Risk Adjustment, Selection and Plan Design in Medicare Advantage

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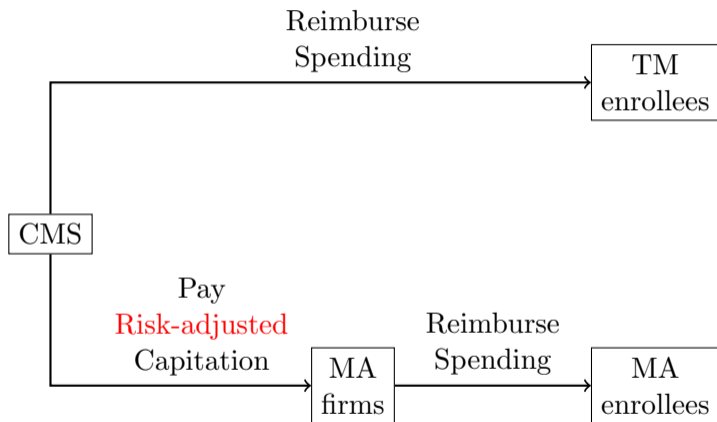# Medicare Market Structure

Consumer Choices

Plan Type	Premium	Generosity	Network Restriction	Additional Benefits
TM+Medigap	High	Good	No	No
MA	Low	Bad	Yes	Yes

Table: Overview of Plan Attributes

▶ MA plans have a one-year term.
▶ During the open enrollment period each year, consumers need to choose their plan for the next year (TM or MA).

Demand Model Objaective

Objective: Explain how consumer heterogeneity influences the plan choice.

Key Assmption: Consumers' subjactive health perception, a private information, impacts their preference for plan generosity.

Construct a model captures the effect of private health perception on plan choice.

Data Source

Time Range: 2016-2018

- **Consumer Data**
  - Medicare Current Beneficiary Survey (MCBS)
  - Individual demographics, plan choices, and chronic conditions, spendings.

- **Plan Data**
  - Multiple Public Datasets
  - Plan attributes and market share information.

Consumer Summary Statistics

Table: Summary Statistics of Consumers by Plan Type (Weighted Average)

	TM	MA	Overall
MA Enrollment	-	-	0.279
Age	73.887	74.283	73.997
Female	0.524	0.557	0.533
Income	70203	50484	64697
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
Medicare:			
Capitation	8913	8847	8894
Spending	8340	6012	7692

Utility Function

Consumer i's utility from plan j (TM+Medigap is outside option)

$$u_{ij} = \beta_i g_j - \alpha_i p_j + \lambda_i^A A_j + \lambda^X X_j + \xi_j + \varepsilon_{ij} \tag{1}$$

- ▶ g_j: generosity
- ▶ p_j: premium
- ▶ A_j: indicator for MA plan type
- ▶ X_j: other observed characteristics
- ▶ ξ_j: unobserved plan quality
- ▶ ε_{ij}: unobserved idiosyncratic perference, assume i.i.d. $\varepsilon_{ij} \sim$ TIEV

Consumer Hetrogeneity

Health perception affects perference for generosity

$$\beta_i = \bar{\beta} + \gamma \ln e_i \tag{2}$$

e_i is unobserved health perception, assume

$$\ln e_i = \ln k_i + \tau_i, \quad \tau_i \sim \mathrm{N}(0, \sigma_\tau^2) \tag{3}$$

where k_i is observed risk-adjusted capitation rate.

Consumer Hetrogeneity

Income level affects perference for premium

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

where inc_i the indicator for high income level.

Education level, race, Medicaid and ESI coverage affects perference for MA

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

Estimation Stragety

Following the two-step estimation approach by Goolsbee and Petrin (2004).

Step 1: Weighted MLE with simulation to estimate unlinear heterogeneity parameters ϑ and mean utilities δ.

Step 2: 2SLS to estimate the linear parameters in $\hat{\delta}$.

Step 1: Weighted MLE

Search for ϑ that solve:

$$\max_{\vartheta} \underbrace{\sum_m \sum_i w_{mi} \cdot \sum_{j \in \mathcal{J}_m} y_{mij} \times \ln(\Pr_{mi}(j|k_{mi};\vartheta))}_{\text{Weighted log-likelihood}}$$

$$\text{s.t.} \quad \underbrace{s_{mj} = \sum_i w_{mi} \times \Pr_{mi}(j|k_{mi};\vartheta)}_{\text{Market share matching condition}} \quad \forall j = 1,...J, \quad \forall m \tag{6}$$

- ▶ w_{mi}: sampling weight for consumer i in market m.
- ▶ y_{mij}: indicator for consumer i choosing plan j in market m.
- ▶ $\Pr_{mi}(j|k_{mi};\vartheta)$: probability for consumer i choosing plan j in market m.
- ▶ s_{mj}: observed market share for plan j in market m.

Step1: Parameters to Estimate

- ▶ ϑ: heterogeneity parameters.
    - ▶ γ: effect of health perception on generosity perference. (from $\beta_i = \bar{\beta} + \gamma \ln e_i$)
    - ▶ ρ^{inc}: effect of high income level on premium perference.
    - ▶ $\rho^{\text{edu}}, \quad \rho^{\text{white}}, \quad \rho^{\text{Mcd}}, \quad \rho^{\text{ESI}}$: effects on MA perference.
    - ▶ σ_τ: standard deviation of unobserved health perception.
- ▶ δ: mean utility of plans.

Step 1: Estimation Result of Consumer Heterogeneity

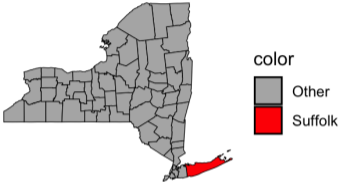| Variable	Parameter	Estimate	Standard Error
Generosity Preference			
Health Perception	γ	0.115	(0.052)
Premium Preference			
High Income	ρ^{inc}	-0.473	(0.248)
MA Type Preference			
High Education	ρ^{edu}	-0.275	(0.203)
White Race	ρ^{white}	-0.173	(0.280)
Medicaid	ρ^{Mcd}	0.039	(0.244)
Employer-Sponsored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

Step 2: IV Construction

Summary: Following Fan (2013), use average demographics of counties where competing plans operate, excluding the target county.

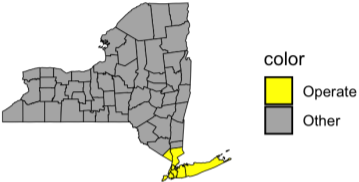e.g. 2018, NY, Suffolk, Plan ID: `H5521-120`, by Aetna
- ▶ This plan is available in an additional 8 counties within New York.
- ▶ Across these counties, there are 21 competing plans.
- ▶ Together, these competing plans operate in 62 New York counties.
- ▶ The average demographics of these 62 counties, excluding Suffolk, are used as the IV.
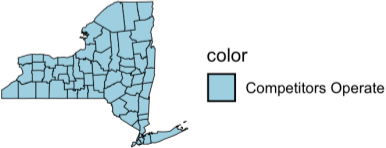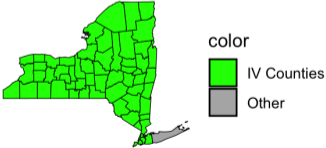
Step 2: IV Construction Example

Step 2: Estimation Results of Mean Utilities

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)

Overview of Supply

- MA firms solve the profit maximization problem through strategic plan design.
- Plan design is selecting premium and generosity for *predetermined set of plans.*
- *predetermined set of plans* means that, except for generosity and premiums, all other plan attributes are already fixed.
- Networks and additional benefits vary across plans, resulting in distinct optimization conditions for each firm.

Thank You!