Risk Adjustment, Selection, and Plan Design in Medicare Advantage

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Abstract

This paper explores the intricacies of plan design within the Medicare Advantage (MA) market, spotlighting the imperfections of the Risk Adjustment mechanism aimed at mitigating advantageous selection. Despite these mechanisms, consumers' private health perceptions—information not fully captured by Risk Adjustment yet known to consumers—guide their plan choices. This dynamic enables MA firms to ingeniously design plans that attract healthier individuals, thereby accruing excess profits. This study delves into how such health perceptions, divergent from observable risk scores or capitation rates, shape consumer preferences towards plan generosity. It further examines how firms, despite not knowing each consumer's health perception, leverage this knowledge to strategically design plans. The objective is to quantify the impact of advantageous selection, fostered by the limitations in Risk Adjustment, on overpayments within the MA market, thereby shedding light on the prevalence of low-premium, low-generosity MA plans and their financial implications.

Keywords: self-selection, risk adjustment, plan design, Medicare Advantage
JEL Codes: I13, I18, D82

1 Introduction

Medicare comprises two main components: Medicare Advantage (MA) and Traditional Medicare (TM). Within TM, there's a segment called Medigap, which is government-designed. The primary funding for MA plans comes from government capitation, which is risk-adjusted. However, MA has been a subject of controversy. Data indicates that individuals who enroll in MA tend to be healthier and incur lower costs. This phenomenon, often termed "cream skimming," suggests that insurance companies might be profiting inappropriately.

The crux of my research aims to delve into an underlying issue. Given that the calculation for capitation is a simple average, it inherently incentivizes MA companies to design plans with low generosity. By doing so, they can attract healthier individuals, thereby maximizing their profits. In essence, even though capitation takes into account varying risk levels among individuals, it's still challenging to predict with precision. This imprecision in risk adjustment provides an avenue for MA companies to strategically target healthier demographics.

My contribution is to provide a story to explain how the overpayment happens in MA market. This story is based on the fact that the capitation is a simple average and only percisely predict the average cost of group, not the cost of individual. Under this imperfect risk adjustment, MA firms still have the incentive to select the healthy individuals, and deter the unhealthy individuals. Even though they cannot deter the unhealthy individuals directly, they can deter them indirectly by designing the low-generosity plan. Consequently, the MA firms can make extra profit by selecting the healthy individuals, and the government will overpay the MA firms. Compared with the previous literature, my story provides a mechanism to explain how the overpayment related to risk adjustment.

2 Industry Background

2.1 The Medicare System

Medicare represents a fundamental component of the United States' social insurance system. It is administered by the Centers for Medicare & Medicaid Services (CMS), an agency within the Department of Health and Human Services (HHS). Established in 1965, Medicare's primary purpose is to provide health insurance coverage to individuals aged 65 and older, as well as to younger people with certain disabilities and diseases.

The funding for Medicare comes from three main sources: payroll taxes levied on workers and employers, premiums from beneficiaries, and contributions from the federal budget. This multifaceted funding structure ensures Medicare's operation and sustainability, supporting a wide range of healthcare services for its beneficiaries.

Medicare's financial significance is profound, accounting for a substantial portion of the federal budget with total expenditures reaching $905.1 billion in 2022. This reflects the program's broad impact, covering 65.0 million individuals, including both seniors and disabled persons (CMS, 2023). Notably, a significant number of beneficiaries, approximately 46 percent, choose Medicare Advantage (Part C) plans, indicating a strong preference for these private health plan options.

In the following section, we will delve into the specifics of Medicare Advantage, exploring its features and the role it plays in the broader Medicare ecosystem.

2.2 Medicare Advantage

Medicare is divided into several parts, with Traditional Medicare (TM) encompassing Part A (hospital insurance) and Part B (medical insurance), and Medicare Advantage (MA) offering an alternative way for beneficiaries to receive their Medicare benefits through private health plans. While TM is directly managed by the federal government, MA plans are offered by private insurers that contract with CMS to provide all Part A and Part B services.

Medicare Advantage was initiated in the Balanced Budget Act of 1997, MA's development, detailed by Mcguire et al. (2011), reflects a significant ideological and practical shift towards incorporating market mechanisms within Medicare. The introduction of Medicare Advantage was driven by a confluence of factors aiming to infuse the Medicare program with the efficiencies of market competition and the diversity of plan options.

The rationale behind MA's introduction centered on the belief that market competition could drive down costs, increase efficiency, and offer beneficiaries a wider array of health plan choices, each tailored to meet their unique healthcare needs. This strategy aimed to har-

ness the organizational efficiencies of Health Maintenance Organizations (HMOs) and other provider networks to streamline healthcare delivery and outcomes. It represents a notable policy transition towards incorporating private sector dynamics into Medicare, intending to secure better healthcare results for beneficiaries at lower costs.

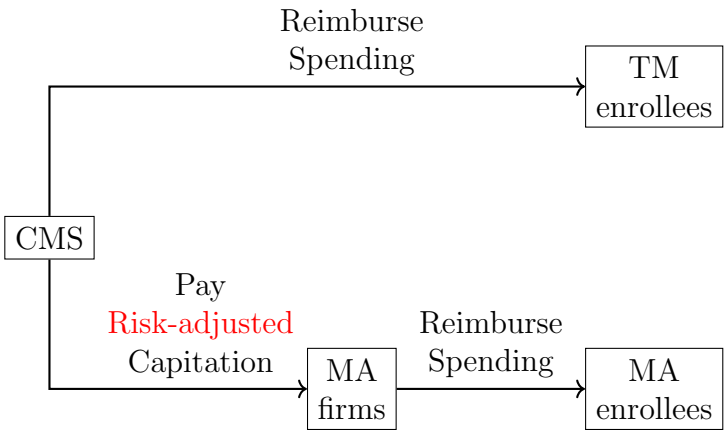

Figure 1: Medicare Market Structure

As illustrated in Figure 1, the Medicare market structure delineates the choice for enrollees between Traditional Medicare (TM) and Medicare Advantage (MA), which are mutually exclusive options. MA firms generate revenue through a mix of capitation payments from the government (CMS) and premiums charged to enrollees. [1]

The relationship between TM enrollees and CMS is direct; CMS reimburses the cost of medical bills under the fee-for-service model for the basic Medicare coverage. In contrast, MA enrollees engage directly with private MA firms, where the firms are responsible for covering medical bills based on cost-sharing mechanisms. These cost-sharing requirements are mandated not to exceed the basic Medicare coverage standards, effectively shifting the Medicare benefits provider role from CMS to MA firms for enrollees opting for MA plans. Consequently, CMS compensates MA firms with capitation payments, transferring the requisite funds to support the enrollees' Medicare benefits under the MA scheme.

Notably, the capitation payments to MA firms are risk-adjusted to account for the varying health status of enrollees, underscoring the financial model that underpins MA plans.

2.3 Risk Adjustment

The introduction of risk adjustment mechanisms in Medicare Advantage (MA) plans aims to address a critical challenge: the mitigation of favorable selection, or "cream skimming."

[1] Compare to capitation payments, the revenue from premiums is much smaller. The main source of revenue for MA firms is the capitation payments from CMS.

This issue arises as MA plans, under a uniform capitation payments for all enrollees, might pursue strategies to enroll predominantly healthier individuals. Such individuals represent lower healthcare costs, potentially enabling plans to maximize profits. This behavior not only undermines the equity and sustainability of the Medicare system but also contravenes the principle of social insurance by restricting access for high-cost patients and potentially leading to disproportionately high payments to MA plans relative to the actual cost of care provided.

Risk adjustment seeks to mitigate these incentives by adjusting capitations based on the health status of individual enrollees, aiming to dissuade plans from engaging in cream skimming. Despite these efforts, challenges persist in fully neutralizing the financial incentives for selecting healthier individuals. The following discussion will explore the effectiveness of risk adjustment and the complexities involved in achieving its intended goals.

Risk adjustment utilizes the Hierarchical Condition Category (HCC) model to assign risk scores based on beneficiaries' health conditions. This process enables the adjustment of payments to Medicare Advantage (MA) plans, ensuring they reflect the health status of enrollees.

2.3.1 HCC Model Overview

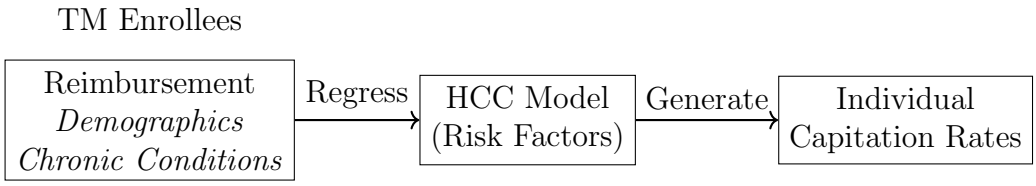

Figure 2: Process of HCC Coding

Figure 2 provides a simplified overview of the HCC risk adjustment system. Initially, the CMS gathers data on Fee-for-Service reimbursement records for Traditional Medicare enrollees, alongside information on their chronic conditions and demographics. Subsequently, CMS constructs the HCC model by regressing FFS reimbursements against these chronic conditions and demographic factors.

While the actual HCC model encompasses more complexity than this simplified description, it essentially serves to estimate the expected reimbursement for each individual based on their observable health status. Detailed components and workings of the HCC model are elaborated in the Appendix.

2.3.2 Limitations of HCC

While the HCC model plays a crucial role in risk adjustment within Medicare Advantage plans, its predictive capabilities are subject to certain limitations. A notable constraint is the model's modest R-squared value. As recorded by CMS (2021), the Version 22 CMS-HCC model employed during the dataset period of 2016-2018 reports an R-squared of 0.1189. This statistic suggests that the HCC model explains merely 11.89% of the variance in individual reimbursement amounts, indicating a significant gap in its ability to forecast individual healthcare costs accurately.

The crux of the challenge lies in the inherent difficulty of precise individual-level cost prediction. The HCC model, by design, estimates the average cost for groups of individuals with similar health conditions, as categorized into 86 HCCs (varying by model version). However, this simplification may not adequately capture the complex health status spectrum of Medicare beneficiaries. The diversity in actual healthcare costs among individuals with ostensibly similar conditions underscores the model's limitations in granularity.

Furthermore, the rationale behind the limited number of HCC categories is rooted in practicality. An overly complex model featuring thousands of HCCs would be cumbersome to implement and manage, thus detracting from its utility. It's important to recognize that the HCC model's effectiveness is evaluated on a group level rather than at the individual level. While it provides a reasonable estimation of average care costs for people within the same health category, its precision diminishes significantly when applied to predict costs for individuals.

The key insight here is that within groups having the same observable health conditions (the same HCCs), there can be significant discrepancies in their actual health status, yet CMS allocates the similar capitation to these individuals. This aspect is crucial for understanding how MA firms might engage in selection practices.

Ideally, a flawless risk adjustment mechanism would eliminate the incentives for favorable selection. However, the reality may diverge from this ideal.

2.4 Cream Skimming and Overpayment

Cream skimming within Medicare Advantage (MA) refers to the strategic enrollment of healthier individuals by MA plans, a practice that can lead to overpayment when capitation payments exceed the actual cost of care provided. This section explores the evidence of cream skimming, previous explanations for its occurrence, and how MA plans navigate the highly regulated environment to possibly engage in favorable selection.

Xu et al. (2023) highlighted the significantly higher profit margins in Medicare Advantage (MA) compared to other insurance markets, despite similar contract pricing with healthcare providers as evidenced by Trish et al. (2017) between MA and Traditional Medicare (TM).

One potential driver of these higher margins is the practice of upcoding, where MA plans might encourage providers to report more severe diagnoses, inflating risk scores and subsequently, capitation payments. While Geruso and Layton (2020) noted that upcoding leads to excess public spending, it alone does not fully account for the observed overpayments, given the absence of systematic evidence that MA enrollees' risk scores are disproportionately higher than those in TM.

Jacobson et al. (2019), among others, highlights a pivotal aspect of Medicare Advantage (MA) plans: enrollees in MA tend to be healthier compared to their counterparts in Traditional Medicare (TM), despite having *similar* risk scores. This discrepancy leads to a situation where MA plans receive overpayments, as the actual healthcare expenditures for these healthier individuals fall below the predicted costs.

Supporting evidence from Brown et al. (2014) and Lieberman and Ginsburg (2023) not only underscores the presence of significant overpayments attributed to this favorable selection but also clarifies that such selection refers to enrolling individuals who are healthier than their capitation predicted. Given that capitation is designed to reflect the average cost for individuals with similar observable health conditions, it inherently includes variability where some individuals' costs will exceed the average while others will fall below it. The insight from these studies suggests that, given a capitation rate, MA plans tend to select individuals whose expected costs are on the lower side of this average, thereby engaging in favorable selection.

Yet, a critical question arises: How do MA plans engage in favorable selection amidst stringent regulatory environments?

MA Market Regulations MA plans operate under tight regulations designed to ensure equitable access and treatment. These include mandates to offer identical premiums to all enrollees, prohibit discrimination based on health status, and enforce open enrollment periods during which any eligible individual can join an MA plan without the risk of being denied due to health conditions.

Despite these regulatory constraints, MA plans may manage to selectively enroll profitable individuals though some means. Aizawa and Kim (2018) points to advertising as a strategic and scalable tool that MA plans employ to attract demographics (e.g., race[2]) associated with lower-than-average healthcare costs for individuals with comparable chronic

[2]Race is not included as a factor in the HCC model.

conditions (similar risk socre). This approach, while effective in achieving favorable selection, also skirts the edge of legal risk since it targets specific demographics.

This direct approach to favorable selection, aiming to enroll individuals whose healthcare costs are anticipated to be lower than the assigned capitations, encounters significant practical challenges. The regulatory environment, coupled with the inherent unpredictability of individual health outcomes, renders such targeted selection difficult to implement on a practical level.

In conclusion, while evidence indicating that MA plans engage in favorable selection, the feasibility of implementing such selection at the individual level—especially under the stringent MA regulations and considering the unpredictable nature of health outcomes—appears to be constrained. A significant observation in this context is that a majority of MA enrollees incur actual healthcare costs that are lower than their assigned capitations. This pattern could be interpreted more as a consequence of the favorable selection mechanism rather than evidence of MA plans directly targeting individuals whose actual costs are anticipated to be below their capitation rates.

Such an interpretation suggests a shift in perspective, proposing that the prevalent lower-than-expected healthcare expenditures among MA enrollees might stem from broader, systemic strategies employed by MA plans rather than explicit individual-level selection. This nuanced understanding, viewing favorable selection as an emergent property of strategic plan design and operational tactics, will be delved into in the subsequent sections.

2.5 Revising Favorable Selection in MA

Diverging from the conventional understanding by (Brown et al., 2014; Aizawa and Kim, 2018; Lieberman and Ginsburg, 2023; MedPAC, 2023), this study seeks to enrich the discourse on favorable selection within Medicare Advantage (MA) plans. Traditional perspectives widely suggest or imply that the phenomenon of favorable selection observed in MA could be attributed to plans directly selecting individuals whose actual healthcare expenditures are lower than those predicted by risk adjustment models. However, considering the regulatory and practical challenges inherent to such direct individual-level selection, this approach seems implausible.

This research introduces a fresh perspective on the implementation of favorable selection within MA plans: the widespread occurrence of MA enrollees incurring lower healthcare costs than predicted is not evidence of direct selection by MA plans. Instead, it may represent the outcome of a different form of favorable selection. This alternative strategy relies on attracting individuals with positive health perceptions—those who perceive themselves to

be healthier. This selection criterion is both practical and implementable, especially if we consider that an individual's health perception linearly influences their preference for plan generosity.

Such a strategy would naturally result in the same observed pattern: a majority of MA plan enrollees having lower actual healthcare costs than those projected by risk adjustment models. The underlying reason for this pattern may stem from the imperfections of the current risk adjustment model. We can show the intuition of this by the following simplified demonstration.

2.5.1 Incentive for Selection

Figure 3 illustrates the concept of assured overpayment within the frameworks of both absent and imperfect risk adjustment mechanisms. Assured overpayment describes scenarios where individuals' actual healthcare costs consistently fall below their allocated capitation, independent of the specific capitation assigned. Imperfect risk adjustment is characterized by capitation adjustments based on observed health conditions that, nevertheless, fall short in precisely predicting individual healthcare costs.

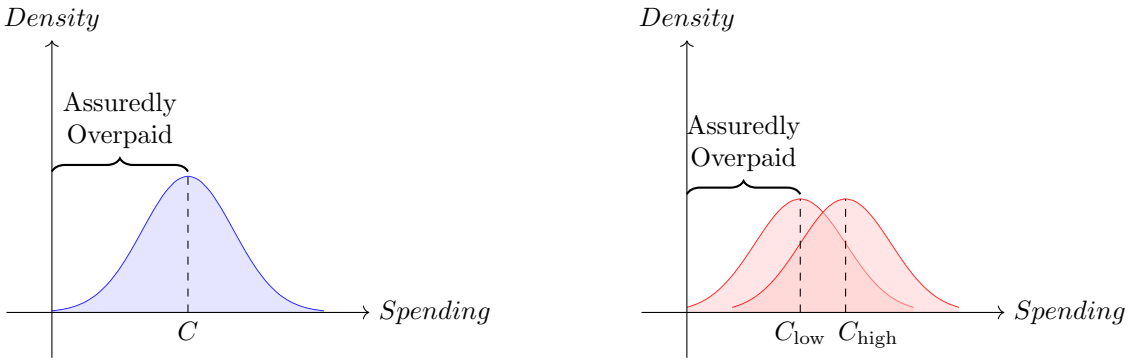

Figure 3: Incentive for Selection

1. **No Risk Adjustment**: In this scenario, all enrollees are allocated the same capitation, denoted as C. Actual healthcare spending exhibits a distribution around C, leading to overpayment for individuals to the left of the distribution and underpayment for those to the right. This scenario uncovers the intrinsic selection incentive that risk adjustment seeks to mitigate.

2. **Imperfect Risk Adjustment**: In this scenario, capitations, C_{low} and C_{high}, vary based on observed health conditions. Despite the variation, actual spending within

each capitation group still centers around C_{low} and C_{high}. Regardless of the capitation amount, individuals with actual spending lower than C_{low} are assuredly overpaid, and those with spending above C_{high} are assuredly underpaid, illustrating that assuredly overpaid enrollees remain prevalent under imperfect risk adjustment.

A critical insight from this analysis, viewed from an *ex post* perspective, is the enduring presence of assuredly overpaid enrollees regardless of any possible capitation rates. While imperfect risk adjustment aims to align capitations more closely with individual observable health conditions, it does not eliminate the selection incentives intrinsic to Medicare Advantage (MA) plans. Individuals significantly to the left of the spending distribution invariably receive overpayments, underscoring a persistent selection bias. Conversely, those significantly to the right face assured underpayments.

This *ex post* analysis underscores the limitations of imperfect risk adjustment models in fully mitigating selection biases within MA plans. However, the subsequent discussion will transition back to an *ex ante* perspective, exploring how prospective plan design adjustments and enrollee behaviors might influence, and potentially mitigate, these biases before they materialize.

Despite the complexities of reality, the underlying intuition of assured overpayment remains valid. In reality, the risk adjustment mechanism introduces more than just two levels of capitation rates, yet significant issues persist.

Firstly, a substantial variance in actual healthcare costs within the same risk score is observed, indicating a distribution of costs rather than uniform expenses across individuals (Brown et al., 2014). This variance suggests that the risk adjustment model, while sophisticated, cannot account for the full range of individual healthcare spending.

Secondly, the lowest possible capitation rate is significantly above zero, approximately around \$4,000—a figure set for individuals without any HCCs, according to CMS (2021). Given that a considerable portion of individuals incur healthcare costs below this threshold, there remains substantial room for MA plans to benefit from assured overpayment.

These facts underscore a persistent incentive for MA plans to engage in selection strategies, specifically aiming to attract individuals with lower actual healthcare costs and deter those with higher costs. The analysis of this selection incentive, from an *ex post* perspective, acknowledges the outcomes of these strategies rather than merely their anticipation.

However, it is crucial to revisit this issue from an *ex ante* perspective as well. Before the actual healthcare costs materialize, MA plans face the challenge of not being able to precisely predict individual actual spending and would base their strategies on expected outcomes. The next section shifts back to an *ex ante* analysis, further exploring how MA plans might implement these strategies in anticipation.

2.5.2 Health Perception

Turning our focus back to an *ex ante* perspective, it's important to consider how beneficiaries' plan decisions are influenced by their perceptions of health prior to any engagement with healthcare services. Health perception, defined as an individual's subjective assessment of their health status, does not necessitate professional medical knowledge. Instead, it provides a personal insight into one's health that can significantly vary even among individuals categorized within the same observable health conditions (HCCs). Therefore, those with a positive health perception could often end up incurring very low healthcare spending across the entire Medicare population. As previously analyzed in Section 2.5.1, these individuals are more likely to be categorically overpaid *ex post*.

In practice, consumers are typically unaware of their specific capitation rates, a detail reserved for transactions between CMS and MA plans. Consequently, plan choices are predominantly influenced by individuals' own health perception rather than by capitation rates or risk scores.

When a substantial proportion of beneficiaries who hold positive health perceptions consistently experience overpayment, it establishes a trend of overpayment at the group level—where the average capitation exceeds the group's average expected healthcare expenditure. This suggests that the existing risk adjustment mechanisms might unintentionally promote overpayments among those beneficiaries with good feeling of their health status. Recognizing this, MA plans can adopt strategic approaches to target such groups on a macro level, capitalizing on the collective health perceptions to enhance their profitability. This strategy allows MA plans not just to navigate but also to exploit the nuances of risk adjustment to their advantage.

2.5.3 Group Level Selection

MA plans operate on a principle that transcends individual capitation rates, focusing instead on attracting groups characterized by positive health perceptions while dissuading those with negative ones. This approach reflects a broader, more strategic form of selection that aligns with how insurance firms inherently think—on a group level and from an *ex ante* perspective rather than individual level.

At the heart of this strategy lies the acknowledgment of inherent uncertainties at the individual level: a positive health perception does not invariably translate into low healthcare costs. In certain instances, individuals with a positive health outlook may incur unexpectedly high healthcare expenses. However, when considering the broader picture at the group level, these uncertainties tend to diminish. Collectively, a group with a predominantly positive

health perception is likely to incur lower healthcare costs compared to a group with a negative health outlook. This predictability of group-level average profits underpins the MA firms' strategy, focusing on anticipated averages rather than individual discrepancies.

This strategic approach is corroborated by observations within MA plans mentioned earlier, where the bulk of beneficiaries exhibit healthcare expenditures significantly below the average for the broader Medicare population and below their respective capitations. This pattern predominantly arises because the majority of MA enrollees possess a positive health perception. Nonetheless, a minor segment within MA plans might have expenditures that exceed their capitation rates, underscoring that individual health perceptions are not infallible predictors of actual healthcare costs on a singular level. Despite these anomalies, the overarching trend in MA underscores that the average actual spending remains below the average capitation, enabling MA firms to secure substantial profit margins.

The feasibility of this group-level selection strategy hinges on specific conditions. These conditions, essential for the strategic alignment of MA plans with beneficiaries' health perceptions, will be elucidated in the subsequent section.

2.6 Selection via Plan Design

This section explores the strategic potential for Medicare Advantage (MA) plans to design offerings that systematically attract beneficiaries based on their health perceptions, independent of individual capitation rates. The successful implementation of this strategy hinges on meeting several critical conditions:

Influence of Health Perception on Plan Preferences The preferences of beneficiaries for certain plan attributes, particularly regarding the generosity of cost-sharing arrangements, are significantly influenced by their health perceptions. Here, "generosity" signifies the degree to which a plan mitigates out-of-pocket expenses for enrollees, a crucial factor for individuals with bad health perceptions who anticipate high healthcare utilization, but less so for those with positive health perceptions.

Plan Design Flexibility MA plans enjoy considerable latitude in shaping their offerings, especially in terms of generosity. This flexibility enables them to tailor plans that resonate with individuals harboring positive health perceptions.

Availability of an Outside Option The effectiveness of MA plans' selective appeal is contingent upon the availability of alternative options for those who find a particular MA

plan's design unattractive. This condition ensures that individuals seeking more comprehensive coverage due to negative health perceptions have viable alternatives, thereby reinforcing the strategy's effectiveness.

With these conditions as a backdrop, we anticipate the following outcomes from this selective strategy:

1. MA plans will be deliberately designed to attract beneficiaries with positive health perceptions and deter those with negative ones.

2. Consequently, individuals with positive health perceptions will gravitate towards MA plans, while those with negative perceptions will seek alternatives.

3. This alignment results in MA plans experiencing lower average actual healthcare expenditures than their average capitation rates, thereby augmenting MA firms' profit margins.

This strategy underscores the critical role of plan design in influencing MA enrollment patterns and underscores the economic dynamics of health insurance. In Section 3, we will delve into empirical evidence supporting the efficacy of this mechanism. This evidence includes factual verification of plan design flexibility and availability of an outside option, alongside data-driven analysis for the influence of health perception on plan preferences and the verification of expected outcomes, thereby demonstrating the practical implementation of revised favorable selection strategies within MA plans.

3 Empirical Evidence

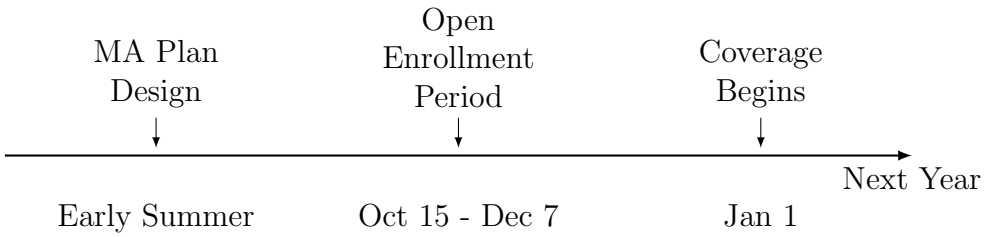

Figure 4: Annual Timeline

In this section, we present empirical evidence to bolster our research findings, primarily focusing on validating consumer behavior assumptions within Medicare Advantage (MA) plan decisions. We highlight the importance of the MCBS data due to its interview timing coinciding with the MA open enrollment period. We further delve into the design nuances of MA plans, pointing out how their features resonate with our theoretical predictions. The consistent role of Medigap as an 'outside option' is also underlined. We conclude by shedding light on the rationale behind MA firms' selection strategies in the backdrop of the current risk adjustment framework.

3.1 Consumer Behavior

We explore foundational assumptions about consumer behavior in the MA market. Central to our model is the premise that consumers have private insights about their health status and spending, influencing their plan choices. The subsequent sections provide empirical support for these claims. Before we proceed, we present a brief overview of the MCBS (Medicare Current Beneficiary Survey) dataset.

3.1.1 MCBS Interview

The MCBS is a nationally representative survey of Medicare beneficiaries conducted by the Centers for Medicare and Medicaid Services (CMS). The survey is conducted annually, with each respondent being interviewed during the fall of the year. Notably, the MCBS interview timing aligns closely with the Medicare open enrollment period, when consumers decide on their Medicare plans, which includes choices between MA plans and Medigap plans.

The synchronicity of the MCBS interview with the open enrollment period offers a compelling advantage: it allows us to infer that the health perceptions expressed by consumers during the interview likely mirror their health perceptions when making plan decisions.

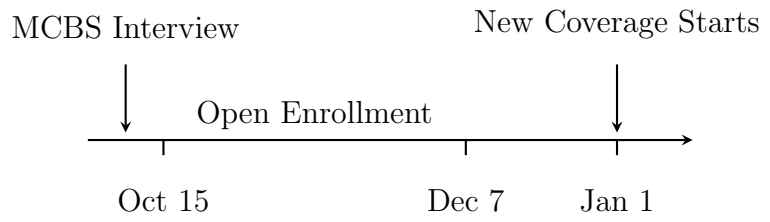

Figure 5: Consumers' Annual Timeline

Given that the new plan coverage only commences on January 1st of the subsequent year, it underscores the idea that plan decisions are made based on health perceptions. In essence, this timeline serves as a proxy, helping us correlate the timing of health self-assessments with the actual plan choice, thereby bolstering the validity of our assumptions about consumer behavior.

To gauge consumers' health perception, we utilize a specific question from the MCBS: "General health compared to others of the same age." This question offers five possible responses: "Excellent", "Very Good", "Good", "Fair", and "Poor". For our analysis, we group the responses of "Excellent", "Very Good", "Good", and "Fair" as "Above Poor," distinguishing them from the "Poor" response. Given the observation that responses of Excellent, Very Good, Good, and Fair are generally positive perceptions, albeit of varying degrees, we opted for this classification to mitigate the effects of potential subjective interpretation differences among respondents. This categorization will be instrumental in the subsequent sections as we delve deeper into understanding consumers' private information and its influence on their MA plan decisions.

3.1.2 Consumers' Private Information

Below, we furnish evidence that bolsters the claim that consumers have private information regarding their health status or prospective spending. The juxtaposed distribution graphs in Figure 6 contrast the spending patterns of individuals categorizing themselves as "Above Poor" against those considering themselves "Poor." The left graph corresponds to individuals who chose TM-Medigap for the subsequent year, while the right graph represents those opting for MA. A discernible pattern emerges from both TM-Medigap and MA plans: individuals with "Above Poor" perceptions predominantly exhibit lower spending, while those with "Poor" perceptions consistently show higher spending. Such patterns, when combined with the fact that plan choices and health perception responses are made prior to the commencement of coverage, lend credence to the idea of consumers possessing private information.

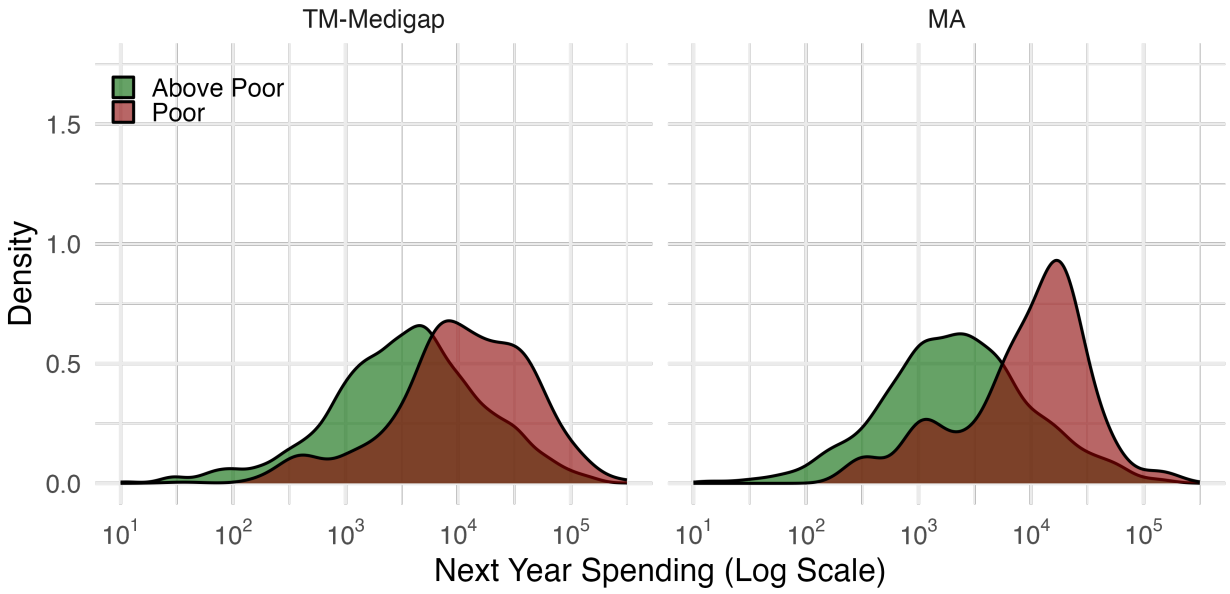

Figure 6: Spending distribution of consumers based on health perception across TM-Medigap and MA plans.

3.1.3 Consumers' Plan Decisions Based on Private Information

To provide further evidence that consumers make MA plan decisions based on their private information, we analyzed the association between individual health perceptions and their subsequent MA enrollment decisions.

Firstly, it's important to note that MA plans generally have lower generosities compared to TM-Medigap. Hence, we use MA enrollment as a proxy for choosing a plan with lower generosity.

Descriptive Statistics: Based on the data, we observed that among those who perceive themselves as "Poor", only 21.6% enroll in an MA plan the following year. In contrast, among the "Above Poor" group, the MA enrollment rate is 28.3%. This suggests that individuals with a more negative health perception are less inclined to choose MA plans, which, as established earlier, are typically of lower generosity.

Logistic Regression Analysis: To delve deeper into this relationship, we conducted a logistic regression analysis with MA enrollment in the subsequent year as the dependent variable. The predictors include health perception, income, race, gender, age, and education level.

The results of this regression are detailed in Appendix Table 6. In brief, the negative and statistically significant coefficient for the self health perception ("GENHELTH_poor" variable) reinforces our earlier observation: individuals with a poorer health perception are

less likely to enroll in an MA plan. Other significant predictors, such as income and education level, provide additional insights into the factors influencing MA plan decisions.

In conclusion, our empirical evidence strongly suggests that consumers' private health perceptions, among other factors, play a crucial role in their MA plan decisions. Notably, MA firms can exploit this aspect to implicitly select healthier individuals for their plans. The subsequent sections will present the evidence supporting this assertion.

3.2 MA Plan Design and Selection

3.2.1 Existence of Expensive High Generosity Outside Option

A critical component in our narrative is the presence of an expensive, high-generosity outside option. In the context of our study, this role is fulfilled by Medigap (Medicare Supplement Insurance).

Medigap is an additional insurance coverage for beneficiaries under the Traditional Medicare (TM) system, designed to cover out-of-pocket expenses. The design of Medigap plans is standardized by the Centers for Medicare and Medicaid Services (CMS) into various plans labeled as A, B, C, and so on. These plans are offered across all markets by private insurance firms. One of the unique characteristics of Medigap is its pricing mechanism: it permits age-based pricing and does not operate under a capitation system. As a result, Medigap plans often come with high premiums but offer substantial generosity.

In practice, most beneficiaries opting for Traditional Medicare (TM) don't rely on standalone TM. Instead, they often have supplementary plans complementing their TM coverage. Some of these supplementary plans are sponsored by employers, while others are purchased individually. Among these supplementary options, Medigap stands out as an open and highly popular choice for many. Given this context, we've chosen Medigap to represent the outside option in our study.

Given the limitations in our MCBS dataset, where we cannot ascertain the specific Medigap plan chosen by TM beneficiaries, we use Plan C, which was popular during our study period, as a representative for this outside option.

To underscore the relevance of this outside option in our analysis, it's essential to recognize the static nature of Medigap from the perspective of MA firms. Medigap plans, being standardized and consistently available across markets, serve as a given when MA firms design their offerings. Their design remains relatively consistent year after year, making them a predictable component in the competitive landscape that MA firms navigate.

3.2.2 Prevalence of Cheap Low Generosity MA Plans

As depicted in Table 2, Medicare Advantage (MA) plans are, on average, relatively affordable with an annual premium of just $200. Despite their low premiums, these plans come with a higher potential out-of-pocket cost, signifying their lower generosity.

The CMS-provided star ratings, which measure the quality of healthcare services within HMO or PPO networks, are made available to consumers during their plan selection process. This ensures that consumers are informed about the prospective quality of medical care they would receive upon opting for a particular MA plan.

Additionally, MA plans stand out by offering supplemental non-medical benefits, most notably in dental, vision, and hearing categories, that are not typically covered by Traditional Medicare (TM).

Table 1: Comparison of Popular MA and Medigap plans in Suffolk County 2016

Medicare Advantage			
Plan Code	Premium	Out-Of-Pocket	Additional Benefits
H3370-032	$372	Copay & Coinsurance [3] with minor variations	Dental, Vision, Hearing
R5342-001	$0		Vision, Hearing
H4922-001	$0		Dental, Vision
...			
TM-Medigap			
Plan Code	Premium	Out-Of-Pocket	Additional Benefits
Plan C	$3108	No [4]	No

Taking a more granular look, we can consider a sample comparison of popular MA and Medigap plans in Suffolk County for the year 2016, as illustrated in Table 1. The contrasts are obvious. For instance, while the Medigap Plan C demands an annual premium of $3108 [5] and offers no out-of-pocket costs or additional non-medical benefits, MA plans offer lower or even zero premiums. These MA plans do introduce out-of-pocket expenses in the form of copay and coinsurance, but they compensate by offering non-medical benefits.

To draw a comparison, while TM combined with Medigap might entail premiums running into several thousands of dollars annually, MA plans tend to offer much cheaper premiums, lower generosity, and a set of non-medical benefits. Such features make them particularly appealing to consumers who perceive themselves to be in better health.

3.3 Motivation for MA Selection

[5] This is weighted average premium across all age groups.

4 Data

4.1 Data Source and Description

Our research relies on data from two main sources: the Medicare Current Beneficiary Survey (MCBS) and public datasets from the CMS website.

We also utilize several public datasets available from the CMS website. These datasets offer insights into various aspects of Medicare Advantage (MA) plans. They cover areas such as plan benefits, enrollment details, star ratings, and more.

Together, the MCBS and the public datasets give us a thorough understanding of both the individual choices and the attributes of Medicare Advantage plans.

For more information on data source, please refer to the Appendix: Data Details.

4.2 Data Cleaning

'standard consumers' are defined as those who are enrolled only for the age, and not for disability or end-stage renal disease (ESRD). They live in the community rather than institutions, and are not dual-eligible for Medicaid.

'standard MA plans' are defined as those MA plans that are not employer-sponsored, cost, or special needs plans(SNP).

Not every market offer MA plans, and MCBS data is not available for all markets, and we only use the MA markets with MCBS data.

4.2.1 Generating HCC Risk Scores

Given the absence of direct capitation information in the Medicare Current Beneficiary Survey (MCBS) dataset, we adopt a methodology to approximate HCC risk scores for each individual. This approach is informed by the general process used to generate actual HCC risk scores, which involves regressing Fee for Service (FFS) reimbursement amounts on chronic conditions and demographic data. The MCBS dataset provides comprehensive data on enrollees' chronic conditions and demographics, enabling us to simulate the HCC risk score generation process.

This simulated HCC risk score aims to mirror the expected reimbursement for an individual, conditional on their observable health status, as would be calculated in the real HCC model. [6] A detailed description of the simulation process is provided in the Appendix D.2,

[6]The actual process of generating HCC risk scores is complex, involving numerous factors beyond the scope of this study. Our simulation is an approximation designed to facilitate analysis within the limitations of the MCBS dataset.

offering insights into how we adapted the HCC model's principles to our dataset's context.

4.3 Data Summary Statistics

Table 2: Weighted Statistics of MA Plans

	variable	Mean	SD
1	premium	200.07	380.01
2	OOP	2003.33	501.66
3	star_rating	4.03	0.52
4	HMO	0.72	-
5	PPO	0.19	-
6	dental_comprehensive	0.49	-
7	dental_preventive	0.75	-
8	vision_exam	0.97	-
9	vision_wear	0.73	-
10	hearing_exam	0.80	-
11	hearing_aid	0.69	-

Table 3: Sample Weighted Means for Personal Level Variables

	Sample Weighted Mean		
	TM	MA	Overall
MA enrollment	0.000	1.000	0.279
age	73.887	74.283	73.997
female	0.524	0.557	0.533
income	70203.150	50484.140	64697.450
capitation	8913.000	8847.121	8894.605
spending	8340.925	6012.250	7692.691
Race:			
White	0.873	0.827	0.860
Black	0.062	0.098	0.072
Hispanic	0.008	0.020	0.011
Education:			
High	0.607	0.469	0.568
Medium	0.359	0.468	0.389
Low	0.035	0.063	0.042

5 Model

5.1 Consumer Private Information

We explore two pivotal aspects of consumer in Meidcare Advangtage market: risk-adjusted capitation rates and self-assessed health perception.

Risk-adjusted Capitation (k_i): This term refers to the capitation amount adjusted for risk for consumer i, where capitation represents the funds allocated to each consumer. The amount of capitation varies among consumers, determined by their chronic conditions and demographic characteristics. Calculated by CMS using the HCC risk adjustment model along with county-level benchmark rates, this capitation amount essentially represents the average cost of Medicare Part A and B for a consumer sharing the same health status and demographic traits as consumer i. However, since the actual costs for consumers with identical health statuses and demographic characteristics vary, this capitation does not precisely reflect the health status of consumer i. Typically, consumers are not aware of this rate, although it is observable in the data.

Self-assessed Health Perception (e_i): This metric is subjective, 'representing private information not observable in the dataset but known to the consumers. It quantifies the consumer's personal assessment of their own health status, influencing their preferences for plan generosity. A higher value of e_i indicates a poorer health perception, suggesting that the individual perceives their health status to be worse. Conversely, a lower value signifies a better or more positive (good) health perception.

Although e_i is not directly observable in the data, the individual capitation reflects an average cost for Medicare Part A & B services, tailored to consumers with similar health statuses and demographic characteristics to consumer i. Therefore, we model e_i as following a distribution centered around the capitation k_i, with a variance of σ_τ^2. This approach allows us to infer a consumer's self-assessed health perception based on the capitation, under the assumption that higher capitations are associated with poorer self-assessed health perceptions.

The relationship between the capitation k_i and the self-assessed health perception e_i is formalized as follows:

$$\ln(e_i) = \ln(k_i) + \tau_i, \quad \tau_i \sim N(0, \sigma_\tau^2) \tag{1}$$

Here, τ_i signifies the discrepancy between the observable capitation (reflecting the average cost of care for similar individuals) and the unobservable self-assessed health perception. By employing the logarithmic transformation of e_i and k_i, we ensure that health perception is represented as a positive value, facilitating the interpretation of higher values as indicative

of poorer health perceptions.

5.2 Demand Model

As eligible beneficiaries of the Medicare system, individuals annually decide between two primary types of plans. [1] The first type is the Medicare Advantage (MA) plan, which is designed and offered by private insurance companies. MA plans typically feature lower premiums but offer less generous coverage. The second type, Medigap, is a government-designed plan that acts as a supplement. Unlike MA plans, Medigap plans usually have higher premiums but provide more generous coverage.

It is important to note that consumers' decisions are influenced by their own health perceptions, denoted as e_i (alternatively expressed as $\exp(\ln k_i + \tau_i)$, following our previous distributional assumptions). This factor reflects the consumers' anticipation of their health needs and significantly affects their plan choice.

MA plans are designed and offered by private insurance firms. Depending on the county of residence, consumers typically have access to several MA plans provided by different companies. Generally, the insurance marketplace displays various details about these plans, including monthly premiums and information related to plan generosity, such as copayments, coinsurance, and maximum out-of-pocket costs. To construct a comprehensive measure of plan generosity, we opt for a variable used officially by CMS. Additionally, the marketplace also presents information on the quality of the insurance network, additional benefits, and more.

Here, the choice set for consumers consists of these MA plans in this county and an outside option of Medigap. The utility function of consumer i opting for MA plan j is expressed as:

$$u_{ij} = \beta_i g_j - \alpha_i p_j + \lambda_i^A A_j + \lambda^X X_j + \xi_j + \varepsilon_{ij} \tag{2}$$

The attributes of the insurance plans represented in the utility functions are detailed as follows:

[1] In our model, we specifically categorize the choice as between opting for MA or Traditional Medicare (TM) combined with Medigap. This distinction is intentional: consumers may choose TM without any additional insurance, but this is a rare decision due to TM's low generosity. To enhance coverage, one option is to enroll in supplemental insurance, which generally means choosing Medigap, although it could also include other private insurance types. Enrolling in Medigap requires staying within TM. Alternatively, choosing MA excludes staying in TM, making these options mutually exclusive; consumers can either shift to MA or remain in TM with Medigap.

Medigap, as a supplemental insurance, is government-designed and available in every market, making it the most popular supplemental insurance. Due to data availability, we focus on the most popular Medigap Plan C and TM combination as the outside option during our study period.

- g_j: Represents the generosity measure of plan j, indicating the extent of coverage and benefits provided. A higher value denotes a more generous plan. This measure is constructed using the measurement method officially endorsed by CMS, ensuring consistency and reliability in plan evaluation.

- p_j: Represents the comprehensive annual premium of plan j. This figure aggregates the costs associated with the plan, including the premiums for Medicare Part C (Medicare Advantage) or Medigap, as applicable, along with the mandatory premiums for Medicare Part. It is crucial to note that this total does not encompass the premium for Medicare Part D, thereby focusing on the core coverage components essential to the consumer.

- A_j: Identifies whether plan j is a Medicare Advantage (MA) plan.

- X_j: Captures the exogenous characteristics of plan j, including additional benefits in dental, vision, and hearing, as well as quality and type of the provider network.

- ξ_j: Reflects the unobserved quality of plan j, encompassing aspects of the plan's value not directly captured by the observable attributes. This latent quality factor influences consumer preferences and choices beyond the measurable features.

- ε_{ij}: Represents the idiosyncratic preferences of consumer i towards plan j. Assumed to follow an independent and identically distributed Type 1 Extreme Value (T1EV) distribution, this term captures the unique and unpredictable elements of individual choice behavior.

We incorporate individual heterogeneity into the model to account for variations in consumer preferences based on personal characteristics and socio-economic status. Specifically, the heterogeneity in preferences for plan generosity, premiums, and the type of plan (Medicare Advantage or otherwise) is modeled as follows:

- The heterogeneity in preferences for plan generosity (β_i) is influenced by the consumer's health perception (e_i):

$$\beta_i = \bar{\beta} + \gamma \ln e_i \tag{3}$$

  where e_i is the consumer i's self-assessed health perception (private information). We assume that $\ln e_i \sim N(\ln k_i, \sigma_\tau^2)$.

- The heterogeneity in preferences for plan premiums (α_i) is associated with the consumer's income level:

$$\alpha_i = \bar{\alpha} + \rho^{\text{inc}} \text{inc}_i \tag{4}$$

where inc_i is a dummy variable indicating if the consumer's income is above the Income to Poverty Ratio (IPR) 200% threshold (including spouse's income).

- The heterogeneity in preferences for Medicare Advantage plans (λ_i^A) is related to education, race, and other health plan coverages:

$$\lambda_i^A = \bar{\lambda}^A + \rho^{\text{edu}}\text{edu}_i + \rho^{\text{white}}\text{white}_i + \rho^{\text{Mcd}}\text{Mcd}_i + \rho^{\text{ESI}}\text{ESI}_i \tag{5}$$

where:

- edu_i is a dummy variable indicating if the consumer has a high education level,
- white_i is a dummy variable indicating if the consumer is non-minority (white),
- Mcd_i is a dummy variable indicating if the consumer is covered by Medicaid,
- ESI_i is a dummy variable indicating if the consumer is covered by employer-sponsored insurance (ESI).

The inclusion of these four dummy variables (education, race, Medicaid, and employer-sponsored insurance) is informed by demographic analyses of individuals who opt for MA plans. Statistical averages suggest a correlation between the choice of Medicare Advantage plans and factors such as race and education level. Furthermore, Medicaid targets the underprivileged segments of the population, offering a social welfare safety net, while employer-sponsored insurance (ESI) is typically provided to those still in employment, often ensuring comprehensive coverage. Possessing such coverage could significantly influence preferences for Medicare plans. This selection of variables aims to capture the nuanced effects of socio-economic status and existing health coverage on the preferences for Medicare Advantage versus other options.

Building upon the aforementioned utility function for MA plans, we also define the utility for consumer i when opting for the outside option, which comprises Traditional Medicare (TM) plus Medigap, as follows:

$$u_{i0} = \beta_i g_0 - \alpha_i p_0 + \xi_0 + \varepsilon_{i0} \tag{6}$$

This establishes a basis for comparing the attractiveness of MA plans relative to this outside option. Accordingly, the mean utility difference for an MA plan j, relative to the outside option, can be expressed as:

$$\delta_j = \bar{\beta}(g_j - g_0) - \bar{\alpha}(p_j - p_0) + \bar{\lambda}^A A_j + \lambda^X X_j + \xi_j - \xi_0 \tag{7}$$

Here, δ_j captures the differential in mean utility between plan j and the outside option, anchored at zero for the latter. This differential reflects variations in plan generosity, premiums, exogenous characteristics, and unobserved quality, delineating the comparative appeal of MA plans.

Expanding on this framework, the utility of consumer i for choosing plan j incorporates individual-specific heterogeneities, as detailed below:

$$\begin{aligned} u_{ij} = \delta_j &+ \gamma \ln e_i(g_j - g_0) - \rho^{\text{inc}}\text{inc}_i(p_j - p_0) \\ &+ (\rho^{\text{edu}}\text{edu}_i + \rho^{\text{white}}\text{white}_i + \rho^{\text{Mcd}}\text{Mcd}_i + \rho^{\text{ESI}}\text{ESI}_i)A_j \\ &+ \varepsilon_{ij} \end{aligned} \tag{8}$$

Through this refined specification, we elucidate the complex interplay between plan characteristics and individual preferences, underscoring the dynamic decision-making process of Medicare beneficiaries. The model delineates the likelihood of an individual consumer i selecting plan j, contingent on their expected costs e_i, as follows. This likelihood is encapsulated by a logit choice model, predicated on the assumption that the idiosyncratic taste shocks, ε_{ij}, adhere to a Type 1 Extreme Value (T1EV) distribution:

$$\Pr(j|e_i; X, g, p) = \frac{\exp\big(u_{ij}(e_i; X, g, p)\big)}{\sum_{j'=0}^{J} \exp\big(u_{ij'}(e_i; X, g, p)\big)} \tag{9}$$

Expanding upon this, the model further allows for the expression of this probability in terms of observable factors k_i and unobservable factors τ_i, enhancing the model's applicability:

$$\Pr(j|k_i, \tau_i; X, g, p) = \frac{\exp\big(u_{ij}(k_i, \tau_i; X, g, p)\big)}{\sum_{j'=0}^{J} \exp\big(u_{ij'}(k_i, \tau_i; X, g, p)\big)} \tag{10}$$

Notably, while the priviate information of health perception e_i remains unobservable, our model framework facilitates estimation of plan choice probabilities through the integration over the distribution of τ_i:

$$\Pr_i(j|k_i; X, g, p) = \int_{\tau} \Pr_i(j|k_i, \tau_i; X, g, p) dF_{\tau}(\tau_i) \tag{11}$$

Consequently, demand for plan j, denoted $q_j(X, p)$, is derived as the aggregate of individual choice probabilities, weighted by w_i, the sampling weight of consumer i:

$$q_j(X,p) = \sum_i w_i \cdot \Pr_i(j|k_i;g,p) = \sum_i w_i \cdot \int_\tau \Pr_i(j|k_i,\tau_i;g,p) dF_\tau(\tau_i) \tag{12}$$

This segment of our study introduces a demand model that takes into account the influence of private health perception on consumer choice among Medicare plans. By integrating individual characteristics and perceived health status, the model aims to provide a more nuanced understanding of consumer preferences and decision-making processes. Furthermore, this demand model lays the groundwork for our subsequent analysis of the supply side, specifically how Medicare Advantage (MA) firms can maximize their profits through the mechanism of selection. This foundational understanding of consumer behavior is crucial for exploring the strategic interactions between consumers and MA firms in the health insurance marketplace.

5.3 Supply Model

[This section is currently under development and will be updated with content in due course.]

6 Estimation

6.1 Demand Estimation

Following the two-step estimation approach outlined by Goolsbee and Petrin (2004), our methodology first involves performing a weighted maximum likelihood estimation (MLE) to recover parameters capturing preference heterogeneity and mean utility among consumers. This step is followed by a two-stage least squares (2SLS) regression using instrumental variables (IVs) to estimate the remaining parameters that affect mean utility δ.

In our demand model, initially tailored for single-market analysis, we expand our approach to encompass multiple markets. In the demand estimation, we will use all markets within the sampling scope of the MCBS that offer Medicare Advantage plans. Our dataset encompasses thousands of county-year observations, each providing a rich blend of individual-level data and product-specific information necessary for calculating the probabilities of plan selection.

6.1.1 Consumer Heterogeneity

The first step estimation is formalized as search paramter set ϑ to maximize the weighted log-likelihood function with constriants:

$$\begin{aligned} \max_{\vartheta} & \underbrace{\sum_{m}\sum_{i} w_{mi} \cdot \sum_{j\in\mathcal{J}_m} y_{mij} \times \ln(\Pr_{mi}(j|k_{mi};\vartheta))}_{\text{Weighted log-likelihood}} \\ \text{s.t.} \quad & \underbrace{s_{mj} = \sum_{i} w_{mi} \times \Pr_{mi}(j|k_{mi};\vartheta)}_{\text{Market share matching condition}} \quad \forall j = 1, ...J, \quad \forall m \end{aligned} \tag{13}$$

- w_{mi}: sampling weight for consumer i in market m.
- y_{mij}: indicator for consumer i choosing plan j in market m.
- s_{mj}: observed market share for MA plan j in market m.

The estimation process aims to identify a set of parameters that maximize the likelihood of observed individual plan selections across multiple markets, subject to specific constraints. These constraints require that, for each Medicare Advantage (MA) plan within every market, the model-predicted market shares align with the observed market shares.

The parameter set ϑ encompasses elements that reflect consumer heterogeneity, as detailed in the demand model section, alongside the mean utilities δ_j associated with each

Table 4: Estimation Results of Consumer Heterogeneity

Variable	Parameter	Estimate	Standard Error
Generosity Preference			
Health Perception	γ	0.115	(0.052)
Premium Preference			
High Income	ρ^{inc}	-0.473	(0.248)
MA Type Preference			
High Education	ρ^{edu}	-0.275	(0.203)
White Race	ρ^{white}	-0.173	(0.280)
Medicaid	ρ^{Mcd}	0.039	(0.244)
Employer-Sponsored Insurance	ρ^{ESI}	-2.543	(0.404)
Private Information			
Standard Deviation of HP	σ_τ	3.983	(2.733)

plan. This approach acknowledges the multifaceted nature of consumer preferences and the varying appeal of MA plans.

Addressing the challenge posed by unobservable private information, we employs simulations of individual-specific discrepancies, τ_i, which are presumed to follow a standard normal distribution. This methodology allows for the indirect capture and incorporation of private information into the model, through the estimation of the standard deviation, σ_τ, among other parameters.

Following the estimation results presented in Table 4, we can interpret the parameters within the context of consumer preferences and their heterogeneity in Medicare plan choices.

Firstly, the parameter γ, associated with health perception, is positive and statistically significant, indicating a clear preference trend. A higher value of health perception, which in this context represents a poorer self-assessed health status, is associated with a greater value placed on plan generosity. This result aligns with the intuitive expectation that consumers who perceive their health as poorer are more likely to value plans offering more generous benefits, as they anticipate higher healthcare needs.

The estimation results pertaining to premium preferences and Medicare Advantage (MA) plan types preference reveal distinct influences of demographic and socio-economic factors on plan choice. The parameter ρ^{inc} specifically sheds light on the sensitivity to premium levels among different income groups. The negative estimate associated with high income individuals indicates that wealthier consumers exhibit less sensitivity to plan generosity, attributed to their greater financial capacity to cover higher premiums. This insight underscores the importance of considering income levels in designing insurance products that cater to consumer

affordability and value perception.

Among the socio-economic status indicators, the preference for Medicare Advantage (MA) plans is most significantly influenced by access to Employer-Sponsored Insurance (ESI). The parameter associated with ESI, ρ^{ESI}, shows a notably negative estimate, suggesting that individuals with ESI are significantly less likely to opt for MA plans. This finding aligns with the expectation that ESI, typically a benefit linked to employment and often serving as the primary payer, offers more generous coverage compared to MA plans. Consequently, individuals with ESI have little incentive to enroll in MA, validating our model's prediction through the substantial negative value of ρ^{ESI}.

In this section, out analysis utilizing weighted maximum likelihood estimation and simulation of private information, provides a clear picture of consumer heterogeneity in the Medicare market. The results highlight key trends and preferences among beneficiaries, affirming the importance of accounting for consumer heterogeneity in studying health insurance plan selection.

6.1.2 Plan Mean Utility

Following the examination of consumer heterogeneity and its impact on plan preferences, we now turn our attention to the second component of our demand estimation: the influence of observable plan attributes on plan mean utilities. This part of our analysis seeks to understand how observable plan attributes affect the overall attractiveness of Medicare Advantage plans to beneficiaries.

In our demand model, the expression for mean utility is captured by Equation 7, which encompasses the effects of observable plan characteristics, adjusted for the baseline of outside option (g_0, p_0, ξ_0), and includes the unobserved plan quality ($\xi_j - \xi_0$), leading to potential endogeneity issues.

This endogeneity arises because plan generosity and premiums are endogenous choices made by firms, determined in response to market conditions, strategic considerations, and other unobserved factors. Firms design these attributes with an understanding of consumer preferences and competitive landscapes, which could correlate observable plan features with unobserved plan quality, thereby introducing endogeneity issues into the model.

To address the endogeneity stemming from unobserved plan quality, we introduce an instrumental variable (IV) approach, drawing inspiration from the methodology proposed by Fan (2013). This approach constructs instruments from market-level demographic characteristics to isolate the impact of observable attributes from the confounding effects of unobserved quality.

The detailed exposition of the IV methodology follows,

Table 5: Estimation Results of Plan Mean Utility

Variable	Parameter	Estimate	Standard Error
Mean Preference on			
MA indicator	$\bar{\lambda}^A$	-1.917	(0.224)
Premium	$\bar{\alpha}$	-1.316	(0.354)
Generosity	$\bar{\beta}$	1.006	(0.388)
Network			
Star Rating	-	0.282	(0.028)
HMO	-	0.204	(0.029)
Additional Benefits			
Dental	-	-0.077	(0.033)
Vision	-	-0.015	(0.031)
Hearing	-	0.031	(0.034)

6.2 Supply Estimation

[This section is currently under development and will be updated with content in due course.]

7 Conclusion

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Appendix

A Additional Figures

Table 6: Logistic Regression Results

	Dependent variable:
	MA_next_year
GENHELTH_poor	-0.601^{***}
	(0.167)
log_income	-0.373^{***}
	(0.031)
race_white	-0.401^{***}
	(0.069)
female	-0.033
	(0.046)
age	-0.012^{***}
	(0.003)
edu_high	-0.367^{***}
	(0.049)
Constant	4.675^{***}
	(0.428)
Observations	9,751
Note:	*p<0.1; **p<0.05; ***p<0.01

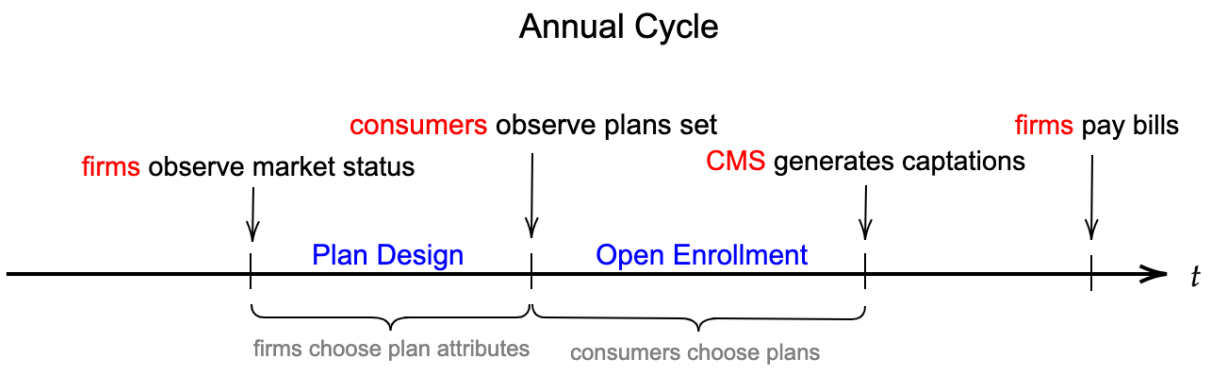


Figure 7: Medicare Plan Enrollment Timeline

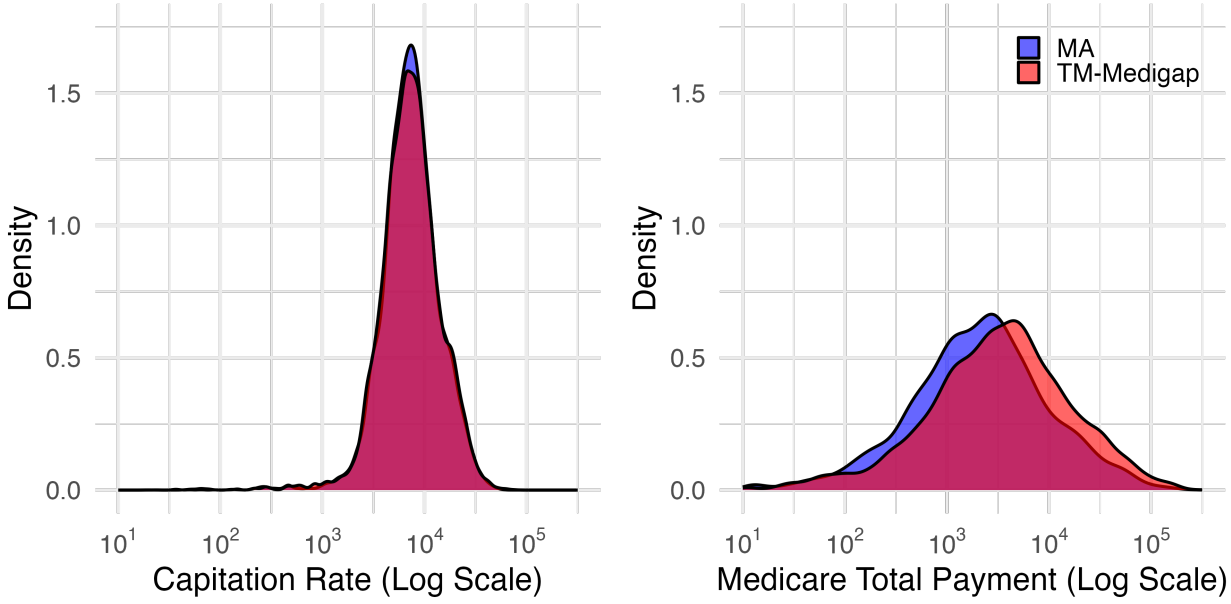


Figure 8: Distribution of Capitation and Payment by Plan Type

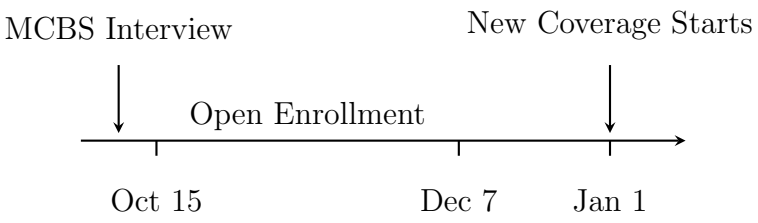


Figure 9: Anuual Timeline

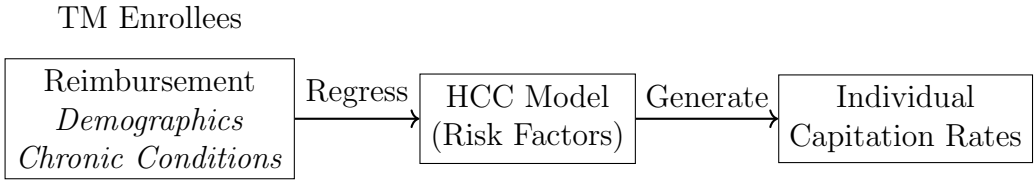
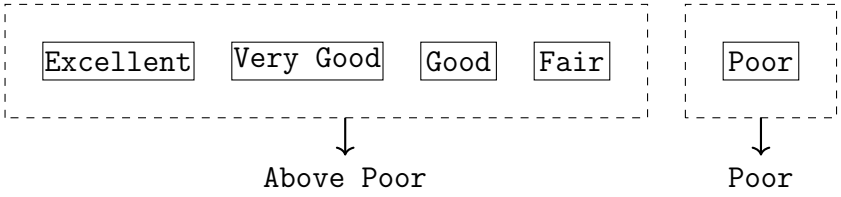
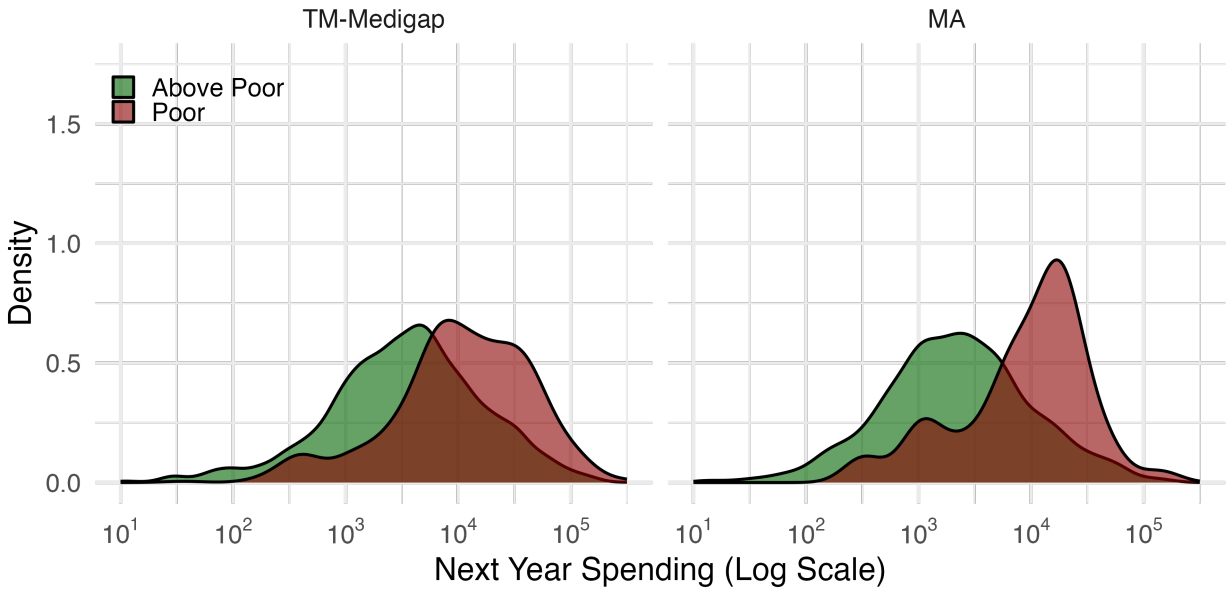
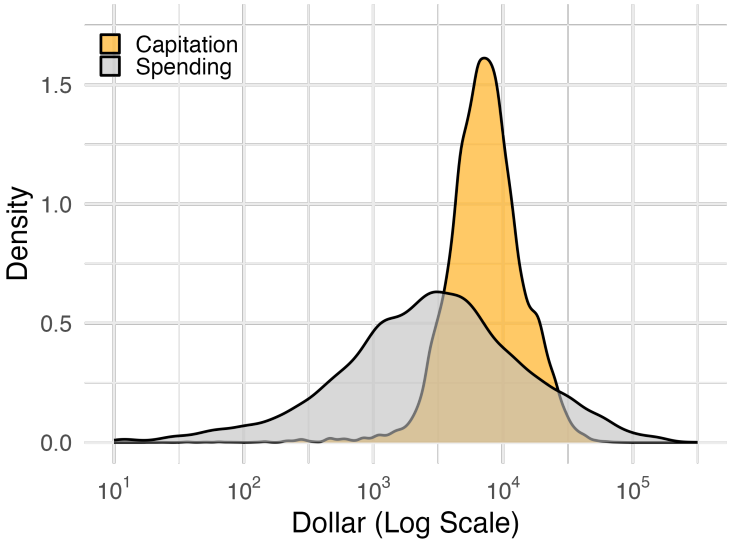


Figure 10: capitation calculation







B Industry Details

[This section is currently under development and will be updated with content in due course.]

C Data Details

C.1 Data Sources

C.1.1 MCBS Data Source

The Medicare Current Beneficiary Survey (MCBS) is a continuous survey of a national sample of Medicare beneficiaries. Our study uses data from 2016 to 2018. The MCBS captures individual-level information about self-reported health status, medical service use, insurance plans, payments, and demographics. More about MCBS can be found on the MCBS website.

The MCBS data from 2016 to 2018 consists of two parts: the Survey File and the Cost Supplement. The Survey File provides demographic characteristics, health status, and healthcare use. The Cost Supplement, on the other hand, focuses on the healthcare expenses of the Medicare population.

C.1.2 Public Data Source

The public datasets used in this study are sourced from various official CMS (Centers for Medicare & Medicaid Services) databases. Most of the data can be directly downloaded via the provided links.

`benefit` MA plan additional benefits. Benefits Data

`contract` Contract and firm information. Monthly Enrollment by CPSC

`enrollment` MA enrollment. Monthly Enrollment by CPSC

`special_plan_enrollment` Enrollment of special plans. Monthly Enrollment by CPSC

`landscape` MA Plan star-ratings. MA Landscape Files

`penetration` Medicare-eligible population. MA State/County Penetration

`ratebook` County benchmark rates. Ratebooks & Supporting Data

`plan_OOP` Official MA Plan generosity measure. OOPC Resources

`Medigap_state_level` Medigap state level data. Medigap State Level

C.2 Data Cleaning

	State	All	MA	Sample		State	All	MA	Sample
1	AK	23	0	0	27	MT	56	39	0
2	AL	67	66	12	28	NC	100	99	22
3	AR	75	75	3	29	ND	53	8	0
4	AZ	15	15	6	30	NE	93	18	0
5	CA	58	39	17	31	NH	10	8	0
6	CO	64	33	7	32	NJ	21	21	14
7	CT	8	8	5	33	NM	33	29	5
8	DC	1	0	0	34	NV	17	10	2
9	DE	3	3	0	35	NY	62	62	26
10	FL	67	66	20	36	OH	88	88	29
11	GA	159	156	18	37	OK	77	61	1
12	HI	5	4	0	38	OR	36	36	1
13	IA	99	91	4	39	PA	67	66	23
14	ID	44	39	0	40	RI	5	5	0
15	IL	102	88	10	41	SC	46	45	6
16	IN	92	92	3	42	SD	65	29	0
17	KS	105	39	3	43	TN	95	92	13
18	KY	120	117	11	44	TX	254	229	33
19	LA	64	63	6	45	UT	29	19	1
20	MA	14	13	6	46	VA	134	132	9
21	MD	24	24	8	47	VT	14	14	1
22	ME	16	16	0	48	WA	39	29	8
23	MI	83	83	28	49	WI	72	71	14
24	MN	87	84	13	50	WV	55	54	7
25	MO	115	110	12	51	WY	23	1	1
26	MS	82	80	1		**Total**	**3136**	**2669**	**409**

Table 7: Sample Markets Summary for 2016

Note: "All" refers to the total number of counties in the state, "MA" denotes the number of counties offering MA options, and "Sample" represents the number of counties covered in the MCBS sample that offer MA options. These counties are included in the estimation sample.

D Risk Adjustment

[This section is currently under development and will be updated with content in due course.]

D.1 HCC Details

D.2 Simulation of HCC Risk Scores Generation

This section details the methodology employed to simulate HCC risk scores for individuals in the MCBS dataset, mimicking the actual process based on regression of FFS reimbursements against chronic conditions and demographic information. The appendix elaborates on the specific data used, the regression model, and the assumptions made to approximate the HCC model within the constraints of available data. Additionally, we present the results of our simulation, providing a foundation for the analysis conducted in the main sections of this study.

E Capitation Rate Calculation

[This section is currently under development and will be updated with content in due course.]