Reclassification Risk in the Small Group Health Insurance Market

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A very important issue in designing markets for health insurance is reclassification risk

- Occurs when an adverse and persistent health shock leads to higher future premiums or worse coverage

Reclassification risk can lead to insurance market failure

- Limits long-run risk protection from insurance

A main goal of 2010 Affordable Care Act (ACA) is to reduce reclassification risk

- Principally through community rating provisions
- These exist for both individual and small group markets
We consider reclassification risk in the small group health insurance market

- Provides insurance to employers with 2-50 employees
- 18 million subscribers and $100 billion in revenue in 2013

Reclassification risk potentially very salient here:

- Consider individual at an employer with 5 employees
- Suppose individual or her co-worker is diagnosed with diabetes with an expected cost of $25,000 per year going forward
- A market that passes through risk to the employer will increase premiums by $25,000
- This will cost individual $5,000 per year in extra charges
Reclassification risk prior to ACA

- How much reclassification risk existed in small group market before the ACA?
  - On one hand, influential studies have documented substantial variation in premiums
    - Cutler (1994), Cebul et al. (2011), Bundorf et al. (2012)
    - A plausible cause of this premium variation is reclassification risk, from employers with higher health risk facing higher premiums (Gruber, 2000)
  - On the other hand, findings of low correlation between premiums and health risk
    - Using survey data, Pauly and Herring (1999) find this in both individual and small group plans
    - Herring and Pauly (2006) attribute this to market providing reclassification risk protection
    - Posit “guaranteed renewability” contracts that don’t increase rates when health risk increases
  - Thus, overall there are mixed findings here and more evidence is needed
    - Better understanding of reclassification risk in this market is important
    - Particularly true given centrality of reclassification risk reduction to ACA (and importance of ACA)
Goals of this paper

1. To examine extent of reclassification risk in the small group market
2. To evaluate the mechanisms underlying the reclassification risk that we find
3. To understand the welfare consequences of alternate pricing policies relative to current environment

We make use of a unique dataset on the small group market:

- Data provided to us by a large health insurer, which we refer to as “United States Insurance Company” (USIC)
- We have a four-year panel of USIC claims and premiums for 10 states
- Unique access to large dataset on the small group market
Overview of paper

- We develop a simple model of insurance in the small group market
  - Model shows that the welfare loss from reclassification risk is increasing in pass-through from health risk to premiums
  - Estimate pass through coefficient as a “sufficient statistic” (Chetty, 2008, 2009; Einav et al. 2010)
  - We don’t estimate structural model

- Evaluate reclassification risk by estimating pass-through from changes in health risk at an employer to changes in per-enrollee premiums
  - Our estimation controls for selection in and out of small group insurance

- We consider whether guaranteed renewability contracts with liquidity constraints can explain our findings

- We simulate counterfactuals with community rating and full experience rating
Relation to literature

- Paper builds on substantial literature that analyzes reclassification risk:
  - Buchmueller and DiNardo (2002) consider impact of community rating on adverse selection
  - Cutler and Reber (1998), Bundorf et al. (2012), Einav et al. (2010), and Kowalski (2015) study reclassification risk among employees with multiple plans at an employer

- And, guaranteed renewability contracts:
  - Pauly et al. (1995) discuss guaranteed renewability contracts in theory
  - Atal et al. (2019) analyze guaranteed renewability contracts in Germany
  - Ghili et al. (2019) consider optimal guaranteed renewability contracts with liquidity constraints

- Our unique data add value here
  - We can understand the extent of reclassification risk in the real world
  - We also test whether our findings can be explained by guaranteed renewability contracts
Remainder of talk

1. Model
2. Data
3. Empirical Approach
4. Results
5. Counterfactuals
6. Conclusion
Model

- Simple and stylized model of reclassification risk, pricing, and selection in health insurance industry
  - Two time periods, periods $t = 1, 2$; discount factor $\delta$
  - Period represents a year, typical length of a health insurance contract
  - Empirical work extends beyond two years
- Index enrollees by $i$ and employer by $j$
- Potential enrollees start each period with a risk score, $r_{ijt}$
  - Score is observable based on lagged claims data
  - Leads to health shock $H$ with distribution $dF_H(r_{ijt})$
  - Proportional to expected insured costs, $E[c_{ins}(H)] = \gamma r_{ijt}$
- Employer has mean risk score over its population, $R_{jt} = \frac{1}{I_j} \sum_{i=1}^{I_j} r_{ijt}$
- Insurer sets per-person premium based on employer history and score, $p_{jt}(R_{jt})$
- Employers then decide on whether to offer insurance to potential enrollees
- Potential enrollees then decide on take-up
Per-period utility of potential enrollee

- Assume utility is additively separable across periods
- Per-period utility from obtaining insurance (if offered):
  - Function of income $Y_{ijt}$, premium, and out-of-pocket (oop) costs:
    \[
    U^A_{ij}(r_{ijt}, p_{jt}(R_{jt})) = \int u_{ij} \left[ Y_{ijt} - p_{jt}(R_{jt}) - c^{oop}(H) \right] dF_H(r_{ijt})
    \]
    where $c^{oop}$ is out-of-pocket costs
  - We assume that $u_{ij}$ exhibits risk aversion
  - Enrollee pays full $p_{jt}$ through premiums or wage changes
- Per-period utility from not obtaining insurance:
  \[
  U^N_{ij}(r_{ijt}) = \int u_{ij} \left[ Y_{ijt} - c(H) \right] dF_H(r_{ijt})
  \]
  where $c$ is full costs
- Per-period utility overall (if offered insurance):
  \[
  U_{ij}(r_{ijt}, p_{jt}(R_{jt})) = \max \{ U^A_{ij}(r_{ijt}, p_{jt}(R_{jt})), U^N_{ij}(r_{ijt}) \}
  \]
Discounted total value of potential enrollee

- We can write the value function (which accounts for reclassification risk):

\[
V(\vec{r}_{j1}, i) = U_{ij}(r_{ij1}, p_{jt}(R_1)) + \delta \int U_{ij}(r_{ij2}, p_{jt}(R_{j2}))dF_{R,r}(R_{j2}, r_{ij2}|\vec{r}_{j1})
\]

(where \(\vec{r}_{j1}\) is vector of individual risks and \(dF_{R,r}(R_{j2}, r_{ij2}|\vec{r}_{j1})\) is conditional risk score distribution)

- Individuals may face reclassification risk
  - Bad health shock for self or coworker may increase \(R_{j2}\)
  - This may in turn raise premiums \(p_{j2}\)

- Enrollee reclassification risk depends on:
  1. Distribution of employer mean risk score
     - With lots of enrollees, low risk
  2. Pass-through from \(R_{j2}\) to \(p_{j2}\)
     - With community rating, this pass through will be zero

- Individuals in small risk pools without community rating—i.e., people in our sample—may bear a lot of reclassification risk
Full experience rating case

- Consider now the case where all enrollees take up insurance
- Full experience rating implies that:

\[ p_{jt}(R) = E[c(R)] = \gamma R_{jt} \]

(for ease of notation, assume that \( c^{oop} = 0 \))

- The discounted total value (with take-up) is:

\[ V_{ij}(\vec{r}_{j1}) = U_{ij}^A(\gamma R_{j1}) + \delta \int U^A(\gamma R_{j2})dF_R(R_{j2}|\vec{r}_{j1}) \]

- In this case, enrollees are faced with reclassification risk
  - Insurer increases period 2 premium by the increase in risk
  - Purchasing health insurance each year would not solve this problem
Long term contracts

Now consider a binding two-period contract with:

1. $p_{j1} = \gamma R_{j1}$
2. $p_{j2} = \gamma E[R_{j2} | \vec{r}_{j1}]$

Given risk averse individuals (as in CARA):

$$\int U_{ij}^A(\gamma R_{j2}) dF_R(R_{j2} | \vec{r}_{j1}) < U_{ij}^A(\gamma E[R_{j2} | \vec{r}_{j1}])$$

i.e. expected utility lower than utility of expectation

Suppose further that income and risk are the same across periods

- Above contract would maximize utility $U^A$ over break-even contracts
- Competitive insurance industry with binding long-run contracts would have these contracts

Long-run contracts are somewhat like community rating:

- No pass through from health risk to premiums
- However, initial premiums might vary based on employer characteristics
General case: different levels of pass through

Now consider a simple functional form for premiums:

\[ p_{jt} = c_{jt} + \beta R_{jt} \]

- \( \beta = \gamma \) ⇒ full experience rating
- \( \beta < \gamma \) ⇒ incomplete pass through
- \( \beta = 0 \) ⇒ community rating or binding two-period contracts

- \( c_{jt} \) reflects baseline prices at period \( t \), e.g. from healthcare costs

- Note that if \( \beta' < \tilde{\beta} \), then

\[ \int U_{ij}^A(Y_{ij2} - p_{j2} - c - \tilde{\beta}(R_{j2} - E[R_{j2}|\vec{r}_{j1}]))dF_R(R_{j2}|\vec{r}_{j1}) < \int U_{ij}^A(Y_{ij2} - p_{j2} - c - \beta'(R_{j2} - E[R_{j2}|\vec{r}_{j1}]))dF_R(R_{j2}|\vec{r}_{j1}) \]

where \( c_{jt} = c + \tilde{\beta}E[R_{j2}|\vec{r}_{j1}] \) or \( c + \beta'E[R_{j2}|\vec{r}_{j1}] \) (across cases)

- Implication: \( \beta \) is a sufficient statistic for welfare from contract
How much pass through should we expect in our data?

- A competitive market where multi-period contracts are banned will have $\beta = \gamma$
- Insurers that can commit to multi-period contracts can create value with a high $c$ and a low $\beta$
  - But, very difficult to enforce enrollee commitment to multi-period contracts
- One-sided commitment may have existed during our sample (Pauly and Lieberthal, 2008)
  - In these contracts, insurers commit but enrollees can lapse
  - Competitive insurance market with one-sided commitment will result in these commitment contracts (Harris and Holmström, 1982)
  - Optimal one-sided commitment (or guaranteed renewability) contracts have low $\beta$ (Ghili et al., 2019)
- One-sided commitment contracts don’t solve problem of new accounts
  - We would expect a higher $\beta$ in cross-sectional regressions than in pass through regressions
Selection from offer and take-up decisions

- Employers observe premiums and decide whether to offer insurance.
- If offered, enrollees then decide whether to take-up insurance.
- The offer/take-up decision at period \( t \) is given by:

\[
D_{ijt} = \mathbb{I}\{f(R_{jt}, r_{ijt}, x_{ijt}) + \varepsilon_{ijt}^s > 0\}
\]

where \( f(\cdot) \) is a flexible mean utility function to be estimated.

- The premiums that an enrollee faces at period \( t \) are:

\[
p_{ijt} = c_{jt} + \beta R_{jt} + \varepsilon_{ijt}^p
\]

(where \( p \) is now indexed by ‘i’).

- We allow for correlations between \( \varepsilon_{it}^s \) and \( \varepsilon_{it}^p \).
  - Expect negative correlation between premium and selection unobservables.
- Our data contain premiums for potential enrollees who take up insurance.
  - We use semi-parametric controls for selection.
Overview of main data

- We use data from large insurer, USIC
  - Data from 10 states: AR, DE, IL, PA, OK, MO, TN, TX, WI, WY

- Enrollee-level data: linked claims data from 2012-14

- Employer-level data: Premium and enrollment data from 2013-15

- For years and states in our data, relatively few pricing regulations
  - Community rating regulations under ACA technically started in 2014, but were minimal then

- Calculate 2013, 2014 and 2015 risk score from 2012, 2013, 2014 data respectively:
  - Use ACG methodology developed by Johns Hopkins
  - ACG risk score predicts relative current year expected health expenditure given lagged claims and expenditures
States in our estimation sample
### Descriptive statistics on estimation sample

<table>
<thead>
<tr>
<th></th>
<th>Full Sample</th>
<th>Stayers</th>
<th>Joiners</th>
<th>Quitters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: Enrollee-year level</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Unique individuals</td>
<td>336,755</td>
<td>80,031</td>
<td>87,107</td>
<td>113,124</td>
</tr>
<tr>
<td>Observations</td>
<td>646,904</td>
<td>240,093</td>
<td>176,163</td>
<td>186,012</td>
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<tr>
<td>Conditions (%)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Acute myocardial infarction</td>
<td>0.16</td>
<td>0.16</td>
<td>0.16</td>
<td>0.17</td>
</tr>
<tr>
<td>Cancer</td>
<td>2.47</td>
<td>2.57</td>
<td>2.03</td>
<td>2.60</td>
</tr>
<tr>
<td>Hypertension</td>
<td>14.12</td>
<td>14.64</td>
<td>12.26</td>
<td>14.55</td>
</tr>
<tr>
<td>Diabetes</td>
<td>5.57</td>
<td>5.66</td>
<td>4.90</td>
<td>5.90</td>
</tr>
<tr>
<td>Health risk, $r_{ijt}$</td>
<td>1.00 (1.46)</td>
<td>1.01 (1.41)</td>
<td>0.92 (1.40)</td>
<td>1.05 (1.58)</td>
</tr>
<tr>
<td>$r_{ijt} - r_{ij,t-1}$</td>
<td>0.05 (1.07)</td>
<td>0.05 (1.03)</td>
<td>0.06 (1.04)</td>
<td>0.06 (1.19)</td>
</tr>
<tr>
<td><strong>Panel B: Employer-year level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employers</td>
<td>12,242</td>
<td>6,560</td>
<td>2,281</td>
<td>3,401</td>
</tr>
<tr>
<td>Observations</td>
<td>31,044</td>
<td>19,680</td>
<td>4,562</td>
<td>6,802</td>
</tr>
<tr>
<td>Subscribers</td>
<td>21 (27)</td>
<td>21 (26)</td>
<td>23 (27)</td>
<td>20 (28)</td>
</tr>
<tr>
<td>Take up rate (%)</td>
<td>54 (22)</td>
<td>54 (22)</td>
<td>57 (21)</td>
<td>53 (23)</td>
</tr>
<tr>
<td>Health risk for enrolled, $R_{jt}$</td>
<td>1.07 (0.72)</td>
<td>1.05 (0.70)</td>
<td>0.97 (0.59)</td>
<td>1.17 (0.82)</td>
</tr>
<tr>
<td>$R_{jt} - R_{j,t-1}$</td>
<td>0.02 (0.51)</td>
<td>0.01 (0.49)</td>
<td>0.04 (0.45)</td>
<td>0.05 (0.62)</td>
</tr>
<tr>
<td>Paid total claims ($)</td>
<td>4,076 (8,456)</td>
<td>4,003 (8,272)</td>
<td>3,775 (6,951)</td>
<td>4,490 (9,783)</td>
</tr>
<tr>
<td>Out-of-pocket claims ($)</td>
<td>1,092 (889)</td>
<td>1,051 (812)</td>
<td>1,061 (835)</td>
<td>1,232 (1,098)</td>
</tr>
<tr>
<td>Annual premiums ($)</td>
<td>6,162 (2,837)</td>
<td>6,248 (2,689)</td>
<td>5,385 (2,067)</td>
<td>6,433 (3,529)</td>
</tr>
</tbody>
</table>

Note: each observation is one small group enrollee or employer during one year, 2013-15. Table reports mean values (standard deviations). Enrollee “stayers” are employees always in sample; “joiners” are enrollees with one or more full observation but without a full observation in 2013 even though employer is in sample in 2013; and “quitters” are enrollees with one or more full observation but without a full observation in 2015 even though employer is in sample in 2015. Employer definitions are analogous.
Takeaways on selection

- Lots of movement in and out of USIC insurance
  - Small businesses frequently start and stop coverage
  - Potential enrollees also frequently start and stop take-up

- This movement is driven by at least three factors:
  1. Businesses opening and shutting down for reasons orthogonal to insurance premiums
  2. Individuals changing jobs for reasons orthogonal to insurance premiums
  3. Selection of health insurance based on insurance premiums

- There is selection based on risk: quitters are moderately more expensive
  - Suggests possibility of selection based on insurance premiums
  - Our estimates control for selection
  - Our counterfactuals use bounds for individuals who leave sample
Nationally representative Medical Expenditure Panel Survey
  - Allows us to understand selection into small group market insurance take-up

We use panel 18 from the consolidated data in 2013 and 2014

We select individuals who:
1. Were working (not self-employed) at the beginning of the period
2. Had establishment size ≤ 50 individuals (small group)
3. Were offered health insurance via the employer

We use age, gender, health conditions, employer size, and employer sector

<table>
<thead>
<tr>
<th>Choose insurance</th>
<th>Age</th>
<th>Female</th>
<th>Employer size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.72</td>
<td>41.77</td>
<td>0.52</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.45</td>
<td>12.91</td>
<td>0.50</td>
</tr>
<tr>
<td>Observations</td>
<td>1,355</td>
<td>1,355</td>
<td>1,355</td>
</tr>
</tbody>
</table>
Empirical approach

- Our main empirical goal is to recover $\gamma$ and $\beta$
  - Together, they get at insurer pass through:
    \[
    \frac{\partial p}{\partial E[c^{ins}]} = \frac{\partial p/\partial R}{\partial E[c^{ins}]/\partial R} = \frac{\beta}{\gamma}
    \]
  - We use them separately in our counterfactual analysis
- We estimate $\gamma$ with regressions of claims costs on risk scores
- We estimate $\beta$ with selection-adjusted regressions of changes in premiums on changes in employer mean risk scores
Estimation of impact of risk score on claims: $\gamma$

- $\gamma$ scales risk scores into claims dollars
- We estimate regressions of the form:
  \[ c_{ijt}^{ins} = \gamma r_{ijt} + \gamma_2 x_{jt} + \varepsilon_{ijt} \]
- We perform regression just for 2014
- $x_{jt}$ include market fixed effects
- Main identifying assumption:
  - Market FE\textsc{s} control for provider price variation
Estimation of pass through from risk to premiums: $\beta$

- Following Newey (2009), we estimate a two-step semi-parametric selection model:

1. Estimation of selection model
   - Estimation of $D_{ijt} = 1 \{f(R_{jt}, r_{ijt}, x_{ijt}) + \varepsilon_{ijt}^s > 0\}$ with probit specification and flexible form for $f(\cdot)$
   - Define $S_{ijt} \equiv Pr(f(R_{jt}, r_{ijt}, x_{ijt}) + \varepsilon_{ijt}^s > 0)$

2. Estimation of pass through with selection correction
   $$p_{ijt} = \beta R_{jt} + \alpha x_{jt} + FE_{ij} + FE_t + g(S_{ijt}) + \varepsilon_{ijt}$$
   (where $\varepsilon_{ijt}^p = g(S_{ijt}) + \varepsilon_{ijt}$)
   - From theory model, interpretation is:
     $$c_{jt} = FE_{ij} + FE_t + \alpha x_{jt} + \varepsilon_{ijt}^p$$
   - Non-parametric selection correction $g(S_{ijt})$ (using power series approximation)
   - Intuition: approximates inverse Mills ratio from Heckman (1979)
More details on selection and pass through estimation

- We estimate two different specifications for selection equation $f(\cdot)$:
  1. Selection equation from USIC data
     - Selection sample at period $t$ is individuals enrolled at period $t - 1$
     - Variables in $f(\cdot)$: $R_{jt}$, $r_{ijt}$, industry, employer size, age, and gender
     - Lots of regressors but only controls for individuals who left USIC
  2. Selection equation from MEPS data
     - Variables in $f(\cdot)$: proxy for $r_{ijt}$, industry, employer size, age, and gender
     - See hypertension, heart disease, AMI, ischemic stroke, respiratory failure, cancer, diabetes, and asthma
     - Fewer regressors but controls for everyone offered insurance

- Identification
  - Exclusion restrictions needed to credibly identify selection effects
    - Industry and individual risk provide useful exclusion restrictions
  - Have employer fixed effects for treatment equation in main specifications
    - Identification of $\beta$ based on changes in $p_{jt}$ following changes in $R_{jt}$

- Inference
  - We adjust standard errors for two-step estimator and cluster two ways, employer and year
Impact of health risk on claims costs: $\gamma$

Table: Impact of risk on claims

<table>
<thead>
<tr>
<th>Regressor:</th>
<th>Paid amount ($)</th>
<th>Allowed amount ($)</th>
<th>OOP amount ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrollee ACG score, $r_{ijt}$</td>
<td>4,003***</td>
<td>4,483***</td>
<td>480***</td>
</tr>
<tr>
<td>Market FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>204,913</td>
<td>204,913</td>
<td>204,913</td>
</tr>
</tbody>
</table>

Note: each observation is one enrollee during one year. The dependent variables indicate three measures of the total claims amount for that enrollee. The sample is covered individuals with an ACG score in 2014 only. Markets are defined by USIC and roughly represent an MSA or state. Standard errors are clustered at the employer level. *** indicates significance at the 1% level.

- A unit increase in $R$ increases claims cost by $4,003$
- Results with splines are similar
## Estimation of selection equation using USIC and MEPS samples

<table>
<thead>
<tr>
<th></th>
<th>(1) USIC</th>
<th>(2) USIC</th>
<th>(3) MEPS</th>
<th>(4) MEPS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample</strong></td>
<td>USIC</td>
<td>Sample</td>
<td>USIC</td>
<td>MEPS</td>
</tr>
<tr>
<td><strong>Dependent variable:</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>( \text{Drop coverage}_{ijt} )</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Average marginal effect</td>
<td>0.067***</td>
<td>(0.009)</td>
<td>0.005***</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Standard error</td>
<td>0.008</td>
<td>(0.008)</td>
<td>0.001</td>
<td>(0.001)</td>
</tr>
<tr>
<td>( \text{Decline insurance}_{ijt} )</td>
<td></td>
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</tr>
<tr>
<td>Average marginal effect</td>
<td>-0.001***</td>
<td>(0.00001)</td>
<td>-0.039</td>
<td>(0.261)</td>
</tr>
<tr>
<td>Standard error</td>
<td>0.003</td>
<td>(0.003)</td>
<td>0.001</td>
<td>(0.001)</td>
</tr>
<tr>
<td>( R_{jt} )</td>
<td></td>
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<tr>
<td>( r_{ijt} )</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Age ( ijt )</td>
<td>-0.001***</td>
<td>(0.00001)</td>
<td>0.089</td>
<td>(0.092)</td>
</tr>
<tr>
<td>Female ( ijt )</td>
<td>0.003</td>
<td>(0.003)</td>
<td>-0.177</td>
<td>(0.121)</td>
</tr>
<tr>
<td>Employer size ( j_{jt} )</td>
<td>0.001***</td>
<td>(0.0002)</td>
<td>-0.116</td>
<td>(0.124)</td>
</tr>
<tr>
<td>Hypertension ( j_{jt-1} )</td>
<td></td>
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<tr>
<td>Heart disease ( j_{jt-1} )</td>
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<tr>
<td>AMI ( j_{jt-1} )</td>
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<tr>
<td>Ischemic stroke ( j_{jt-1} )</td>
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<tr>
<td>Respiratory failure ( j_{jt-1} )</td>
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<tr>
<td>Cancer ( j_{jt-1} )</td>
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<tr>
<td>Diabetes ( j_{jt-1} )</td>
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<tr>
<td>Asthma ( j_{jt-1} )</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>204,913</td>
<td>1,355</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: “Drop coverage \( ijt \)” indicates that individual was in sample in period \( t \) but not \( t + 1 \).

- Employer risk \( R_{jt} \) predicts leaving USIC sample
Impact of health risk on premiums: $\beta$

<table>
<thead>
<tr>
<th>Panel A: specifications with employer/enrollee fixed effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health risk for enrolled, $R_{jt}$</td>
</tr>
<tr>
<td>Observation level:</td>
</tr>
<tr>
<td>Employer/year No selection correction</td>
</tr>
<tr>
<td>Enrollee/year With selection correction</td>
</tr>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>(2)</td>
</tr>
<tr>
<td>(3)</td>
</tr>
<tr>
<td>(4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: specifications without employer/enrollee fixed effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health risk for enrolled, $R_{jt}$</td>
</tr>
<tr>
<td>Observation level:</td>
</tr>
<tr>
<td>Employer/year No</td>
</tr>
<tr>
<td>Enrollee/year $1^{st}$</td>
</tr>
<tr>
<td>Surveys</td>
</tr>
<tr>
<td>Polynomial Order</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>
| Notes: each observation is either one employer or enrollee during one year. The dependent variable is the premium charged the employer by USIC divided by the number of covered lives. $R_{jt}$ is calculated based on individuals that worked in the employer last year and had a ACG score. Column (1) in Panel A includes employer fixed effects. Columns (2) to (4) in Panel A include enrollee fixed effects. Panel B includes market fixed effects. Standard errors are clustered at the enrollee and year levels. **indicates significance at the 1% level and * indicates significance at the 5% level.

Results with MEPS selection correction are not statistically different from non-selection-corrected estimates.
Takeaways from results on $\beta$

- Across specifications, much less impact than full experience rating
  - With employer FEs, a unit increase in $R$ increases premiums by $624$
  - Without FEs, effect is larger—$2,811$—but still much smaller than cost

- How do we interpret difference between estimates with and without FEs?
  - With FEs: estimates risk pass through for existing employers
  - Without FEs: may reflect higher risk rating for new accounts

- Selection-corrected results somewhat larger than uncorrected results
  - Consistent with higher risk people disproportionately quitting insurance

- “Idiosyncratic” risk also present in this market
  - Standard deviation of premiums is $576$ in FE model
  - Though not correlated with health risk, it also affects welfare
Robustness

1. Robustness to measurement error from risk score definition
   - Evidence

2. Robustness to the inclusion of chronic conditions
   - Panel A
   - Panel B

3. No significant change in other benefits when risk increase
   - Table

4. Splines to check linear relationship between risk and claims
   - Table

5. Roll out of ACA regulations over time do not generate this slow pass through
   - Table
Testing for guaranteed renewability contracts

- What might explain low pass through results?
  - Broadly consistent with Herring and Pauly (2006) and different from Gruber (2000)
  - Could results be driven by guaranteed renewability (GR) contracts?

- Ghili et al. (2019) model optimal GR contracts with liquidity constraints:
  - Insurers set premium schedules that incorporate some increases in premiums over time
  - Enrollees with relative drops in risk scores can obtain new insurance at lower rates
  - Insurers offer to renegotiate with these enrollees, to avoid lapsation and recontracting

- Why does this (partial) reclassification risk occur?
  - GR contracts have to balance risk protection against consumption smoothing
  - Only way to avoid this would be to front load premiums
  - But this would lead to underconsumption by the young
Testable implications of optimal GR model

1. Incomplete pass through from health risk to premiums, $0 < \beta < \gamma$
   - GR contracts add value because they lower reclassification risk

2. Groups with health risk increases face less reclassification risk than groups with health risk decreases
   - Groups with health risk decreases are the ones that renegotiate

3. Groups with high ex ante risk face more reclassification risk
   - They have a higher probability of a health risk drop

We demonstrate that these implications hold in calibrated GR contracts from Handel et al. (2019)—an earlier version of Ghili et al. (2019) with more data reported
   - For implication 1, $\beta = $1821 ($410) in Handel et al.

We then test for whether they hold in our data
Second implication of GR model

Table: Impact of risk on premiums using splines, with simulated guaranteed renewability data and USIC data

<table>
<thead>
<tr>
<th>Sample:</th>
<th>Panel A: specifications with enrollee fixed effects (N= 90,826)</th>
<th>Panel B: specifications without enrollee fixed effects (N=181,652)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HHW</td>
<td>USIC</td>
</tr>
<tr>
<td>Dependent variable: change in annual employer mean premium, ( p_{jt} )</td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td>Spline, ( \Delta R_{jt} \leq 0 )</td>
<td>3,612*** (88)</td>
<td>2,973*** (742)</td>
</tr>
<tr>
<td>Spline, ( \Delta R_{jt} &gt; 0 )</td>
<td>172*** (26)</td>
<td>1,638*** (478)</td>
</tr>
<tr>
<td>Polynomial Order</td>
<td>No 1(^{st}) 6(^{th})</td>
<td>No 1(^{st}) 6(^{th})</td>
</tr>
</tbody>
</table>

Note: each observation is one enrollee for which we have a complete observation for years 2014 and 2015. Column (1) uses simulated data from [?]. In Columns (2) to (4), the dependent variable is the premium charged the employer by USIC divided by the number of covered lives. Markets are defined by USIC and roughly represent an MSA or state. All specifications include year fixed effects. We two-way cluster standard errors at the enrollee and year levels. \( \ast \ast \ast \) 1% level, \( \ast \ast \) 5% level, and \( \ast \) 10% level.

Consistent with implication 2, we observe more risk-based pricing when health risk drops
Third implication of GR model

Table: Impact of risk on premiums heterogeneity stratifying on initial risk

<table>
<thead>
<tr>
<th>Sample:</th>
<th>HHW</th>
<th>USIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1{(R_{j1} \leq 1)} \times \Delta R_{jt}</td>
<td>(1) 279***</td>
<td>(2) 39 337***</td>
</tr>
<tr>
<td>1{(R_{j1} &gt; 1)} \times \Delta R_{jt}</td>
<td>(91) 2,798***</td>
<td>(63) 65</td>
</tr>
</tbody>
</table>

Panel B: specifications without enrollee fixed effects (N=181,652)

<table>
<thead>
<tr>
<th>Sample:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1{(R_{j1} \leq 1)} \times R_{jt}</td>
<td>(1) 615***</td>
<td>(2) 1,313***</td>
</tr>
<tr>
<td>1{(R_{j1} &gt; 1)} \times R_{jt}</td>
<td>(205) 3,181***</td>
<td>(106) 2,002***</td>
</tr>
</tbody>
</table>

Note: each observation is one enrollee for which we have a complete observation for years 2014 and 2015. Column (1) uses simulated data from [?]. In Columns (2) to (4), the dependent variable is the premium charged the employer by USIC divided by the number of covered lives. Markets are defined by USIC and roughly represent an MSA or state. All specifications include year fixed effects. We two-way cluster standard errors at the enrollee and year levels. *** 1% level, ** 5% level, and * 10% level.

Consistent with implication 3, we observe greater reclassification risk for ex-ante high risk individuals.
Computation of counterfactuals

- **Steps to counterfactual approach**
  1. Non-parametrically construct 10 year path of $r_{jt}$ and $R_{jt}$
     - We use risk model with two lags
  2. Evaluate how future risk distribution translates into future premium distribution and oop costs, under baseline and counterfactuals
     - When individuals remain at employer: use FE/selection controlled $\beta$ estimate
     - When individuals leave sample: bound them as facing draw from cross-sectional premium distribution
     - With selection model, individuals who stay have selected premium distribution
     - Model residual distribution for idiosyncratic risk
  3. Examine how this risk translates into utility loss for insured
     - We use CARA preference parameter of $\sigma = 0.000428$ from Handel (2013)
     - Examine robustness to less risk averse ($\sigma = 0.00008$) as in HHW
     - Certainty equivalent price independent of income

- **We show, for a ten year horizon after insurance purchase:**
  - Certainty equivalent income loss from risk
  - Standard deviation of premiums and healthcare expenditures
Mean certainty equivalent income loss from risk

USIC's pricing policy adds value relative to full experience rating

Results similar but smaller with $\sigma = 0.00008$. Table
Mean standard deviation in premiums

- Standard deviation of premiums largely from switchers
Mean standard deviation in health care expenditures

- OOP spending adds a lot of risk

![Graph showing mean standard deviation in health care expenditures over years after enrollment.](image-url)
Value created by pooling within small group

Pooling within small group adds moderate value relative to individual insurance with same pass through
Conclusion

- We seek to understand extent of reclassification risk in small group health insurance market
  - Sample of 12,000 employers from period before ACA community rating regulations were effective
  - Researchers had very different priors on reclassification risk in this period

- We develop a simple two-period model of insurer pricing and offer/take-up
  - We estimate pass through from changes in health risk to changes in premiums, $\beta$

- We find $\beta / \gamma = 16\%$ pass through from change in health risk to change in premiums
  - Results much larger without enrollee fixed effects

- Limited reclassification risk is consistent with USIC offering guaranteed renewability contracts
  - We test other implications of guaranteed renewability contracts and find that they hold
  - Most importantly, reclassification risk occurs on the downside and not on the upside

- Despite guaranteed renewability contracts, still substantial reclassification risk
  - High turnover of employees limits value from guaranteed renewability contracts
  - Nonetheless, USIC pricing policy added 60% of the difference in consumer welfare between experience rating and community rating
Appendix
With MEPS correction, impact of health risk on premiums: \((\beta)\)

### Table: Impact of risk on premiums with USIC sample correction

<table>
<thead>
<tr>
<th></th>
<th>Observation level:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Employer/year</td>
</tr>
<tr>
<td></td>
<td>No selection</td>
</tr>
<tr>
<td></td>
<td>No selection</td>
</tr>
<tr>
<td></td>
<td>No selection</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
</tr>
</tbody>
</table>

**Panel A: specifications with employer/enrollee fixed effects**

- Health risk for enrolled, \(R_{jt}\):
  - Column (1): \(188^{**}\) \((87)\)
  - Column (2): \(195^{***}\) \((82)\)
  - Column (3): \(195\) \((82)\)
  - Column (4): \(196\) \((92)\)

**Panel B: specifications without employer/enrollee fixed effects**

- Health risk for enrolled, \(R_{jt}\):
  - Column (1): \(1,749^{***}\) \((120)\)
  - Column (2): \(2,263^{***}\) \((88)\)
  - Column (3): \(2,210^{**}\) \((88)\)
  - Column (4): \(2,175^{***}\) \((93)\)

- FE Year: Yes, Yes, Yes, Yes
- Polynomial Order: No, No, 1\(^{st}\), 6\(^{th}\)
- Observations: 31,044, 448,259, 448,259, 448,259

Note: each observation is either one employer or enrollee during one year. The dependent variable is the premium charged the employer by USIC divided by the number of covered lives. \(R_{jt}\) is calculated based on individuals that worked in the employer last year and had a ACG score. Column (1) in Panel A includes employer fixed effects. Columns (2) to (4) in Panel A include enrollee fixed effects. Panel B includes market fixed effects. Standard errors are clustered at the enrollee and year levels. \(^{***}\) indicates significance at the 1% level and \(^{**}\) indicates significance at the 5% level.

- Results with MEPS correction are not statistically different from main estimates
### Table: Impact of risk on premiums by market concentration

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variable:</strong> annual employer mean premium, $p_{jt}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td><strong>Panel A: market HHI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health risk for enrolled, $R_{jt}$</td>
<td>624*** (121)</td>
<td>617*** (146)</td>
<td>700*** (116)</td>
</tr>
<tr>
<td>HHI</td>
<td>0.035*** (0.008)</td>
<td>0.057 (0.032)</td>
<td></td>
</tr>
<tr>
<td>$R_{jt} \times$ HHI</td>
<td></td>
<td></td>
<td>-0.023 (0.057)</td>
</tr>
<tr>
<td><strong>Panel B: share of largest insurer</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health risk for enrolled, $R_{jt}$</td>
<td>624*** (121)</td>
<td>617*** (87)</td>
<td>711*** (101)</td>
</tr>
<tr>
<td>Share of leader insurer</td>
<td>280** (58)</td>
<td>447** (245)</td>
<td></td>
</tr>
<tr>
<td>$R_{jt} \times$ Share of leader insurer</td>
<td></td>
<td></td>
<td>-174 (228)</td>
</tr>
<tr>
<td>Enrollee FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>448,259</td>
<td>448,259</td>
<td>448,259</td>
</tr>
</tbody>
</table>

Note: each observation is one enrollee during one year. Markets are defined by USIC and roughly represent an MSA or state. $R_{jt}$ is calculated based on individuals that worked in the employer last year and had a ACG score. HHI and share of leader insurer indexes are taken from Kaiser Family Foundation State Health Facts database. Standard errors are clustered at the employer level. *** indicates significance at the 1% level and ** indicates significance at the 5% level.
### Table: Impact of risk on premiums with lagged risk score

<table>
<thead>
<tr>
<th>Regressor:</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health risk for enrolled, $R_{jt}$</td>
<td>624**</td>
<td>450</td>
<td>2,811***</td>
<td>1,822**</td>
</tr>
<tr>
<td></td>
<td>(121)</td>
<td>(92)</td>
<td>(109)</td>
<td>(112)</td>
</tr>
<tr>
<td>Lagged health risk for enrolled, $R_{j,t-1}$</td>
<td>218</td>
<td>1,311**</td>
<td>(54)</td>
<td>(98)</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Enrollee FE</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Market FE</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>448,259</td>
<td>160,062</td>
<td>448,259</td>
<td>264,145</td>
</tr>
</tbody>
</table>

Note: each observation is one enrollee during one year. The dependent variable is the premium charged the employer by USIC divided by the number of covered lives. $R_{jt}$ is calculated based on individuals that worked in the employer last year and had a ACG score. Standard errors are clustered at the employer level. ** indicates significance at the 5% level and *** indicates significance at the 1% level.
## Table: Impact of risk on claims using splines

<table>
<thead>
<tr>
<th>Regressor:</th>
<th>Dependent Variable: Paid amount ($)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spline employee ACG score, ( r_{ijt} \in [0, 1) )</td>
<td>2,746**</td>
<td>2,836**</td>
<td>(94)</td>
<td>(96)</td>
<td></td>
</tr>
<tr>
<td>Spline employee ACG score, ( r_{ijt} \in [1, 2.5) )</td>
<td>3,174**</td>
<td>3,190**</td>
<td>(151)</td>
<td>(151)</td>
<td></td>
</tr>
<tr>
<td>Spline employee ACG score, ( r_{ijt} \in [2.5, 5) )</td>
<td>4,284**</td>
<td>4,282**</td>
<td>(361)</td>
<td>(361)</td>
<td></td>
</tr>
<tr>
<td>Spline employee ACG score, ( r_{ijt} \in [5, \infty) )</td>
<td>4,692**</td>
<td>4,689**</td>
<td>(398)</td>
<td>(398)</td>
<td></td>
</tr>
<tr>
<td>Spline employee ACG score, ( r_{ijt} \in [0, .32) )</td>
<td>2,503**</td>
<td>2,633**</td>
<td>(559)</td>
<td>(563)</td>
<td></td>
</tr>
<tr>
<td>Spline employee ACG score, ( r_{ijt} \in [.32, .57) )</td>
<td>3,756**</td>
<td>3,814**</td>
<td>(411)</td>
<td>(411)</td>
<td></td>
</tr>
<tr>
<td>Spline employee ACG score, ( r_{ijt} \in [.57, 1.13) )</td>
<td>1,189**</td>
<td>1,289**</td>
<td>(421)</td>
<td>(420)</td>
<td></td>
</tr>
<tr>
<td>Spline employee ACG score, ( r_{ijt} \in [1.13, \infty) )</td>
<td>4,345**</td>
<td>4,344**</td>
<td>(185)</td>
<td>(185)</td>
<td></td>
</tr>
<tr>
<td>Market FE</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Splines</td>
<td>Fixed cut points</td>
<td>Fixed cut points</td>
<td>Quartiles</td>
<td>Quartiles</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>204,913</td>
<td>204,913</td>
<td>204,913</td>
<td>204,913</td>
<td></td>
</tr>
</tbody>
</table>

Note: each observation is one enrollee during one year. The dependent variables indicate the total claims amount paid by USIC for that enrollee. The sample is covered individuals with an ACG score in 2014 only. Standard errors are clustered at the employer level. 

* indicates significance at the 1% level.
**Table:** Impact of risk on premiums, with chronic conditions, panel A

<table>
<thead>
<tr>
<th>Regressor:</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health risk for enrolled, $R_{jt}$</td>
<td>624**</td>
<td>648**</td>
<td>626**</td>
<td>625**</td>
<td>628**</td>
</tr>
<tr>
<td>Lag % cancer at employer</td>
<td>(116)</td>
<td>(117)</td>
<td>(135)</td>
<td>(124)</td>
<td>(116)</td>
</tr>
<tr>
<td>Lag % transplant at employer</td>
<td>2**</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lag % AMI at employer</td>
<td>(4)</td>
<td>(2)</td>
<td>(0.5)</td>
<td>(0.5)</td>
<td></td>
</tr>
<tr>
<td>Lag % diabetes at employer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.3)</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Enrollee FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>448,259</td>
<td>448,259</td>
<td>448,259</td>
<td>448,259</td>
<td>448,259</td>
</tr>
</tbody>
</table>

Note: each observation is one enrollee during one year. The dependent variable is the premium charged the employer by USIC divided by the number of covered lives. $R_{jt}$ is calculated based on individuals that worked in the employer last year and had an ACG score. Chronic disease regressors indicate the mean percent of enrollees with a claim for the disease in the previous year. Standard errors are clustered at the employer level. *** indicates significance at the 1% level.
**Table: Impact of risk on premiums, with chronic conditions, panel B**

<table>
<thead>
<tr>
<th>Regressor:</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health risk for enrolled, $R_{jt}$</td>
<td>624**</td>
<td>627**</td>
<td>633**</td>
<td>627**</td>
<td>625**</td>
</tr>
<tr>
<td>Lag % hypertension at employer</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Lag % heart failure at employer</td>
<td></td>
<td>2**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lag % kidney disease at employer</td>
<td></td>
<td></td>
<td>0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lag % asthma at employer</td>
<td></td>
<td></td>
<td></td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Enrollee FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>448,259</td>
<td>448,259</td>
<td>448,259</td>
<td>448,259</td>
<td>448,259</td>
</tr>
</tbody>
</table>

Note: each observation is one enrollee during one year. The dependent variable is the premium charged the employer by USIC divided by the number of covered lives. $R_{jt}$ is calculated based on individuals that worked in the employer last year and had a ACG score. Chronic disease regressors indicate the mean percent of enrollees with a claim for the disease in the previous year. Standard errors are clustered at the employer level. ** indicates significance at the 1% level.
<table>
<thead>
<tr>
<th>Regressor:</th>
<th>In-network maximum OOP ($)</th>
<th>Coinsurance rate (%)</th>
<th>In-network deductible ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Health risk for enrolled, $R_{jt}$</td>
<td>303</td>
<td>-0.43</td>
<td>159</td>
</tr>
<tr>
<td></td>
<td>(113)</td>
<td>(0.57)</td>
<td>(58)</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Enrollee FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>448,259</td>
<td>448,259</td>
<td>448,259</td>
</tr>
</tbody>
</table>

Note: each observation is one enrollee during one year. Each dependent variable is a measure of plan benefits. $R_{jt}$ is calculated based on individuals that worked in the employer last year and had a ACG score. Standard errors are clustered at the employer level. ** indicates significance at the 5% level and * indicates significance at the 10% level.
Table: Impact of risk on premiums with heterogeneity by different periods

<table>
<thead>
<tr>
<th></th>
<th>Dependent variable: annual employer mean premium, ( p_{jt} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Health risk for enrolled, ( R_{jt} )</td>
<td>568*</td>
</tr>
<tr>
<td></td>
<td>(85)</td>
</tr>
<tr>
<td>Enrollee FE</td>
<td>Yes</td>
</tr>
<tr>
<td>Market FE</td>
<td>No</td>
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<tr>
<td>Year FE</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>281,932</td>
</tr>
</tbody>
</table>

Note: each observation is one enrollee during one year. The dependent variable is the premium charged the employer by USIC divided by the number of covered lives. \( R_{jt} \) is calculated based on individuals that worked in the employer last year and had an ACG score. Standard errors are clustered at the employer level. ** indicates significance at the 1% level and * indicates significance at the 5% level.
Robustness to measurement error

1. Compare to USIC’s risk score for 227 employers in 2013 (with both):
   - Pearson correlation is 0.836 and the Spearman (rank) correlation is 0.881
   - Find smaller $\beta$ with this sample for USIC’s risk score than for ACG score
   - Size of measurement error too small for full pass through:
     * Robustness checks suggest uncorrelated measurement error
     * Formula is $\beta^{estimate} = \frac{\beta^{true} \sigma_{RR}}{\sigma_{RR} + \sigma_{\omega\omega}}$, where:
       $\sigma_{\omega\omega} = 0.22$ is the variance of the measurement error
       $\sigma_{RR} = 0.52$ is variance of the (USIC) true risk score
       In this case, $\beta^{true} = \frac{624}{\sigma_{RR} + \sigma_{\omega\omega}} = $893
     * Measurement error explains small part of pricing relative to full experience rating

2. Instrument for ACG score with own risk score (ORS):
   - Constructed ORS using claims data and random forest techniques
   - Used ORS as instrument for ACG score and find smaller and imprecisely estimated $\beta$ with employer FE's
Mean certainty equivalent income loss from risk

Effects smaller with less risk aversion but still relative differences are large.