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)
   - if health conditions priced
   - individuals face risk of changing health type
     - leading to potentially high premiums at bad times

2. Adverse selection (AS)
   - if charged average premiums, healthy individuals may opt out, leading to premium increase...
   - standard Akerlof lemons inefficiency
   - 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
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
  - 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*
  - 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) \( x \times EU_x(ACG) \)

- 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
Final product is a population, with $\theta$ for every person and policy of interest
- treats insurance policy as a financial asset

Distribution of $\theta$ 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

<table>
<thead>
<tr>
<th>Ages</th>
<th>Mean</th>
<th>S. D.</th>
<th>S. D. of ACG</th>
<th>S. D. around ACG</th>
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## Population Health States

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## Health State Transitions: 30-35 year olds

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<th>6</th>
<th>7</th>
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<tr>
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<td>0.08</td>
<td>0.12</td>
<td>0.24</td>
<td>0.18</td>
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<td>0.08</td>
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<td>0.37</td>
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Health State Transitions: 50-55 year olds

<table>
<thead>
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<tr>
<td>$\lambda_t = 3$</td>
<td>0.09</td>
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<tr>
<td>$\lambda_t = 4$</td>
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<td>$\lambda_t = 5$</td>
<td>0.09</td>
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<tr>
<td>$\lambda_t = 6$</td>
<td>0.00</td>
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<tr>
<td>$\lambda_t = 7$</td>
<td>0.03</td>
</tr>
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</table>
• 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)

<table>
<thead>
<tr>
<th>Ages</th>
<th>Q1 Share 90</th>
<th>Q2 Share 90</th>
<th>Q3 Share 90</th>
<th>Q4 Share 90</th>
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<td>35-39</td>
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<td>40-44</td>
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<tr>
<td>45-49</td>
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<tr>
<td>50-54</td>
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PART II

Long-Term Contracts
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

\begin{align*}
\text{Healthy} & \quad y_2 \\
\text{Not} & \quad y_2 - \mathbb{E}(m|\lambda) < y_1 < y_2 \\
y_1 & \\
y_2 - \mathbb{E}(m|\lambda)
\end{align*}
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 $\lambda_t$ (ACG), summarizes expected health costs, $\mathbb{E}[m_t | \lambda_t]$

- Health expenses $m_t$ and $\lambda_{t+1}$ determined by density $f_t(m_t, \lambda_{t+1} | \lambda_t)$
  - the transitions just showed you

- Symmetric learning:
  - $m_t$ and $\lambda_t$ observed by consumers and firms

- We assume industry is competitive, firms risk neutral, discount factor $\delta$, capital market frictions
## Health State Transitions: 30-35 year olds

<table>
<thead>
<tr>
<th>$\lambda_t$</th>
<th>$\lambda_{t+1}$</th>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
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<th>7</th>
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<td>$\lambda_t = 1$</td>
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<td>0.13</td>
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<td>0.11</td>
<td>0.20</td>
<td>0.37</td>
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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 $\lambda_t$
- 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)
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 $\gamma_j = 4.39 \times 10^{-4}$

$\delta = 0.975$

With those parameters, find optimal contracts, and welfare
Results: Welfare

For each contracting scenario $X$ and income profile we find a constant certainty equivalent $CE_X$

- $C_{NB}^*$ = full insurance of $m$ and $\lambda$ (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

<table>
<thead>
<tr>
<th>Income</th>
<th>$C_{NB}^*$</th>
<th>$CE_S$</th>
<th>$CE_D$</th>
<th>$CE_{ACA}$</th>
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<tr>
<td>Manager</td>
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<td>46.94</td>
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Switching Costs

Welfare Impact: CARA coeff 0.0004

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<td>$C^*$</td>
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PART III

One-period contracts: Republican’s Reform
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 \( p = \{p_a\} \) for ages \( a = 25, \ldots, 64 \).
- The value for an age \( a \) consumer with current type \( \lambda \) (ACG) is:

\[
V_a(\lambda, \gamma, 0|p) = \max \{ E_0(u_\gamma(c)|\lambda) - \phi_0 + \beta E(V_{a+1}(\lambda', \gamma, 0|p)|\lambda), \\
E_H(u_\gamma(c)|\lambda) - p_a - \phi_R + \beta E(V_{a+1}(\lambda', \gamma, 1|p)|\lambda) \}
\]

and

\[
V_a(\lambda, \gamma, 1|p) = \max \{ E_0(u_\gamma(c)|\lambda) - \phi_0 + \beta E(V_{a+1}(\lambda', \gamma, 0|p)|\lambda), \\
E_H(u_\gamma(c)|\lambda) - p_a + \beta E(V_{a+1}(\lambda', \gamma, 1|p)|\lambda) \}
\]

- where \( E(V_{a+1}(\lambda', \gamma, 1|p)|\lambda) \) is the expectation wrt future type \( \lambda' \) given current type \( \lambda \).
- \( \chi = 0 \) means out of market, \( 1 = \text{in} \).
- \( \phi \) is the penalty for returning to the market.
Part III: Equilibrium premiums

- For a given \( p \) we find \( V_a(\lambda, \chi|p) \)
- \( V_a(\lambda, \chi|p) \) and \( p \) determine participation and insurer’s cost for every \( a \)
- Update \( p \) such that insurers break for every \( a \)
- Update \( V_a(\lambda, \chi|p) \) for new \( p \)
- Iterate
  - not a contraction, need not converge, it did so far

Equilibrium involves: consumers optimizing and firms breaking even
## Part III:
Equilibrium Participation: Preliminary Numbers

<table>
<thead>
<tr>
<th>Age</th>
<th>Static, penalty =</th>
<th>House</th>
<th>Senate</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0</td>
<td>$400</td>
<td>30%</td>
<td>Year out</td>
</tr>
<tr>
<td>25 – 29</td>
<td>0.17</td>
<td>0.18</td>
<td>0.19</td>
</tr>
<tr>
<td>30 – 34</td>
<td>0.20</td>
<td>0.20</td>
<td>0.21</td>
</tr>
<tr>
<td>35 – 39</td>
<td>0.28</td>
<td>0.28</td>
<td>0.30</td>
</tr>
<tr>
<td>40 – 44</td>
<td>0.32</td>
<td>0.33</td>
<td>0.34</td>
</tr>
<tr>
<td>45 – 49</td>
<td>0.37</td>
<td>0.37</td>
<td>0.39</td>
</tr>
<tr>
<td>50 – 54</td>
<td>0.44</td>
<td>0.44</td>
<td>0.47</td>
</tr>
<tr>
<td>55 – 59</td>
<td>0.48</td>
<td>0.48</td>
<td>0.51</td>
</tr>
<tr>
<td>60 – 64</td>
<td>0.57</td>
<td>0.57</td>
<td>0.59</td>
</tr>
</tbody>
</table>

Igal Hendel (Northwestern University)
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