

The private insurance contracts offered to the risk group with high endowments are smaller when Medicaid is primary as shown in panels 4c-4d. The high-endowment risk group receives no public insurance benefits when Medicaid is a secondary insurer because net private indemnities count against the means test income threshold. When Medicaid is the primary payer, the net private indemnity is excluded from the means-test and members of this risk group now qualify for Medicaid benefits. Medicaid outlays for the risk group increase from 0 to 0.0338. With Medicaid covering T units of the loss, the value of an additional unit of private insurance (MRS) declines for both types and coverage and premiums fall. Despite the smaller contract size, profits are higher in this scenario than when Medicaid is a secondary payer. This is due to the relaxation of the participation constraint: individuals no longer need to pay for coverage they could otherwise receive for free through Medicaid to purchase additional protection. In this setting, private insurance becomes more valuable because the net private indemnity is excluded from the Medicaid means test. Finally, we wish to emphasize that the high-risk individuals receive full coverage of the loss in both scenarios.

We complete our analysis of the 1-period model by summarizing its properties. First, when Medicaid and claims processing costs are absent, high-risk types always receive complete coverage. Type L may be excluded, but LTCI takeup in a given risk group is always positive. Second, claims processing costs increase the marginal costs of providing private insurance, which leads to declines in takeup rates, coverage ratios, and profits. In the presence of these costs, risk groups with high endowments relative to the size of the loss and risk groups with a high fraction of the high-risk type are more likely to be excluded, and, with multiple risk groups, aggregate LTCI takeup can decline. Third, means-tested public insurance crowds out private insurance and can create the possibility of no-trade contracts when the risk group's endowment is sufficiently low. Thus, public insurance can also depress private LTCI takeup. Crowding out is particularly strong when public insurance is a secondary payer as is the case with Medicaid.

Figure 4: Optimal contracts when Medicaid is still means-tested but a primary payer.



(a) Medicaid Secondary
Low $w + a$

(b) Medicaid Primary
Low $w + a$

(c) Medicaid Secondary
High $w + a$

(d) Medicaid Primary
High $w + a$

Note: The parameterization used to create this figure is: $\sigma = 1.1$, $\phi = 0.8$, $\theta^L = 0.2$, $\theta^H = 0.5$, $w + a = 1.0$, $m = 0.8$, $\lambda = 1$, $\underline{c}_{Nh} = 0.45$ in the upper panels and $\underline{c}_{Nh} = 0.33$ in the lower panels. Reducing the consumption floor in this model is isomorphic to increasing the endowment.

2.2 The Quantitative Model

Our quantitative model extends the one-period model in several ways. Most Americans pay for long-term care expenses using their personal savings. We adopt a multi-period framework with incomplete information about LTC risk and other risks faced during retirement, and allow individuals to self-insure by saving. At birth, individuals observe a public indicator of their health and labor productivity, and make a savings decision. Individuals are forward-looking and understand that they will have the opportunity to purchase private LTCI in the future. They also recognize that, when making their purchase decision, they will have an informational advantage over the insurer regarding their health status but may be denied coverage. In other words, they recognize that, based on their observable characteristics, there may be no contract that both they are willing to purchase and that is profitable for the insurer to offer. Finally, households understand that private insurance is expensive and that Medicaid provides free benefits, but those benefits are means-tested and subject to a secondary-payer provision.

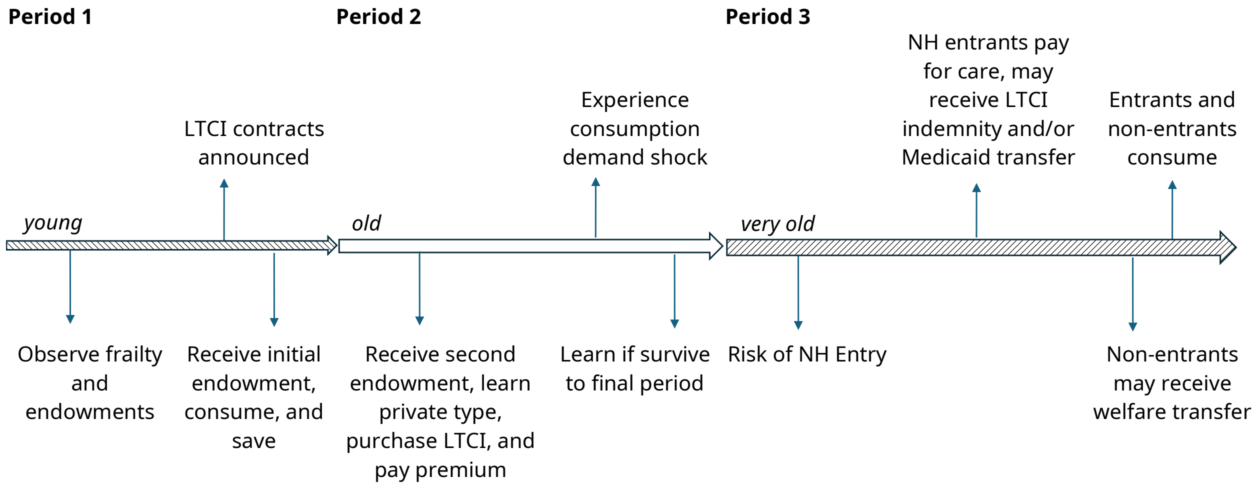
In the U.S., the average age of private LTCI purchase is 60, while the average age of NH entry is 83. During this period, individuals face a variety of risks, such as the risk of acute medical expenses or the risk of a spousal death event. Moreover, the timing of an NH event is uncertain, and individuals who experience a NH event very late in life are likely to have consumed a larger fraction of their lifetime endowment beforehand. Consequently, at LTCI purchase age, individuals likely face uncertainty about their resources at the time of NH entry. In the quantitative model, we capture this uncertainty in a tractable way. We assume that individuals experience a consumption demand shock that occurs after LTCI purchase. Eligibility for Medicaid at NH entry depends on the realization of this shock: individuals become eligible only under sufficiently large shocks that deplete their resources. As a result, private LTCI that insures against states where the demand shock is small can be valuable. However, unlike the simple model without post-purchase uncertainty, individuals will not want a full coverage private LTCI contract since Medicaid provides them with partial protection against NH risk in expectation.

Our objective is to propose welfare-enhancing reforms to private and public insurance arrangements for long-term care risk. While our one-period model includes claims processing costs on the private insurer, it abstracts from additional costs of insurance provision including those incurred by the public insurer. It also abstracts from public insurance financing. In the quantitative model, we assume that Medicaid is funded through income taxation. Our quantitative model also recognizes the broader range of administrative costs faced by private insurers, as well as the fact that public LTCI also incurs administrative costs. The costs of producing private insurance in the quantitative model consist of a variable-cost component (claims processing cost) that is proportional to indemnities and a per-capita fixed-cost component that is proportional to the fraction on individuals who purchase private insurance. The variable-cost component captures commissions paid to insurance agents and brokers. The fixed-cost component captures both underwriting costs and costs of paying claims. Medicaid does not pay commissions. However, Medicaid incurs fixed costs of paying claims. In particular, Medicaid must assess applicants' benefit eligibility and transfer amounts. These costs are captured by assuming that the public insurer in the model also incurs per-capita fixed costs, which are proportional to the fraction of individuals receiving Medicaid benefits.

2.2.1 Individual's problem

Figure 5 shows the timing of events in the model. At birth, an individual draws his frailty status f and lifetime endowment of the consumption good $\mathbf{w} = [w_y, w_o]'$ which are jointly distributed with density $h(f, \mathbf{w})$. Frailty status and endowments are noisy public indicators of NH risk. He also observes his survival probability from period 2 to period 3, $s_{f,\mathbf{w}}$, which varies with f and $\mathbf{w}$, and the menus of LTCI contracts that will be available in period 2. A working-aged individual then decides how to divide his earnings, w_y, between consumption c_y and savings a. Individuals are forward-looking, and their savings decision decisions are influenced by Medicaid and also the structure of LTCI contracts. Medicaid benefits are means-tested, and this creates an incentive for low-income individuals to save less to qualify

Figure 5: Timeline of events in the baseline model.



for Medicaid. Private LTCI contracts are costly to produce, and high-income individuals may prefer to save more and self-insure against NH risk.

In period 2, the individual receives a pension w_o and observes his true risk of entering a NH conditional on surviving to period 3: $\theta^i_{f,\mathbf{w}}$, $i \in \{g, b\}$ with $\theta^g_{f,\mathbf{w}} < \theta^b_{f,\mathbf{w}}$. With probability ψ the individual realizes a low (good). NH entry probability, $i = g$, and with probability $1 - \psi$ he realizes a high (bad) NH entry probability, $i = b$. The individual's true type $i \in \{g, b\}$ is private information. We assume that NH entry probabilities also depend on f and $\mathbf{w}$. The individual then chooses a LTCI contract from the menu offered to him by the private insurer.[8] The insurer observes and conditions the menu of contracts offered to each individual on their frailty status, endowments, and assets. We assume that the insurer observes assets because, as we discussed above, LTC insurers are required by regulators in many states to ascertain that the LTCI product sold to an individual is suitable (affordable).[9] Each menu contains two incentive-compatible contracts: one for the good types and one for the bad types. A contract consists of a premium $\pi^i_{f,\mathbf{w}}(a)$ that the individual pays to the insurer and an indemnity $\iota^i_{f,\mathbf{w}}(a)$ that the insurer pays to the individual if the NH event occurs.

After purchasing LTCI, individuals experience a demand shock that induces them to consume a fraction κ of their young endowment where $\kappa \in [\underline{\kappa}, \overline{\kappa}] \subseteq [0, 1]$ with density $q(\kappa)$. The demand shock creates uncertainty about the size of wealth at the time of NH entry and is important if the model is to account for the observation that Medicaid only provides partial coverage of NH expenses for many households.

[8]We assume the insurer does not offer insurance to working-age individuals in period 1 because LTCI takeup rates are low among younger individuals. For example, only 9% of LTCI buyers were less than 50 years old in 2015 according to LifePlans, Inc. "Who Buys Long-Term Care Insurance? Twenty-Five Years of Study of Buyers and Non-Buyers in 2015–2016" (2017).

[9]The reference in footnote 2 contains a model worksheet for reporting financial assets that is used to determine suitability. Lewis et al. (2003) reports that 31 States had adopted some form of suitability guidelines by 2002 and Chapter 5 of "Wall Street Instructors Long-term Care Partnerships online training course" https://www.wallstreetinstructors.com/ce/continuing_education/ltc8/id32.htm explains how suitability is assessed in the state of Florida.

Period 2 ends with the death event. With probability $s_{f,w}$ individuals survive until period 3 and with probability $1 - s_{f,w}$ they consume their wealth and die.[10] We model mortality risk because it is correlated with frailty and wealth and affects the likelihood of NH entry.

Finally, in period 3 the NH shock is realized and those who enter a NH pay the cost m and receive the private LTCI indemnity. NH entrants may also receive benefits from the public means-tested LTCI program (Medicaid). Medicaid is a secondary insurer in that it guarantees a consumption floor of $\underline{c}_{NH}$ to those who experience a NH shock and have low wealth and low levels of private insurance.

An individual of type $(f, \mathbf{w})$ solves the following maximization problem, where the dependence of choices and contracts on f and $\mathbf{w}$ is omitted to conserve notation,

$$U_1(f, \mathbf{w}) = \max_{a \geq 0, c_y, \mathbf{c}_o, \mathbf{c}_{NH}} u(c_y) + \beta U_2(a),$$

with

$$U_2(a) = \left[\psi u_2(a, \theta^g_{f,\mathbf{w}}, \pi^g, \iota^g) + (1-\psi) u_2(a, \theta^b_{f,\mathbf{w}}, \pi^b, \iota^b)\right],$$

and

$$u_2(a, \theta^i, \pi^i, \iota^i) = \int_{\underline{\kappa}}^{\overline{\kappa}} \Big\{ u(\kappa w_y) + \alpha \Big[s_{f,\mathbf{w}} \big(\theta^i u(c^{i,\kappa}_{NH}) + (1-\theta^i) u(c^{i,\kappa}_o)\big) + (1 - s_{f,\mathbf{w}}) u(c^{i,\kappa}_o) \Big] \Big\} q(\kappa) d\kappa,$$

subject to

$$\begin{aligned} c_y &= w_y - T(w_y) - a, \\ c^{i,\kappa}_o + \kappa w_y &= y_o - T(y_o) + a - \pi^i(a), \\ c^{i,\kappa}_{NH} + \kappa w_y &= y_o - T(y_o) + a - m + \iota^i(a) - \pi^i(a) + TR(y_o, a, \pi^i(a), \iota^i(a), m, \kappa), \end{aligned} \tag{13}$$

for $i \in \{g, b\}$. Income in old age is defined as

$$y_o \equiv w_o + ra + d_{\mathbf{w}} \Pi, \tag{14}$$

where Π denotes aggregate profits, $d_{\mathbf{w}}$ is an individual's dividend expressed as a share of aggregate profits, and r denotes the (net) real interest rate. The parameter β captures discounting between the time individuals start working and the start of retirement, while the parameter α captures discounting between the start of retirement and the moment of NH entry. Taxes are progressive, specifically,

$$T(y) = \tau \max(y - \tau_0, 0),$$

where τ is the tax rate and τ_0 units of income are tax exempt. The baseline Medicaid transfer

[10] There is evidence that individuals anticipate their death. Poterba et al. (2011) have found that most retirees die with very little wealth and Hendricks (2001) finds that most households receive very small or no

is

$$TR(y_o, a, \pi, \iota, m, \kappa) = \max\left\{0, \underline{c}_{NH} - \left[y_o - T(y_o) + a - m + \iota - \pi - \kappa w_y\right]\right\}. \qquad (15)$$

In the following analysis, we will also consider policy reforms where Medicaid benefits are means-tested but Medicaid is a primary payer. Under this assumption, Medicaid transfers are given by

$$TR^P(y_o, a, \pi, \iota, m, \kappa) = \max\left\{0, \underline{c}_{NH} - \left[y_o - T(y_o) + a - m - \kappa w_y\right]\right\},$$

and the individual's problem is found by replacing TR with TR^P in equation (13).

U.S. retirees with low means receive income transfers from the Supplemental Security Income (SSI) program and other medical expense assistance from Medicaid. We capture these other programs in a simple way. We start by solving the individual's problem above which assumes that there is only a single consumption floor in the NH state. Then we check whether the individual prefers to save nothing, not purchase LTCI, and consume the consumption floors $\underline{c}_{NH}$ in the NH state and $\underline{c}_o$ in the non-NH state. If he does, we assign him the two consumption floors and set his savings and private LTCI coverage to zero.[11]

2.2.2 Insurer's problem

The insurer observes each individual's endowments $\mathbf{w}$, frailty status f, and assets a. He does not observe an individual's true NH entry probability, $\theta^i_{f,\mathbf{w}}$, but knows the distribution of NH risk in the population and the individual's survival risk $s_{f,\mathbf{w}}$. We assume that the insurer does not recognize that asset holdings depend on $\mathbf{w}$ and f through household optimization. We believe that this is realistic because most people purchase private LTCI relatively late in life. Note that the demand shock, κ, is realized after the LTCI is contracted.

The insurer chooses a menu of contracts $\left(\pi^i_{f,\mathbf{w}}(a), \iota^i_{f,\mathbf{w}}(a)\right)$, $i \in \{g, b\}$ for each group of observable types that maximizes expected revenues, taking into account that individuals face survival risk after insurance purchase. As in the simple model, the insurer incurs a variable cost of paying claims with constant of proportion $\lambda - 1 \geq 0$. In addition, he incurs a per-capita fixed cost of paying claims $\gamma \geq 0$. His maximization problem is

$$\Pi(h, \mathbf{w}, a) = \max_{(\pi^i_{f,\mathbf{w}}(a), \iota^i_{f,\mathbf{w}}(a))_{i\in\{g,b\}}} \psi\left\{\pi^g_{f,\mathbf{w}}(a) - s_{f,\mathbf{w}}\theta^g_{f,\mathbf{w}}\left[\lambda\iota^g_{f,\mathbf{w}}(a) + \gamma I(\iota^g_{f,\mathbf{w}}(a) > 0)\right]\right\} \qquad (16)$$
$$+ (1-\psi)\left\{\pi^b_{f,\mathbf{w}}(a) - s_{f,\mathbf{w}}\theta^b_{f,\mathbf{w}}\left[\lambda\iota^b_{f,\mathbf{w}}(a) + \gamma I(\iota^b_{f,\mathbf{w}}(a) > 0)\right]\right\}$$

subject to the incentive compatibility and participation constraints

$$(IC_i) \quad u_2(a, \theta^i_{f,\mathbf{w}}, \pi^i_{f,\mathbf{w}}(a), \iota^i_{f,\mathbf{w}}(a)) \geq u_2(a, \theta^i_{f,\mathbf{w}}, \pi^j_{f,\mathbf{w}}(a), \iota^j_{f,\mathbf{w}}(a)), \quad \forall i, j \in \{g, b\}, i \neq j \quad (17)$$
$$(PC_i) \quad u_2(a, \theta^i_{f,\mathbf{w}}, \pi^i_{f,\mathbf{w}}(a), \iota^i_{f,\mathbf{w}}(a)) \geq u_2(a, \theta^i_{f,\mathbf{w}}, 0, 0), \quad \forall i \in \{g, b\}. \quad (18)$$

inheritances. Our assumption eliminates any desire for agents to use LTCI to insure survival risk.

[11]Modeling SSI in this way helps us to generate the low levels of savings of individuals in the bottom wealth quintile without introducing additional nonconvexities into the insurer's maximization problem.

Let $\tilde{h}(f, \mathbf{w}, a)$ denote the measure of agents with frailty status f, endowment $\mathbf{w}$, and asset holdings a. Then total profits for the insurer are given by

$$\Pi = \sum_{\mathbf{w}} \sum_{f} \sum_{a} \Pi(f, \mathbf{w}, a) \tilde{h}(f, \mathbf{w}, a). \tag{19}$$

2.3 Government's problem

In period 1 the government taxes the income of workers and saves the proceeds, earning an interest rate of $1+r$. Then in period 2, it taxes old individuals' income and uses its resources to finance the two means-tested welfare programs. Like the private insurer, the government incurs administrative costs of running both of these programs.[12] These costs are assumed to be per capita fixed costs and, hence, proportional to the fraction of individuals receiving transfers. Let γ_{gov} denote the cost per transfer recipient.

Given the two consumption floors guaranteed by the programs, $\{\underline{c}_{NH}, \underline{c}_o\}$, the income tax rate τ is set to satisfy the government budget constraint

$$REV = \sum_{\mathbf{w}} \sum_{f} \left[TR^{f,\mathbf{w}} + \gamma_{gov} fracTR^{f,\mathbf{w}} \right] h(f, \mathbf{w}), \tag{20}$$

where $TR^{f,\mathbf{w}} h(f, \mathbf{w})$ is aggregate government transfers to individuals of type $(f, \mathbf{w})$ via the two welfare programs and $fracTR^{f,\mathbf{w}}$ is the fraction of individuals of type $(f, \mathbf{w})$ receiving government transfers. Aggregate government revenue, REV, is given by

$$REV \equiv \sum_{\mathbf{w}} \sum_{f} (1+r) T(\omega_y) h(f, \mathbf{w}) + \sum_{\mathbf{w}} \sum_{f} \sum_{a} T(y_o) \tilde{h}(f, \mathbf{w}, a),$$

where the tax function $T(\cdot)$ is defined in equation (15) and income in old age y_o is defined in equation (14).

2.4 Equilibrium

We solve for a competitive equilibrium under the assumption that the real interest rate is exogenous. The U.S. economy has strong international financial linkages and it is unlikely that changes in LTCI arrangements would have a large effect on U.S. real interest rates. Medicaid is financed with an income tax that distorts savings incentives, and Medicaid incurs administrative costs that depend on private insurance market contracts. We thus solve a fixed point problem that ensures that the government budget constraint is satisfied, that insurance markets clear, and that total dividend income received by individuals equals total profits generated by the private LTC insurer, i.e., $\sum_{\mathbf{w}} \sum_{f} d_{\mathbf{w}} \Pi h(f, \mathbf{w}) = \Pi$.

Definition 1. Competitive Equilibrium. Given a distribution of individuals by frailty and endowments $h(f, \mathbf{w})$, a real interest rate r, and consumption floors $\{\underline{c}_{NH}, \underline{c}_o\}$, a competitive equilibrium consists of a set of insurance contracts $\{\pi^i_{f,\mathbf{w}}(a), \iota^i_{f,\mathbf{w}}(a)\}$, $i \in \{g, b\}$; profits Π; a government income tax rate τ; consumption allocations $\{c_y^{f,\mathbf{w}}, c_o^{f,\mathbf{w},i,\kappa}, c_{NH}^{f,\mathbf{w},i,\kappa}\}$, $i \in \{g, b\}$;

[12] In Braun and Kopecky (2024) we assume that administrative costs only apply to the Medicaid program.

and savings policy $a^{h,\mathbf{w}}$ such that the consumption allocations and saving policy solve the individuals' problems and the insurance contracts solve the insurer's problem, total dividend income is equal to total profits of the insurer, the distribution of agents by frailty, endowments and assets is such that

$$\tilde{h}(f, \mathbf{w}, a) = \begin{cases} h(f, \mathbf{w}), & \text{if } a = a^{f,\mathbf{w}}, \\ 0, & \text{otherwise,} \end{cases}$$

and the government budget constraint holds.

3 Parametrization

A key feature of U.S. long-term care insurance arrangements that our framework captures is that people have heterogeneous exposures to LTC risk and demand for private insurance. In our model, the likelihood of an individual requiring long-term care, along with his ability to manage this risk, is influenced by the individual's frailty, mortality risk, and permanent earnings. Individuals in the model also have private information about their true NH entry probability, and parameterizing our model requires us to resolve some subtle identification issues. Our identification strategy and specific data targets for most model parameters are the same as in Braun et al. (2019). However, the model here is a general equilibrium framework, and there are consequently new parameters that we need to parameterize.

Table 1: Government policy parameters

Parameter	Description	Value
τ	income tax	0.0153
τ_0	tax exemption	0.2744
γ_{gov}	Medicaid fixed admin. cost	0.0022

We assume that public insurance benefits are financed through taxation and that public insurance requires per-capita fixed costs of administration. Table 1 reports the values of the government policy parameters in the baseline economy. The income tax rate, τ, is set such that the government budget constraint, equation (20), holds, yielding an income tax rate of 1.53%. The tax exemption, τ_0, is set to \$7,200 per year or 27.44% of the average earnings per adult aged 18–64 in year 2000.[13] According to the 2008 Actuarial Report on the Financial Outlook for Medicaid, Medicaid spent \$17.3 billion on program administration in FY 2007, representing 5.2% of total outlays. The per-capita fixed cost of administering the two public insurance programs in the model, γ_{gov}, is set such that the total administrative costs of both means-tested welfare programs are 5.2% of total program outlays. This results in a value of γ_{gov} of 0.0022.

Consistent with the way the U.S. long-term care insurance system works in practice, the public LTC insurance program in the baseline economy is significantly less costly to

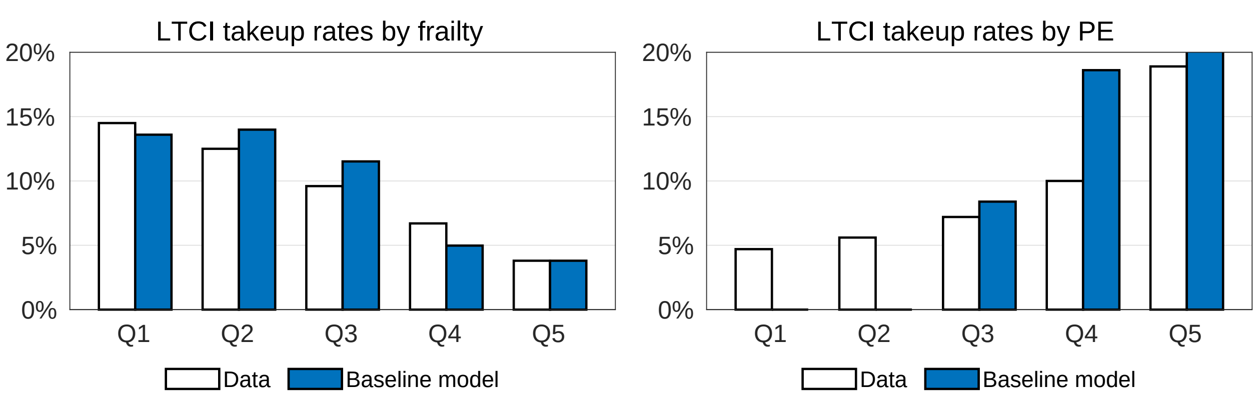
[13] In the model, endowments to the young are calibrated to permanent earnings. We normalize the mean young endowment to 1. This is equivalent to a mean permanent earnings of \$1,049,461 in 2000, or the

administer than private insurance. As in Braun et al. (2019), $\lambda - 1$, the proportional claims processing cost of providing private insurance is set such that total variable costs are consistent with commissions paid to brokers. These costs amounted to 12.6% of present-value premium on average in the year 2000.[14] The per-capita fixed cost, γ, is set such that total fixed costs capture underwriting costs and costs of paying claims. These costs amounted to 20% of present-value premium on average in 2000. The resulting values of λ and γ are 1.195 and 0.019, respectively. Private LTC insurers incur larger administrative costs because they pay large commissions to brokers and conduct extensive medical underwriting. Medicaid, in contrast, pays no commissions to brokers and does not conduct medical underwriting.

Additionally, we assume that all the insurer's profits are distributed to the top 1 percent of earners. This assumption reflects the fact that the income of executives and other highly affluent individuals is more sensitive to fluctuations in profits compared to others. In the policy experiments we consider, the welfare of the top 1 percent is primarily influenced by changes in profit-based income and taxes. This is partly because the top 1 percent owns the private insurer, and partly due to the fact that this group is generally healthier, prefers to self-insure against LTC risk, and is highly unlikely to receive Medicaid LTCI benefits.

The remaining parameters of our model are set in the same way as in Braun et al. (2019).[15] We posit 750 distinct risk groups that differ by frailty and permanent earnings. Some parameters are set directly using the data, while others are estimated by minimizing the distance between data moments and model counterparts. Most data statistics are based on an HRS data sample period that runs from 1992 to 2012. Our frailty index is constructed to reflect the underwriting criteria used by LTC insurers. Finally, lifetime NH entry probabilities for HRS respondents are estimated using an auxiliary simulation model. In the parameterization, the consumption floor provided by Medicaid, c_{NH}, and the consumption floor for those who do not enter a NH, c_o, are both set to 1.855% of mean permanent earnings in the economy or \$6,540 a year. This value consists of a consumption allowance of \$30 per month and housing and food expenses of \$515 per month. These numbers are consistent with Medicaid and SSI transfer amounts to a single elderly individual in 2000.

Figure 6: LTCI Takeup rates by frailty and PE quintiles in the Model and US data.



Note: Data source is 62–72 year olds in our HRS sample. Frailty and PE increase across quintiles.

average earnings per adult aged 18–64 in 2000 multiplied by 40 years.

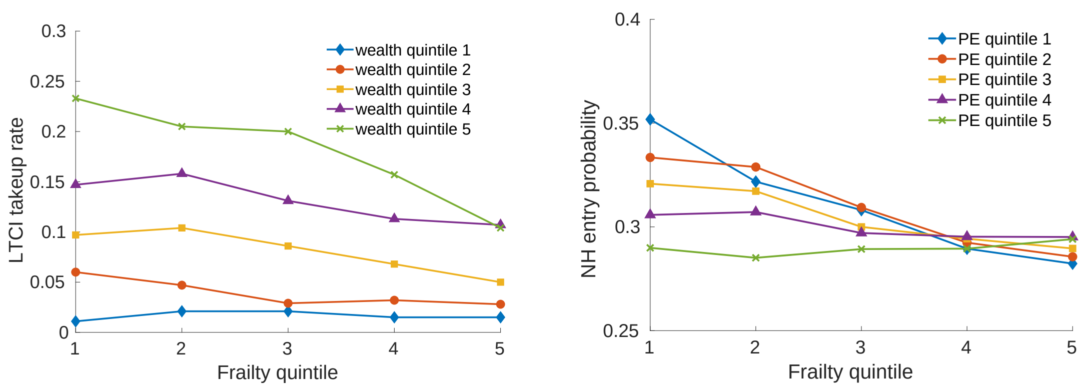
[14] See Eaton (2016) for a breakdown of administrative costs as a share of premium revenue.

[15] Table 4 in the Appendix reports many of the baseline parameter values.

We now compare statistics from our general equilibrium model with US data statistics on LTCI takeup rates and lifetime NH entry risk estimated in Health and Retirement Study (HRS) data. Figure 6 reports the private LTCI takeup rates in our HRS data sample and the model. The left panel reports LTCI takeup rates by frailty quintile. Our frailty index is constructed so that less frail individuals have a low value of an index. PE quintiles are organized to increase in PE. Thus, the individuals with the highest earnings appear in Q5. Observe that private LTCI takeup rates decline with frailty in the data and in our model while LTCI rates increase with PE in both the data and in our model.

These results are puzzling because lifetime NH entry risk is slightly decreasing in frailty and doesn't vary much with PE (Figure 7). According to our model, the dispersion of private NH entry risk has to increase in frailty, f, and decline in PE/wealth, if the model is to account for the empirical patterns of LTCI takeup and NH entry. In particular, we set ψ, the overall fraction of individuals of type g to reproduce the overall dispersion in the self-reported NH entry probabilities in our HRS data. Then we vary the probabilities of NH entry $\{\theta^L_{f,\mathbf{w}}, \theta^H_{f,\mathbf{w}}\}$ by $(f, \mathbf{w})$ to reproduce the LTCI takeup rates and the NH entry rates by frailty and wealth/PE quintiles.

Figure 7: LTCI Takeup Rates and Lifetime NH Entry Rates in the Data



(a) LTCI takeup rates (b) NH entry rates

Note: LTCI takeup rates are those of 62–72 year-olds in our HRS sample. NH entry rates are for an NH stay of 100 days or longer, and are based on our auxiliary simulation model, which is estimated using HRS data. Frailty, wealth, and PE increase across quintiles. The wealth and PE quintiles reported here are marginal and not conditional on the frailty quintile, so for example, only around 7% of people in frailty quintile 1 are in wealth quintile 1, while 33% are in wealth quintile 5.

We do not directly target the dispersion of private information by frailty and PE quintile; consequently, the fit of these statistics provides a way to assess the model's fit with the data. Table 2 reports the standard deviation of self-reported (private) NH entry probabilities by frailty and PE quintile in our HRS data and in the model. Observe that the dispersion of private information increases with frailty and decreases with PE in both the data and our model.

4 Results

We present two sets of results. We start by documenting how public insurance, administrative costs and asymmetric information influence takeup rates of different risk groups. Then we

Table 2: Standard deviation of self-reported NH entry probabilities by frailty and PE quintile.

	Frailty quintile				
	1	2	3	4	5
Data	1.00	1.00	1.03	1.27	1.47
Model	1.00	1.08	1.20	1.32	1.47
	Permanent earnings quintile				
	1	2	3	4	5
Data	1.00	0.92	0.85	0.79	0.76
Model	1.00	0.96	0.91	0.80	0.58

Note: The standard deviations of frailty and PE quintile 1 are normalized to 1. Data values are standard deviations of self-reported probabilities of entering an NH in the next 5 years for HRS respondents ages 65–72, excluding observations where the probability is 0, 100% or 50%. The decline in standard deviation with PE in the data is robust to how we handle these observations.

use the model to analyze how three distinct reforms influence welfare of different individuals, government expenditures, and the functioning of the US private LTCI market.

4.1 The Contributions of Medicaid, Administrative Costs and Asymmetric Information to Low Takeup and Low Coverage Rates.

Our analysis of the 1-period model suggests that administrative costs and Medicaid have a potentially large impact on the private LTCI market. However, that analysis only considers the situation of a single risk group. Our quantitative model is a considerably more detailed model of public and private LTCI that reproduces some of the main features of US LTCI arrangements. We now use it to assess the quantitative significance of administrative costs, Medicaid, and asymmetric information for takeup and coverage rates of private LTCI.

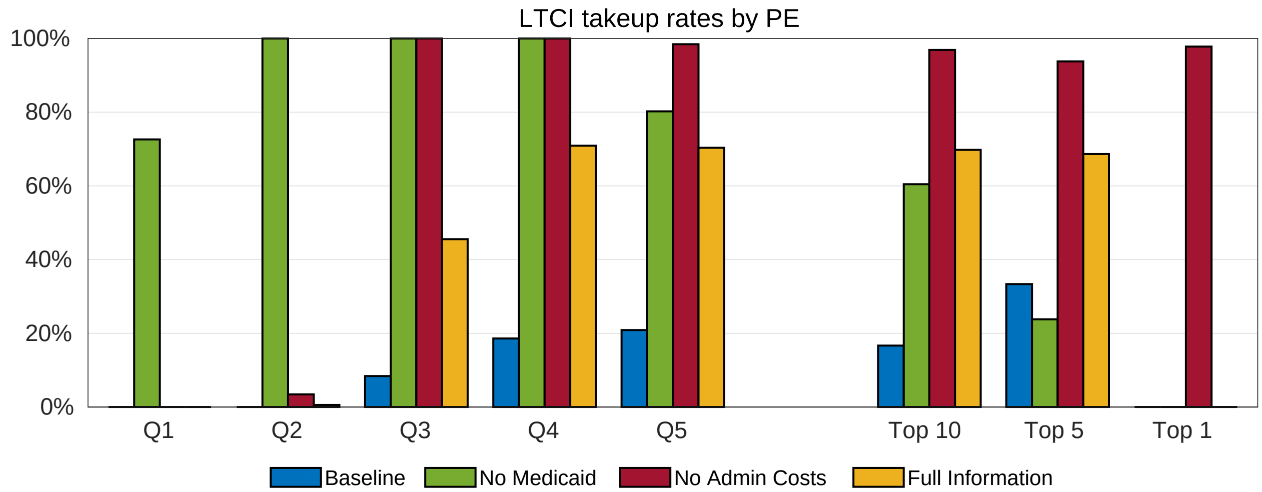
Figure 8 reports LTCI takeup rates by PE quintile for the baseline and three alternative economies and Figure 9 reports coverage rates. The 'No Medicaid' economy sets the consumption floor provided by Medicaid to NH entrants, c_{NH}, to 0.001 of mean permanent earnings or approximately \$350 per year.[16] The 'No Administrative Costs' economy sets the fixed administrative costs to zero and the variable costs, λ, to one and the 'Full Information' economy assumes that the insurer can directly observe each individual's NH entry probability, θ.

A comparison of the Baseline and 'No Medicaid' economies in Figure 8 indicates that Medicaid has a pronounced crowding out effect on private LTCI takeup. Removing Medicaid increases private LTCI takeup from 9.6% to 90.6%. Takeup increases in all five PE quintiles and even in the top 10 percentiles of PE. There is essentially no basis for private insurers to trade with individuals in PE Q1–Q2 in the Baseline. Even at higher PE levels, Medicaid depresses LTCI takeup because it provides an outside option to individuals that tightens

[16] We do not reduce c_{NH} to zero because then some individuals would experience negative consumption.

Figure 8: LTCI Takeup Rates in Alternative Model Scenarios.

	Baseline	No Medicaid	No Admin Costs	Full Information
LTCI takeup rate (%)	9.6	90.6	60.4	37.5



their participation constraints. When Medicaid is absent, all households in PE Q2–Q4 purchase private LTCI and nearly all in PE Q1.[17] An LTC event is very costly, even for households with moderate PE, and demand for private insurance is highly inelastic when public insurance is not available.

Figure 9 shows that removing Medicaid also impacts coverage rates, but the effects are smaller and more nuanced. Recall that, in the baseline economy, individuals do not want full private insurance contracts because Medicaid partially insures them against NH risk. Depending on the size of their consumption demand shock, they may or may not receive Medicaid benefits. Since they are partially insured in expectation against NH entry risk by Medicaid, they prefer partial insurance coverage from the private insurer. Consequently, removing Medicaid should increase private LTCI coverage levels. However, this is not necessarily the case due to two offsetting effects. First, removing Medicaid increases incentives to save. As saving rates go up, the willingness to pay for a marginal increase in private insurance declines, reducing coverage levels. Second, the composition of individuals who purchase private LTCI changes. Absent Medicaid, a larger share of private insurance purchasers are from the lower part of the PE distribution, where the ability to self-insure LTC risk with savings is lower and demand for private insurance is more inelastic. The net impact of these different effects is a small increase in the average coverage rate from 60% in the baseline to 66.2% in the 'No Medicaid' economy.

We next compare private LTCI takeup and coverage rates in the Baseline economy to those in the 'No Administrative Costs' economy. Removing administrative costs leads to a marked increase in takeup, from 9.6% to 60.4%. This overall increase is due to a sharp rise in takeup among affluent individuals in PE quintiles 3 through 5, including those in the top

[17]The increase in Q1 is less than 100 percent because the consumption floor is very small but still positive.

10th, 5th, and 1st percentiles. In the absence of administrative costs, over 90% of individuals in these higher PE groups purchase private LTCI.

Coverage rates also go up slightly on average, rising from 60% to 62.3%. Coverage rates increase the most for individuals with PE around the 85th percentile. These individuals are the most exposed to LTC risk in the baseline. They have a relatively low probability of qualifying for Medicaid but are not wealthy enough to easily self-insure through savings. As PE falls, and the likelihood of qualifying for Medicaid benefits rises, individuals prefer less coverage from the private insurer. As explained above, this is true even though Medicaid is a secondary payer and private insurance replaces (as opposed to tops up) Medicaid benefits, because as income falls, the probability of being eligible for Medicaid goes up. Consequently, lower-income individuals' expected NH costs are smaller, and the amount of coverage they want from the private insurer is also smaller. Individuals in the top percentiles of PE also prefer less coverage compared to those with lower PE because they are better able to self-insure through savings.

Finally, removing private information also has a large impact on private LTCI takeup and coverage levels. When the insurer has full information, take-up rates increase to 37.5% and the average coverage rate increases to 83.1%. Private insurance takeup rates in PE Q4–Q5 and the top 10 and top 5 percentile exceed 60 percent, with coverage rates of 80 percent or higher. The increases in take-up are due to a large increase in take-up rates of low-risk types, whose take-up rises from 9.5% to 52.1%. In contrast, take-up rates of high-risk types decline from 9.7% to 1.7%. Since the insurer directly observes each individual's risk type, he no longer has to design menus that satisfy incentive compatibility. As a result, high-risk types no longer cross-subsidize low-risk types or become excluded. Instead, the insurer offers them more coverage with a lower load. By the same token, the insurer also offers more coverage to high-risk types, but the loads on these contracts go up, as do denial rates.

The overall message that emerges from this analysis is that all three frictions depress private insurance markets. But Medicaid is most important for lower PE groups.

4.2 Policy Reforms

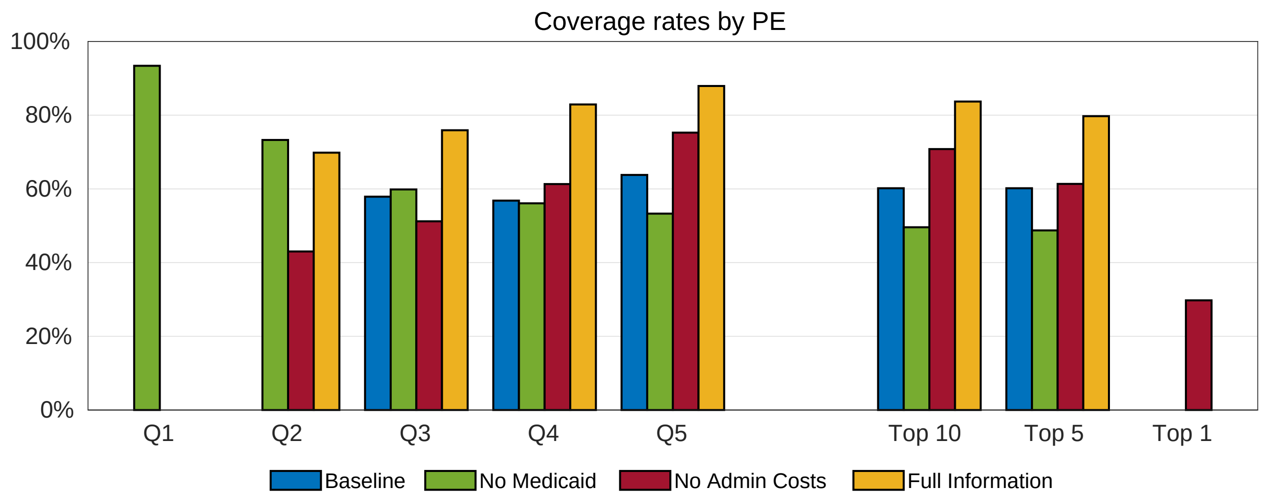
We have established that our quantitative model accounts for the empirical distributions of private LTCI takeup rates and the dispersion in self-reported NH entry probabilities.[18] We have also shown that Medicaid, administrative costs, and adverse selection depress takeup and coverage rates in distinct ways. Medicaid crowds out private insurance at all five PE quintiles and is particularly important for understanding takeup and coverage rates of households with low personal resources. Administrative costs and adverse selection, in contrast, are important contributing factors to low takeup and coverage rates of affluent households.

We now use our quantitative model to consider the aggregate and distributional consequences of three distinct policy reforms. We will assess each reform based on how it impacts the fiscal situation of the government, the functioning of the private market for LTCI, and individual and aggregate welfare. The ensuing analysis assumes that the government adjusts the income tax rate to balance its budget each period and that the private insurer's profits are distributed to individuals in the top 1 percent of PE. How profits get distributed across PE

[18] Braun et al. (2019) provides a more detailed analysis of the empirical fit of the model.

Figure 9: Coverage Rates in Alternative Model Scenarios.

	Baseline	No Medicaid	No Admin Costs	Full Information
Coverage rate (%)	60.0	66.2	62.3	83.1



groups can influence our welfare conclusions and it is well known that equity holdings of US companies are concentrated among high-income individuals. Our assumption implies that, for the most affluent individuals in the economy, LTCI reforms primarily impact household wealth via the LTCI profits channel.

The 'No Medicaid' economy. Our baseline specification has two forms of public insurance. Individuals with low resources receive means-tested public LTCI benefits if they enter a NH. Poor elderly households can also qualify for means-tested social insurance if they don't experience the NH event. In the 'No Medicaid' economy the consumption floor guaranteed to NH entrants, c_{NH} is set to 0.001 of mean permanent earnings or approximately \$350 per year. The consumption floor provided to poor elderly individuals that do not experience a NH event, c_o, remains at its baseline value. Lowering the Medicaid LTC consumption floor close to zero produces large fiscal savings. The fraction of individuals receiving public transfers falls from 49.3 to 5.4 percent, public outlays on social insurance decline by 88.2 percent, and tax revenues fall from 0.016 to 0.002 as a share of mean PE.

Reducing the scale of publicly funded LTCI has a large positive impact on demand for private LTCI, especially by individuals in PE Q2–Q4 because the cost of a nursing home stay is large relative to their means. Private LTCI rises to 100 percent in PE Q2–Q4. Private LTCI takeup also increases in Q1 but the magnitude of the increase is smaller because some individuals in this group still qualify for Medicaid. Aggregate LTCI takeup rates rise from 10 to 91 percent. The insurer, recognizing that demand for private LTCI is now inelastic in PE Q1–Q4 responds by offering policies with higher premiums and more coverage. Profits also rise sharply in PE Q1–Q4, and aggregate profits increase from 0.07 to 31.5 percent of premium revenue (Table 3).

Welfare of a newborn declines when Medicaid is essentially removed and a 23 percent

Table 3: Welfare and indicators of the private and public LTCI in the Baseline, 'No Medicaid', 'Universal Medicaid' and 'Medicaid Primary' economies

Scenario	Baseline	No Medicaid	Universal Medicaid	Medicaid Primary
Welfare (newborn)	-2.757	-3.390	-2.704	-2.749
Compensating variations (%)		22.96	-1.92	-0.29
Average:				
Medicaid outlays (% change from baseline)		-88.2	185.5	-3.32
Govt tax revenue	0.016	0.002	0.035	0.015
NH entrants on Medicaid (%)	49.29	5.42	100.0	47.94
Profits/Premium revenue (%)	0.072	31.508	0.000	5.438
LTCI takeup rate	0.096	0.906	0.000	0.633
Fraction of NH costs covered	0.600	0.662	NaN	0.370
Load	0.407	0.558	NaN	0.504
Profits/Premium revenue (%) by PE Quintile				
1	NaN	49.37	0.000	NaN
2	NaN	37.56	0.000	0.747
3	0.057	22.84	0.000	3.030
4	0.109	16.83	0.000	5.879
5	0.046	9.97	0.000	8.469
High PE				
top 10	0.115	4.23	0.000	6.436
top 5	0.115	3.01	0.000	7.223
top 1	NaN	NaN	0.000	NaN
Compensating Variations (%) by PE Quintile				
1		45.32	0.370	-0.001
2		12.47	-4.106	-0.081
3		2.614	-4.943	-1.061
4		-0.170	-2.844	-0.737
5		-1.981	-0.099	-0.353
High PE				
top 10		-2.964	0.752	-0.296
top 5		-4.531	1.471	-0.223
top 1		-16.25	2.709	-1.027

Note: Results are reported by permanent earnings (PE) quintiles and for the top 10, 5, and 1 percentiles of the PE distribution.

supplement to consumption is required to make a newborn individual who does not yet know her initial income and health status indifferent between the 'No Medicaid' and the baseline economy. We have seen that profits are particularly high on contracts offered to low-income individuals because these groups no longer qualify for (free) Medicaid benefits. It follows that these same groups experience the biggest welfare losses. For instance, the compensating variation for individuals in the lowest PE quintile is 45.3 percent. High PE groups, in contrast, prefer the 'No Medicaid' economy to the baseline. They are not very likely to qualify for Medicaid benefits, and when Medicaid is scaled back, they benefit from lower taxes. This is the reason why compensating variations in PE quintiles four and five are negative. Individuals in the top 1 percent own the private insurer and also benefit from higher dividends on their shares.

The Universal Medicaid economy. Americans are aging and the demand for long-term care services is rising, yet the US private insurance market is small and declining. Private insurers are hampered by adverse selection and high marketing and underwriting costs. These frictions disappear when the government provides universal public LTCI. We now analyze an economy in which the medical expenses associated with an NH stay are fully covered by universal public insurance. In this economy, the private market for LTCI becomes dormant and government LTC expenditures increase by nearly 186 percent, to a level equivalent to approximately 1.2 percent of GDP (or about 20 percent of US Social Security outlays in 2023). This reform increases ex ante welfare and increases redistribution from wealthy individuals to low- and middle-class individuals. A deduction of 1.92 percent of consumption makes a newborn individual indifferent between this economy and the baseline. Middle-class individuals are the biggest beneficiaries of universal public LTCI. Compensating variations are negative for PE quintiles 2 through 5 and are particularly significant for PE quintile 3 (-4.94 percent). Interestingly, PE quintile 1 prefers the baseline. For these individuals, public insurance of LTC risk is similar in both economies, but some members of this group are now paying higher income taxes. All three high PE groups prefer the baseline too. Individuals in these groups are relatively healthy and have the resources to self-insure LTC risk. They prefer not to pay higher income taxes to finance a public insurance program whose primary beneficiaries are low- and middle- class individuals. The top PE group experiences the largest welfare loss. Their tax burden is highest and their profit income is now zero because the private LTCI market is dormant.

The Medicaid primary economy. We previously illustrated that the Medicaid secondary payer provision depressed private LTCI takeup in the 1-period model. We now use our quantitative model to show that this theoretical result is quantitatively significant by documenting how the quantitative model's properties change when Medicaid benefits are means-tested but Medicaid is the primary payer. As shown in Column 4 in Table 3, this policy reduces government expenditures on Medicaid, increases the size of the private LTCI market, and increases welfare.

The most surprising result from this reform is that government expenditures on Medicaid are 3.3 percent lower when Medicaid is the primary payer. The fiscal savings are concentrated in PE quintiles 2 and 3. The main reason Medicaid expenditures fall is that these groups now save more and enter retirement with more wealth. Wealth at the start of period 2 before individuals receive their second endowment is 18% higher in PE quintile 2 and 5% higher in PE quintile 3. With higher wealth, fewer of them satisfy the Medicaid means-test. The fraction of individuals qualifying for Medicaid falls by 1.7 percentage points in the second PE quintile, by 1.9 percentage points in the third PE quintile and the aggregate fraction of NH entrants qualifying for Medicaid benefits falls from 49.3 to 47.9 percent. Aggregate Medicaid benefits per recipient also decline. Medicaid benefits per recipient decline by 0.67 percentage points in PE quintile 3. They exhibit small increases in PE quintiles 2, 4 and 5 but the first effect is larger and aggregate Medicaid outlays per recipient decline by 0.18 percentage points.

Making Medicaid the primary payer also has a positive impact on the functioning of the private insurance market. Private insurance takeup rates increase in Q2–Q5 and in the top 10 and top 5 percentile PE groups, and average LTCI takeup increases from 9.6 percent in the baseline to 63.3 percent in this scenario. Profitability increases for all insured groups, even though the average coverage rate of private insurance policies declines from 60 percent to 37 percent. Private LTCI policyholders who satisfy the Medicaid means-test now qualify for free Medicaid benefits. Consequently, WTP for a given level of private insurance is higher. However, individuals prefer private policies with partial coverage levels that top up their Medicaid benefits.

Finally, observe that welfare is higher in the Medicaid primary scenario compared to the baseline. The increase in welfare of a newborn is not as large here as in the 'Universal Medicaid' scenario, but that scenario exhibited considerable disagreement between high PE and other PE groups. There is no conflict in this scenario. Welfare increases in all PE quintiles as well as in the three High PE groups. Most PE groups benefit because they have higher total insurance coverage compared to the baseline for LTC risk. The top 1 percentile PE group still prefers to self-insure LTC risk but they benefit from higher dividend income (insurer profits increase) and lower taxes. Individuals in PE quintile 1 also benefit from lower taxes, but the effect is quantitatively small.

5 Conclusion

The United States and other advanced economies are aging, and associated with aging is higher demand for LTC services. Yet, private LTCI insurance markets are shrinking, and most Americans find themselves paying for expensive long-term care episodes out of pocket. In this paper, we used a quantitative structural model of public and private insurance in the US to consider reforms to the LTCI market.

Our results explain why it is difficult to build a consensus behind large-scale reductions or increases in public LTCI. A smaller public LTCI program increases the welfare of affluent individuals because their tax bill falls and they have the resources to pay their own LTC expenses. However, it has a large negative impact on the welfare of the poor who are the main beneficiaries of the US Medicaid program. A larger public LTCI program benefits middle-class individuals who are too wealthy to be well covered by Medicaid but too poor to easily self-insure. But, it results in welfare losses of the rich and very poor who both prefer a cheaper public LTCI program. Interestingly, we find that a reform that removes the secondary payer provision of Medicaid while retaining the means-test would likely garner broad support because it increases private LTCI takeup rates, increases the profitability of insurers, and increases the welfare of low-, middle-, and high-income individuals.

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6 Appendix

6.1 Monopoly versus Competition

An equilibrium in the contract market may fail to exist under perfect competition. In contrast, with a monopolist insurer, a unique optimal contract always exists. To illustrate the source of this divergence, Figure 10 compares the contracting outcomes for the same calibration under competition and monopoly.

The key difference between the competitive market and the monopolist is that in the competitive market, the optimal menu of contracts must earn zero profits. For such a menu to constitute an equilibrium, no alternative contract menu can exist that both (i) earns positive profits and (ii) is strictly preferred by both private information types. If such a menu exists, an entrant could profitably offer a pooling contract that attracts both types, undermining the original zero-profit menu. Since this alternative contract earns positive profits, it cannot be part of a competitive equilibrium—implying that no equilibrium exists.

In Figure 10a, the points Hce and Lce represent the optimal zero-profit contracts. However, contracts located above the green dashed line and below the indifference curve of the low-risk type yield positive profits and are preferred by both types. Pooling contracts in this region sufficiently increase insurer profits from low-risk types to offset losses incurred from attracting high-risk types. The existence of these profitable and attractive pooling contracts renders the zero-profit menu $\{\mathsf{Hce}, \mathsf{Lce}\}$ unsustainable as a competitive equilibrium.

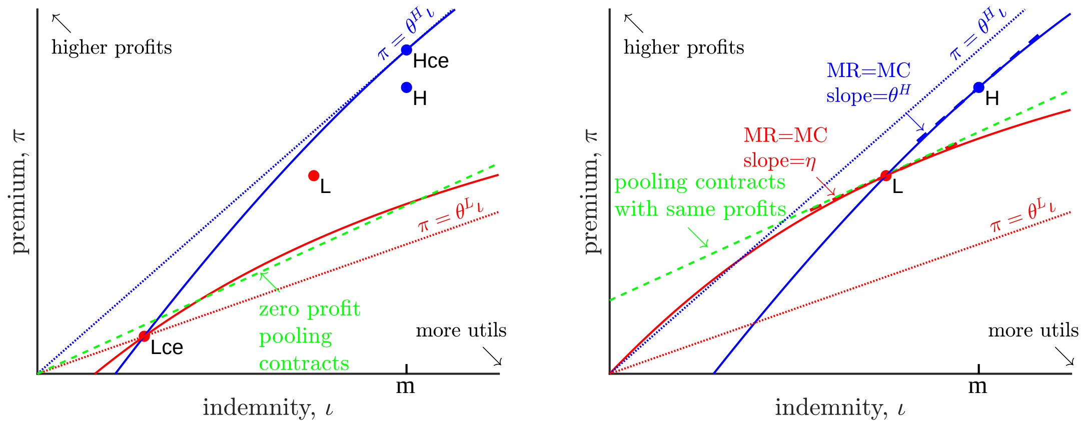
The likelihood of such pooling contracts arising is higher when the cost of pooling for low-risk types is low—either because the proportion of high-risk types is small, or because the incremental risk associated with high-risk types is modest. In these cases, insurers can profit by offering contracts with more generous coverage to low-risk types, since the cost of also attracting high-risk types is small.

By contrast, under monopoly (Figure 10b), no pooling contract exists that is strictly preferred by both types relative to the monopolist's optimal menu $\{\mathsf{H}, \mathsf{L}\}$ and earns higher profits. The only pooling contracts that yield higher profits lie northwest of the green dashed line but make the low-risk type worse off. The monopolist, by fully extracting consumer surplus subject to the participation and incentive compatibility constraints of the individuals, leaves no room for further profitable deviations and, hence, the equilibrium always exists.

6.2 Calibration

Table 4 reports the calibrated values of the main model parameters. More details on our calibration strategy can be found in Braun et al. (2019).

Figure 10: Optimal contracts when the market is competitive.



(a) Competitive Market (b) Monopoly

Note: Points H and L are the optimal contracts for type-H and type-L individuals under monopoly. Points Hce and Lce are the optimal zero-profit contracts under competition. The parametrization used to create both figures is $\sigma = 1.1$, $\psi = 0.8$, $\theta^L = 0.2$, $\theta^H = 0.5$, $w + a = 1.0$, $m = 0.8.$, $\lambda = 1$, and $\underline{c}_{NH} = 0$.

Table 4: Model Parameters

Description	Parameter	Value
Risk aversion coefficient	σ	2
Preference discount factor	β	0.94
Retirement preference discount factor	α	0.20
Interest rate (annualized)	r	0.00
Frailty distribution	f	BETA(1.54,6.30)
Young endowment distribution	w_y	$\ln(w_y) \sim \mathcal{N}(-0.32, 0.64)$
Copula parameter	ρ_{f,w_y}	-0.29
Demand shock distribution	κ	$1 - \kappa \sim$ truncated log-normal
Demand shock mean	μ_κ	0.6
Demand shock standard deviation	σ_κ	0.071
Fraction of good types	ψ	0.709
Nursing home cost	m	0.0931
Insurer's variable cost of paying claims	λ	1.195
Insurer's fixed cost of paying claims	γ	0.019
Medicaid consumption floor	$\underline{c}_{NH}$	0.01855
Welfare consumption floor	$\underline{c}_o$	0.01855