Social Interactions in the Demand for Private Health Insurance: Evidence from Linked Employer-Employee Data

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4 September 2024

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Motivation

- Does peer health affect PHI demand?
- If so, for whom? why?

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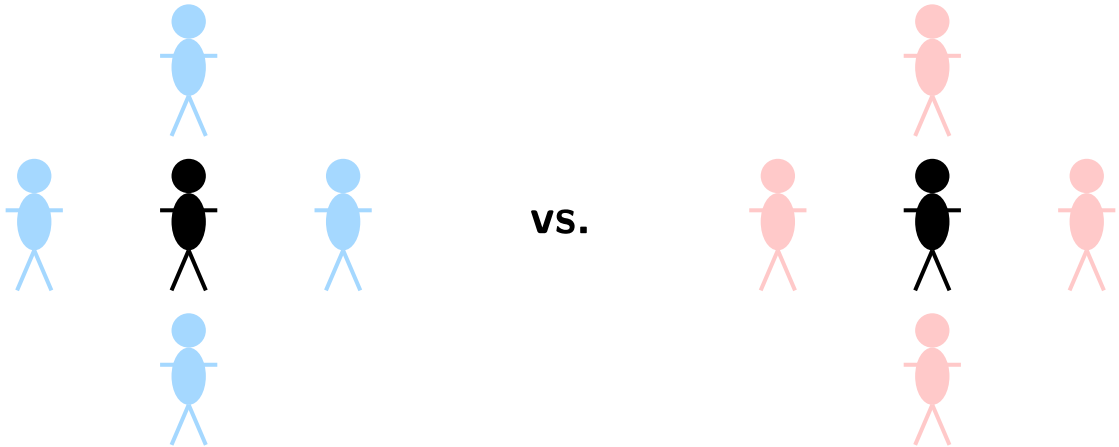
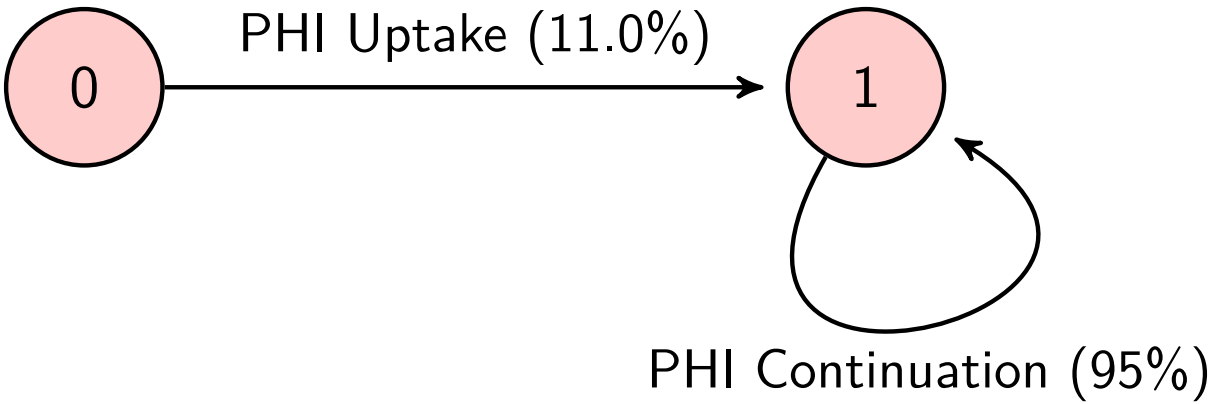
  1. Salient risk hypothesis $\rightarrow$ Bounded Rationality*
  2. Relative health hypothesis



Introduction

- This study investigates the effects of **coworkers' health condition** on private health insurance (**PHI**) demand using Australian linked employee-employer data.
- Coworkers as **"free consultants"** in many decisions.
  - Maven Influence
- Peer effects in transitional probabilities:



Literature: Insurance

- Lieber & Skimmyhorn (2018) investigate the peer effects in financial decisions such as retirement savings, life insurance, and charitable giving.
  - Peers affect charitable giving decision, but do not affect retirement savings or insurance purchase.
  - Observability of the decision could be critical.
- Handel et al. (2024) investigate the determinants of choice quality in the Netherlands.
  - People tend to choose similar plans as their peers.

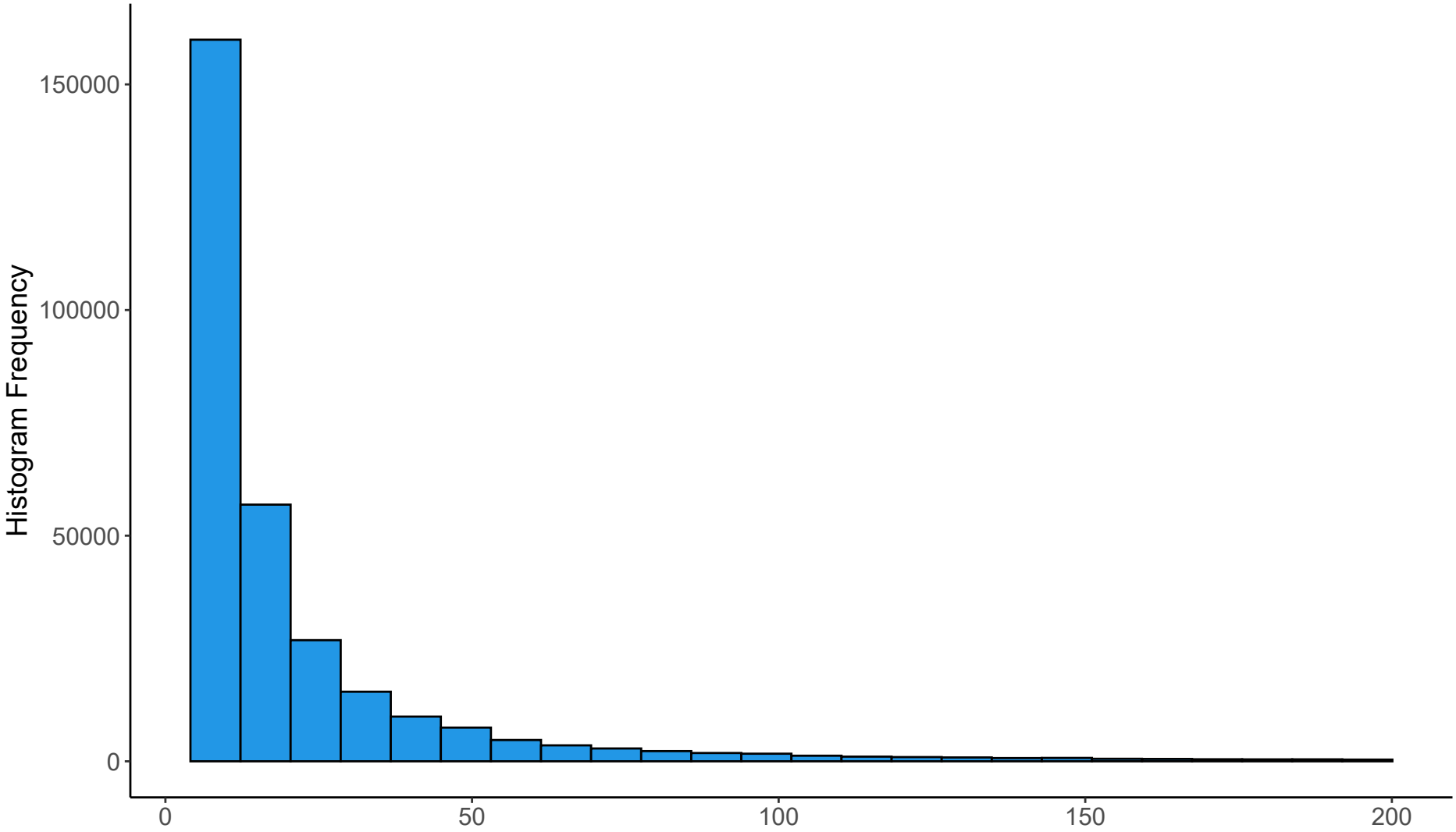
Literature: Econometrics

- Binary outcomes with linear probability model (Boucher & Bramoullé, 2020)
- Our econometric results also relate to the discussions on heterogeneity in peer effects estimations (Lin et al., 2021).
- Microfoundations:
  - The linear-in-means model implies a quadratic utility function that is very restrictive.
  - Boucher et al. (2024) shows individuals often deviate from LIM behavior and propose an alternative with the CES utility function.
    - Conventional identification strategies may be inadequate (Bramoullé et al., 2009).
  - Our empirical strategy does not impose any restriction of the consumers' utility function (regarding the endogenous effects).

Data

- Newly available high quality linked administrative data, similar to Scandinavian countries.
- Population-based administrative records.
  - Individual tax records + health records + *other*
- Advantages:
  - Australia is larger and culturally distinct from countries in which such data are typically available.
  - Small firms!

Firm Sizes



Measuring Health

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Measuring Health

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- **Pharmaceutical Benefits Scheme (PBS)**: a government-funded program that provides subsidized prescription medicines.
- **Filter:** Patients need a prescription from a physician to utilize PBS.
  - "Expenditure and prescriptions twelve months to 30 June 2016" (Thomas & Marlton, 2016)
- **Variable:** *The total number of PBS Transactions in the financial year 2015-2016 (PTC)*

PBS Utilization by Age, Gender and PHI Status

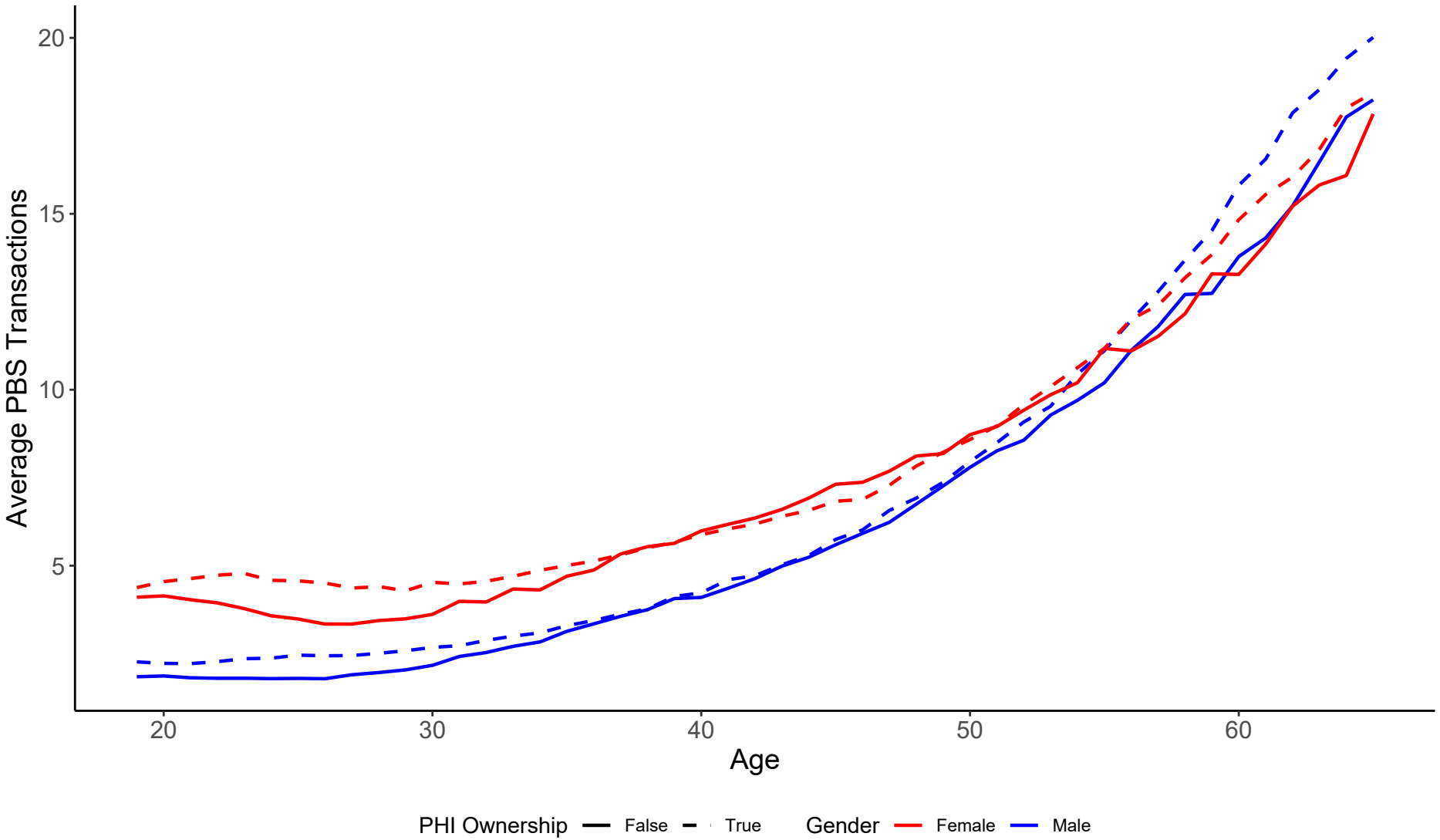

Figure: PTC by Age, Gender and PHI Status

PHI Status by Age and Gender

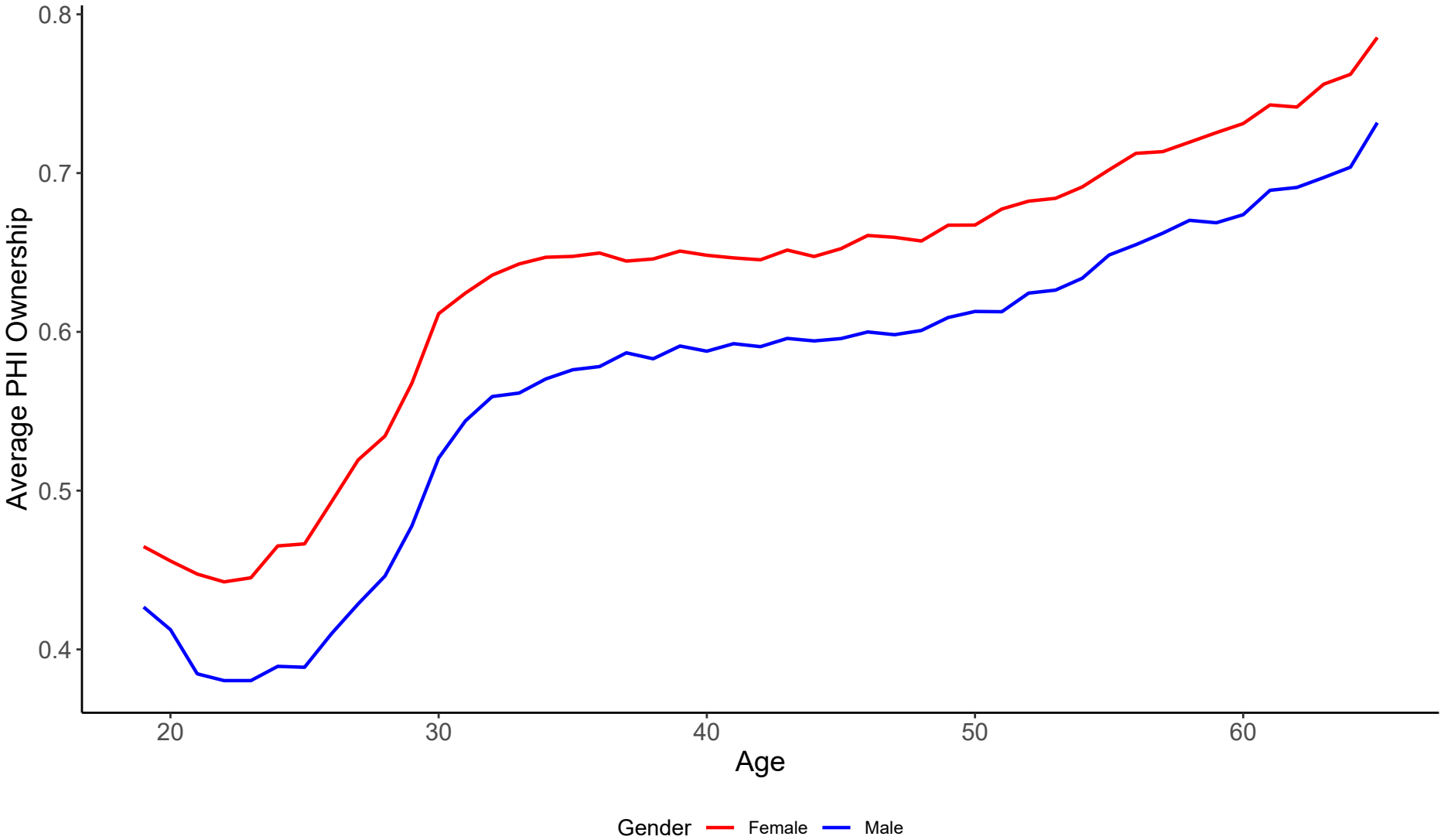

Figure: PHI Status by Age and Gender

Econometric Specification

- Linear probability model (Boucher & Bramoullé, 2020).
- Model transition probabilities

$$\mathbb{P}\left[y_{i,t+1} = 1 | y_{i,t} = Y, a_{j,Y}, h_{i,t}, \overline{h}_{-i,t}, \boldsymbol{z}_{i,t}, \boldsymbol{x}_{i,t+1}\right] \tag{1}$$

where

- $a_{j,Y}$: The firm j fixed effects conditional on Y at time t.

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where

- $a_{j,Y}$: The firm j fixed effects conditional on Y at time t.
- $h_{i,t}$: The health proxy variable at time t.
- $\overline{h}_{-i,t}$: Co-workers' average h, excluding i at time t.
  - ***Main interest!!***

Identification (1): Measuring Health

$$h_{i,t} = \ln(PTC_{i,t}) - \mathbb{E}\left[\ln(PTC_{i,t}) | PHI_{i,t} = y, j, \boldsymbol{z}_{i,t}\right] \tag{2}$$

- **Un/Healthy**: Deviations from the gender-age norms ($\boldsymbol{z}_{i,t}$).
- We assume Equation 2 linear in $\boldsymbol{z}_{i,t}$.
  - In practice, it is *a non-linearized linear model.*
- Plugging linearized Equation (2) to the main model, we show that own health and co-worker's health condition are identified from PTC coefficients ($p_{i,t} = \ln(PTC_{i,t})$),

$$\begin{aligned}&\mathbb{P}[y_{i,t+1} = 1 | y_{i,t} = Y, \dots] \\ =&c_{j,Y} + \alpha_Y p_{i,t} + \beta_Y \overline{p}_{-i,t} + \boldsymbol{z}'_{i,t}\theta_Y + \overline{\boldsymbol{z}}'_{-i,t}\lambda_Y + \boldsymbol{x}'_{i,t+1}\delta_Y.\end{aligned}$$

Identification (2): Endogenous Peer Effects

$$\begin{aligned}&\mathbb{P}[y_{i,t+1} = 1 | y_{i,t} = Y, \dots] \\ &= c_{j,Y} + \alpha_Y p_{i,t} + \beta_Y \overline{p}_{-i,t} + \boldsymbol{z}'_{i,t}\theta_Y + \overline{\boldsymbol{z}}'_{-i,t}\lambda_Y + \boldsymbol{x}'_{i,t+1}\delta_Y. \end{aligned} \tag{3}$$

- **Firm fixed effects** ($c_{j,Y}$): Allowed to vary with the transitional direction, i.e., Y.
  1. Sample Sorting: Firm-level correlated effects.
  2. Endogenous Peer Effects: Co-workers average PHI ownership excluding i in the firm.
     - Main identification challenge in peer effects estimations (Manski, 1993; Bramoullé et al., 2009).
     - We exploit the fact that the outcome variable is binary and $\overline{y}_{-i}$ can only take two values within the firm conditional on $y_{i,t-1} \in \{0, 1\}$. Example Simulations
- **Source of Identification**: Variation in firm sizes.

On Contextual Effects Identification Problem

- Boucher et al. (2024): Point out misspecification problem with linear-in-means models (Manski, 1993; Bramoullé et al., 2009).
  - Theoretical and empirical implications demonstrated.
- This implies that any misspecification of endogenous effects terms will potentially cause spurious contextual effects (purpose of this paper).

$$y = f(\bar{y}) + \gamma\bar{x} + \beta x + \epsilon.$$

- Our identification approach prevents such spurious correlation mechanically.
  - **Con:** Cannot attain efficiency gains via network sparsity restrictions: Homophily (McPherson et al., 2001; Currarini et al., 2009). *This can be seen in our estimated standard errors.*

Results

Specifications	**PHI Uptake**	**PHI Continuation**
$\ln(PTC_{i,t})$	0.0053***	0.0017***
	(0.0002)	(0.0002)
Co-worker average	0.0029*	0.0007
	(0.0017)	(0.0008)
Obs.	3,791,887	5,893,954
R2	0.080	0.038

Results: By Gender (Our Baseline)

	PHI uptake		**PHI continuation**	
Gender	*Female*	*Male*	*Female*	*Male*
$\ln(PTC_{i,t})$	0.0067***	0.0035***	0.0016***	0.0016***
	(0.0003)	(0.0004)	(0.0002)	(0.0003)
Co-worker average	**0.0136*** **	-0.0029	-0.0003	0.0002
	(0.0044)	(0.0030)	(0.0018)	(0.0020)
Obs.	1,737,497	2,054,390	3,024,033	2,869,921
R^2	0.079	0.082	0.034	0.040

Results: Relationship

	PHI uptake					
Spouse?	*Yes*			*No*		
Gender	*All*	*Female*	*Male*	*All*	*Female*	*Male*
Co-worker average	0.0007	0.0016	-0.0035	0.0037	**0.0133****	-0.0005
	(0.0020)	(0.0091)	(0.0056)	(0.0031)	(0.0067)	(0.0044)
Obs.	1,536,854	693,895	842,959	2,255,033	1,043,602	1,211,431
R^2	0.014	0.014	0.013	0.144	0.138	0.152

	PHI continuation					
Spouse?	*Yes*			*No*		
Gender	*All*	*Female*	*Male*	*All*	*Female*	*Male*
Co-worker average	0.0011*	0.0019	0.0010	0.0000	0.0021	-0.0018
	(0.0007)	(0.0019)	(0.0023)	(0.0031)	(0.0056)	(0.0053)
Obs.	3,613,842	1,797,295	1,816,547	2,280,112	1,226,738	1,053,374
R^2	0.023	0.022	0.023	0.037	0.033	0.040

Appendix Summary

Results: By Age

	PHI uptake					
Age	*Less than 35*			*35 or Older*		
Gender	*All*	*Female*	*Male*	*All*	*Female*	*Male*
Co-worker average	-0.0015	0.0103	-0.0053	**0.0041****	**0.0154*****	-0.0003
	(0.0048)	(0.0101)	(0.0064)	(0.0019)	(0.0058)	(0.0042)
Obs.	1,895,073	859,243	1,035,830	1,896,814	878,254	1,018,560
R^2	0.062	0.061	0.064	0.104	0.097	0.109

	PHI continuation					
Age	*Less than 35*			*35 or Older*		
Gender	*All*	*Female*	*Male*	*All*	*Female*	*Male*
Co-worker average	-0.0004	0.0065	-0.0045	0.0009	0.0001	0.0030
	(0.0043)	(0.0088)	(0.0075)	(0.0006)	(0.0016)	(0.0020)
Obs.	1,914,289	1,004,482	909,807	3,979,665	2,019,551	1,960,114
R^2	0.029	0.027	0.031	0.017	0.016	0.019

Appendix Summary

Results: Nonlinearity

	PHI uptake							
Gender	*Female*				*Male*			
PTC threshold	*10*	*20*	*30*	*40*	*10*	*20*	*30*	*40*
Prop. co-workers exceeding threshold	0.0220*	0.0344**	0.0659***	0.0653**	-0.0023	-0.0022	-0.0096	0.0006
	(0.0115)	(0.0171)	(0.0246)	(0.0307)	(0.0089)	(0.0121)	(0.0155)	(0.0205)
Obs.	1,737,497	1,737,497	1,737,497	1,737,497	2,054,390	2,054,390	2,054,390	2,054,390
R^2	0.079	0.079	0.079	0.079	0.082	0.082	0.082	0.082
	PHI continuation							
Gender	*Female*				*Male*			
PTC threshold	*10*	*20*	*30*	*40*	*10*	*20*	*30*	*40*
Prop. co-workers exceeding threshold	0.0065	-0.0004	-0.0039	-0.0057	0.0095*	0.0102	0.0132	0.0218**
	(0.0045)	(0.0057)	(0.0075)	(0.0102)	(0.0053)	(0.0068)	(0.0082)	(0.0099)
Obs.	3,024,033	3,024,033	3,024,033	3,024,033	2,869,921	2,869,921	2,869,921	2,869,921
R^2	0.034	0.034	0.034	0.034	0.040	0.040	0.040	0.040

Robustness Check: Alternative Measure

Decision	**PHI uptake**			**PHI continuation**		
Gender	*All*	*Female*	*Male*	*All*	*Female*	*Male*
$\ln(PPC_{i,t}+1)$	0.0029***	0.0038***	0.0019***	0.0015***	0.0017***	0.0012***
	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0002)
Co-worker average	0.0016*	0.0067***	-0.0012	0.0006	0.0000	-0.0003
	(0.0008)	(0.0023)	(0.0014)	(0.0004)	(0.0010)	(0.0011)
Obs.	3,791,887	1,737,497	2,054,390	5,893,954	3,024,033	2,869,921
R^2	0.080	0.079	0.082	0.038	0.034	0.040

Appendix Summary

Robustness Check: Firm Size Restrictions

	PHI uptake					
Gender	*Female*			*Male*		
Maximum firm size	*50*	*200*	*1000*	*50*	*200*	*1000*
$\ln(PTC_{i,t}+1)$	0.0079***	0.0073***	0.0072***	0.0045***	0.0040***	0.0037***
	(0.0008)	(0.0005)	(0.0004)	(0.0005)	(0.0004)	(0.0003)
Co-worker average	**0.0206*** **	**0.0176*** **	**0.0169*** **	0.0020	0.0005	-0.0010
	(0.0053)	(0.0048)	(0.0045)	(0.0032)	(0.0029)	(0.0028)
Obs.	457,083	714,344	991,399	658,552	1,016,928	1,376,536
R^2	0.098	0.095	0.088	0.096	0.097	0.092

	PHI continuation					
Gender	*Female*			*Male*		
Maximum firm size	*50*	*200*	*1000*	*50*	*200*	*1000*
$\ln(PTC_{i,t}+1)$	0.0015***	0.0019***	0.0019***	0.0012***	0.0016***	0.0017***
	(0.0004)	(0.0003)	(0.0002)	(0.0004)	(0.0002)	(0.0002)
Co-worker average	-0.0006	0.0006	0.0010	-0.0007	0.0004	0.0004
	(0.0021)	(0.0019)	(0.0018)	(0.0021)	(0.0019)	(0.0018)
Obs.	748,841	1,101,305	1,555,456	793,805	1,203,204	1,730,320
R^2	0.043	0.040	0.037	0.049	0.046	0.043

Appendix Summary

Discussions: Summary

- Co-workers' bad health conditions increase PHI demand only for females *if they did not own PHI in the past.*
  - Alternative Measures
- We find that effects are stronger for singles and older females.
  - By Family Structure
  - By Age
- Exclusion of large firms increases efficiency and the magnitude of coefficient.
  - Firm Size Restrictions
- Extreme health conditions have stronger effects.

Why do People Purchase PHI in Australia?

Salient Risk Hypothesis

Table 5
Individual characteristics by reasons given for purchasing health insurance.

	No insurance	Reason given for purchasing private health insurance				
		Sense of security	Greater choice, less wait	Financial reasons	Always had it	Age, health condition
Percent of sample (percent of insured sample)	52.9	22.1 (46.9)	21.6 (46.0)	9.4 (19.9)	8.1 (17.1)	4.1 (8.7)
Fair or poor health	0.246	0.119*	0.131*	0.087*	0.162*	0.320*
No. of long-term health conditions	2.97	2.89*	3.08*	2.70*	3.31*	3.69*
Hospital nights in last 12 months	0.337	0.247*	0.309	0.185*	0.349	0.612*
Had a GP visit last 2 weeks	0.261	0.214*	0.221*	0.172*	0.240	0.332*
Never a smoker	0.377	0.525*	0.519*	0.477*	0.530*	0.515*
Sedentary	0.408	0.268*	0.287*	0.239*	0.296*	0.346*
Moderate to vigorous exercise	0.247	0.335*	0.325*	0.364*	0.330*	0.252
Post-graduate degree	0.032	0.085*	0.097*	0.134*	0.068*	0.080*
Bachelors degree	0.081	0.179*	0.182*	0.243*	0.151	0.175*
Mental health index	16.31	14.37*	14.49*	14.42*	14.28*	16.38
Employed	0.511	0.693*	0.674*	0.845*	0.562*	0.602*
Mean income decile	4.22	6.59*	6.47*	7.72*	6.23*	5.83*

Note: The groups formed by the different reasons for purchasing insurance are not mutually exclusive.
* Difference between the mean for a particular insured group and the mean for the group without insurance is significant at the .05 level.

Buchmueller, T. C., Fiebig, D. G., Jones, G., & Savage, E. (2013). Preference heterogeneity and selection in private health insurance: The case of Australia. Journal of Health Economics, 32(5), 757-767.

Why do People Purchase PHI in Australia?

1. Financial Reasons
   - Reduced tax liabilities
   - Lifetime health cover
2. Health Reasons
   - Access to private hospitals
   - Choice of doctor and flexibility in selecting treatment options
   - Coverage for extras such as dental and physiotherapy
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- In Reddit discussions related to purchasing private health insurance (PHI) during 2015 and 2016:
  - 854 comments were categorized by ChatGPT.
  - 183 users provided reasons for purchasing an LLM:
    - Health reasons: 81 users
    - Financial reasons: 76 users
    - Both health and financial reasons: 26 users

Conclusion

- We estimate contextual peer effects (Manski, 1993) without instrumental variables by exploiting the availability of consumers' decisions in two consecutive periods.
- Implied Structural Model is Flexible — unlike empirical literature on peer effects.
- We find significant heterogeneity, which is often difficult to disentangle due to data limitations.

Thank You!

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Additional Slides

- Microfoundation
- Literature
- Graphs
- Other Estimations

Microfoundations

- The linear-in-means model implies a quadratic utility function that is very restrictive.
- Research by Boucher et al. (Econometrica) shows individuals often deviate from LIM behavior and propose an alternative with the CES utility function.
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Conclusion

Simulation: DGP

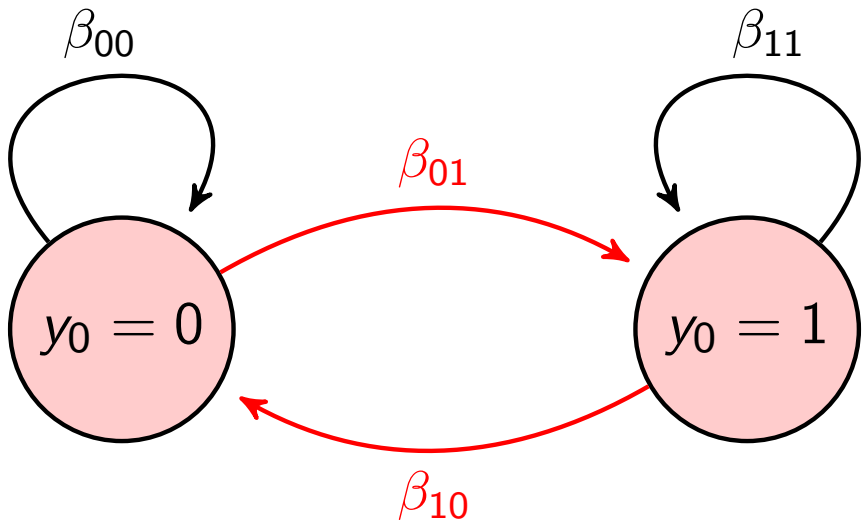
$$\mathbb{P}[y_{i,1} = 1 | y_{i,0}, \bar{y}_{-i,0}, x_{i,1}, \bar{x}^0_{-i,1}, \bar{x}^1_{-i,1}] =$$

$$\alpha y_{i,0} + \gamma x_{i,1} \qquad \text{(own effects)}$$

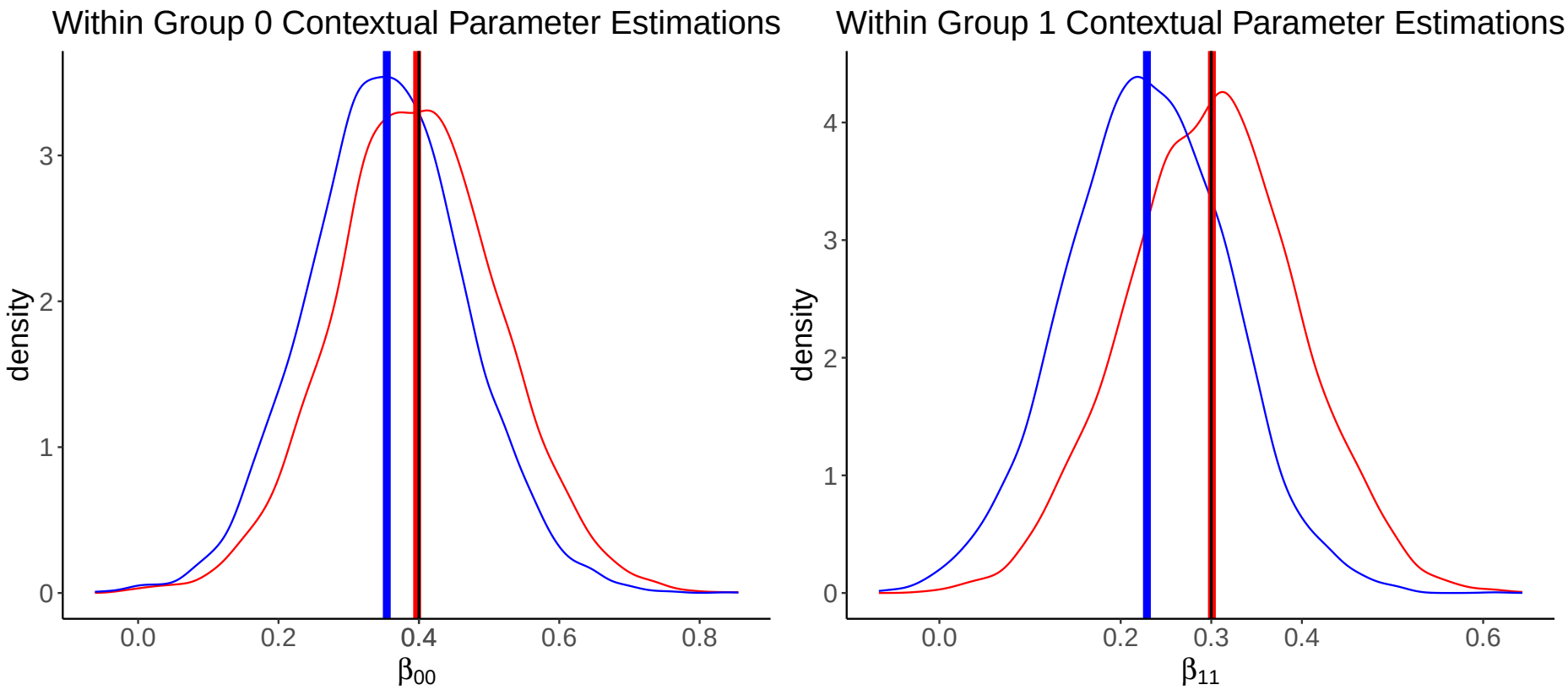
$$+ (1 - y_{i,0})\rho_0 \bar{y}_{-i,0} + y_{i,0}\rho_1 \bar{y}_{-i,0} \qquad \text{(endogenous effects)}$$

$$+ (1 - y_{i,0})\beta_{00} \bar{x}^0_{-i,1} + (1 - y_{i,0})\beta_{10} \bar{x}^1_{-i,1}$$

$$+ y_{i,0}\beta_{01} \bar{x}^0_{-i,1} + y_{i,0}\beta_{11} \bar{x}^1_{-i,1} \qquad \text{(contextual effects)}$$

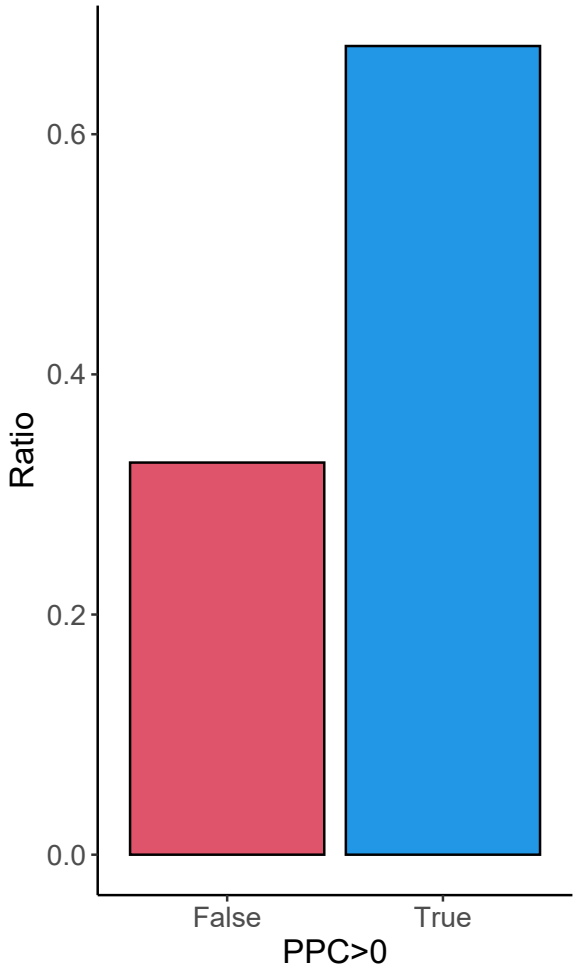


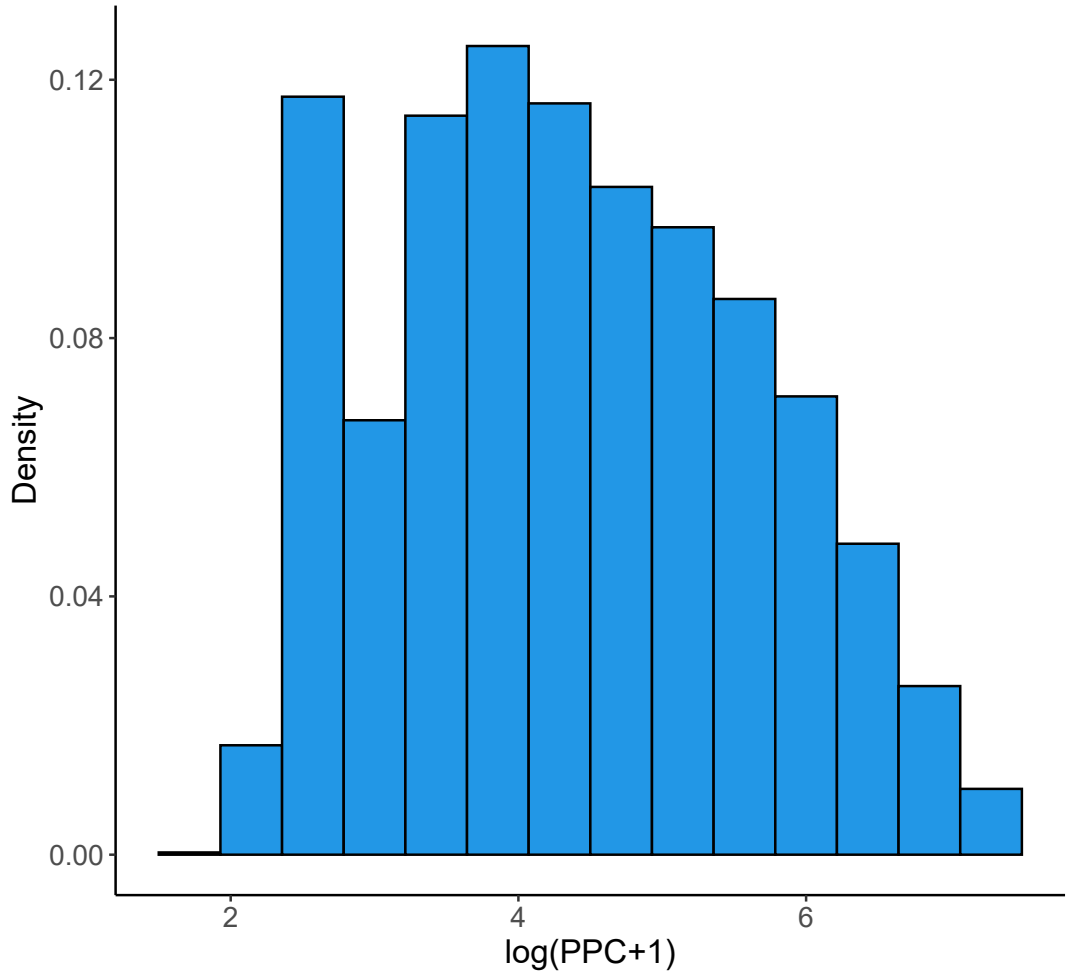
Simulation: Results



Identification (2)

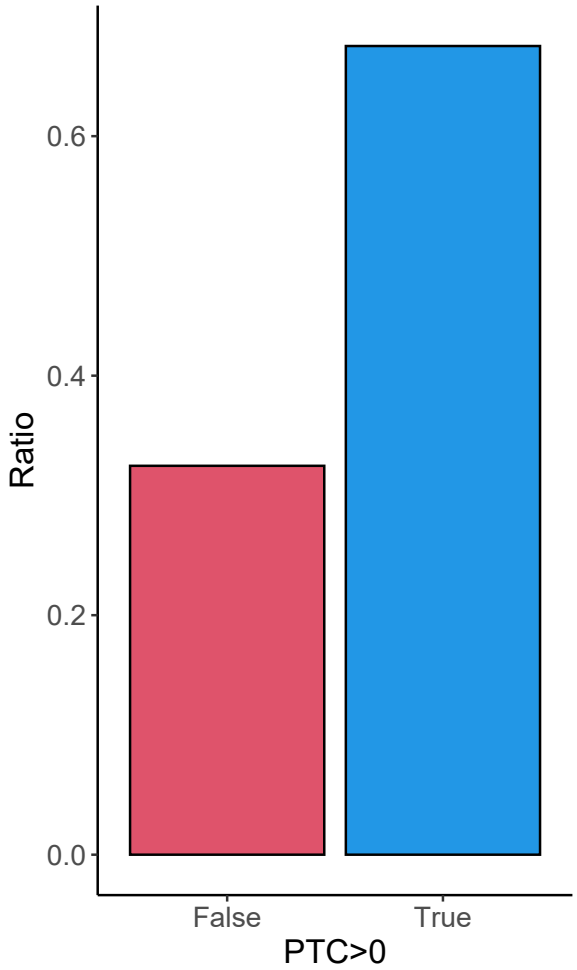
Patient Contribution Distribution

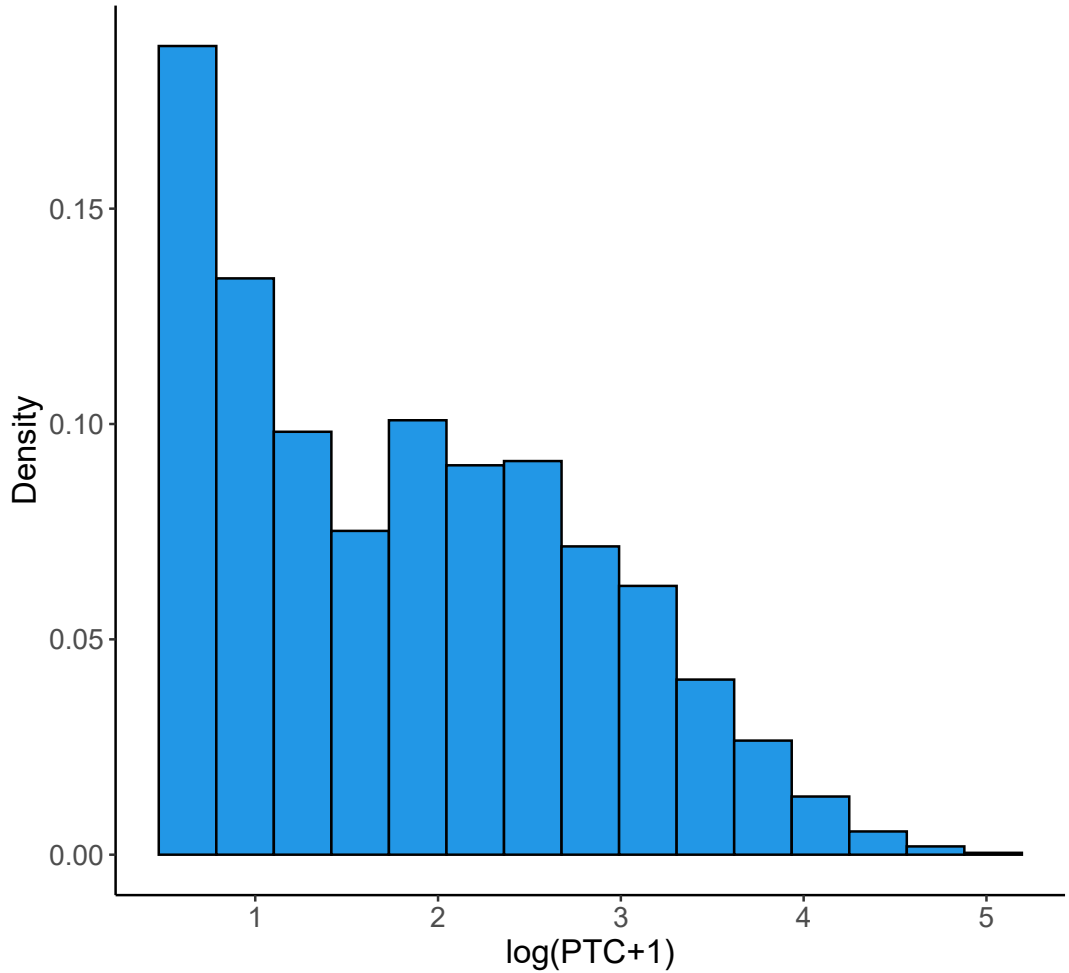




Appendix

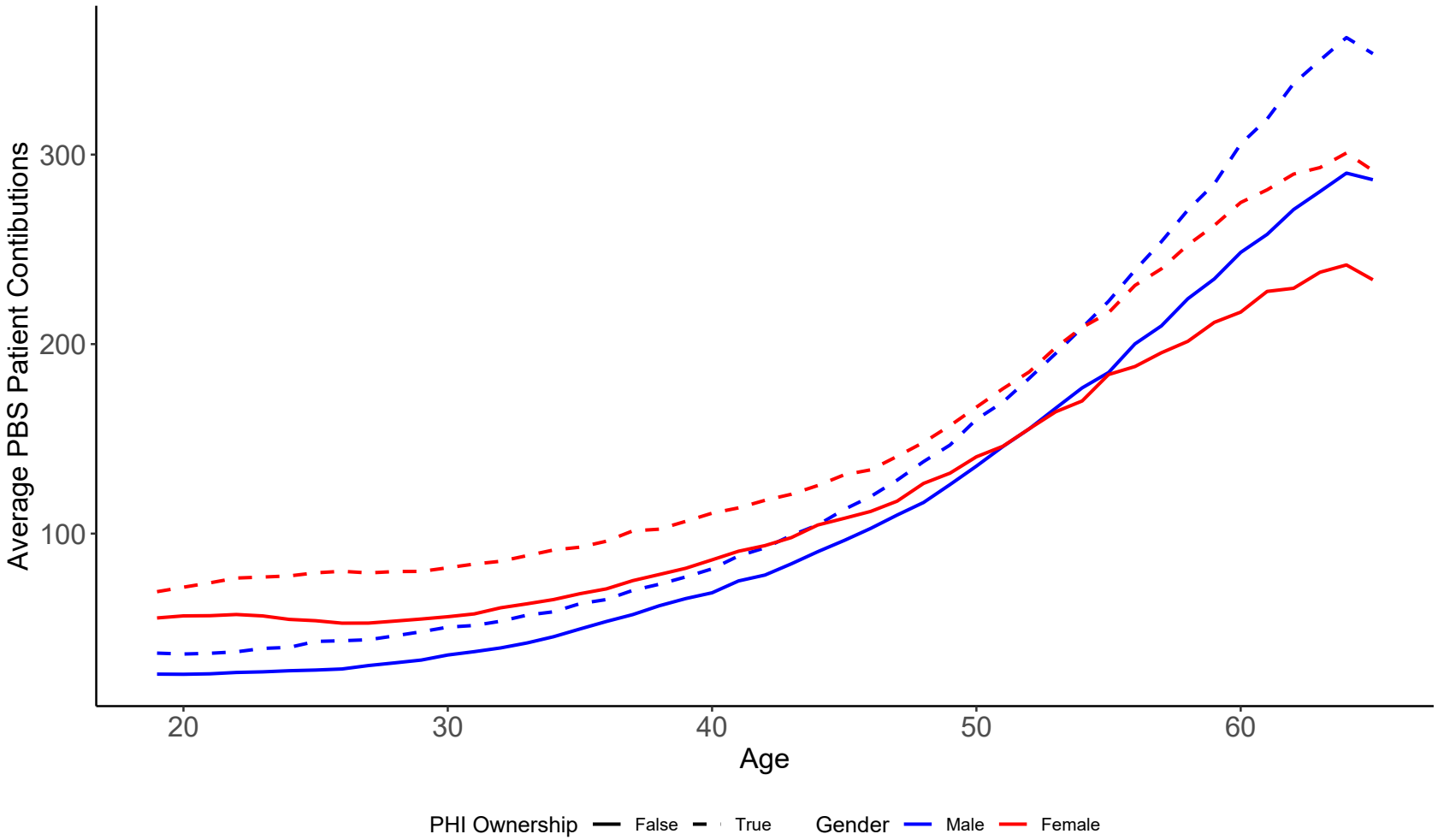
Patient Contribution Distribution





Appendix

Patient Contribution by Age



Appendix

A Simple Example for Identification

A simple example: Consider a firm, j with four employees. Assume $PHI_{1,t} = PHI_{2,t} = 1$ and $PHI_{3,t} = PHI_{4,t} = 0$. The average PHI ownership excluding the focal individual is computed as $\overline{PHI}_{-i,t} = 1/3, \quad i = 1, 2$ and $\overline{PHI}_{-i,t} = 2/3, \quad i = 3, 4$. These terms are captured by $c_{j,1}$ and $c_{j,0}$, respectively.

Appendix Identification (2)

References I

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