The Value of Medicaid Long-Term Care: Evidence from the Deficit Reduction Act of 2005 *

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Abstract

Public long-term care (LTC) insurance helps the elderly protect against financial risks, yet its value is hard to measure. This paper provides a novel answer to this question by employing a quasi-experiment from the Deficit Reduction Act (DRA) that restricts seniors' Medicaid LTC access. I find that in response to the DRA, single elderly individuals reduced their home equity by $66.75K (12.1%), while increasing non-LTC consumption by $10.5K (22.5%). Using these findings and a two-stage budgeting model, I then estimate that seniors' willingness to pay for Medicaid LTC is $1.2 per dollar of its net resource cost. This evidence shows that the government's intention to limit the provision of Medicaid LTC harms social welfare.

JEL classification: H41, H53, I13, I18, J14, J18

Keywords: Medicaid, long-term care, willingness to pay, home equity, consumption

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1 Introduction

In the last two decades, there has been a substantial increase in long-term care (LTC) expenditures in the United States. As illustrated by Figure 1, total LTC expenditures rose from $125 billion in 1996 to $350 billion by 2016. This rapid growth of LTC spending is due to two reasons: high demand and huge cost. About 42% of adults aged 65 and above have reported functional limitations in 2017 (CDC, 2017), suggesting that the demand for LTC is extensive. Meanwhile, the cost of LTC is overwhelming compared to seniors' income. In 2019, the average annual cost of a private room in a nursing home was around $102,200, which is almost four times larger than 200% of the Federal Poverty Level (see in Figure 2). As the population ages and disabling health conditions become increasingly common, these costs may keep rising.

This paper builds on the fact that LTC costs are one of the largest financial risks faced by senior adults. Therefore, finding a way to pay for LTC becomes a big concern. Medicare does not cover most LTC expenses, and the private insurance market for LTC is small. More than half of total costs are paid by the Medicaid LTC program, and individuals who are not eligible for Medicaid LTC mainly pay LTC costs out of pocket. As a result, Medicaid LTC eligibility offers a valuable resource for senior adults to deal with such unexpected financial risks. This leads to the research question of this paper: How much are senior adults willing to pay for Medicaid LTC?

This question is challenging since Medicaid LTC, as public health insurance, is not traded in a well-functioning market. This prevents us to implement welfare analysis based on estimates of ex-ante willingness to pay derived from contract choices. To investigate this question, I build my analysis in two steps. First, I identify the impact of Medicaid LTC eligibility on individuals' consumption behavior using a quasi-experiment. Second, I construct a two-stage budgeting model to evaluate the value of Medicaid LTC to recipients in terms of the amount of non-housing, non-LTC consumption they would need to give up to be indifferent between receiving and not receiving Medicaid LTC.

Specifically, for my first step, I make use of a policy change under the federally mandated Deficit Reduction Act (DRA). Before 2006, the primary residence was a non-countable asset when determining eligibility for Medicaid LTC services, and therefore acts as a popular channel for sheltering assets. However, after the passage of the DRA in 2006, individuals with home equity above $500,000 were not able to receive payments for Medicaid LTC services. This is the largest change to Medicaid LTC eligibility since its enactment in 1965. If individuals have little demand for LTC services, then a policy that influences the eligibility for Medicaid LTC should barely affect their utility levels. On the other hand, if individuals perceive that they will use a large amount of LTC services, then the same policy should significantly affect their well-being by distorting their consumption behavior.

Using detailed panel data from the biennial survey of Health and Retirement Study (HRS) and the Consumption and Activities Mail Survey (CAMS), I test how the DRA affects the consumption behavior of senior adults. The main challenge for identification of the policy impact is that it was implemented across all states in the United States during the housing market crash with the subsequent financial crisis. Thus a simple difference-in-differences approach in estimating individuals' consumption change during this period could simply reflect broader trends and not be in any way caused by the provision of the DRA.

I address this identification challenge by employing a triple-difference (DDD) framework. I make use of the fact that seniors with home equity below the equity cap are not influenced by the policy. I use these individuals as the control group and use those with home equity above \$500K as the treatment group. To account for the possible impact of the housing market crash, I use a younger cohort aged 55-64 who are not eligible for Medicaid LTC services as the second control group.

By dividing total non-LTC expenses into the consumption of housing services and the consumption of non-housing goods and services, I establish two main empirical findings. First, individuals with home equity above the DRA-imposed cap reduce their home equity by \$66,750 to \$97,950 depending on regression specification. Most of the impact of this restriction policy is concentrated among individuals whose home equity is closer to the cutoff point (\$500,000), who have difficulties caring for themselves, and who have less advantaged social-economic status. Further, with the evidence showing that home value growth captures most of the movement pattern of home equity growth and that loan-to-value ratio is stable, we can deduce that this restriction policy pushes the seniors to sell their original house and move into a lower-value one without changing the mortgage rate.

Second, I find that the DRA induces individuals to increase non-housing, non-LTC consumption by \$10,500. The increase in non-LTC consumption is mainly driven by the increase in nondurables spending. Individuals affected by the DRA change their spending habits by investing \$10,720 more on nondurables, while consumption changes in other categories are insignificant. These results support a hypothesis of affected seniors "burning up" money and distorting consumption to regain eligibility for Medicaid LTC.

Using these empirical findings, I then evaluate seniors' willingness to pay for Medicaid LTC by applying a modified framework from Finkelstein et al. (2019). Specifically, an individual's willingness to pay for Medicaid LTC refers to the non-housing, non-LTC consumption she would need to give up to be indifferent between receiving and not receiving Medicaid LTC. In my model, I employ a two-stage budgeting framework that allocates total expenditure in two stages: in the first stage, expenditure is allocated to LTC consumption and non-LTC consumption, and in the second stage, non-LTC consumption is further divided into housing and non-housing consumption. By assuming the separability of components in the utility function, the optimizing individual's first-order condition allows me to value the marginal impacts of Medicaid LTC on any potential arguments of the utility function through the marginal utility of that single argument. As a result, I establish the link between non-housing, non-LTC consumption with Medicaid LTC status. Total willingness to pay then can be divided into two parts: a transfer term and a pure-insurance term. The transfer term captures the recipients' expected valuation of the transfer of resources from the rest part of the economy to them, and the pure-insurance term captures the valuation of a budget-neutral reallocation of resources across different states of the world. Lastly, I obtain the value of Medicaid LTC by combining the estimates of these two parts.

The calibration result reveals that the willingness to pay for Medicaid LTC by seniors is $1.2 per dollar of net cost, suggesting that seniors' willingness to pay for Medicaid LTC exceeds its net cost. This estimate is on par with existing measures of willingness to pay in other health insurance contexts, such as general health insurance covered by Medicare and Medicaid. This finding implies that the efficient allocation of Medicaid LTC services has not been achieved yet, and the implementation of the DRA is not welfare-improving.

To my knowledge, the paper is one of the first studies to provide empirical evidence on the importance of LTC expenses for multi-dimensional consumption behavior using a quasi-experiment. It is also one of the first studies to evaluate seniors' willingness to pay for public long-term care insurance under a two-stage budgeting framework. Incorporating housing and non-housing consumption into the individual's optimization problem allows me to fix the distortion of consumption due to the DRA restriction and to obtain a more accurate estimate of the value of Medicaid LTC.

The rest of this paper is organized as follows. Section 2 provides more details with the relevant literature. Section 3 describes the background of long-term care in the United States and the institutional details of Medicaid LTC. Section 4 proposes a simple conceptual framework to understand the link between the policy and consumption arrangements among seniors. Section 5 describes the data and presents the empirical strategy and the main results. Section 6 gives more details on the model and evaluates the willingness to pay for Medicaid LTC. Finally, I conclude in Section 7.

2 Literature

The findings in this paper contribute to several strands of the economics literature. First, this study contributes to a growing literature on the importance of LTC expenses for consumption behavior. Theoretical work on savings response to old-age out-of-pocket health expenses shows that uncertain medical expenses explain slow rates of dissaving among elderly Americans after retirement (Kotlikoff, 1986; Hubbard et al., 1995; Palumbo, 1999; Scholz et al., 2006; De Nardi et al., 2010). Allowing for retirees to face both risky medical expenses and risky nursing home expenses in a life-cycle framework, Kopecky and Koreshkova (2014) show that over half of seniors' savings are due to the presence of nursing home expenses.

Empirical evidence on the importance of LTC expenses for consumption behavior, however, is relatively less. One main reason for this scarcity is because it's hard to find an exogenous variation on LTC provision. This study is one of the first to utilize a quasi-experiment to look at individuals' multi-dimensional consumption responses to unexpected LTC expenses. The work most closely related to this study is Ricks (2018). Like him, I also use the exogenous variation on LTC expenses from the DRA. The key differences between my work and his are twofold. First, I follow policy implementation as the treated period, as opposed to relying on only anticipatory effects of the policy. Second, I adopted a more rigorous empirical approach by using a triple-difference strategy that is less impacted by self-reporting measurement errors and the potential violation of parallel trends. Once these concerns are taken into account, I find that the effect of nursing home expense risk on savings is substantial.

Second, this study is one of the first to estimate the value of public long-term care insurance with an empirical framework. Despite the challenges related to population aging and the provision of long-term care, few previous studies have addressed willingness to pay for long-term care services. Most of this literature has focused on European countries. Those studies rely on the contingent valuation method by directly asking respondents to report their WTP to evaluate various components for long-term care services (Amilon et al., 2020; Callan and O'Shea, 2015; Nieboer et al., 2010). However, the main concern of the contingent valuation method is that the respondents may not give a meaningful answer to serve as the basis for an inference about the WTP of the entire population (Haveman and Weimer (2001)). This paper, instead, uses a "model-based" approach to estimate WTP for public LTC services in the United States among senior adults with the knowledge of their responsive consumption behavior.

This approach is methodologically related to Finkelstein et al. (2019), who develop a model to estimate willingness to pay for Medicaid among working-age adults (19-64). My research is different from their work in three dimensions. First, I extend their model to explicitly incorporate housing consumption into decision making in which seniors bear both LTC expenses and non-LTC expenses. This is very important since recent literature finds the important role of housing in retirees' dissaving behavior (Nakajima and Telyukova, 2020). Second, to calculate willingness to pay for Medicaid LTC, I modify their definition of willingness to pay to take into account the equilibrium under the corner solution due to constrained optimization resulted from the policy intervention (see more details in Section 6). Lastly, the main focus of this paper is senior adults whose willingness to pay for public health insurance can be very different from working-age adults.

Third, in a broad sense, this paper adds to the literature on the importance of examining how the public health insurance program affects seniors' behavior. The focuses of those studies range across assets reallocation, living arrangement decisions, and private insurance takeup (Mommaerts (2018); Lin and Prince (2013); Greenhalgh-Stanley (2012); Engelhardt and Greenhalgh-Stanley (2010); Coe (2007)). The key contribution of this study is employing empirical findings from the policy change to deduce the value of public health insurance.

3 Policy Background

This section provides details on the institutional environment of the long-term care service in the United States and the details of the Medicaid LTC program.

3.1 Demographic Transition and Long-Term Care in United States

As the baby boomers age and the longevity among Americans increases, the current growth of the population aged 65 and older is unprecedented in U.S. history. The number of Americans aged 65 and above is projected to nearly double from 52 million in 2018 to 95 million by 2060, and the share of seniors of the total population will rise to 23 percent (Mather et al. (2015)). Because the overall size of the older population increases rapidly, the number of disabled older Americans is also expected to rise substantially.

Since the majority of long-term care services users are senior adults (Harris-Kojetin et al. (2019)), this simultaneous aging of the population and increasing prevalence of disability signals a likely surge in the use of long-term care. Long-term care includes a range of services and supports that older individuals may need to meet their health or personal needs over a long period of time. Specifically, it includes assistance in performing activities of daily living (ADLs)[1], instrumental activities of daily living (IADLs)[2], and other health maintenance tasks. According to the analysis of the U.S. Department of Health and Human Services in 2018, approximately 70% of elderly individuals will depend on long-term care at some point during their lives. Though some of the long-term care received by seniors is provided informally by the family at home, the availability of family caregivers declines over time because of rising divorce rates (Kennedy and Ruggles (2014)), increasing childlessness (Baudin et al. (2015)), and rising labor force participation of women (Greenwood et al. (2016); Fernández (2013)). The reduced availability of informal care expands the demand for paid services among seniors, such as formal home care or nursing home care. In 2018, formal long-term care added up to $379 billion, or over 10% of national health expenditures (NHE, 2018).

Long-term care is generally not covered by Medicare or general private health insurance. Medicare, the public health insurance for individuals aged 65 and over, provides coverage for short-term post-acute care, but it does not cover long-term care over an extended period. In addition, less than 11% of Americans have a private LTC insurance policy (Musumeci et al. (2019)). As a result, the lack of other insurance coverage makes Medicaid the largest public payer for LTC.

3.2 Medicaid Long-Term Care

Medicaid LTC is a means-tested, joint federal-state program that provides health insurance for the frail elderly population. In 2016, an estimated 62% of long-term care users residing in nursing homes had Medicaid as a payer source (Harris-Kojetin et al. (2019)). Medicaid LTC, therefore, acts as one major avenue through which seniors can insure themselves against the uncertainty of long-term care costs. However, not all older individuals are eligible. Eligibility for Medicaid LTC requires that an individual's income and assets fall below defined thresholds. Though eligibility tests vary by marital status and by state, minimum eligibility requirements are determined at the federal level. Traditionally, a homeowner's primary residence was not considered as a countable asset when determining Medicaid LTC eligibility as long as the individual planned to return to the home. This was true for both married and unmarried homeowners. For the former, community spouse provisions prevented the primary residence from becoming a countable

[1] ADLs are the basic self-care tasks. They include walking, eating, dressing, toileting, bathing, and transferring.

[2] IADLs require more complex thinking skills, including organizational skills. They include managing finances, managing transportation, shopping and meal preparation, housework, managing communication and managing medications.

asset if the beneficiary's spouse resided there. For the latter, the house was only countable if the beneficiary left the home without intent to return.

3.3 The Home Equity Exemption Provision of the Deficit Reduction Act

One major change to Medicaid LTC eligibility enacted by the DRA is on the program's home equity exemption. Previously, Medicaid LTC recipients could reserve a home of unlimited value while receiving long-term care reimbursements. The DRA instead claims that individuals shall not be eligible for long-term care assistance if the individual's equity interest [3] in the individual's home exceeds $500K. This was and continues to be the only mandatory federal change in the status of home equity with respect to Medicaid LTC eligibility.

The DRA was first introduced on October 27, 2005, and was signed into law on February 8, 2006. Since the DRA allows the new rules not to take effect immediately if state legislation is required to implement them,[4] the full implementation date can be considered as of January 1, 2007, when all states were required to have the policies in place. This restriction rule requires that all states deny payments for long-term care services if an individual's equity interest exceeds the threshold. Because of this, individuals with LTC demand whose home equity is above the threshold would have to reduce their home equity below the threshold in order to be eligible for Medicaid LTC coverage.

A critical note is that this new limit does not apply if a spouse remains living in the home. Married households with one spouse remaining in the home should not be affected by the DRA change in any state because the community spouse provision overrides the equity limit provision. Thus, the target population affected by the restriction policy is unmarried homeowners with at least $500K in equity who do not share the house with other individuals. This paper specifically exploits variations coming from this home equity exemption of the DRA as a quasi-experiment. Such differences in the criterion of Medicaid LTC eligibility could induce the targeted population's response accordingly. Next, I will use a two-stage budgeting model to illustrate how single seniors respond to the policy

[3]The equity interest is determined by dividing the total equity among all homeowners. For example, a single homeowner with $500K in home equity would carry an equity interest of $500K (i.e., $500K divided by one owner). In the case of two joint owners of a home, if the combined home equity is $500K, then each owner would carry an equity interest of $250K (i.e., $500K divided by two owners).

[4]Particularly, the DRA imposes a deadline on state legislation that the new rules take effect the first day of the first calendar quarter beginning after the end of the state legislature's next session. If a state's next legislative session begins in September 2006 and ends in December 2006, for example, the deadline is January 1, 2007.

change in greater detail in Section 4.

4 Conceptual Framework

This section provides a discussion of the theory-based predictions on how the impact of the DRA on seniors' consumption decisions will vary, depending on individuals' demand for long-term care. I present the baseline version of the model in this section to motivate empirical estimations. More details of the model for welfare analysis will be described in Section 6.

4.1 Conceptualizing Consumption Decisions

In order to interpret the empirical findings and connect them to the predictions of willingness to pay from the economic model, it is important to understand what changes mechanically when an individual faces the shock with regard to the eligibility of Medicaid LTC.

Consider a retired single individual, who belongs to the target population affected by the DRA, seeking to maximize her expected utility. Her utility depends on the consumption of LTC services, l, and the consumption of non-LTC goods, nl, which can be separated as the consumption of housing, h, and the consumption of non-housing goods and services, c. Under the assumption of weak separability of preferences, the utility function is as follows:

$$u = v(l, c, h) = f[v_l(l), v_{nl}(c, h)] \tag{1}$$

where f is an increasing function, and v_l and v_{nl} are the sub-utility functions associated with LTC services and non-LTC goods, respectively. For the sake of brevity, I refer to l as "LTC spending", to h as "home equity", and to c as "consumption".

Figure 3 illustrates a two-stage budgeting model framework such that the individual allocates total expenditure in two stages: at the first stage, total expenditure is allocated to two broad groups of goods (LTC and non-LTC in Figure 3), while at the second stage, group expenditures on non-LTC goods are allocated to the individual commodities (home equity and consumption in Figure 3). At each of these two stages, only information appropriate to that stage is required (Deaton and Muellbauer (1980)).

4.2 Expected Impacts of the DRA

As noted before, a distinguishing feature of the DRA is that only single seniors with home equity above \$500K are affected by this restriction policy. Therefore, we can expect that those individuals who used to enjoy Medicaid LTC with home equity above the threshold would respond to this policy. While they are all affected by this policy, the demand for long-term care varies from person to person. As a result, the budget share spent on non-LTC goods and services could increase or remain the same depending on the eligibility of Medicaid LTC. Based on the targeted population's various demands for long-term care, I formalize this insight into the following two propositions.

Proposition 1. *After the introduction of Medicaid LTC restriction policy, for individuals with home equity greater than the home equity cutoff point ($\overline{H}$), if their demand for long-term care services is small, they do not apply for Medicaid LTC, and only decrease home equity and consumption on a small scale to compensate the cost for long-term care services.*

This point is illustrated in Figure 4(a), where it shows a hypothetical individual's budget constraint and indifference curve for home equity and all other consumption. Without the Medicaid LTC restriction policy, the individual can achieve maximal utility level at U_0 with home equity H_0 ($H_0 > \overline{H}$) and consumption C_0 at point A. After the implementation of the new policy, the individual has to choose a new consumption-home-equity bundle that satisfies a new budget constraint. When she chooses to give up Medicaid LTC and allocates a small proportion of total expenditures on long-term care, group expenditures on home equity and consumption falls on a small scale, as reflected in the small inward shift from I_1 to I_2. At the new budget constraint, the individual could afford less on home equity and consumption, and her new utility-maximizing bundle is B, where the utility level is U_1. In contrast, if the individual chooses to keep Medicaid LTC by downsizing home equity to \$500K, her budget constraint moves back to I_1, and the optimal utility level she can achieve is $\overline{U}$ at point C. Note that U_1 is greater than $\overline{U}$, therefore, the individual decides not to apply for Medicaid LTC and to pay long-term care out-of-pocket. In this case, as illustrated in Figure 4(a), the individual moves from her initial optimal consumption bundle A to her new optimal consumption bundle B. Her consumption of home equity and all other goods decrease from H_0 to H_1 and C_0 to C_1, respectively.

Proposition 2. *After the introduction of Medicaid long-term care restriction, for individuals with home equity greater than the home equity cutoff point ($\overline{H}$), if their demand for long-term care services is large, they apply for Medicaid LTC and decrease home equity to the level of the cutoff point ($\overline{H}$). As a result, their consumption level increases.*

Figure 4(b) depicts the case when an individual's demand for long-term care is large. Similarly, the individual gets U_0 at point A before the implementation of the Medicaid LTC restriction policy. If the individual loses Medicaid LTC, she needs to allocate a large share of total expenditures on long-term care. As a result, the budget constraint for home equity and consumption shifts inward significantly from I_1 to I_2. The new utility-maximizing bundle is at point B with utility level U_1. Note that U_1 is smaller than the utility level $\overline{U}$ when the individual adjusts home equity to $\overline{H}$ and keeps relying on Medicaid LTC. As a result, the individual decides to reduce home equity to $\overline{H}$ to gain back Medicaid LTC eligibility and moves to a new consumption bundle C with consumption rising from C_0 to C^*.

The discussion above traced out two theoretical predictions on home equity and consumption responses to the DRA. First, individuals with small demand for long-term care will reduce both home equity and consumption to compensate for the expenditure of long-term care that used to be covered by Medicaid. Second, individuals with substantial demand for long-term care will decrease home equity to the cutoff point so that they can continue to use Medicaid LTC. As a result, their consumption rises to absorb extra funding released from the reduction of home equity.

Of course, people may have different responses to the DRA that depend on their individual preferences or characteristics. Broadly speaking, the model I discussed here can be the basis for an analysis of threshold effects in the evaluation of treatment effects under endogeneity. While this is an ambitious and interesting exercise, it is beyond the scope of this paper. Here, I consider how on average an individual is likely to be affected by the DRA. Therefore, by observing the direction of the change of consumption, we can figure out which case discussed above is dominant in the market.

5 Empirical Analysis

The theory suggests that seniors with considerable home equity may respond differently to the same policy change, depending on their demand for long-term care. In this section, I develop an empirical framework for using the DRA policy to identify and estimate the effect of Medicaid LTC eligibility on single seniors' consumption behavior.

5.1 Data Sources

5.1.1 Data for the Estimation of Home Equity

To explore the hypotheses of the impact of the DRA on home equity proposed in Section 4.2, I first make use of the data from the Health and Retirement Study (HRS) conducted by the University of Michigan. The HRS dataset is a nationally representative dataset that tracks households age 50 and above biennially. It provides detailed information on basic demographic characteristics, health and functioning, health care and insurance, medical expenses, and housing assets. The survey began in 1992. Since the early data on assets were underreported (see De Nardi et al., 2010), and the large impacts of the 2008 Great Recession progressed into the early 2010s, this paper utilizes seven waves of the HRS from 1996 to 2008.

In addition, I supplement these public-use files by adding state-of-residence information from the restricted HRS data with permission from the HRS administration. Using state information is crucial for my analysis because home market dynamics and Medicaid LTC policies differ remarkably across states.

As most of the population affected by the restriction rule are single homeowners, the main sample in my empirical analysis consists of single individuals aged 65 and above. Moreover, since the DRA is considered fully implemented in 2007, I further restrict the focus of the analysis to the elderly who held unmarried status from 2006 to 2008. This leaves us with 4,126 individuals, of whom 403 seniors aged 65 and above in 2006 owned houses with home equity larger than the cutoff point of the restriction rule ($500K).

5.1.2 Data for the Estimation of Consumption

To measure the impact of the DRA on consumption, I rely on the Consumption and Activities Mail Survey (CAMS). The CAMS was first conducted in 2001 and mailed to 5,000 households selected at random from HRS 2000 core survey. For the later waves, the CAMS followed the same households. The average response rate was 77.3 percent (Hurd and Rohwedder, 2006). The design strategy adopted by CAMS was to choose spending categories from the Consumer Expenditure Survey (CEX), which asks about approximately 260 categories. However, to reduce the burden to respondents, the categories of the final questionnaire was aggregated further, which focused on six expensive items (automobile; refrigerator; washer or dryer; dishwasher; television; computer) and on 26 non-durable spending categories. The reference period for the expensive items is "last 12 months," and for the non-durables, it varied: the respondent could choose the reference period between "amount spent monthly" and "amount spent yearly" for regularly occurring expenditures like mortgage and insurance where there is little or no variation in amounts, and "amount spent last week," " amount spent last month," and "amount spent in last 12 months" for all other categories.

The fact that the sample in CAMS was drawn from the HRS population allows me to link the spending data to the substantial amount of information collected in the HRS core survey for the same individuals and households. For my analysis of the impact of the DRA on consumption, I mainly follow RAND CAMS categories which divide total household spending into four subsets: nondurables, durables, housing, and transportation.

5.2 Empirical Model

This section serves two purposes. First, it tests whether and how the seniors with home equity above the cutoff point will change their home equity after the implementation of the DRA. Second, it examines how their consumption responds to the policy. Combining these two results, I will be able to pin down which case discussed in Section 4 plays a key role in the data.

5.2.1 Effects on Home Equity

I investigate whether the change of home equity exemption rule led to changes in seniors' home equity. Before introducing the main identification strategy, I need to clarify the main outcome of interest first. Consistent with the housing market literature (see Garriga and Hedlund, 2020; Mian et al., 2013; Mian and Sufi, 2011), I use the changes of home equity as the outcome variable. The main idea to use the home equity growth is to control for individual-specific time trend since home equity may change over a steady rate due to the changing pattern of home value and home loan. The feasibility of using home equity growth is shown in Appendix C.

5.2.1.1 Identification Strategy: Triple-Difference Estimate

Specifically, I employ a triple-difference (DDD) framework to analyze the impact of the DRA on home equity. The first difference compares home equity changes before and after the provision of the DRA for single seniors with home equity above the cutoff point ($500K) in 2006. I define those seniors meeting such criteria as the high-home-equity (treatment) group. Since the first difference is likely to be confounded by other changes taking place during the same period, I use single seniors with home equity below \$500K as the control group (low-home-equity group). This low-home-equity group serves as a useful control to the treatment group because the group members would have been exposed to all the changes that were taking place during the period of interest, but were not affected by the restriction rule. However, during the same period, from 2006 to 2008, the housing market crashed and triggered the decline of housing prices until 2012 (see Butrica and Mudrazija, 2016; Mian and Sufi, 2011). If only using the difference-in-difference framework, it is possible that the estimates reveal the individuals' responses to the housing market crash instead of the policy. I, therefore, construct the third variation by comparing the double-difference (as computed above) among single seniors in the middle-aged population (aged 55-64). The use of the younger cohort as a comparison group for seniors is credible since the two cohorts are of similar age and they all experienced the same housing market crash during the period of interest. However, the younger cohort is barely affected by the DRA due to the fact that the Medicaid LTC services are generally restricted to people aged 65 or older (Harris-Kojetin et al., 2019).

Formally, the triple-difference framework for home equity and its deterministic factors is as follows:

$$\begin{aligned} y_{it} = g_i + \delta_0 \cdot \text{Post}_t + \delta_1 \cdot \text{Senior}_i \cdot \text{Post}_t + \delta_2 \cdot \text{Above}_i \cdot \text{Post}_t \\ + \lambda \cdot \text{Above}_i \cdot \text{Senior}_i \cdot \text{Post}_t + \beta \cdot x_{it} + \varepsilon_{it} \end{aligned} \tag{2}$$

where y_{it} is the change of home equity in two consecutive waves for individual i in year t. $Post_t$ is an indicator that equals to one if the year is 2007 or later. $Senior_i$ is an indicator that equals one if the individual is aged above 65 in 2006, and equals to zero if the individual is aged 55-64 in 2008.[5] $Above_i$ is an indicator that equals to one if the individual's home equity in 2006 belongs to the high-home-equity group.[6] One concern with

[5]Selecting middle-aged sample based on their ages in 2008 (the end of analysis period) avoids the overlapping of age groups during the analysis period.

[6]There are three reasons why I choose home equity instead of equity interest as the criteria of the high-home-equity group. First and most importantly, the law of equity interest for couples varies by state. In community property states, such as CA, usually spouses own equally on the property. Therefore, it's fine to define that $\textit{equity interest} = \frac{\textit{home equity}}{2}$. However, if the couples are in common law states, then the house belongs to whoever with name on the deed. For example, if only a husband's name is on the deed, the equity interest for the husband equals the home equity. For his wife, the equity interest is then zero. Because of such difference across states and the lack of information on who's name is on the deed from the HRS, it could bring noises to my identification if using equity interest as the criteria. Second, middle-aged couples with home equity larger than \$1000K in the sample are rare. Therefore, if using \$1000K as the criteria instead, the total sample size shirks and the estimation would lose statistical power. Lastly, I proved in Appendix D that using home equity as the criteria defining the high-home-equity group shows no statistically significant difference as using equity interest.

this crude categorization is that individuals with huge gaps in their home equity could also have very different consumption behavior in response to the same policy. To ensure that the estimation of home equity changes between the treatment group and the control group only differs by the policy impact, I impose a restriction on regression samples to home equity ranging from $300K to $700K in 2006. g_i denotes individual fixed effects. Additional time-varying controls are included in the vector x_{it}, which mainly consists of health status across the years. According to previous literature, physical ability, diabetes, and cancer diagnoses act as strong predictors of long-term care needs (Ricks (2018); Davidoff (2010); Gaugler et al. (2007)), so I include indicators for diabetes status, cancer status, having at least one ADLs/IADLs, and having memory problems. The main coefficient of interest is λ (the DDD estimator), and δ_0 through δ_2 are the estimates of the double interaction terms and linear terms, respectively. Beyond the individual fixed effects, I also include state fixed effects to ensure that when people move to different states, the impact of geographical factors on home equity is captured. Robust standard errors are clustered at the state level.

5.2.1.2 Summary Statistics of the HRS Data

Table 1 reports the summary statistics for the entire analysis sample described in Section 5.2.1.1. An observation is an individual-year, and summary statistics are presented for the balanced sample in a pre-DRA year.

Columns (1) - (4) corresponds to the sample of single seniors, who are the main population affected by the DRA. As seen in Table 1, among single seniors with home equity in the range $300K-$700K, the average home equity in 2006 is roughly $432.4K with 35% of the sample holding equity larger than $500K. Individuals in the analysis sample have experienced housing appreciation from 2004 to 2006 for about $118.9K (38%) and depreciation from 2006 to 2008 for around $92.5 (21%). This fluctuation of home equity suggests the possible impact of the housing market crash. If we fail to eliminate this housing market effect, it is hard to argue that the estimates are the result of the restriction policy. Of note, the analysis sample is mostly white and female, and the average annual personal income is $61.6K in 2004. 14% of the sample reports diabetes, 20% has cancer, and 19% has difficulty in at least one ADL or IADL.[7]

Columns (5) - (8) corresponds to the sample of the middle-aged population with home equity in the range $300K-$700K. Compared with single seniors, the distribution and the

[7]The analysis sample lives in a better socio-economic status compared to the whole singe seniors sample whose home equity range from -$115K to $5500K (seen in Table B.1). For example, the mean home equity of the whole single seniors is $108.2K, which is far below the mean of the analysis sample.

appreciation of home equity before the DRA are similar, suggesting that using a middle-aged sample as the comparison group is credible. Relative to single seniors, the group of middle-aged consists of a more male, and well-educated population, who are less likely to have Medicaid in 2004 and enjoy better health status.

5.2.1.3 Parallel Trends

Before presenting the main regression results, I test for parallel trends in the triple-difference framework by comparing the periods 1996-1998, 1998-2000, 2000-2002, 2002-2004 to 2004-2006. Table 2 shows the results. In odd-numbered columns, I run the regressions without controlling for individual fixed effects but using individual characteristics instead, and in even columns I additionally control for individual fixed effects. All coefficients on the DDD term are insignificant so we can not reject the null hypothesis of parallel trends.

Figure 6 shows different patterns of home equity changes across years between the high-home-equity group and the low-home-equity group for single seniors and middle-aged individuals, respectively. In the left panel of Figure 6, I show evidence on single seniors. Overall, the changes in home equity rise for both the high-home-equity group and the low-home-equity group from 1998 to 2006, and the gap between these two groups grows slightly. In contrast, after 2006, the high-home-equity group suffers a bigger reduction in home equity compared to the low-home-equity group. To check if this jump is fully due to the impact of the housing market crash, I conduct a similar comparison of home equity growth among middle-aged people as presented in the right panel of Figure 6. Before 2006, the changes in home equity for both the high-home-equity group and the low-home-equity group show a similar pattern to the single seniors. However, after 2006, although home equity falls for both groups, the trend remains similar to the previous years. Figure 6 and the estimates in Table 2 suggest that using middle-aged people as the second control group is credible in eliminating the impact of the housing market crash.

5.2.1.4 Homogeneous DDD Estimator

The triple-difference estimates based on equation (2) are presented in Table 3. The results with only controls for individual characteristics and state fixed effects are shown in column (1). The results with individual fixed effects are presented in column (2). Additionally, columns (3) and (4) include weights. Robust standard errors are clustered at the state level in each column. All DDD terms are significantly negative, suggesting that the impact of the Medicaid LTC restriction policy deepens the decline of home equity by

\$66.75K-\$97.96K. Comparing with the mean equity value of the high-home-equity group in 2006, these estimates suggest that the DRA intensifies the depreciation of home equity by 12.1%-17.8%.

5.2.1.5 Heterogeneous DDD Estimator

One concern with the homogeneous DDD estimator is that it fails to capture different levels of responses to the Medicaid LTC restriction policy. Specifically, single seniors in the high-home-equity group whose home equity is closer to \$500K would have a larger incentive to lower their equity and be eligible for Medicaid LTC. Therefore, for single seniors with home equity far above \$500k, assuming that their incentive to decrease home equity is the same as those with home equity close to \$500K is unrealistic. Another advantage of using a heterogeneous DDD identification strategy is that we can pin down the targeted regression sample. For example, if we find that people with home equity more than \$700K stop responding to the policy, then it is rational to restrict the main regression sample to people with home equity in the range \$300K-\$700K. Therefore, I adjust equation (2) to capture the heterogeneous response as follows:

$$\begin{aligned} y_{it} = g_i + \delta_0 \cdot \text{Post}_t + \delta_1 \cdot \text{Senior}_i \cdot \text{Post}_t + \delta_2 \cdot \text{Above}_i \cdot \text{Post}_t \\ + (\lambda_1 + \lambda_2 \cdot H_{i04}) \cdot \text{Above}_i \cdot \text{Senior}_i \cdot \text{Post}_t + \beta \cdot x_{it} + \varepsilon_{it} \end{aligned} \tag{3}$$

where λ_2 is the parameter of interest, and indicates the extent to which the tripe-difference estimate in equation (2) is differentially coming from individuals' responses further away from \$500K. H_{i04} denotes individual i's home equity in 2004. Using the lagged level H_{i04} can avoid any possible reverse causality since home equity itself is impacted by the policy. The estimation controls and clustering are the same as in equation (2).

The heterogeneous DDD estimates based on equation (3) are presented in Table 4. The regression sample of columns (1) and (2) expands to individuals with home equity in 2006 ranging from \$200K to \$800K. For columns (3) and (4), the range changes to \$100K to \$900K. The first row shows that the DDD estimates presented in Table 3 is mainly driven by seniors whose home equity is close to \$500K. The estimates with heterogeneous DDD impacts are presented in the second row. All estimates are positive and statistically significant, suggesting that the more an individual's home equity is above \$500K, the less likely that person would respond to the restriction rule and decrease home equity. Additionally, I calculate the corresponding home equity level in 2006 where the impact of restriction policy is zero, namely the turning point. The estimates of the turning point are quite stable with different specifications. Individuals with home equity around \$615K-

$660K stop responding to the DRA. This evidence supports the validity of using home equity in the range $300K-$700K as the main regression sample.

5.2.1.6 Mechanisms for Changing Home Equity

After showing the negative impact of the DRA on home equity, it remains unclear how seniors change home equity. Since home equity is the sum of home value and home loan, two channels are available for adjusting home equity: decreasing home value or increasing home loan. Figure 7 shows the changes in home value growth and home loan growth across the years. As presented in the top panel of Figure 7, the changes in home value growth are similar to the changes in home equity growth in Figure 6. For the middle-aged population, the moving patterns are similar between the high-home-equity group and the low-home-equity group, regardless of the timing. In contrast, for single seniors, although the changes of home value growth between two groups are alike before 2006, the high-home-equity group suffers a bigger fall of home value changes thereafter.

At the same time, we do not observe many variations with home loan growth among different comparison groups as shown in the bottom panel of Figure 7. This evidence suggests that seniors move to lower-valued houses in order to decrease home equity as a result of the DRA.

Table 5 presents the DDD estimates using home value changes and home loan changes as dependent variables. For high-home-equity single seniors, being exposed to the Medicaid restriction policy aggravates the decline of home value by $112.64K. This decline echoes the channel of lowering home equity by reducing home value. When it comes to home loan changes, the result of the DDD estimation is negative and significant, which contrasts to the channel of lowering home equity by increasing home loan. In column (3), I also check whether the portfolio of home wealth changes after the restriction policy. The result for the loan-to-value ratio is zero and insignificant, indicating that the impact of the restriction policy is pushing seniors to sell their original houses and move into lower-valued houses without changing the mortgage rate.

5.2.2 Effects on Consumption

With evidence on the negative impact of the DRA on home equity as shown in Section 5.2.1, to what extent the DRA impacts the consumption of all other non-LTC goods remains a key piece of the puzzle for understanding individuals' distortion behavior. The direction of the change of consumption determines which case predicted in Section 4.2 is likely to be the targeted population's response to the DRA.

Same to the empirical exercise on home equity, I employ a triple-difference (DDD) method to analyze the impact of the DRA on consumption. I follow equation (2) to estimate a DDD estimator of policy impact by comparing the difference of consumption between the high-home-equity and the low-home-equity group among single seniors with the difference among the middle-aged group. y_{it} is the total non-LTC consumption that includes non-LTC medical expenditures, transportation spending, durable goods spending, and non-durable goods spending. The controls and clustering are the same as in equation (2).

5.2.2.1 Summary Statistics of the CAMS Data

I present additional summary statistics for consumption details in Table 6. Specifically, I divide total consumption into five categories: LTC expenditures, non-LTC medical expenditures, transportation spending, durables spending, and nondurables spending. As seen in Table 6, among single seniors, the mean total expenditures in 2006 is $41.41K. The largest share of total expenditures goes to nondurables goods (78%), and the second-largest share is on transportation (6%). Compared with singles seniors, the average of total expenditures among the middle-aged group is higher ($54.36K), and the share on nondurables reduces to 68% while the share on transportation goes up to 28%.

5.2.2.2 Estimation Results on Consumption

Following my empirical strategy in Section 5.2.1, I first test for parallel trends in the triple-difference framework comparing the years 2002 and 2004 with 2006. Due to the small sample size of the CAMS dataset, I expand the regression sample to individuals with home equity in the range $200K-$800K.[8] As seen in Table 7, the coefficients on the DDD term before the restriction policy are insignificant, so we can not reject the null hypothesis of parallel trends.

Table 8 shows the main results of the impact of the DRA on non-LTC consumption. The estimates without weights or individual fixed effects (columns (1)-(3)) suggest that the DRA induces increased non-LTC consumption of $4.47K-$6.60K. Including controls for both individual fixed effects and weights increases the estimate to $10.5K. Two points are worth noting.

First, the estimates under all specifications are positive, though the coefficients for the first three columns are not statistically significant. These stable signs of the estimates

[8] The results are similar if I restrict the regression sample to the range $300K-$700K. The tables are available upon request.

support the hypothesis that the DRA causes individuals to consume more on non-LTC goods and services. Again, these coefficients are based on a small sample size of the CAMS, which might be the reason for the loss of statistical power of the estimates.

Second, the use of a younger cohort as the second control group may not provide valid estimates for analyzing the impact on consumption. As seen from the Table 6, the consumption behavior of the middle-aged could be very different from the seniors, such as the total consumption is higher among the middle-aged and they spend more on transportation goods and services. This difference has also been confirmed in the literature (Drolet et al. (2007); Williams and Drolet (2005)). Therefore, to establish robust empirical results, I use married seniors instead as the second control group to eliminate the financial crisis impact on consumption.

I construct a DDD estimator of the DRA impact by comparing the difference of consumption between the high-home-equity and the low-home-equity group among single seniors with the difference among married seniors. Formally, the triple-difference equation for consumption and deterministic factors is as follows:

$$\begin{aligned} y_{it} = g_i + \delta_0 \cdot \text{Post}_t + \delta_1 \cdot \text{Single}_i \cdot \text{Post}_t + \delta_2 \cdot \text{Above}_i \cdot \text{Post}_t \\ + \lambda \cdot \text{Above}_i \cdot \text{Single}_i \cdot \text{Post}_t + \beta \cdot x_{it} + \varepsilon_{it} \end{aligned} \tag{4}$$

where $Single_i$ is an indicator equal to one if the individual is single during 2006-2008. Other independent variables are defined in the same way as in equation (2). The whole regression sample consists of all individuals aged 65 and above in 2006. Standard errors are clustered at the state level.

Before the DRA, the triple-difference estimates are insignificant. If anything, the estimates in Table 9 suggest that single seniors with home equity above \$500K consume less compared to married couples with similar housing assets. After showing the parallel trends results in Table 9, the triple-difference estimates based on equation (4) are presented in Table 10. The results indicate that the DRA induces single seniors to increase consumption by \$6.49K-\$12.03K. These significant signs of the DDD estimators suggest the positive effects of the DRA on individual consumption.

5.2.2.3 Mechanisms for Changing Consumption

Since total non-LTC consumption is the sum of transportation spending, non-LTC medical expenditures, durables spending, and nondurables spending, exploring which mechanism results in the increment of total non-LTC consumption helps us to understand seniors' distortion behavior comprehensively. Table 11 reports the triple-difference estimators for the four different categories of non-LTC consumption by comparing seniors with the middle-aged population. All columns include individual fixed effects and weights. The estimates suggest that single seniors with equity above $500K increase consumption in all categories, especially for nondurables, though the coefficients are not statistically significant. If use the married couples as the second group instead, as seen in Table 12, the channel through which individuals increase consumption becomes more clear. Individuals affected by the DRA change their spending habits by investing $10.72K more on nondurables, while consumption on other categories are insignificant. These results strengthen the belief that affected seniors distort their consumption to gain Medicaid LTC by ”burning up” money.

5.2.3 Heterogeneity in Responses by Individuals' Characteristics

The results above display that the average impact of the DRA on seniors' home equity is negative, and the average impact on consumption is positive. These two pieces of evidence support the proposition 2 that due to the large demand for long-term care services, on average individuals will manipulate their home equity to the cutoff point of the DRA to gain Medicaid LTC, and therefore expand consumption on non-LTC goods and services. However, exploring the cross-sectional heterogeneity in other variables of interest is also important since it provides insights into the underlying motivation for individual distortion behavior. Table 13 shows other sources of heterogeneity, focusing on the sample of individuals aged 55 and over. I first examine the effect of the restriction policy by gender, under the hypothesis that female seniors have lower demand for long-term care services in the short run because they are on average healthier. Columns (1) and (2) show that the effects are stronger for male seniors though the difference is not statistically significant. Columns (3) and (4) report the estimates by education in order to explore the hypothesis that individuals with less advantaged social-economic status are more likely to be on the margin of qualifying for Medicaid long-term care services. The results show that the effects are concentrated in the less educated population. The restriction policy induces a decrease in their home equity of almost $89.96K-$129.73K. Columns (5) and (6) report estimates by whether individuals report difficulty caring for themselves with at least one ADL/IADL, to examine the hypothesis that individuals who need more long-term care are more likely to be hit by the restriction policy. The results show that the effect of the restriction policy is concentrated among individuals who need care (i.e., ”dependent”). The restriction policy induces a $141.11K-$158.79K decrease in their home equity. Analogously, people with Medicaid two years before 2006 are more likely to decrease home equity.

5.3 Robustness and Placebo Exercises

In this section, I address two potential concerns with my main identification strategy. First, I present two tables showing robustness around my definition of the targeted population and middle-aged population. At baseline, I define the targeted population as those with home equity in the range \$300K-\$700K, and define the middle-aged population as people aged 55-64 in 2008. In Appendix Table B.2 and Table B.3, I examine two alternative definitions. First, I present results including a broader group of individuals with home equity in the range \$200K-\$800K. Second, maintaining my baseline definition of the targeted population, I instead alter the definition of middle-aged to individuals aged 50-64. As seen from Table B.2 and Table B.3, broadening the regression sample and the definition of the middle-aged population, the results are all significantly negative and consistent with the baseline results.

Second, since the change of home equity closely relates to the absolute equity level before the DRA, another potential concern might be that individuals with high-home-equity may reduce their equity more due to other reasons that happened to take effect in the period of 2006 to 2008. For example, the preference for living in a high-valued house happened to vary during the financial crisis when people felt pessimistic about the economy. To address this concern, I run a placebo test where I use a "false" treatment definition that treats those with home equity in 2006 above \$600k (not the policy cutoff point) as the "Above" group. The results of this exercise are presented in Table B.4. All specifications lead to insignificant results. Moreover, the signs of all estimates are positive, which is opposite to our hypothesis that seniors would drop home equity in order to gain Medicaid LTC services. This exercise supports the conclusion that the effects found in the primary analysis are likely attributed to the DRA.

I also test the sensitivity of the baseline results by using alternative definitions of the treatment period. The baseline analysis focuses on the period around the policy intervention. One concern is that the treatment effect is an outcome of the natural home equity movement across time. In order to test the validity of the treatment effects, I use consecutive HRS wave-pairs to re-examine equation (2) for 1998 through 2008. By examining different "post" periods, we can compare the results with the estimates presented in Table 3. If no effects are found across consecutive waves where no policy intervention took place, then the effects found in the primary analysis are more likely due to the change of Medicaid LTC policy. Specifically, I keep the definition of treatment status constant over time such that $Above_i$ and $Senior_i$ are based on reported characteristics in the former of the two years in each wave-pair. On the contrary, $Post_t$ is equal to one for the later of the two years. For example, estimates for the period 1998 and 2000 would consider the post-period as 2000 and define treatment status based on characteristics in 1998. The results of this placebo test are presented in Figure A.1. Estimates of λ from equation (2) are plotted on the y-axis with 90% confidence intervals. The x-axis reports the first year for any consecutive year pair. For example, 1998 represents the change in home equity growth for the period 1998 to 2000. The estimates for 2006 are exactly the same as the estimates presented in column (4) of Table 3. I find no effects over the period 1998 through 2004. In 2006, the point estimate is negative and significantly different from zero. This test provides evidence of little reduction in home equity among the treatment group relative to the control group prior to the DRA. Thus, this finding reassures us that the results I find in the main analysis are not driven by differential trends of home equity changes across the different groups.

6 Welfare analysis

6.1 Structural Framework

Section 5 shows that the DRA drives individuals to reduce home equity and waste money on nondurable goods and services. Although these results provide evidence that individuals manipulate their home equity to gain Medicaid LTC, it is still not clear how much would individuals value Medicaid LTC. The aggregate willingness to pay for Medicaid LTC is an important measurement of social benefits, which can help us assess the economic efficiency of the DRA policy. This section expands the model in Section 4 to calculate the willingness to pay for Medicaid LTC, defined as the maximum amount of non-LTC consumption that the individual would need to give up in the world with Medicaid LTC that would leave her at the same level of expected utility as in the world without Medicaid LTC.

6.1.1 Preferences

Following the setups in Section 4, a retired individual maximizes her utility u as described in equation (1). To make the model better fit with reality, I allow the individual to reserve part of her assets, r, either to transfer to children or to deposit to funds. More specifically, the utility function has the following form:

$$u = v(c, r, h, l) = f[v_{nl}(c, r, h), v_l(l)]. \tag{5}$$

As in Section 4, for the sake of brevity, I refer to l as "LTC spending", to h as "home equity", to c as "consumption", and to r as "savings".

6.1.2 Medicaid LTC

The presence of Medicaid LTC services is captured by the variable m, with $m = 1$ indicating that the individual is insured by Medicaid LTC and $m = 0$ representing not being insured. To avoid fully specifying the utility function, following Finkelstein et al. (2019), I assume that the individual is affected by Medicaid LTC services only through its impact on her budget constraint, namely, the out-of-pocket price for LTC services $p(m)$. Other ways through which Medicaid LTC might affect c, h, r, or l, such as through an effect on a nursing home's willingness to treat a patient, are ruled out by this assumption. For implementation purposes, I assume that $p(m)$ is constant in l. The function of out-of-pocket spending on LTC takes the form:

$$s(m, l) \equiv p(m) \times l \tag{6}$$

Note that I do not impose $p(0) = 1$ so that individuals without Medicaid LTC do not need to pay total LTC spending out of pocket. This allows individuals who are not insured by Medicaid LTC to have access to implicit insurance.

6.1.3 Individual Problem

An individual chooses optimal consumption, c, home equity, h, savings, r, and long-term care spending, l, subject to her budget constraint. Note that h can be described as the home equity level before the DRA implemented (h_0) minus the shrinkage of home equity after the DRA (Δh). The decline of home equity, $\Delta h > 0$, suggests that the individual taps into her home equity to extract money for consumption. Additionally, I introduce a parameter ϕ that denotes the underlying state of the world. I assume that each individual is drawn from the population distribution of ϕ. Therefore, by observing the distribution of outcomes across individuals, such as $l(\phi)$ and $y(\phi)$, I am able to infer the distribution of ϕ. Formally, the individual optimization problem is as follows:

$$\max_{\{c, \Delta h, r, l\}} u(c, h_0 - \Delta h, r, l(\phi)) \tag{7}$$

subject to

$$c + r + s(m, l) = y(\phi) + \Delta h. \tag{8}$$

where $y(\phi)$ represents state-contingent total resources. Consumption, c, home equity decrements, Δh, reserved resources, r, and long-term care demand, l, therefore depend on Medicaid LTC status, m, and the underlying state of the individual, ϕ. This dependence is denoted by $c(m;\phi)$, $\Delta h(m;\phi)$, $r(m;\phi)$, and $l(m;\phi)$respectively.

6.1.4 Willingness to pay

Following Finkelstein et al. (2019), the willingness to pay for Medicaid LTC $\theta(1)$ is measured in terms of forgone consumption for keeping the same utility level with or without Medicaid LTC. Specifically, $\theta(1)$ is defined as the amount of consumption that the individual would need to give up in the world with Medicaid LTC that would leave her at the same level of expected utility as in the world without Medicaid LTC:

$$\begin{aligned} &E[u(c(1;\phi)-\theta(1), \Delta h(1;\phi), r(1;\phi), l(1;\phi))] \\ &= E[u(c(0;\phi), \Delta h(0;\phi), r(0;\phi), l(0;\phi))] \end{aligned} \tag{9}$$

where the expectations are taken with respect to the possible states of the world, ϕ. One big difference between my paper and Finkelstein et al. (2019) is that I need to take into account consumption distortion due to the home equity ceiling resulted from the new policy. This point is illustrated in Figure 5, where the top figure illustrates the way to calculate willingness to pay if individuals do not face the home equity restriction. The figure shows both an individual's choice of housing and other goods (point A) when she has Medicaid LTC and the choice when she is not covered by Medicaid LTC (point B). According to the definition in equation (9), the willingness to pay under this case is the gap of $C_0 - C_0'$ as shown in Figure 5(a). However, this calculation method cannot be directly employed by this paper. Model prediction and empirical results tell us that the individual with home equity above $500K would decrease equity to the cutoff point to gain Medicaid LTC and change her choice bundle over housing and consumption accordingly. As a result, the proper calculation of the willingness to pay for Medicaid LTC for the high-home-equity group is illustrated in Figure 5(b). Point B is still the individual's choice bundle if she is not covered by Medicaid LTC. Point C (instead of point A) shows the choice bundle if the individual is covered by Medicaid LTC when she downsizes equity to the cutoff point $\overline{H}$. Therefore, the true willingness to pay for Medicaid LTC for the high-home-equity group should be the gap of $C^* - C^{*\prime}$.

Now consider a "marginal" expansion in Medicaid LTC services. Under this expansion, m denotes a linear coinsurance term between full Medicaid LTC coverage ($m = 1$) and no Medicaid LTC coverage ($m = 0$) such that $p(m) \equiv mp(1) + (1-m)p(0)$. Then out-of-pocket spending in equation (6) can be written as follows:

$$s(m,l) \equiv [m \times p(1) + (1-m) \times p(0)] \times l \tag{10}$$

Remember, I assume in Section (6.1.2) that the individual is affected by Medicaid LTC services only through $p(m)$. Therefore, the marginal expansion of Medicaid LTC service relaxes the individual's budget constraint by $-\frac{\partial s}{\partial m}$:

$$-\frac{\partial s(m, l(m;\phi))}{\partial m} = (p(0)-p(1))l(m;\phi) \tag{11}$$

Under this "marginal" expansion of Medicaid LTC services, the amount of consumption the individual would need to give up in a world with m insurance is $\theta(m)$, such that she would achieve the same level of expected utility when $m = 0$. Similarly as in equation (9), $\theta(m)$ satisfies the following equation:

$$\begin{aligned} &E[u(c(m;\phi)-\theta(m), \Delta h(m;\phi), r(m;\phi), l(m;\phi))] \\ &= E[u(c(0;\phi), \Delta h(0;\phi), r(0;\phi), l(0;\phi))]. \end{aligned} \tag{12}$$

After taking optimization of equation (12) over m and applying the envelope theorem, the marginal impact of insurance on recipients' willingness to pay takes the form:

$$\frac{d\theta(m)}{dm} = E[\frac{u_c}{E[u_c]}((p(0)-p(1))l(m;\phi))] \tag{13}$$

where u_c is the partial derivative of utility with respect to consumption. $\frac{u_c}{E[u_c]}$ measures the relative value of consumption in each state of the world to its average value, and $(p(0)-p(1))l(m;\phi)$ measures how much an increase in Medicaid LTC services releases the individual's budget constraint in each state.

The marginal value of Medicaid LTC services in equation (13) can be decomposed into a transfer (T) term and a pure-insurance (PI) term. Specifically, the decomposition has the following form:

$$\frac{d\theta(m)}{dm} = \underbrace{((p(0)-p(1))E[l(m;\phi)]}_{\text{Transfer}} + \underbrace{Cov[\frac{u_c}{E[u_c]}, (p(0)-p(1))l(m;\phi)]}_{\text{Pure-Insurance}} \tag{14}$$

where the transfer term captures the recipients' expected valuation of the transfer of resources from the rest part of the economy to them. The pure-insurance term captures the valuation of a budget-neutral reallocation of resource across different states of the world.

The pure-insurance term will be positive if resources are moved into states of the world with higher marginal utilities of consumption.

To get the nonmarginal total willingness to pay for Medicaid LTC services, I integrated $\frac{d\theta}{dm}$ from $m = 0$ to $m = 1$. With $\theta(0) = 0$, we can get the following form:

$$\begin{aligned}\theta(1) &= \int_0^1 \frac{d\theta(m)}{dm} dm \\ &= \underbrace{(p(0) - p(1)) \int_0^1 E[l(m;\phi)]dm}_{\text{Transfer}} + \underbrace{\int_0^1 Cov[\frac{u_c}{E[u_c]}, (p(0) - p(1))l(m;\phi)]dm}_{\text{Pure-Insurance}}\end{aligned} \tag{15}$$

6.1.5 Implementation

To evaluate the total willingness to pay as in equation (15), first of all, we need information on $l(m;\phi)$ to acquire the transfer term. Since we do not observe the path of $l(m;\phi)$ for interior values of m, I follow Finkelstein et al. (2019) to make the statistical assumption as follows:

Assumption 1. *The integral expression for $\theta(1)$ in equation 15 is well approximated by:*

$$\theta(1) \approx \frac{1}{2}(\frac{d\theta(0)}{dm} + \frac{d\theta(1)}{dm}). \tag{16}$$

Though the evaluation of the transfer term does not need to specify about a utility function, the evaluation of the pure-insurance term requires specification of the marginal utility of consumption. Hence, I assume the utility function has the following form:

Assumption 2. *The utility function is as follows:*

$$u(c, h, r, a) = \frac{(c^{\eta} h^{1-\eta})^{1-\sigma}}{1 - \sigma} + w(r) + v(l), \tag{17}$$

where consumption is aggregated by a Cobb-Douglas function, with η determining the relative importance of housing and consumption. The utility function applied to the aggregated goods is a standard CRRA function with risk aversion parameter σ. $w(.)$ and $v(.)$ are the sub-utility functions for reserved resources and the long-term care needs, respectively. These two functions are left unspecified.

Utility thus has three additive components: a standard CRRA function in consumption c and h with a coefficient of the relative risk aversion of σ and a coefficient of relative importance of housing η, and two unspecified functions with respect to r and l.

The assumption that consumption, reserved resources, and LTC demand are additive is commonly made in the aging and health literature (see De Nardi et al., 2016; Brown and Finkelstein, 2008). It restricts the marginal utility of the consumption to be independent of reserved resources and LTC demand. This assumption simplifies the implementation of my estimates. The Cobb-Douglas function with respect to housing and all other consumption follows Nakajima and Telyukova (2020). This utility function is common among the literature that incorporates housing into a macroeconomic framework (Díaz and Luengo-Prado, 2010; Gervais, 2002).

Under this assumption, the pure-insurance term in equation (14) can be written as

$$Cov[\frac{\eta \cdot ((h_0 + \Delta h)^{1-\eta})^{1-\sigma} \cdot c(m;\phi)^{\eta(1-\sigma)-1}}{E[\eta \cdot ((h_0 + \Delta h)^{1-\eta})^{1-\sigma} \cdot c(m;\phi)^{\eta(1-\sigma)-1}]}, (p(0) - p(1))l(m;\phi)] \tag{18}$$

Using this equation, we can calculate the marginal value of $\frac{d\theta(0)}{dm}$ and $\frac{d\theta(1)}{dm}$ separately. After applying the Assumption 1, we can use estimates of $\frac{d\theta(0)}{dm}$ and $\frac{d\theta(1)}{dm}$ to achieve the estimatation of $\theta(1)$.

6.2 Social Costs

The provision of Medicaid LTC requires the use of economic inputs that could be used to produce other things. With the knowledge of the individual's willingness to pay for Medicaid LTC, it is naturally to benchmark the estimates of willingness to pay against social costs. To calculate Medicaid LTC social costs, I consider long-term care spending only. This simplification allows me to abstract from potential administrative costs or any other mechanisms that could impose fiscal externalities on the government. Under this assumption, the net resource cost of Medicaid LTC per recipient, C, is given by:

$$C = E[l(1;\phi) - s(1, l(1;\phi))] - E[l(0;\phi) - s(0, l(0;\phi))]. \tag{19}$$

The net resource cost can be considered as how a change in Medicaid LTC coverage affects social costs. Holding everything else constant, the total social costs when $m = 1$ is $E[l(1;\phi) - s(1, l(1;\phi))]$, and the total social costs when $m = 0$ is $E[l(0;\phi) - s(0, l(0;\phi))]$, so C captures the change when switching the Medicaid LTC coverage on and off. If I rearrange equation (19), C can be described as follows:

$$C = E[l(1;\phi) - l(0;\phi)] + E[s(0, l(0;\phi)) - s(1, l(1;\phi))]. \tag{20}$$

Therefore, the net resource cost of Medicaid LTC is composed of two parts: the average increase in long-term care spending induced by Medicaid LTC, denoted by $l(1;\phi) - l(0;\phi)$ and the average decrease in out-of-pocket spending due to Medicaid LTC, denoted by $s(0, l(0;\phi)) - s(1, l(1;\phi))$.

6.3 Estimation

With the welfare expressions in place, I now discuss how I measure the the key estimates empirically. The first section summarizes required empirical objects, while the following sections discuss outcomes of interest.

6.3.1 Required Empirical Objects

Table (14) summarizes the empirical objects that I need for the evaluation of individuals' willingness to pay for Medicaid LTC, $\theta(1)$, and the net resource cost of providing Medicaid LTC, C. Specifically, to calculate willingness to pay, first, I need information on mean LTC spending for individuals, on the distribution of consumption, and on the distribution of out-of-pocket spending, all with and without Medicaid. Second, the out-of-pocket price of Medicaid LTC and home equity before the DRA are required. Since my empirical results find that individuals with home equity above $500K would reduce their home equity, the change of home equity after the DRA is also required. I use my empirical findings to adjust individuals' home equity in 2008 on the basis of their equity in 2006. Moreover, calibration parameters, σ, and η are necessary. Additionally, estimating the net resource cost requires the information of mean out-of-pocket spending, with and without Medicaid.

Importantly, since I need information on long-term care spending, I have to restrict the sample to individuals who claim to have lived in a nursing home for positive days between 2006 and 2008. This leaves us with the final sample of 460 individuals. Among them, 39 individuals belong to the high-home-equity group and 83% are unmarried. Now I discuss how I construct the aforementioned empirical objects.

6.3.2 Long-Term Care Spending

The HRS provides measure of utilization of nursing home. Specifically, the HRS asks how many days respondents have stayed in a nursing home. With the average cost for a private room in nursing home being $206 per day in 2006 (Houser (2007)), the average annual long-term care spending in my sample for insured ($m = 1$) is $49,013 and $46,434 for uninsured ($m = 0$). Medicaid LTC increases total long-term care spending by about \$2579.

6.3.3 Out-of-Pocket Spending

I assume that the insured have zero out-of-pocket spending ($s(1, l(1; \phi)) = 0$). This assumption is reasonable because Medicaid LTC pays for stays in a nursing home from the first day and for as long as the individual needs the care. To satisfy this assumption, I further restrict the insured sample to those with zero out-of-pocket spending in nursing homes.[9] This leaves us with 236 insured individuals.

The measurement of annual out-of-pocket spending for the uninsured ($m = 0$) is based on self-reported out-of-pocket long-term care expenditures in the past 2 years, divided by 2. Average annul out-of-pocket long-term care expenditures for uninsured is $E[s(0, l(0; \phi))] = \$15835$.

6.3.4 Out-of-Pocket Prices

The estimation of willingness to pay for Medicaid LTC requires that we know the out-of-pocket price of long-term care with Medicaid, $p(1)$, and without Medicaid, $p(0)$. For those with Medicaid LTC, since they pay nothing out of pocket toward long-term care services, $p(1) = 0$. For $p(0)$, I measure it as the ratio of mean out-of-pocket spending to mean total long-term care spending for uninsured ($p(0) = \frac{E[s(0,l(0;\phi))]}{E[l(0;\phi)]}$). I estimate $p(0) = 0.34$, which implies that the uninsured pay \$0.34 on the dollar for their long-term care spending, with the remainder of the expenses being paid by external parties. This is consistent with estimates from other contexts.[10]

[9] This paper uses zero-nursing-home cost as the measurement for Medicaid LTC status for two reasons. First, the HRS does not include the question directly asking individuals' status of Medicaid LTC. Instead, the HRS asks about Medicaid status, which provides a wider range of services than Medicaid LTC. In my sample, 69% of individuals with Medicaid reporting zero out-of-pocket spending for LTC. I define them as Medicaid LTC insured people. Second, it could happen that in the middle of nursing home stays, the individual qualified for Medicaid LTC. Since I assume that individuals' willingness to pay are the same for all qualified people when they make consumption decisions based on expected LTC demand. Individuals should apply for Medicaid LTC before and enjoy Medicaid LTC from the first day in nursing facilities. Therefore, full coverage of Medicaid LTC is considered as insured, and partial Medicaid LTC coverage is considered as uninsured. Thus, $p(0)$ could include the case when an individual receives partial coverage from Medicaid LTC.

[10] In the 2018 NHS, I estimate that non-Medicaid-LTC recipients pay about 33% of their LTC expenses out-of-pocket per capita. The Kaiser Commission on Medicaid and Long-Term Care estimates that the average non-Medicaid-LTC person in the United States pays about 39% of their total long-term care expenses out of pocket in 2013 (fig.3 of Reaves and Musumeci (2015)).

6.3.5 Consumption Inputs

For the evaluation of $\theta(1)$, I need information on the distribution of consumption. Because the final HRS sample for evaluating willingness to pay is small (460) and the CAMS data further reduce the sample size to a quarter of the initial sample, to preserve statistical power of this analysis, I use consumption proxy approach to measure consumption. In particular, I proxy for non-LTC consumption c, using the individual's out-of-pocket LTC spending, s, combined with average values of non-LTC expenditure and out-of-pocket LTC spending. This framework is consistent with the approach used in Finkelstein et al. (2019). Specifically, the consumption proxy takes the following form:

$$c = \bar{c} - (s - \bar{s}), \tag{21}$$

where $\bar{c}$ represents the average non-LTC expenditure and $\bar{s}$ denotes the average out-of-pocket long-term care spending among the uninsured.

This consumption proxy approach is based on several assumptions. First, it assumes that the only channel by which Medicaid LTC influences consumption is by decreasing out-of-pocket spending. This rules out other channels by which Medicaid LTC affects consumption such as by changing income. Considering that the subjects in this paper are retired seniors, this assumption seems reasonable. Second, it assumes that consumption would be the same for all seniors if they had the same out-of-pocket long-term care spending. This is an assumption made for convenience. However, it approximates the reality to the extent that heterogeneity in non-LTC expenditure is limited since its magnitude comparing with long-term care spending is relatively small.

For my baseline analysis, to acquire the estimate of $\theta(1)$ in equation (15), I also need information on the coefficient of relative risk aversion, σ, and on the relative importance of consumption, η. Following the literature, I assume $\sigma = 3$ (see Finkelstein et al., 2019; De Nardi et al., 2016) and $\eta = 0.83$ (see Nakajima and Telyukova, 2020). In the standard life-cycle consumption-savings model, means-tested social insurance is typically modeled as a government-provided consumption floor (e.g., De Nardi et al., 2016, 2010). Therefore I also impose a consumption floor $c_{floor} = \$1977$ for my baseline results (as in Finkelstein et al., 2019). The sensitivity analysis by varying σ, η, and c_{floor} is presented in the section of robustness checks.

6.4 Results on Willingness to Pay

Table (15) shows the estimates of the key objects. Without any assumptions about the utility function, the net cost of Medicaid LTC (C) is equivalent to the average increase in long-term care spending induced by Medicaid LTC plus the average reduction in out-of-pocket spending due to the insurance coverage (as shown in equation (19)). The estimates for C is \$9915 per recipient year.

The estimates of the transfer term in equation (15) is obtained by using only the estimates of the impact of Medicaid LTC on l and p. The change in the out-of-pocket price for long-term care because of insurance is 0.34. Applying linear approximation as shown in Assumption 1 and the estimates of $E[m(0;\phi)]$ and $E[m(0;\phi)]$, I calculate the transfer term of \$8,314.

Then I calculate the pure-insurance term by incorporating the previous empirical findings into a specific utility function as defined in equation (17). This requires an estimate of the joint distribution of consumption and out-of-pocket spending for the uninsured, which follows from equation (21). Following the finding that individuals with home equity larger than \$500K in 2006 decreased their home equity by \$66.75K on average and relaxed their budget constraint by \$10.5K, the total pure-insurance component is therefore calculated as \$3,937. Adding this to the transfer term, the willingness to pay for Medicaid LTC is \$12,251.

For assessing the economic efficiency of the DRA, we need to measure the social benefits against social costs. The last row of Table (15) provides the benchmark. It compares willingness to pay to the net cost and the estimate of $\frac{\theta(1)}{C}$ is 1.2. This suggests that recipients are willing to pay \$1.2 of per dollar of providing Medicaid LTC. This is consistent with the estimates from other contexts.[11]

Of course, this baseline result is sensitive to the framework used and to the specific implementation assumptions. To check on the sensitivity to a variety of alternative assumptions, I conduct robustness checks in Appendix B. As shown in Table (B.5), across different values on σ,η, and c_{floor}, willingness to pay is around the same magnitude as the baseline estimation. And the estimates of the net cost value is also stable around \$10K. The smallest estimate of $\frac{\theta(1)}{C}$ is \$1.15 when assuming the consumption floor is \$2000, and the largest estimate is \$1.59 when the consumption floor is assumed to be \$1500. When adjusting the value of σ or η, the estimates of $\frac{\theta(1)}{C}$ are stable and range from \$1.21 to \$1.36.

[11] Finkelstein et al. (2019) find that willingness to pay for Medicaid among 19-64 is \$0.5-\$1.2 per dollar of net resource cost. Hendren and Sprung-Keyser (2020) show that willingness to pay for Medicare is \$1.63 per dollar of net resource cost.

7 Conclusion

Welfare policies that affect health insurance eligibility may change individuals' consumption behavior, including housing assets and savings. Evaluating such policies requires us to take these features into account, ultimately informing the design of policies that are welfare-improving.

In this paper, I use the Deficit Reduction Act that ceases the eligibility of Medicaid LTC for people with high home equity to establish that it causes changes in both the consumption of housing services and the consumption of non-LTC goods. The triple-difference analysis estimates a reduction of $66.75K in home equity and an increase of $10.5K in non-LTC consumption among the high-home-equity single seniors. Combining these two empirical results with a two-stage-budgeting model, I document that the majority of the population affected by the DRA are individuals with a large demand for long-term care.

Using the model, I further estimate seniors' willingness to pay for Medicaid LTC. After correcting the distortion behavior of consumption, I show that seniors are willing to pay $1.2 per dollar of the net cost of providing Medicaid LTC. This result is stable in the sense that the estimates of willingness to pay relative to net resource cost ranging from 1.2 to 1.6 across different specifications.

Crucially, my estimation of willingness to pay is specific to my setting. In particular, the value of Medicaid LTC may well differ when it is expanded to cover individuals with different social-economic status, or when it is mandatory rather than voluntary. Further studies that extend the analysis regarding the aforementioned limitations can help us understand the value of Medicaid LTC more comprehensively.

Policy implications from the findings in this paper are twofold. First, the findings on the effects of the DRA on home equity and consumption re-emphasize the responsive behavior among elderly households to gain eligibility for social insurance programs. Second, as noted in Chetty and Finkelstein (2013), the kernel of analyzing social insurance programs is answering whether the government intervention improves welfare. The motivation of the DRA is to improve America's Medicaid LTC delivery and financing system by limiting its eligibility. However, my evaluation shows that the current recipients' willingness to pay is larger than the net resource cost, suggesting that the efficient allocation of Medicaid LTC services has not been achieved yet.

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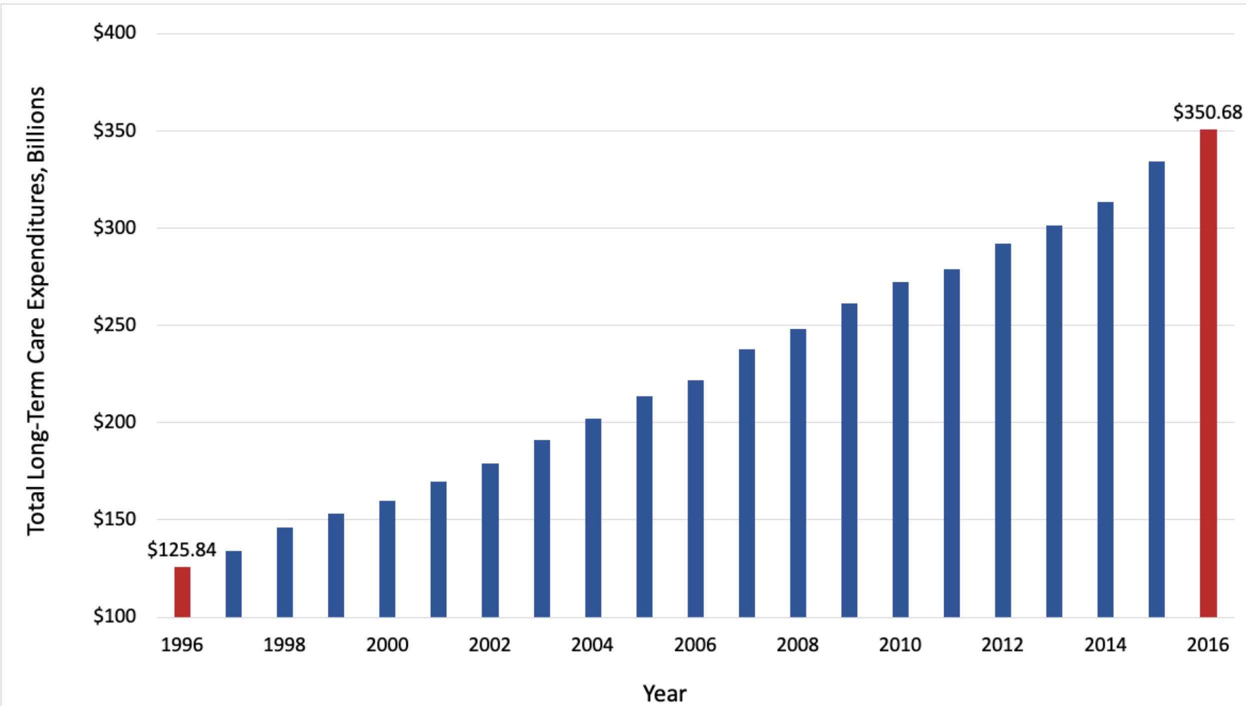
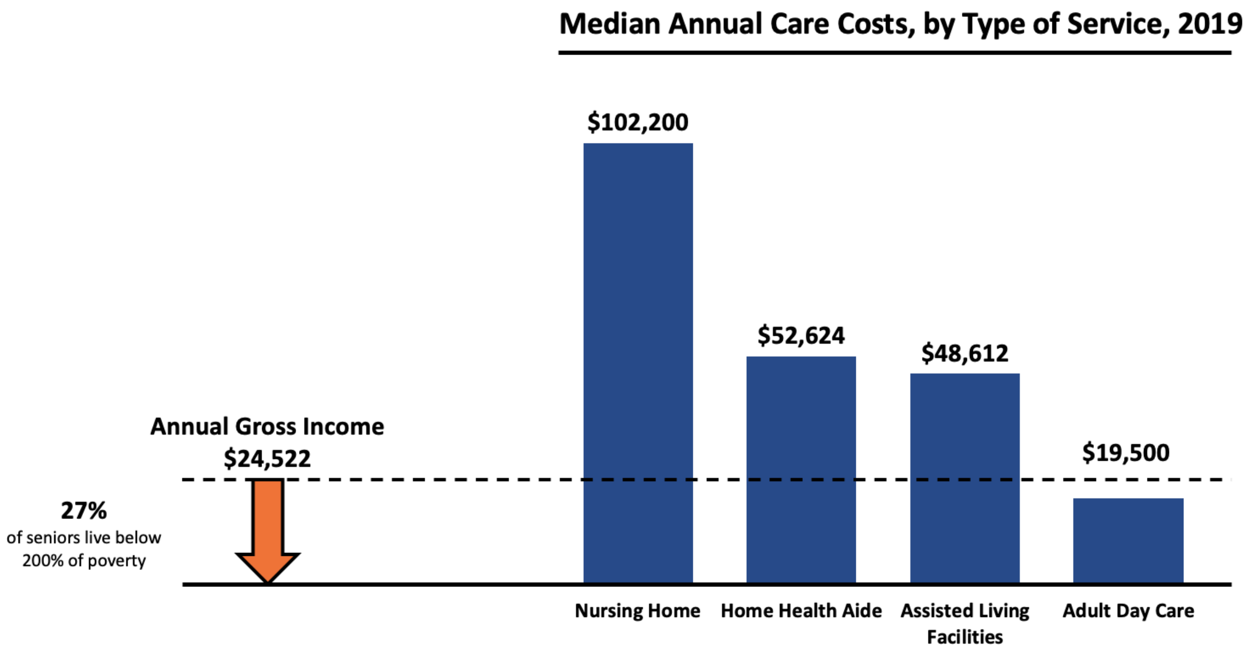
Figures

Figure 1: Total Long-Term Care Expenditures, 1996-2006



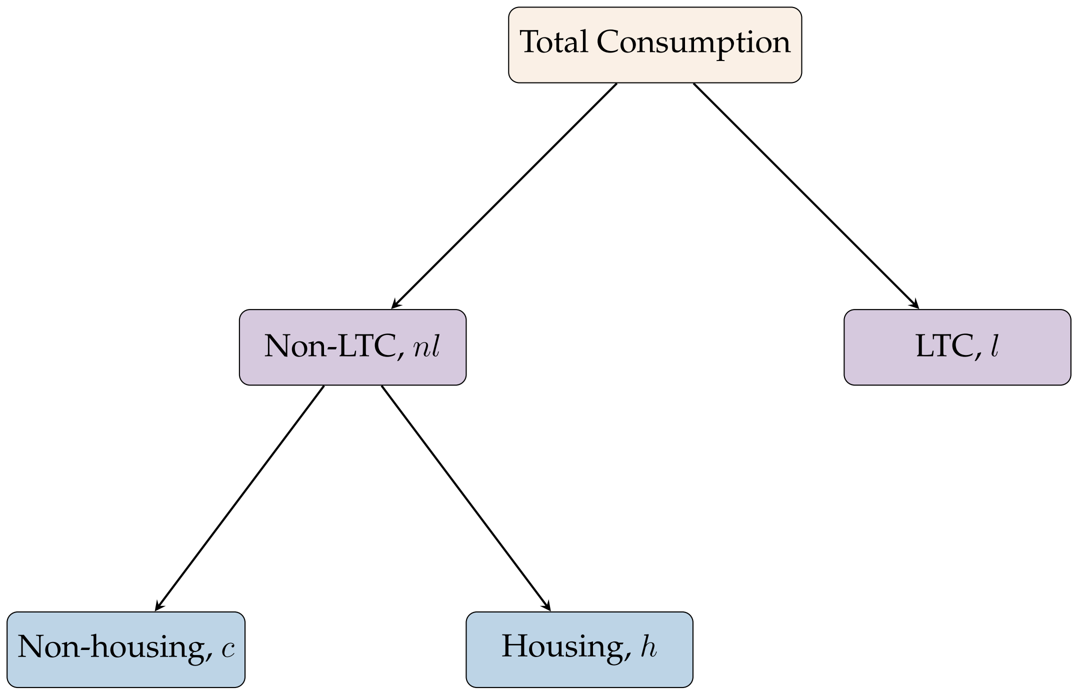
NOTES: This figure presents the yearly total national long-term care (LTC) expenditures for the US. Total LTC expenditures includes spending on residential care facilities, nursing homes, home health services, and home and community-based waiver services. This figure does not include Medicare spending on post-acute care (e.g., $77.8 billion in 2016). This is consistent with the estimates from Kaiser Family Foundation.
SOURCE: Estimates in this figure is based on 2018 National Health Expenditure Accounts from CMS, Office of the Actuary

Figure 2: Long-Term Care Costs Can Exceed Seniors' Income



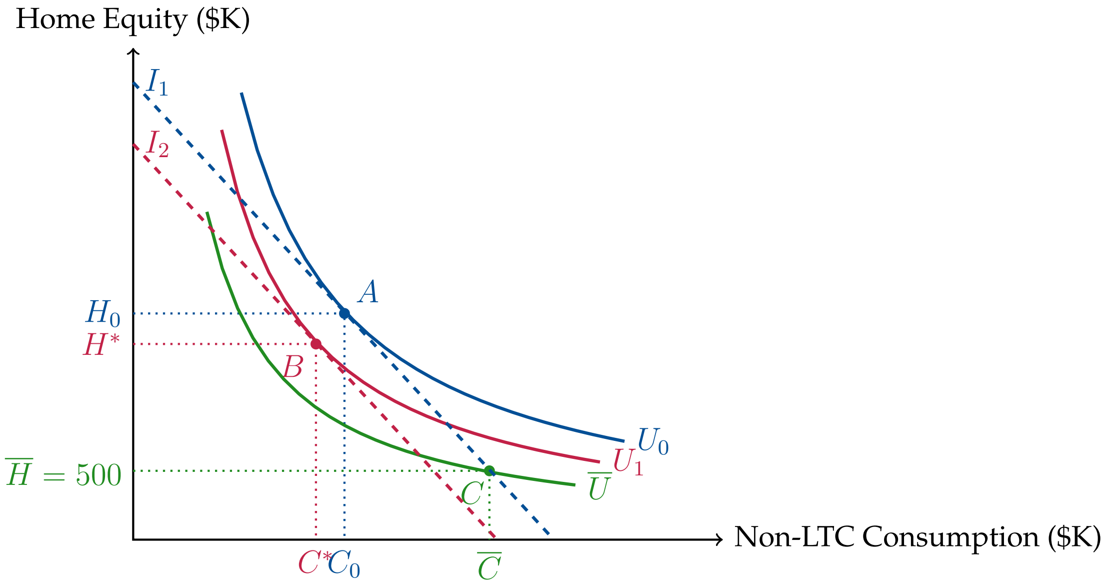
NOTES: This figure presents median annual long-term care costs by type in 2019. In 2019, the median annual cost of nursing home was $102,200. Home-based services are less expensive, but still represent a major financial burden for individuals. In 2019, the median cost for one year of home health aide was $52,624 and adult day care totaled almost $19,500. Accordingly, the 200% of FPL in 2019 was $24,522, and 27% of seniors annual gross income was below it.
SOURCE: Estimates in this figure is based on Genworth 2019 cost of care survey, https://www.genworth.com/aging-and-you/finances/cost-of-care.html; U.S. Department of Health and Human Services, 2019 Poverty Guidelines.

Figure 3: The Utility Tree for A Two-Stage Budgeting Model

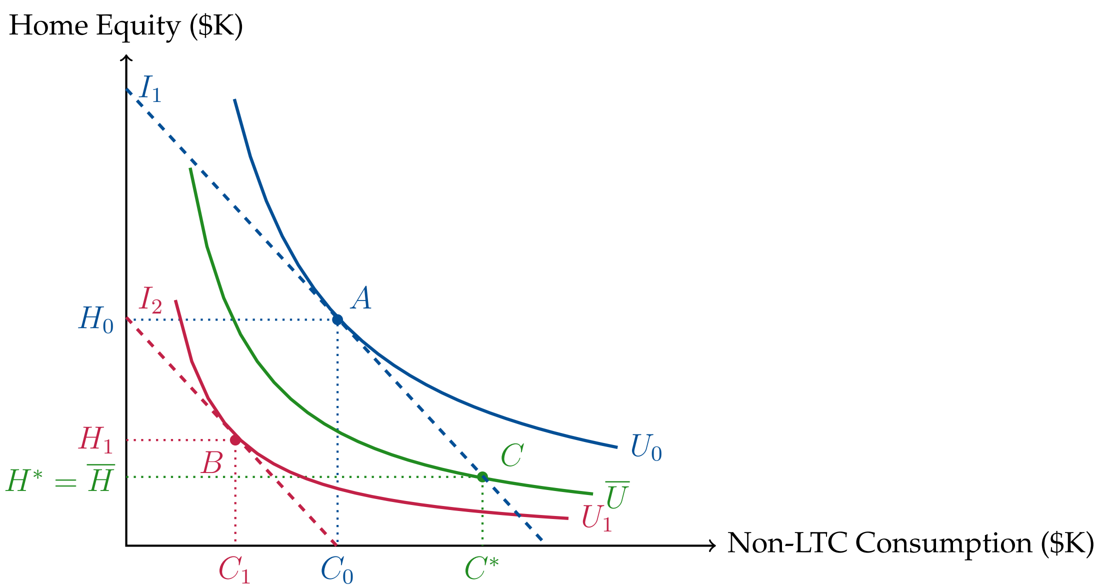


NOTES: This figure describes the framework of a two-stage budgeting model. As illustrated in this figure, the individual allocates total expenditure in two stages: at the first stage, total expenditure is allocated to LTC and non-LTC, while at the second stage, total non-LTC expenditure is allocated to consumption, c, and home equity, h.

Figure 4: Individuals' Response to the DRA Under Different Demand for LTC



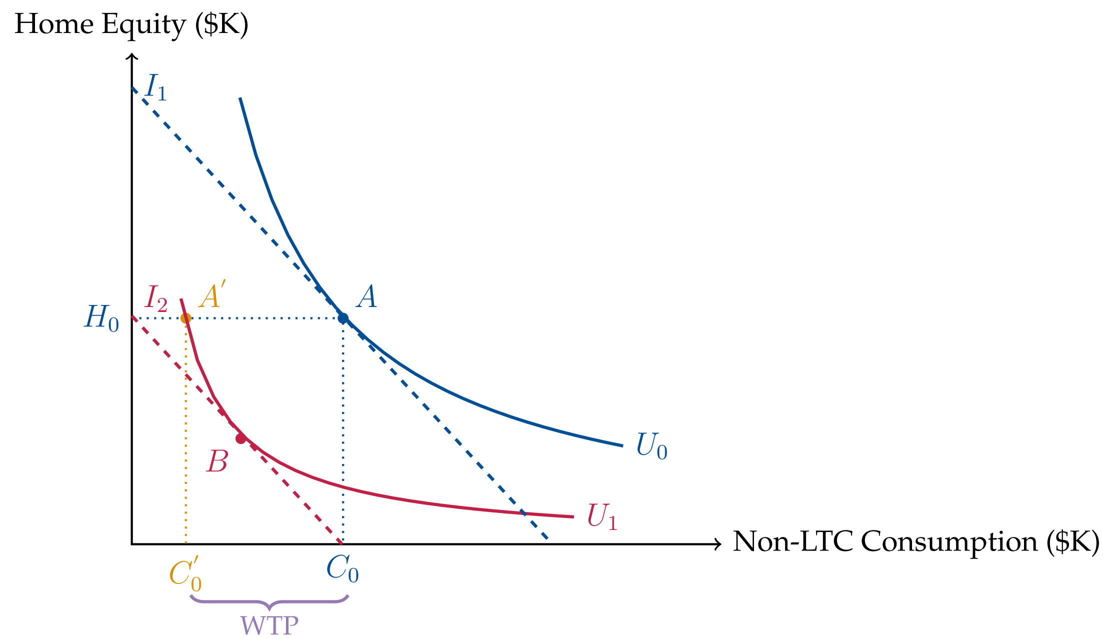
(a) Optimal H^* and C^* for small LTC demand



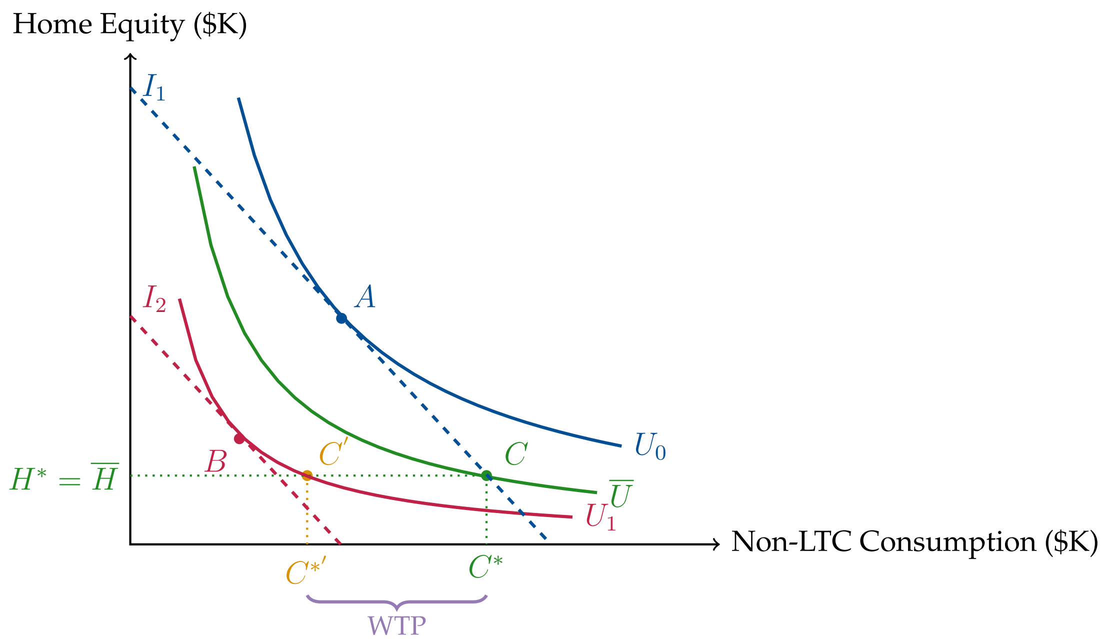
(b) Optimal H^* and C^* for large LTC demand

NOTES: Both top and bottom figures show the change of utility curves and budget constraints according to an individual's LTC demand. Prior to the DRA, the individual chooses to consume at point A. The top figure shows how the constrained optimization between non-housing consumption and home equity would change if the individual's demand for LTC is small, while the bottom figure shows how this optimization problem changes when the individual's demand for LTC is large.

Figure 5: Evaluation of Willingness to Pay (WTP) With or Without Constrained Optimization



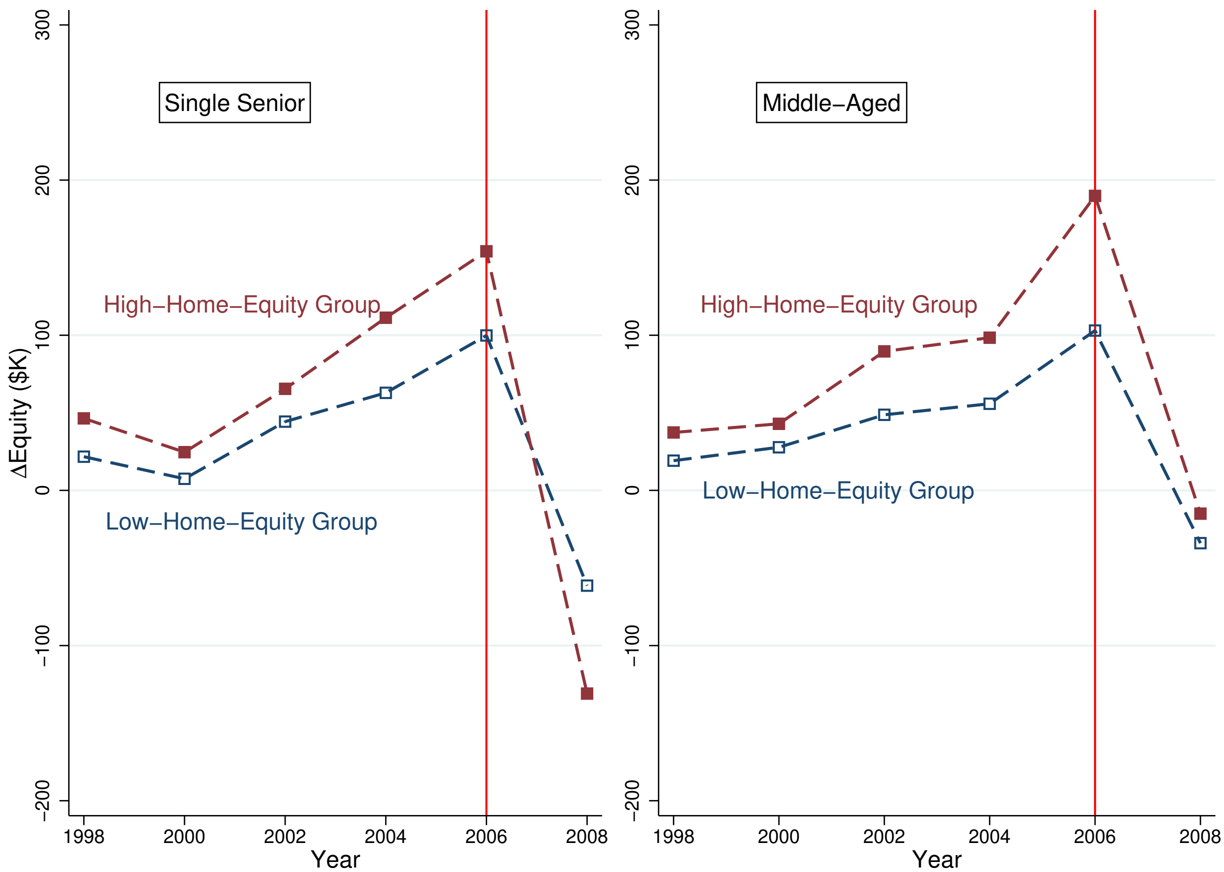
(a) Willingness to pay with no constrained optimization



(b) Willingness to pay with constrained optimization

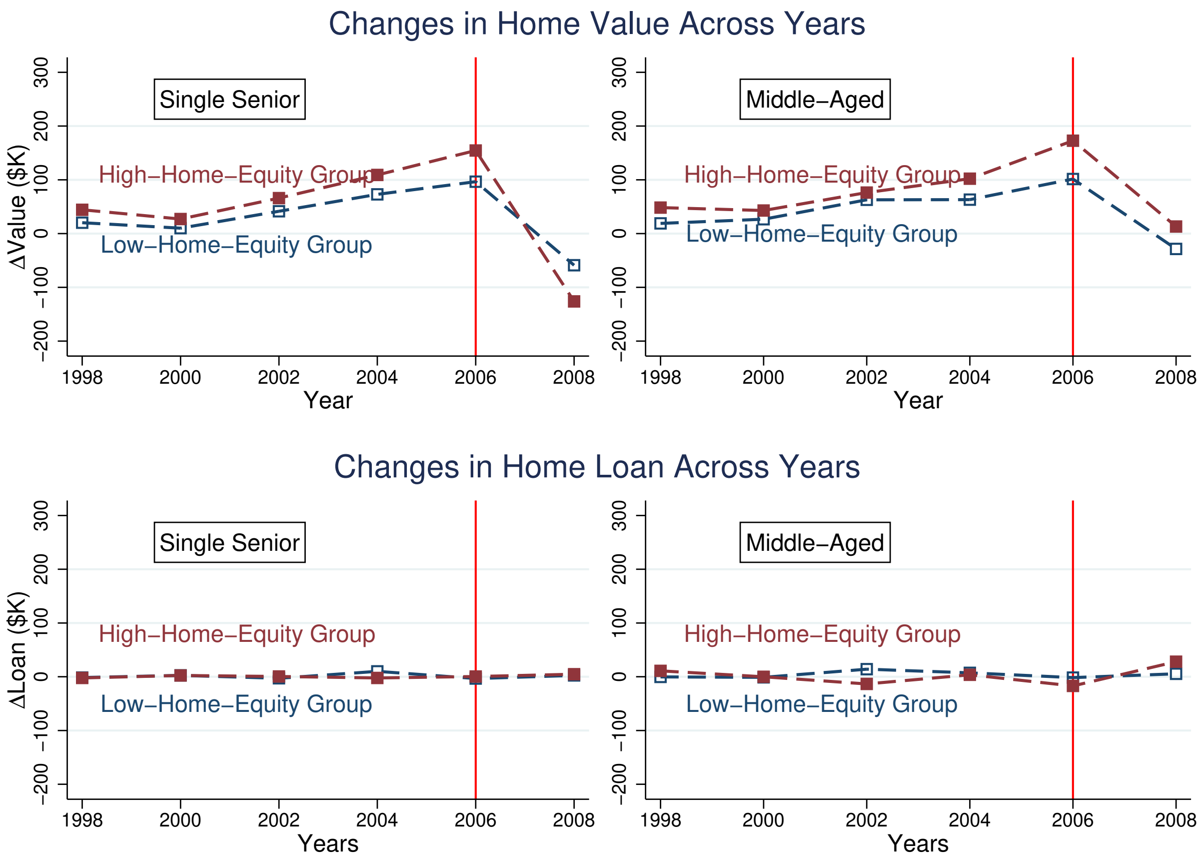
NOTES: Both top and bottom figures show the change of utility curves and budget constraints when an individual's LTC demand is large. Prior to the DRA, the individual chooses to consume at point A. The top figure shows how to calculate willingness to pay when the individual faces non-constrained optimization, while the bottom figure shows how the evaluation of willingness to pay changes when the individual faces constrained optimization.

Figure 6: Changes in Home Equity Across Years



NOTES: Dependent variable in both panels are the change of equity in consecutive two waves. The left panel represents individuals who are single and aged above 65 and in 2006. The right panel represents individuals aged 55-64 in 2008. Red dotted line (high-home-equity group) represents individuals with home equity in 2006 greater than $500K. Blue dotted line represents individuals with home equity in 2006 smaller than $500K. The average of $\Delta Equity$ are plotted for each even-numbered year from 1998 to 2008. Sample restricted to individuals with home equity in 2006 ranging from $300K to $700K.

Figure 7: Changes in Home Value and Home Loan Across Years



NOTES: Dependent variable in the top two panels are the change of home value in consecutive two waves. Dependent variable in the bottom panels are the change of home loan in consecutive two waves. The left figure in each panel represents individuals who are single and aged above 65 and in 2006. The right figure in each panel represents individuals aged 55-64 in 2008. Red dotted line (high-home-equity group) represents individuals with home equity in 2006 greater than \$500K. Blue dotted line represents individuals with home equity in 2006 smaller than \$500K. The average of $\Delta Value$ and of $\Delta Loan$ are plotted for each even-number year from 1998 to 2008. Sample restricted to individuals with home equity in 2006 ranging from \$300K to \$700K.

Tables

Table 1: Pre-DRA Summary Statistics

Variables	Single Seniors N (1)	Mean (2)	Median (3)	Std Dev (4)	Middle Aged N (5)	Mean (6)	Median (7)	Std Dev (8)
HRS dataset								
Housing Asset								
Home value, 2006 ($K)	335	460.59	450	120.10	628	531.75	500	183.93
Home debt, 2006 ($K)	335	28.19	0	65.34	628	106.25	50	142.31
Home equity, 2006 ($K)	335	432.40	400	102.26	628	425.50	400	107.75
Home equity $\geqslant$ $500K	117	550.68	540	51.98	168	576.35	566.5	58.60
Change in home price, 2004-2006 ($K)	320	117.92	100	145.15	612	130.36	100	141.77
Change in home price, 2006-2008 ($K)	335	-90.89	-50	169.78	628	-31.83	-50	473.45
Change in home debt, 2004-2006 ($K)	320	-1.01	0	47.15	612	-0.21	0	103.83
Change in home debt, 2006-2008 ($K)	335	1.60	0	52.52	628	7.08	0	92.27
Change in home equity, 2004-2006 ($K)	320	118.93	103.5	140.74	612	130.57	120	135.33
Change in home equity, 2006-2008 ($K)	335	-92.49	-50	166.21	628	-38.91	-50	473.74
Health Status								
Diabetes	334	0.14	0	0.35	627	0.10	0	0.29
Cancer	335	0.20	0	0.40	627	0.09	0	0.29
Difficulty w/ memory	335	0.03	0	0.18	628	0.02	0	0.13
Any ADLs /IADLs	335	0.19	0	0.39	628	0.08	0	0.27
Health Insurance and Health Services								
Medicaid, 2004	320	0.02	0	0.14	612	0.01	0	0.08
Ever had overnight stay in nursing home, 2004	320	0.03	0	0.17	612	0.00	0	0.04
Ever used home care services, 2004	320	0.07	0	0.25	612	0.01	0	0.11
Basic Characteristics								
Age, 2006	335	75.44	74	7.52	628	57.65	58	2.90
Male	335	0.29	0	0.45	628	0.44	0	0.50
White	335	0.90	1	0.29	628	0.89	1	0.32
Black	335	0.05	0	0.22	628	0.05	0	0.21
Native	335	0.90	1	0.30	628	0.86	1	0.35
Number of kids	335	2.96	3	2.15	628	2.64	2	1.56
Less than high school education	335	0.12	0	0.32	628	0.05	0	0.22
Income, 2004 ($K)	320	61.62	32.01	105.52	612	88.07	60	100.72

NOTES: Summary statistics are for individuals with home equity in 2006 in the range of $300K-$700K. Diabetes, Cancer, Difficulty w/ memory, and Any ADLs/IADLs are indicators if the individual reported having symptoms. Income is defined as personal income.

Table 2: Testing the Parallel Trends Assumption - Home Equity

Dependent Variable ($K)	$\Delta Equity$							
Treatment Years	06							
Control Years	98		00		02		04	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Senior × Above × Post	-54.90	-71.99	-25.80	-30.54	23.13	16.17	-37.51	-42.03
	(53.948)	(48.534)	(41.532)	(41.278)	(32.662)	(32.555)	(69.310)	(70.302)
Above × Post	93.45	95.17	86.04**	83.00**	24.11	22.11	51.07	49.56
	(64.196)	(67.820)	(33.166)	(30.533)	(32.800)	(30.271)	(49.107)	(44.920)
Post	65.33***	84.13	63.51***	79.84	68.83***	77.07	55.73***	23.38
	(17.929)	(271.606)	(15.579)	(80.585)	(19.105)	(52.806)	(16.151)	(41.176)
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	No	Yes	No	Yes	No	Yes	No	Yes
Weights	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	516	516	1,256	1,256	1,274	1,274	1,324	1,324
R-squared	0.27	0.26	0.29	0.31	0.20	0.17	0.14	0.08

NOTES: The analysis uses individuals with home equity in the range of $300K-$700K in 2006, prior to the launch of the DRA (1996-1998 through 2004-2006). $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above $500K. $Senior$ is an indicator variable denoting that an individual aged above 65 in 2006, and $Senior = 0$ when an individual aged 55-64 in 2008. Each observation is an individual-year. Odd-numbered columns do not include individual fixed effects, and even-numbered columns additionally include individual fixed effects. All columns include weights and state FE (to control the impact of geographical factors when people move to different states). Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table 3: Triple-Difference (DDD) Estimate of the Impact of the DRA on Home Equity

Dependent Variable ($K)	ΔEquity			
Comparison Years	06-08			
	(1)	(2)	(3)	(4)
Senior × Above × Post	-97.96**	-94.29**	-75.12**	-66.75*
	(37.988)	(38.569)	(33.902)	(34.452)
Above × Post	-41.98	-41.46	-49.76	-47.60
	(55.014)	(53.288)	(38.175)	(36.371)
Post	-154.21***	-347.24***	-147.29***	-334.90***
	(16.633)	(89.131)	(16.791)	(83.633)
Specification	λ=DDD			
Mean home equity ($Above = 1$), 2006	550.68			
Additional controls	YES	YES	YES	YES
State FE	YES	YES	YES	YES
Weights	NO	NO	YES	YES
Individual FE	NO	YES	NO	YES
Observations	1,828	1,828	1,828	1,828
R-squared	0.13	0.18	0.12	0.17

NOTES: Results presented are for individuals with home equity in the range of $300K-$700K in 2006. $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above $500K. $Senior$ is an indicator variable denoting that an individual aged above 65 in 2006, and $Senior = 0$ when an individual aged 55-64 in 2008. Even-numbered columns include individual fixed effects, and columns (3)-(4) include weights. All columns include state FE to control the impact of geographical factors on home equity when people move to different states. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table 4: Heterogeneous Triple-Difference (DDD) Estimate of the Impact of the DRA on Home Equity

Dependent Variable	ΔEquity			
Comparison Years	06-08			
	(1)	(2)	(3)	(4)
Senior $\times$ Above $\times$ Post	-156.42***	-484.02***	-171.11***	-496.11***
	(56.208)	(39.529)	(44.359)	(45.619)
Senior $\times$ Above $\times$ Post $\times$ H_{i04}	0.21**	0.97***	0.27***	1.02***
	(0.095)	(0.064)	(0.081)	(0.069)
Above $\times$ Post	-41.99	-41.19	-49.77	-47.48
	(55.014)	(53.387)	(38.173)	(36.384)
Post	-154.33***	-335.44***	-147.29***	-327.33***
	(16.705)	(87.092)	(16.836)	(79.501)
Specification	$\lambda = \lambda_1 + \lambda_2 \cdot H_{i04}$			
Reg Sample	$H_{i06} \in [200, 800)$		$H_{i06} \in [100, 900)$	
Turning point	659.99	615.42	641.98	636.65
Additional controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Individual FE	No	Yes	No	Yes
Weights	Yes	Yes	Yes	Yes
Observations	3,400	3,400	6,658	6,658
R-squared	0.11	0.18	0.11	0.18

NOTES: Results presented in columns (1)-(2) are for individuals with home equity in the range of \$200K-\$800K in 2006. Results presented in columns (3)-(4) are for individuals with home equity in the range of \$100K-\$900K in 2006. $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above \$500K. $Senior$ is an indicator variable denoting that an individual aged above 65 in 2006, and $Senior = 0$ when an individual aged 55-64 in 2008. H_{i04} denotes an individual's home equity level in 2004. Turning point is the home equity level where the impact of the DRA is zero. Even-numbered columns include individual fixed effects, and columns (3)-(4) include weights. All columns include state FE to control the impact of geographical factors on home equity when people move to different states. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table 5: Triple-Difference (DDD) Estimate of the Impact of the DRA on Home Value and Home Loan

Dependent Variables	ΔValue	Δ Loan	Loan/Value
Comparison Years		06-08	
	(1)	(2)	(3)
Senior × Above × Post	-112.64**	-37.51*	-0.03
	(43.995)	(19.360)	(0.027)
Above × Post	-15.34	34.42**	0.02
	(39.627)	(12.656)	(0.017)
Post	-145.98***	1.31	0.05***
	(14.729)	(9.480)	(0.008)
Additional controls	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
Weights	Yes	Yes	Yes
Observations	1,828	1,828	1,776
R-squared	0.12	0.08	0.21

NOTES: Results presented are for individuals with home equity in the range of \$300K-\$700K in 2006. $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above \$500K. $Senior$ is an indicator variable denoting that an individual aged above 65 in 2006, and $Senior = 0$ when an individual aged 55-64 in 2008. The reduction of sample size in column (3) is due to the fact that the denominator of $\frac{\text{loan}}{\text{value}}$ cannot equals to zero. All columns include individual FE and weights. All columns additionally include state FE to control the impact of geographical factors on home equity when people move to different states. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table 6: Pre-DRA Summary Statistics: Consumption Details

Variables	Single Seniors N (1)	Mean (2)	Median (3)	Std Dev (4)	Middle-Aged N (5)	Mean (6)	Median (7)	Std Dev (8)
Panel A: HRS dataset								
Medical Consumption								
LTC expenditures, 2006 ($K)	335	0.19	0	0.39	628	0.15	0	0.36
Non-LTC medical expenditures, 2006 ($K)	335	1.75	0.9	4.51	628	1.43	0.7	2.43
Panel B: CAMS dataset								
Non-medical Consumption								
Transportation spending, 2006 ($K)	104	6.76	3	12.91	111	15.27	8.04	15.73
Durables spending, 2006 ($K)	104	0.36	0	0.79	111	0.68	0	1.12
Nondurables spending, 2006 ($K)	104	32.35	23.77	28.38	111	36.83	32.33	21.12

NOTES: Summary statistics are for individuals with home equity in the range $300K-$700K in 2006. Since the CAMS randomly selects part of HRS households to measure spending, the total sample size of the CAMS dataset is less than the HRS dataset. The measure of transportation spending is the sum of all of the spending in the household on up to three automobile purchases, vehicle insurance, vehicle maintenance, car payment of vehicle financing, and gasoline. The measure of durable spending is the sum of all of the household spending on durable goods excluding autos. There are five durable categories: refrigerator, washer/dryer, dishwasher, television, and computer. The measure of nondurable spending in general include: gifts, clothing, charitable contributions, dining out, utilities, food and beverages, trips and vacations, sports, etc.

Table 7: Testing the Parallel Trends Assumption - Consumption

Dependent Variable ($K)	Non-LTC Consumption			
Comparison Years	02-06		04-06	
	(1)	(2)	(3)	(4)
Senior × Above × Post	-5.36	-10.14	2.20	-0.13
	(9.959)	(9.738)	(7.090)	(7.046)
Above × Post	-0.12	3.99	1.50	4.11
	(6.990)	(6.330)	(6.683)	(6.668)
Post	9.58***	-23.40	3.05	0.14
	(2.545)	(21.301)	(2.091)	(5.556)
Additional controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Individual FE	No	Yes	No	Yes
Weights	Yes	Yes	Yes	Yes
Observations	464	464	454	454
R-squared	0.21	0.10	0.34	0.08

NOTES: The analysis uses individuals with home equity in the range of $200K-$800K in 2006, prior to the launch of the DRA (2000-2002 through 2004-2006). Since the CAMS randomly selects part of HRS households to measure spending, the total sample size of the CAMS dataset is less than the HRS dataset. $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above $500K. $Senior$ is an indicator variable denoting that an individual aged above 65 in 2006, and $Senior = 0$ if an individual aged 55-64 in 2008. Even-numbered columns include individual fixed effects, and all columns include weights. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table 8: Triple-Difference (DDD) Estimate of the Impact of the DRA on Consumption

Dependent Variable ($K)	Non-LTC Consumption			
Comparison Years	06-08			
	(1)	(2)	(3)	(4)
Senior × Above × Post	4.47	6.44	6.60	10.50*
	(4.770)	(4.808)	(5.514)	(6.196)
Above × Post	1.25	-0.08	0.77	-2.12
	(3.267)	(3.293)	(3.308)	(3.616)
Post	-1.53	-7.00	-1.10	-10.12
	(1.989)	(7.520)	(2.513)	(8.187)
Mean ($Above = 1$), 2006	46.72			
Additional controls	YES	YES	YES	YES
State FE	YES	YES	YES	YES
Weights	NO	NO	YES	YES
Individual FE	NO	YES	NO	YES
Observations	764	764	764	764
R-squared	0.23	0.07	0.20	0.07

NOTES: Results are presented for individuals with home equity in the range $200K-$800K in 2006. Since the CAMS randomly selects part of HRS households to measure spending, the total sample size of the CAMS dataset is less than the HRS dataset. $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above $500K. $Senior$ is an indicator variable denoting that an individual aged above 65 in 2006. Even-numbered columns include individual fixed effects, and columns (3)-(4) include weights. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table 9: Testing the Parallel Trends Assumption - Consumption

Dependent Variable ($K)	Non-LTC Consumption			
Comparison Years	02-06		04-06	
	(1)	(2)	(3)	(4)
Single × Above × Post	-11.01	-13.72	-1.96	-1.14
	(11.414)	(11.702)	(4.523)	(4.073)
Above × Post	3.36	1.99	5.44	4.22
	(6.828)	(5.927)	(3.775)	(2.915)
Post	-1.33	-17.72**	-4.33**	-9.18**
	(1.815)	(8.522)	(2.126)	(3.507)
Additional controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Individual FE	No	Yes	No	Yes
Weights	Yes	Yes	Yes	Yes
Observations	462	462	566	566
R-squared	0.24	0.08	0.22	0.12

NOTES: The analysis uses senior individuals aged 65 and above with home equity in the range of $200K-$800K in 2006, prior to the launch of the DRA (2000-2002 through 2004-2006). $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above $500K. $Single$ is an indicator variable denoting that an individual were unmarried during 2006-2008. Even-numbered columns include individual fixed effects, and all columns include weights. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table 10: Tripe-Difference (DDD) Estimate of the Impact of the DRA on Consumption

Dependent Variable ($K)	Non-LTC Consumption			
Comparison Years	06-08			
	(1)	(2)	(3)	(4)
Senior × Above × Post	7.77**	6.49	12.03***	10.43*
	(3.211)	(3.998)	(4.089)	(5.172)
Above × Post	0.82	0.14	-0.26	-0.25
	(3.080)	(3.185)	(2.902)	(3.261)
Post	-2.29*	-6.52	-1.05	-8.78
	(1.342)	(9.047)	(1.252)	(12.327)
Additional controls	YES	YES	YES	YES
State FE	YES	YES	YES	YES
Weights	NO	NO	YES	YES
Individual FE	NO	YES	NO	YES
Observations	798	798	798	798
R-squared	0.29	0.16	0.27	0.13

NOTES: Results are presented for senior individuals aged 65 and above with home equity in the range $200K-$800K in 2006. $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above $500K. $Single$ is an indicator variable denoting that an individual were unmarried during 2006-2008. Even-numbered columns include individual fixed effects, and columns (3)-(4) include weights. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table 11: Tripe-Difference (DDD) Estimate the DRA Effects on Different Categories of Consumption

Dependent Variable ($K)	Transportation	Non-LTC medicals	Durables	Nondurables
Comparison Years		06-08		
	(1)	(2)	(3)	(4)
Senior × Above × Post	3.01	1.23	0.15	6.11
	(3.090)	(1.071)	(0.372)	(5.442)
Above × Post	-3.04	-0.05	-0.18	1.15
	(2.711)	(0.438)	(0.232)	(2.085)
Post	1.02	-0.61	0.13	-10.65
	(3.358)	(0.638)	(0.148)	(6.749)
Individual FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Weights	Yes	Yes	Yes	Yes
Observations	764	764	764	764
R-squared	0.01	0.10	0.23	0.11

NOTES: Results are presented for individuals with home equity in the range $200K-$800K in 2006. $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above $500K. $Senior$ is an indicator variable denoting that an individual aged above 65 in 2006. All columns include individual fixed effects and weights. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table 12: Tripe-Difference (DDD) Estimate the DRA Effects on Different Categories of Consumption

Dependent Variable ($K)	Transportation	Non-LTC medicals	Durables	Nondurables
Comparison Years	06-08			
	(1)	(2)	(3)	(4)
Single × Above × Post	-2.01	1.94	-0.21	10.72**
	(2.898)	(1.235)	(0.288)	(4.436)
Above × Post	1.35	-0.83	0.16	-0.97
	(1.673)	(0.610)	(0.177)	(1.941)
Post	-0.14	0.97	-0.23*	-9.37
	(3.195)	(2.918)	(0.134)	(10.264)
Individual FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Weights	Yes	Yes	Yes	Yes
Observations	798	798	798	798
R-squared	0.14	0.07	0.15	0.12

NOTES: Results are presented among senior individuals aged above 65 with home equity in the range $200K-$800K in 2006. $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above $500K. $Single$ is an indicator variable denoting that an individual were unmarried during 2006-2008. All columns include individual fixed effects and weights. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table 13: Heterogeneous Effects

Left-hand-side variable ($K)	Δ Equity							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Interaction variable	Male	Male	Less than high school	Less than high school	Any ADLs or IADLs, 06	Any ADLs or IADLs, 06	Medicaid, 04	Medicaid, 04
Senior × Above × Post	-91.30**	-63.23*	-80.47**	-62.94*	-76.91**	-54.93	-90.58**	-70.83**
	(37.397)	(34.298)	(34.434)	(32.771)	(36.461)	(32.882)	(36.124)	(33.121)
Senior × Above × Post ×	-21.63	-35.38	-129.73**	-89.96*	-158.79***	-141.11***	-274.68*	-198.44
Interaction Term (listed as top of column)	(40.500)	(35.147)	(57.329)	(46.609)	(42.830)	(35.245)	(158.038)	(167.875)
Above × Post	-45.03	-47.84	-44.99	-47.81	-42.28	-47.79	-42.27	-47.90
	(53.994)	(46.062)	(53.980)	(46.079)	(53.974)	(46.075)	(53.969)	(46.046)
Post	-155.01***	-147.68***	-155.09***	-147.89***	-155.36***	-148.11***	-155.09***	-147.75***
	(16.758)	(14.795)	(16.750)	(14.914)	(16.700)	(14.836)	(16.747)	(14.822)
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Weights	No	Yes	No	Yes	No	Yes	No	Yes
Observations	1,828	1,828	1,828	1,828	1,828	1,828	1,828	1,828
R-squared	0.13	0.12	0.13	0.12	0.13	0.12	0.13	0.12

NOTES: Results are presented among individuals with home equity in the range $200K-$800K in 2006. $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above $500K. $Senior$ is an indicator variable denoting that an individual aged above 65 in 2006. Even-numbered columns include individual fixed effects, and all columns include weights. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table 14: Overview of Empirical Objects

Notation (1)	Meaning (2)
A. Empirical Estimated Objects	
A.1 Willingness to pay, θ	
A.1.1 Transfer Term, $(p(0)-p(1))\int_0^1 E[l(m;\phi)]dm$	
$E[l(m;\phi)]$ for $m=0,1$	Mean LTC spending without and with Medicaid
$p(m)$ for $m=0,1$	Out-of-pocket price for LTC services without and with Medicaid
A.1.2 Pure-Insurance Term, $\int_0^1 Cov[\frac{u_c}{E[u_c]},(p(0)-p(1))l(m;\phi)]dm$	
$c(m;\phi)$ for $m=0,1$	Distribution of non-LTC consumption without and with Medicaid
$s(m;l(m;\phi))$ for $m=0,1$	Distribution of out-of-pocket LTC spending without and with Medicaid
h_0	Home equity in 2006
Δh for $Above=0,1$	The changes of home equity for $h_0 \geqslant 500$ group and $h_0 < 500$ group
A.2 Net resource cost, $C=E[l(1;\phi)-l(0;\phi)]+E[s(0,l(0;\phi))-s(1,l(1;\phi))]$	
$E[s(m;\phi)]$ for $m=0,1$	Mean out-of-pocket spending without and with Medicaid
B. Parameters of the Utility Function	
σ	Coefficient of relative risk aversion
η	Relative importance of non-long-term-care consumption

Table 15: Willingness to Pay (WTP) for Medicaid LTC

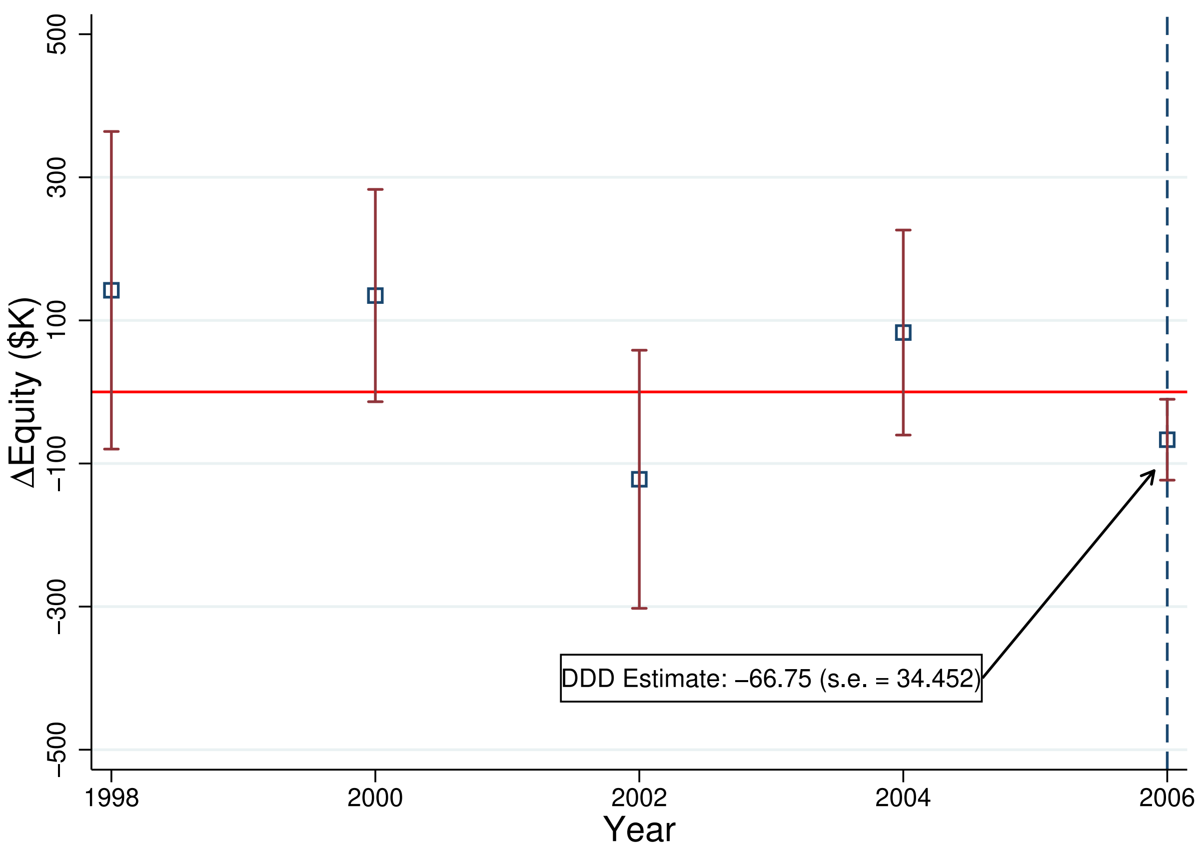
	Benefit
WTP, $\theta(1)$	12251
(standard eror)	(3075.15)
Transfer term, T	8314.38
Pure-Insurance term, PI	3936.63
	Cost
Net cost, C	9915
	Benchmark
WTP as fraction of net cost, $\frac{\theta(1)}{C}$	1.24

NOTES: Estimates of willingness to pay and corresponding net cost are expresses in dollars per year per Medicaid LTC recipient. Standard errors are bootstrapped.

Appendices

A Figures

Figure A.1: Changes in Home Equity Across Consecutive Year Pairs



NOTES: This figure uses consecutive HRS wave-pairs to re-examine equation (2) over the period 1996 to 2008. Specifically, the y-axis corresponds to the estimate of the tripe-difference term, and is measured in $K. The x-axis denotes the pre-period year within the consecutive year pair. I keep the definition of treatment status constant over time such that $Above_i$ and $Senior_i$ are based on reported characteristics in the former of the two years in each wave-pair. On the contrary, $Post_t$ equals to one for the later of the two years. For example, in the x-axis , "1998" represents the estimate for the period 1998 and 2000, where the outcome in 1998 equals to the home equity growth from 1996 to 1998. Within this wave-pairs, the post-period is 2000 and I define treatment status based on characteristics in 1998.

B Tables

Table B.1: Pre-DRA Summary Statistics

Variables	Single Seniors N (1)	Mean (2)	Median (3)	Std Dev (4)
HRS dataset				
Housing Asset				
Home value, 2006 ($K)	4126	120.32	60	224.81
Home debt, 2006 ($K)	4126	12.10	0	39.03
Home equity, 2006 ($K)	4126	108.23	49.5	214.17
Change in home price, 2004-2006 ($K)	3983	17.67	0	152.12
Change in home price, 2006-2008 ($K)	4126	-4.89	0	267.44
Change in home debt, 2004-2006 ($K)	3983	1.09	0	27.65
Change in home debt, 2006-2008 ($K)	4126	-0.23	0	30.11
Change in home equity, 2004-2006 ($K)	3983	16.58	0	152.47
Change in home equity, 2006-2008 ($K)	4126	-4.65	0	266.87
Health Status				
Diabetes	4116	0.21	0	0.41
Cancer	4111	0.17	0	0.37
Difficulty w/ memory	4126	0.06	0	0.25
Any ADLs or IADLs	4123	0.32	0	0.47
Health Insurance and Health Services				
Medicaid, 2004	3958	0.15	0	0.36
Ever had overnight stay in nursing home, 2004	3982	0.05	0	0.21
Ever used home care services, 2004	3980	0.09	0	0.28
Basic Characteristics				
Age, 2006	4126	76.27	75	7.98
Male	4126	0.23	0	0.43
White	4126	0.78	1	0.41
Black	4126	0.19	0	0.39
Native	4124	0.90	1	0.30
Less than high school education	4126	0.31	0	0.47
Number of kids	4035	3.16	3	2.32
Income, 2004 ($K)	3983	30.17	18.30	58.73

NOTES: Summary statistics are for individuals with all home equity values. Diabetes, Cancer, Difficulty w/ memory, and Any ADLs/IADLs are indicators if the individual reported having symptoms. Income is defined as personal income.

Table B.2: Robustness to Regression Sample

Dependent Variable ($K)	ΔEquity			
Comparison Years	06-08			
	(1)	(2)	(3)	(4)
Senior × Above × Post	-81.75***	-80.98***	-64.01**	-58.64*
	(29.186)	(29.633)	(31.669)	(32.293)
Above × Post	-91.49**	-88.37**	-89.22**	-89.48**
	(41.387)	(40.352)	(38.330)	(37.814)
Post	-117.79***	-216.45***	-113.45***	-224.66***
	(15.030)	(61.883)	(14.481)	(66.679)
Additional controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Individual FE	No	Yes	No	Yes
Weights	No	No	Yes	Yes
Observations	3,400	3,400	3,400	3,400
R-squared	0.12	0.19	0.11	0.17

NOTES: Results presented are for individuals with home equity in the range of $200K-$800K in 2006. $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above $500K. $Senior$ is an indicator variable denoting that an individual aged above 65 in 2006. Even-numbered columns include individual fixed effects, and columns (3)-(4) include weights. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table B.3: Robustness to Definition of the Middle-Aged

Dependent Variable ($K)	Δ Equity			
Comparison Years	06-08			
	(1)	(2)	(3)	(4)
Senior × Above × Post	-97.06***	-90.57***	-76.19**	-63.93*
	(37.286)	(37.309)	(33.202)	(33.189)
Above × Post	-45.78	-40.15	-46.44	-43.15
	(52.556)	(53.299)	(43.218)	(45.206)
Post	-160.85***	-349.72***	-153.58***	-356.12***
	(14.016)	(92.533)	(14.625)	(98.326)
Additional controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Individual FE	No	Yes	No	Yes
Weights	No	No	Yes	Yes
Observations	1,876	1,876	1,876	1,876
R-squared	0.13	0.19	0.12	0.17

NOTES: Results presented are comparing individuals aged above 65 in 2006 with individuals aged 50-64 in 2008. Sample is restricted to individuals whose home equity in the range of $300K-$700K in 2006. $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above $500K. $Senior$ is an indicator variable denoting that an individual aged above 65 in 2006. Even-numbered columns include individual fixed effects, and columns (3)-(4) include weights. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table B.4: Placebo Test to Alternative Definition of "Above" Group

Dependent Variable	ΔEquity			
Comparison Years	06-08			
	(1)	(2)	(3)	(4)
Senior × Above × Post	42.00	48.08	57.07	61.86
	(78.743)	(81.148)	(79.304)	(83.105)
Above × Post	-70.88	-70.68	-74.88	-74.53
	(54.899)	(55.429)	(53.315)	(56.978)
Post	-177.35***	-481.99***	-165.56***	-480.20***
	(36.861)	(91.656)	(36.956)	(109.143)
Additional controls	YES	YES	YES	YES
State FE	YES	YES	YES	YES
Weights	NO	NO	YES	YES
Individual FE	NO	YES	NO	YES
Observations	1,116	1,116	1,116	1,116
R-squared	0.13	0.18	0.13	0.17

NOTES: Results presented are comparing individuals aged above 65 in 2006 with individuals aged 55-64 in 2008. Sample is restricted to individuals whose home equity in the range of $400K-$800K in 2006. $Post = 1$ indicates the year of 2008. $Post = 0$ indicates the year of 2006. $Above = 1$ when an individual's home equity in 2006 is above $600K. $Senior$ is an indicator variable denoting that an individual aged above 65 in 2006. Even-numbered columns include individual fixed effects, and columns (3)-(4) include weights. Robust standard errors, clustered by state, are in parentheses. (*** p<0.01, ** p<0.05, * p<0.1)

Table B.5: Robustness Checks of Key Estimates for Evaluation of Willingness to Pay

		σ			η			c_{floor}		
	Baseline (1)	2 (2)	4 (3)	5 (4)	0.6 (5)	0.7 (6)	0.9 (7)	1500 (8)	2000 (9)	2500 (10)
WTP for Medicaid LTC	12251	11980	13114	13512	11951	12225	12206	15990	11396	11960
Net Costs, C	9915	9915	9915	9915	9915	9915	9915	10080	9907	9734
WTP Relative to Net Cost	1.24	1.21	1.32	1.36	1.21	1.23	1.23	1.59	1.15	1.23

NOTES: This table presents the sensitivity of my baseline results of willingness to pay to alternative assumptions related to consumption. Column (1) reports the baseline specification. Columns (2)-(10) report the estimates under alternative assumptions about risk aversion (columns (2)-(4)), relative importance of consumption (columns (5)-(7)), and the consumption floor (columns (8)-(10)).

C Home Equity Growth as the Outcome Variable

To show the feasibility of using home equity growth as the outcome variable in my empirical analysis, let us consider a two-way fixed effects regression model with time trends as follows:

$$Y_{it} = \alpha_i + \gamma_t + g_i \times t + \lambda \times P_{it} + \beta \times X_{it} + \epsilon_{it} \tag{22}$$

where Y_{it} is the absolute level of home equity for senior i during year t. α_i and γ_t denote individual fixed effects and year fixed effects respectively. g_i captures the impact of time trend which varies across individuals. P_{it} is an indicator variable which equals to 1 if the individual is affected by the DRA policy. I use X_{it} to control for other time-varying individual characteristics which have effects on home equity. ϵ_{it} is an idiosyncratic error term.

The repeated observations of the same individual make it possible to remove α_i via differencing. By taking the difference of two consecutive years, we can get rid of α_i as follows:

$$y_{it} = \eta_t + g_i + \lambda \times \Delta P_{it} + \beta \times \Delta X_{it} + \varepsilon_{it} \tag{23}$$

where η_t is equal to $(\gamma_t - \gamma_{t-1})$ and ε_{it} is equivalent to $\epsilon_t - \epsilon_{t-1}$. Now the main outcome of interest is home equity changes in consecutive two years, i.e., y_{it} is equal to ΔY_{it}. Then using panel data techniques, we can estimate λ, the policy effect.

D Triple-Difference Cutoff Standard

D.1 Set Up

To show the feasibility of using home equity as the criterion defining the treated group in my empirical analysis, let us consider the triple-difference estimator either based on home equity interest (HI) or home equity (HE). Consider two groups of population that will be compared within the triple-difference framework: single seniors (ss) and middle-aged (m), where middle-aged can be further divided into married middle-aged (m) and single middle-aged (sm). Known that the outcome is home equity, the triple-difference (DDD) estimator can be described as follows:

$$
\begin{aligned}
\text{DDD} = &\{E(\text{HE}|\text{ss}=1,\text{HI}>=500k,T>06)-E(\text{HE}|\text{ss}=1,\text{HI}>=500k,T<06)\}\\
&-\{E(\text{HE}|\text{ss}=1,\text{HI}<500k,T>06)-E(\text{HE}|\text{ss}=1,\text{HI}<500k,T<06)\}\\
&-\{E(\text{HE}|\text{m}=1,\text{HI}>=500k,T>06)-E(\text{HE}|\text{m}=1,\text{HI}>=500k,T<06)\}\\
&+\{E(\text{HE}|\text{m}=1,\text{HI}<500k,T>06)-E(\text{HE}|\text{m}=1,\text{HI}<500k,T<06)\}
\end{aligned}
$$

To make the equation look simpler, the above equation can be written as

$$
\begin{aligned}
\text{DDD} = &\{E(\text{HE}^{ss}|\text{HI}^{ss}>=500k,T>06)-E(\text{HE}^{ss}|\text{HI}^{ss}>=500k,T<06)\}\\
&-\{E(\text{HE}^{ss}|\text{HI}^{ss}<500k,T>06)-E(\text{HE}^{ss}|\text{HI}^{ss}<500k,T<06)\}\\
&-\{E(\text{HE}^{m}|\text{HI}^{m}>=500k,T>06)-E(\text{HE}^{m}|\text{HI}^{m}>=500k,T<06)\}\\
&+\{E(\text{HE}^{m}|\text{HI}^{m}<500k,T>06)-E(\text{HE}^{m}|\text{HI}^{m}<500k,T<06)\}
\end{aligned}
$$

For singles, HI=HE; for couples, HI=HE/2. If we divide middle-aged group into married middle-aged and single middle-aged, then we can get the following:

$$
\begin{aligned}
\text{DDD} = &\{E(\text{HE}^{ss}|\text{HE}^{ss}>=500k,T>06)-E(\text{HE}^{ss}|\text{HE}^{ss}>=500k,T<06)\}\\
&-\{E(\text{HE}^{ss}|\text{HE}^{ss}<500k,T>06)-E(\text{HE}^{ss}|\text{HE}^{ss}<500k,T<06)\}\\
&-\{[\frac{n^{mm}}{n^{m}}E(\text{HE}^{mm}|\text{HE}^{mm}>=1000k,T>06)+\frac{n^{sm}}{n^{m}}E(\text{HE}^{sm}|\text{HE}^{sm}>=500k,T>06)]\\
&-[\frac{n^{mm}}{n^{m}}E(\text{HE}^{mm}|\text{HE}^{mm}>=1000k,T<06)+\frac{n^{sm}}{n^{m}}E(\text{HE}^{sm}|\text{HE}^{sm}>=500k,T<06)]\}\\
&+\{[\frac{n^{mm}}{n^{m}}E(\text{HE}^{mm}|\text{HE}^{mm}<1000k,T>06)+\frac{n^{sm}}{n^{m}}E(\text{HE}^{sm}|\text{HE}^{sm}<500k,T>06)]\\
&-[\frac{n^{mm}}{n^{m}}E(\text{HE}^{mm}|\text{HE}^{mm}<1000k,T<06)+\frac{n^{sm}}{n^{m}}E(\text{HE}^{sm}|\text{HE}^{sm}<500k,T<06)]\}
\end{aligned}
$$

where n^a denotes the total number of observations among a group.

D.2 Research Question

The key question is whether the DDD coefficient would be the same with using either home interest or home equity as the cutoff criterion. For singles, both cutoff criteria would give the same results. Therefore, the difference mainly comes from married middle age group. Thus, the key question now changes to whether the average difference of married middle age group before and after the policy based on home interest cutoff criterion would be the same as the difference based on home equity criterion. In this sense, we need to proof the following equation:

$$
\begin{aligned}
E(\text{HE}^{mm}|\text{HE}^{mm} >= 1000k, T > 06) - E(\text{HE}^{mm}|\text{HE}^{mm} >= 1000k, T < 06) \\
-E(\text{HE}^{mm}|\text{HE}^{mm} < 1000k, T > 06 + E(\text{HE}^{mm}|\text{HE}^{mm} < 1000k, T < 06) \\
= E(\text{HE}^{mm}|\text{HE}^{mm} >= 500k, T > 06) - E(\text{HE}^{mm}|\text{HE}^{mm} >= 500k, T < 06) \\
-E(\text{HE}^{mm}|\text{HE}^{mm} < 500k, T > 06 + E(\text{HE}^{mm}|\text{HE}^{mm} < 500k, T < 06)
\end{aligned}
$$

Since the main regression is focus on individuals with home equity $\in$ [300,700), the above equation should be modified as the following (with abbreviation):

$$
\begin{aligned}
E(\text{HE}^{mm}|\text{HE}^{mm} \in [1000, 1400), T > 06) - E(\text{HE}^{mm}|\text{HE}^{mm} \in [1000, 1400), T < 06) \\
-E(\text{HE}^{mm}|\text{HE}^{mm} \in [600, 1000), T > 06 + E(\text{HE}^{mm}|\text{HE}^{mm} \in [600, 1000), T < 06) \\
= E(\text{HE}^{mm}|\text{HE}^{mm} \in [500, 700), T > 06) - E(\text{HE}^{mm}|\text{HE}^{mm} \in [500, 700), T < 06) \\
-E(\text{HE}^{mm}|\text{HE}^{mm} \in [300, 500), T > 06 + E(\text{HE}^{mm}|\text{HE}^{mm} \in [300, 500), T < 06)
\end{aligned}
$$

To make the equation looks simpler, let

$$F(1000, 1400) = E(\text{HE}^{mm}|\text{HE}^{mm} \in [1000, 1400), T > 06) - E(\text{HE}^{mm}|\text{HE}^{mm} \in [1000, 1400), T < 06)$$

In other words, $F(a, b)$ meaning the before and after average difference for those whose home equity belong to $[a\$k, b\$k)$ before the policy implemented. Therefore, the key question is to proof the following,

$$F(500, 700) - F(300, 500) = F(1000, 1400) - F(600, 1000)$$

$\Leftrightarrow$

$$
\begin{aligned}
\frac{n_{[500,600)}}{n_{[500,700)}} \times F(500, 600) + \frac{n_{[600,700)}}{n_{[500,700)}} \times F(600, 700) - F(300, 500) \\
= F(1000, 1400) - [\frac{n_{[600,700)}}{n_{[600,1000)}} \times F(600, 700) + \frac{n_{[700,1000)}}{n_{[600,1000)}} \times F(700, 1000)
\end{aligned}
$$

$\Leftrightarrow$

$$\frac{n_{[500,600)}}{n_{[500,700)}} \times F(500,600) + (\frac{n_{[600,700)}}{n_{[500,700)}} + \frac{n_{[600,700)}}{n_{[600,1000)}}) \times F(600,700)$$
$$-F(300,500) - F(1000,1400) + \frac{n_{[700,1000)}}{n_{[600,1000)}} \times F(700,1000)$$
$$= 0$$

where $\frac{n_{[a,b)}}{n_{[c,d)}}$ is the fraction of observations with home equity belong to [a,b) among [c,d) group.

This can be tested by regression, where $F(a,b)$ is the interaction term $D_{(a,b)} \times$ Post among married middle age group. The F-statistic is 0.94, so that we cannot reject the null hypothesis, which says that using home equity as the criterion is same as using home interest.