Health Insurance Market Design

FTC Microeconomics Conference, November 2nd 2017

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Introduction

- Lots of interest has focused on creation and regulation of health insurance markets (exchanges)
    - Affordable Care Act (ACA) in United States (2010)
    - Netherlands (2006), Switzerland (1996), Private market in Germany
    - Private employer exchanges US
- This type of regulated insurance market, termed managed competition, characterized by:
    - Annual policies (in most cases)
    - "Free entry" of insurers
    - Pre-specified financial coverage levels plans can offer (60%, 70%, 80%, 90% in U.S.)
    - Minimum coverage (health conditions included)
    - Restrictions on pricing pre-existing conditions, demographics

- Ongoing work in US congress replacing the ACA
  - (some) relates to market rules
  - proposals by different Republicans
    - Better Way: Paul Ryan, Patient Care Act: Orrin Hatch, Empowering Patients First Act: Thomas Price, Health Care Choice Act: Ted Cruz, Healthcare Accessibility, Empowerment, and Liberty Act: William Cassidy and Peter Sessions
- All proposals include repealing participation mandate
  - mandate intended to prevent market unravelling
  - but perceived as infringing freedom
- Some proposals remove ban on pricing of pre-existing conditions

- Market design (rules) needed to contend with two potential problems:
  - or two risks: i. type (conditions), ii. medical costs given type

1. Reclassification risk (RR)
   1. if health conditions priced
   2. individuals face risk of changing health type
      - leading to potentially high premiums at bad times
2. Adverse section (AS)
   1. if charged average premiums, healthy individuals may opt out, leading to premium increase...
   2. standard Akerlof lemons inefficiency
   3. may even lead to the collapse of the market

- Tension between: AS and RR
- AS can be contended with by pricing of health condition
  - individualized prices (rather than average) can eliminate adverse selection
  - less adverse selection, implies more trade, higher welfare
- But pricing health conditions leads to more premium uncertainty
  - exacerbating RR, lowers welfare
- Relates to notion of insurance
  - two risks

Introduction

Main Economic Issues: Pricing Rules

- Market rules dictate extent of these concerns
- The Affordable Care Act (ACA) went to one extreme
  - banning pricing of health conditions, eliminating RR
- The potential costs of the ban is AS, in terms of:
  - low participation (mitigated by mandate) or
  - (if mandate effective) underinsurance (low coverage)
- Since pricing rules affect AS vs RR trade-off
- Policy question: how costly are AS and RR?
  - where in that trade-off is welfare highest?
  - answer depends on: preferences toward risk and transitions across health types (costs) over time

- Most regulations stipulate one-year contracts
- Longer contracts, as in private German HI market, might improve welfare
- Long-term contracts might:
  - eliminating AS through health based pricing
  - while insuring RR through commitment to future policy terms
- Policy question: are long term contracts welfare improving?
  - answer depends on: preferences toward risk and transitions across health types (costs) over time

Introduction

Main Economic Issues: Repeal and Replace

- All Republican proposals eliminate the mandate
  - there is no penalty for not participating
- Instead they propose:
  - penalties while returning to the market
    - House of Representatives bill: 30% penalty for non-continuous coverage
    - Senate bill penalizes with 6 months exclusion when back
- Both alternatives, to enhance participation, create dynamics:
  - although contracts are yearly
  - current consumer behavior affects future payoffs
  - thus, finding demand and equilibrium, entails a DP problem
- Policy question: which type of penalties performs better?
  - answer depends on: preferences toward risk and transitions across health types (costs) over time

Market Design

Data Requirements for Simulations

- One can simulate equilibria and compute welfare, in all 3 set -ups:
  - one period contracts with different pricing rules
  - one period contracts with rules generating demand dynamics
  - long term contracts
- Data needed:
  - distribution of health types ("health state")
    - distribution of costs given types
  - health state transitions (from year to year)
  - preferences toward risk (parameter)

Data

In the work I will discuss...

- Individual-level panel: provided by large employer (10k emp/25k covered lives) from 2004-2009
  - Plan choices, plan characteristics and consumer demographics
  - Medical claims data (ICD-9 codes) for every person covered in PPO (65%)
    - medical claims reflect health realizations
- Leveraged with: Adjusted Clinical Group (ACG) program:
  - software developed by Johns Hopkins Medical School
  - provides risk score conditional on previous medical claims (ICD-9 codes) and demographics
  - used by insurers for underwriting
  - $\Longrightarrow$we have access to the same information insurers do

Data

- We treat the large employer as the *population* in the exchange
- Having an ACG score for each person, we basically *observe* distribution of risk types
    - the distribution of types is data, rather than estimated
- Use ACG changes over time to estimate health *transitions*
- Estimate distribution of realized medical costs given ACG
    - reflects uncertainty faced by each type
- *Risk preferences*
    - Choice Model in Handel, Hendel, Whinston (2015)
    - Comparable choices in the literature: Collier et al. (2017)

From the Data to the Simulations

Ingredients

- For each person in population we know:
  - risk type (ACG)
  - estimated risk preference (CARA parameter)
  - estimated distribution of costs given ACG (uncertainty faced)
- With: type, uncertainty and risk preferences
  - compute expected utility from an insurance **policy** with Actuarial Value (**AV**) x: $EU_x(ACG)$
- Knowing expected utility, we get willingness to pay for any level of coverage as:
  - e.g., WTP for a 60% policy is: $\theta_{60} = EU_{60}(ACG) - EU_0(ACG)$
- Compute WTP for every person in the population (given their ACG and age)
  - which represents demand for such policy

From the Data to the Simulations

- Final product is a population, with θ for every person and policy of interest
  - treats insurance policy as a financial asset
- Distribution of θ determines:
  - demand
  - costs (given premiums)
- With WTP of every person in population we can simulate
  - static contracts
  - long term contracts
  - dynamic consumer behavior

Population Health Costs

Sample Total Health Expenditure Statistics				
Ages	Mean	S. D.	S. D. of ACG	S. D. around ACG
All	6,099	13,859	6,798	9,228
25-30	3,112	9,069	4,918	5,017
30-35	3,766	10,186	5,473	5,806
35-40	4,219	10,753	5,304	6,751
40-45	5,076	12,008	5,942	7,789
45-50	6,370	14,095	6,874	9,670
50-55	7,394	15,315	7,116	11,092
55-60	9,175	17,165	7,414	13,393
60-65	10,236	18,057	7,619	14,366

Population Health States

AGE:			Health States:				
	1	**2**	**3**	**4**	**5**	**6**	**7**
25-30	0.49	0.19	0.14	0.07	0.04	0.03	0.04
30-35	0.41	0.18	0.13	0.08	0.06	0.06	0.07
35-40	0.27	0.30	0.13	0.06	0.09	0.07	0.09
40-45	0.19	0.28	0.16	0.09	0.12	0.08	0.10
45-50	0.01	0.15	0.32	0.15	0.13	0.12	0.12
50-55	0.00	0.10	0.25	0.19	0.15	0.16	0.15
55-60	0.00	0.01	0.01	0.25	0.24	0.28	0.22
60-65	0.00	0.00	0.00	0.18	0.24	0.26	0.31

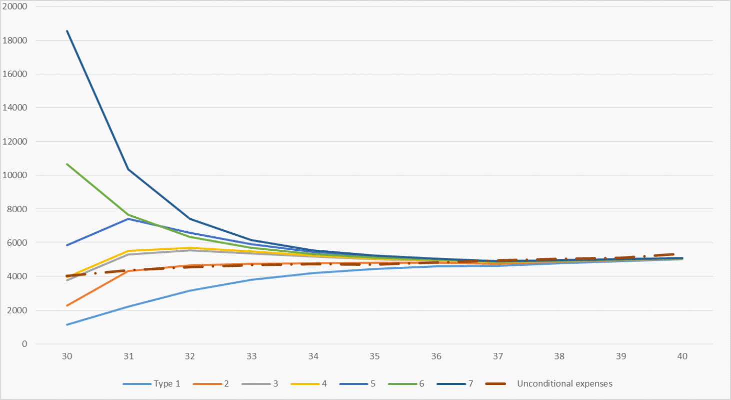
Health State Transitions: 30-35 year olds

		λ_{t+1}						
		1	**2**	**3**	**4**	**5**	**6**	**7**
	$\lambda_t = \mathbf{1}$	0.72	0.13	0.05	0.05	0.02	0.01	0.03
	$\lambda_t = \mathbf{2}$	0.35	0.25	0.12	0.11	0.04	0.03	0.11
λ_t	$\lambda_t = \mathbf{3}$	0.15	0.23	0.19	0.15	0.10	0.08	0.10
	$\lambda_t = \mathbf{4}$	0.20	0.08	0.12	0.24	0.18	0.12	0.08
	$\lambda_t = \mathbf{5}$	0.10	0.10	0.05	0.20	0.20	0.20	0.15
	$\lambda_t = \mathbf{6}$	0.16	0.11	0.14	0.11	0.08	0.22	0.19
	$\lambda_t = \mathbf{7}$	0.11	0.11	0.07	0.04	0.11	0.20	0.37

Health State Transitions: 50-55 year olds

		λ_{t+1}						
		1	**2**	**3**	**4**	**5**	**6**	**7**
	$\lambda_t = \mathbf{1}$	0.67	0.15	0.10	0.02	0.02	0.01	0.03
	$\lambda_t = \mathbf{2}$	0.25	0.37	0.20	0.09	0.04	0.02	0.04
λ_t	$\lambda_t = \mathbf{3}$	0.09	0.21	0.21	0.20	0.12	0.10	0.08
	$\lambda_t = \mathbf{4}$	0.10	0.19	0.26	0.12	0.10	0.19	0.05
	$\lambda_t = \mathbf{5}$	0.09	0.19	0.14	0.15	0.10	0.19	0.15
	$\lambda_t = \mathbf{6}$	0.00	0.09	0.13	0.09	0.19	0.23	0.28
	$\lambda_t = \mathbf{7}$	0.03	0.10	0.10	0.10	0.21	0.16	0.29

Health State Persistence starting at age 30



- We need a solution concept to predict outcomes under different market rules
- For example, in the context of static contracts we used Riley equilibrium
    - think of breaking-even premiums
- In the context of long term contracts, we find competitive equilibria
    - optimal contracts subject to break even and lapsation constraints

PART I

One-period Contracts: Pricing Rules

Part I: One-Period Contracts

Handel, Hendel and Whinston (2015)

- We find that markets fully unravel if only age is priced
  - like in the ACA
- We estimated: cost of AS (namely, of underinsurance) under Obamacare (ACA) is about $600 per person/year
- If health conditions are priced
  - trade increases, some individuals get high level of coverage (90% Actuarial Value)
  - so AS is reduced (but in a very limited way)
- Downside: premiums become uncertain (over time), creating RR
  - although AS is reduced, welfare declines as more conditional priced
  - we find the risk associated with uncertain premium is a lot more costly
- Take away: ACA did well banning pricing of health conditions
  - less costly to suffer AS than RR

Part I: One-Period Contracts

Handel, Hendel and Whinston (2015)

	Q1	Q2	Q3	Q4
Ages	Share 90	Share 90	Share 90	Share 90
All	**35.2**	**0**	**0**	**0**
25-29	63	25	0	0
30-34	63	42	0	0
35-39	52	50	0	0
40-44	38	0	0	0
45-49	63	18	0	0
50-54	27	0	0	0
55-59	33	0	0	0
60-65	0	0	0	0

PART II

Long-Term Contracts

Part II: Long Term contracts: One Sided Commitment

Handel, Hendel and Whinston (2017)

- Firms can offer long term contracts
  - like in German private health insurance market or US life insurance
- Consumers can lapse any time, without termination fees
- Competitive equilibrium maximizes consumer welfare, breaking even ex-ante
  - offering contracts that are "lapsation-proof"

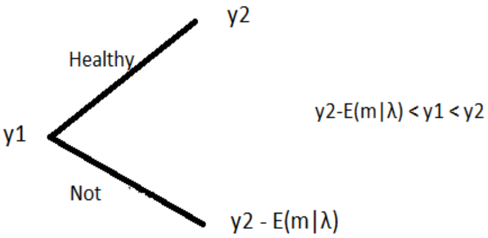
Part II: Long Term contracts: One Sided Commitment

Why one sided commitment?

- Legal reasons only one-sided feasible
- Why is it an interesting case?
  - first impression is that, when insurers can commit they will promise coverage to fully insure risk of developing a condition
  - solving reclassification risk concern
  - why wouldn't they fully insure risk averse buyers if they can commit to do so?
- Turns out: consumer inability to commit compromises insurance
  - we can see it in the simplest set-up in next figure

Simplest Example

One Sided Commitment: 2 periods, 2 (second period) states



Model

Handel, Hendel and Whinston (2017): Set up

- T periods, $U = \mathbb{E}\left[\sum_t \delta^t u(c_t)\right]$
  - $T = 40$, from age 25 to 65 (Medicare)
- Individual income in period t: y_t
- Health state λ_t (ACG), summarizes expected health costs, $\mathbb{E}[m_t|\lambda_t]$
- Health expenses m_t and λ_{t+1} determined by density $f_t(m_t, \lambda_{t+1}|\lambda_t)$
  - the transitions just showed you
- Symmetric learning:
  - m_t and λ_t observed by consumers and firms
- We assume industry is competitive, firms risk neutral, discount factor δ, capital market frictions

Health State Transitions: 30-35 year olds

		λ_{t+1}						
		1	**2**	**3**	**4**	**5**	**6**	**7**
	$\lambda_t = \mathbf{1}$	0.72	0.13	0.05	0.05	0.02	0.01	0.03
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	$\lambda_t = \mathbf{7}$	0.11	0.11	0.07	0.04	0.11	0.20	0.37

Equilibrium Contracts

Predictions

- Optimal contract offers a minimum guaranteed consumption level
- Guarantee is bumped up to match outside offers after good news
- New guaranteed consumption level is the first-period consumption of an optimal contract that would start at that date and state λ_t
- Optimal contracts equate $u'(c)$ only across states with no outside offers (bad states)
- Consumption guarantee parallels downward rigid wages in Harris and Holmstrom (1982)

Elements from Data

Simulating Equilibrium Contracts and Welfare

- The key ingredients are: health status and transitions over time, risk preferences
- Age dependent annual transitions across a 7 health-state partition (using 5-year bins)
- We use estimated risk preferences from HHW (2015) choice model: CARA with population mean $\gamma_j = 4.39 * 10^{-4}$
- $\delta = 0.975$

- With those parameters, find optimal contracts, and welfare

Results: Welfare

- For each contracting scenario X and income profile we find a constant certainty equivalent CE_X
  - $C^{*\square}_{NB}$ = full insurance of m and λ (medical and RR), no borrowing
  - CE_S = unregulated market (health conditions priced)
  - CE_D = dynamic contracts (one-sided commitment)
  - CE_{ACA} = ACA (60% coverage policies with deductible and OOP max)

- CE_X = dollar equivalent of utility in regime x

Risk Aversion:

CARA coeff 0.00008

	Certainty Equivalent			
Income	C^{*}_{NB}	CE_S	CE_D	CE_{ACA}
Flat-net	53.67	52.47	53.62	52.85
Manager	47.20	46.41	46.94	46.80

Switching Costs

Welfare Impact: CARA coeff 0.0004

Switching Cost		Flat-net	Manager
D		52.76	34.10
$1,000$		52.95	34.95
$5,000$		53.39	36.92
$10,000$		53.58	38.82
C^{*}□		53.67	37.93

PART III

One-period contracts: Republican's Reform

Part III: Republican Reform

Static Contracts with Consumer Dynamics

- Ghili, Hendel and Whinston (2017) go back to static contracts
  - firms offer one-period contracts
  - with no pricing of health conditions
  - but penalties for lack of continuous coverage
- Simulate:
  - House of Representatives proposal: 30% premium increase for returning buyers
  - Senate proposal: 6 months without coverage, $EU_0(ACG)$
- Unlike the mandate, both options generate consumer dynamics

Part III:
Consumer Problem

- Given a vector of premiums $\mathbf{p} = \{p_a\}$ for ages $a = 25, ..., 64$.
- The value for an age a consumer with current type λ (ACG) is:

$$
\begin{aligned}
V_a(\lambda, \gamma, 0|\mathbf{p}) \quad = \quad & \max\{\ E_0(u_\gamma(c)|\lambda) - \phi_0 + \beta E(V_{a+1}(\lambda', \gamma, 0|\mathbf{p})|\lambda)\ , \\
& E_H(u_\gamma(c)|\lambda) - p_a - \phi_R + \beta E(V_{a+1}(\lambda', \gamma, 1|\mathbf{p})|\lambda)\ \}
\end{aligned}
$$

and

$$
\begin{aligned}
V_a(\lambda, \gamma, 1|\mathbf{p}) \quad = \quad & \max\{ E_0(u_\gamma(c)|\lambda) - \phi_0 + \beta E(V_{a+1}(\lambda', \gamma, 0|\mathbf{p})|\lambda)\ , \\
& E_H(u_\gamma(c)|\lambda) - p_a + \beta E(V_{a+1}(\lambda', \gamma, 1|\mathbf{p})|\lambda)\ \}
\end{aligned}
$$

-
  - where $E(V_{a+1}(\lambda', \gamma, 1|\mathbf{p})|\lambda)$ is the expectation wrt future type λ' given current type λ.
  - $\chi = 0$ means out of market, $1 =$ in.
  - ϕ is the penalty for returning to the market

Part III:
Equilibrium premiums

- For a given $\mathbf{p}$ we find $V_a(\lambda, \chi|\mathbf{p})$
- $V_a(\lambda, \chi|\mathbf{p})$ and $\mathbf{p}$ determine participation and insurer's cost for every a
- Update $\mathbf{p}$ such that insurers break for every a
- Update $V_a(\lambda, \chi|\mathbf{p})$ for new $\mathbf{p}$
- Iterate
    - not a contraction, need not converge, it did so far
- Equilibrium involves: consumers optimizing and firms breaking even

Equilibrium Participation: Preliminary Numbers

	Static, penalty =		House	Senate
Age	$0	$400	30%	Year out
25 – 29	0.17	0.18	0.19	1.00
30 – 34	0.20	0.20	0.21	1.00
35 – 39	0.28	0.28	0.30	1.00
40 – 44	0.32	0.33	0.34	1.00
45 – 49	0.37	0.37	0.39	1.00
50 – 54	0.44	0.44	0.47	0.99
55 – 59	0.48	0.48	0.51	0.97
60 – 64	0.57	0.57	0.59	0.75

Concluding Remarks

- Plenty can be simulated
- Treating health insurance policies as financial instruments
    - non-financial components can be accommodated
- Using data firms are increasingly willing to share (e.g., Alcoa, Microsoft)
- Ideally, governments would be willing to collect and share
- ACG software extremely useful
    - replacing parametric assumptions in prior literature with data
    - same data/information used by market participants