# Risk-Based Selection in UI: Evidence & Implications

C. Landais (LSE), A. Nekoei (IIES), P. Nilsson (IIES), D. Seim (SU), J. Spinnewijn (LSE)

Warwick - Applied Workshop

June 22, 2017

# Motivation

- In (almost) all countries, unemployment insurance (UI) is mandated with no coverage choice:
  - pay payroll tax when employed
  - receive UI benefit when unemployed
- Large literature on UI design, but silent on adverse selection (AS)
  - AS seen as key argument for UI mandate
  - but no direct evidence: no market, no choices observed
- Fundamental questions of UI design remain unanswered
  - Should governments in fact mandate UI?
  - If not, how should governments allow for choice?

# This Paper: Risk-Based Selection in UI

- Exploits **unique setting & data** in Sweden:
  - Swedish workers have access to basic UI benefit, but can opt to buy more comprehensive UI coverage
- Provide **first direct evidence of risk-based selection in UI**:
  - Positive correlation tests
  - Further decomposition using risk variation and price variation
  - Result: UI choices are severely adversely selected
- Analyze implications and provide **new insights for design of UI**
  1. Universal mandate of suppl. coverage inefficient despite severe AS
  2. Large subsidy for suppl. coverage ($\sim 74\%$ of $\Delta AC$ seems optimal due to severe AS
  3. Minimum mandate is desirable in combination with large subsidy

# Related Literature

- Large literature on PCTs in insurance markets:
  - uses data on plan choices and claims (often proprietary data)
  - see Chiappori and Salanie 2000 and many others
- No direct evidence on adverse selection in UI:
  - Hendren (2017): only paper on AS in UI
  - uses surveyed job loss expectations to assess workers' private info.
  - AS can explain non-existence of private market for supplements to mandated public UI
- Recent literature assesses welfare and policy implications of adverse selection:
  - stylized models taking insurance plans as given (e.g., Einav et al. 2010)
  - new work considers endogeneity of plans (e.g., Azevedo et Gottlieb 2017, Veiga and Weyl 2017)

# Outline

1. Institutional Background & Data
2. Positive Correlation Test
3. Beyond Correlation Test
   - Variation in Risks
   - Variation in Prices
4. Policy implications and welfare

# Swedish UI System

- A worker chooses between 2 types of coverage.
- Basic coverage:
  - mandated and funded by payroll tax ($p_0$)
  - benefit is flat and low ($b_0 \approx 20\%$ for median income earner)
- Comprehensive coverage:
  - workers can voluntary opt for supplemental coverage ($p_1 - p_0$)
  - pay UI premia to UI funds (*Kassa*) for at least 12 months
  - benefit $b_1$ replaces 80% of pre-U wage (with cap and floor)
- Gvt defines premia and UI benefit levels ▸ Additional institutional details
  - no price discrimination (age, gender,...)
  - no price differentiation across Kassa's
  - *Kassa* subsidized by gvt
- Data on UI choices and employment history for universe of Swedish workers ▸ Data

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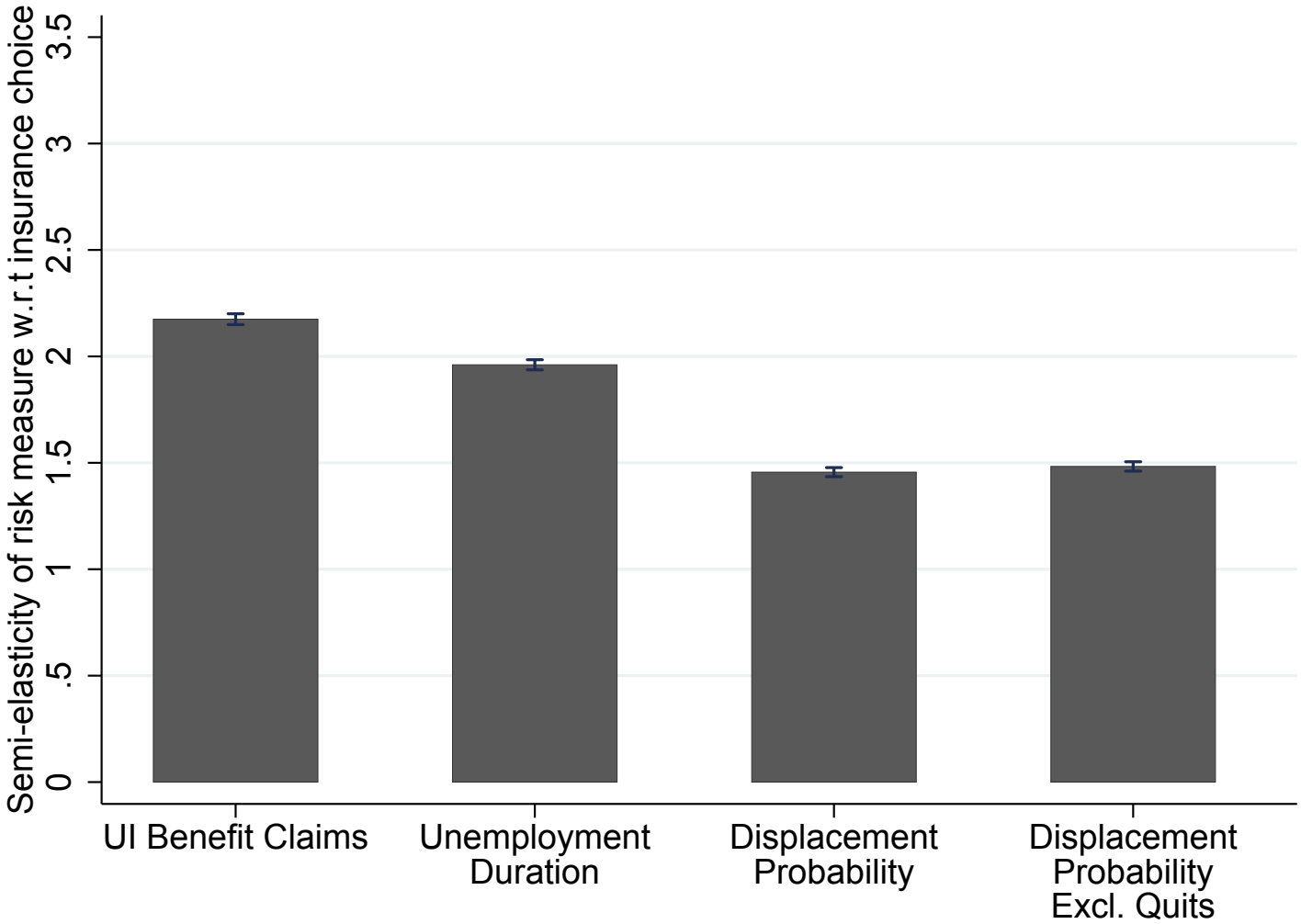
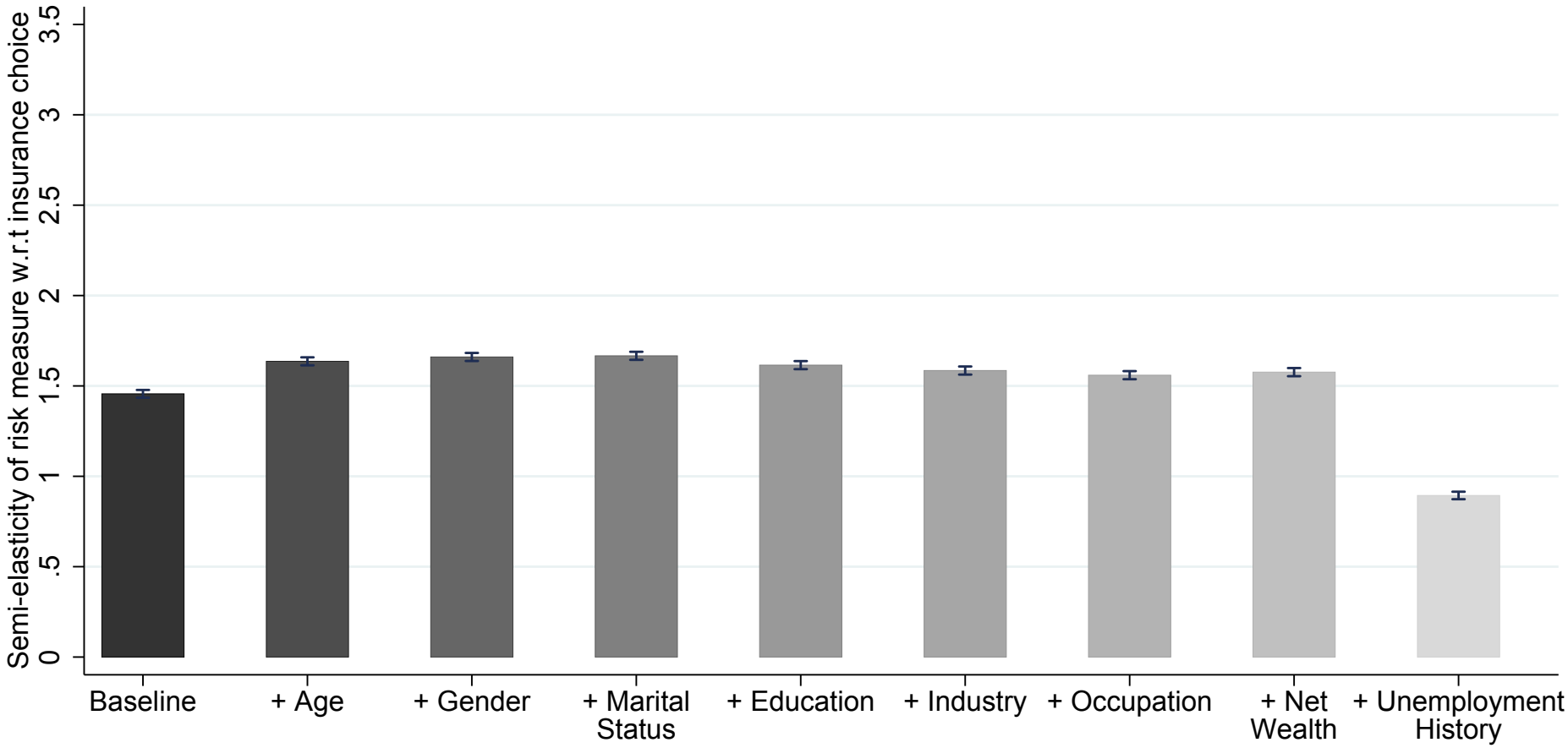
# Positive Correlation Tests: $\mathbb{E}_I[y_i] \geq \mathbb{E}_U[y_i]$




*Notes:* All regressions focus on workers meeting the work eligibility requirement, and control for year F-E, and for covariates affecting premium paid and benefit received, i.e. Union membership, and earnings level.

# Positive Correlation Tests: Unpriced Observables

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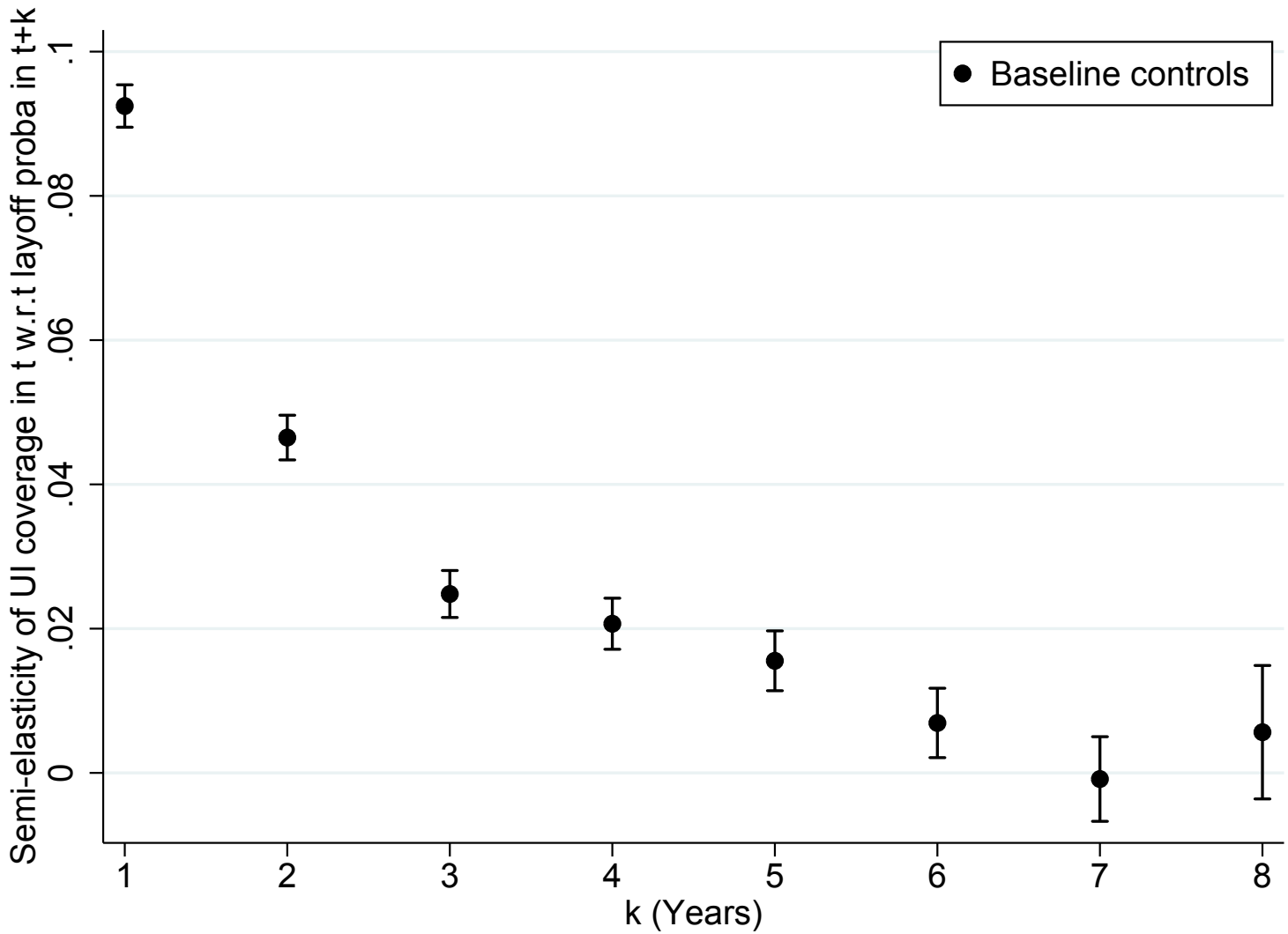
# Positive Correlation Test: Dynamics




▸ Full Dynamics

*Notes:* All regressions focus on workers meeting the work eligibility requirement, and control for year F-E, and for covariates affecting premium paid and benefit received, i.e. Union membership, and earnings level.

# Positive Correlation Test: Decomposition

- Consider linear model of wtp for supplemental coverage $v$ $(= v_1 - v_0)$:

$$v = b\pi + cX + \mu$$

- **Issue**: PCT with ex-post realization of risk type $\pi$

$$b_{OLS,bivar.} = \text{risk-based selection} + \text{MH} - \text{attenuation bias} + \text{selection on risk-related heterogeneity}$$

- Go beyond PCT using two strategies:
  1. Risk variation
  2. Price variation

# Positive Correlation Test: Decomposition

- Consider linear model of wtp for supplemental coverage $v$ $(= v_1 - v_0)$:

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$$b_{IV\text{-Risk}} = \textbf{risk-based selection} + \sout{\text{MH}} - \sout{\text{attenuation bias}} + \sout{\text{selection on risk-related heterogeneity}}$$

- Go beyond PCT using two strategies:
  1. **Risk variation**
     - Use *instruments* for individuals' risks: firm shocks, tenure
     - Direct test for risk-based selection
  2. Price variation

# Positive Correlation Test: Decomposition

- Consider linear model of wtp for supplemental coverage $v$ $(= v_1 - v_0)$:

$$v = b\pi + cX + \mu$$

- **Issue**: PCT with ex-post realization of risk type $\pi$

$$b_{\text{Inverse - Price}} = \textbf{risk-based selection} + \cancel{\text{MH}} - \cancel{\text{attenuation bias}} + \textbf{selection on risk-related heterogeneity}$$

- Go beyond PCT using two strategies:
  1. Risk variation
  2. **Price variation**
     - Reveals welfare-relevant selection, given unpriced heterogeneity

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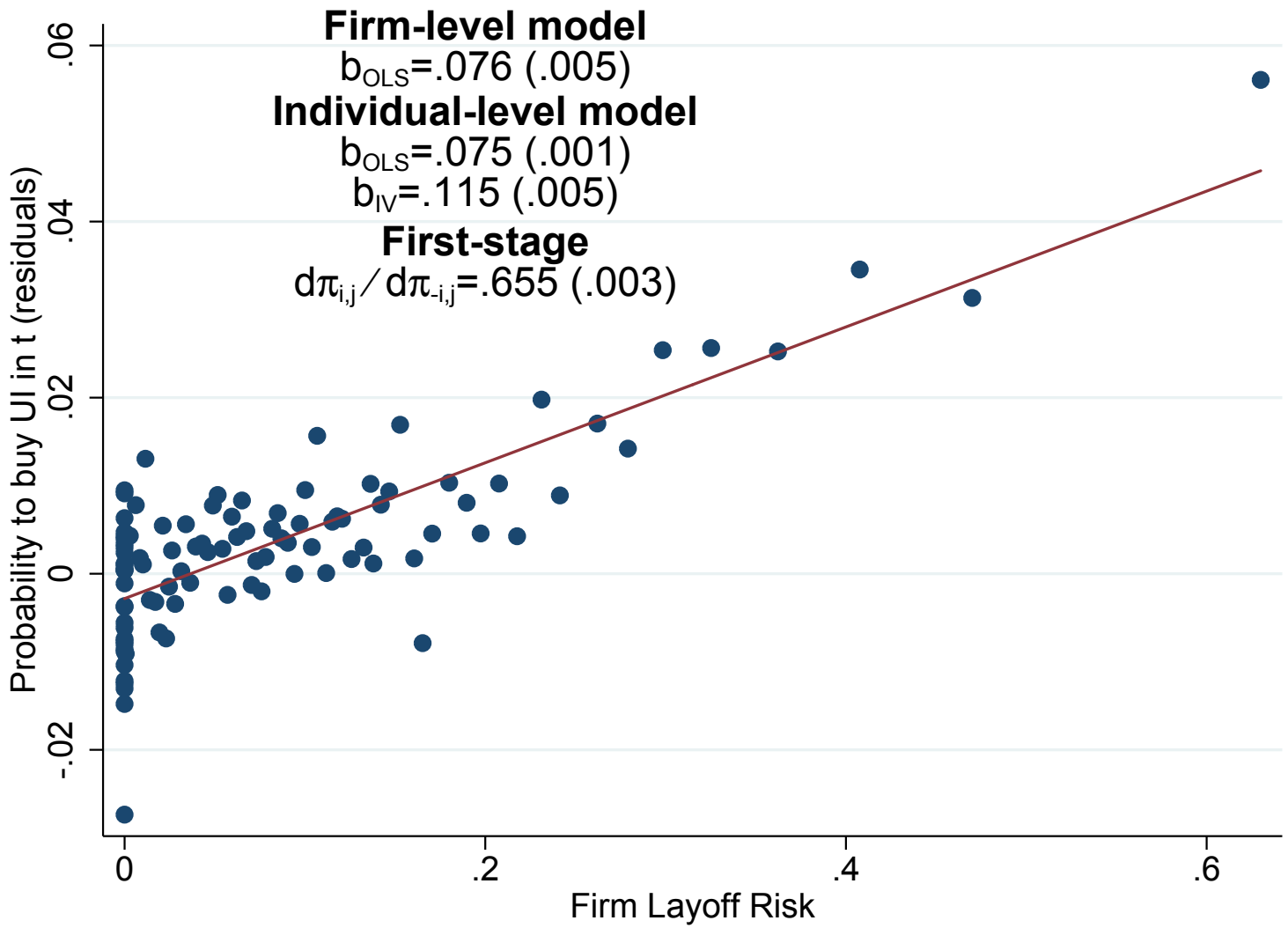
# Risk Variation: Results

1. Use exogenous variation in individuals' risks
   - shocks in firm-level risk $\bar{\pi}_{-i,j}$ ▸ Firm Level
   - shocks in tenure ranking – Last-In-First-Out regulation ▸ Tenure Ranking
2. Firm Switchers ▸ Firm Switchers
   - Individuals who switch firm lose tenure rank, are more likely to be laid-off and are more likely to buy UI
   - Larger effect for larger changes in firm riskiness $\bar{\pi}_j$
3. Firm Collective Layoff Notifications ▸ Layoff Notifications
   - Individuals in firms experiencing shocks (i.e. collective layoff notification) more likely to buy insurance

# Firm Level Risk

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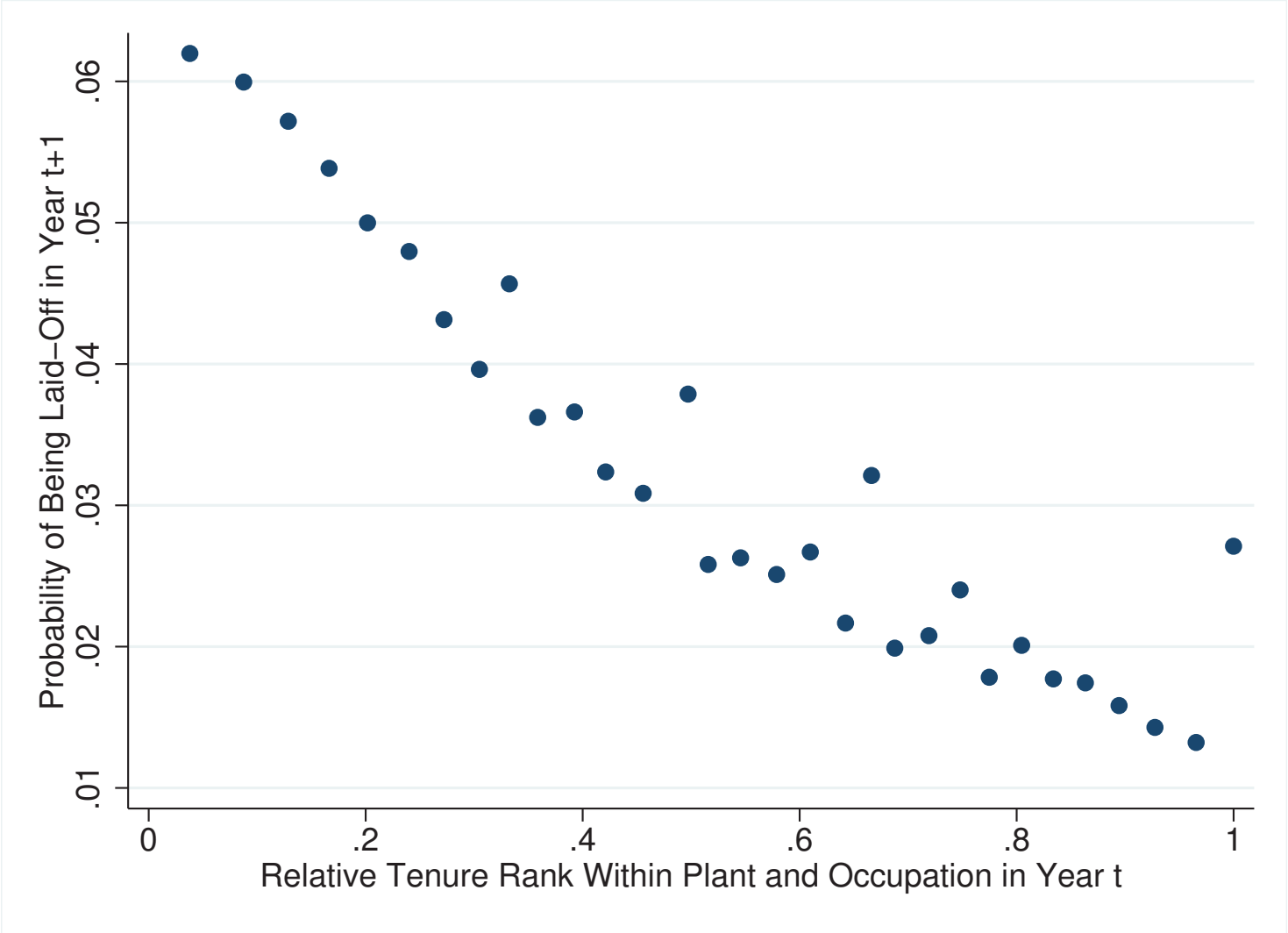
# Tenure Ranking

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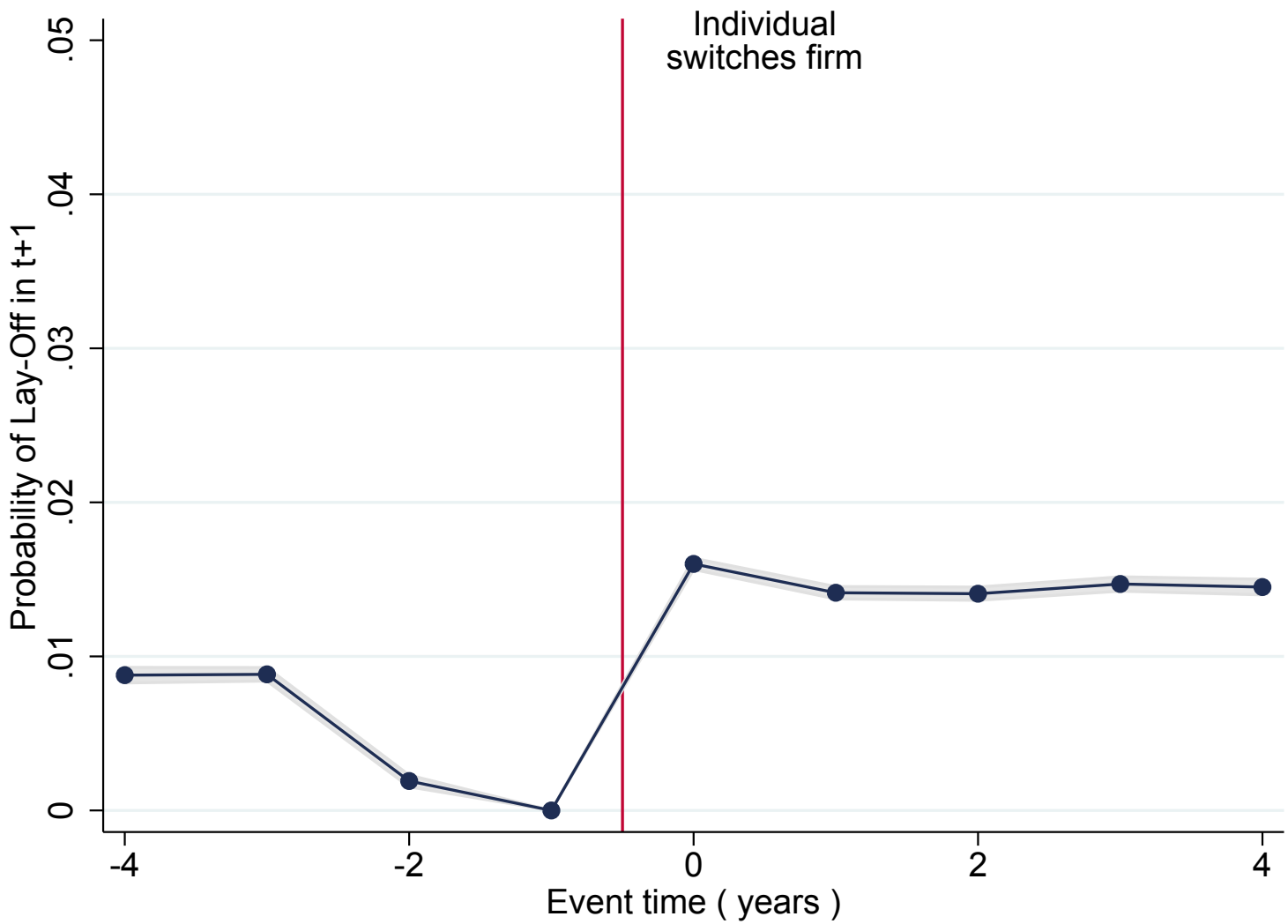
# Firm Switchers

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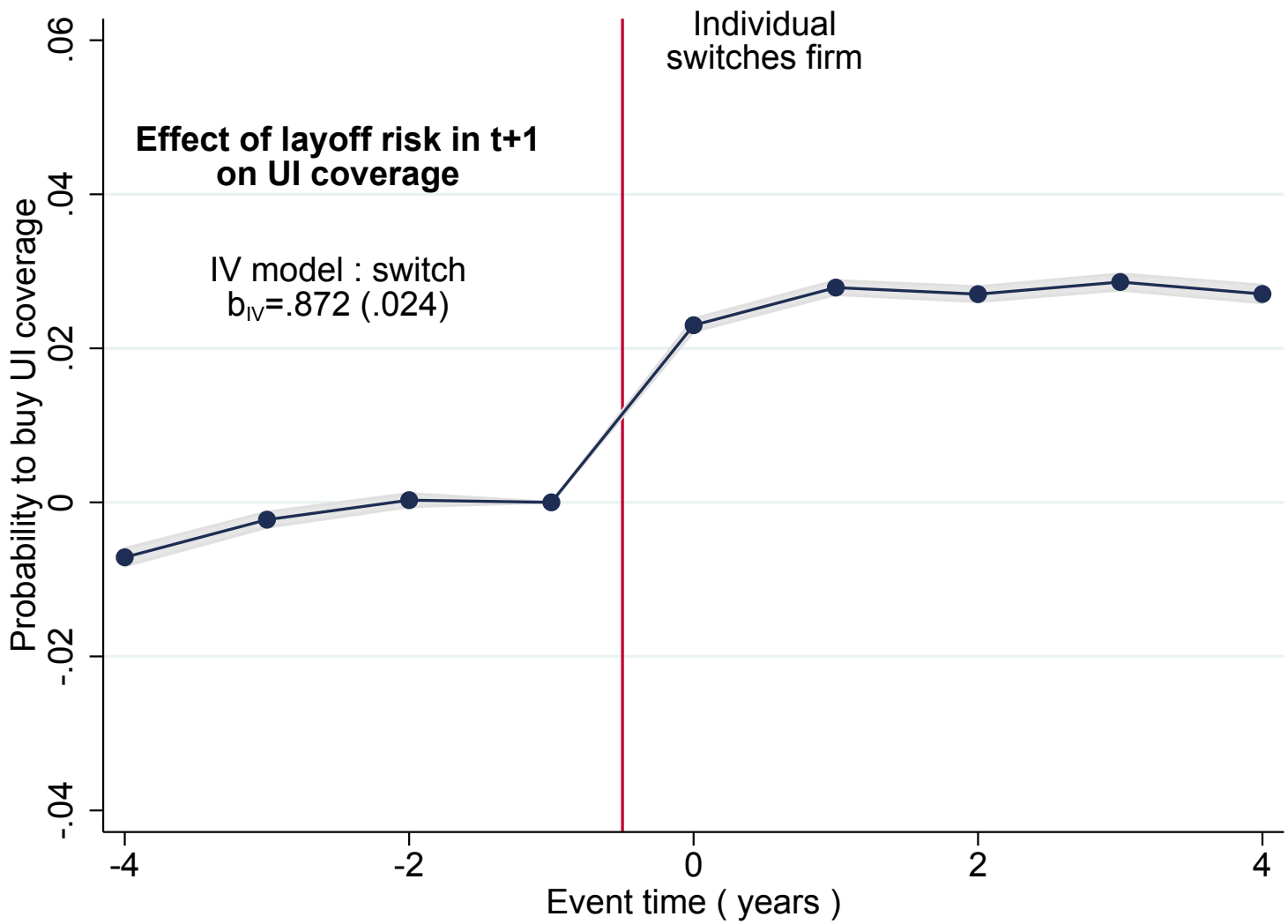


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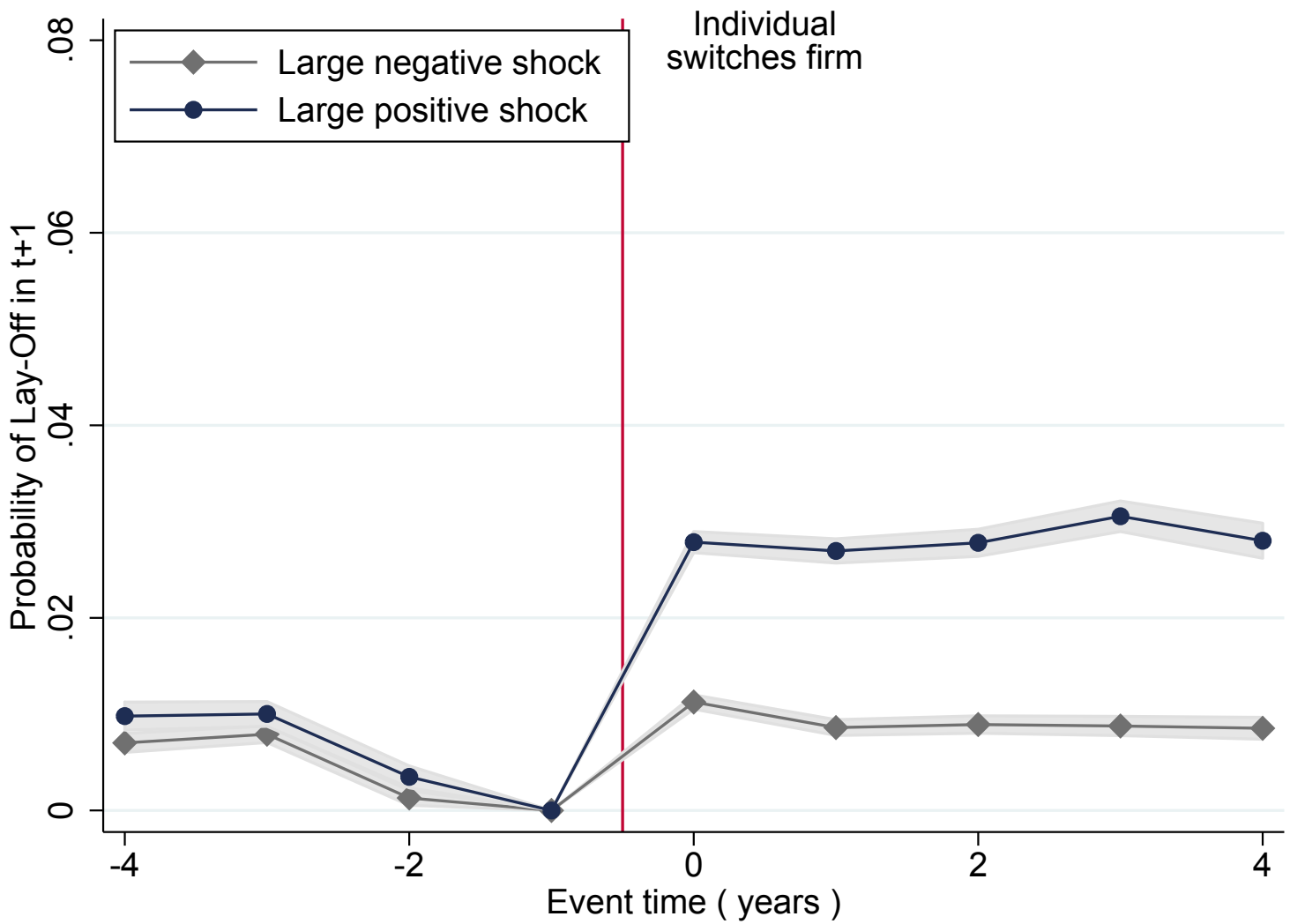


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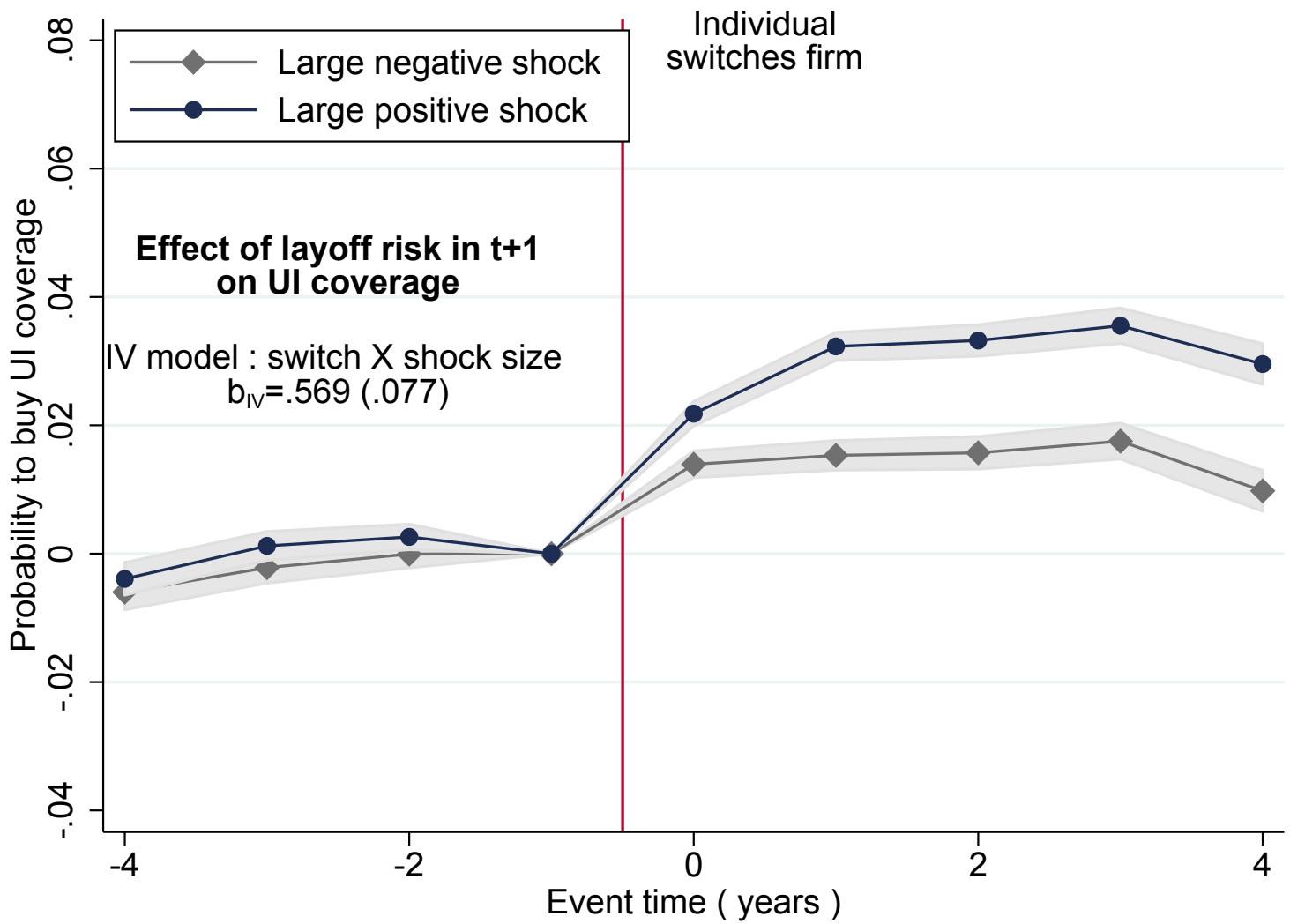


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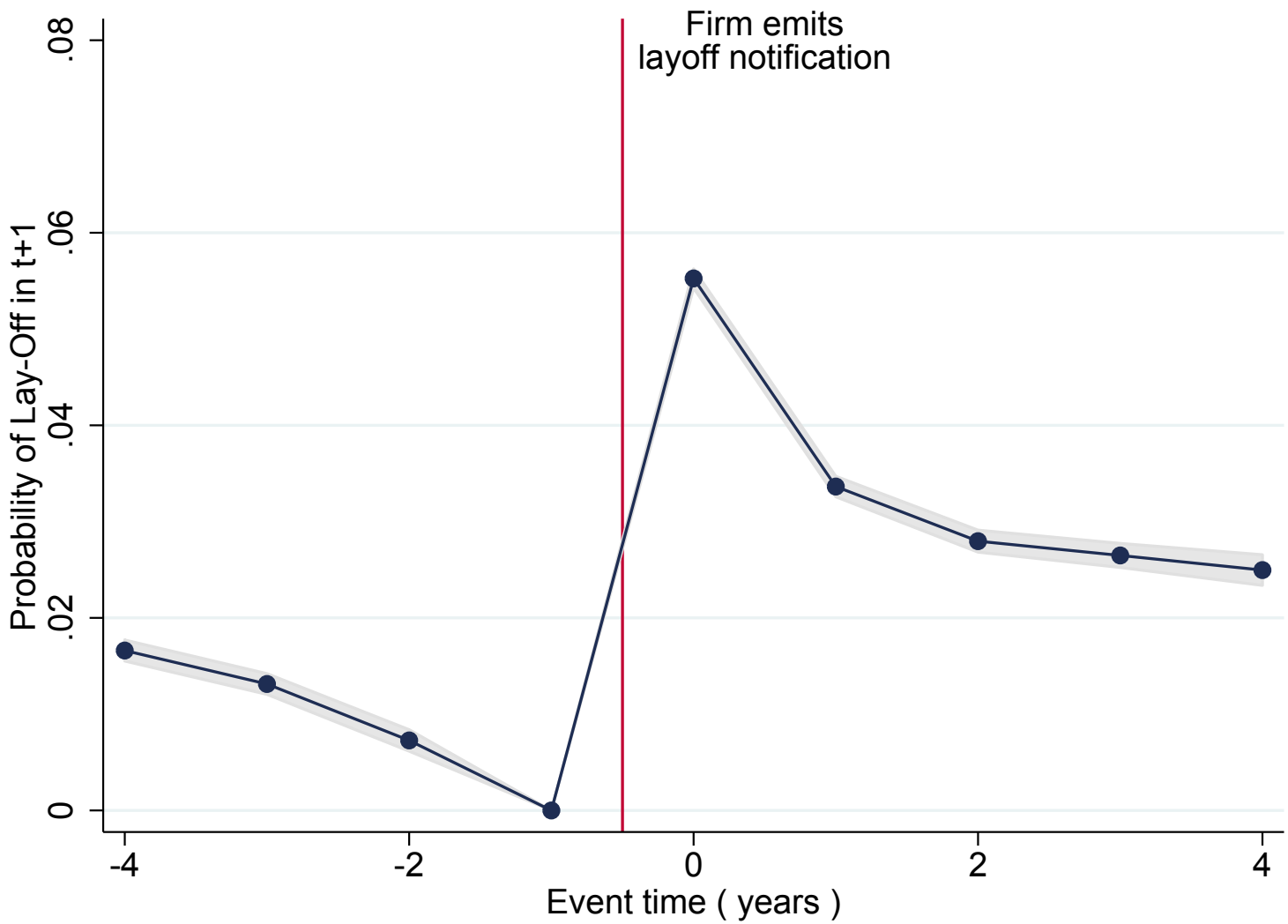
# Firm shocks - Collective Layoff Notification

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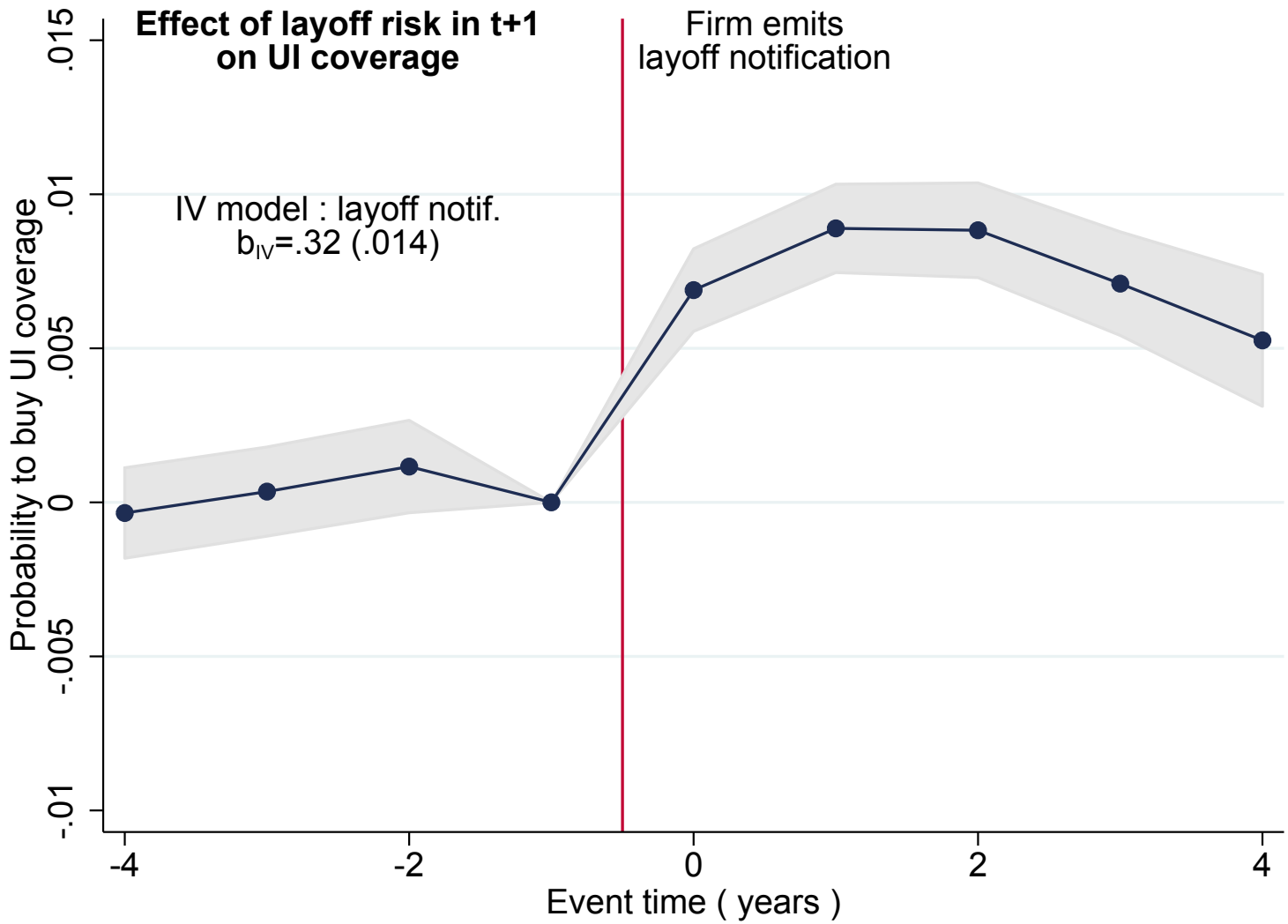


▸ Back

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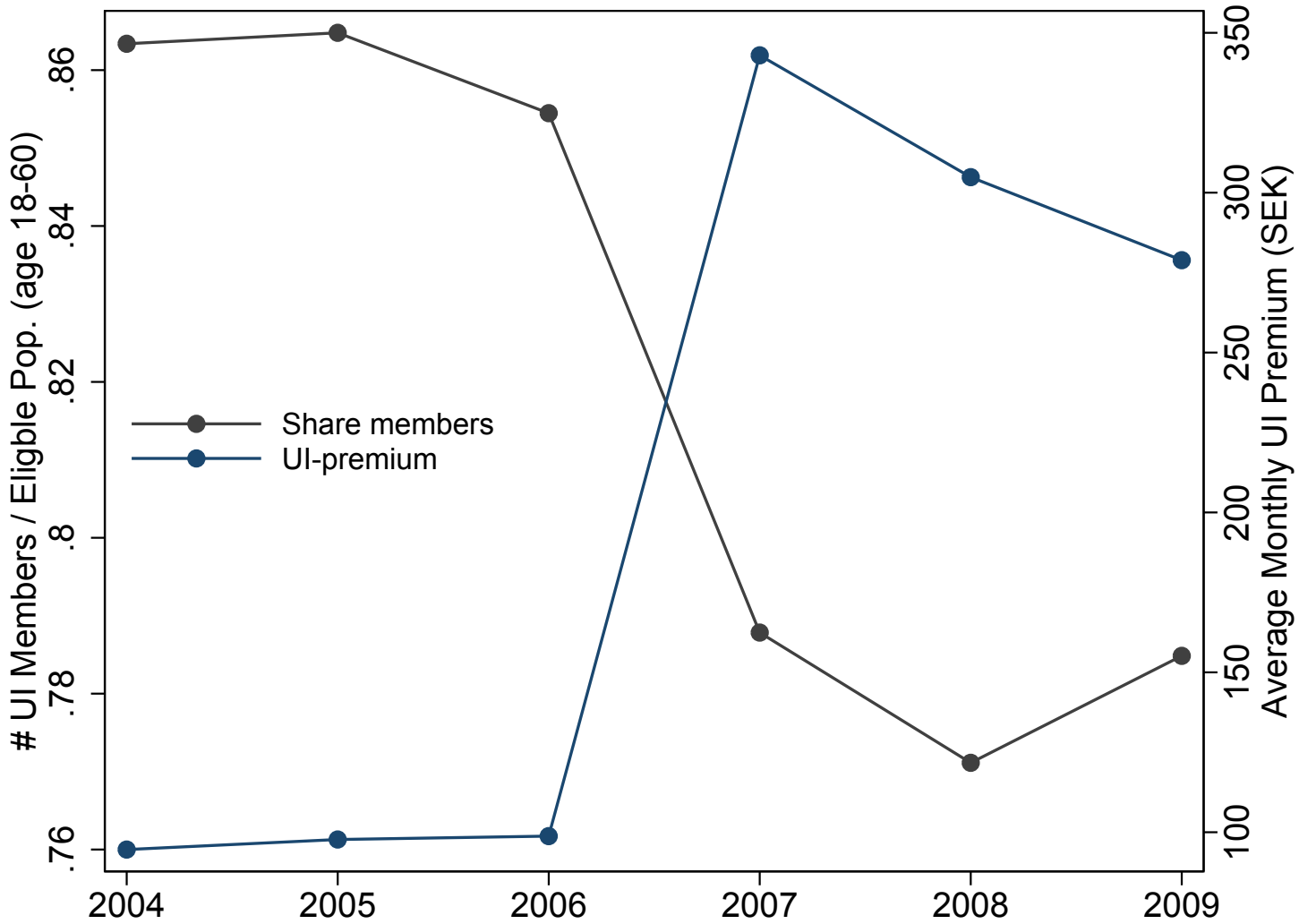
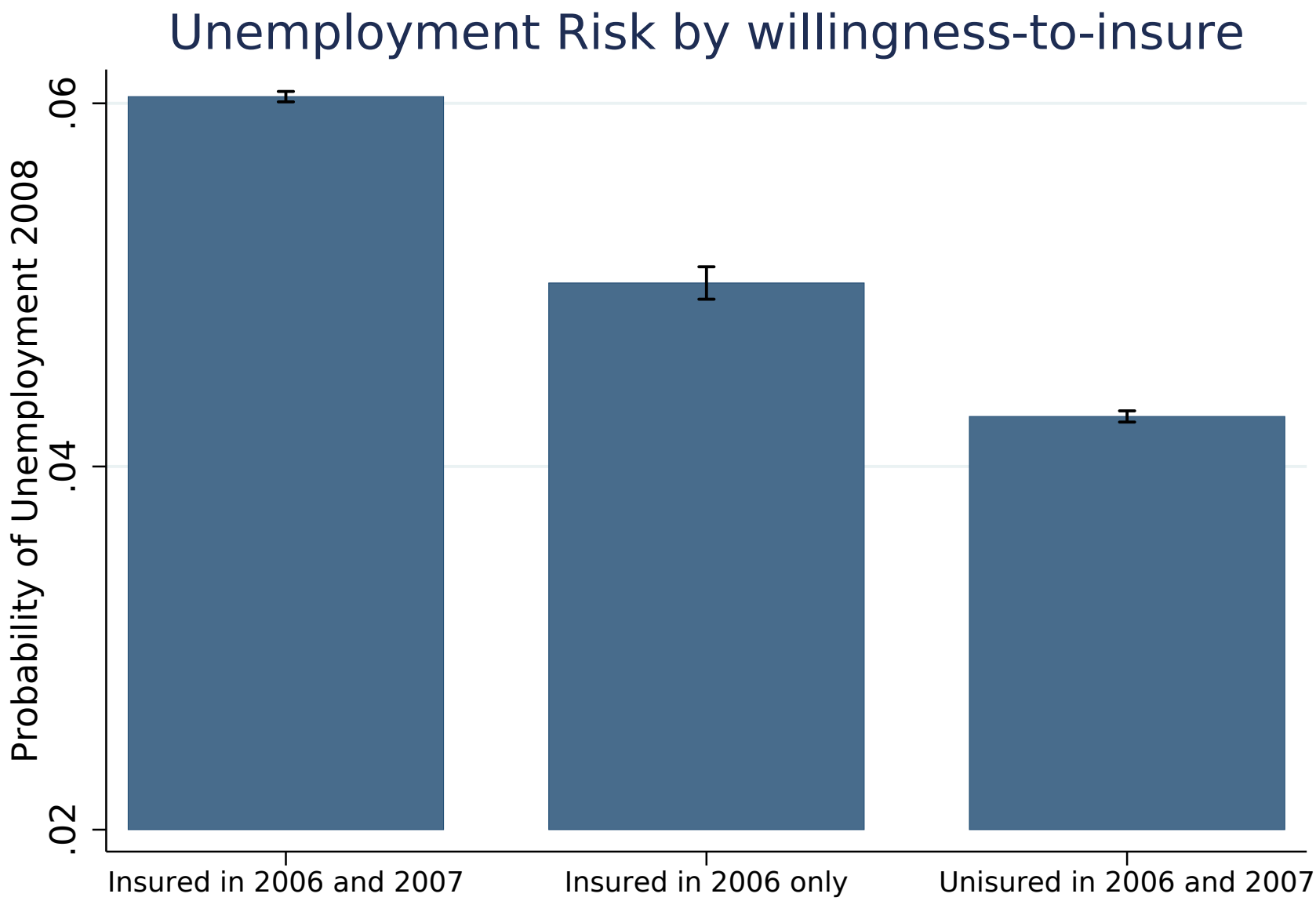
# Price Variation: the 2007 Reform



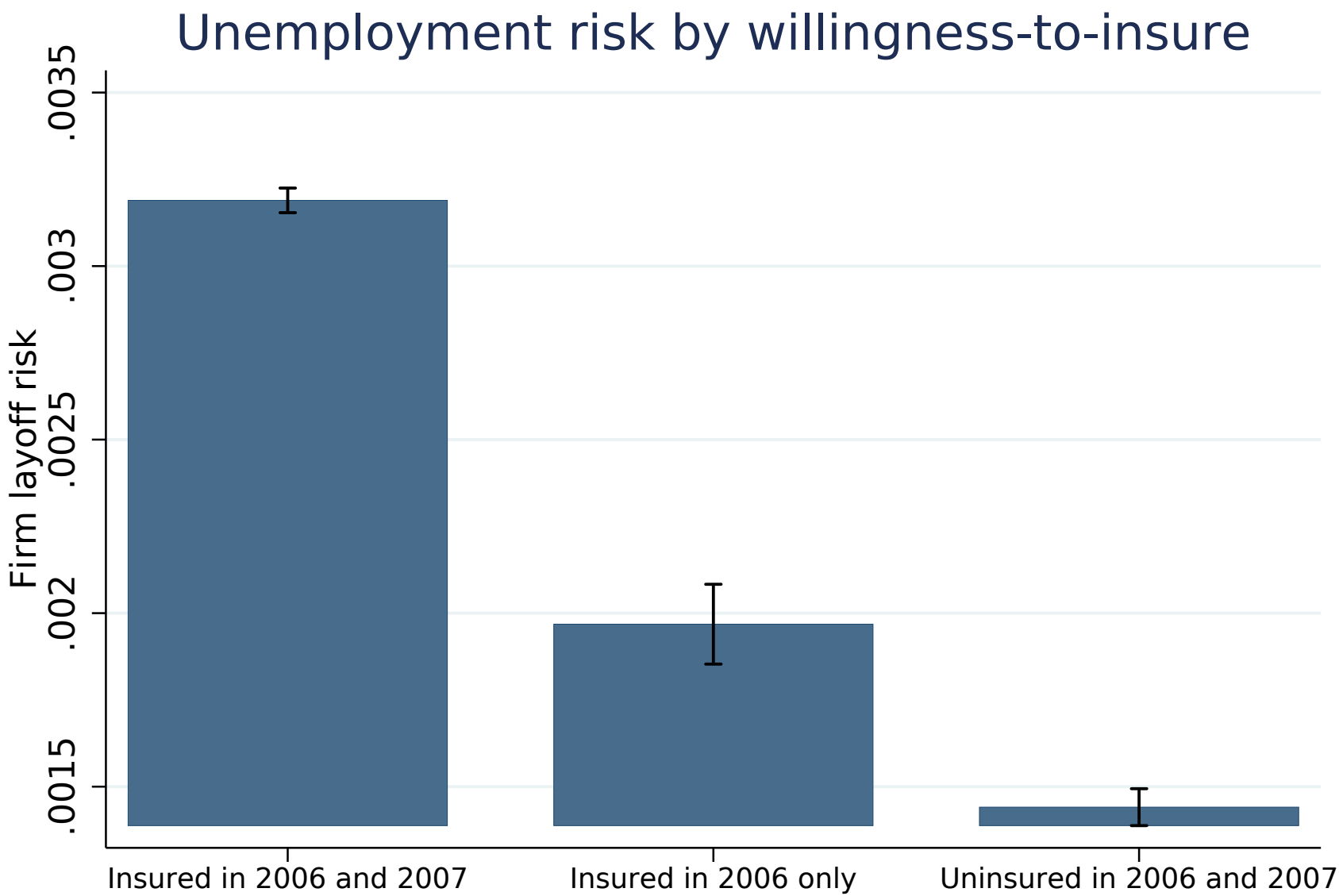

▸ Transition Rates

# Unemployment Risk by Willingness to Pay



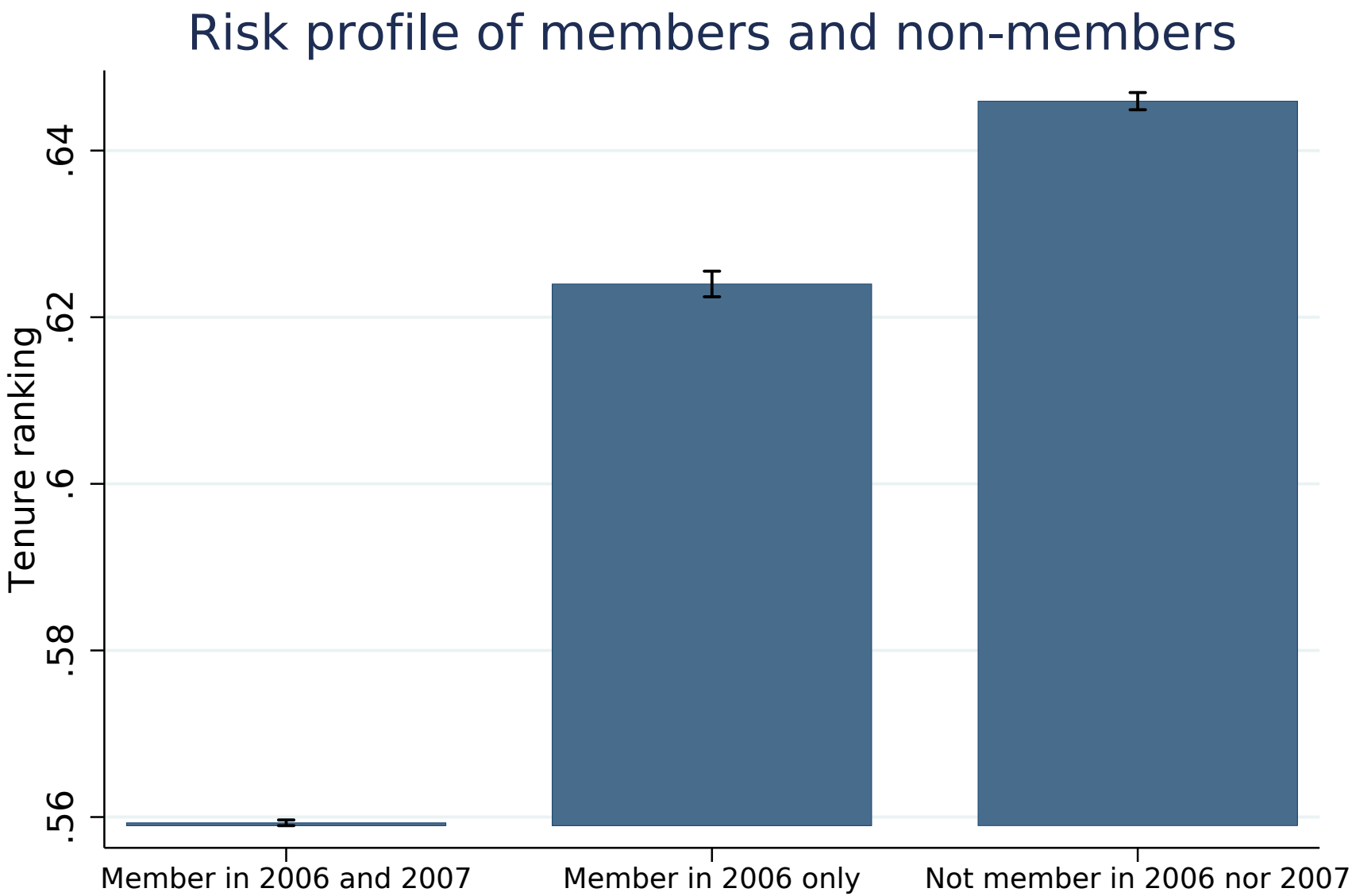

Group means of unemployment probability, indicating whether or not and individual registered as unemployed at the PES in 2008

# Robustness: Firm Risk by Willingness to Pay



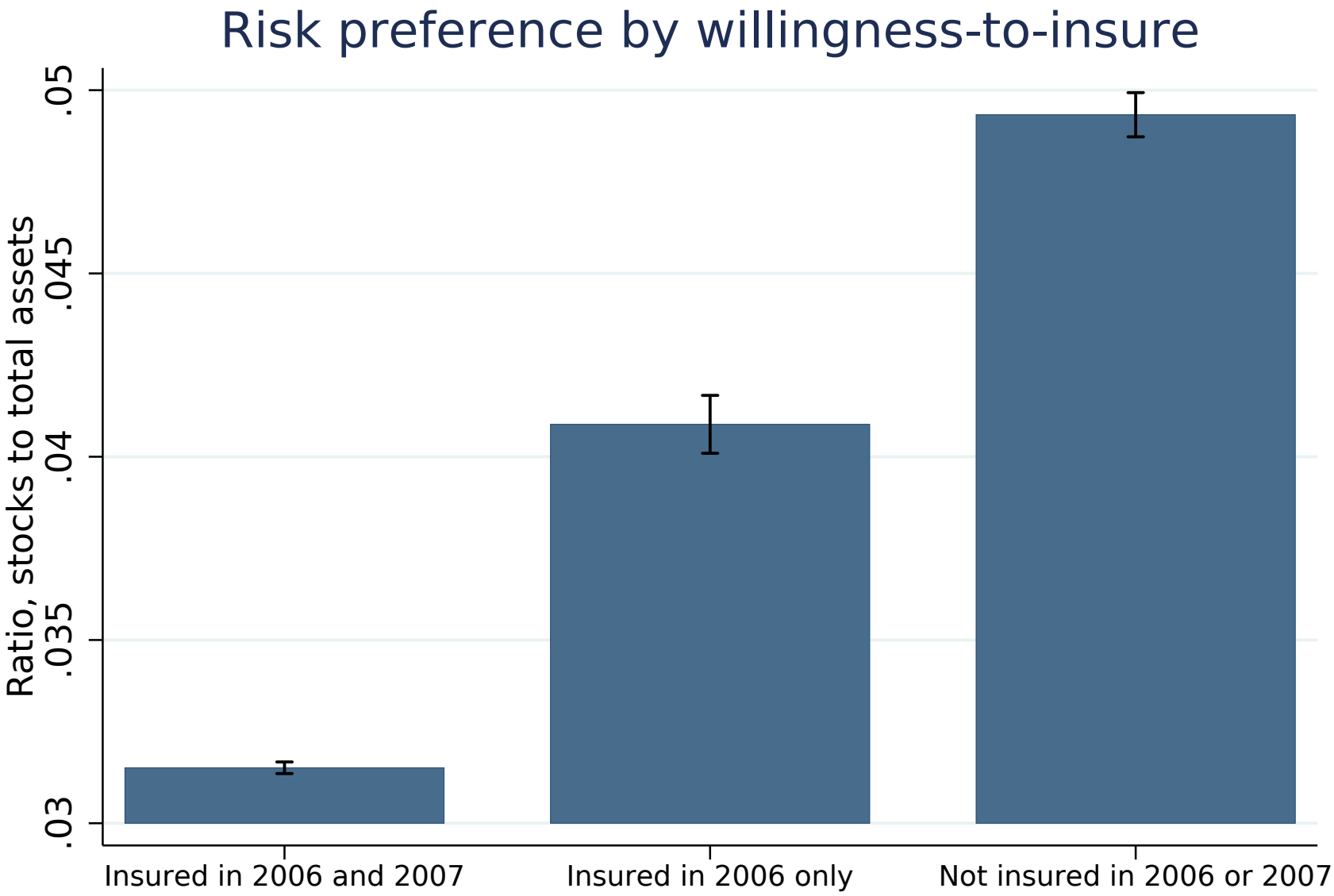

Group means of firm layoff risk. A firm's layoff risk is measured as the share of employees receiving a lay-off notification in 2006
For each individual, the variable is set equal to the layoff risk of the firm he/she is working at in 2006.

# Robustness: Tenure by Willingness to Pay




Group means of tenure risk, based on relative tenure within the firm in 2006, controlling for age and actual tenure (in months).
A relative tenure of 0 indicates that the employee was the last one hired.

# Selection on Preferences




Group means of stock value to total asset value ratio constructed as share of total assets in 2006.
Individuals with less than SEK 20,000 in total asset value have been removed.

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# Implications for Unemployment Policy

- Risk-based selection causes UI markets to be inefficient
  - gvt response = mandate generous UI coverage
  - but no direct evidence that this response is optimal

- Swedish set-up with coverage choice allows for investigation of unexplored questions for design of UI
  1. Should we mandate individuals to buy generous UI coverage?
  2. Should UI policy allow for choice, and how?

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  1. Should we mandate individuals to buy generous UI coverage?
  2. **Should UI policy allow for choice, and how?**

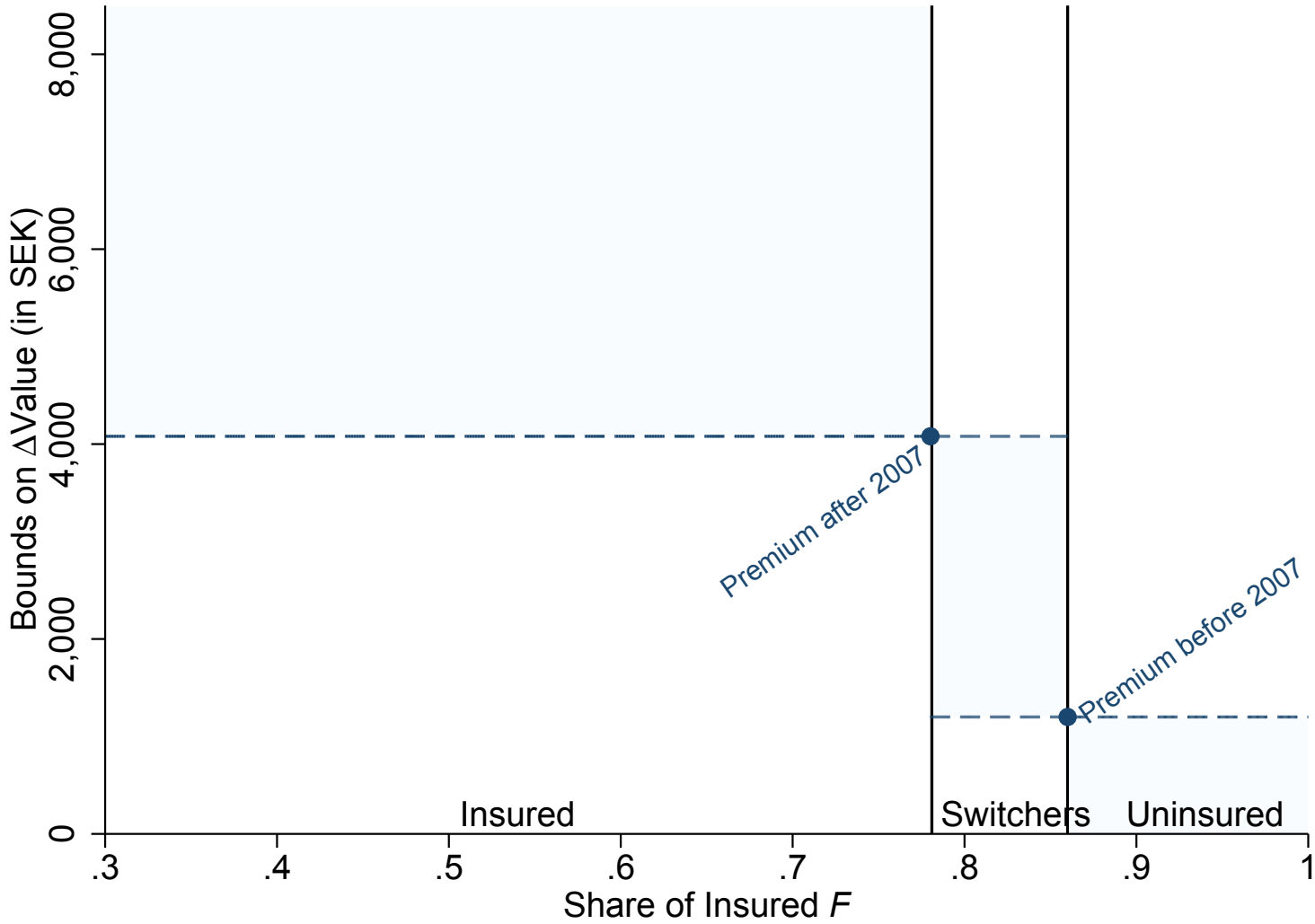
# Q1: Universal Mandate of Generous UI Coverages?

- Exploit observed UI choices given price variation
  - Traces (locally) demand curve, i.e., wtp [RP argument]
  - Traces (locally) relevant cost curves

  $\Rightarrow$ Socially efficient to insure individual if $v_1 - v_0 \geq c_1 - c_0$
- Implementation suggests:
  - Not socially efficient to further reduce population of uninsured

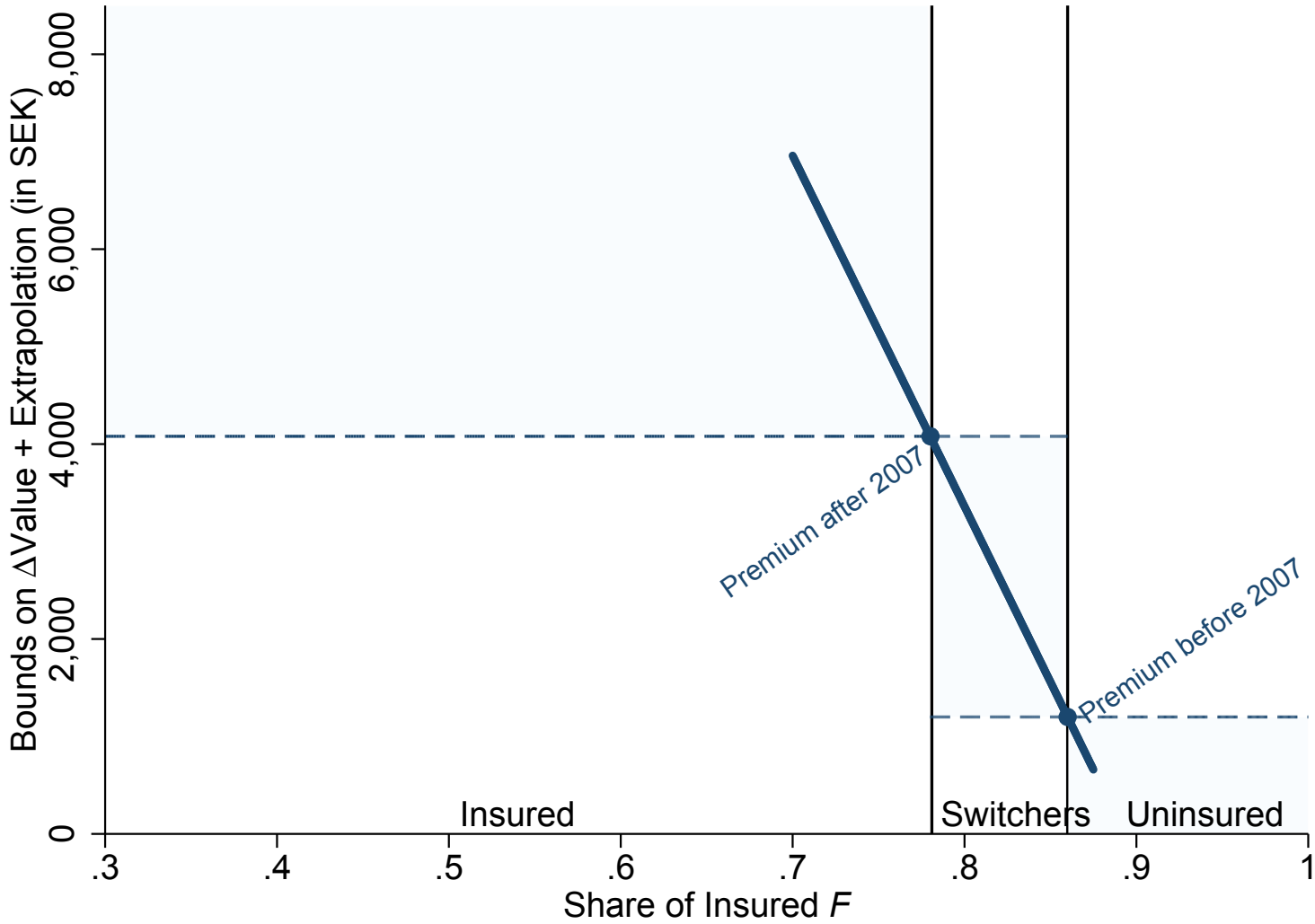
  $\Rightarrow$ Mandates of generous UI coverage (cf. Europe) not necessarily optimal

# Implementation: Graphical Representation




▸ Cost curves

# Implementation: Graphical Representation

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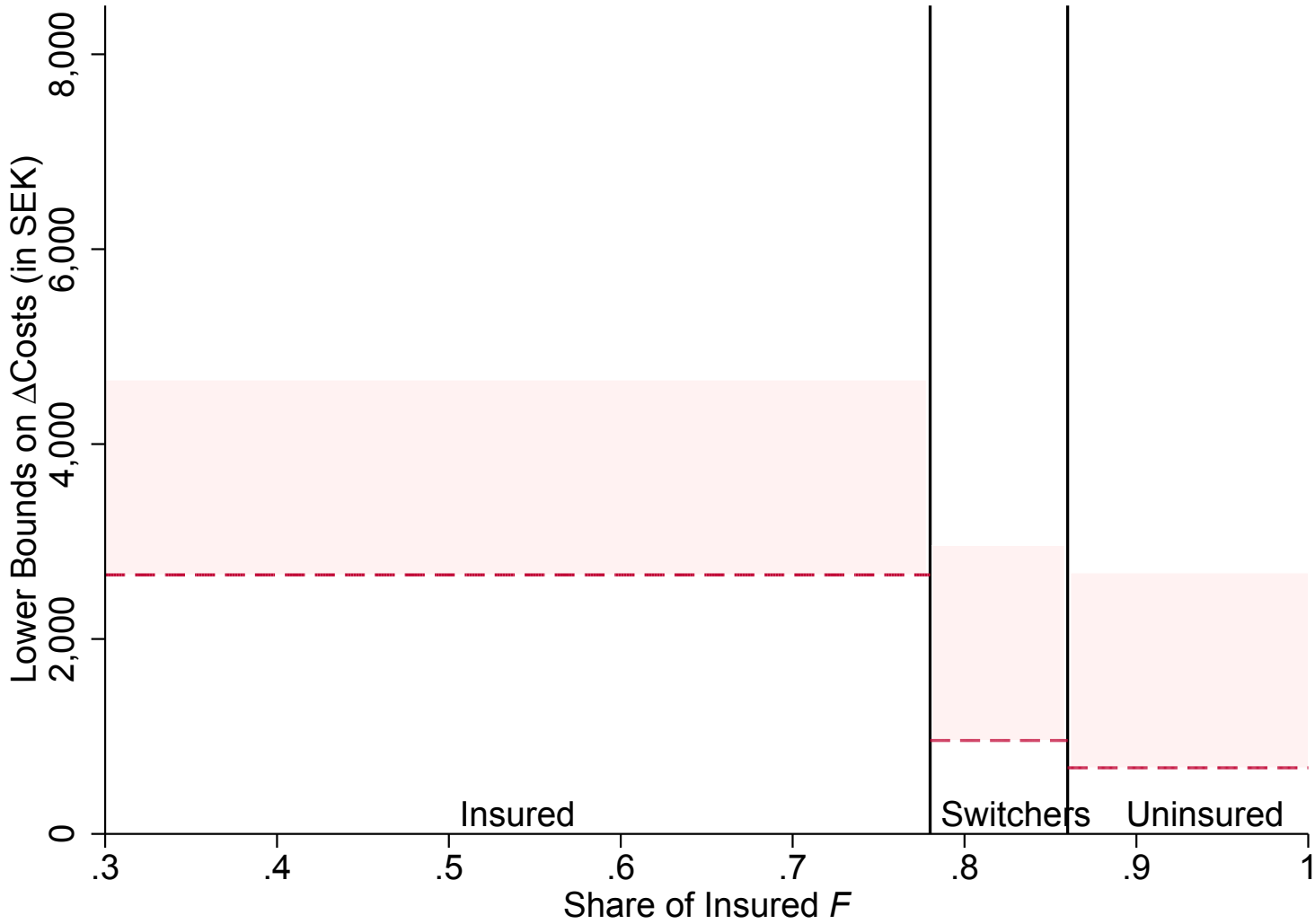


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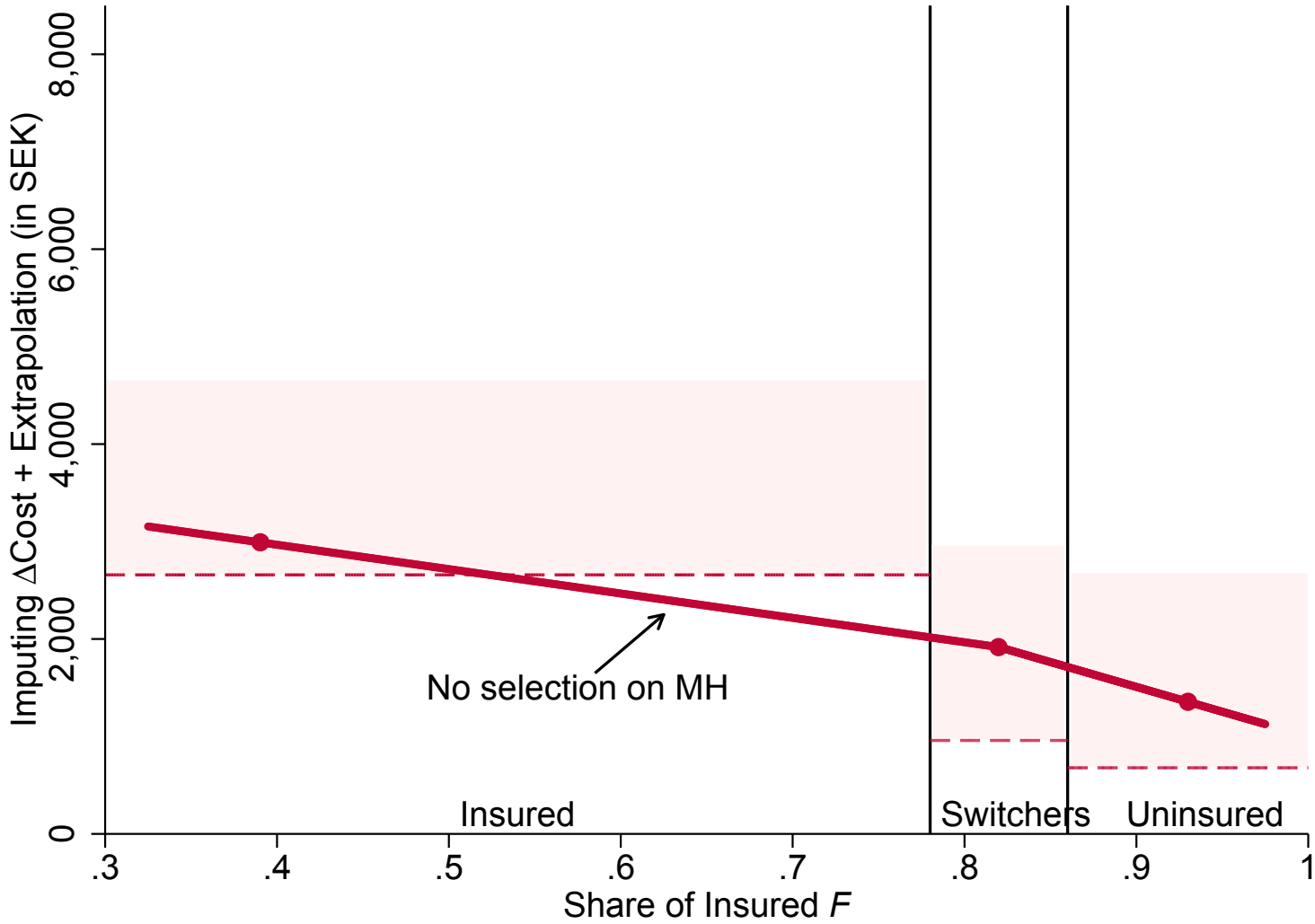


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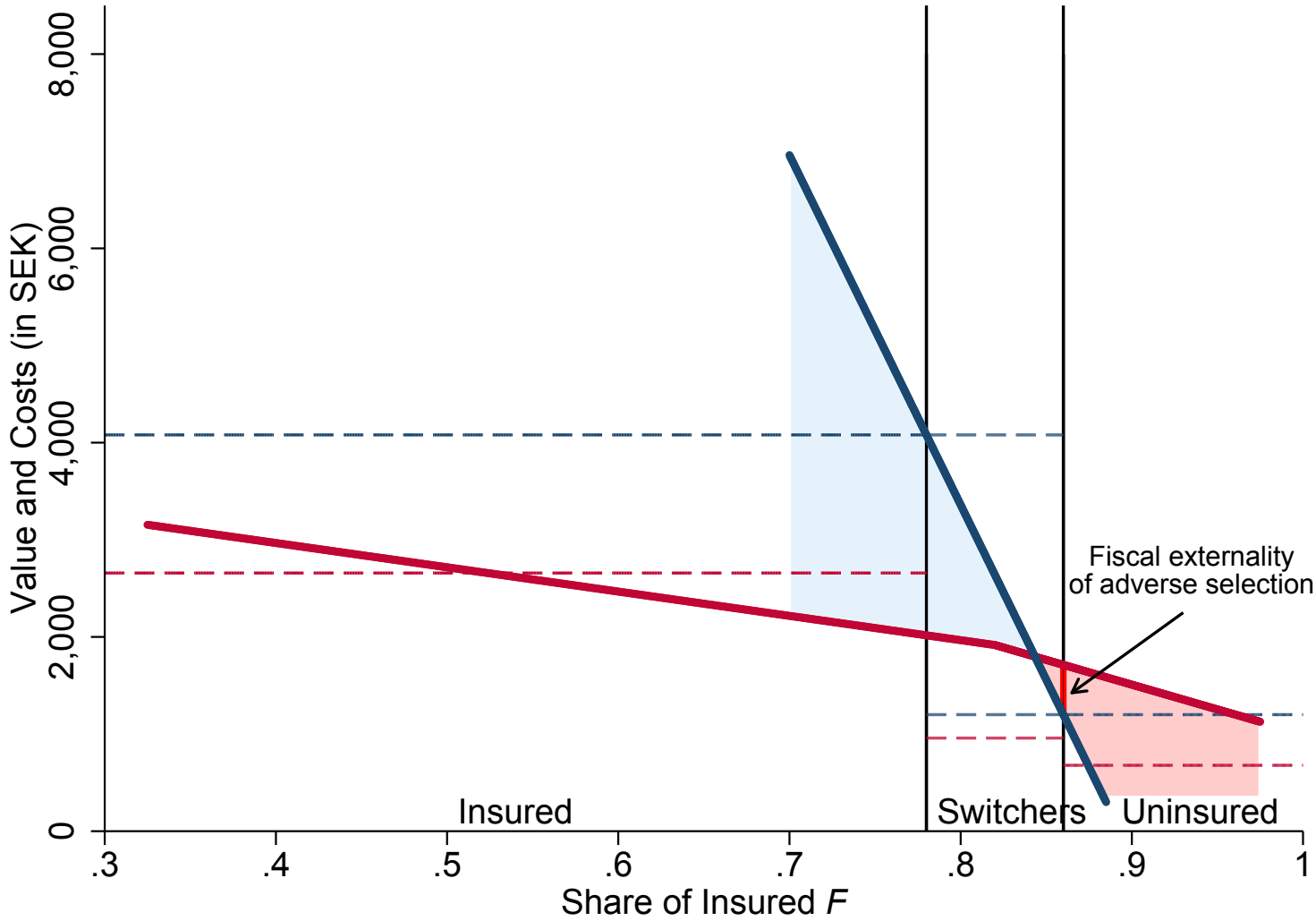


▸ Cost curves

# Q2: How to Provide Choice?

- How to allow for choice under adverse selection?
  1. subsidy $S$ to induce people to buy generous coverage
     $\rightarrow$ *reduce* adverse selection
  2. minimum mandate $b_0$ to increase coverage for the minimally insured
     $\rightarrow$ *mitigate* consequences of adverse selection

- In Sweden:
  1. large subsidy – premium covers only 26 percent of difference in average costs between comprehensive and basic coverage
  2. low minimum mandate – benefit level corresponds to 20 percent of median earnings

- How to evaluate whether this is optimal?

# Q2: Optimal Subsidy

- **Optimal subsidy** $S$ solves:

$$\underbrace{\frac{p_1 - p_0 - E_M(c_1 - c_0)}{p_1 - p_0}}_{\text{AS externality}} \times \varepsilon_{\frac{1-F}{F}, p_1 - p_0} = \underbrace{\frac{E_U\left(-\frac{\partial u_0}{\partial p_0}\right) - E_I\left(-\frac{\partial u_1}{\partial p_1}\right)}{\lambda}}_{\text{Cost of Redistrib. from U to I}}$$

- Optimal subsidy trades off:
  - Reducing adverse selection in supplemental coverage
  - Vs Cost of redistribution from *Uninsured* to *Insured*

# Q2: Optimal Subsidy

- **Optimal subsidy** $S$ solves:

$$\underbrace{\frac{p_1 - p_0 - E_M(c_1 - c_0)}{p_1 - p_0}}_{\text{AS externality}} \times \varepsilon_{\frac{1-F}{F}, p_1 - p_0} = \underbrace{\frac{E_U\left(-\frac{\partial u_0}{\partial p_0}\right) - E_I\left(-\frac{\partial u_1}{\partial p_1}\right)}{\lambda}}_{\text{Cost of Redistrib. from U to I}}$$

- Using envelope conditions, welfare gain from reducing adverse selection simplifies to the corresponding fiscal externality:

$$\begin{aligned} dB &= [(p_1 - p_0) - E_M(c_1 - c_0)] \times dF \\ &= [(E_I(c_1) - E_U(c_0) - S) - E_M(c_1 - c_0)] \times dF \\ &= [E_I(c_1) - E_M(c_1) + E_M(c_0) - E_U(c_0) - S] \times dF \end{aligned}$$

# Q2: Optimal Subsidy

- **Optimal subsidy** $S$ solves:

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- Implementation in Sweden (before 2007):
  - AS externality is negative ($= -.51$) due to large subsidy
  - demand elasticity (using 2007 variation) equals .19
  - large subsidy is optimal for value of redistr. (from U to I) $= .10$
- Supplemental coverage can be valuable despite absence of private market (cf. Hendren), but large subsidy is needed

# Q2: Optimal Minimum Mandate

- Optimal minimum mandate solves:

$$\underbrace{\frac{E_U u'(c_u) - \lambda}{\lambda} - \varepsilon_{E_U(\pi), b_0}}_{\text{Baily-Chetty for } b_0} = \underbrace{\frac{p_1 - p_0 - E_M(c_1 - c_0)}{E_U(c_0)}}_{\text{AS externality}} \times \varepsilon_{1-F, b_0}$$

- Trade-off: insurance value vs. MH + **adverse selection**
  - mitigates impact of AS for those ending up with basic coverage
  - but worsens AS in supplemental market
    - increasing minimum coverage makes residual market more adversely selected ($\sim$ Azevedo & Gottlieb '17)
    - by worsening adverse selection, generous mandate can explain absence of private UI market ($\sim$ Hendren '16)

▸ Discussion

# Q2: Optimal Minimum Mandate

- Optimal minimum mandate solves:

$$\underbrace{\frac{E_U u'(c_u) - \lambda}{\lambda} - \varepsilon_{E_U(\pi), b_0}}_{\text{Baily-Chetty for } b_0} = \underbrace{\frac{p_1 - p_0 - E_M(c_1 - c_0)}{E_U(c_0)}}_{\text{AS externality}} \times \varepsilon_{1-F, b_0}$$

- Implementation in Sweden (before 2007):
  - Insurance value estimates range $\in [.2, .8]$ (Landais & Spinnewijn '16)
  - our imputation of cost curves implies MH cost $\sim .6$
  - large subsidy makes AS externality negative $(\sim -.5)$
- Minimum mandate is desirable in combination with high subsidy!

▸ Discussion

# Conclusion

- We provide first direct evidence of risk-based selection in UI
  - We go beyond PCT using compelling variation in risk and prices
  - Results show that UI is severely adversely selected
- We examine the implications for the design of UI.
  - Despite AS, mandate of generous coverage is not efficient
  - High subsidy and positive minimum mandate are optimal. The two policies are complementary.
- Extensions using richness of data and unique set up:
  - Explore value of insurance (e.g., Landais & Spinnewijn '16).
  - Account for potential **frictions underlying insurance demand** (e.g., Handel, Kolstad & Spinnewijn '16).

# The Swedish UI System: Details (I)

- Eligibility rules for displaced workers:
  - Work requirement to be eligible to any UI coverage (minimum or supplemental):
    - Within the past 12 months have worked more than 6 calendar months at least 80h per month
  - To be eligible to supplemental UI coverage:
    - Fulfill work requirement + have been contributing to a UI-fund for 12 mths prior to layoff
- Quits
  - Cannot receive UI benefits for first 10 weeks of U spell
  - In our data, we can identify quits to control for potential extra moral hazard from quits vs layoffs
- Basic coverage:
  - Fixed daily amount of 320 SEK ($\approx$ 20% of median daily wage)
- Supplemental coverage:
  - Identical for all UI funds
  - 80% of daily wage up to cap
  - Daily benefit = Max(320, min(.8*daily wage, 680))

# The Swedish UI System: Details (II)

- Premia determination:
  - Government controls formula for premia of supplemental coverage
  - No price discrimination (by gender, age, etc.)
  - No price differentiation across UI funds (until 2007, limited differentiation after 2007)
- Link between Kassas and Unions:
  - UI funds were historically linked to Unions
  - But not necessary to be member of Union to be member of Kassa
  - Being member of Kassa does not buy Union membership
  - We observe and always control for Union membership in regressions

▸ Back

# Data

- UI fund membership info for universe of workers (2002-2009) ▸ Details
- Public Employment Service (1990-2015) + UI benefit registers ▸ Details
- LISA (tax, transfers and demographics) (1999-2015) ▸ Details
- Wealth register ▸ Details
- RAMS (matched employer-employee) (1985-2015) ▸ Details
- Layoff-notification register (2002-2012) ▸ Details

# Data: Details (I)

- UI fund membership info
  - From tax data (2002-2006): total premia paid each year
  - From Kassa data sent to Ministry (2005-2009): dummy for membership as of Dec. of each year
  - Covers universe of Swedish individuals above 18
- Public Employment Service (PES)
  - Individuals need to register with PES to get any transfer
  - Record entry - exit date for any unemployment spell from 1990 to 2015
  - Merged with IAF data on UI benefit payments + info on daily wage for benefit computation + info on quits vs layoffs + Kassa membership info for unemployed individuals

Back

# Data: Details (II)

- LISA
  - All income, taxes and transfers + all demographics info
  - Covers universe of Swedish individuals above 18
- Wealth Tax register (1999-2007)
  - Sweden levied Wealth Tax until 2007
  - Records all assets and debts for universe of Swedish taxpayers
  - Used to compute risk proxies, self-insurance / consumption smoothing opportunities, etc.
- RAMS (1985-2015)
  - Matched employer-employee data
  - Reports monthly earnings for each employed individual in any Swedish firm
  - Can compute tenure and tenure ranking for each employee within a firm
  - Can compute layoff risk for each employee within a firm

Back

# Data: Details (III)

- Layoff-notification register (2002-2012)
  - Under Sweden's employment-protection law, employer intending to displace 5 or more workers simultaneously, (or 20 or more workers within a 90-day period), must notify the PES in advance.
  - Two steps:
    1. Intended number of displaced workers must be reported to the PES with cause for displacement
    2. No later than 1 mth after 1st report, list must be submitted with names of displaced workers and displacement dates.
  - lists are determined in negotiations with labor unions
  - "last-in-first-out" principle

▸ Back

# Data: Sample Restrictions and Controls

- We restrict our sample to individuals who are eligible for UI and thus make an actual choice to buy the supplemental coverage or not
  - We consider individuals in the labor force between 18 and 60 years old between 2002 and 2006
  - Since individuals have to work at least half-time for at least six months to be eligible, we drop individuals' choices in year $t$ when their annual earnings are below one quarter of the annual earnings (loneink) at the minimum wage proxied by a janitor's wage (see XX).
  - We check robustness for individuals who have not been unemployed in year $t$.
- We condition on observables that affect the premium individuals pay and the benefits they receive
  - The UI fee depends on whether an individual is unionized and employed, so we control for unionization and whether or not an individual has been unemployed in year $t$
  - The UI benefit level replaces 80% of the pre-unemployment earnings, but capped at a daily level of 730sek. Our imputation of the potential benefit level indicates that this level is reached for annual earnings of 206kSEK. So we control linearly for annual earnings up to this level and a dummy for having annual earnings above 206kSEK.
  - We impute the potential benefit level based on the annual earnings (loneink) in year $t$, using the formula $b = min(730, max(320, 0.8 * (532.23 + .18 * (LoneInk_t))))$ (XXX subject to change - for now estimated on 18-55)
  - We check robustness for individuals who have annual earnings above 206kSEK

## Table: Summary statistics

| | Mean | P10 | P50 | P90 |
|---|---|---|---|---|
| | **I. Unemployment** | | | |
| Layoff probability | 2.84% | - | - | - |
| Unemployment probability | 3.86% | - | - | - |
| Unemployment spell (days) | 8.86 | 0 | 0 | 0 |
| Duration of spell (days) | 218.06 | 28 | 121 | 518 |
| | **II. Union and UI Fund Membership** | | | |
| Union membership | 0.67 | - | - | - |
| UI fund membership | 0.77 | - | - | - |
| | **III. Demographics** | | | |
| Age | 40.08 | 28 | 40 | 52 |
| Fraction men | 0.51 | - | - | - |
| Fraction married | 0.43 | - | - | - |
| | **IV. Income and Wealth, SEK 2003(K)** | | | |
| Gross earnings | 195.9 | 0 | 202.5 | 363.8 |
| Net wealth | 337.7 | -190.1 | 47.5 | 991.9 |
| Bank holdings | 43.2 | 0 | 0 | 104.7 |

Table: Summary statistics: individuals with supplemental UI

| | Mean | P10 | P50 | P90 |
|---|---|---|---|---|
| | **I. Unemployment** | | | |
| Layoff probability | 3.33% | - | - | - |
| Unemployment probability | 4.56% | - | - | - |
| Unemployment spell (days) | 10.31 | 0 | 0 | 0 |
| Duration of spell (days) | 214 | 28 | 118 | 510 |
| | **II. Union and UI Fund Membership** | | | |
| Union membership | 0.83 | - | - | - |
| UI fund membership | 1.00 | - | - | - |
| | **III. Demographics** | | | |
| Age | 40.36 | 29 | 40 | 52 |
| Fraction men | 0.49 | - | - | - |
| Fraction married | 0.45 | - | - | - |
| | **IV. Income and Wealth, SEK 2003(K)** | | | |
| Gross earnings | 219.8 | 18.5 | 221.3 | 371.2 |
| Net wealth | 287.2 | -180.3 | 74.3 | 950.8 |
| Bank holdings | 40.2 | 0 | 0 | 105.1 |

Table: Summary statistics: individuals without supplemental UI

| | Mean | P10 | P50 | P90 |
|---|---|---|---|---|
| | **I. Unemployment** | | | |
| Layoff probability | 1.24% | - | - | - |
| Unemployment probability | 1.49% | - | - | - |
| Unemployment spell (days) | 3.8 | 0 | 0 | 0 |
| Duration of spell (days) | 269.16 | 49 | 175 | 601 |
| | **II. Union and UI Fund Membership** | | | |
| Union membership | 0.10 | - | - | - |
| UI fund membership | 0 | - | - | - |
| | **III. Demographics** | | | |
| Age | 39.12 | 26 | 39 | 52 |
| Fraction men | 0.58 | - | - | - |
| Fraction married | 0.38 | - | - | - |
| | **IV. Income and Wealth, SEK 2003(K)** | | | |
| Gross earnings | 110.7 | 0 | 3.9 | 321.8 |
| Net wealth | 517.4 | -225.2 | 0 | 1,216.7 |
| Bank holdings | 54.2 | 0 | 0 | 102.5 |

# Note on PCT: wtp model vs inverse model

- PCT can be implemented in two ways:
  - by running latent variable model for insurance $v^*$:

$$v = b\pi + \epsilon, \text{ where } \epsilon = cX + \mu$$

$$v^* = 1 \quad \text{iff} \quad v > p$$

  - by running inverse model for risk $\pi$:

$$\pi = \beta v^* + \eta$$

$$v^* = 1 \quad \text{iff} \quad v > p$$

- Estimates from both models are closely related (assuming no measurement error)

$$\beta = \frac{cov(\pi, v)}{var(v)} = [b + c\frac{cov(\pi, X)}{var(\pi)}]\frac{var(\pi)}{var(v)} = \hat{b}_{OLS,bivar.}\frac{var(\pi)}{var(v)}$$

- $\beta$ matters for insurer's pricing, i.e., how average risk $E(\pi|v)$ varies with wtp (see Einav et al. '10). See later.

Back

# Decomposition of PCT: Details

Choice model

$$v = b\pi + cX + \mu$$

For $b_{OLS}$ we use

$$\tilde{\pi} = \pi + f(a) + m$$

$$\begin{aligned} b_{OLS,bivar.} &= \frac{cov(\tilde{\pi}, v)}{var(\tilde{\pi})} \\ &= \frac{cov(\tilde{\pi}, b\pi)}{V(\tilde{\pi})} + c\frac{cov(\tilde{\pi}, X)}{V(\tilde{\pi})} + \frac{cov(\tilde{\pi}, \mu)}{V(\tilde{\pi})} \\ &= b\left[\frac{V(\pi)}{V(\tilde{\pi})} + \frac{cov(f(a), \pi)}{V(\tilde{\pi})} + \frac{cov(m, \pi)}{V(\tilde{\pi})}\right] + c\frac{cov(\tilde{\pi}, X)}{V(\tilde{\pi})} + \frac{cov(\tilde{\pi}, \mu)}{V(\tilde{\pi})} \end{aligned}$$

So, assuming Classical Errors-in-Variables $cov(m, \pi) = 0$ and measurement-error and moral hazard problem, uncorrelated with other variables

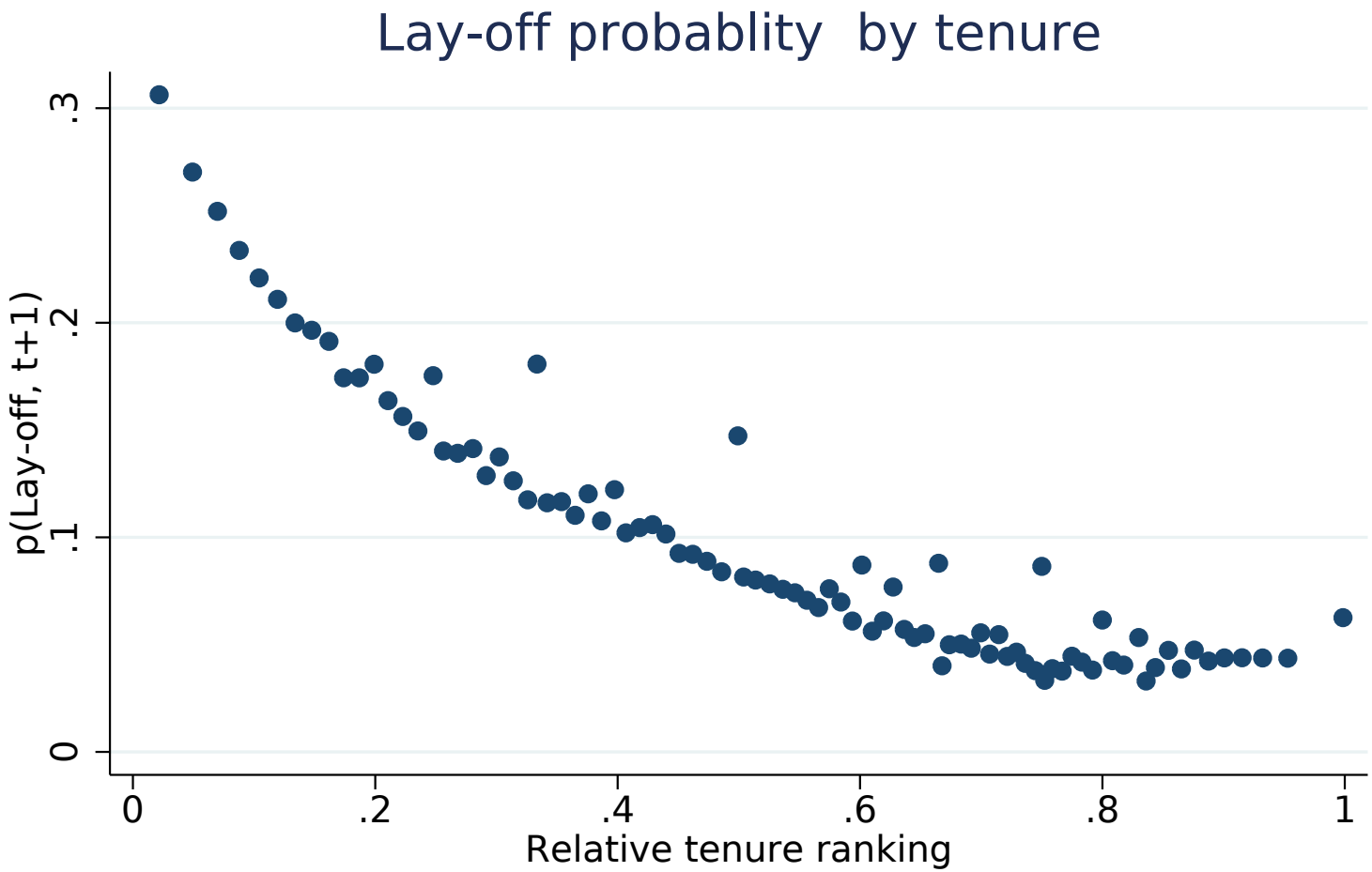
$$b_{OLS,bivar.} = \left[b + c\frac{cov(\pi, X)}{V(\pi)}\right]\frac{V(\pi)}{V(\tilde{\pi})} + b\frac{cov(f(a), \pi)}{V(\tilde{\pi})} + \frac{cov(\tilde{\pi}, \mu)}{V(\tilde{\pi})}$$

So:

1. $b_{OLS,bivar.}$ without controls gives the above
2. $b_{OLS}$ with controls relative to (1) allows to back out $c\frac{cov(\pi,X)}{V(\tilde{\pi})}$
3. $b_{IV}$ relative to (2) allows to back out $\left[\frac{V(\pi)}{V(\tilde{\pi})} + \frac{cov(f(v),\pi)}{V(\tilde{\pi})}\right]$, assuming no selection on unobservables (exclusion restriction is valid)

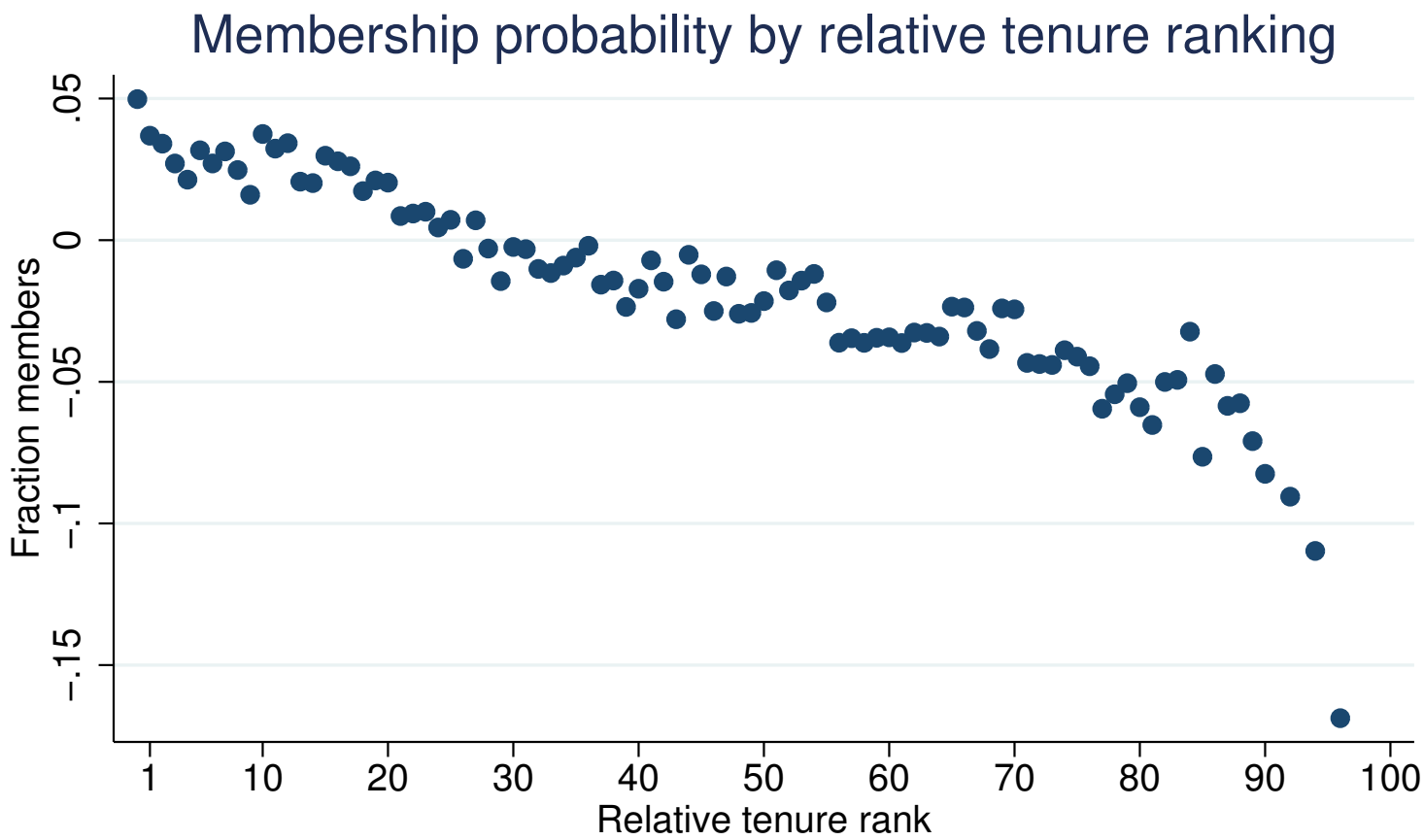
Back

# Tenure & Unemployment Risk - Cross-sectional




Notes: Relative tenure ranking for year t on x-axis, dummy taking the value 1 ifindividual received any unempl. benefits in t+1 on y-axis.

# Tenure & UI Fund Coverage - Cross-sectional




Year: 2007–9
Graph considers all employees aged 18–60
in firms with 50 or more employees.
Relative ranking = 100*(ranking/#employees)
Controls: Age– and tenure–FE.

▸ Back

# Tenure - Cross Section - Details

- Computation of relative tenure ranking:
- Each individual is ranked with a tenure rank (1 for last in) within the firm he is observed in year $t$
- Take for each individual percentile of this rank within the firm
- First-stage: plot average average probability of being laid-off in t+1 ($L_{t+1}$) (y-axis) vs percentile of tenure rank (x-axis)
- Strong correlation between tenure and layoff proba suggests that last-in first out is well-enforced
- Correlation holds when introducing comprehensive set of covariates
- Reduced-form: plot average residuals of regression of proba to buy UI on UNION, year, education, marital status, gender, age, occupation/industry (y-axis) vs percentile of tenure rank (x-axis)
- Reduced-form suggests strong correlation between risk and proba to buy UI $\Rightarrow$ risk-based selection drives PCT
- IV model assumptions: exclusion restriction requires $cov(\mu, T) = 0 \Rightarrow$ no unobservables correlated with tenure ranking
- Potential issues: individual heterogeneity ($\mu_i$) correlated with tenure
- Further check: if such unobservables are fixed within individual, can be differenced out using variation over time

▸ Back

# Switchers' Design - Details

- Using panel data, one can control for (unobserved) individual fixed $\mu_i$ that may be confounding cross-sectional IV $\Rightarrow$ exploit within individual variation in tenure and/or firm risk
- Main source of variation in tenure and/or firm risk = switching firm ($S$)
- When individuals switch firm, tenure goes down and individual risk $\pi_i$ goes up, irrespective of $\bar{\pi}_{-i,j}$ $\Rightarrow$ Event study design around firm switches
- First-stage graphs shows that indeed, after switch, proba of future layoff significantly increases
- Reduced-form shows that proba to buy UI also significantly increases just after switch
- IV model: individual fixed-effect model where $\pi_{i,t}$ is instrumented by $S$
- Potential issue: IV estimate is very large. Individuals may re-optimize at specific times (switches)
- To control for this, exploit also differential variation in firm risk when switching and look at difference in change of proba to buy according to whether individuals move to much riskier ("positive shock") or less risky firm ("negative shock") than previous firm, conditional on previous firm's risk
- First-stage graphs shows that proba of future layoff significantly increases for individuals moving to more risky vs less risky firm
- Reduced-form shows that proba to buy UI significantly increases for individuals moving to more risky vs less risky firm
- IV model: individual fixed-effect model of buying insurance where $\pi_{i,t}$ is instrumented by $S \times \Delta\bar{\pi}_{-i,j}$
- Identification assumption with this IV design: requires no selection on switching to different firm types ($cov(\mu, S \times \Delta\bar{\pi}_{-i,j}) = 0$)

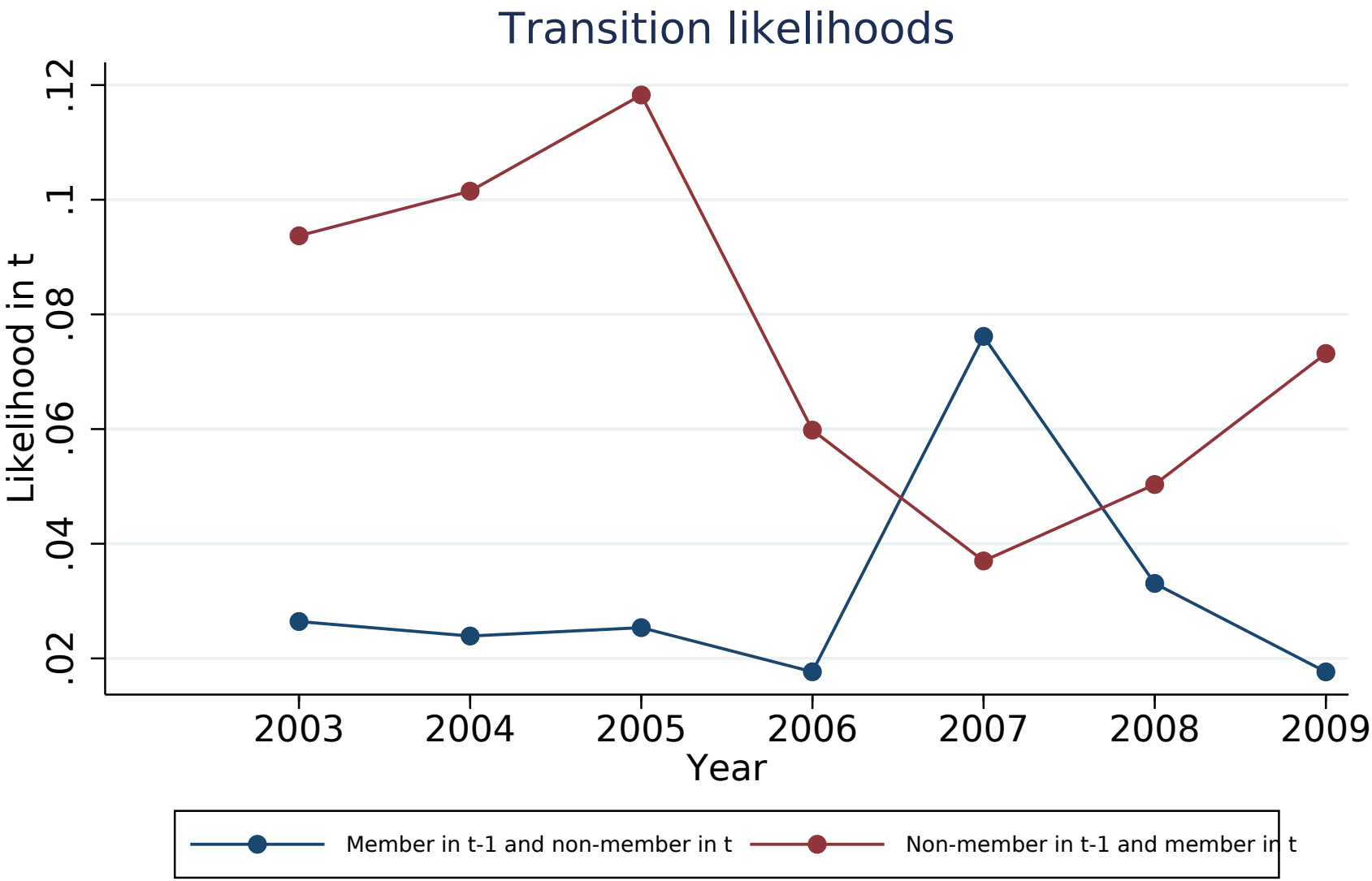
▸ Back

# Firm Shocks Design - Details

- Potential concern with previous designs = firm-level heterogeneity may create that $cov(\mu, S \times \Delta\bar{\pi}_{-i,j}) \neq 0$ when looking at switchers
- In other words, more risky firms may have unobserved characteristics that also correlate with higher UI coverage
- If such characteristics are fixed over time, can use variation in a firms' riskiness for individuals who stay in the firm to difference out both individual and firm-level (fixed) heterogeneity
- Design: use layoff notification $N \Rightarrow$ sharp indication of a sudden increase in proba of layoff within the firm
- First-stage: individuals who are in firm who emit a layoff notification experience sharp increase in future individual layoff proba $\pi_i$
- Reduced-form: individuals who are in firm who emit a layoff notification experience sharp increase in proba to buy UI
- IV: model with both individual and firm f-e where instrument $\pi_{i,j,t}$ by $N_{j,t}$
- Identification assumption: requires no time-varying heterogeneity correlated with $N_{j,t}$ ($cov(\mu_t, N_{j,t}) = 0$)

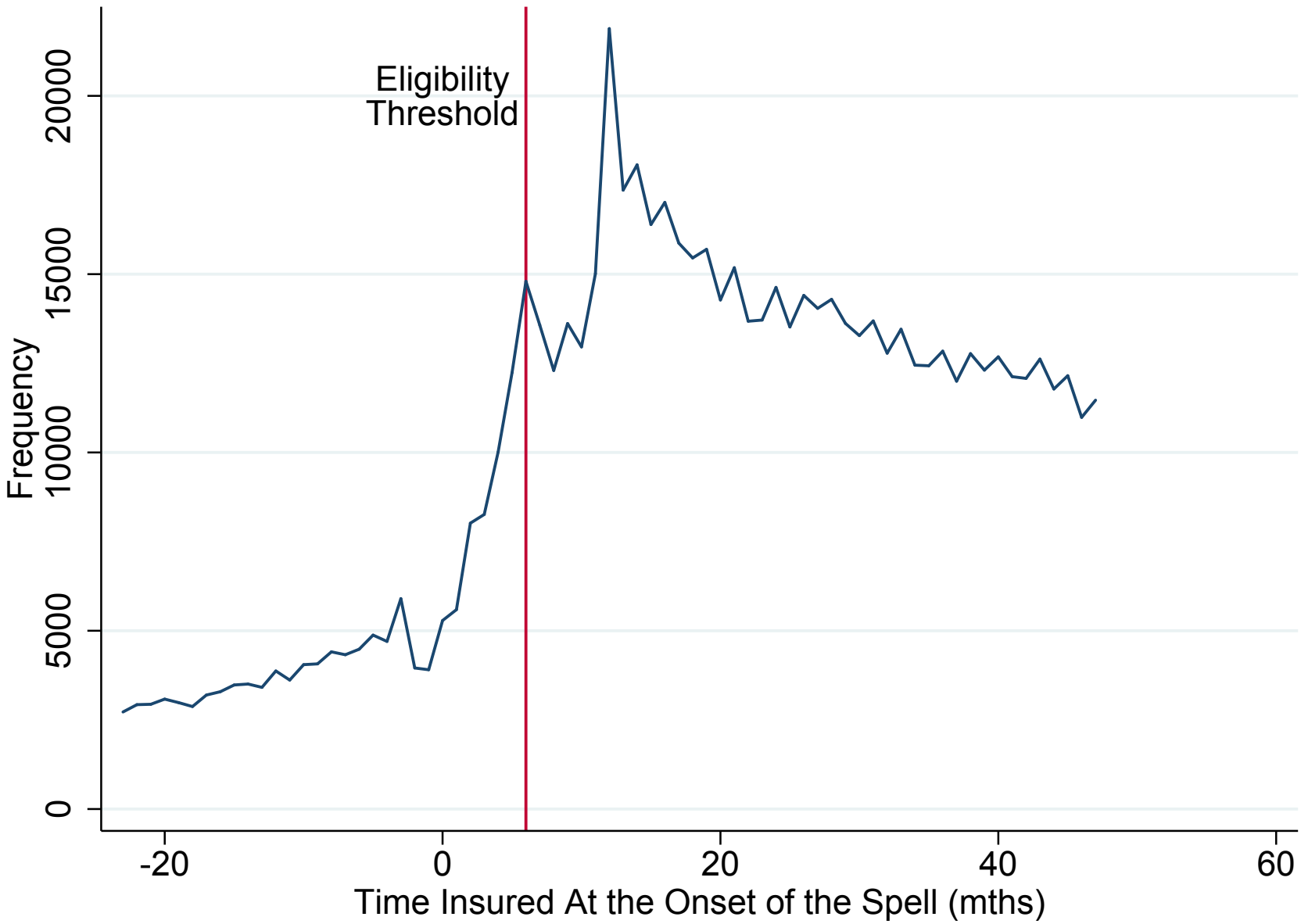
▸ Back

# Price Variation: the 2007 Reform

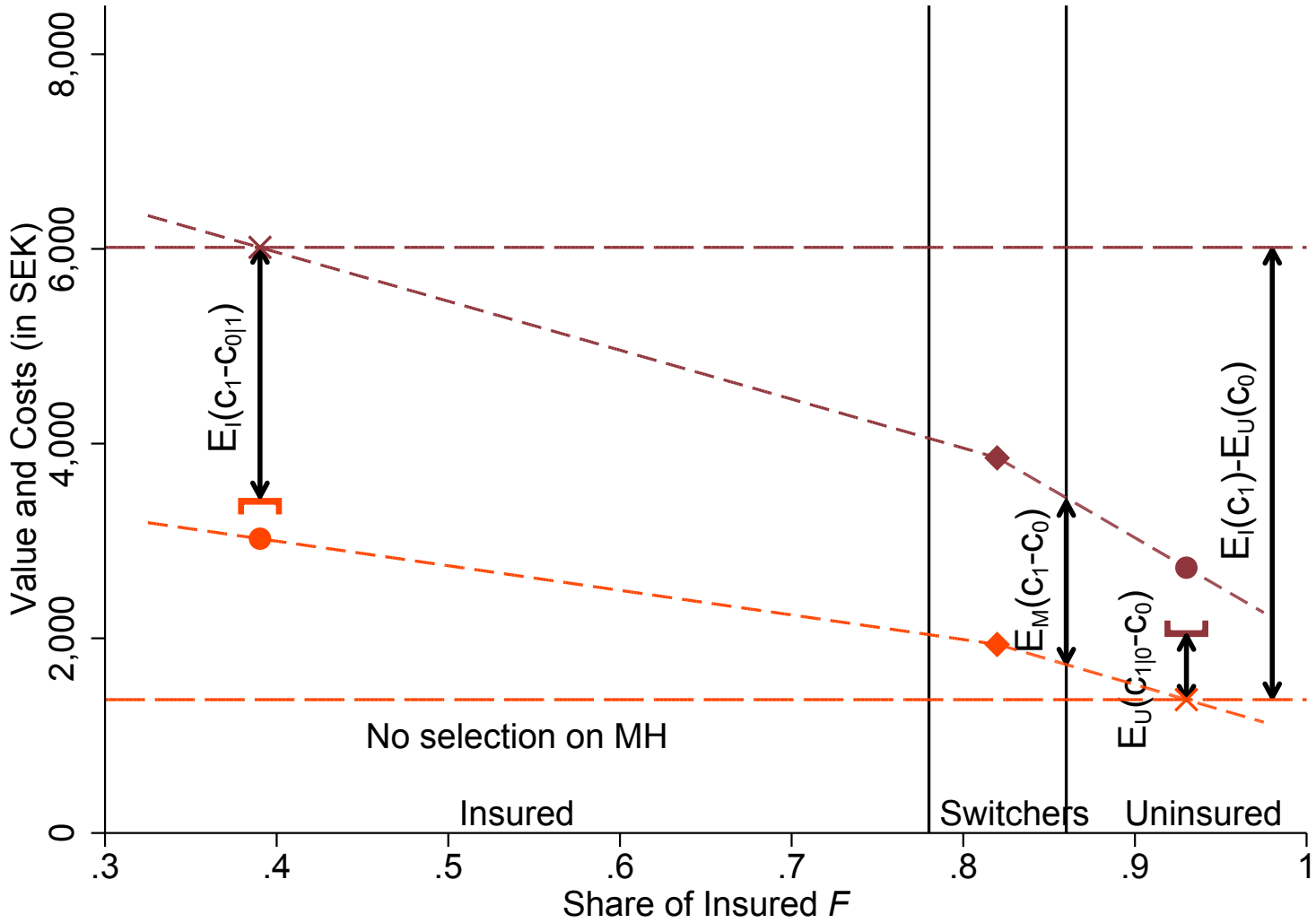



The graphs shows that likelihood that individuals switch their UI membership status in t compared to t-1.
Ages 30-55, excl. duplicates in membership datasets.
Membership from 2002-2004 uses the tax data, membership from 2005-2009 uses the binary ui data.

# Proba density function of layoffs by membership duration



# Cost of Providing Comprehensive vs. Basic Coverage




▸ Back

# Discussion

- Our policy recommendations are local, but the relevant trade-offs are clearly identified and estimable.
- Structural model would allow us to assess non-marginal, joint reforms:
    - clearly valuable: e.g., formulae indicate that $S$ and $b_0$ are complementary policies ($\sim$ Rothschild & Stiglitz '76)
- Challenge: model selection with multi-dimensional heterogeneity and moral hazard!
- Direction: use sufficient statistics as moments for model estimation to preserve the local recommendations

# Extensions

- Similar characterization for $b_1$: Baily-Chetty prescibes benefit level that is too high in an adversely selected market.

  ▸ Details

- We consider stylized framework, but accounts for selection, moral hazard and multi-dimensional heterogeneity.
- Future work could extend work with private market with endogenous contracts (e.g., Chetty & Saez '10, Azevedo & Gottlieb '16)
  - government accounts for fiscal externality of marginals for both plans
  - private insurers only consider impact on their own plan
  - private equilibrium suffers from over-insurance at "intensive margin", but under-insurance at "extensive margin"

# Supplemental Coverage: How to set $b_1$

- In Sweden both coverage options are set by government:
- **Optimal unemployment policy** $b_1$ (with mandate $b_0$)

$$\frac{E_I u'(b_1 - p_1) - E_I u'(w - p_1)}{E_I u'(w - p_1)} - \varepsilon_{E_I(\pi), b_1} \cong -\frac{AS}{E_I(\pi)\, b_1} \times \varepsilon_{F_I, b_1}$$

- Compared to universal mandate, allowing for $b_1 (> b_0)$ increases welfare for those buying it, but introduces adverse selection:
  - less risky people value an (actuarially fair) increase in coverage the least, i.e., $\varepsilon_{F_I, b_1} < 0$
- Government accounts for fiscal externality of marginals for both plans
  - private insurers would only consider impact on their own plan
  - private equilibrium suffers from over-insurance at "intensive margin", but under-insurance at "extensive margin"

▸ Back