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ABSTRACT

A marked feature of health insurance plan choice is inconsistent choices through the overweighting of premiums relative to out-of-pocket spending. We show that this source of inconsistency disappears when both types of spending come from the same source of designated funds. We focus on the MediSave program in Singapore, whereby residents can pay their health insurance premiums with cash or MediSave funds, but are subject to limits that vary by age and over time. By exploiting variations in those limits, we consistently find that when individuals are able to pay their health insurance premiums with MediSave funds, they are less price sensitive and more willing to enroll in more generous plans—which results in lower spending levels and variance, and lower adverse selection in the market. The results suggest a strong role for mental accounting in insurance decisions.

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An online appendix is available at http://www.nber.org/data-appendix/w32331

1 Introduction

One of the most financially significant annual decisions households face is their choice of health insurance plan. A growing literature has documented that individuals choose their health insurance plans in a manner inconsistent with standard neoclassical choice models, including making dominated health insurance choices (Abaluck and Gruber, 2011, 2016; Bhargava et al., 2017; Handel and Schwartzstein, 2018). In particular, individuals appear to focus more on premium payments than on expected out-of-pocket medical expenses when considering which plan is the best for them. However, there is little understanding of why this is the case.

Another important body of literature on behavioral economics suggests that the nature of how money is labeled, either externally or through personal accounting, can impact spending through "mental accounting" (Thaler, 1990, 1999). Past research has shown evidence of mental accounting in shopping (Abeler and Marklein, 2017; Milkman and Beshears, 2009), government transfers (Beatty et al., 2014; Hastings and Shapiro, 2018; Kooreman, 2000), gasoline consumption (Hastings and Shapiro, 2013), savings/retirement decisions (Card and Ransom, 2011; Choi et al., 2009; Feldman, 2010; Kooreman et al., 2013), consumption over different payment cards (Gelman and Roussanov, 2023), and the use of medical savings accounts (Leive, 2022). However, there has been only limited exploration of the role of mental accounting in the health insurance arena.

In this paper, we combine these insights to suggest that the sources of funds can play an important role in how individuals choose their insurance plans. In particular, we assess whether the labeling of payment methods for insurance premiums, as opposed to out-of-pocket expenses, influences health insurance decisions. Our analysis carries broad policy implications concerning the prevalent use of designated accounts, such as medical savings accounts, and payment methods such as automatic premium deductions for insurance.

To do so, we study the interaction between a dedicated medical savings program and a voluntary supplementary private insurance in Singapore. MediSave is the only universal medical savings account in the world.[1] It covers not only medical spending but also premiums for both public and private health insurance. Given that Singapore residents are allowed to make cash top-ups to their MediSave Accounts up to a limit and, prior to 2017, cash out a portion of the balances after age 55, MediSave is almost fungible with cash and bank deposits during our study period, especially for those aged 55 and above. At the same time,

1. Unless otherwise stated, all descriptions of the policy background pertain to the period from 2013 to 2015. In the appendix, we describe the evolution before and after the study period. For any discrepancies between the descriptions in the paper and current regulations, please refer to the latest Central Provident Fund Act via Singapore Statute Online (`https://sso.agc.gov.sg/Act/CPFA1953?ValidDate=20220801`).

most Singapore residents top up the available public health care coverage (MediShield) with private insurance through the Integrated Shield (IP) program. These plans are regulated and come in four distinct types, varying in their cost and quality of health care facility covered.

Critically, there is a legislated withdrawal limit on MediSave that can be used to pay for premiums for IPs (hereafter, withdrawal limits). The excess amount of premiums exceeding the withdrawal limit is paid in cash. As a result, when premiums for these plans are below the limit, individuals pay both their health insurance premiums and out-of-pocket medical expenses out of their MediSave Accounts. But when premiums for these plans are above the limit, they are paid on the margin in cash, while out-of-pocket medical expenses are still paid through MediSave. In this paper, we ask: If individuals are forced to pay premiums in cash, rather than MediSave funds, do they react differently, despite the two being fungible? If so, this can potentially explain why there are such large choice inconsistencies in health insurance choices.

Importantly for our purposes, there are significant quasi-experimental variations in the correspondence between withdrawal limits and IP premiums across age and over time. This allows us to consider three alternative strategies for identifying the impact of labeling. The first is a regression discontinuity (RD) design that exploits the interaction between the premium withdrawal limits and age-varying IP premiums. In particular, when enrollees are at young ages, IP premiums are below the withdrawal limits, and thus fully payable by MediSave. As premiums increase with age, there is a plan-specific age threshold, above which one needs to pay the excess amount in cash. For example, during our study period from 2013 to 2015, individuals start to pay premiums in cash for plans with the highest coverage at age 50. Our RD design, therefore, focuses on the insurance choices of the highest-coverage plans around age 50, and ask: When the highest-coverage plan premiums move from being fully payable out of MediSave to being partially paid in cash, does it impact the odds of enrolling in those plans?

The second strategy is a difference-in-differences (DID) design that identifies the effect of the change in premium payment method *from cash to MediSave*. The DID design complements the RD design, since the latter identifies the effect of the change *from MediSave to cash*. On November 1, 2013, the government raised the withdrawal limit from SG$800 to SG$1,000 for those above 65 and from SG$1,000 to SG$1,200 for those above 75.[2] Importantly, IP premiums remained *unchanged*. This policy change provides a quasi-experiment in which the cash outlay for premiums decreases only for those above 65, and premiums remain unchanged.

Finally, we follow the previous literature in estimating a conditional logit model that

2. In 2013, 1 SG$ ≈ 0.8 US$.

incorporates all variations in limits and premiums (Abaluck and Gruber, 2011). This allows us to reflect more broadly the wide variation in premiums and withdrawal limits across all types of plans and ages, and to more specifically compare the effects of premiums paid out of MediSave versus cash with the effects of out-of-pocket medical expenses paid out of MediSave.

Estimates from all three approaches show that the labeling of payments for premiums, relative to out-of-pocket spending, significantly impacts insurance plan choices. The RD estimates show that IP enrollees are much more likely to exit the highest-coverage plan at age 50, when they start to pay the premiums for such plans partially in cash. We also show that this is driven by a notable increase in switching down to less generous plans, a reduction in switching up from less generous plans, and an exit from IPs altogether. DID results show that with the SG$200 cash payment replaced by MediSave, IP enrollees above age 65 are less likely to switch down to lower-coverage plans or opt out of IPs, and more likely to switch up to higher-coverage plans, compared with enrollees below age 65. Conditional logit estimation results are consistent with previous literature, and show that individuals overweight premiums relative to out-of-pocket medical expenses. However, when we decompose the premiums into MediSave-paid and cash-paid components, we find that the willingness to pay for MediSave-paid premiums and out-of-pocket medical expenses are almost identical, but that for cash-paid premiums is nearly three times as large. This suggests that health insurance choices become more consistent when both premiums and out-of-pocket costs are paid from an account with the same label.

We are also able for the first time to address two important criticisms of the choice inconsistency literature. First, this literature has focused primarily on ex ante definitions of inconsistent choices and not on ex post outcomes. We show in our context that more inconsistent choices after age 50 lead to both higher levels and higher variance of spending in the chosen plan. Second, we also address the criticism initially levied by Handel (2013) that a potential disadvantage of reducing choice inconsistencies is increased adverse selection: When individuals choose plans that more closely match premiums to expected out-of-pocket medical expenses, it increases the segmentation of the population by risk type. In our context, however, we find the opposite: Allowing premium payment with MediSave actually brings healthier enrollees into the IPs and higher-coverage plans, which mitigates adverse selection.

These findings strengthen our understanding of choice inconsistencies, which suggests that reducing the discrepancy in sensitivity to premiums versus out-of-pocket expenses could improve choices and reduce adverse selection. This has important policy implications; in the US, a tangible example of this would be the option to use Health Savings Account (HSA) balances for premiums for insurance beyond restricted types, potentially resolving the adverse selection dilemma in the health insurance sector.[3]

The response of plan choices to MediSave is consistent with the behavioral theory of mental accounting. Despite the fact that money is fungible across different financial accounts, individuals categorize MediSave and cash into separate accounts and exhibit different marginal propensities in choosing health insurance. While empirically differentiating specific behavioral hypotheses is challenging, our results from various empirical designs consistently align with the predictions of the mental accounting theory and offer less support for alternative theories, such as liquidity constraints, self-control problems, and biases due to salience. Our findings regarding health insurance choices offer a relatively compelling example of the potential impact of mental accounting on real-world decisions that involve risk and uncertainty, and our investigation of ex post welfare and adverse selection sheds further light on the market consequences of behavioral biases.

Our paper proceeds as follows. Section 2 reviews the relevant literature on medical savings accounts, health insurance choice, and mental accounting. Section 3 discusses the relevant institutional features in Singapore. Section 4 discusses the unique data that we use in our analysis. Sections 5-7 present the results on insurance choice from our various identification strategies, and Section 8 explores the implications of our findings for individual welfare and adverse selection in the health insurance market. Section 9 interprets the results within the framework of alternative decision theory models. Section 10 concludes with a discussion of the policy implications of our findings.

2 Literature Review

This paper contributes to several strands of literature. First, this paper is closely related to the literature on medical savings accounts (MSAs). Despite their size and growing popularity, there is relatively little empirical work on the impacts of MSAs.[4] Most early studies are theoretical models or simulation exercises (Baicker et al., 2006; Pauly and Herring, 2000; Robinson, 2005; Steinorth, 2011; Zabinski et al., 1999). Recent empirical work on Health

3. Insurance premiums payable by HSAs are restricted to those for long-term care, health care while receiving unemployment benefits, health care continuation coverage required by federal law, and Medicare Part A, Part B, Part D, and Medicare Advantage plans. Notably, contributions to HSAs are not allowed after enrollment in Medicare.

4. Since Singapore introduced the first medical savings account scheme (MediSave) in 1984, MSAs have also been implemented in China (since 1998), the United States (since 2003), and South Africa (since 1994) (Hsu, 2010). These accounts cover all Singapore residents, 24% of the Chinese population (in 2020), 10% of US residents (in 2021), and 5% of South African residents (in 2015). China: Statistical Bulletin of the People's Republic of China on National Economic and Social Development 2020; US: https://www.devenir.com/hsa-assets-hit-100-billion-milestone/; South Africa (North, 2020)

Savings Accounts (HSAs) in the US and Personal Accounts in China has evaluated the effects of MSAs on insurance coverage and medical spending, but their findings have been inconclusive (Fan et al., 2016; Glied and Remler, 2005; Leive, 2022; Ye, 2015). The closest reference is Davis et al. (2023), who employ data from 15 universities and do not find evidence that employers' contributions to HSAs influence employees' choice of insurance plans. The main distinction in their context compared with ours is that HSAs primarily function as savings vehicles for healthcare expenditures, rather than directly contributing to insurance premium payments. Moreover, HSAs are only available to US taxpayers enrolled in a high-deductible health plan (HDHP). To the best of our knowledge, the current paper is the first comprehensive study on how medical savings accounts affect insurance enrollment, choice inconsistency, ex post welfare, and adverse selection.

Second, this paper adds to the rich literature on failures in markets for insurance. Much of the early literature on health insurance markets focused on adverse selection, both in theory (Akerlof, 1970; Rothschild and Stiglitz, 1976) and empirics (Chiappori and Salanie, 2000; Einav et al., 2010; Finkelstein and Poterba, 2004). More recently, research has documented failures caused by behavioral biases. For instance, in the face of complicated insurance contracts, individuals often leave money on the table, not infrequently by choosing a dominated plan (Abaluck and Gruber, 2011, 2016; Bhargava et al., 2017; Handel and Schwartzstein, 2018). A rich model that controls for other plan features suggests that this is because individuals typically overvalue premiums relative to expected out-of-pocket medical expenses (Abaluck and Gruber, 2011). Interventions such as reducing inertia, providing information, optimizing choice set, standardization, and AI assistance are likely to improve insurance choices (Abaluck and Gruber, 2023; Ericson and Starc, 2016; Gruber et al., 2020; Handel, 2013).

This literature has been limited in two important ways. On the one hand, there has been relatively little focus on the ex post welfare implications of choice inconsistencies. Few articles have assessed the impact of inconsistent choices on the ex post medical spending level and variance. There has also been relatively little exploration of the implications of choice inconsistencies for adverse selection in health insurance markets. Handel (2013) suggests that an important trade-off may exist between choice inconsistencies and adverse selection, and Gruber et al. (2020) and Samek and Sydnor (2020) have documented that the use of decision support to reduce inconsistencies does indeed exacerbate adverse selection. Meanwhile, Polyakova (2016) has shown that reduced inertia can mitigate adverse selection. Our findings contribute to deeper understanding of the welfare consequences of choice inconsistencies and their implications for adverse selection.

On the other hand, there has been little effort to unravel the behavioral mechanisms behind these findings. Ericson and Sydnor (2018) have suggested that the choice inconsistency results can be potentially explained by liquidity constraints. Another explanation is present bias, whereby individuals focus more on near-term premiums than longer-term out-of-pocket medical expenses. Abaluck et al. (2018) have suggested that salience may play a role, with premiums being more salient than out-of-pocket medical expense features. Our paper enriches this strand of literature by showing that mental accounting may play an important role in health insurance choices.

Third, we contribute to the literature on mental accounting. Instead of employing hypothetical choice scenarios (Thaler, 1990, 1999), recent studies have shown that individuals violate fungibility and practice mental accounting in real life (Abeler and Marklein, 2017; Hastings and Shapiro, 2013). Compared with income from general sources, individuals are willing to consume more food given SNAP (Hastings and Shapiro, 2018), more fuel given winter fuel payment (Beatty et al., 2014), and more child goods given child benefits (Kooreman, 2000). Gelman and Roussanov (2023) show that households use different payment cards to manage budgets and arrange consumption in a fashion consistent with the mental accounting heuristic. The voluntary marginal propensity to save also varies with the income component (base salary versus bonus) and the contributor to compulsory savings (employer versus employee) (Card and Ransom, 2011; Kooreman et al., 2013). Unlike these studies, which focus on typical consumption goods, this paper provides the first empirical evidence of the violation of fungibility in an important decision making process with risk and uncertainty—health insurance choice.

We illustrate the interplay between insurance choices, ex post welfare, and adverse selection in the context of behavioral biases. Our findings suggest that establishing a dedicated account for medical expenses and health insurance premiums can mitigate choice inconsistencies, enhance welfare, and decrease adverse selection. This has major policy implications for the insurance market. Unlike the conventional market for consumption goods, the insurance market is characterized by information asymmetry and grapples with inherent challenges such as adverse selection. Thus, understanding the role of mental accounting in this distinct context is crucial, because it affects not only insurance decisions at the individual level but also welfare and adverse selection at the market level.

3 Institutional Background

This section describes the healthcare system, medical savings accounts, and health insurance system in Singapore.[5] Singapore ranks as the healthiest country in Asia and has one of the most efficient healthcare systems in the world.[6] For example, the life expectancy at birth is over 83 in Singapore, compared with 79 in the US and 81 in the UK in 2018.[7] Meanwhile, the share of GDP devoted to total healthcare expenses is less than 5% in Singapore, compared with 18% in the US and 10% in the UK in 2018.[8]

Singapore's institutional context offers two advantages for our study. First, Singapore is the only country in the world that has a national medical savings account scheme. All Singapore residents—citizens and permanent residents—have medical savings accounts. They can use the savings in these accounts to pay not only healthcare expenses, but also premiums for both public and private health insurance. This provides us with a unique opportunity to study medical savings accounts and private health insurance choices at the population level. Second, for those who buy private insurance, their coverage is commonly integrated with public health insurance through Integrated Shield Plans (IPs). Thus, the enrollment and claims data related to the IPs are captured by the government.[9] This gives us comprehensive datasets for conducting empirical analysis.

3.1 The health system in Singapore

Singapore features a hybrid of public and private healthcare delivery systems and an integrated healthcare financing system. Private general practitioners provide about 80% of primary care, and public polyclinics provide the rest; by contrast, public hospitals provide more than 85% of inpatient services, and private hospitals provide the rest (Lim, 2013).

There are four classes of wards in public hospitals. Class A, B1, B2, and C wards are single, four-bed, six-bed, and eight-bed rooms, respectively. Only class A and B1 wards have

5. The empirical analysis in this paper covers the period from 2013 to 2015. Thus, we mainly introduce the institutional details that were in place during this period, and only briefly note some historical facts and subsequent changes in policy.

6. Bloomberg's Global Health Index for 2020:
https://worldhealth.net/news/bloombergs-global-health-index-2020/#:~:text=The%20Bloomberg%20Global%20Health%20Index,malnutrition%2C%20and%20causes%20of%20death.
Bloomberg Health-Efficiency Index 2020:
https://sg.finance.yahoo.com/news/guide-healthcare-financing-singapore-004551751.html

7. Life expectancy: https://data.worldbank.org/indicator/SP.DYN.LE00.IN.

8. Healthcare expenses: https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS.

9. See https://www.lia.org.sg/media/1521/managingsingaporehealthinsurancecost_hitf_20161013.pdf.

air-conditioning, and only patients in these two classes of wards can choose their doctors.[10] Class A and B1 wards account for less than 20% of the public hospital beds (Lim, 2013). Class A wards charge the highest fees, and class C wards charge the lowest.

Singapore's healthcare financing system is comprised of four layers of protection against health risks (Lim, 2013). First, the government provides all Singaporeans with subsidies for approved medical services. Most relevant for our study, the government does not subsidize inpatient services in private hospitals and class A wards in public hospitals. It subsidizes inpatient services in class B1 wards by 20%; the subsidy in class B2 and C wards is means-tested, ranging from 50% to 80% of the total inpatient expense. Second, MediSave requires all Singapore residents to save for medical expenses, especially in old age. Third, MediShield—a public health insurance scheme—covers catastrophic illnesses. On top of MediShield, Integrated Shield Plans (IPs)—private health insurance plans—provide supplemental insurance. Finally, MediFund acts as the ultimate safety net for low-income Singaporeans who cannot afford medical bills, even with the first three layers of protection.

The four-layer healthcare financing system aims to strike a balance between providing financial protection and containing healthcare expenses (Lim, 2013). As in other developed countries, government subsidies and MediFund ensure universal access to basic medical services. Unlike in other developed countries, MediSave, MediShield, and IPs promote individuals' responsibility for their own health, and thus create private incentives to contain healthcare expenses. Our paper focuses on MediSave, MediShield, and IPs, and specifically on how MediSave affects health insurance choices. We next describe MediSave, MediShield, and IPs.

3.2 MediSave

Singapore is the first nation that has established a comprehensive mandate for resident savings, specifically for one's own and one's family's healthcare. As a medical savings account, the MediSave Account is one of the three accounts under the mandatory Central Provident Fund (CPF) savings scheme.[11] During most of our study period, working Singaporeans and their employers are required to save 11.5% to 36% of their monthly wage in the three CPF accounts (Panel A of Appendix Table A1): (1) the Ordinary Account for a first home purchase, education, etc.; (2) the Special Account for approved investment products and retirement;

10. Air-conditioning is relevant in Singapore, where 90% of days have temperatures above 26 degrees Celsius and relative humidity above 75%. Data sources: `https://data.gov.sg/dataset/historical-daily-weather`; `https://data.gov.sg/dataset/historical-daily-weather`.

11. Appendix A1 describes the CPF in detail.

and (3) the MediSave Account for approved medical expenses and health insurance.[12] These contributions are subject to an annual limit, which is currently SG$37,740.

The share of savings to the MediSave Account out of monthly wage ranges from 7% for the age group below 35 to 9.5% for the age group above 50.[13] The government sets the MediSave Contribution Ceiling—the maximum total amount one can accumulate in their MediSave Accounts in total.[14] This was SG$48,500 in 2015. Amounts beyond that level are transferred to other savings accounts in the CPF scheme. Savings in the MediSave Account are less liquid than cash or bank deposits before age 55, but earn more interest than bank deposits. The interest rate for these savings is 4% per annum, which is far above the one-year deposit rate.[15] This is a fully funded account that is invested in special government securities, and the government provides a backstop guarantee of 4% per year.[16] Moreover, these savings are tax-free.

Residents use MediSave to pay both out-of-pocket medical expenses (OOP) and ex ante health insurance premiums for themselves and their family members, including spouses, parents, and children. MediSave can only be used to pay medical expenses in public healthcare institutions or approved private healthcare institutions. Although there are legislated limits for OOP payable by MediSave, these limits are carefully set and adjusted over time to be sufficient for subsidized care. As for insurance premiums, the payment for premiums of IPs, including both the public and private insurance component, is subject to a withdrawal limit that varies by age and year. These withdrawal limits are set by the government and periodically updated to ensure that the premiums remain affordable for policyholders.[17]

12. CPF members can also make cash top-ups to their CPF up to a limit with tax relief and allocated proportionally across the three accounts. Moreover, voluntary top-ups to the Special Account and the MediSave Account are also allowed.

See https://www.cpf.gov.sg/member/faq/growing-your-savings/retirement-sum-topping-up-scheme/what-are-the-differences-between-topping-up-my-retirement-saving

13. As for the other two accounts in CPF, the contribution rate to the Ordinary Account decreases from 23% for those below age 35 to 1% for those above age 65, while the rate for the Special Account goes from 6% for those below age 35 to 1% for those above age 65.

14. The MediSave Contribution Ceiling is subject to an annual adjustment to account for medical cost inflation (see Table A4). Since 2016, it has been replaced by the Basic Healthcare Sum.

15. The interest rate for one-year banks' fixed deposit was about 0.33% on average from 2013 to 2015. See https://eservices.mas.gov.sg/Statistics/msb/InterestRatesOfBanksAndFinanceCompanies.aspx.

16. As part of CPF funds, MediSave funds are administered by the government. CPF monies are invested by the CPF Board (CPFB) in Special Singapore Government Securities. CPF members bear no investment risk in their balances in the CPF, and the return is guaranteed. Please refer to https://sprs.parl.gov.sg/search/sprs3topic?reportid=oral-answer-1850 for details about the investment process of CPF funds.

17. The limits are usually enough to cover the full premium of the public insurance component (MediShield), and part of the premium of the private insurance component. For details on the use of MediSave, please see https://www.moh.gov.sg/cost-financing/healthcare-schemes-subsidies/medisave.

After age 55, savings in the MediSave Account become more liquid, because residents are allowed to cash out part of their balance. In 2015, residents could withdraw SG$5,000 and any further cash balances after setting aside a MediSave minimum sum in the MediSave Account and a CPF minimum sum in all CPF accounts.[18] The majority of CPF members can meet the minimum sum when they turn age 55.[19] In particular, about six out of ten active CPF members could meet the MediSave minimum sum when they turned 55 in 2013 and 2014.[20]

A withdrawal can be made at any time after the age of 55 with negligible hassle cost.[21] Individuals are well informed about withdrawal options and procedural details through an advance withdrawal invitation and monthly talks held by the CPF board. It takes the CPF owners just 10 minutes to complete the application form online or in a hard copy, and it takes the CPF board between two to ten days to process the application and then transfer the funds directly to the bank account of the CPF owner.

Although well informed about the withdrawal option, approximately 40% of CPF members aged 55 to 70 have no intention of making a cash withdrawal. Furthermore, of those who withdrew funds, over half deposited the money into their bank savings accounts without a specific purpose or immediate use.[22] This suggests that liquidity constraints are not the major reason why most CPF holders withdraw their funds after age 55. Otherwise, they would have made a withdrawal to increase their consumption.

The MediSave scheme in Singapore differs from the Health Savings Accounts (HSAs) scheme in the US which helps individuals under age 65 save for healthcare expenses. First, the HSAs scheme is voluntary, but MediSave is compulsory. US residents can choose to enroll in the HSAs scheme when they have voluntarily enrolled in an eligible high-deductible health insurance plans.[23] The enrollment rate for HSAs is around 10%, whereas the enrollment rate

18. The MediSave minimum sum is the minimum amount one needs to maintain in one's MediSave Account before making a CPF withdrawal after age 55. It is subject to an annual adjustment to account for medical cost inflation (see Table A4). The MediSave minimum sum was scrapped in 2016. Appendix A2 provides a detailed description of the CPF withdrawal rules at age 55.

19. According to the our calculations, a worker who began working at the age of 25 with average wage growth and earned the 2015 median monthly wage of SG$3949 at age 55 could have accumulated approximately SG$310,000 in their CPF account (excluding MediSave), provided they did not purchase residential properties with CPF funds. When they reach the age of 65, the accumulated amount will increase to SG$469,000. The accumulated sum exceeds the minimum sum of SG$161,000 by a considerable margin.

20. CPF Trends, 2014 and 2015: https://www.cpf.gov.sg/Assets/members/Documents/CPFTrends_MedisaveMinimumSum2014.pdf; https://www.cpf.gov.sg/Assets/members/Documents/CPFTrends_Medisave_Scheme_2015.pdf (visited on April 1, 2019).

21. Prior to 2014, members could only make one withdrawal per year.

22. Retirement and Health Study: https://www.cpf.gov.sg/content/dam/web/member/infohub/documents/WhatdoCPFmembersdowiththecashwithdrawalsfromtheirCPFafter55.pdf

23. For example, in 2018, HSAs-eligible health insurance plans must have had at least a deductible of US$1,350 for individual plans, and US$2,500 for family plans.

for MediSave is 100%.[24] Second, US residents generally use HSAs to pay out-of-pocket medical expenses, but Singapore residents use MediSave to pay both out-of-pocket medical expenses and health insurance premiums.[25] Third, HSA deposits can only be withdrawn tax-free for qualified medical expenses (at any age), while MediSave allows for a partial tax-free withdrawal of cash after age 55 after meeting a minimum account balance.[26]

3.3 MediShield and Integrated Shield Plans

The health insurance system in Singapore consists of two layers. MediShield is a public scheme that provides catastrophic health insurance. It covers inpatient expenses in class B2 and C wards in public hospitals.[27] During our study period from 2013 to 2015, inpatient expenses are subject to coinsurance rates of 10% to 20% and deductibles of SG$1,500-3,000. The policy year claim limit for total reimbursement is SG$70,000, and the lifetime limit is SG$300,000. Annual MediShield premiums are risk-rated by age only, ranging from SG$50 for the age group below 20 to SG$1,190 for the age group above 85; the maximum coverage age is 92. Both OOP and MediShield premiums are payable by MediSave, which is a common practice for Singaporeans. On November 1, 2015, MediShield was replaced by MediShield Life—a compulsory scheme for all Singaporeans. Since this reform occurred after the end of our study period, we focus on MediShield in our study.

IPs are a private scheme that provides additional insurance coverage on top of MediShield.[28] Only MediShield enrollees are allowed to upgrade to IPs. The MediShield and the private insurance component of IPs are integrated, similar to Medicare and Medigap in the US. There are two major differences: (1) MediShield and IPs are available for all residents, but Medicare and Medigap are mainly for those aged 65 and above; and (2) MediShield is voluntary, but Medicare is compulsory. Both IPs and Medigap are voluntary. In 2014, enrollment rates for MediShield and IPs were 95% and 65%, respectively, for all Singapore residents; enrollment rates in Medicare and Medigap were about 93% and 25%, respectively, for all US

24. https://www.devenir.com/hsa-assets-hit-100-billion-milestone/.

25. Limited types of insurance whose premiums are payable by HSAs are listed in Footnote 3.

26. Withdrawals from HSAs for non-medical expenses incur income taxes at any age, and if made before the age of 65, an additional 20% penalty is applied.

27. If patients choose to stay in a Class B1 or A ward in a public hospital or seek treatment at a private hospital, the benefits provided by MediShield will be pegged to the prices for class B2 or C wards and patients will be responsible for the extra cost. Besides inpatient expenses, MediShield also covers large outpatient expenses for approved diseases and treatments, including kidney dialysis, chemotherapy, radiotherapy, immunosuppressants for an organ transplants, and erythropoietin for chronic kidney failure. The coinsurance rate for these outpatient expenses is 20% without deductibles.

28. In other words, IPs are operated by private insurers and consist of (1) the MediShield component provided by the government and (2) the private insurance component provided by the private insurers. Appendices A3 and A4 provide more details on the history of MediShield and IPs, respectively, and how MediShield is integrated into the IPs.

residents aged 65 and above.[29]

More specifically, IPs provide additional coverage for (1) inpatient expenses in class A and B1 wards in public hospitals, (2) inpatient expenses in private hospitals, and (3) pre- and post-hospitalization expenses.[30]

IPs are regulated by the government. First, only authorized private insurers are eligible to issue IPs. In 2014, five private insurers were authorized to issue a total of 14 IPs.[31] Second, there are restrictions on the plan design of IPs. For example, IPs are guaranteed renewable and there is a minimum co-insurance of 10%. However, insurers can determine their own premiums and level of coverage.

There are four types of IPs. Type P plans cover all wards in both public and private hospitals. Type A, B, and C plans fully cover wards in public hospitals up to class A, B1, and B2, respectively. These plans only partially cover higher-level wards or private hospitals. Type P plans provide the most generous coverage, including the highest reimbursement limits and proration factors, and thus charge the highest premiums. Appendix A4 provides the details of the benefit packages for each of these plans.

IP premiums are risk-rated by age only (Appendix Table A5). For example, the average premiums for type P (type C) plans ranged from SG$200 (SG$85) for the age group below 16 to over SG$6,800 (SG$1,900) for the age group above 84 in 2014. Importantly for our empirical work, these premiums are payable by MediSave up to withdrawal limits that vary by age and over time. Premiums above withdrawal limits cannot be paid from MediSave. Moreover, these withdrawal limits have been adjusted over the years. Sections 5 and 6 discuss variations in both IP premiums and MediSave withdrawal limits across ages and years. These variations are used to study the effect of MediSave on individuals' choice of IPs.

In recent years, Singapore has undergone a series of reforms to its healthcare system, and

29. Enrollment in MediShield and IPs:
`https://www.lia.org.sg/media/1521/managingsingaporehealthinsurancecost_hitf_20161013.pdf`;
enrollment in Medicare:
`https://acl.gov/sites/default/files/Aging%20and%20Disability%20in%20America/2015-Profile.pdf`;
enrollment in Medigap:
`https://www.medpac.gov/trends-in-medigap-enrollment-2010-to-2015/`.

30. IPs also provide more generous coverage than MediShield for approved outpatient expenses, including kidney dialysis, chemotherapy, radiotherapy, immunosuppressants for organ transplants, and erythropoietin for chronic kidney failure.

31. The five insurers are AIA, Aviva, NTUC, Prudential, and Great Eastern. In addition to the 14 plans, they also issue another nine IPs that are only renewable for existing enrollees. In other words, these IPs do not accept new enrollees or switchers from other plans. The number of plans remains constant during our sample period.

in particular its healthcare financing system. MediShield Life, which provides more generous coverage than MediShield, has been mandatory for all Singaporeans since November 2015. Since our study period ends in October 2015, we discuss later policies in the appendix for interested readers and leave the study of these policy changes for future research.

In summary, Singapore has a system that provides basic health coverage with co-payment requirements and mandates that individuals save to meet these out-of-pocket costs, while offering private insurance to provide additional coverage. This sets up a natural trade-off between paying health care costs out of pocket versus buying supplemental insurance, which motivates our empirical work.

4 Data Sources and Empirical Overview

Our empirical analyses draw on four administrative datasets from the Ministry of Health (MOH) in Singapore.[32] To the best of our knowledge, this is the first study to combine and examine such a comprehensive set of administrative healthcare data from Singapore.

The first dataset is the IPs enrollment dataset, which includes all IP enrollees in Singapore. This dataset contains information on enrollees' choices of IPs, insurers, and commencement and termination dates for each insurance period. The second is an ancillary information file that contains features of all IPs that have been available in the market at any time. The features include premiums, deductibles, reimbursement limits, coinsurance rates, etc.

The third is a medical claims dataset and contains all claims under MediSave, MediShield, and IPs. For each claim, it reports three categories of de-identified information. Payment information covers the total bill amount after any subsidies, a complete list of payers—cash, MediSave, MediShield, IPs, and third-party payers—and the payment amount paid by each payer. The information on treatment episodes includes medical institutions, admit/discharge dates, diagnoses, discharge outcomes, etc. The information on patient characteristics includes gender, birthdate, etc.

The fourth is the polyclinics dataset, which records outpatient visits at all polyclinics. Similar to the medical claim dataset, it also contains information on payment, treatment episodes, and patient characteristics for each visit.

The Ministry of Health is able to merge these datasets through plan names and privacy-protected identifiers.[33] Our analysis focuses on Singapore citizens because non-citizen per-

32. The MOH in Singapore is accredited for providing the data; the copyright to the data belongs to the Government of Singapore.

33. The identifier is a system ID used to link these datasets together. It does not contain any personal information and cannot be used to link to external datasets.

manent residents receive lower subsidies than citizens hospitalization in class B2 and C wards in public hospitals.

The four datasets complement each other, which benefits our analysis. First, the datasets contain the choices and claims for all private health insurance plans for all Singaporeans. This enables us to study health insurance choices at the population level. Our results are thus more representative than those in the literature, which are typically restricted to health insurance choices among the elderly or employees of a single employer (e.g., Abaluck and Gruber, 2011). Moreover, the literature has documented that elderlies' health insurance choices suffer from cognitive limitations (Abaluck et al., 2018; Keane and Thorp, 2016), which is less of a concern in our study. Second, our datasets record all inpatient care in both public and private hospitals as long as the patient submits claims for MediSave, MediShield, or IPs, regardless of whether the inpatient expenses are covered by the IPs. The rich records enable us to more fully assess the effects of insurance choices on ex post medical spending and on adverse selection. Third, our datasets record the use of MediSave to buy private health insurance and medical services for all Singaporeans. This enables us to study the role of medical savings accounts at a broader level and add to the prior papers based on evidence from a single employer or a small geographic unit.

We conduct three empirical analyses to investigate how health insurance choices are affected by the institutional feature whereby residents can use MediSave to pay premiums for private insurance in Singapore.[34] Specifically, we estimate the effect of the premium payment method—MediSave versus cash—on insurance choices. Both premium payment methods and insurance choices might be affected simultaneously by residents' unobserved preferences. To solve the endogeneity issue, in the first analysis, we use a regression discontinuity (RD) design, exploring variations in premiums across ages. In the second analysis, we use a difference-in-differences (DID) design, exploring variations in MediSave withdrawal limits across ages and time. In the third analysis, we estimate a conditional logit model to distinguish willingness to pay between MediSave-paid premiums, cash-paid premiums, and MediSave-paid OOP.

5 Regression Discontinuity Estimates

For our first analysis, we take advantage of the discontinuities in IP premiums by age. Figure 1 shows that during our sample period (March 2013-October 2015), premiums are

34. We conducted the empirical analysis using anonymized data in a secure lab operated by the MOH, in accordance with the MOH's safe custody and use requirements laid down. The data we use have been stripped of any personal identifiers. We only generated and analyzed aggregate results to arrive at the conclusions in this paper.

stable below age 20; they increase for each 10-year interval of age before 40, and every 5-year interval after that.

Table 1(a) shows the withdrawal limits for paying premiums from MediSave Accounts during our sample period. Before November 2013, the withdrawal limit was SG$800 for people younger than 75, SG$1,000 for ages between 75 and 79, and SG$1,200 for older ages beyond 80 (Column (2)); after that that, the withdrawal limits were raised by an additional SG$200 for residents above age 65 (Column (3)). Comparing premiums with withdrawal limits, we observe a certain age threshold for each plan. Before reaching the threshold, enrollees are allowed to pay premiums fully by MediSave, and most Singaporeans do pay premiums using MediSave before the threshold.[35] After the threshold, they must pay premiums partially in cash.

These thresholds are outlined in Table 1(b) and illustrated in Figure 2. Table 1(b) presents the respective ages at which premium payments must be made, at least in part, using cash; Figure 2 depicts the fraction of plans by each type that requires cash payment across ages.[36] In the case of the six type P plans, this requirement consistently applies at age 50 (Figure 2). At this juncture, premiums for these plans span from SG$898 to SG$1,130; all surpass the SG$800 cap by varying margins, ranging from SG$98 to SG$330 (Columns (4)-(5) and Columns (7)-(9) of Table 1(b)). For types A, B, and C plans, the relevant age threshold varies by plan (Figure 2). For example, for the two most expensive type A plans, premiums range from SG$842 to SG$885, which exceeds the payout threshold at age 55 of SG$800 by SG$42 to SG$85; for the six less expensive type A plans, the premium can be paid in full out of MediSave until age 60 (Columns (4)-(5) and Columns (7)-(9) of Table 1(b)). The age at which cash must be used to pay premiums rises as plans become less generous (and therefore less expensive).[37]

5.1 Motivating facts

We provide some motivating facts regarding changes in insurance choices across these age thresholds. Specifically, the age threshold for all six type P plans is 50. Before 50, the

35. In 2015, 82% of IP premiums were payable by MediSave (calculated by us using IP enrollment data); the total amount of MediSave used to pay for IPs accounted for 65% of total IP premiums (calculated by us using statistics from `https://data.gov.sg/`), and 80% of all IP premiums payable by MediSave (calculated by authors using IP enrollment data).

36. Panel A in Table 1(b) and Figure 2(a) show the case before November 2013, and Panel B in Table 1(b) and Figure 2(b) show the case after November 2013

37. Comparing Panels A with B in Table 1(b) and Figure 2(a) with (b), after MediSave withdrawal limits were raised by SG$200 for those aged above 65 in November 2013, the age threshold for four out of seven type B plans and one type C plan increased from age 65 to age 70, and the age threshold for another type C plan increased from age 73 to age 83. Since our RD design only analyzes those below age 65 (in both baseline and specification tests), the change in November 2013 does not interfere with our RD analysis.

average premium is SG$685, and the MediSave withdrawal limit for paying IP premiums is SG$800. From 50 and onwards, the average premium increases to SG$1,028, while the MediSave withdrawal limit for paying IP premiums remains the same (Table 1(a)). So, starting from 50, type P enrollees must pay premiums of SG$228 in cash on average.

We focus on type P plans at age 50 for four reasons. First, type P plans enroll nearly 70% of all IP enrollees under age 50—and more than 50% across all ages—which makes them the most important IP option. Second, the life-cycle socioeconomic environment remains stable across the age threshold of 50; no studies in Singapore observe a structural break at age 50 in terms of employment, wage, health, or family structure. Third, compared with other age thresholds, the age threshold at 50 is less likely to be confounded by other policies. We observe no other policies that affect residents' insurance choices and healthcare demand at 50 in Singapore except for the reduction in CPF contribution rates which will be discussed in detail shortly. By contrast, residents are allowed to conditionally withdraw from their CPF accounts from age 55; they are granted various eldercare grants and subsidies from age 60; and they start receiving a pension from the CPF from age 65.[38] Finally, type P plans have the cleanest change at age 50. For all other types of plans, as shown in Table 1(b), the point at which payments cross from MediSave to cash is spread across multiple ages.

Our key results are shown in Figure 3. The share of total enrollment in type P plans dramatically decreases from 0.46 at age 49 to 0.37 at age 50, when people cannot fully use MediSave to pay type P premiums. Meanwhile, the enrollment rate for type A plans increases dramatically, from 0.31 at 49 to 0.35 at 50. This is consistent with the contention that paying premiums in cash on the margin significantly affects plan choices.

There are two major threats to our identification, which we will discuss in greater detail in Section 5.6. First, at age 50, premiums for type P plans also increase by SG$343 on average, of which SG$115 is payable by MediSave, and SG$228 must be paid in cash (Appendix Table A5). Second, at age 50, the employer's CPF contribution rate decreases from 16% to 14%, and the employee's contribution rate decreases from 20% to 18.5% (Appendix Table A1). The former reduces total earnings and the latter increases people's disposable income. Therefore, the impact of the change on the demand for insurance is ambiguous. We perform several falsification tests to address these confounding factors that may affect one's insurance choices. In particular, we conduct falsification tests using age thresholds at which premiums rise or CPF contribution rates change, but the payment methods remain consistent.

38. The government provides several eldercare grants and subsidies for Singaporeans above age 60, such as the Home Caregiving Grant, which subsidizes senior care.

5.2 Specification

We adopt a sharp RD design around the age threshold of 50 to estimate the effect of payment methods on insurance choices of type P plans. We estimate the following model:

$$Y_{ijt} = \alpha_0 + \alpha_1 Above50_{it} + f^l(Age_{it} - 50) + f^r(Age_{it} - 50) \times Above50_{it} + \mathbf{X'_{ijt}}\boldsymbol{\alpha} + \delta_j + \delta_{m_t} + \delta_{y_t} + \epsilon_{ijt}, \tag{1}$$

where Y_{ijt} denotes insurance choices of enrollee i in plan j at the time of enrollment t. Specifically, we examine four outcomes: (1) whether an enrollee enrolls in a type P plan (hereafter, a type P enrollee for simplicity); (2) whether a type P enrollee switches down to a type A, B, or C plan; (3) whether a type P enrollee opts out of IPs; and (4) whether a type A enrollee switches up to a type P plan. The independent variable of interest, $Above50_{it}$, is a dummy variable that takes the value of 1 if enrollee i is over 50 at t and 0 otherwise. $f^l(\cdot)$ and $f^r(\cdot)$ are polynomial functions of the age difference between enrollee i's age and 50. We include $f^r(Age_{it} - 50) \times Above50_{it}$ to allow different functional forms for the effect of age on insurance choices below and above 50. Age_{it} is measured in months in the baseline analysis and changed to quarters in a robustness test.

Although it is not necessary for identification, we control for individual covariates and fixed effects for current plan j, enrollment year, and enrollment month to increase estimation precision. The vector of individual covariates, $\mathbf{X_{ijt}}$, includes demographics (indicators of being male and living in an HDB flat[39]), health status (medical spending/number of visits to hospitals/polyclinics one year before enrollment), and experience with the IPs to account for inertia in plan choice (the cumulative number of months enrollee i has enrolled in the same type of plan as j up to time t). The model also includes fixed effects for the current plan j (δ_j) to eliminate potential impacts of plan heterogeneity on the switching decision.[40]

39. There are two types of housing in Singapore: One is built and managed by a government agency—the Housing Development Board (HDB), and the other by private companies. According to the statistics published by the Department of Statistics of Singapore, 80% of households were living in HDB flats in 2015 (Resident Households By Type Of Dwelling, Annual: `https://tablebuilder.singstat.gov.sg/table/TS/M810351`). Compared with a private housing owner, an HDB owner has a lower income on average. The average monthly household income from work for households residing in HDBs is SG$8,790, compared with SG$21,808 for households in private residences (Household Income From Work and Type of Dwelling: `https://tablebuilder.singstat.gov.sg/table/CT/17721`). The housing data used here is from the Resale Flat Dataset, which is administered by the HDB and renewed monthly based on the date of registration for transactions in the HDB. It contains housing price (SG$/$m^2$), flat type, and flat area, which are used for analysis in Section 9.1. Housing data are merged with the IP enrollment data by the MOH in a secure lab. For enrollees with multiple records in both datasets, we rely on the latest record before the enrollment date to remain current with housing information updates.

40. For example, some services may be unobserved by the researchers. When the dependent variable is whether one enrolls in a type P plan, we include first-time participants in the sample. They are assigned a separate plan indicator—"no previous plan"—as a reference group.

In other words, the estimation in Equation (1) examines within-plan variations, rather than cross-plan variations, in insurance plan choices; this resolves the concern that enrollees switch plans due to unobserved plan-specific attributes that vary with age. In addition, enrollment month fixed effects (δ_{m_t}) are included to account for seasonal occurrences such as holiday promotions by insurance companies; enrollment year fixed effects (δ_{y_t}) are included to account for unobserved time-varying factors common to all Singaporeans, such as government policies and economic development. ϵ_{ijt} is an error term. Standard errors are clustered at age in months to account for common characteristics within cells of the same age.

We use a local polynomial approximation approach to estimate Equation (1) (Lee and Lemieux, 2010). Our baseline specifications for $f^l(\cdot)$ and $f^r(\cdot)$ are linear functions; we follow Gelman and Imbens (2019) in using low-order polynomial specifications. Our baseline bandwidth is 12 months to the left and right of the age threshold of 50 to investigate enrolling in, switching down from, and opting out of type P plans; the bandwidth is expanded to 24 months when we investigate switching up from type A plans to obtain a comparable sample size.[41] We apply a uniform kernel to weight observations, and examine our results using a triangle kernel in the appendix.

5.3 Sample and summary statistics

We start with the IP enrollment dataset and create a sample of enrollees' plan choices by the time of enrollment, including decisions to opt out of IPs. We then retrieve demographic information from the medical claims and polyclinic datasets, including birthdate and gender. We drop enrollees with no records in either dataset (7.3% of enrollees or 7.7% of enrollment) from our analysis.[42] We match IP enrollment data with medical claims data and polyclinics data, summarize the number of visits and total medical spending in hospitals /polyclinics during the one-year period before enrollment, and use them as individual covariates ($\mathbf{X_{ijt}}$) in Equation (1).

We focus on the period between March 2013 and October 2015 because the age thresholds for cash outlays for all type P plans are fixed during that time. We exclude enrollments and dropouts that occur within the one-year insurance period from our sample.[43] We use three samples for our analyses of different outcome variables: (1) a full sample of IP enrollees

41. To avoid ad hoc bandwidth selection for the RD design, we also show RD estimates based on Equation (1) with various bandwidths in the appendix.

42. This is necessary because age is the running variable in our RD design and the key information used to define the treatment group in our DID design. We find no significant difference in plan choices between enrollees with and without demographic information.

43. IPs are typically in place for one year. Any switch from or exit from a plan within one year is considered an early termination. We add these early terminators back in the sample as a robustness test, and the results do not deviate from our baseline findings.

used to examine whether an IP enrollee enrolls in a type P plan; (2) a sample of type P enrollees used to examine whether a type P enrollee switches down to a type A, B, or C plan and whether a type P enrollee opts out of IPs; and (3) a sample of type A enrollees used to examine whether a type A enrollee switches up to a type P plan. We exclude first-time participants from the last two samples, since we examine subsequent insurance choices given a previous plan choice of type P or A.

Appendix Table B1 summarizes the variables used in our RD analysis for the three samples. We have a sample of 173,000 enrollees, of whom 42% are in type P plans, 47% are male, and 78% live in HDB flats. They have consistently enrolled in their current plan type for 68 months on average. We have a sample of 74,000 type P enrollees and 109,000 type A enrollees to study the decision to switch or exit a plan. Compared with type P enrollees, type A enrollees are similar in age and gender, but less likely to live in HDB flats; they also tend to use more medical services from polyclinics and fewer from hospitals.

5.4 Validity checks

The RD estimate of α_1—the coefficient on $Above50_{it}$—captures the causal effect of cash outlays for type P plans if the continuity assumption holds. The assumption is that the potential insurance choices would have evolved smoothly in the absence of the change in the payment method for the premiums for type P plans at 50 (Imbens and Lemieux, 2008). To verify this assumption, we present two tests. First, we investigate the smoothness of age distribution around the age threshold of 50. Appendix Figure B1 shows that age density is continuous across 50 for all three samples, as confirmed by the McCrary (2008) density test. Second, we test for discontinuity in baseline covariates around the age threshold of 50. Appendix Figure B2 plots the local means of covariates (demographics, experience, and health) by age bins around 50. Some covariates are correlated with age, but none is discontinuous at 50. We also perform RD estimation on the covariates. Appendix Table B2 shows that RD estimates are generally small and statistically insignificant, which confirms that baseline covariates all do not change discontinuously around 50.

5.5 Results

RD estimates from Equation (1) are presented in Table 2. Panel A shows RD estimates of the effect of cash outlays for premiums on enrolling in type P plans. Column (1) only includes plan fixed effects, column (2) adds individual baseline covariates, and column (3) further controls for enrollment year and enrollment month fixed effects. The various specifications consistently show that IP enrollees are less likely to choose a type P plan once they turn 50 and must pay premiums partially in cash. The estimated decrease in the odds of having a type P plan is five percentage points and statistically significant at 1% level, which presents a 13% relative decrease. Figure 4(a) plots the means and linear estimations of the share of enrollment in type P plans by age, along with the 95% confidence interval; the figure shows a noticeable discontinuity in the share of enrollment in type P plans at the age threshold of 50, consistent with the estimation results.

Panels B and C of Table 2 show that a considerable proportion of type P enrollees switch down to lower-coverage plans or opt out of IPs after age 50. The estimates suggest that the probability of switching down increases by three percentage points, which represents an increase of over 100% relative to the average switching-down rate of 0.028; the probability of opting out of IPs increases by eight percentage points, which represents a two-fold increase relative to the average opting-out rates of 0.036. Since our later falsification tests suggest that premium increases at age 50 are unlikely to be the reason for the decline in type P plan enrollment, we conclude that the cash outlays for premiums are the primary cause. Graphical patterns in Figures 4(b)-(c) support the estimation results, and further demonstrate that the requirement to pay cash for premiums for type P plans significantly encourages an exit from those plans.

The last panel of Table 2 presents RD estimates of the effect of cash outlays for premiums on switching up to type P plans by type A enrollees. The estimates show a decrease of 0.4 percentage points in the probability of switching up to type P plans, which represents a 30% decrease against the average switching-up rate of 0.013. The significant estimates are also corroborated by the graphical patterns in Figure 4(d).

5.6 Potential confounders and falsification tests

In this subsection, we address two key concerns with our RD design. One concern is that, at age 50, premiums for type P plans increase by SG$343 on average, of which SG$115 is payable by MediSave and SG$228 must be paid in cash (Appendix Table A5). To separate the impact of cash payments from overall premium increases, we conduct two types of falsification tests.

First, we perform tests around ages other than 50 when premiums increase, but the payment method remains the same. For instance, at ages 40 and 45, premiums for an average type P plan increase by SG$275 and SG$61, respectively, but are entirely payable by MediSave because they remain below the withdrawal limits; at ages 55 and 60, premiums for an average type P plan increase by SG$155 and SG$445, respectively, and must be paid in cash because the premiums have already exceeded the withdrawal limits at age 50. According to Figures 5(a)-(d), these premium increases do not significantly affect insurance choices at most of these ages, except for a modest enrollment drop at age 60 due to the substantial cash outlay. However, the magnitude at age 60 is only one-fifth of that at age 50, when cash outlays for type P plans increase by only SG$228. Secondly, we use a sample of type B enrollees to perform falsification tests. Like those of type P plans, premiums for type B plans also increase at age 50, in this case by SG$167. But as the premiums are still below the MediSave withdrawal limits, they are fully payable by MediSave. In fact, as Figure 5(e) shows, there is a small increase in enrollment in type B plans at age 50 (perhaps due to buying down from plan type P), which is inconsistent with a large premium effect.[44]

To understand how the premium increase impacts demand at age 50, we isolate the demand change at this age that can be attributed to premium adjustments. This is achieved by using price elasticities of demand (PED) calculated from premium discontinuities at other ages. We first compute PED for type P plans at ages 30, 40, 45, 55, 60, 65, and 70, respectively, using the type P enrollment changes illustrated in Figure 3 and the corresponding premium changes provided in Appendix Table A5.[45] Based on these implied elasticities, we impute the change in type P enrollment at age 50, assuming that the elasticities remain constant. By dividing the imputed type P enrollment change by the realized enrollment change at age 50, we can gain a rough idea of the share that is explained by changes in premiums.

We estimate that 0%-10% of the enrollment change at age 50 can be explained by the price change using the PED implied at ages 30-40, when premium payments are fully paid by MediSave. On the other hand, we estimate that 30%-50% of the effects are explained by the price change using the PED estimated at ages 55 and over, where premium payments are fully paid by cash on the margin. Putting these together, and using the fact that one-third of the increased premium payments at age 50 come from MediSave and two-thirds from cash, we can get an aggregate PED of -0.15, which implies that only 30% of the change in type P enrollment at age 50 can be explained by price changes alone. The remaining 70% of the change might be attributable to the change in the payment method from MediSave to cash at the extensive margin—i.e., the first time IP enrollees pay the premiums by cash.

The other concern is the discrete change in CPF contribution rates at age 50 (Appendix Table A1). In particular, when individuals reach age 50, the CPF contribution rate for

44. We also perform the same exercise on other insurance plan choices. Appendix B1 reports and discusses the full results.

45. In particular, we use the following equation:

$$PED = \frac{\Delta Enrollment\ in\ P}{\Delta Mean\ Premiums\ of\ P\ plans} \times \frac{Mean\ Premiums\ of\ P\ plans}{Mean\ Enrollment\ in\ P}.$$

More details on the exercise are explained in the Appendix B2.

We do not use the RD estimates as the change in type P enrollment because falsification tests in Appendix B1 show virtually no effect except for age 60 (Appendix Table B7). However, the same exercise using the RD estimates at age 60 yield consistent results.

employers drops by two percentage points, moving from 16% to 14%. Meanwhile, the rate for employees decreases by 1.5 percentage points. The decrease in the employer's CPF contribution rate results in a net decrease in total income due to lower pension contributions from employers. On the other hand, the reduced contribution requirement for employees effectively boosts their disposable income since they now contribute a smaller portion of their pre-tax salary to the CPF. Furthermore, the allocation from CPF to MediSave increases from 9% to 9.5%, indicating a rise in CPF savings that can be used for healthcare. Given these complexities, it's uncertain how insurance choices might be affected.[46]

Despite the ambiguous predictions, we eliminate concern regarding this issue using the same falsification tests above. Compared with the rate at age 50, employer's contribution rates at ages 55 and 60 decrease by a larger amount, 3.5 percentage points, and the employee's contribution rate decreases by a larger amount—4.5 and 5.5 percentage points, respectively. Results in Figure 5(c) and (d) show that the change in type P plan enrollment at ages 55 and 60 is much smaller than that at age 50. Moreover, enrollment in type B plans experiences a slight increase (rather than decrease) at age 50, even though type B enrollees experience the same CPF contribution changes (Figure 5(e)). Both falsification tests imply that our baseline findings are not driven by the changes in the CPF contribution and allocation rate at age 50.

5.7 Robustness checks

Literature on the methodology of RD design recommends sensitivity analysis of RD specifications with respect to bandwidths, kernels, and polynomial orders (Cattaneo et al., 2018; Imbens and Lemieux, 2008; Lee and Lemieux, 2010). In the appendix, we present RD estimates from various specifications. Appendix Figure B3 plots RD estimates with different bandwidths ranging from 6 months to 36 months around age 50; Appendix Table B3 presents RD estimates with alternative polynomial orders and a triangular kernel. Our findings are generally robust to the choice of bandwidths, functional forms, and weighting schemes. One exception is the analysis of switching up by type A enrollees. Effects have the expected sign but are not precisely estimated with quadratic/cubic functional form.

We also check whether our baseline findings are robust to alternative measures and samples. Column (1) of Appendix Table B6 shows results with age measured in quarters instead of months. To avoid plan switching due to unknown reasons, we exclude individuals who switch plans or opt out within one year of enrollment from our baseline sample. Column (2) shows that our conclusions still hold if these enrollees are included in the sample. An

46. In Appendix A5, we use the median income level, as an illustration, to further show that discrete changes in the CPF contribution and allocation rates at age 50 do not confound our RD analysis.

additional concern is that IP enrollees may not have sufficient balances in their MediSave Accounts to pay the premiums with MediSave up to the withdrawal limits. This conjecture is not directly testable because information regarding enrollees' MediSave Accounts' balance is unavailable. To alleviate such a concern, we conduct two tests by focusing on enrollees who are most likely to accumulate sufficient Medisave balances. Specifically, we only include enrollees who have never used other family members' MediSave Accounts or those who have never been hospitalized during the past three years in the next two columns. All four columns show results very similar to what is presented in the main analysis.

6 Difference-in-Differences Estimates

The previous section suggests that cash outlays negatively affect the choice of a high-coverage plan using variations in IP premiums across ages; in particular, at age 50. In this section, we present our second research design, in which the identification source comes from variations in MediSave withdrawal limits across ages and time. Specifically, we exploit a legislated change to MediSave withdrawal limits for IP premiums in a difference-in-differences (DID) framework.

In November 2013, the Singapore government raised MediSave withdrawal limits for IP premiums by SG$200 for residents above 65 (Table 1(a)). Given that the IP premiums for the same age group remain unchanged, the adjustment to withdrawal limits only led to a decrease in the cash outlay for IP premiums among enrollees above 65. By exploiting this quasi-experimental shock to MediSave withdrawal limits, we identify the causal effects of decreasing cash outlays on health insurance plan choices in a DID design. The DID framework compares the insurance choices of those who are allowed to withdraw an additional SG$200 from MediSave to pay for IP premiums (the treatment group) with the choices of those who face unchanged withdrawal limits (the control group) before and after November 2013, holding total premiums constant. Specifically, the treatment group consists of enrollees aged between 65 and 69, and the control group consists of enrollees aged between 60 and 64. The sample period is between May 2013 and April 2014; that is, six months before and after the reform.

The DID design complements the RD design in several respects. First and foremost, cash withdrawals from the MediSave are allowed for any purpose at any time after age 55, which implies that the MediSave and cash are almost fungible for the sample in the DID design. Second, the RD design identifies the effect of the change in payment method from MediSave to cash, whereas the DID design identifies that from cash to MediSave. Third, the RD design examines the change in cash outlays at both the extensive margin and the intensive margin, while the DID design only examines the change at the intensive margin. Lastly, unlike the RD design, the change in cash outlays is not accompanied by premium changes in the DID design. This allows us to confirm our conclusion that changing premiums is not completely driving the response we see at age 50.

6.1 Specification, validity checks, sample, and variables

The model specification is as follows:

$$Y_{ijt} = \beta_0 + \beta_1 Above65_i \times Post_t + \beta_2 Above65_i + \mathbf{X'_{ijt}}\boldsymbol{\beta} + \delta_j + \delta_{m_t} + \epsilon_{ijt}, \quad (2)$$

where Y_{ijt} denotes insurance choices of enrollee i in plan j at the time of enrollment t. Specifically, we examine four outcomes. First, to parallel our RD analysis, we model enrollment in type P plans. Second, to expand the analysis, we perform a broader examination of switching down to a lower-coverage plan, opting out of IPs, and switching up to a higher-coverage plan. $Above65_i$ indicates that enrollee i is above 65 and belongs to the treatment group. $Post_t$ indicates that the enrollment occurred after November 2013. We control for the same set of covariates and fixed effects as in the RD design.[47] The variable of interest is the interaction term $Above65_i \times Post_t$. Its coefficient, β_1, captures the average effect of increasing withdrawal limits (in other words, decreasing required cash outlays) on insurance choices.

We construct DID samples and variables following the RD design. We focus on the period from May 2013 to April 2014 and enrollees aged between 60 and 69. We exclude type C enrollees because some are unaffected by the reform.[48] When examining switching and opting out, we exclude first-time participants. We further exclude type P enrollees when analyzing switching up. Appendix Table B8 summarizes the variables used in our DID analysis.

Estimates of β_1 can be interpreted as causal if the parallel trends assumption holds. That is, in the absence of a change in withdrawal limits, the insurance choices of enrollees in the treatment and control groups would have evolved in parallel. We conduct two tests to assess the validity of this assumption. First, we investigate the dynamics of insurance choices around the policy change. Specifically, we partition the sample into six periods, and each period covers two months. We then estimate the dynamic version of Equation (2) as

47. Because the study sample for the DID analysis is the single year between May 2013 and April 2014 and we have already controlled for month-fixed effects, we do not include year-fixed effects in Equation (2).

48. As Table 1(b) shows, the withdrawal limits reform did not change cash outlay for one type C plan because, before the reform, premiums for that plan were fully payable by MediSave up to age 73.

follows:

$$Y_{ijt} = \beta_0 + \sum_{k=-3,k\neq -1}^{k=2} \gamma_k 1\{T_t - T_0 = k\} \times Above65_i + \beta_2 Above65_i + \mathbf{X}'_{\mathbf{it}}\boldsymbol{\beta} + \delta_j + \delta_{m_t} + \epsilon_{ijt}, \quad (3)$$

where T_0 represents the period when the reform occurs (November-December 2013). The dummy variable $1\{T_t - T_0 = k\}$ indicates that month t is the j^{th} period relative to T_0, and k equals -3, -2, -1, 0, 1, or 2. The period before T_0 is omitted as the default group, so the estimates of γ_{-1} are normalized to zero. Other variables are defined in the same way as in Equation (2). This specification enables us to estimate treatment effects separately for each period before and after the policy change. If the parallel trends assumption holds, we expect that the estimated coefficients on the interaction term between $Above65_i$ and the pre-shock indicators ($1\{T_t - T_0 = -3\}$ and $1\{T_t - T_0 = -2\}$) are close to zero and statistically insignificant.

Second, we perform two placebo tests to further assess the validity of the parallel trends assumption. In one test, we assume that the policy change targets IP enrollees above 55 (75). Accordingly, we define the treatment group as those between 55 and 59 (75 to 79) and the control group as those between 50 to 54 (70 to 74). In the other placebo test, we assume that the policy change occurred in November 2014 instead of November 2013. We then re-estimate Equation (2) with the sample from May 2014 to April 2015. Insignificant DID estimates from these tests verify the parallel trends assumption.[49]

6.2 Results

Table 3 reports estimation results based on Equation (2). Panel A reports the estimated effects of raising withdrawal limits on the overall probability of choosing a type P plan. Column (1) reports DID estimates with plan fixed effects, column (2) adds individual controls, and column (3) additionally controls for enrollment month FEs. The results consistently suggest that raising MediSave withdrawal limits for IP premiums significantly increases enrollment in the most generous plans by enrollees above 65 by 0.8 percentage points. The estimate corresponds to a 4.5% increase compared with the sample mean of 0.178.

The first column of Table 4 illustrates the dynamic estimates from Equation (3). Consistent with our estimates from Equation (2), coefficients on the interaction terms of $Above65_i$ and the post-shock indicators are mostly significantly positive. The estimation also demon-

49. We note that both the static and dynamic specifications of our DID design (Equations (2)-(3)) are not subject to the current criticism regarding heterogeneous treatment effects (e.g., de Chaisemartin and D'Haultfœuille, 2020), because it is a sharp design and does not vary in the timing of treatment across subjects.

strates that the estimated coefficients on the interaction terms of $Above65_i$ and the pre-shock indicators are close to zero and statistically insignificant. These results suggest that the plan choices of enrollees above and below age 65 exhibit parallel trends before the shock.

Panels B and C in Table 3 show that compared with IP enrollees in the control group, those in the treatment group exhibit a lower probability of switching down to less generous plans and opting out of IPs after the reform. Estimates from all specifications consistently show that switching-down (opting-out) rates decrease by around 40% (75%) compared with the sample mean of 0.013 (0.039). The dynamic estimates in columns (2)-(3) in Table 4 verify the parallel trends assumption.

Panel D of Table 3 presents the results of our analysis regarding enrollees' decision to switch up. The results show that allowing enrollees to pay a larger proportion of IP premiums with MediSave significantly encourages switching up to a higher-coverage plan. The estimate accounts for a 60% increase compared with the sample mean (0.005). As shown in the last column of Table 4, the parallel trends assumption is again confirmed.

How do the DID estimates compare to prior RD estimates? The DID estimation relies on cross-time variation in MediSave withdrawal limits to estimate the effect of an SG$200 increase in MediSave payment (i.e., an SG$200 decline in cash payment), holding premiums constant. The estimation results indicate that for every SG$100 increase in MediSave payment, enrollment in type P plans increases by 2.2%. The RD estimation relies on cross-age variations in premiums and estimates the effect of an average increase of SG$343 in premiums, of which SG$228 must be paid in cash. If we assume a negligible price effect of premiums paid by MediSave—an assumption that is largely validated by falsification tests in Figure 5—the RD estimation examines the effect of a decrease of an average of SG$228 in the MediSave payment (i.e., an increase of an average of SG$228 in the cash payment). The estimation results indicate that for every SG$100 decrease in the MediSave payment, enrollment in type P plans decreases by 5.6%—a larger percentage than what we assume from DID estimation.[50]

Notably, the DID estimates reflect the impact of lowering cash payments versus MediSave, while the RD estimation shows the impact of being forced to use cash. Moreover, the DID estimate examines the change in cash payment only at the intensive margin, whereas the RD estimate reflects the effect of the change in cash payment at both the extensive and intensive margins. The larger RD results might be partially because the mere requirement for cash payments can sway people's decisions.

50. If we take the price effect estimated in Section 5.6 into consideration, the RD estimation results indicate that for every SG$100 increase in the cash payment, type P enrollment decreases by about 4%, which is still larger than what the DID estimation implies.

6.3 Robustness checks

Appendix Table B9 reports our results using a placebo treatment group and placebo event time. Panel A (Panel B) shows nil effects when we estimate Equation (2) using the sample of IP enrollees aged 51 to 60 (71 to 80) and assume the policy change targets enrollees above 55 (75). In Panel C, we rerun our analysis using the sample period between May 2014 and April 2015, assuming that the new policy was implemented one year later, in November 2014. We find no significant results in these placebo tests, which bolsters our confidence in our baseline findings.

We assess the robustness of our findings to alternative estimation samples in Appendix Table B10. First, we employ propensity score matching (PSM) method to enhance comparability of the treatment and control groups (column (1)). Specifically, we use nearest-neighbor matching with one neighbor to construct the matched sample. Second, we include those involved in early insurance termination (column (2)). Finally, to alleviate concern that enrollees might not have sufficient balances in their MediSave Accounts, we exclude enrollees who, during the past three years, have ever used others' accounts (column (3)) or those who have ever been hospitalized (column (4)). Results from all tests are similar to our baseline findings, which suggest that a higher MediSave payout motivates switching to higher-coverage insurance plans.

7 Conditional Logit Estimates

Previous findings from both the RD design and the DID design consistently suggest that the payment method for premiums, MediSave versus cash, significantly affects insurance choices. This section complements previous analyses using a conditional logit model to further estimate IP enrollees' willingness to pay between MediSave-paid premiums and cash-paid premiums. By adding structure, we can potentially say more about how individuals value MediSave- versus cash-paid premiums. In particular, we are able to directly compare sensitivity to premiums paid through MediSave, premiums paid in cash, and out-of-pocket medical expenses (OOP). Such insights regarding consumer responsiveness to the three components were not uncovered in previous analyses employing RD and DID methods.

7.1 Specification, variables, and sample

Following Abaluck and Gruber (2011), the utility that IP enrollee i perceives when choosing plan j at time t is determined by the premium, the expected OOP, and the variance of OOP, along with other pertinent plan features as delineated in the specification below:

$$u_{ijt} = \theta_1 P(ms)_{ijt} + \theta_2 P(cash)_{ijt} + \theta_3 \mu_{ijt} + \theta_4 \sigma^2_{ijt} + \mathbf{X'_{jt}} \boldsymbol{\eta} + \psi_{b(j)t} + \phi_{ij=c_{ij}(t-1)} + \epsilon_{ijt}, \quad (4)$$

where $P(ms)_{ijt}$ and $P(cash)_{ijt}$ are premiums paid by MediSave and cash, respectively; μ_{ijt} is the expected OOP; σ^2_{ijt} is the variance of OOP; and X_{jt} denotes a wide range of plan characteristics that may affect IP enrollees' choices, including dummies for plan types (type P, A, and B), deductibles for class A wards in public hospitals and private hospitals, annual limits, and proration factors for private hospitals.[51] The model also includes insurer fixed effects, $\psi_{b(j)t}$, to control for unobserved insurer characteristics, such as customer service, and unobserved enrollees' preference for a specific brand. To account for inertia in insurance choice, we include $\phi_{ij=c_{ij}(t-1)}$, an indicator for whether plan j is chosen by enrollee i at $t-1$. The error term, ϵ_{ijt}, represents unobserved individual preferences over plan characteristics not included in the model and absorbs the influence of potential measurement errors in the expected OOP variables; it is assumed to follow an *i.i.d* Type I extreme value distribution. We estimate Equation (4) using the maximum likelihood method.

In our choice model, enrollees choose IPs based on plan characteristics. All characteristics in Equation (4) are known to decision-makers with certainty, except for distribution of the OOP. We parameterize this distribution by its expectation and variance. To compute expected OOP, we consider three approaches; in each case, when computing OOP, we follow the literature and ignore moral hazard-induced differences across plans (Abaluck and Gruber, 2011). The first is a "backward-looking" approach, which uses spending from the previous year as a measure of future expectations. At the other extreme, we can adopt a "perfect foresight" approach that assumes enrollees possess perfect information at the time of enrollment and know precisely how much they would spend on each potential plan in the coming year. Finally, as a middle case, we can use a "rational expectations" approach, which assumes that individuals model their next year's expectation as a prediction based on the previous year's spending, which we assign to individuals based on gender, age, and enrollment time.[52]

In each case, the expected OOP of choosing a particular plan is equal to the OOP calculated from the realized claims with the reimbursement features of that plan. Realized

51. Proration factors indicate the proportion of total spending that is claimable. They vary across room types and insurance companies (Appendix Table A7). Proration factors for private hospitals vary the most across plans.

52. Admittedly, none of the three approaches are perfect, but it is reassuring that the estimation results are robust to alternative model approaches. Extensive trials show that this combination of observed characteristics provides the best prediction for total spending. Groups with fewer than 200 individuals are excluded, which leads to a 5.2% reduction in the total number of observations.

claims are from the medical claim dataset, and the reimbursement features are from the IP information file. To compute variance, we use the rational expectations approach to compute the variance of OOP for each plan among all enrollees in one group and use it as the variance of OOP for all enrollees in that group.

We restrict our estimation sample to enrollees between 40 and 70 years old. For the sample to be comparable with the RD design, we restrict the sample period between March 2013 and October 2015. The lower age limit is ten years younger than the age threshold for type P enrollees to pay cash for the first time, and the upper age limit is the age threshold when cash outlays are required for enrollees in all types of plans.[53] The age restriction provides significant variations in both MediSave and cash payments for IP premiums.

To mitigate measurement errors in the OOP variables, we apply two additional restrictions. First, we eliminate cases in which OOP are financed by MediFund, the government-run fund for needy patients.[54] Second, we exclude enrollees in non-as-charged plans, for whom the calculation of OOP requires detailed items of medical services that are unobserved in our data.[55] Our final sample includes around 1,042,000 plan choices of 435,000 enrollees. Of the enrollees, 49% enroll in a type P plan, 34% in a type A plan, and 16% in a type B plan. Average premiums are SG$760, of which SG$668 is payable by MediSave, and SG$92 is supposed to be paid in cash.

7.2 Results

Table 5 presents estimation results of the conditional logit model from Equation (4). Coefficients, rather than the marginal effects, are reported. We start with a simplified model that does not discriminate by payment method for premiums. Columns (1)-(3) include the total amounts of premiums, the expected OOP, the variance of OOP, other plan characteristics, and insurer fixed effects. The results show a significantly negative coefficient on Premium, which indicates that every SG$100 increase in premiums leads to a 38.6% to 39.4% reduction

53. The only plan for which the age threshold is above 70 (see Table 1(b)) is a non-as-charged plan (see Footnote 55), which is excluded from the analysis.

54. We are not able to explicitly identify these cases, given our datasets. Hence, we eliminate cases with extremely high bills that exceed the 99^{th} percentile.

55. IPs are classified as as-charged (AC) plans and non-as-charged (NAC) plans based on how reimbursement limits are set. AC plans have only one annual limit for all claims in the insurance period, and NAC plans enforce separate limits for different categories of claims in addition to an annual limit for all claims. For example, the insurance company NTUC offered both AC and NAC type P plans during the sample period. The NAC plan stipulates distinct reimbursement caps such as SG$4,000 monthly for chemotherapy and SG$2,200 daily for ICU stays, while the AC plan adopts a holistic approach and offers a singular annual reimbursement threshold without item-specific limitations. Since the reimbursement structure for the AC plan is more friendly to enrollees, the NAC plans were only renewable and no longer available to new enrollees during our sample period.

in the probability that a given plan is chosen.[56] This estimate implies an average elasticity of -2.56.[57] The coefficient on OOP is around one-third as large as the coefficient on Premium, which indicates that enrollees are willing to pay an extra SG$30 in premiums if they expect that they will have SG$100 more in OOP.[58] The coefficient on the variance of OOP is negative and statistically significant, which implies that enrollees value the risk protection function of IPs.

Coefficients on other plan characteristics are large and statistically significant. The results imply that enrollees' choices are substantially affected by plan attributes beyond their influences on OOP. For example, enrollees are willing to pay about SG$670, SG$780, and SG$900 more to upgrade from type C plans to type B, A, and P plans, respectively; enrollees are willing to pay around SG$80 to have a 0.1 unit increase in the proration factor that corresponds to a 10 percentage point higher proration factor for bills for private hospitals. The significantly positive coefficients on indicators of the previous choice of plan or insurer suggest that enrollees are willing to continue enrolling in their prior plan or other plans from the same insurer. This result is consistent with choice inertia documented in the literature (Handel, 2013).

Evidence from the above model estimates is generally in line with the findings of choice inconsistency in the health insurance market by Abaluck and Gruber (2011). First, the coefficient on premiums is three times larger than that on the expectation of OOP, which indicates that individuals put more weight on the premiums than on the expected OOP.[59] Second, other purely financial plan characteristics play an important role in individuals' plan choice decisions even after controlling for their implications for the OOP and risks. A third choice inconsistency found by Abaluck and Gruber (2011) is that individuals do not attach value to the risk protection function of health insurance. Although in our context we find that individuals do slightly value the risk protection of IPs, the implied coefficient of absolute risk aversion is much lower than estimates in the literature (e.g., Einav et al., 2013; Handel

56. The implied reduction in the probability of enrollee i choosing plan j is derived from the equation $-\frac{\partial log(S_{ij})}{\partial Premium_{ij}} = -(1 - S_{ij}) \times \theta$, where S_{ij} is the choice probability or the market share of plan j, and θ is the coefficient on Premium. We assume that the choice probability S_{ij} approximates zero.

57. The implied elasticity is based on the equation $\frac{\partial log(S_{ij})}{\partial log(Premium_{ij})} = (1 - S_{ij}) \times Premium_{ij} \times \theta$. Thus, it varies across plans and enrollees' ages, and -2.56 is the weighted average.

58. The willingness to pay for a one unit increase in certain characteristics is calculated by the ratio of the coefficient on the given characteristic to the coefficient on $Premium_{ij}$.

59. An alternative explanation for the gap could be a differential measurement of premiums and OOP. Abaluck and Gruber (2011) discusses this alternative extensively and shows that it cannot explain a gap of nearly this size. Moreover, if measurement error were a major determinant of the low coefficient on OOP, that estimate would vary much more across different methods of estimating OOP.

and Kolstad, 2015).[60]

After confirming choice inconsistencies in the context of IP enrollment, we extend the analysis by exploiting the unique feature whereby, due to the size of MediSave withdrawal limits, OOP may be fully payable by MediSave, but payment for IP premiums incurs some cash outlay. Specifically, we examine how IP enrollees allocate weights to MediSave-paid premiums, cash-paid premiums, and expected OOP at the time of plan choice. To do so, we decompose total premiums into MediSave and cash components and re-estimate the conditional logit model in Equation (4).

The MediSave-paid premiums and cash-paid premiums are calculated based on the plan premiums and MediSave withdrawal limits, rather than enrollees' actual payment methods. In this sense, they are features of a plan instead of choices made by enrollees, which offers two advantages. First, enrollees' choices of payment method and insurance plans are jointly influenced by unobserved preferences, while plan premiums and MediSave withdrawal limits are externally determined. Second, we do not observe whether enrollees use cash to pay for the premiums when they are fully payable by MediSave, but this possibility could be ruled out if we obtain different estimates of weights associated with MediSave-paid premiums and cash-paid premiums.

Results are shown in columns (4)-(6) of Table 5. We continue to find that the coefficient on premiums paid in cash is about three times as large as the coefficient on the expected OOP. But the coefficient on premiums paid by MediSave is one-third the size of the cash premium coefficient, and is comparable to the coefficient on the expected OOP. That is, when premiums are paid in cash and OOP are payable from MediSave, there is strong evidence of choice inconsistency; but when premiums and OOP are both paid from MediSave, they are weighted equally.

This is a striking finding: A simple relabeling of the source of payment significantly changes how enrollees weigh premium versus OOP. However, this should not be surprising given our RD and DD results. This logit framework simply codifies what we showed earlier: Individuals become much more sensitive to premium payments when they move from MediSave to cash.

60. Based on the framework of Abaluck and Gruber (2011) and the estimation result in Column (3) of Table 5, we compute the coefficient of absolute risk aversion as 1.4×10^{-7} by $\frac{(2\theta_4)}{\theta_3}$ (scaled by 10^{-6}, as we measure OOP in hundreds and the variance of OOP by 10^8), or as 2×10^{-7}, converted to US$$^{-1}$ units (multiplied by 1.4, the average exchange rate between SG$ and US$ in 2015). Following Cohen and Einav (2007), this estimate implies that an individual would be indifferent between US$0 and a 50-50 lottery of earning US$100 or losing US$99.99 (averaging over results in columns (1)-(3)). We use the income per capita of SG$25,000 in 2015 in Singapore in the calculation. The corresponding estimate is 1.9×10^{-3} in Einav et al. (2013), and 1.6×10^{-4} in Handel and Kolstad (2015).

8 Implications for Individual Welfare and Adverse Selection

The type of analysis in Section 7 has been subject to two criticisms in previous incarnations. The first is that it is hard to conclude that these results are truly choice inconsistencies, both because we do not know the exact process by which expectations are formed and because functional forms of utility may exist, under which such choices would be consistent. Under this view, the only unambiguous argument for choice inconsistencies is evidence of dominated choices, as in Bhargava et al. (2017). That is, absent dominance, we can't assume based on ex ante choices that individuals are ex post worse off.

Fortunately, in our context, the ability to examine not only choices but also ex post spending allows us to enrich the welfare discussion. In particular, we can ask whether shifting the form of premium payment from MediSave to cash leads to ex post worse choices on average, at least along financial dimensions.

We do this in Figure 6. The figure reruns the RD analysis with two alternative dependent variables: total enrollee spending, including premiums and OOP, and the variance of such spending. We find that at age 50, both total spending and the variance of spending rise. That is, upon turning age 50, enrollees choose plans that are ex post financially dominated on average.[61] This would lead to a welfare decrease unless (1) the form of the utility function is such that a higher mean cost and a higher variance do not lower utility or (2) there is a sharp and discrete shift in tastes toward less comfortable hospital accommodations at age 50. Neither seems likely.

The second criticism is that choice inconsistencies have a potentially positive general equilibrium effect: They reduce adverse selection by mitigating the extent to which enrollees match with the plan that minimizes their cost (Handel, 2013). When individuals consistently choose insurance plans, healthier individuals will gravitate toward lower premium/lower generosity plans, while sicker individuals will gravitate to higher premium/higher generosity plans—which leads to adverse selection and a potential market breakdown in the generous plans, as in Culter and Reber (1998). But if choices are inconsistent, these gravitational pulls may weaken, and thus reduce selection pressures on markets.

This raises the concern that strategies aimed at minimizing choice inconsistencies may exacerbate the adverse selection issue. Indeed, Gruber et al. (2020) and Samek and Sydnor (2020) find this to be the case for the specific example of offering better decision support tools. But this need not hold in all circumstances. Polyakova (2016) finds that reduc-

61. Given the stringent regulations in the IP market, we expect each plan to be actuarially sound to the same degree. Thus, it seems unlikely that the increased spending we observe is because premium differences between the most comprehensive plans and the others do not reflect their true actuarial value.

ing switching costs in Medicare Part D leads to lower adverse selection due to differential switching elasticities between the healthy and the sick.

We can investigate the effect of the form of payment on adverse selection in our context as well, using both the RD and DID approaches. For the RD approach, we can ask: When premiums are paid partially by cash rather than fully by MediSave, how does the risk pool of the most generous plan change? This type of selection test follows Gruber et al. (1999) and Einav et al. (2010): By examining the average spending of those with type P plans before and after age 50, we can infer the impacts on the marginal enrollee in the plan. If moving to cash payments on the margin at age 50 causes the healthiest individuals to leave the plan, then the average spending of plan enrollees would go up; conversely, if it causes the sickest individuals to leave the plan, then average spending would go down.

To assess this, we measure total medical spending, including insurance reimbursements and OOP, at ages 48-49, before the choice upon age 50, to abstract from the impacts of the choice on future spending. We investigate only type P enrollees, so that any moral hazard effects of being enrolled in plan P are constant in the sample. We then assess whether, after age 50, the remaining enrollees in plan P are sicker (as measured by higher spending when they were age 48-49) or healthier (as measured by lower spending at 48-49). We use the same RD specification as Equation (1), but here the dependent variable is ex ante medical spending, not plan enrollment.

Panel A of Table 6 reports our results. We consider two measures: average spending at ages 48-49, and a dummy for having positive spending at those ages. Both measures show that the average enrollee in plan type P gets sicker after age 50, which suggests that the marginal leavers at age 50 are the healthier enrollees. That is, there is a more elastic enrollment response to paying premiums in cash, rather than by MediSave, among the healthier enrollees, which causes them to leave at age 50 at higher rates. This suggests that the more inconsistent choices after age 50 are leading to more, not less, adverse selection. Like Polyakova (2016), this adds a wrinkle to the argument in Handel (2013), and demonstrates that the way in which choice inconsistencies emerge and are resolved can have different impacts on selection.

We can also carry out a similar test within our DID framework. The intuition of the test is the same: We investigate the effects of raising withdrawal limits for individuals aged 65 and older on average medical spending. As is previously shown, this elevation in withdrawal limits mitigates the inconsistency in plan choices for these individuals, as evidenced by the increasing enrollment in type P plans. By replacing the enrollment measure with a total medical spending measure from the previous year, which includes insurance reimbursement and OOP, we can assess whether the previous year's average spending of those enrolled in type P plans changes after age 65. If adverse selection worsens after age 65, then the previous year's average spending in type P plans would go up. In fact, as Panel B in Table 6 shows, we find in fact that average spending from the previous year by those enrolled in type P plans over age 65, versus those below age 65, goes down after withdrawal limits are increased. This suggests that raising withdrawal limits after age 65 causes healthier people to differentially stay in the most generous plan, compared with before the increase.

To summarize, our earlier findings show that moving the source of premium payments from cash to MediSave Accounts decreases choice inconsistencies. Here we show that this decreased choice inconsistency leads to both lower levels and variance of spending, and a healthier risk pool. While our findings may not be as conclusive as demonstrating dominance, they are nonetheless quite compelling in suggesting an improvement in individual welfare; our study serves as an initial inquiry into the extent of adverse selection, similar to the approach of Handel (2013) rather than a thorough assessment of welfare impacts.

9 Interpretation

We have shown that the payment method has an important impact on health insurance choices. IP enrollees are more willing to pay for insurance premiums out of a medical savings account than in cash. However, this contradicts some predictions in financial and behavioral economics. First, according to traditional finance theories, individuals are expected to hold assets with the highest return given the risk level. MediSave is almost risk-free, but it pays an interest rate (4%), much higher than that of one-year bank fixed deposits (around 0.31% to 0.34%). Thus, it is optimal for individuals to leave money in MediSave Accounts. Second, the literature on behavioral economics suggests that the marginal propensity to consume increases with liquidity (Thaler, 1990). In that sense, individuals should be more willing to spend cash rather than MediSave. In this section, we explore potential explanations for our findings.

9.1 Liquidity constraints

Recent studies have documented the role of liquidity constraints in determining how individuals value insurance plans (Casaburi and Willis, 2018; Ericson and Sydnor, 2018). They show that individuals may attach great importance to premiums because a lump-sum payment for premiums constitutes a liquidity shock. In our context, when the withdrawal limits are not sufficient to pay for IP premiums, liquidity-constrained enrollees may not be able to afford additional cash outlays. However, liquidity constraints are unlikely to be a critical factor in our analysis, for two reasons. First, the average cash outlay for type P plans at age 50 is less than 1% of the annual per capita income. Second, MediSave should be closely fungible with cash because balances above the MediSave Minimum Sum are eligible for withdrawal after age 55 during our study period. Moreover, individuals can use their MediSave to pay for their dependents' qualified medical expenditures. The sample in our DID analysis, in particular, is little constrained by the restricted use of MediSave funds because of the option of cash withdrawal. In practice, Singaporeans are well informed about the cash withdrawal rules as a result of government's efforts; a significant portion of CPF holders either abstain from cash withdrawals or, upon withdrawal, deposit the funds into bank accounts without a designated use.[62]

We also examine the role of liquidity constraints by estimating both the RD and DID regressions in subsamples split by the degree of liquidity constraints, which are proxied by housing prices; this is the best available proxy for wealth in our data.[63] If the liquidity constraints drive our results, we expect to find more pronounced effects of cash outlays on plan choices among liquidity-constrained individuals (i.e., individuals who reside in flats of lower price). To assess this, we conduct our RD and DID estimation separately by deciles of housing prices. In Figure 7, we show the results of this estimation for enrollment in plan type P. The estimates are flat with respect to wealth in either the RD sample, in which IPs enrollees may face potential liquidity constraints due to the restricted use of MediSave, or in the DID sample, in which IPs enrollees are more likely to perceive the fungibility of MediSave and cash.[64] These results further demonstrate that liquidity constraints are unlikely to drive our results.[65]

9.2 Misunderstanding of fungibility

Another explanation for our findings could be that individuals do not understand the fungibility of money in their MediSave Accounts, and therefore perceive the funds available for

62. Refer to Section 3.2 for a detailed description.

63. In this test, we restrict the sample to individuals living in public residences (80% of Singaporean citizens) due to the unavailability of information on private housing.

64. We also use other housing features, such as the HDB flat area and the HDB flat type to illustrate household wealth. In particular, there are seven flat types: 1-room, 2-room, 3-room, 4-room, 5-room, executive, and multi-generation. The official household income survey suggests that the income per capita for an HDB with four rooms and below is about two-thirds of that for an HDB with five rooms or from executive and multi-generation flats (See *Key Household Income Trends, 2020* via `https://www.singstat.gov.sg/-/media/files/publications/households/pp-s27.pdf`). In Appendix Tables B11 and B12, we show RD and DID estimates in subsamples by flat area, flat type, and housing price, respectively. The results suggest that IP enrollees respond significantly to cash outlays for premiums, regardless of the flat area, flat type, or housing price.

65. In a distinct study focused on payday responses, Olafsson and Pagel (2018) document hand-to-mouth behavior whereby individuals who have sufficient liquidity behave as if they were liquidity constrained, suggesting behavioral factors at a play. This insight resonates with our findings in health insurance choices.

paying insurance premiums to have a "use it or lose it" feature. This could, in theory, explain our RD results, if individuals feel that they need to spend all of their premium-eligible dollars on type P premiums before age 50, then reduce coverage levels when their eligible premium dollars no longer cover type P.

We find this explanation unlikely for several reasons. First, there are many possible uses for funds in Medisave Accounts. During our study period, 15% of account owners spend at least SG$1,000 on out-of-pocket expenses each year, and over 60% withdraw funds under the unconstrained post-age 55 regime.[66] It seems unlikely that individuals fear that they will "lose" their funds if they do not use them on premiums. Second, under the strict interpretation of this view, all residents should choose plan type P before age 50, whereas only 70% do so. More generally, 55% of residents over age 50 purchase plans with a premium lower than the withdrawal limit. In other words, they do not spend all of their premium-eligible funds on premiums, so they clearly do not fear losing them.[67]

9.3 Present bias

One behavioral explanation for the inconsistent findings in our logit analysis could be present bias. If individuals are, for example, naïve quasi-hyperbolic discounters, they would focus too much on near-term premiums rather than longer-term out-of-pocket costs. If they were sophisticated, the result might be the opposite, as choosing a high-premium plan with more out-of-pocket protection could be a commitment device (O'Donoghue and Rabin, 1999). But such naively present biased individuals should have chosen the lowest premium plans all along, which contradicts the fact that 70% of enrollees choose the highest-premium plans before age 50.

9.4 Salience

Another alternative explanation arises through salience. Take-up of social benefits is not only a matter of cost and willingness to pay, but also of salience and hassle costs (Currie, 2004). Previous studies on health insurance choices document overreaction to salient features such as premiums, and to nominally large changes in benefit coverage that may be more salient (Abaluck and Gruber, 2011; Abaluck et al., 2018; Heiss et al., 2010). They also highlight the fact that the salience effect is context-dependent (Auriol et al., 2020). In our setting, once enrollees authorize the use of MediSave to pay for IP premiums, the corresponding

66. The MediSave out-of-pocket spending is our calculation based on the medical claims dataset; the MediSave withdrawal data comes from *The Retirement and Health Study* by the CPF: `https://www.cpf.gov.sg/content/dam/web/member/infohub/documents/Post55withdrawals.pdf`.

67. Numbers are computed by us based on IP enrollment data.

amount is automatically deducted from their MediSave Accounts every year, which implies zero marginal transaction costs of paying for IP premiums in MediSave.[68] When premiums exceed the MediSave withdrawal limits, the requirement for a cash outlay for the first time triggers the salience of premiums at the time of enrollment. IP enrollees, therefore, impose greater weight on cash-paid premiums than MediSave-paid premiums.

This could explain the findings in the RD design, but not those in the DID design or the conditional logit model. This is because, in practice, when IP enrollees are required to pay cash for premiums for the first time (e.g., type P enrollees at age 50), they receive a GIRO sign-up form—a widely-used electronic direct debit mechanism in Singapore; once they sign up, the premiums will be automatically deducted from their bank accounts every year—again, this implies zero marginal transaction costs of paying for IP premiums in cash.[69] In this way, the salience of premiums triggered by the first cash outlays may subsequently diminish.

As Drake et al. (2023) point out, the financial costs associated with making on-time payments to initiate coverage may significantly reduce the uptake of insurance plans with very low premiums when compared with zero-premium plans. Therefore, avoiding the hassle of paying in cash may be another motive for type P enrollees to downgrade at age 50. However, this is unlikely to be the primary driving force of changes in plan choices at age 50, because the hassle cost associated with signing up for GIRO is negligible relative to the transaction cost of changing insurance plans. The latter involves consulting an insurance agency, selecting a plan, going through underwriting, and signing a contract.

9.5 Mental accounting

The clearest explanation for our results is mental accounting. The traditional demand theory predicts the fungibility of money. Accordingly, individuals only respond to the price, regardless of the method of payment. In contrast, the mental accounting hypothesis suggests that people usually categorize money based on its origins (inflow versus stock) or intended uses (budgets for different expenses) and do not treat all money as fungible (Thaler, 1990, 1999). In our context, MediSave should be fungible with cash for residents without liquidity constraints because they can make cash top-ups to their MediSave Accounts and withdraw part of their MediSave balances after age 55 during our study period. They can also use their

68. In practice, insurance agents assist IP enrollees with the authorization process when enrollees first participate in IPs. IP enrollees go through a similar procedure to authorize the use of MediSave and/or to make a claim from IPs for treatment in all medical institutions.

69. In Singapore, GIRO is widely used by consumers to pay bills to government agencies and private-sector companies (`https://abs.org.sg/consumer-banking/giro`). To use it, one needs to sign an authorization form for GIRO deductions from a bank account.

own MediSave Account to pay for their dependents' qualified medical expenditures. However, mental accounts may be narrowly bracketed because MediSave is intended for medical use, while cash is for general use. IP enrollees, therefore, may hold separate mental accounts for the two sources of money, violating the fungibility between MediSave and cash. In their minds, the MediSave money and cash are not perfectly, but only partially, substitutable.

How does this explain our findings? First, individuals pay less attention to the use of MediSave because MediSave is less valuable than cash in their minds. This explains our findings in the RD and DID designs that individuals tend to buy more generous plans when using MediSave rather than cash. Second, an account created specifically for medical care serves as a framing device to encourage individuals to jointly consider all medical-related expenses, including health insurance and medical services, and choose the optimal plan. This explains our findings in the conditional logit model, whereby MediSave-paid premiums and MediSave-paid expected out-of-pocket medical expenses are equivalent. Individuals do make the optimal choice, although it is only a local optimization within the MediSave Account. This is consistent with the theory of mental accounting, in which local optimization occurs within a single mental account rather than a global optimization over the entire budget constraint (Heath and Soll, 1996).

10 Conclusion

This paper studies the consequences of medical savings accounts on the efficiency of the private health insurance market. Unlike conventional medical savings accounts, such as Health Savings Accounts (HSAs) in the US, MediSave in Singapore covers both out-of-pocket medical expenses and health insurance premiums. Using multiple empirical approaches, we find that allowing MediSave payment for premiums effectively boosts insurance enrollment and coverage. It also mitigates two important impediments to an efficient private insurance market: choice inconsistency and adverse selection.

While we cannot definitively conclude that our results are purely derived from mental accounting as opposed to competing models of behavioral inconsistency, our results align more closely with mental accounting theories than with alternative explanations. The implication of our findings for behavioral economics is that mental accounting—which has been well documented by real-world evidence with respect to choices over consumption goods—likely applies to the decision making with risk and uncertainty, as is the case with health insurance. Crucially, our discovery that using dedicated savings accounts for health insurance premiums can reduce adverse selection offers valuable insights. It not only sheds light on the dynamics of adverse selection but also demonstrates how these dynamics intertwine with behavioral biases.

To more rigorously differentiate between mental accounting and alternative theories, we need stricter testing of their distinct aspects. Our present conclusion—that individuals mentally equate premiums with out-of-pocket medical expenses—rests on the restrictions of our structural model. Randomized control trials or quasi-experiments that simultaneously vary premiums and out-of-pocket medical expenses would provide a more definitive test of this hypothesis. This could be a valuable direction for future research. Another valuable direction for future work could be to explore supply side responses to savings accounts. For example, Decarolis (2015) showed that insurers might game the low-income subsidy in the Medicare Part D market. Similarly, IP insurers may also price IPs according to the MediSave withdrawal limits. This is not an issue in our study, since we focus on a period when the IP premiums are fixed; but future studies could assess supply side responses to the changes that we see.

Our findings have major implications for medical savings accounts and healthcare financing. Since healthcare cost is increasing all over the world, a number of countries are reacting by shifting from collective responsibility to individual responsibility for healthcare financing. Medical savings accounts are among the most popular devices for doing so. Theoretically, medical savings accounts are effective in addressing the key deficiencies of private health insurance, such as moral hazard, escalating costs, adverse selection, and coverage gaps. However, empirically, the evidence on the effects of medical savings accounts is limited, and provides only mixed evidence for the consequences of HSAs in the US. This paper explores an innovative design in Singapore and finds that expanding the use of medical savings accounts for premium payments is effective for closing coverage gaps, as well as in reducing choice inconsistency and adverse selection. Our findings have important implications for relevant policy designs and suggest the potential value of examining medical savings account schemes in economies other than the US. For example, China combines medical savings accounts with social insurance, and South Africa offers medical savings accounts along with private insurance (Hsu, 2010).

The implications of this paper reach beyond medical spending and suggest broader applications for designated accounts. For instance, to foster home ownership, governments could facilitate the creation of dedicated home purchase savings accounts or lessen penalties for using other accounts, such as the 401K in the US, for this purpose. A prime example is Singapore, where individuals can use their retirement account balances to buy homes. This approach may play a role in Singapore's remarkably high homeownership rate, which reached 89.3% in 2022.

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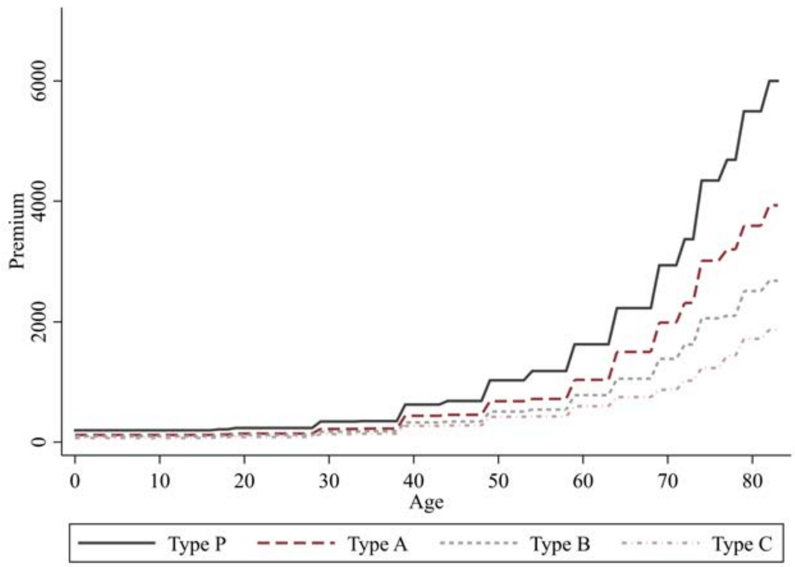
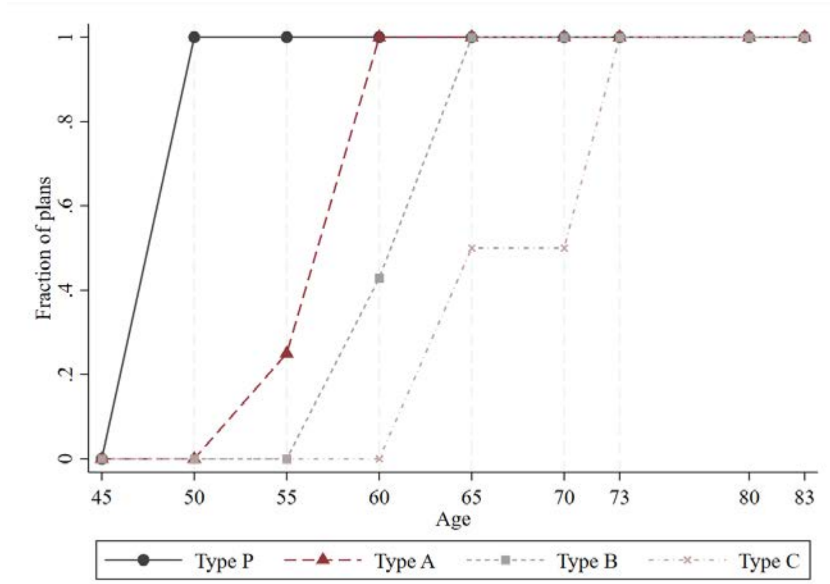
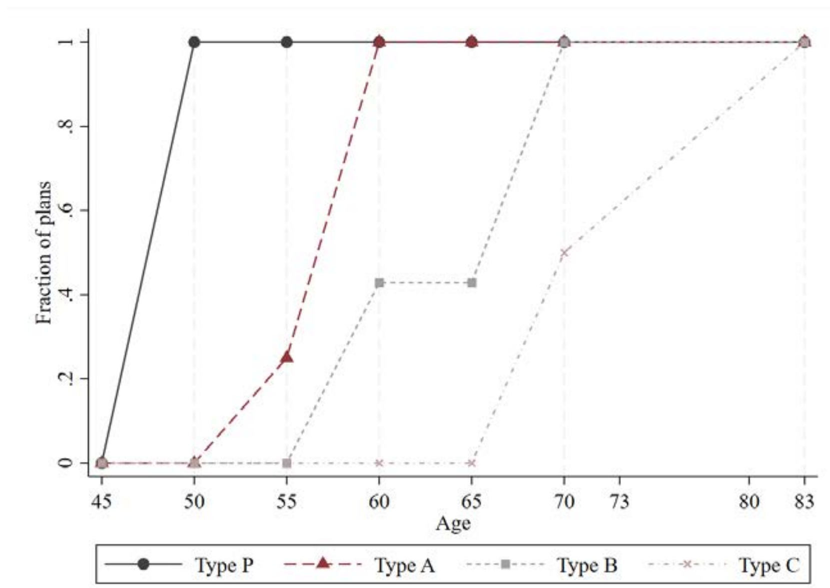


Figure 1 IP premiums by plan type and age

Notes: The figure shows the average IP premiums by plan type and age between March 2013 and October 2015. Premiums are in current Singapore dollars.



(a) From March 2013 to October 2013



(b) From November 2013 to October 2015

Figure 2 Fraction of plans that require cash payment for premiums by plan type and age

Notes: The figures display the proportion of plans within each type that requires cash payments for premiums by age. Figure (a) spans March-October 2013 and figure (b) covers November 2013-October 2015.

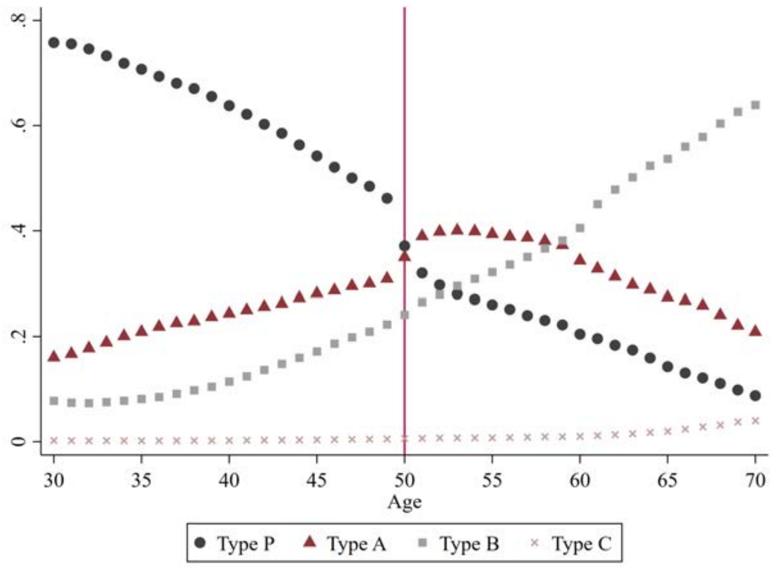
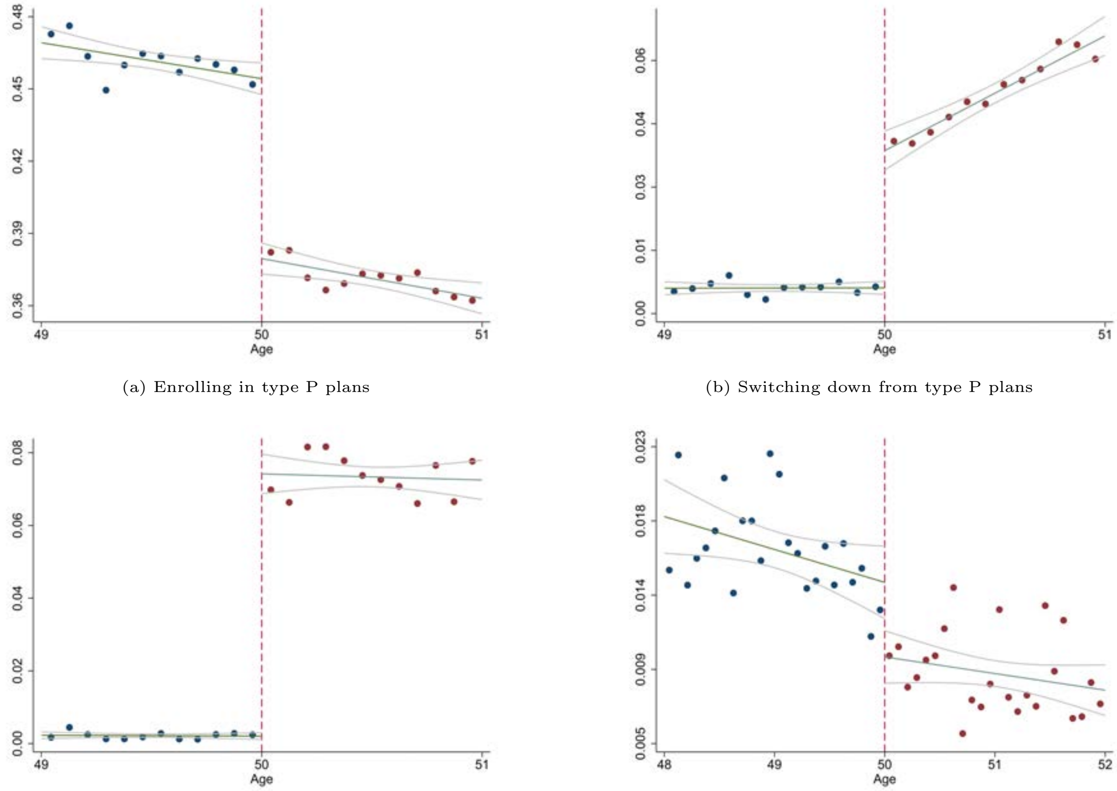


Figure 3 Share of enrollments by plan type and age

Notes: The figure shows the share of enrollment by plan type from age 30 to 70 between March 2013 and October 2015. The vertical line represents the age threshold of 50 when enrollees in type P plans must pay premiums partially in cash for the first time.



(a) Enrolling in type P plans

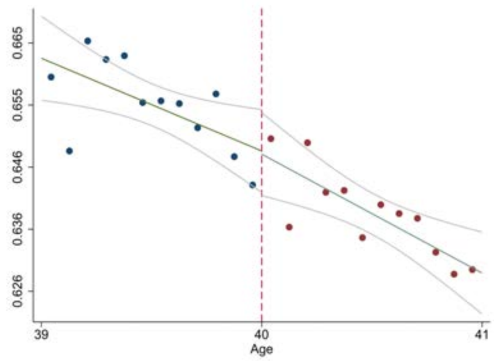
(b) Switching down from type P plans

(c) Opting out of IP from type P plans

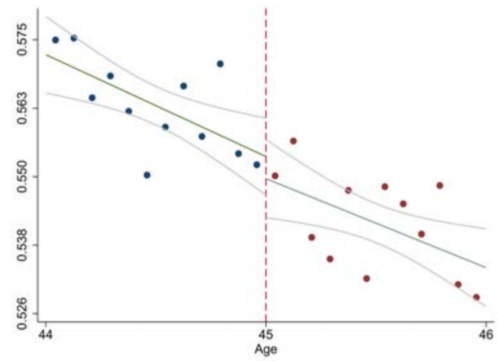
(d) Switching up from type A plans

Figure 4 Plan choices around age 50

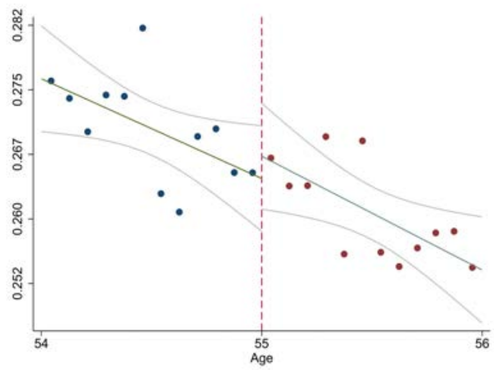
Notes: The figure shows plan choices against enrollees' age at the time of enrollment. Subfigures (a), (b), (c), and (d) plot the average enrollment rate in type P plans, switching-down rate among type P enrollees, opting-out rate among type P enrollees, and switching-up rate among type A enrollees, respectively. A linear fit with a 95% confidence interval is generated separately for each side of age 50. The sample period is from March 2013 to October 2015.



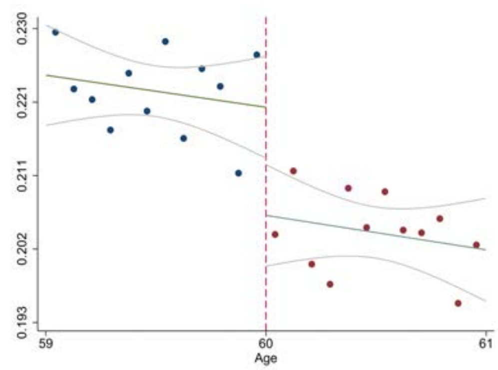
(a) Age 40, enrollment in type P plans



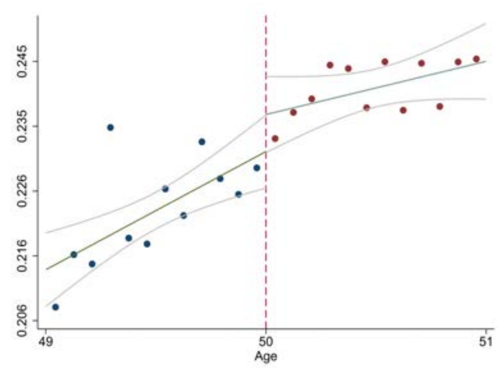
(b) Age 45, enrollment in type P plans



(c) Age 55, enrollment in type P plans



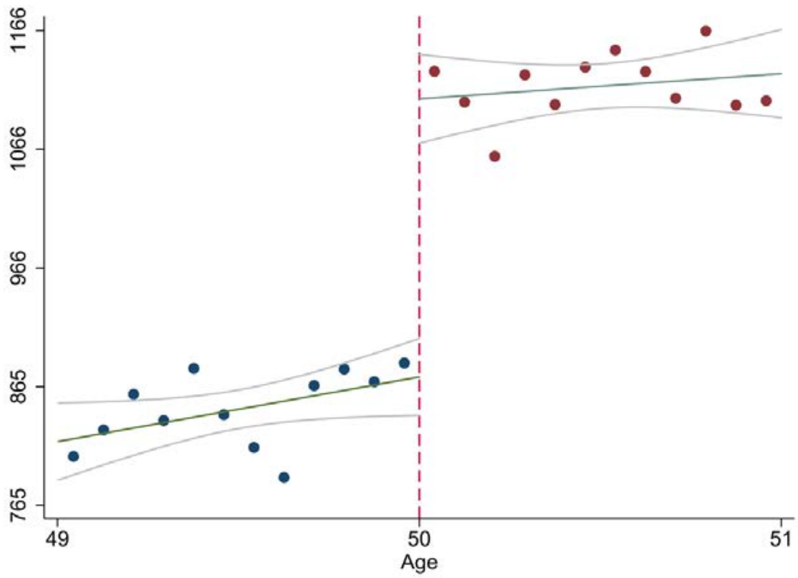
(d) Age 60, enrollment in type P plans



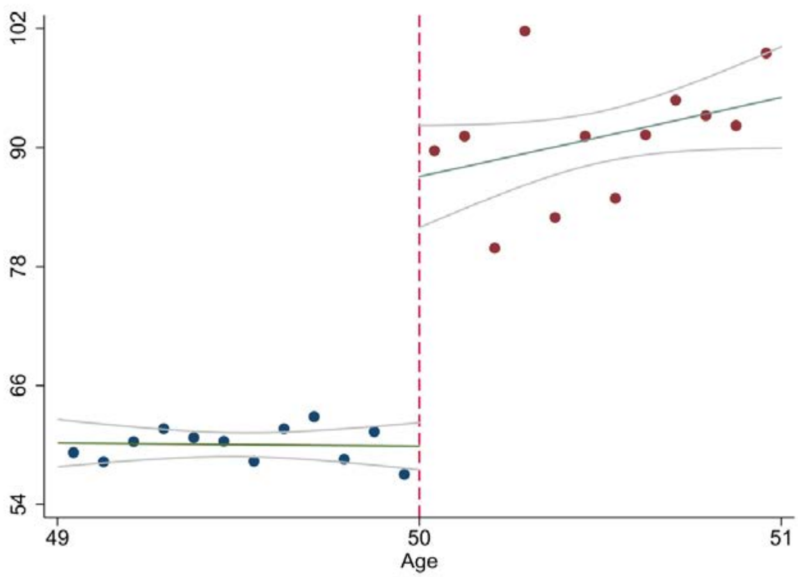
(e) Age 50, enrollment in type B plans

Figure 5 Falsification tests for the RD design

Notes: The figure shows falsification RD plots for enrollment in type P/B plans against age at the time of enrollment. Dots represent the average enrollment rate; a linear fit with a 95% confidence interval is generated separately for each side of the age threshold. Subfigures (a) – (d) show average type P enrollment rates around ages 40, 45, 55, and 60, and subfigure (e) shows the type B enrollment rate around the age of 50. The sample period is from March 2013 to October 2015.



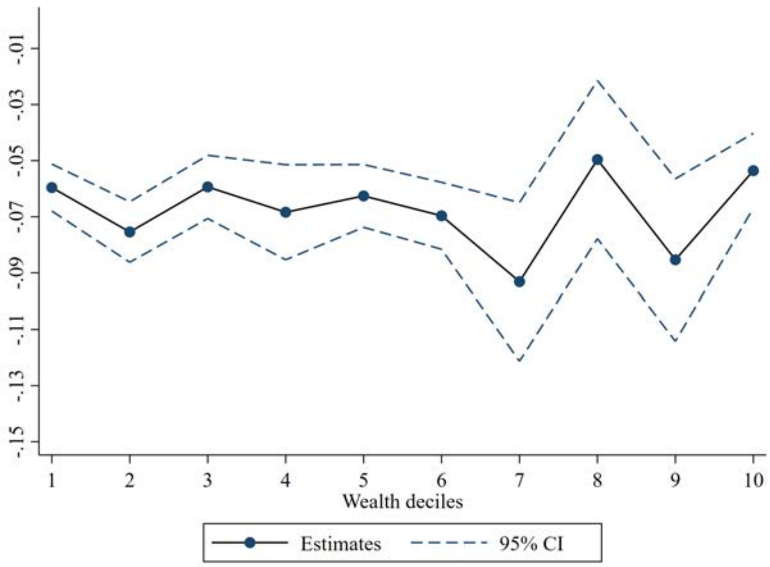
(a) Total enrollee spending



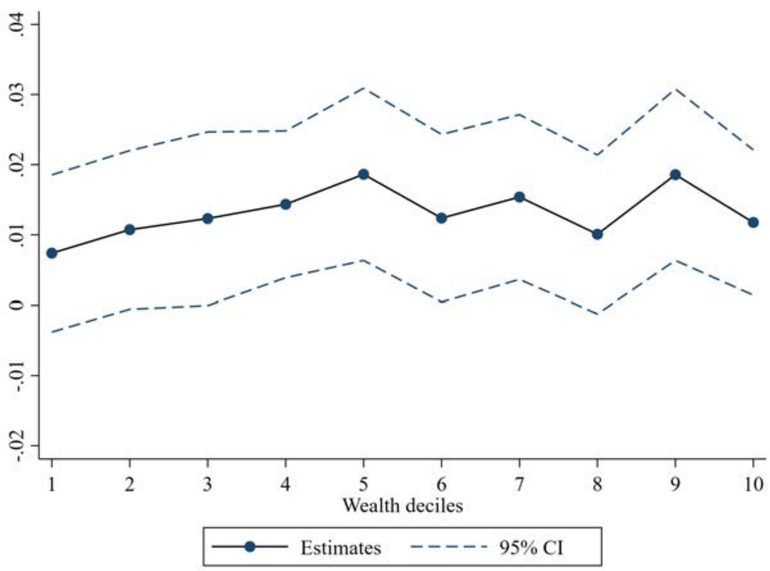
(b) Variance of total enrollee spending ($\times 10^{(-6)}$)

Figure 6 Ex post enrollee spending (premiums plus OOP) around age 50

Notes: The figure shows total enrollee spending (premiums plus out-of-pocket medical spending) versus enrollees' age at the time of enrollment. Subfigures (a) and (b) plot the mean and variance of total spending, respectively. A linear fit with a 95% confidence interval is generated separately for each side of age 50. The sample period is from March 2013 to October 2015.



(a) RD estimates



(b) DID estimates

Figure 7 Heterogeneous estimates by wealth level

Notes: The figure plots the estimated coefficients with a 95% confidence interval specified in RD Equation (1) and DID Equation (2), using subsamples based on deciles of the housing price. In both RD design (a) and DID design (b), dependent variables are indicators of enrolling in type P plans.

Table 1 MediSave withdrawal limits and IP premiums (in SG$)

(a). MediSave withdrawal limits for IP premiums by age

(1) Age	(2) Mar 2013 – Oct 2013	(3) Nov 2013 – Oct 2015
≤ 64	800	800
65 - 74	800	1,000
75 - 79	1,000	1,200
≥ 80	1,200	1,400

(b). Summary of mean premiums, MediSave withdrawal limits, and cash outlays

(1) Age thresholds	(2) Plan type	(3) Number of plans	(4) Min premiums	(5) Max premiums	(6) Average premiums	(7) Withdrawal limits	(8) Min cash	(9) Max cash	(10) Mean cash
Panel A: from March 2013 to October 2013									
50	P	6	898	1,130	1,028	800	98	330	228
55	A	2	842	885	863	800	42	85	63
60	A	6	870	1,119	975	800	70	319	175
60	B	3	820	1023	896	800	20	223	96
65	B	4	874	938	906	800	74	138	106
65	C	1	845	845	845	800	45	45	45
73	C	1	837	837	837	800	37	37	37
Panel B: from November 2013 to October 2015									
50	P	6	898	1,130	1,028	800	98	330	228
55	A	2	842	885	863	800	42	85	63
60	A	6	870	1,119	975	800	70	319	175
60	B	3	820	1023	896	800	20	223	96
70	B	4	1,098	1,219	1,175	1,000	98	219	175
70	C	1	1,025	1,025	1,025	1,000	25	25	25
83	C	1	1,448	1,448	1,448	1,400	48	48	48

Notes: This table summarizes (a) MediSave withdrawal limits for IP premiums by age and (b) the age thresholds and amounts of the first cash outlay for all plans in the market. In Table (b), the sample period is from March 2013 to October 2013 in Panel A, and from November 2013 to October 2015 in Panel B. Monetary values are in current Singapore dollars.

Table 2 RD estimates

	(1)	(2)	(3)
Panel A: enrolling in type P			
Above 50	-0.053***	-0.053***	-0.053***
	(0.002)	(0.002)	(0.002)
Obs	172,922	172,922	172,922
Adjusted R^2	0.855	0.856	0.858
Mean	0.417	0.417	0.417
Panel B: switching down from type P plans			
Above 50	0.033***	0.033***	0.033***
	(0.001)	(0.001)	(0.001)
Obs	74,364	74,364	74,364
Adjusted R^2	0.035	0.041	0.041
Mean	0.028	0.028	0.028
Panel C: opting out of IPs			
Above 50	0.075***	0.075***	0.076***
	(0.004)	(0.004)	(0.003)
Obs	74,364	74,364	74,364
Adjusted R^2	0.062	0.088	0.106
Mean	0.036	0.036	0.036
Panel D: switching up from type A plans			
Above 50	-0.005***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)
Obs	108,881	108,881	108,881
Adjusted R^2	0.017	0.020	0.021
Mean	0.013	0.013	0.013
Plan FEs	Yes	Yes	Yes
Individual controls	No	Yes	Yes
Year and month FEs	No	No	Yes

Notes: This table reports RD estimates from Equation (1) with various specifications. Dependent variables are indicators of enrolling in type P plans in Panel A, switching down in Panel B, opting out in Panel C, and switching up in Panel D; the samples are all enrollees in Panel A, enrollees in type P plans in Panels B and C, and enrollees in type A plans in Panel D. Individual controls include individual demographics, measures for health status, and enrollment experience. Standard errors clustered at age level are in parentheses, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 3 DID estimates

	(1)	(2)	(3)
Panel A: enrolling in type P plans			
Above65 x Post	0.008***	0.007***	0.008***
	(0.001)	(0.001)	(0.002)
Above65	0.008***	-0.013***	-0.014***
	(0.001)	(0.003)	(0.003)
Obs	135,595	135,595	135,595
Adjusted R^2	0.843	0.846	0.846
Mean	0.178	0.178	0.178
Panel B: switching down			
Above65 x Post	-0.003***	-0.002***	-0.005***
	(0.001)	(0.001)	(0.001)
Above65	0.002**	0.004**	0.005***
	(0.001)	(0.002)	(0.002)
Obs	132,058	132,058	132,058
Adjusted R^2	0.029	0.032	0.032
Mean	0.013	0.013	0.013
Panel C: opting out			
Above65 x Post	-0.035***	-0.034***	-0.029***
	(0.003)	(0.003)	(0.003)
Above65	0.017***	0.025***	0.024***
	(0.003)	(0.006)	(0.006)
Obs	132,058	132,058	132,058
Adjusted R^2	0.047	0.073	0.074
Mean	0.039	0.039	0.039
Panel D: switching up			
Above65 x Post	0.002**	0.001**	0.003***
	(0.001)	(0.001)	(0.001)
Above65	-0.002***	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
Obs	106,771	106,771	106,771
Adjusted R^2	0.006	0.008	0.008
Mean	0.005	0.005	0.005
Plan FEs	Yes	Yes	Yes
Individual controls	No	Yes	Yes
Month FEs	No	No	Yes

Notes: This table reports results from the DID design as specified in Equation (2). Dependent variables are indicators of enrolling in type P plans in Panel A, switching up in Panel B, opting out in Panel C, and switching up in Panel D. The sample age is between 60 and 69. Type C enrollees are excluded from all samples. In addition, first-time enrollees are excluded from the samples in Panels B and C, and enrollees in type P plans are further excluded from the sample in Panel D. *Above*65 indicates that the individual is age 65 or above at the time of enrollment. *Post* indicates that the enrollment occurs after November 2013. Individual controls refer to individual demographics, measures for health status, and enrollment experience. Standard errors clustered at age level are in parentheses, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 4 DID estimates: Dynamic specification

	(1)	(2)	(3)	(4)
	Enrollment in Plan P	Switch down	Opt out	Switch up
Above65 x Period (-3)	-0.002	0.002	0.005	-0.001
	(0.002)	(0.002)	(0.004)	(0.001)
Above65 x Period (-2)	0.002	-0.001	0.004	0.001
	(0.002)	(0.002)	(0.003)	(0.001)
Above65 x Period (-1)	0	0	0	0
	-	-	-	-
Above65 x Period (0)	0.009***	-0.005**	-0.029***	0.003*
	(0.002)	(0.002)	(0.003)	(0.001)
Above65 x Period (1)	0.004	-0.004**	-0.028***	0.003**
	(0.003)	(0.002)	(0.004)	(0.001)
Above65 x Period (2)	0.011***	-0.007***	-0.022***	0.004***
	(0.003)	(0.002)	(0.004)	(0.001)
Above65	-0.014***	0.005**	0.021***	-0.001
	(0.003)	(0.002)	(0.006)	(0.001)
Individual controls	Yes	Yes	Yes	Yes
Plan FEs	Yes	Yes	Yes	Yes
Month FEs	Yes	Yes	Yes	Yes
Obs	135,595	132,058	132,058	106,771
Adjusted R^2	0.846	0.032	0.074	0.008
Mean	0.178	0.013	0.039	0.005

Notes: The table presents the estimated coefficients on the interactions between period-to-reform dummies and indicators of being aged over 65 from the regression model specified in Equation (3). Each period contains two months. Specifically, Period (-3) represents an indicator of May-June 2013, Period (-2) represents an indicator of July-August 2013, Period (-1) represents an indicator of September-October 2013, Period (0) represents an indicator of November-December 2013, Period (1) represents an indicator of January-February 2014, and Period (2) represents an indicator of March-April 2014. The period before the policy change (September-October 2013) is omitted, so the estimates on Above65 x Period (-1) are normalized to zero in that period. Dependent variables are indicators of enrolling in type P plans in column (1), switching down in column (2), opting out in column (3), and switching up rate in column (4). Type C enrollees are excluded from all samples. In addition, first-time enrollees are excluded from the samples in columns (2) and (3) and enrollees in type P plans are further excluded from the sample in column (4). Standard errors clustered at age level are in parentheses, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 5 Conditional logit estimates

	(1) Backward looking	(2) Perfect foresight	(3) Rational expectation	(4) Backward looking	(5) Perfect foresight	(6) Rational expectation
Premium (in 100s)	-0.386***	-0.388***	-0.394***			
	(0.003)	(0.003)	(0.003)			
Premium in cash (in 100s)				-0.332***	-0.334***	-0.330***
				(0.007)	(0.003)	(0.005)
Premium in MS (in 100s)				-0.132***	-0.136***	-0.126***
				(0.003)	(0.007)	(0.009)
OOP (in 100s)	-0.117***	-0.115***	-0.125***	-0.117***	-0.115***	-0.106***
	(0.003)	(0.003)	(0.006)	(0.003)	(0.007)	(0.009)
Variance of OOP (x 10^8)	-0.013***	-0.049***	-0.009**	-0.009*	-0.045***	-0.003
	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
Type B	2.697***	2.680***	2.503***	2.425***	2.410***	2.223***
	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)	(0.052)
Type A	3.083***	3.076***	2.936***	2.342***	2.339***	2.191***
	(0.066)	(0.066)	(0.066)	(0.069)	(0.069)	(0.069)
Type P	3.858***	3.869***	3.778***	2.643***	2.660***	2.563***
	(0.103)	(0.103)	(0.103)	(0.109)	(0.109)	(0.108)
Deductibles (in 100s)	-0.004***	-0.003***	0.001***	-0.013***	-0.012***	-0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Annual limit (x 10^6)	0.232***	0.231***	0.225***	0.229***	0.228***	0.221***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Proration factor	3.017***	2.948***	2.566***	2.939***	2.872***	2.461***
	(0.090)	(0.090)	(0.093)	(0.091)	(0.091)	(0.094)
Pre-hospitalization (days)	-0.013***	-0.013***	-0.013***	-0.011***	-0.011***	-0.011***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age to cash pay	0.094***	0.093***	0.090***	0.077***	0.077***	0.074***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Last choice	4.014***	4.014***	4.015***	4.004***	4.005***	4.005***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Last insurer	1.925***	1.925***	1.924***	1.922***	1.922***	1.922***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Insurer FE	Yes	Yes	Yes	Yes	Yes	Yes
# of enrollees	435,284	435,284	435,284	435,284	435,284	435,284
# of choices	1,042,487	1,042,487	1,042,487	1,042,487	1,042,487	1,042,487

Notes: This table displays estimates of the conditional logit model given in Equation (4) estimated by maximum likelihood. Coefficients are estimated parameters of the utility function instead of the marginal effects and each column shows estimated coefficients from a single regression. Columns (1)-(3) show results with the total amount of premiums, expected OOP, variance of OOP, and plan characteristics The remaining columns decompose premiums into payment by MediSave and payment by cash. Standard errors are in parentheses, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 6 Adverse selection

	(1) Spending (Age 48-49)	(2) Positive Spending (Age 48-49)
Panel A: RD analysis		
Above 50	103.248***	0.013**
	(45.513)	(0.005)
Obs	78,406	78,406
Mean	598.327	0.136
Individual controls	Yes	Yes
Plan FEs	Yes	Yes
Year and month FEs	Yes	Yes
	(3) Spending (-1yr)	(4) Positive Spending (-1yr)
Panel B: DID analysis		
Above65 x Post	-900.665**	-0.049***
	(393.611)	(0.012)
Above65	369.668	0.031**
	(306.374)	(0.012)
Obs	25,666	25,666
Mean	1530.575	0.211
Individual controls	Yes	Yes
Plan FEs	Yes	Yes
Month FEs	Yes	Yes

Notes: This table shows the health risk of type P enrollees in the RD design following Equation (1) in Panel A and in the DID design following Equation (2) in Panel B. Health risk is proxied by medical spending between the ages 48 and 49 (columns (1) and (2)) and during the year before plan choices (columns (3) and (4)). Medical spending is measured using total amount of spending or an indicator of incurring positive spending. The sample includes enrollees in type P plans from ages 49 to 51 in Panel A and ages 60 to 69 in Panel B. Individual controls are indicators of being male or of living in an HDB flat. Standard errors clustered at age level are in parentheses, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.