Labor market informality, risk, and public insurance

Lucas Finamor

(Yale University)

Disclaimer

"This research uses information from the Chilean Social Protection Survey (Encuesta de Protección Social). I thank the Undersecretary of Social Protection, the intellectual owner of the survey, for the authorization to use the de-identified dataset. ***All the results from this research are the responsibility of the author and do not implicate the Chilean Undersecretary of Social Protection."***

Research Questions

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- Formal employment tied to a bundle of insurance
  - Unemployment Insurance and Pensions
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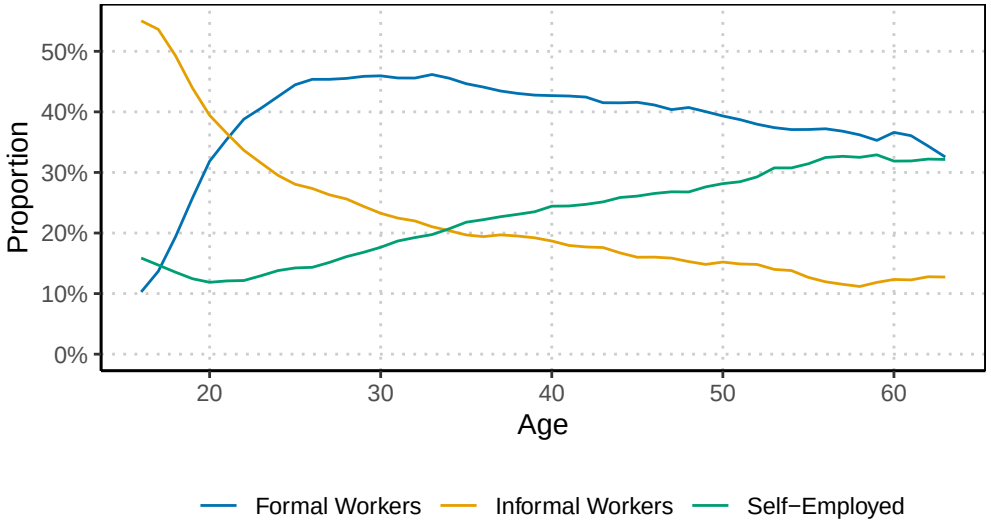
Q2) How do career decisions and savings interact?

- Private savings can be use to self-insure
- Private savings can be use to fund start-up informal activities

Informality over the life-cycle

Cohorts | Gender/Educ | Other Countries



This paper and contributions

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   - Risk-aversion: agents dislike employment risk and income fluctuation
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   - Life cycle: dynamic incentives

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   - Different job characteristics (amenities, hours of work)

This paper and contributions

1. Develop a model with employment and savings decisions, risk, and social insurance
2. Model features rich characterization of informality
3. Estimate the model with rich microdata & exploiting pension reforms
   - Chilean microdata: longitudinal survey + administrative data
   - Estimate the causal effects of early retirement restrictions

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1. Develop a model with employment and savings decisions, risk, and social insurance
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3. Estimate the model with rich microdata & exploiting pension reforms
4. Use the model:
   - Learn drivers of employment decisions
   - Explore interactions between insurance programs
   - Assess pension reforms

Main findings

i. From the estimated model:

- Important drivers for the life-cycle allocation:
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iii. Assessing policy reforms

Institutional setting and data

Data - Chile

Educ levels | more

Encuesta de Protección Social (EPS)

- Panel survey at the individual level
- 7 waves (2002-2020)
- + labor market history

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- Additional data: employment surveys, administrative data (UI, pension claims)

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2. Substantial sector heterogeneity

3. Self-employment
   - Part-time work and flexible work locations Hours Workplace
   - Entry associated with investments in physical capital Regression
   - Use own savings Source of Capital

Model

The model in a nutshell

- Risk-averse individuals **consume, save** and decide **employment status**

	Formal	**Informal**	**Self-employment**
Entry	Receive offer	Receive offer	Pay up-front investment

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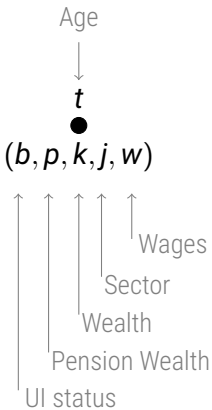
- If not working:
  - Unemployed or Retired (endogenous)
  - No re-entry after retirement
- Arrival/Destruction rates depend on the sector

Model



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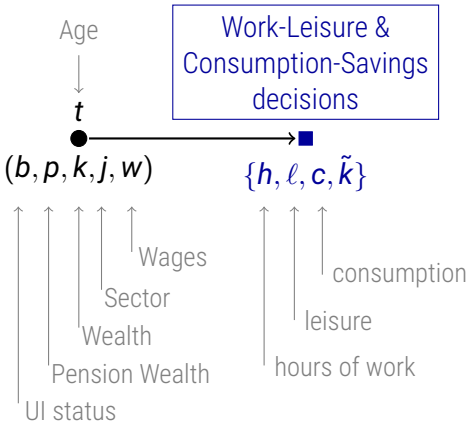
Age
t
Work-Leisure & Consumption-Savings decisions
(b, p, k, j, w)
$\{h, \ell, c, \tilde{k}\}$
Wages
Sector
Wealth
Pension Wealth
UI status
consumption
leisure
hours of work

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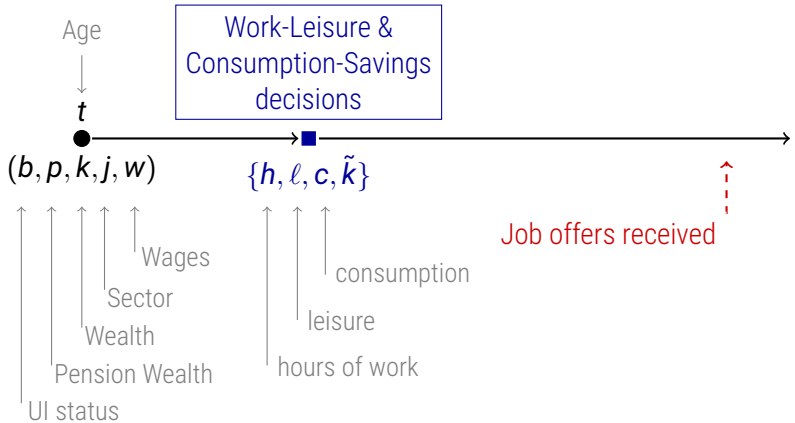
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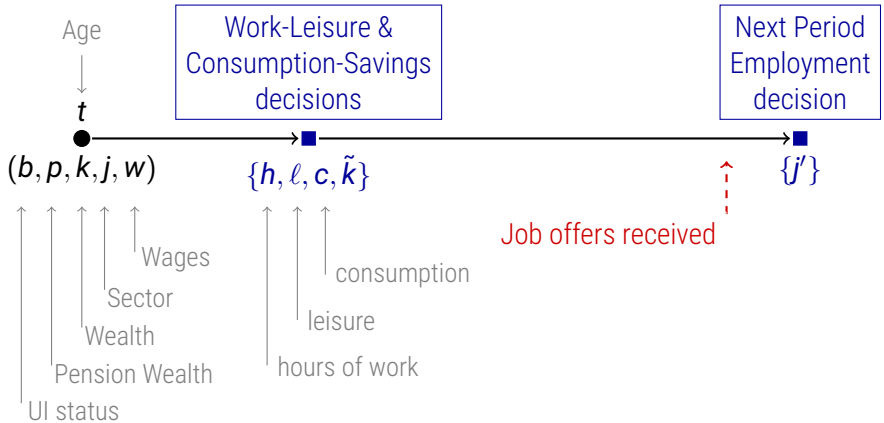
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Work-Leisure & Consumption-Savings decisions
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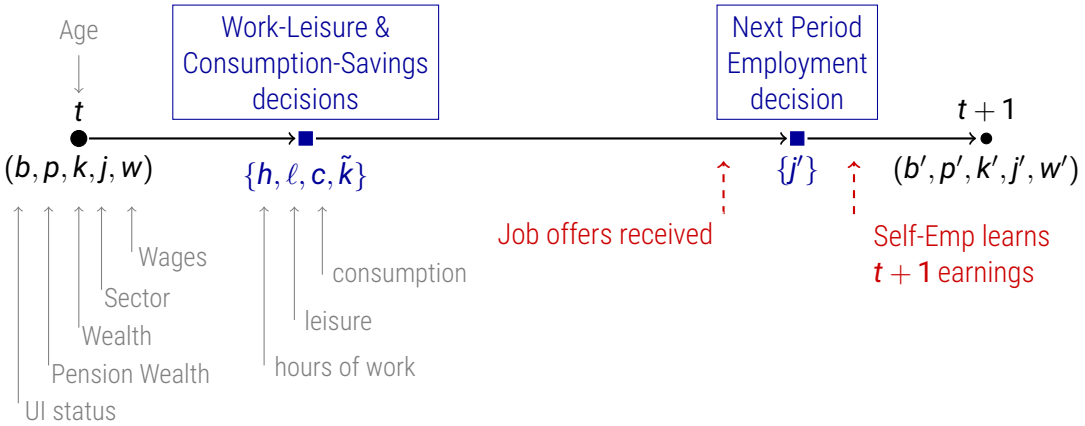
Age
t
(b, p, k, j, w)
Work-Leisure & Consumption-Savings decisions
{h, ℓ, c, k̃}
Next Period Employment decision
{j′}
t + 1
(b′, p′, k′, j′, w′)
Job offers received
Self-Emp learns t + 1 earnings
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Employment choices

A. Utility: composite of consumption and leisure more

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B. Employment transition: choose sector that maximizes utility more

- Formal/Informal: only when receiving an offer
- Self-employment: paying start-up cost
- Retirement is an option when meeting the requirements

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C. Accumulate informal earnings and UI benefits more

D. Bequeath remaining wealth when dying more

Estimation

Two steps estimation

1. Set and estimate some parameters outside the model (interest rates, coefficient of risk-aversion)

Two steps estimation State Space Estimation Details

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2. Estimate remaining parameters using SMM more

Preferences

- Discount factor
- Consumption weight
- Amenities for Self-Employed/Informal sector
- Bequest weight and shifter

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- Wage offer distributions and Self-Employment earnings
- Investment to become Self-Employed
- Ability vectors and types' proportions

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- Choose set of moments related to these parameters

Moments

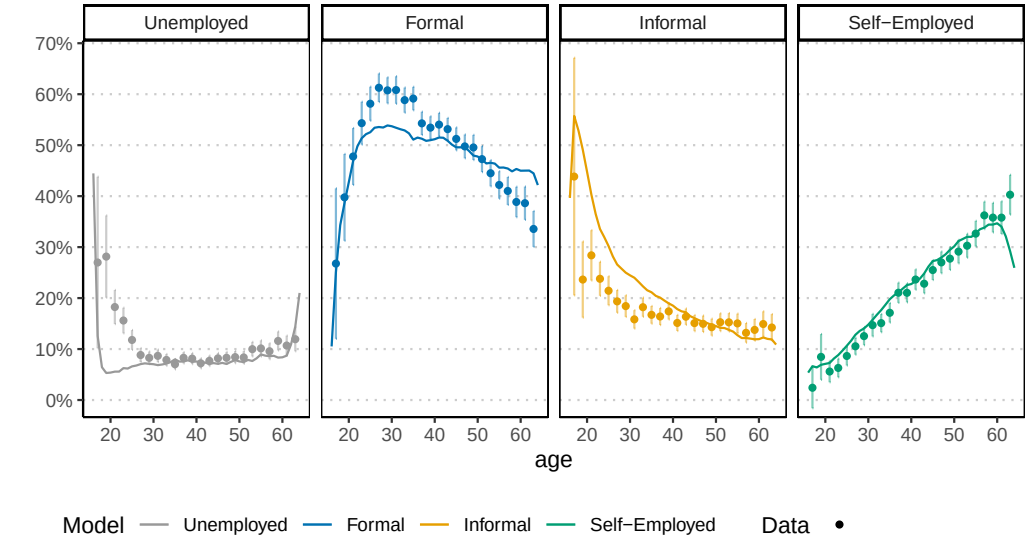
Results

Arrival and destruction rates

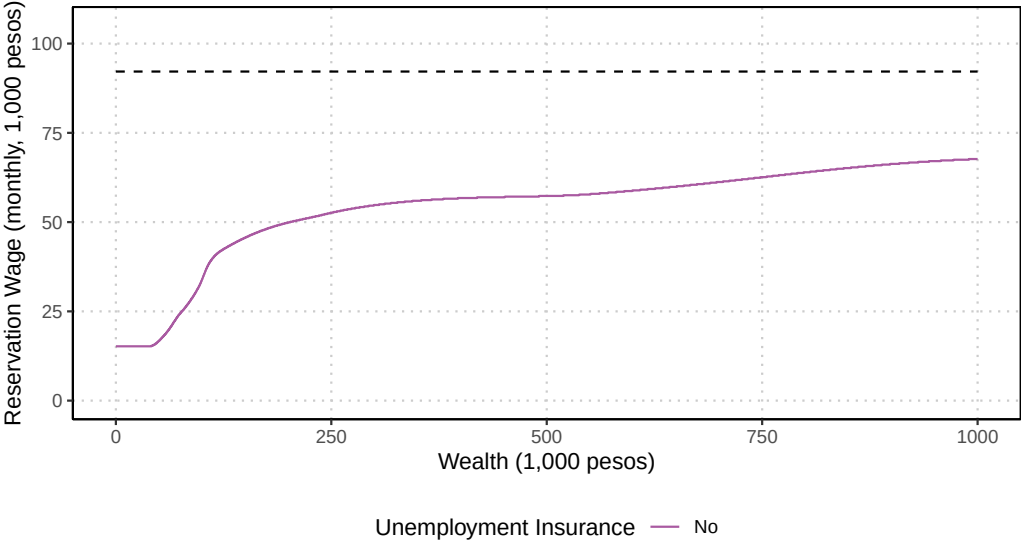
- Informal arrival rates $>$ Formal rates

	Unemp	Formal	Informal	SelfEmp
Destruction	-	0.030	0.003	0.010
	-	(0.001)	(0.000)	(0.001)
Arrival Formal	0.181	0.161	0.054	0.249
	(0.008)	(0.012)	(0.001)	(0.027)
Arrival Informal	0.991	0.850	0.374	0.713
	(0.048)	(0.082)	(0.021)	(0.152)

Sector allocation over the life-cycle



Reservation wages for the informal sector



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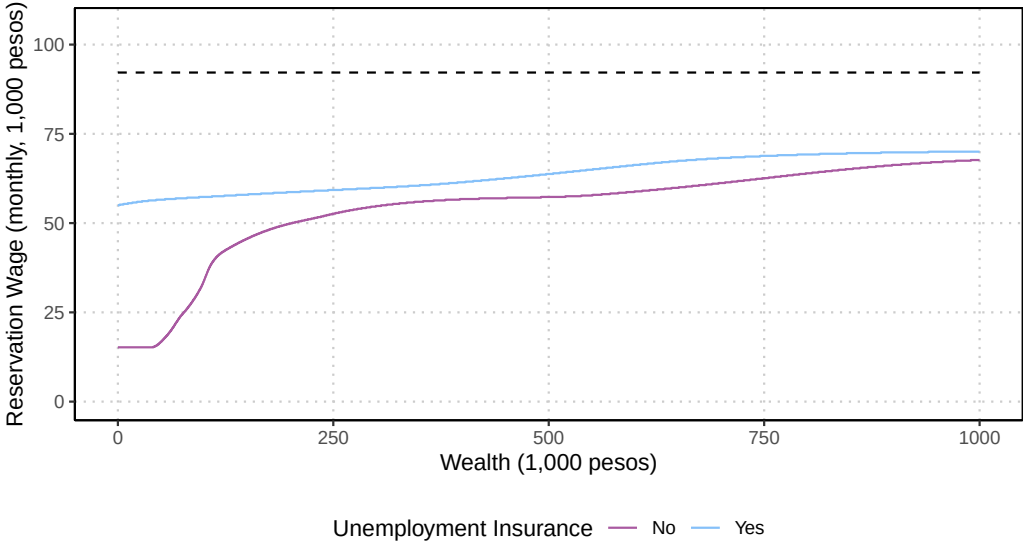

Counterfactuals

Complementarities

Change	Δ Formal participation rate (pp)
Increase in UI	0.25
Increase in Pensions	0.06
Increase in both	0.34

Complementarities

Pension Reform Counterfactuals

- Use the model to run series of counterfactuals on pension reforms:
  - Were implemented (Pension Reform in 2008): decomposition exercise
  - Are discussed: predict effects on labor choices over the life-cycle
    - Importance of the combined safety-net
    - Importance of liquidity

Conclusions

- **Takeaways**
  - Importance of analyzing the bundle of social insurance
  - Life cycle trends: savings (self-insurance and source of capital investment)
- **Directions for future research**
  - Identify complementarities in other settings
  - Frictions in formal employment:
    - Search frictions
    - No part-time work, work-place
  - Endogeneizing labor force participation

Thank you

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Appendix

Presentation

- Introduction
- Institutional setting and data
- Empirical Findings
- Model
- Estimation
- Results
- Counterfactuals
- Conclusions

- Appendix
- Additional Results

- Why Chile
- Risk and Insurance in the model
- Wage growth
- Minimum Wage
- Family and Spouses
- Pension returns risk
- No amenities
- Equal returns
- 2008 Reform
- Welfare
- Value Functions (formulae)

- Agenda

Additional results

- All parameters
- Transitions
- Accepted wages
- Self-Employment earnings
- Self-Employment capital
- Wealth
- Retirement
- Part-time work
- Wage correlation
- Amenities
- Decision to be self-employed
- (Andrews, Gentzkow and Shapiro 2017) Sensitivity analysis
- Untargeted moments pension wealth and contributions

Literature

A. Firms' and workers' formality decision

B. Social Insurance and Informality

C. Self-employment in developing countries

Literature

A. Firms' and workers' formality decision

Zenou (2008), Albrecht, Navarro and Vroman (2009), Ulyssea (2010), Bosch and Esteban-Pretel (2012), Lopez Garcia (2015), Meghir, Narita and Robin (2015), Pardo and Ruiz-Tagle (2016), Ulyssea (2018), Albertini and Terriau (2019), Narita (2020), Haanwinckel and Soares (2021), Herreño and Ocampo (2021), Bobba, Flabbi, Levy and Tejada (2021), Bobba, Flabbi and Levy (2022), Conti, Ginja and Narita (2022), da Costa and Lobel (2022)

Risk-aversion, savings, and social insurance

$$\text{Savings} \Rightarrow \begin{cases} \text{job search behavior} \\ \text{self-employment investment} \end{cases}$$

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B. Social Insurance and Informality

[Unemployment Insurance] Huneeus, Leiva and Micco (2012), Espino and Sanchez (2013), Gonzalez-Rozada and Ruffo (2016), Audoly (2018), Gerard and Gonzaga (2021), Britto (2022), de Azevedo (2022), Bloise and Santos (2022)

[Health Insurance] Calderón-Mejía and Marinescu (2012), Azuara and Marinescu (2013)

[Minimum Wage] Granda and Hamann (2015), Parente (2022), Engbom and Moser (2021)

[Pensions] Attanasio, Meghir and Otero (2011), Behrman, Calderon, Mitchell, Vasquez and Bravo (2011), Cruces and Bérgolo (2013), Todd and Vélez-Grajales (2008), Joubert (2015), McKiernan (2019), Joubert and Todd (2020), Ferreira and Parente (2020), Moreno (2022)

Causal effects of early retirement restrictions

Dynamic model combining main social insurance programs

C. Self-employment in developing countries

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Narita (2020), Bobba, Flabbi, Levy and Tejada (2021), Herreño and Ocampo (2021), Bobba, Flabbi and Levy (2022), Moreno (2022)

Importance of start-up costs, borrowing constraints, and amenities

Consumption/savings choice

Back

$$V_t(\chi) = \max_{h,\ell,c,\tilde{k}} \left\{ \frac{\phi_j (c^\nu \ell^{1-\nu})^{1-\gamma}}{1-\gamma} + \beta \underbrace{\mathbb{E}}_{\downarrow} [V_{t+1}(\chi')] \right\}$$

$\uparrow$ state space

Job Destruction, Arrival Offers, Self-Emp Earnings, Survival,...

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χ: state space

Job Destruction, Arrival Offers, Self-Emp Earnings, Survival,...

(budget constraint)

$$c + \tilde{k} = (1+r)k + y^j(wh)$$

wh: labor earnings

(leisure)

$$\ell = \overline{L} - h$$

$\overline{L}$: stock of hours

(no borrowing constraint)

$$\tilde{k} \geq \underline{B}$$

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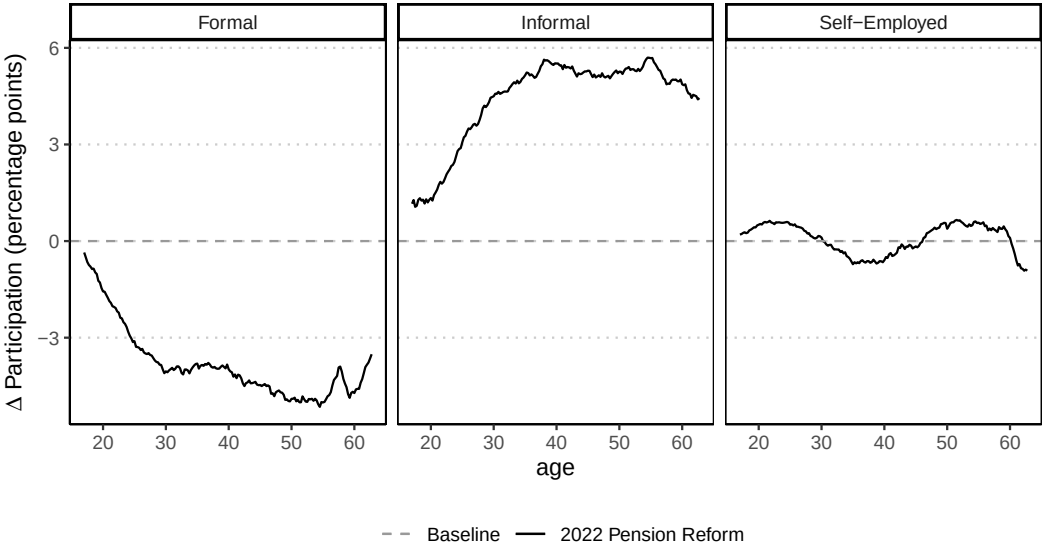
ϕ_j: amenities from each sector

June-August 2022: Discussion of a new pension reform

Counterfactuals II: 2022 Pension Reform

- New pension floor to 250 thousand pesos (doubling)
- Additional 6% of pension contributions (from 10% to 16%)

Counterfactuals II: 2022 Pension Reform Payroll



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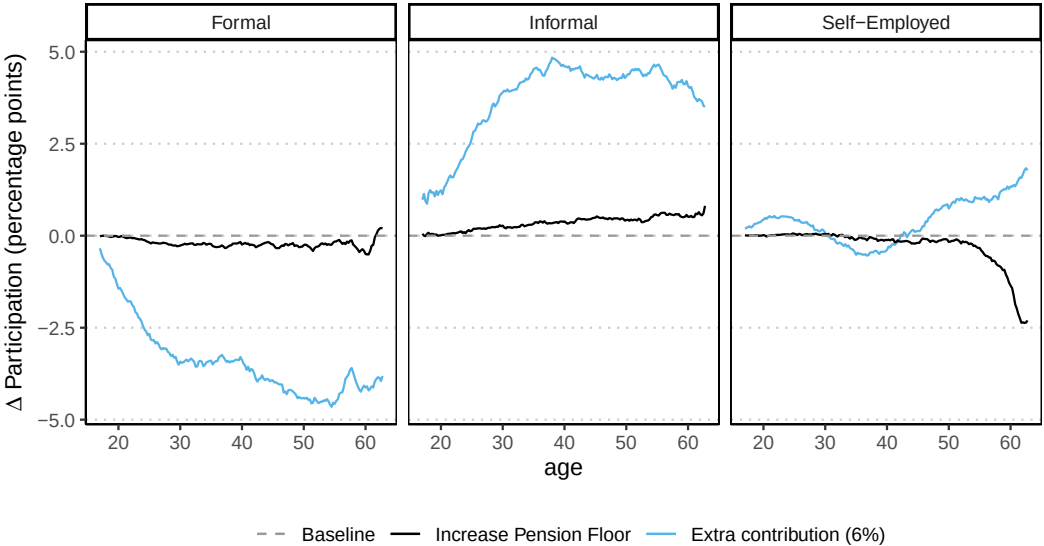

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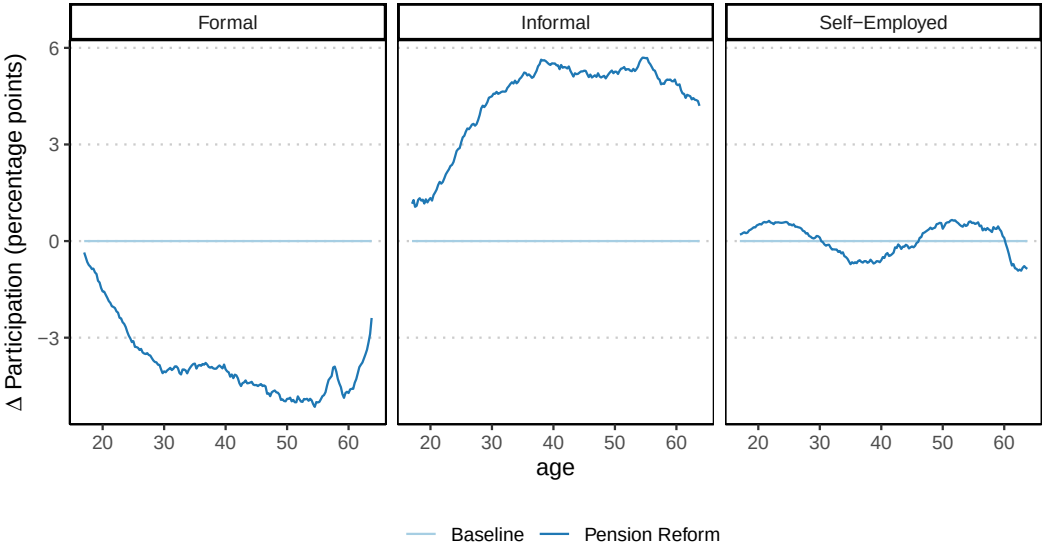

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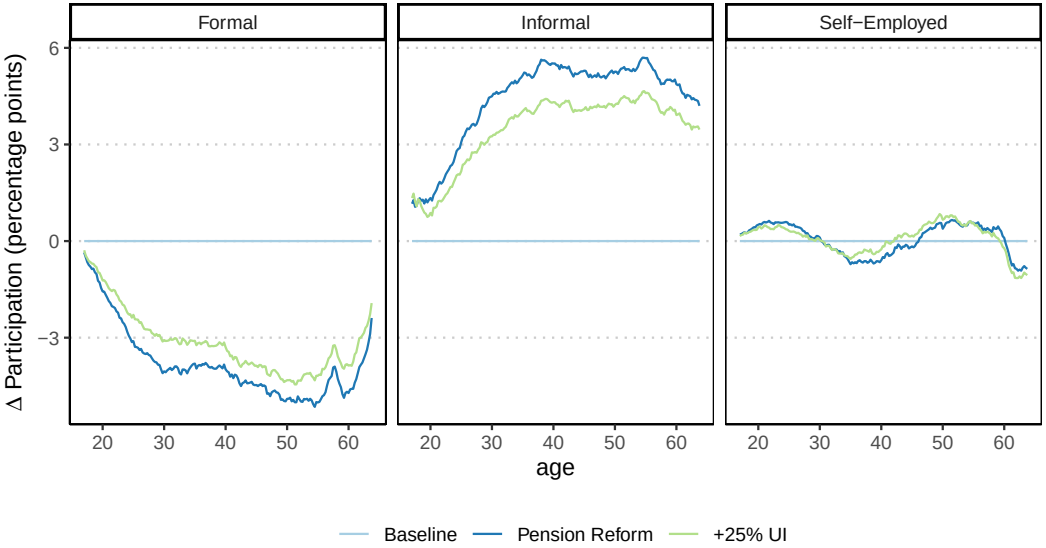

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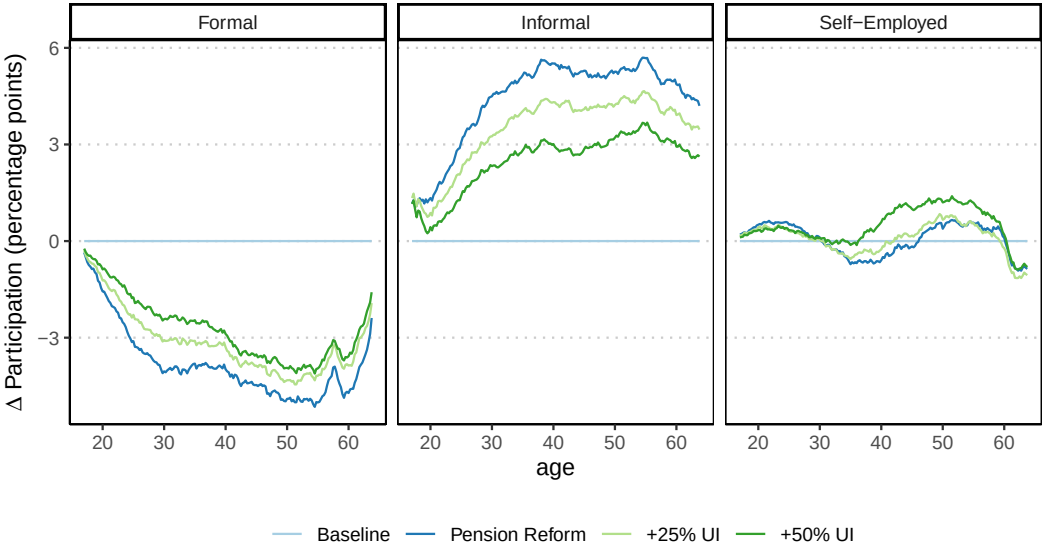

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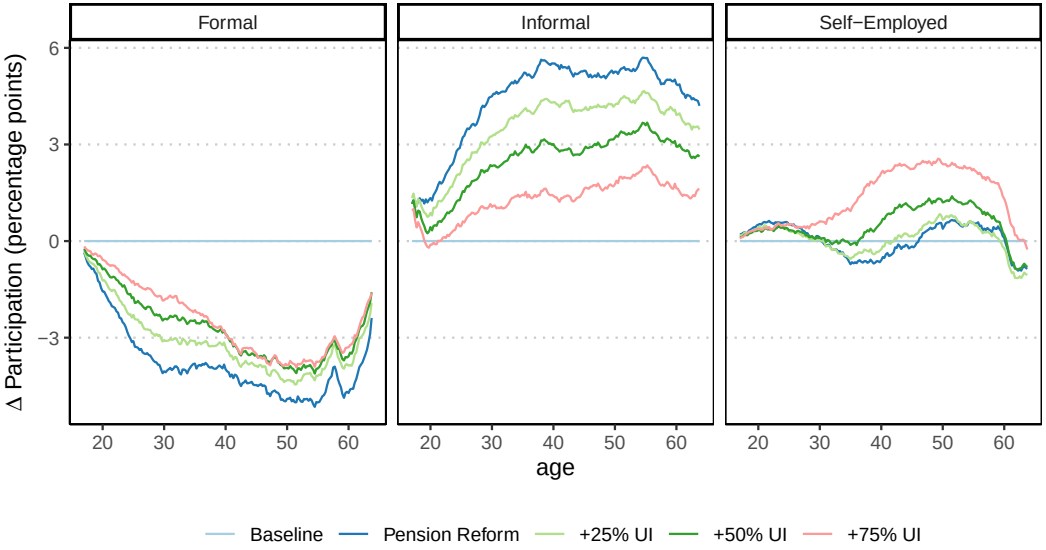

Counterfactuals II: 2022 Pension Reform Payroll

Risk and Social Insurance in the paper

-	In the model	Not in the model
Risk		
Separation shocks	All sectors	-
Earnings shocks (within job)	Self-employment	Formal and informal jobs
Uncertain prospects job-search	All sectors	-
Longevity risk	After retirement	Up to retirement
Returns risk	-	Pension returns, liquid savings returns
Health risk	-	Health shocks
Social Insurance		
Unemployment insurance	When fired	When quitting
Severance payment	Yes	-
Pensions	Yes	-
Welfare programs	Yes	-
Minimum wage	Yes	-
Health insurance	-	No
Disability insurance	-	No

Earnings variance

Back

- Using employment survey I compute the (de-trended) 1-year log-wage growth
- Compute the variance for those formal, informal, and self-employed (and remaining in that state)
- Variance of log-wage increase
  - Formal: 0.100
  - Informal: 0.286
  - Self-employed: 0.631

Setting: Chile

1. Social insurance programs co-existing with labor market informality

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2. Country implemented several reforms in those programs

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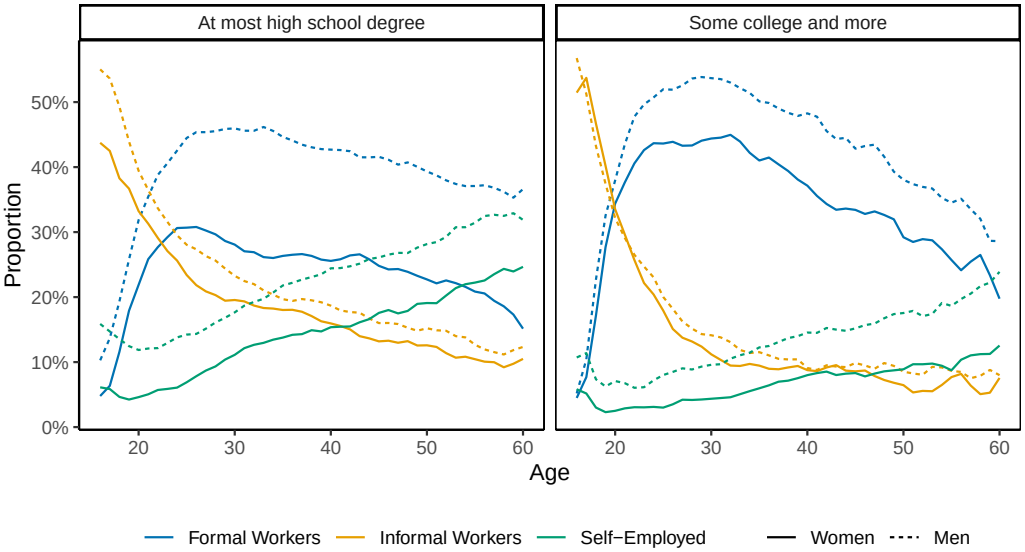
1. Social insurance programs co-existing with labor market informality
2. Country implemented several reforms in those programs
3. Data
   - Long longitudinal survey
   - Disaggregated wealth
   - Administrative data on the pension system

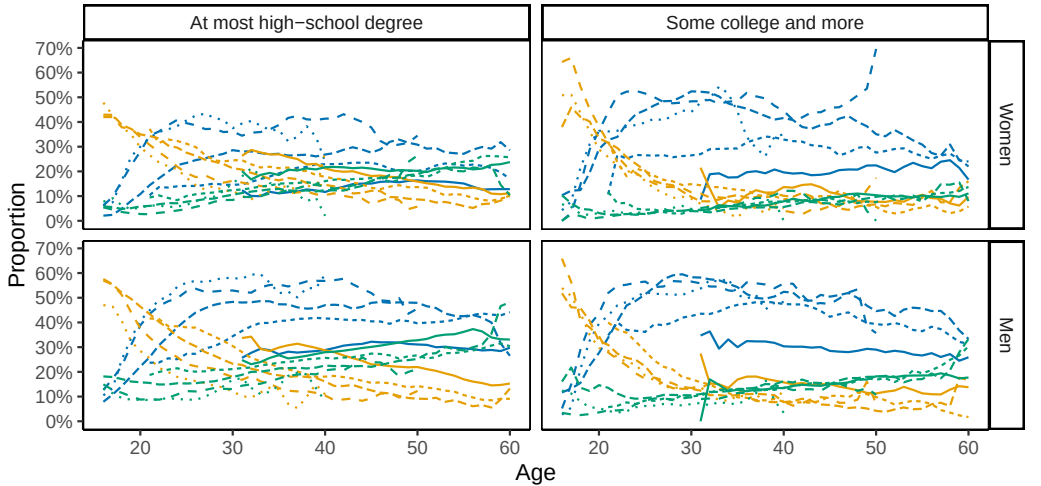
Life Cycle - Educ

Back



Life Cycle - Cohorts

Back



Life Cycle - Other Countries

Back

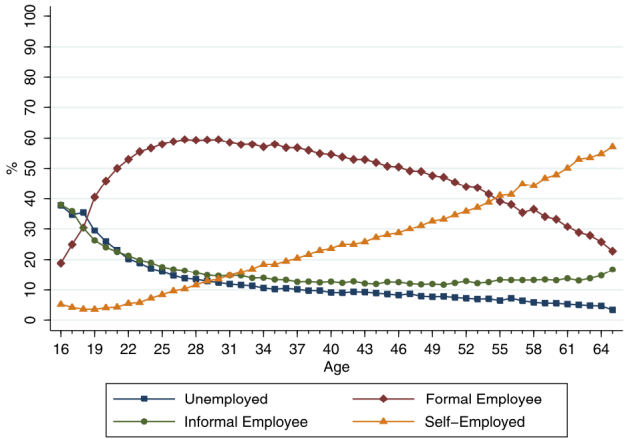
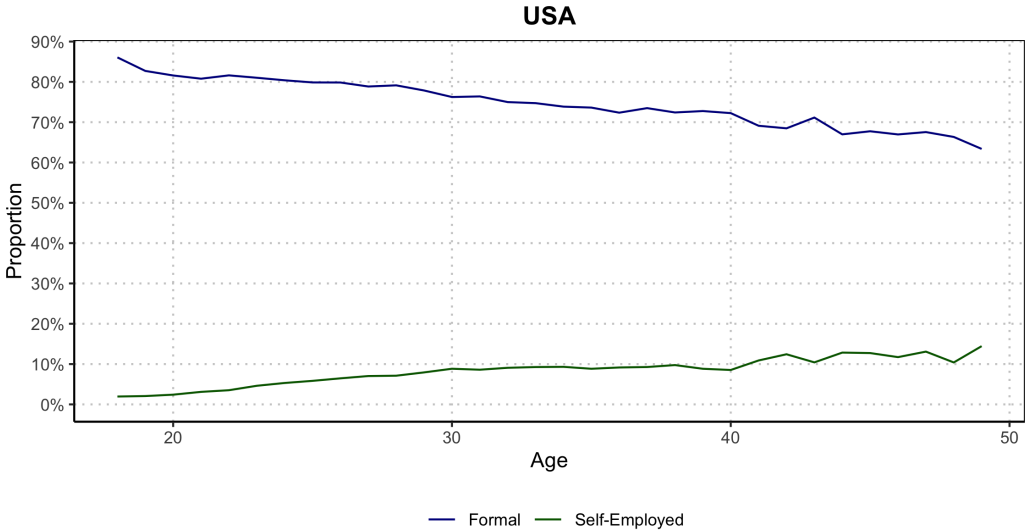


Fig. 1. Composition of workforce by age.

Extracted from Narita (2020)

Life Cycle - Other Countries

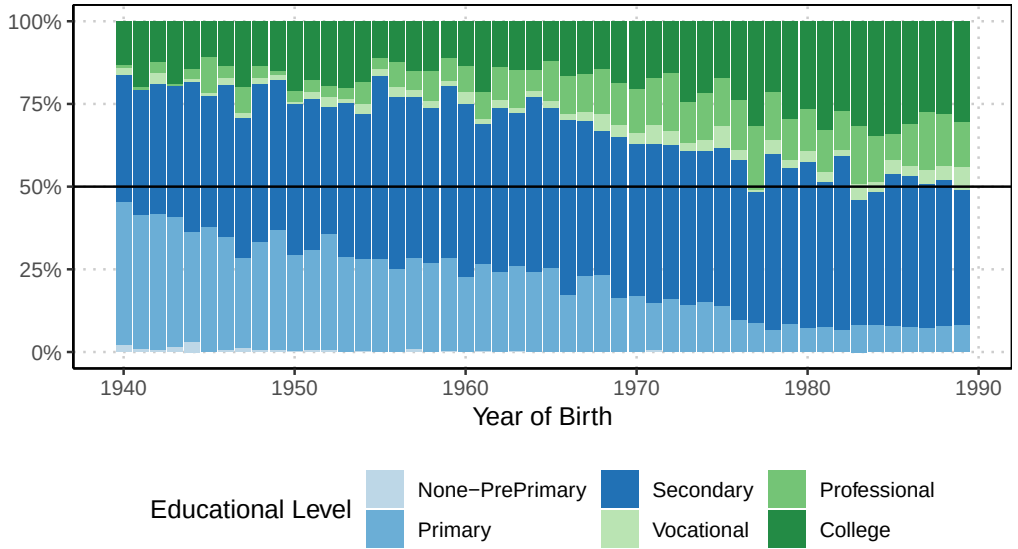
Back



NOTES: NLSY-79. Displayed as % of employed population.

Education over time

Back



Institutional setting - Chile Back

1. **Unemployment Insurance** more payments

   - 3% of wages:
     $\underbrace{\text{(individual account)}}_{\text{forced savings}} + \underbrace{\text{(collective account)}}_{\text{insurance/redistribution}}$
   - Withdrawal schedule (50%,45%,40%,...)
   - Limit of 5 months from the collective account

2. **Severance Payment**

   - One monthly wage for every year on the job

3. **Pension system**

   - Individual capitalization with privately managed accounts
   - 10% of wages
   - Normal retirement age for men is 65

     Early retirement is possible
   - Minimum pension policies

4. **Welfare Programs** and **Income Tax**

Institutional setting - Chile Back

1. **Unemployment Insurance** more payments

   - 3% of wages:
     (individual account) + (collective account)
     forced savings — insurance/redistribution
   - Withdrawal schedule (50%,45%,40%,...)
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   - Normal retirement age for men is 65
     Early retirement is possible
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4. **Welfare Programs** and **Income Tax**

Social Security

Formal Workers Pay:

7% Health System + **0.6%** Unemp Insurance + **10%** Pension Contributions + **≈2%** Commissions & Disab. Insurance

Formal Firms Pay:

2.4% Unemp Insurance

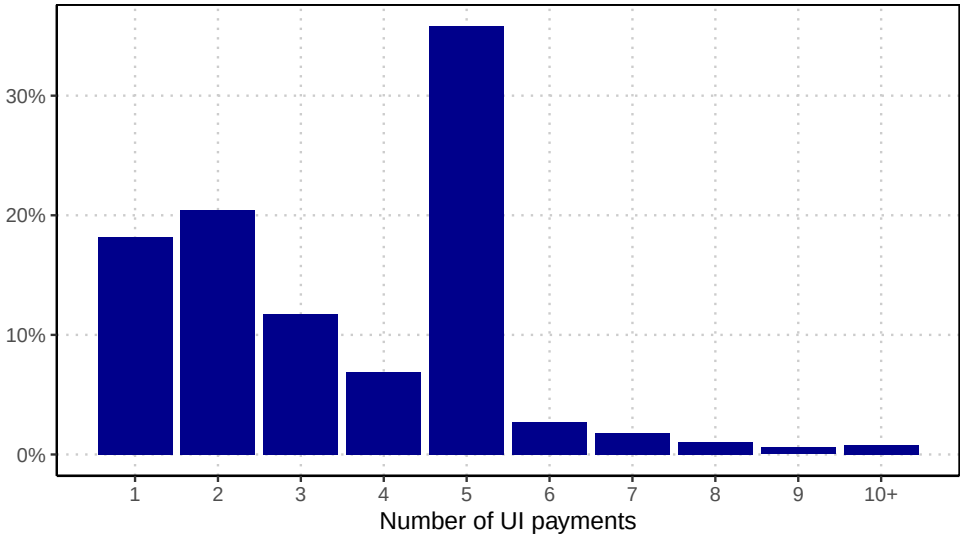
Unemployment Insurance

Back

- Using data from a 20% sample of the UI system
- Among those involuntarily separated in my sample:
  - 72.7% were eligible to use the common funds
  - 43.9% actually used it

UI number of payments

Back



Data manipulation

Back

- Men born between 1941-1989, with at most high school degree
- Discard individuals that did not switch to new pension system in 1980
- Monetary values are in 2004 values (de-trended). 1,000 Chilean pesos $\approx$ 1.50 USD
  Use information that was reported within 18 months
- Restricted monetary values from (2002-2008). Labor market information from (2002-2015)
- Recent data for retirement patterns (up to 2019) and older cohorts to get wealth accumulation at old ages (up to 89 years)

Self-emploment is informal

Back

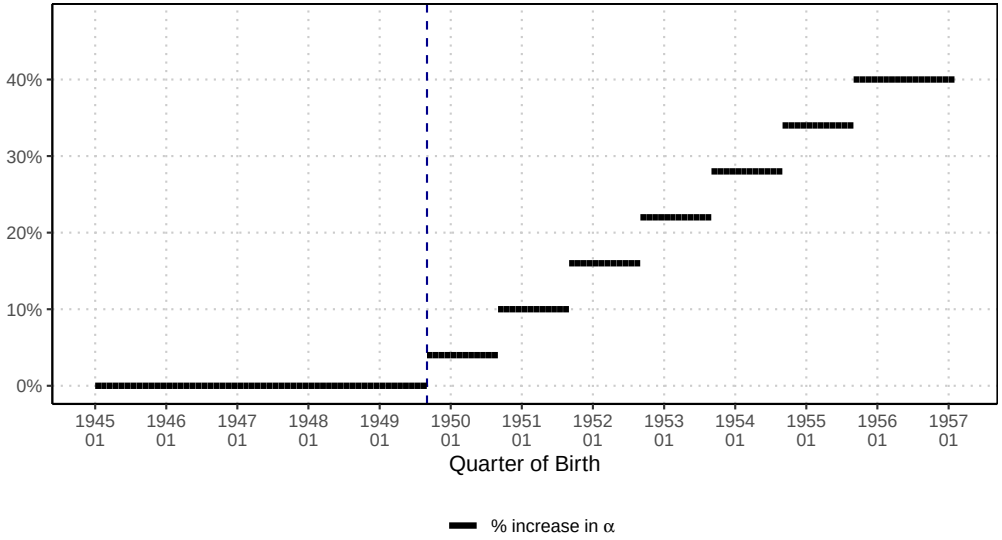
Table: Proportion among self-employed

Variable	Value
Formal Accounting	22.0%
Separate Accounting (from HH)	32.4%
Registered in the Tax Authority	32.7%
Only 1 worker	91.7%
Contributing to Pension	15.7%

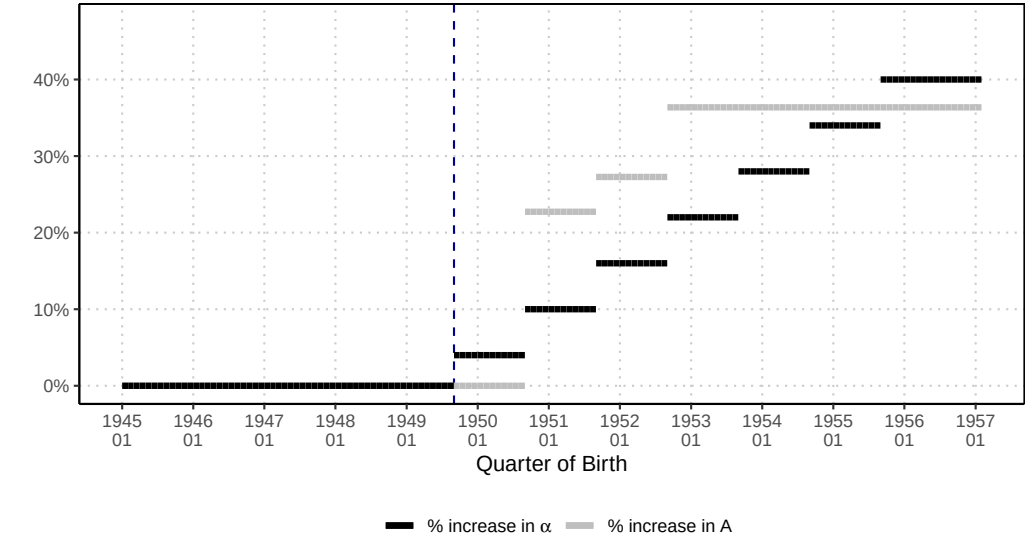
Note: EME 2009/2011 and EPS 2002-2016

2004 Reform — Retirement at age 55

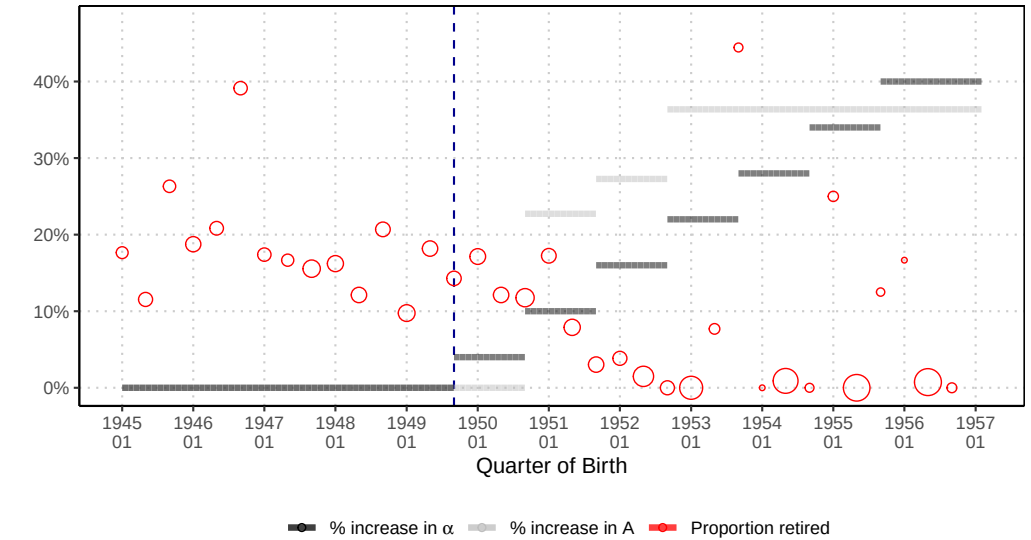
Back



2004 Reform — Retirement at age 55 Back



2004 Reform — Retirement at age 55 Back

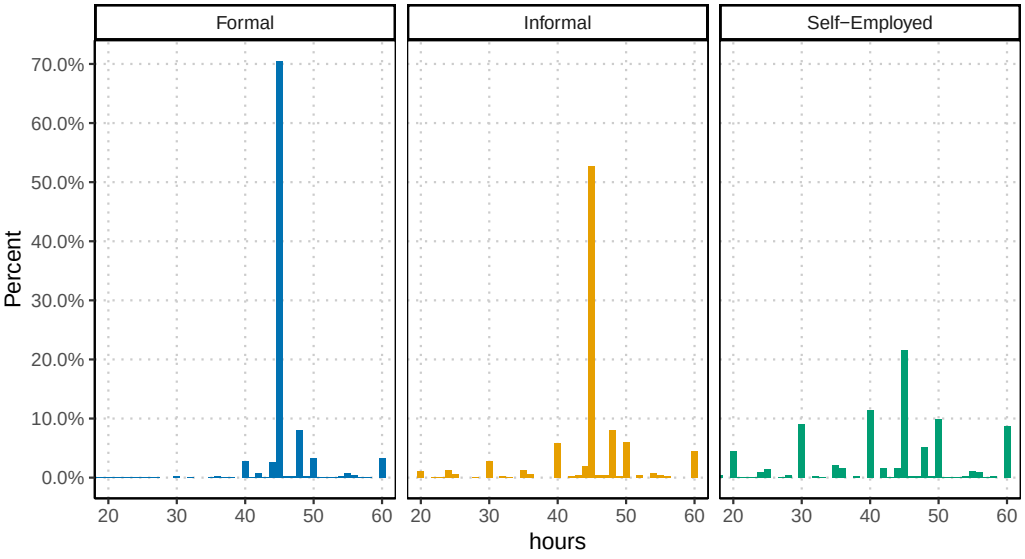


- Working part-time more
  - Self-employed: 24%
  - Informal employees: 8%
  - Formal employees: 2%

- Working at the firm site more
  - Self-employed: 14%
  - Informal employees: 56%
  - Formal employees: 70%

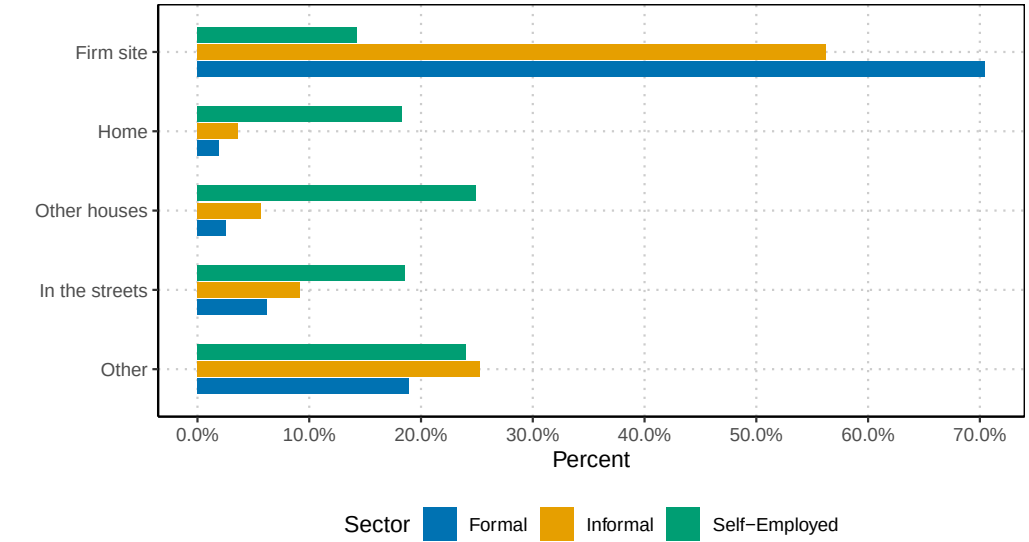
Hours distribution by sector

Back



Work place by sector

Back



2004 Reform — Delayed Retirement

Back

Outcome:	Retired (1)	Contributing (2)
(Intercept)	0.246	0.382
	(0.031)	(0.027)
T1 (Sep1949–Aug1950)	-0.062	0.018
	(0.052)	(0.050)
T2 (Sep1950–Aug1952)	-0.155	0.064
	(0.037)	(0.046)
Age Range	63	63
Age fixed-effects	-	-
Observations	7,584	7,584

2004 Reform — Delayed Retirement

Back

Outcome:	Retired (1)	Contributing (2)	Retired (3)	Contributing (4)
(Intercept)	0.246	0.382		
	(0.031)	(0.027)		
T1 (Sep1949–Aug1950)	-0.062	0.018	-0.040	0.028
	(0.052)	(0.050)	(0.038)	(0.048)
T2 (Sep1950–Aug1952)	-0.155	0.064	-0.105	0.044
	(0.037)	(0.046)	(0.032)	(0.037)
Age Range	63	63	[50–63]	[50–63]
Age fixed-effects	-	-	Yes	Yes
Observations	7,584	7,584	56,105	56,105

2004 Reform — Delayed Retirement

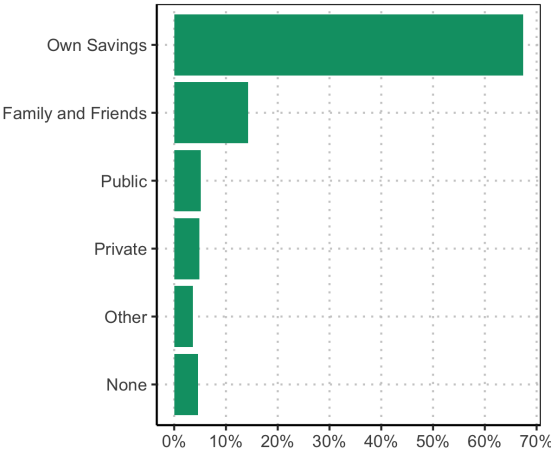
Back

Outcome:	Retired (1)	Contributing (2)	Retired (3)	Contributing (4)	Formal (5)	Informal (6)	Self-Employed (7)
(Intercept)	0.246	0.382					
	(0.031)	(0.027)					
T1 (Sep1949–Aug1950)	-0.062	0.018	-0.040	0.028	0.005	-0.007	-0.003
	(0.052)	(0.050)	(0.038)	(0.048)	(0.042)	(0.019)	(0.032)
T2 (Sep1950–Aug1952)	-0.155	0.064	-0.105	0.044	0.052	0.003	0.045
	(0.037)	(0.046)	(0.032)	(0.037)	(0.039)	(0.016)	(0.030)
Age Range	63	63	[50–63]	[50–63]	[50–63]	[50–63]	[50–63]
Age fixed-effects	-	-	Yes	Yes	Yes	Yes	Yes
Observations	7,584	7,584	56,105	56,105	56,105	56,105	56,105

Empirical Findings III: Physical capital for self-employment

Back

What was the main source of funding to start self-employment activity?



Empirical Findings III: Physical capital for self-employment

- Use panel dimension to investigate wealth held as physical capital
- 4 groups based on the self-employment status in t and $t+1$

Empirical Findings III: Physical capital for self-employment

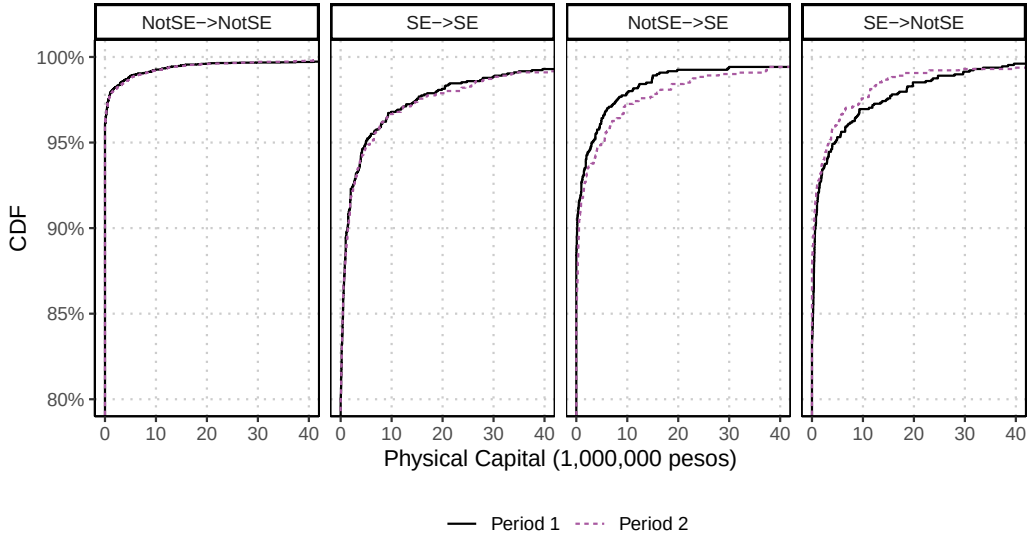
- Use panel dimension to investigate wealth held as physical capital
- 4 groups based on the self-employment status in t and $t+1$
- $Y_i = \beta_g G_i \times Post_t + G_i$
- CDF survey

Outcome variable: Indicator for physical capital > 0

Group		Coeff
Group 00	(NotSE→NotSE)	-0.0002
		(0.0017)
Group 11	(SE→SE)	0.0021
		(0.0100)
Group 01	(NotSE→SE)	0.0335***
		(0.0117)
Group 10	(SE→NotSE)	-0.0451***
		(0.0121)
N Obs		27,926

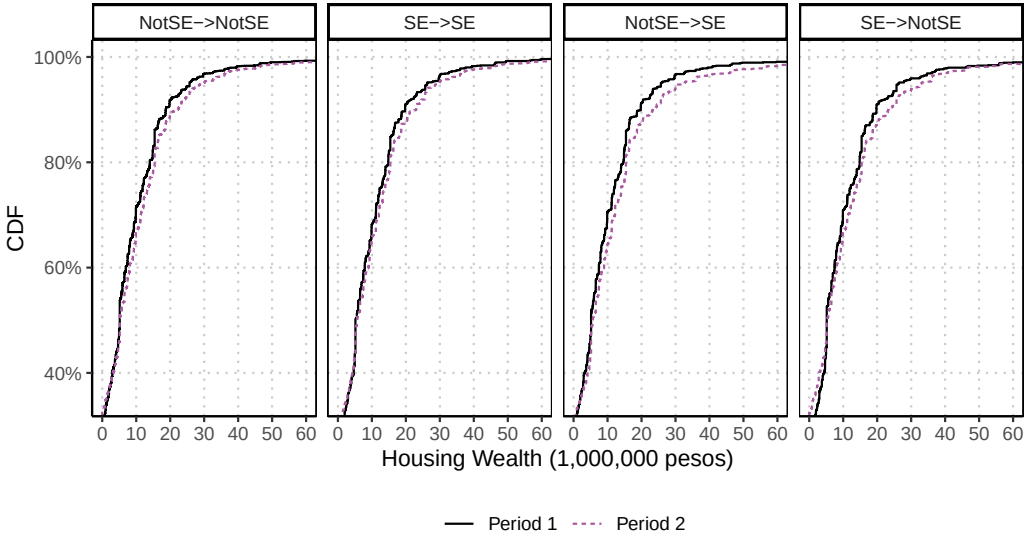
Self-Employment and start-up costs

Back



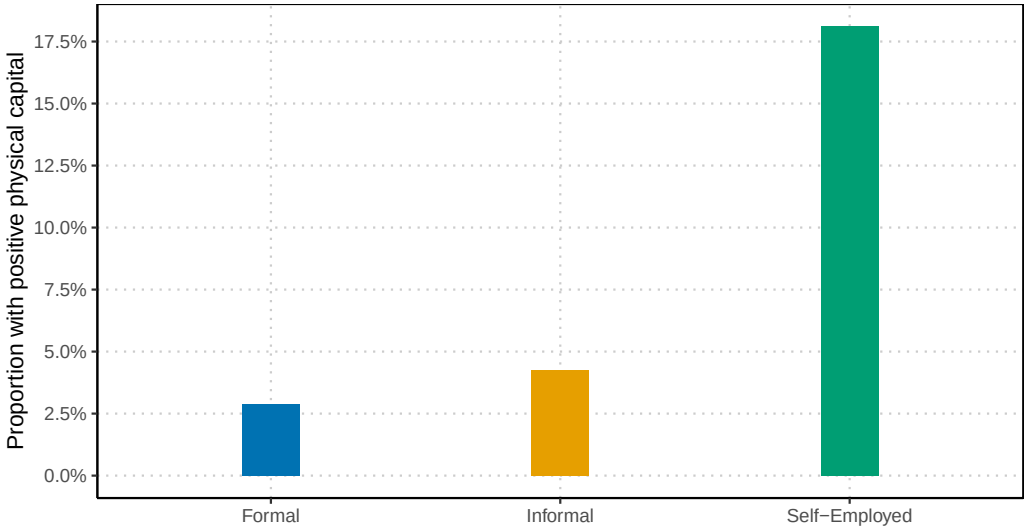
Self-Employment and start-up costs

Back



Physical capital

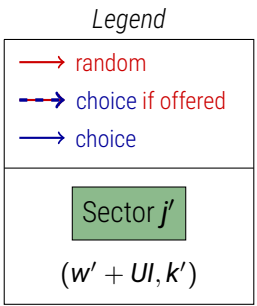
Back



Employment choice

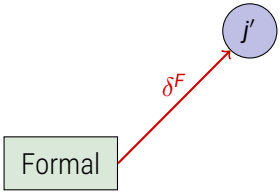
Back

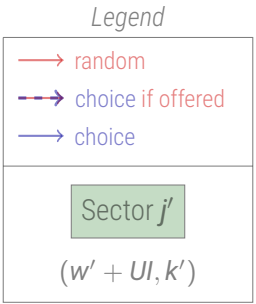
Formal



Employment choice

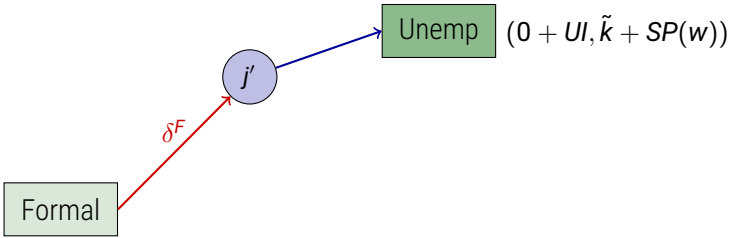
Back





Employment choice

Back



Legend

random

choice if offered

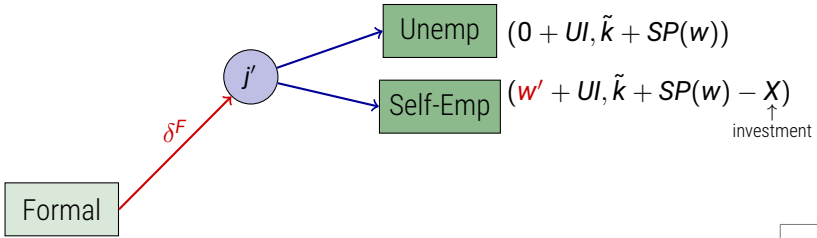
choice

Sector j'

$(w' + UI, k')$

Employment choice

Back



Employment choice

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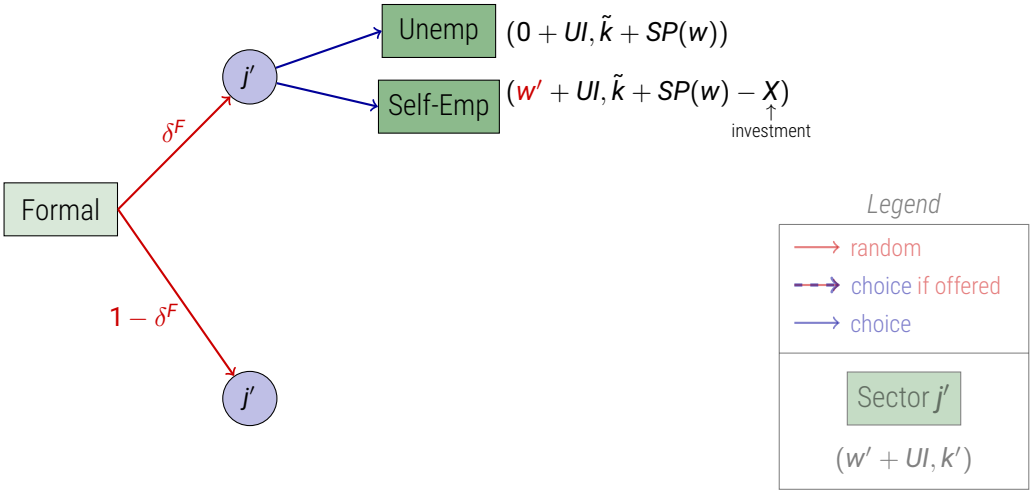

Employment choice

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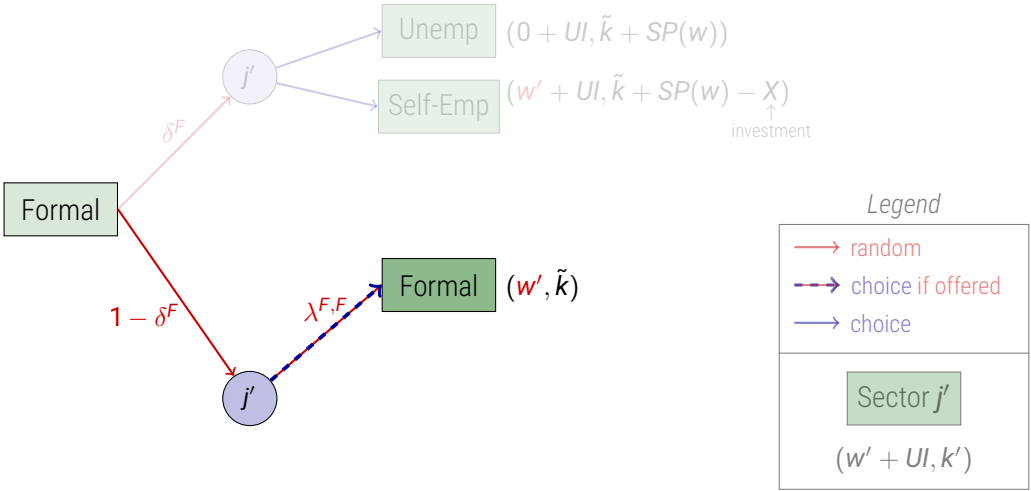

Employment choice

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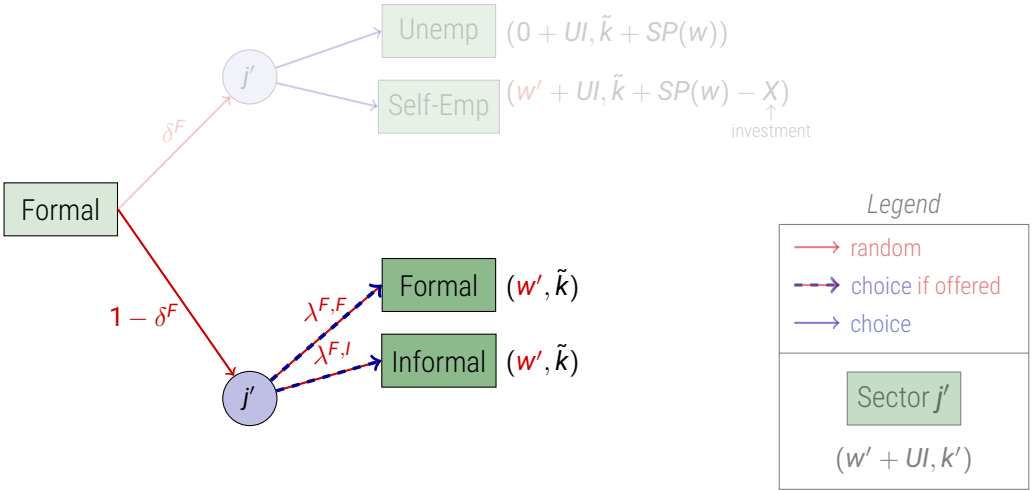

Employment choice

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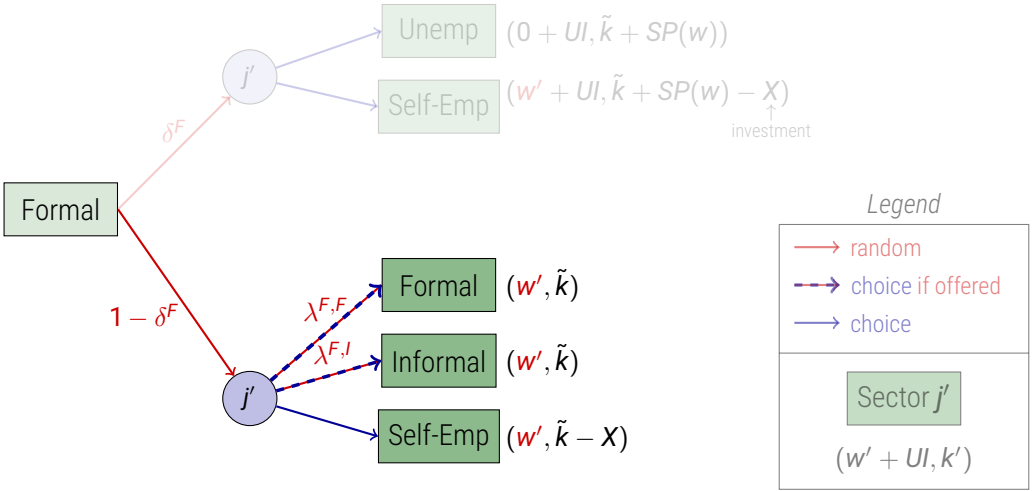

Employment choice

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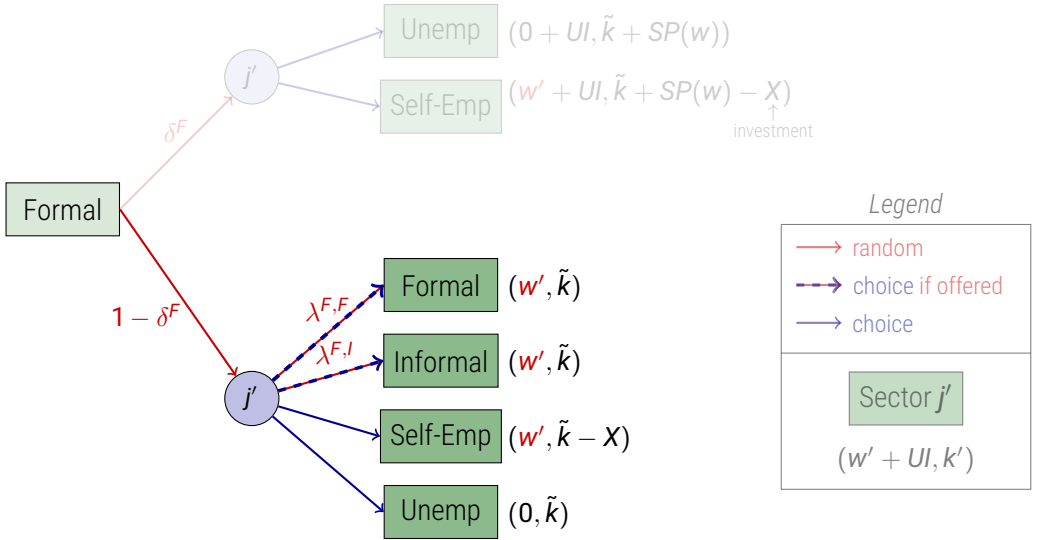
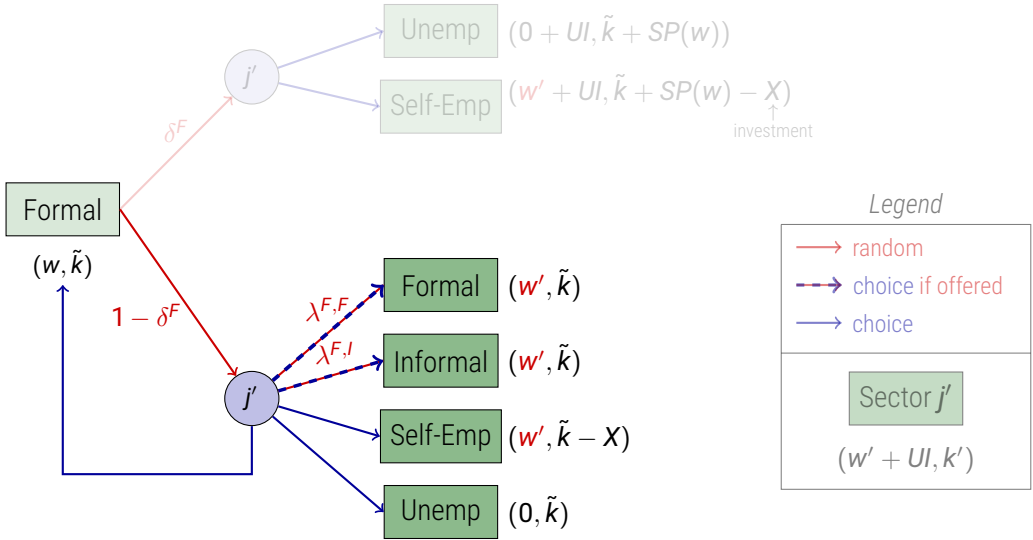


Employment choice

Back



$$\tilde{V}^F_{a+1} := \max \left\{ \overbrace{V_{a+1}(b', p', \tilde{k}, F, w)}^{\text{stay}}, \right.$$

$$\tilde{V}^F_{a+1} := \max \left\{ \overbrace{V_{a+1}(b', p', \tilde{k}, F, w)}^{\text{stay}}, \overbrace{V_{a+1}(b', p', \tilde{k}, U, 0)}^{\text{quit}}, \right.$$

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$$\tilde{V}^F_{a+1} := \max \left\{ \overbrace{V_{a+1}(b', p', \tilde{k}, F, w)}^{\text{stay}}, \overbrace{V_{a+1}(b', p', \tilde{k}, U, 0)}^{\text{quit}}, \right.$$
$$\left. \underbrace{\int V_{a+1}(b', p', \tilde{k} - X, S, \tilde{w}) dW^S(\tilde{w})}_{\text{move SE}}, \underbrace{V^{\text{Ret}}_{a+1}(\tilde{k}, y^P, q)}_{\text{retire}} \right\}$$

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$$\mathbb{E}_F[V_{a+1}(b', p', k', j', w')] =$$

$$\delta_F$$

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$$V^{\text{Ret}}_{a+1}(\tilde{k}, y^P, q) \Bigg\} +$$

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$$V^{\text{Ret}}_{a+1}(\tilde{k}, y^P, q) \Bigg\} + (1 - \delta_F) \Bigg[(1 - \lambda^F_F)(1 - \lambda^I_F) \tilde{V}^F_{a+1} +$$

$$\tilde{V}^F_{a+1} := \max\Bigg\{ \overbrace{V_{a+1}(b',p',\tilde{k},F,w)}^{\text{stay}}, \overbrace{V_{a+1}(b',p',\tilde{k},U,0)}^{\text{quit}}, \underbrace{\int V_{a+1}(b',p',\tilde{k}-X,S,\tilde{w})dW^S(\tilde{w})}_{\text{move SE}}, \underbrace{V^{\text{Ret}}_{a+1}(\tilde{k},y^P,q)}_{\text{retire}} \Bigg\}$$

$$\mathbb{E}_F[V_{a+1}(b',p',k',j',w')] =$$

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$$\tilde{\lambda^F_F} \int \max\Big\{ \tilde{V}^F_{a+1}, V_{a+1}(b',p',\tilde{k},F,\tilde{w}) \Big\} dW^F(\tilde{w}) +$$

$$\tilde{V}^F_{a+1} := \max\Bigg\{ \overbrace{V_{a+1}(b',p',\tilde{k},F,w)}^{\text{stay}}, \overbrace{V_{a+1}(b',p',\tilde{k},U,0)}^{\text{quit}}, \underbrace{\int V_{a+1}(b',p',\tilde{k}-X,S,\tilde{w})dW^S(\tilde{w})}_{\text{move SE}}, \underbrace{V^{\text{Ret}}_{a+1}(\tilde{k},y^P,q)}_{\text{retire}} \Bigg\}$$

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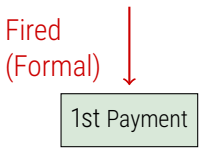
$$\tilde{\lambda^F_F} \int \max\Big\{ \tilde{V}^F_{a+1}, V_{a+1}(b',p',\tilde{k},F,\tilde{w}) \Big\} dW^F(\tilde{w}) +$$

$$\tilde{\lambda^I_F} \int \max\Big\{ \tilde{V}^F_{a+1}, V_{a+1}(b',p',\tilde{k},I,\tilde{w}) \Big\} dW^I(\tilde{w}) \Bigg]$$

Unemployment insurance

Back



Unemployment insurance

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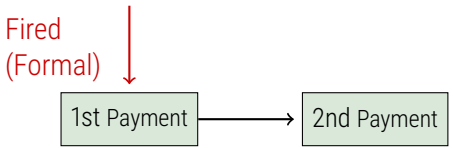

Unemployment insurance

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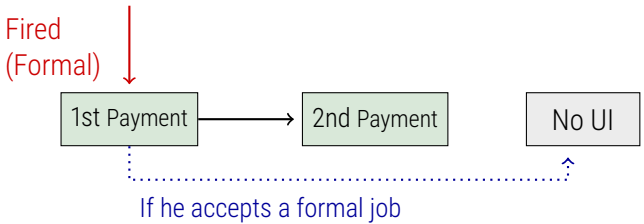
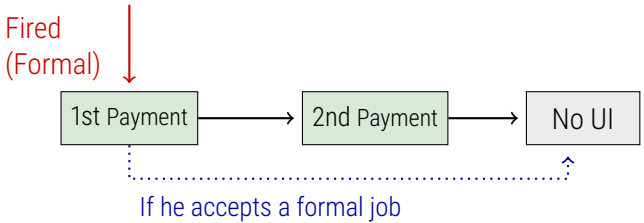


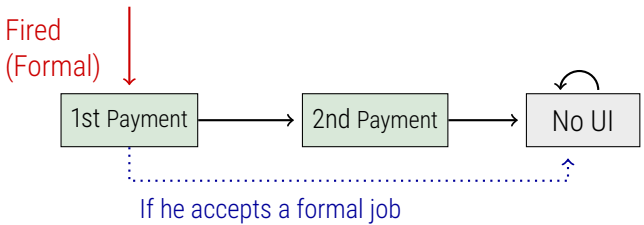
Unemployment insurance

Back



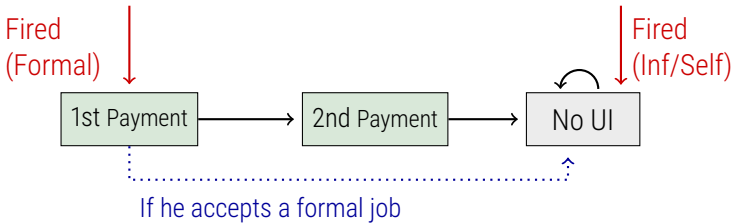
Unemployment insurance

Back



Unemployment insurance

Back



The pension system

Back

Pension wealth

$$p' = p(1 + r^P) + \begin{cases} 0.10w & \text{if formal} \\ 0 & \text{otherwise} \end{cases}$$

- Pension benefits: $y^R(t_R, p)$
- Early retirement is possible if $y^R(t_R, p) \geq \max\{A, \alpha\overline{w}\}$
- Bequeath remaining wealth

$$B(k) = \psi \left[\frac{(\bar{K} + k)^{\nu(1-\gamma)}}{1 - \gamma} \right]$$

State space

Back

1. Age: discrete from 16 to 100 y.o. (quarterly)
2. Type I: Reform 2004 and 2008 (4)
3. Type II: Ability type (2)
4. Wealth: continuous 13 points
5. Pension Wealth: continuous / 10 points
6. Sector: 4
7. Wage: continuous 10 points
8. Hours: discrete part-time x full-time (2 points)
9. UI status: discrete (3 points)

$\Rightarrow$ State space: $\sim$ 24mi points

Estimation Details Back

i. Model is quarterly from age 16-100

ii. Pension reforms come as surprises

iii. Solved numerically

iv. Weighting matrix: inverse of the diagonal of the var-cov matrix

v. Global (Controlled Random Search) + local (Brent's algorithm) — derivative free

vi. Continuous variables are discretized in grid points: capital (13), pension wealth (10) and wage/earnings (10)

vii. Numerical integration using Gauss-Legendre (for Normal and Beta distributions)

viii. Interpolation: linear interpolation for 1D,2D,3D

ix. Numerical derivatives using two symmetrical deviations with a step size of 2.5%

SMM

Back

- GMM estimation with moments computed by simulated data

1. Given a vector of parameters: ξ
2. Obtain the solution of the model: policy functions $P^*(\xi)$
3. Simulate individuals that behave according to $P^*(\xi)$
4. Compute moments from the simulated individuals: $M(P^*(\xi))$
5. Choose ξ^* that minimizes:

$$\left(M\left(P^*(\xi)\right) - \underset{\uparrow}{M_d}\right)' \underset{\downarrow}{\Sigma_{M_d}} \left(M(P^*(\xi)) - M_d\right)$$

moments in the data; weighting matrix

2nd stage parameters

Back

Estimated Parameters (28)

Discount factor (β)	1	(A)
Bequest (ψ,$\overline{K}$)	2	(A)

Moments (222)

(A)	39	Median Wealth $\times$ age groups

2nd stage parameters

Back

Estimated Parameters (28)

Discount factor (β)	1	(A)
Bequest (ψ,$\overline{K}$)	2	(A)
Consumption weight (ν)	1	(B),(C)

Moments (222)

(A)	39	Median Wealth $\times$ age groups
(B)	38	Prop Retired $\times$ age $\times$ cohort
(C)	11	Prop Part-time $\times$ age groups

2nd stage parameters

Back

Estimated Parameters (28)

Discount factor (β)	1	(A)
Bequest (ψ,$\overline{K}$)	2	(A)
Consumption weight (ν)	1	(B),(C)
Amenities (ϕ_j)	2	(D)

Moments (222)

(A)	39	Median Wealth $\times$ age groups
(B)	38	Prop Retired $\times$ age $\times$ cohort
(C)	11	Prop Part-time $\times$ age groups
(D)	81	Emp-Sector $\times$ age groups

2nd stage parameters

Back

Estimated Parameters (28)

Discount factor (β)	1	(A)
Bequest (ψ,$\overline{K}$)	2	(A)
Consumption weight (ν)	1	(B),(C)
Amenities (ϕ_j)	2	(D)
Destruction rates (δ^j)	3	(E)
Arrival rates (λ^{jj})	8	(E)

Moments (222)

(A)	39	Median Wealth $\times$ age groups
(B)	38	Prop Retired $\times$ age $\times$ cohort
(C)	11	Prop Part-time $\times$ age groups
(D)	81	Emp-Sector $\times$ age groups
(E)	14	Transitions

2nd stage parameters

Back

Estimated Parameters (28)

Discount factor (β)	1	(A)
Bequest (ψ,$\overline{K}$)	2	(A)
Consumption weight (ν)	1	(B),(C)
Amenities (ϕ_j)	2	(D)
Destruction rates (δ^j)	3	(E)
Arrival rates (λ^{ij})	8	(E)
Formal Wage (ξ_1^F, ξ_2^F)	2	(F)
Informal Wage (ξ_1^I, ξ_2^I)	2	(G)

Moments (222)

(A)	39	Median Wealth $\times$ age groups
(B)	38	Prop Retired $\times$ age $\times$ cohort
(C)	11	Prop Part-time $\times$ age groups
(D)	81	Emp-Sector $\times$ age groups
(E)	14	Transitions
(F)	13	Formal Wage Percentiles
(G)	13	Informal Wage Percentiles

2nd stage parameters

Back

Estimated Parameters (28)

Discount factor (β)	1	(A)
Bequest (ψ,$\overline{K}$)	2	(A)
Consumption weight (ν)	1	(B),(C)
Amenities (ϕ_j)	2	(D)
Destruction rates (δ^j)	3	(E)
Arrival rates (λ^{ij})	8	(E)
Formal Wage (ξ_1^F, ξ_2^F)	2	(F)
Informal Wage (ξ_1^I, ξ_2^I)	2	(G)
Self-Emp Earnings (σ)	2	(H)

Moments (222)

(A)	39	Median Wealth $\times$ age groups
(B)	38	Prop Retired $\times$ age $\times$ cohort
(C)	11	Prop Part-time $\times$ age groups
(D)	81	Emp-Sector $\times$ age groups
(E)	14	Transitions
(F)	13	Formal Wage Percentiles
(G)	13	Informal Wage Percentiles
(H)	7	Self-Emp Earnings

2nd stage parameters

Back

Estimated Parameters (28)

Discount factor (β)	1	(A)
Bequest (ψ,$\overline{K}$)	2	(A)
Consumption weight (ν)	1	(B),(C)
Amenities (ϕ_j)	2	(D)
Destruction rates (δ^j)	3	(E)
Arrival rates (λ^{jj})	8	(E)
Formal Wage (ξ_1^F, ξ_2^F)	2	(F)
Informal Wage (ξ_1^I, ξ_2^I)	2	(G)
Self-Emp Earnings (σ)	2	(H)
Self-Emp Fixed Cost (x)	1	(D)

Moments (222)

(A)	39	Median Wealth $\times$ age groups
(B)	38	Prop Retired $\times$ age $\times$ cohort
(C)	11	Prop Part-time $\times$ age groups
(D)	81	Emp-Sector $\times$ age groups
(E)	14	Transitions
(F)	13	Formal Wage Percentiles
(G)	13	Informal Wage Percentiles
(H)	7	Self-Emp Earnings

2nd stage parameters

Back

Estimated Parameters (28)

Discount factor (β)	1	(A)
Bequest (ψ,$\overline{K}$)	2	(A)
Consumption weight (ν)	1	(B),(C)
Amenities (ϕ_j)	2	(D)
Destruction rates (δ^j)	3	(E)
Arrival rates (λ^{ij})	8	(E)
Formal Wage (ξ_1^F, ξ_2^F)	2	(F)
Informal Wage (ξ_1^I, ξ_2^I)	2	(G)
Self-Emp Earnings (σ)	2	(H)
Self-Emp Fixed Cost (x)	1	(D)
Self-Emp Physical K (α)	1	(I)

Moments (222)

(A)	39	Median Wealth $\times$ age groups
(B)	38	Prop Retired $\times$ age $\times$ cohort
(C)	11	Prop Part-time $\times$ age groups
(D)	81	Emp-Sector $\times$ age groups
(E)	14	Transitions
(F)	13	Formal Wage Percentiles
(G)	13	Informal Wage Percentiles
(H)	7	Self-Emp Earnings
(I)	1	Physical Capital

2nd stage parameters

Back

Estimated Parameters (28)

Discount factor (β)	1	(A)
Bequest (ψ,$\overline{K}$)	2	(A)
Consumption weight (ν)	1	(B),(C)
Amenities (ϕ_j)	2	(D)
Destruction rates (δ^j)	3	(E)
Arrival rates (λ^{jj})	8	(E)
Formal Wage (ξ_1^F, ξ_2^F)	2	(F)
Informal Wage (ξ_1^I, ξ_2^I)	2	(G)
Self-Emp Earnings (σ)	2	(H)
Self-Emp Fixed Cost (x)	1	(D)
Self-Emp Physical K (α)	1	(I)
Abilities	3	(J)

Moments (222)

(A)	39	Median Wealth $\times$ age groups
(B)	38	Prop Retired $\times$ age $\times$ cohort
(C)	11	Prop Part-time $\times$ age groups
(D)	81	Emp-Sector $\times$ age groups
(E)	14	Transitions
(F)	13	Formal Wage Percentiles
(G)	13	Informal Wage Percentiles
(H)	7	Self-Emp Earnings
(I)	1	Physical Capital
(J)	4	Wage correlations

2nd stage parameters

Back

Estimated Parameters (28)

Discount factor (β)	1	(A)
Bequest (ψ,$\overline{K}$)	2	(A)
Consumption weight (ν)	1	(B),(C)
Amenities (ϕ_j)	2	(D)
Destruction rates (δ^j)	3	(E)
Arrival rates (λ^{ij})	8	(E)
Formal Wage (ξ_1^F, ξ_2^F)	2	(F)
Informal Wage (ξ_1^I, ξ_2^I)	2	(G)
Self-Emp Earnings (σ)	2	(H)
Self-Emp Fixed Cost (x)	1	(D)
Self-Emp Physical K (α)	1	(I)
Abilities	3	(J)
Prop type I	1	(K)

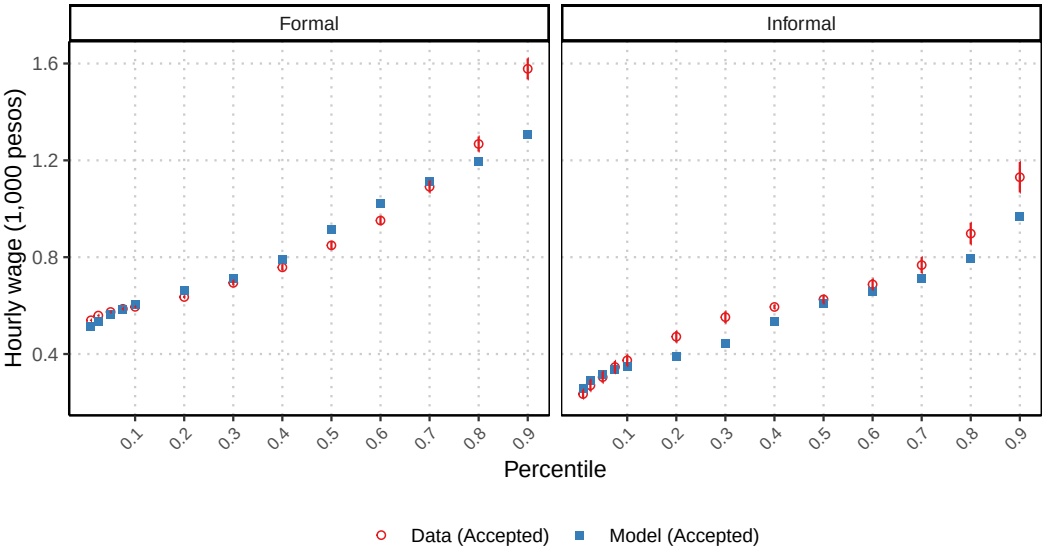
Moments (222)

(A)	39	Median Wealth $\times$ age groups
(B)	38	Prop Retired $\times$ age $\times$ cohort
(C)	11	Prop Part-time $\times$ age groups
(D)	81	Emp-Sector $\times$ age groups
(E)	14	Transitions
(F)	13	Formal Wage Percentiles
(G)	13	Informal Wage Percentiles
(H)	7	Self-Emp Earnings
(I)	1	Physical Capital
(J)	4	Wage correlations
(K)	1	Proportion Never Self-Employed

Preference	β	ν	ψ	$\bar{K}$	ϕ_I	ϕ_S
estimate	0.935	0.407	9,883.3	113,631.8	1.090	0.986
(s.e.)	(0.001)	(0.003)	(3,108.3)	(22,957.6)	(0.011)	(0.007)
Destruction Rates	δ_F	δ_I	δ_S			
estimate	0.030	0.003	0.010			
(s.e.)	(0.001)	(0.000)	(0.001)			
Formal Arrival Rates	$\lambda_{U,F}$	$\lambda_{F,F}$	$\lambda_{I,F}$	$\lambda_{S,F}$		
estimate	0.181	0.161	0.054	0.249		
(s.e.)	(0.008)	(0.012)	(0.001)	(0.027)		
Informal Arrival Rates	$\lambda_{U,I}$	$\lambda_{F,I}$	$\lambda_{I,I}$	$\lambda_{S,I}$		
estimate	0.991	0.850	0.374	0.713		
(s.e.)	(0.048)	(0.082)	(0.021)	(0.152)		
Wage (Shape)	ζ_1^F	ζ_2^F	ζ_1^I	ζ_2^I		
estimate	2.252	39.827	1.906	38.433		
(s.e.)	(0.084)	(1.340)	(0.113)	(1.230)		
Self-Employment	σ	X	α			
estimate	0.062	2,594.4	0.023			
(s.e.)	(0.003)	(63.1)	(0.007)			
Ability Types	g_2	e_1	e_2	$p(\theta_2)$		
estimate	1.711	0.725	0.495	0.570		
(s.e.)	(0.016)	(0.013)	(0.631)	(0.007)		

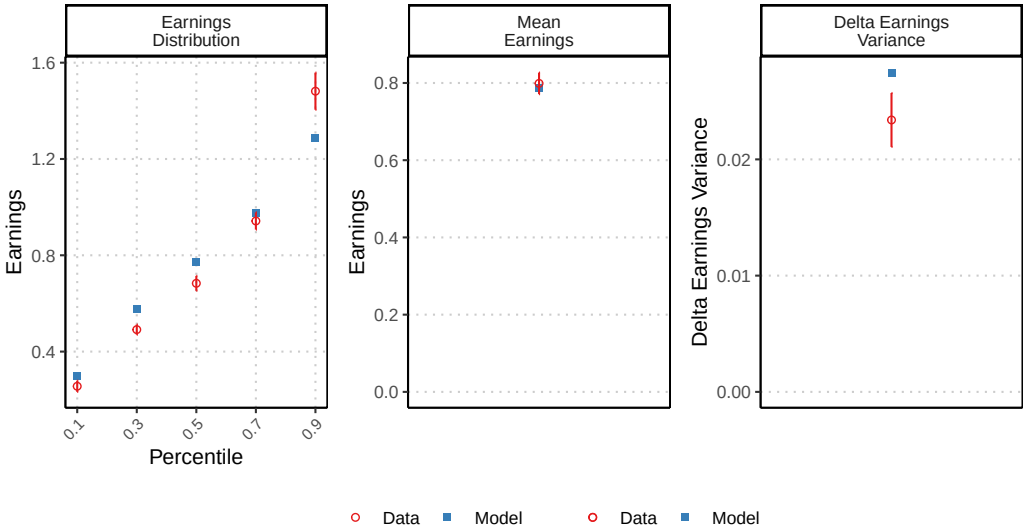
Accepted wages

Back



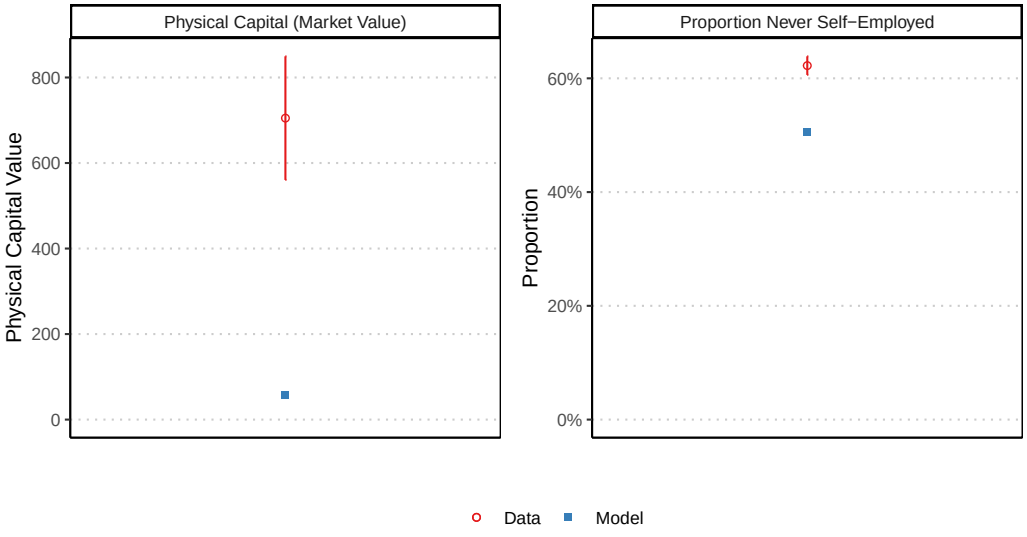
SE Earnings

Back



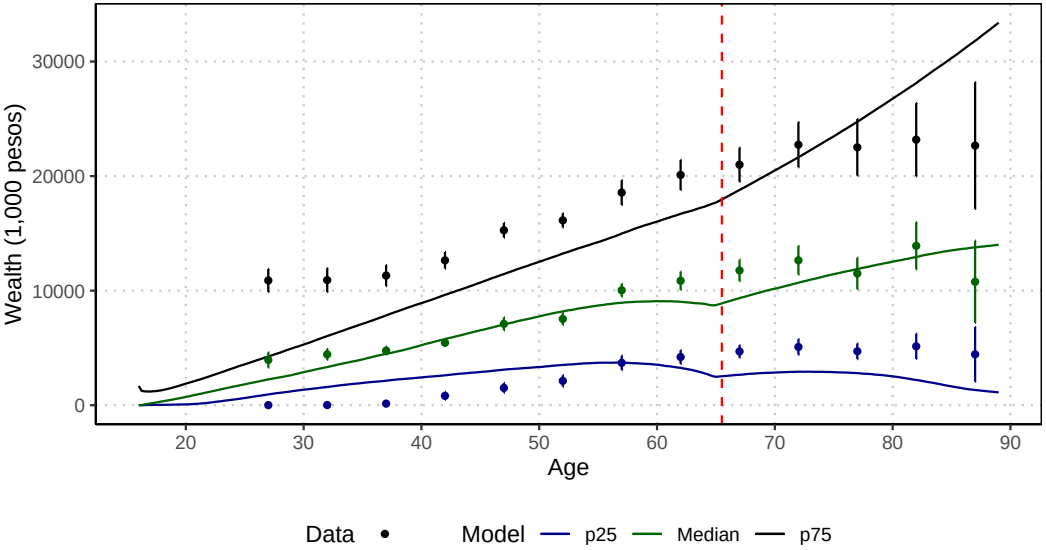
SE Capital Requirements

Back



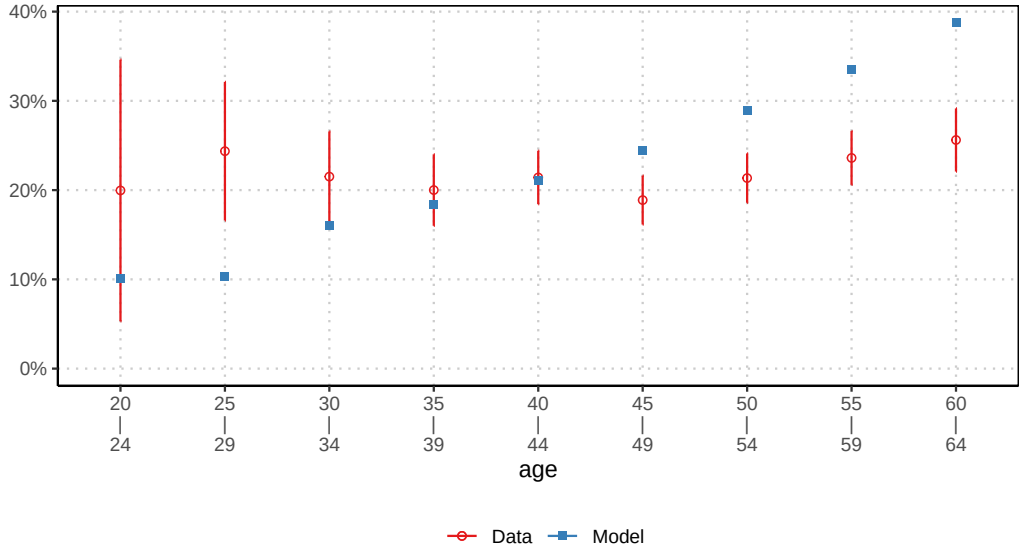
Wealth

Back


Wealth (1,000 pesos)
30000
20000
10000
0
20
30
40
50
60
70
80
90
Age
Data
Model
p25
Median
p75

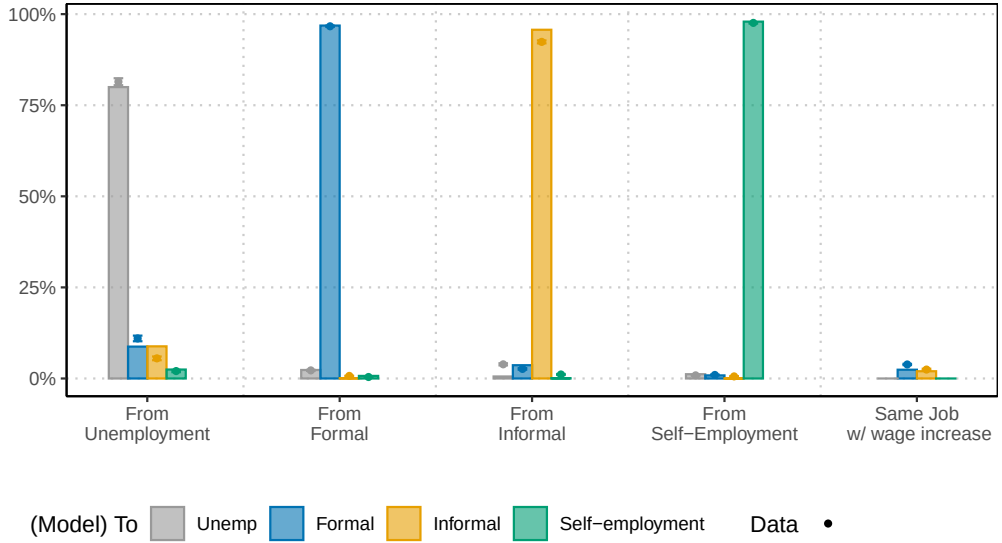
Part-time

Back



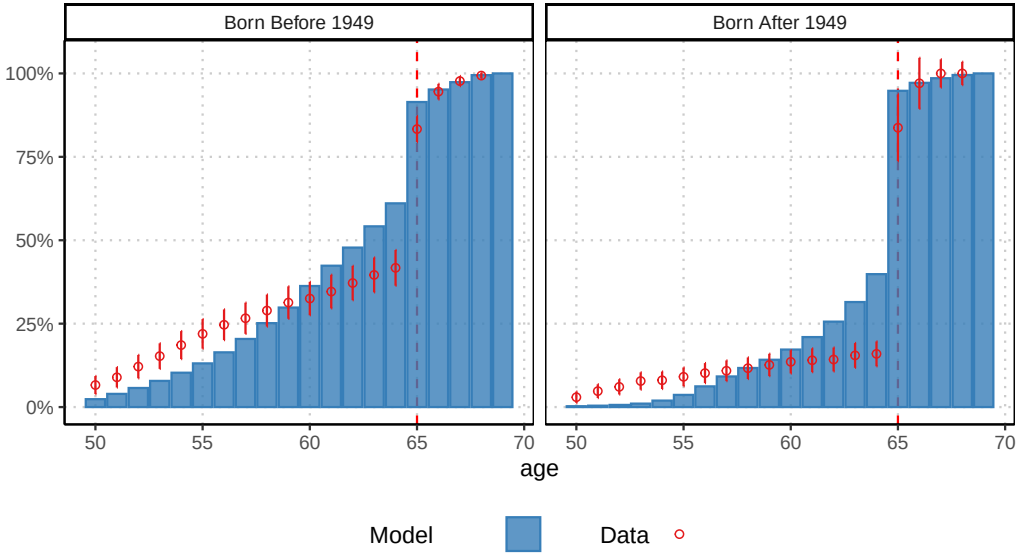
Transitions

Back



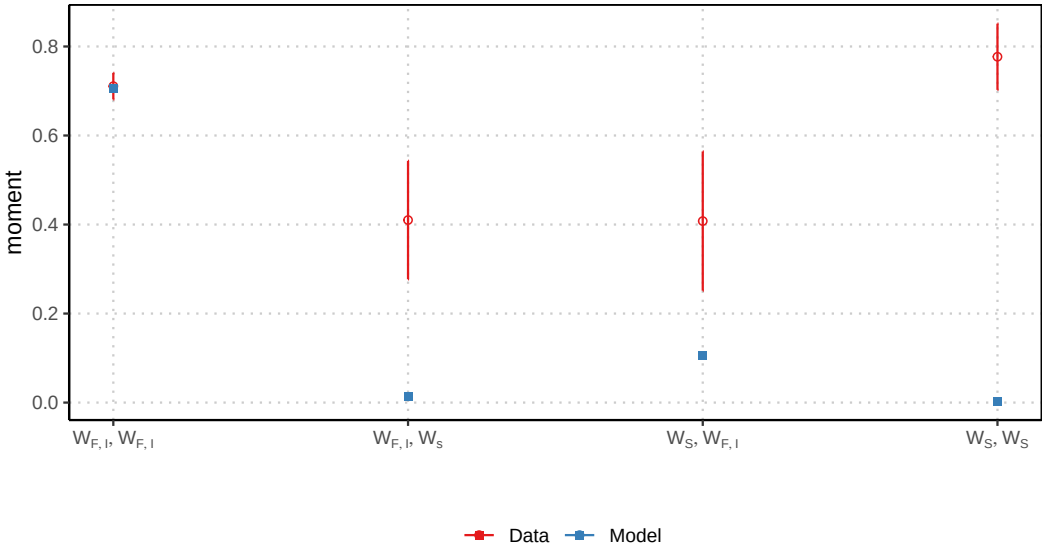
Retirement age

Back



Wage correlation age

Back



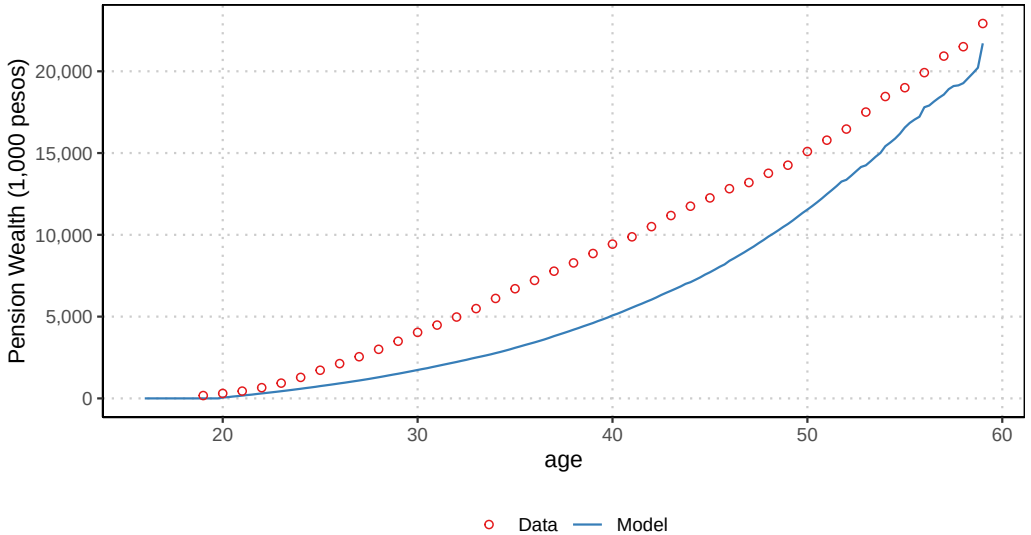
Amenities

- Consumption equivalent (intra-period) to yield the same utility as working formally full-time

Sector	Formal	Unemployed	Informal	Self-employed
Consumption Equivalent	1.000 *(baseline)*	0.501	1.111	0.983

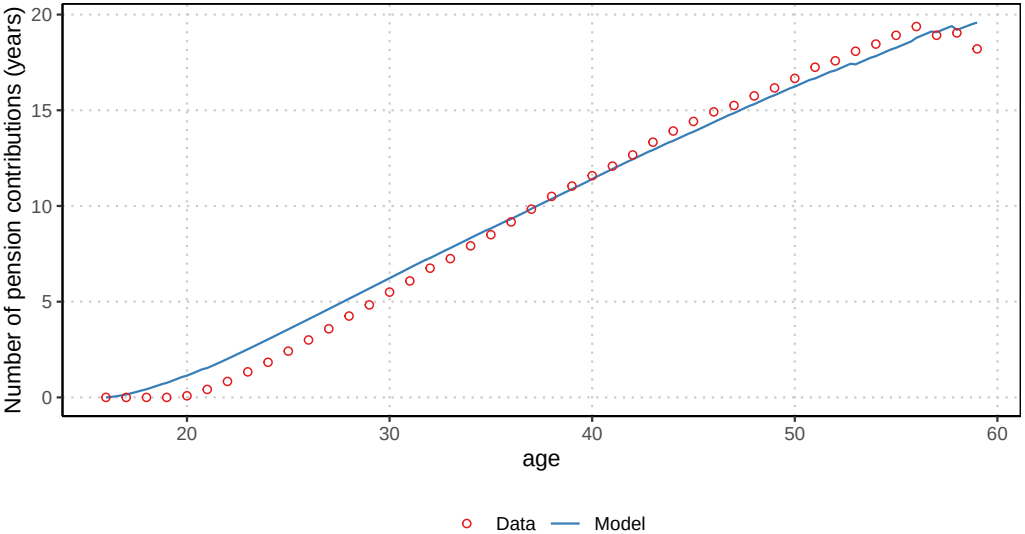
Untargetted moments: pension wealth

Back



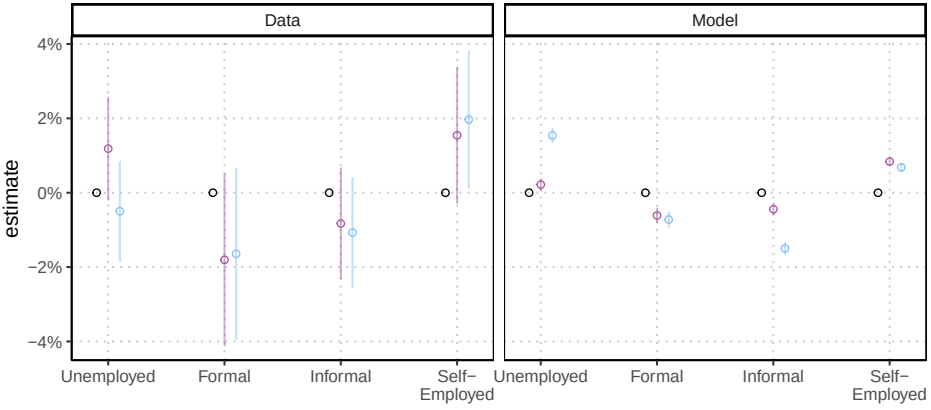
Untargetted moments: pension contributions

Back



Untargeted moments: transitions by wealth

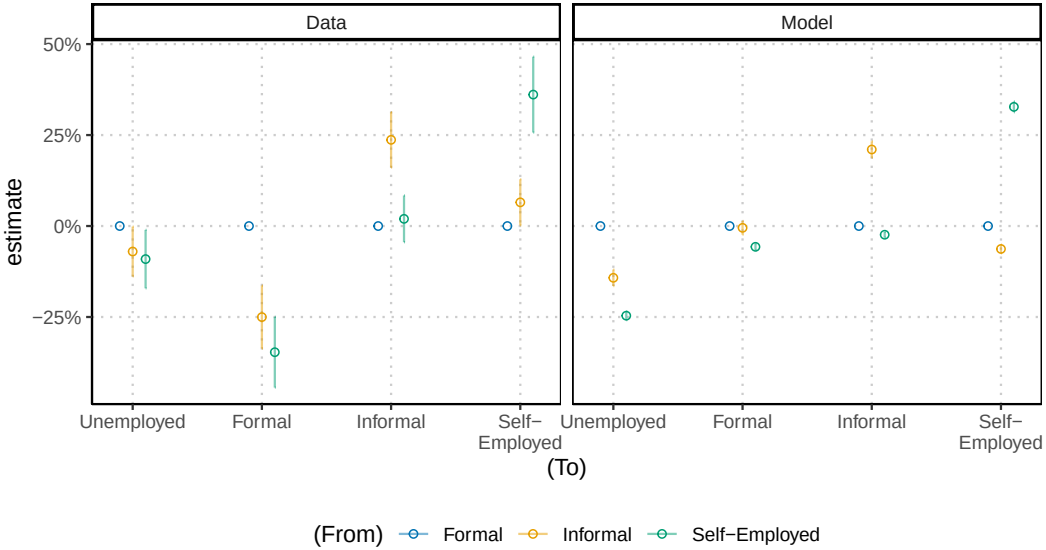
Involuntary only



$$\text{Sector}_{i,t+12} = \sum_{g=1}^{G} \beta^{G} W_{i,t}^{g} + \eta_{\text{sector}(i,t)} + \nu_{\text{age}(i,t)} + \varepsilon_{it}$$

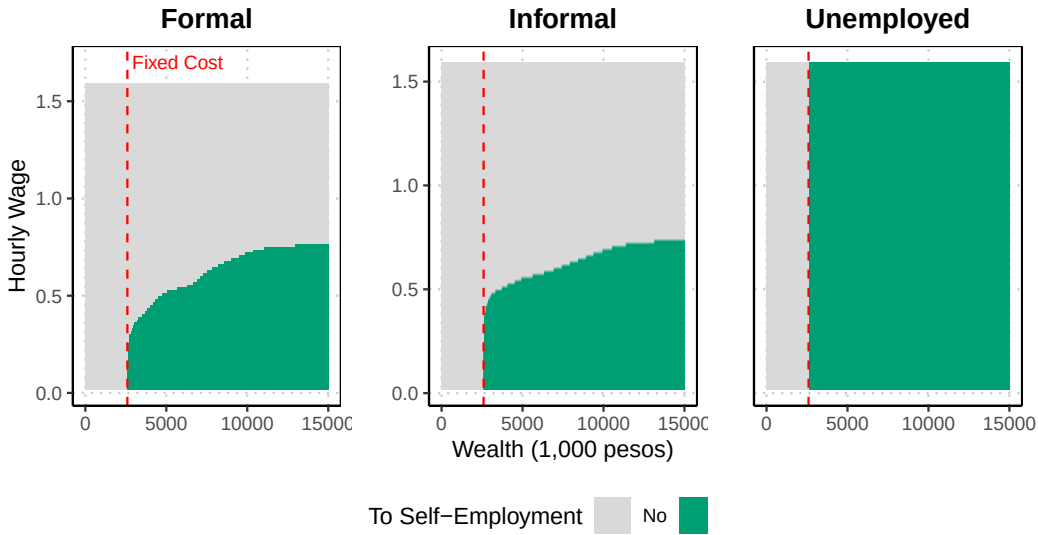
Involuntary transitions

Back



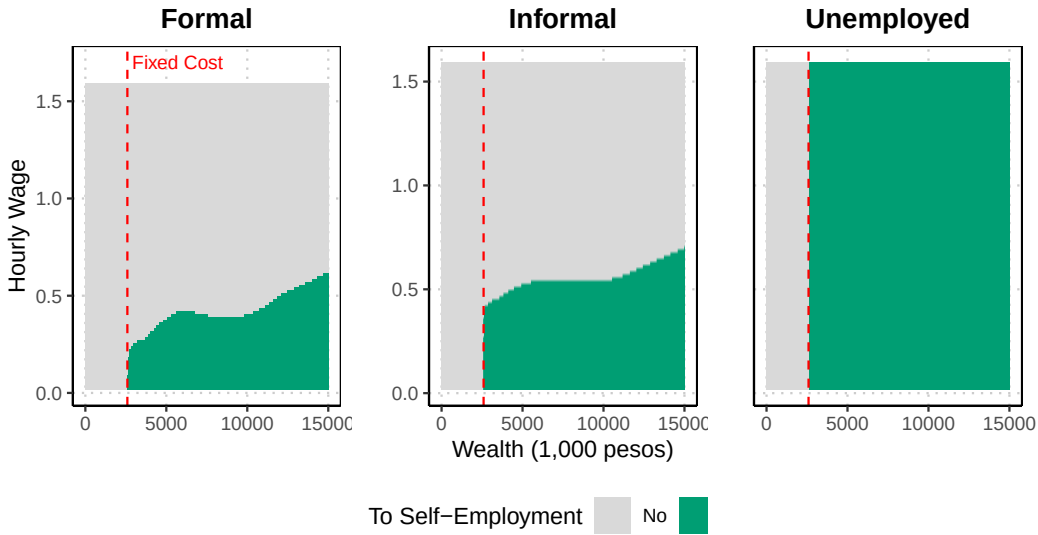
Self-employment decisions – Age 20

Back



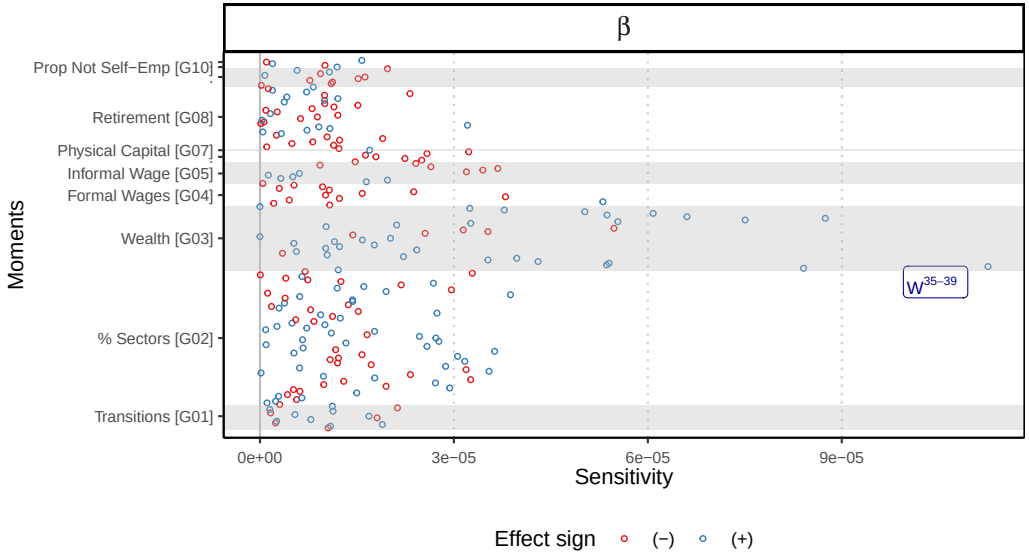
Self-employment decisions – Age 50

Back



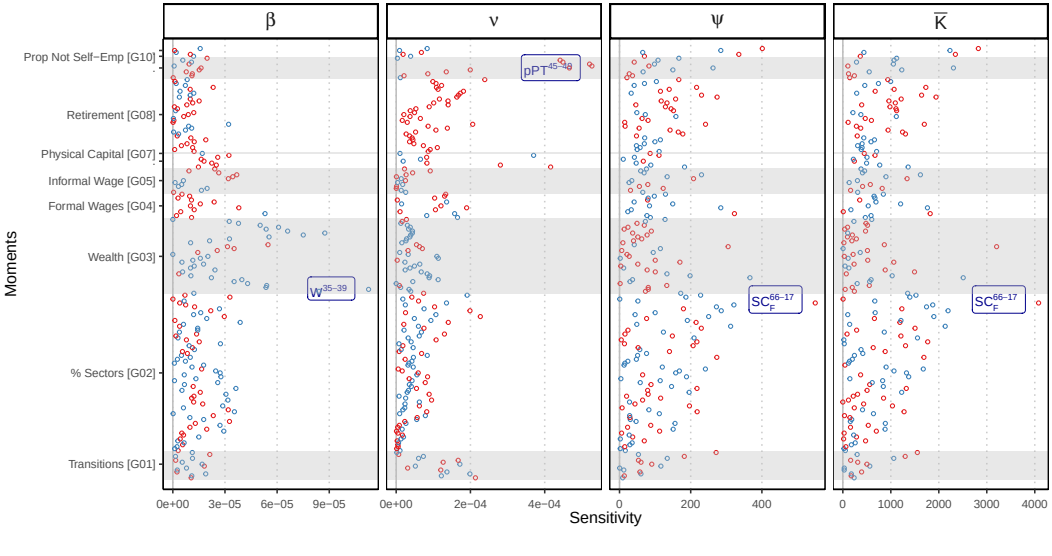
Sensitivity Matrix

Back



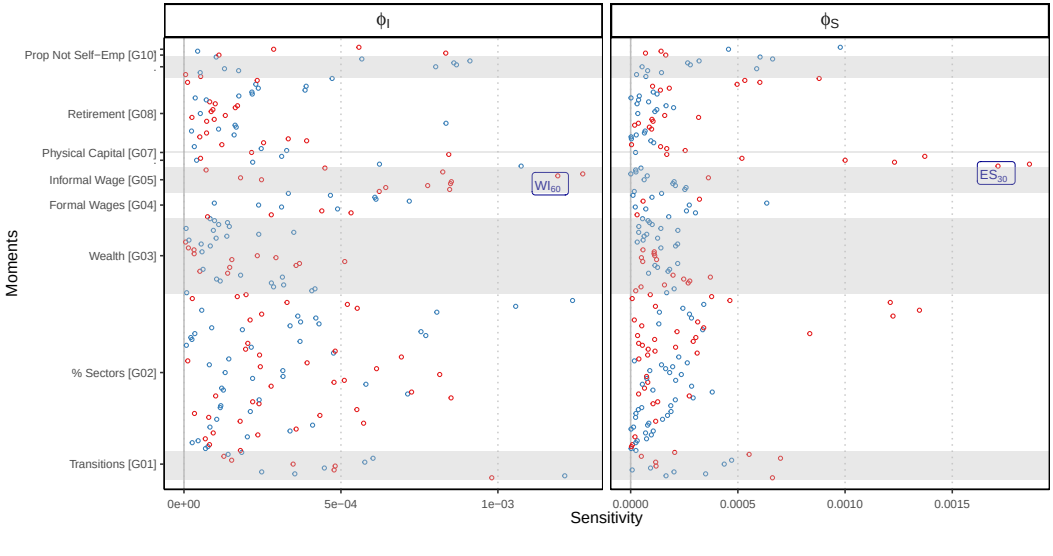
Sensitivity Matrix

Back



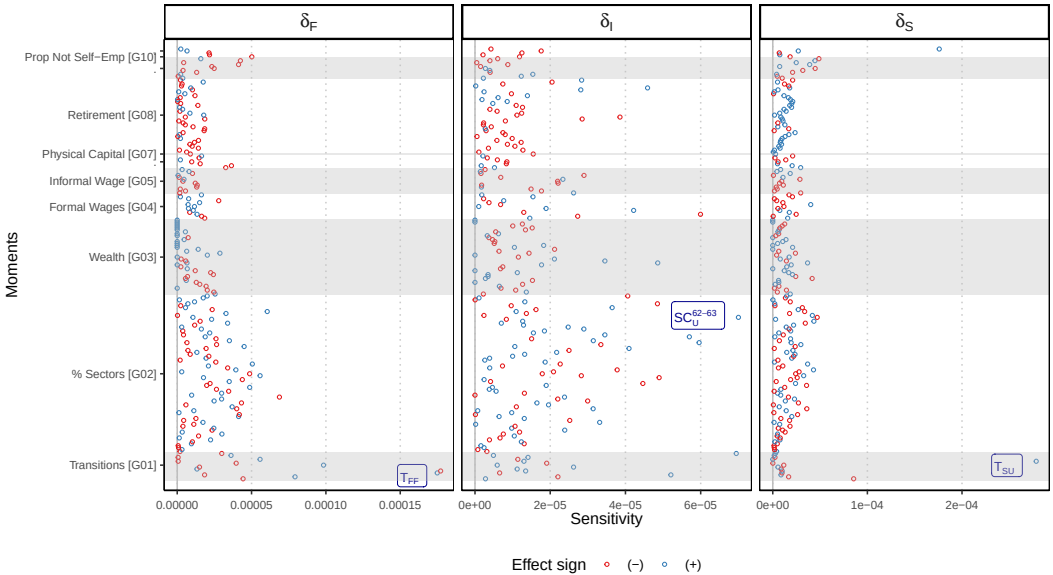
Sensitivity Matrix

Back



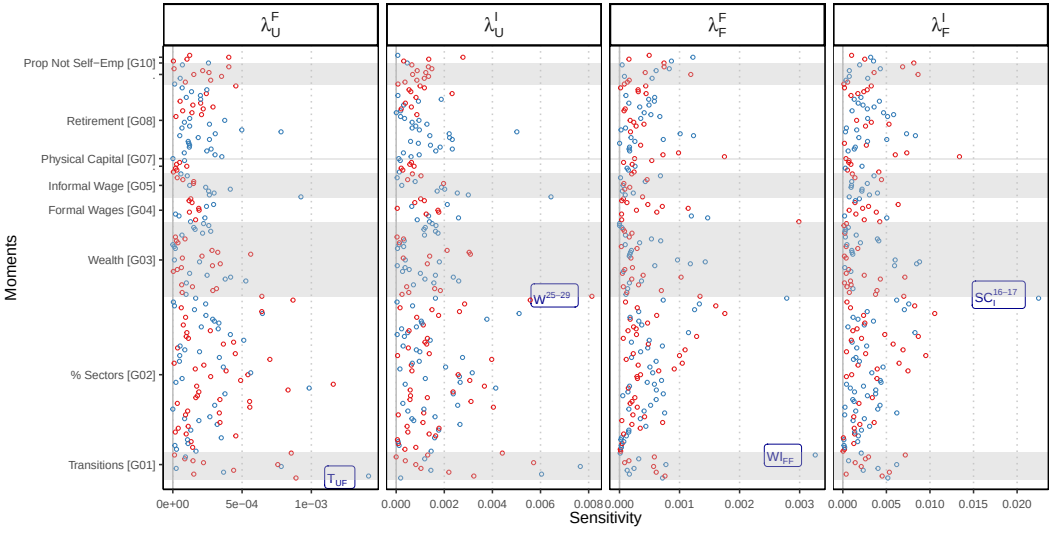
Sensitivity Matrix

Back



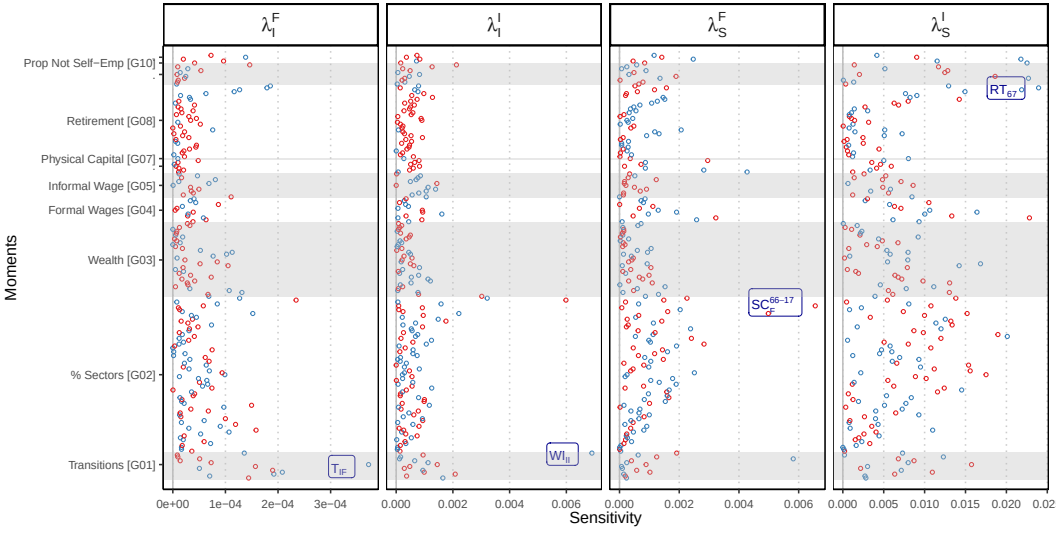
Sensitivity Matrix

Back



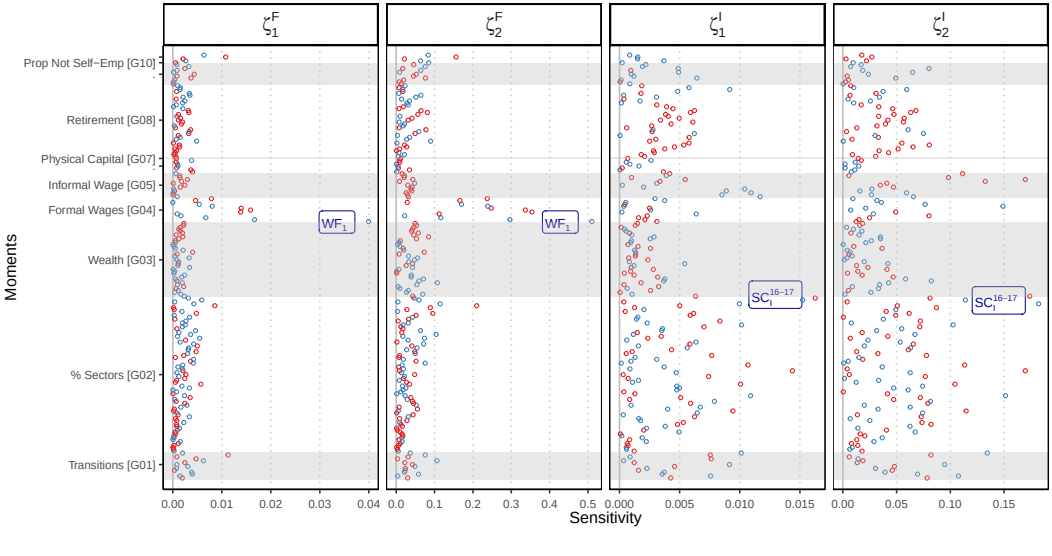
Sensitivity Matrix

Back



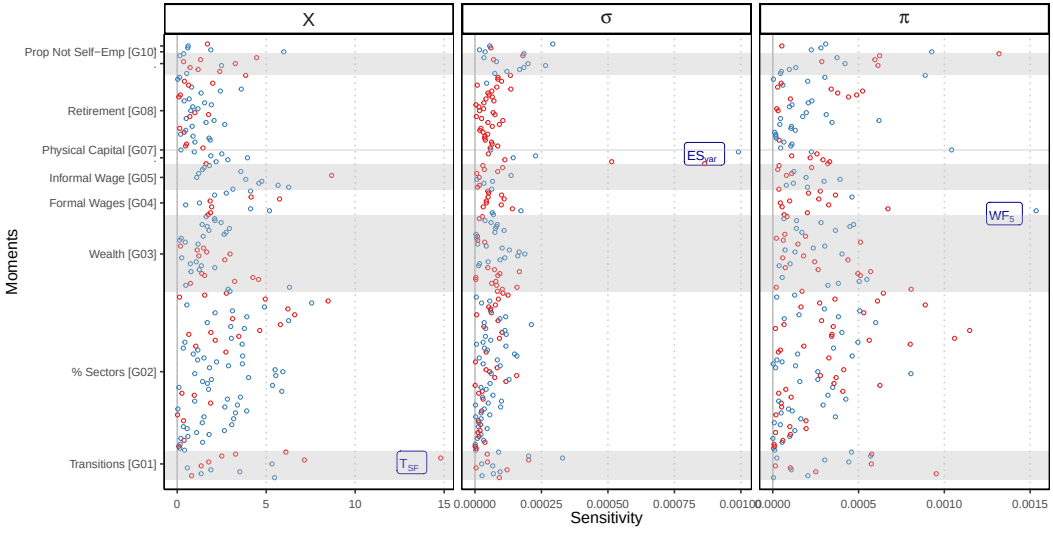
Sensitivity Matrix

Back

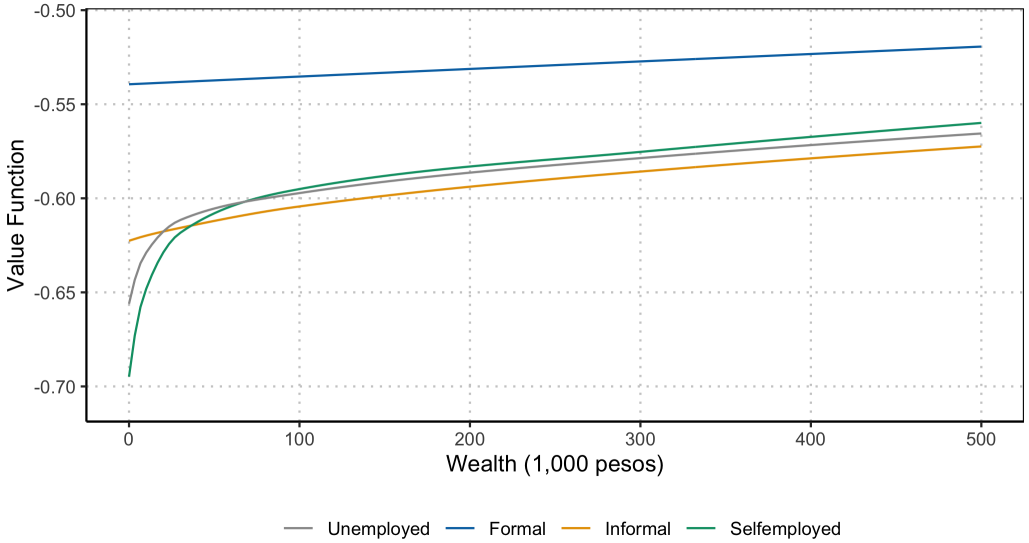


Sensitivity Matrix

Back



Value Function



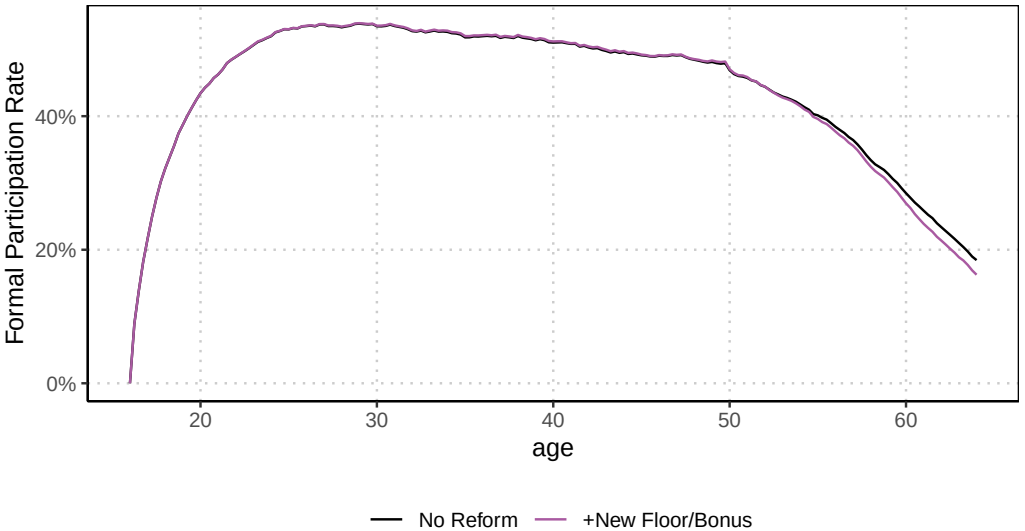
Counterfactuals I — 2008 Pension Reform

A. Increased the generosity of the system

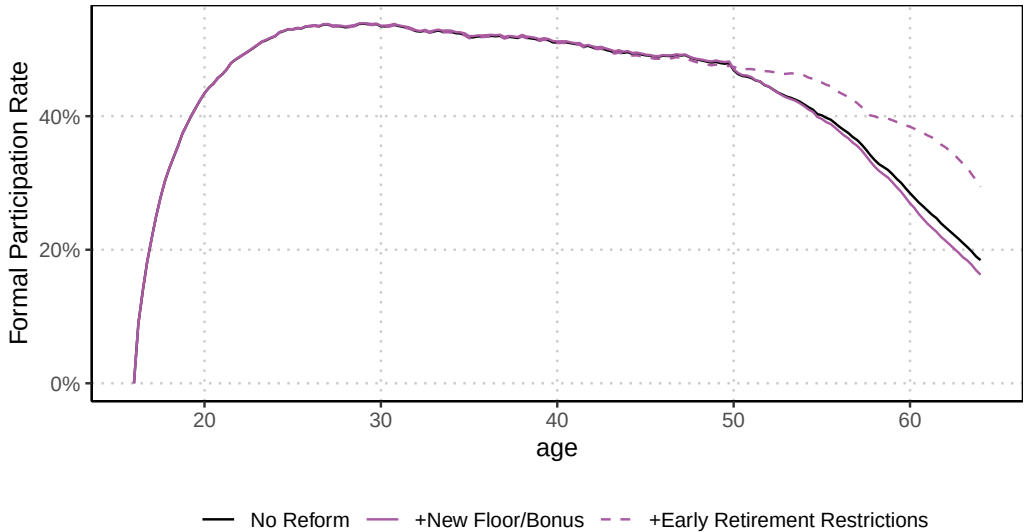
- New higher pension floor Budget Constraint
- Withdrawn with 30% implicit tax rate

B. Tightened the early retirement requirements

Counterfactuals I — 2008 Pension Reform: No disincentive effects

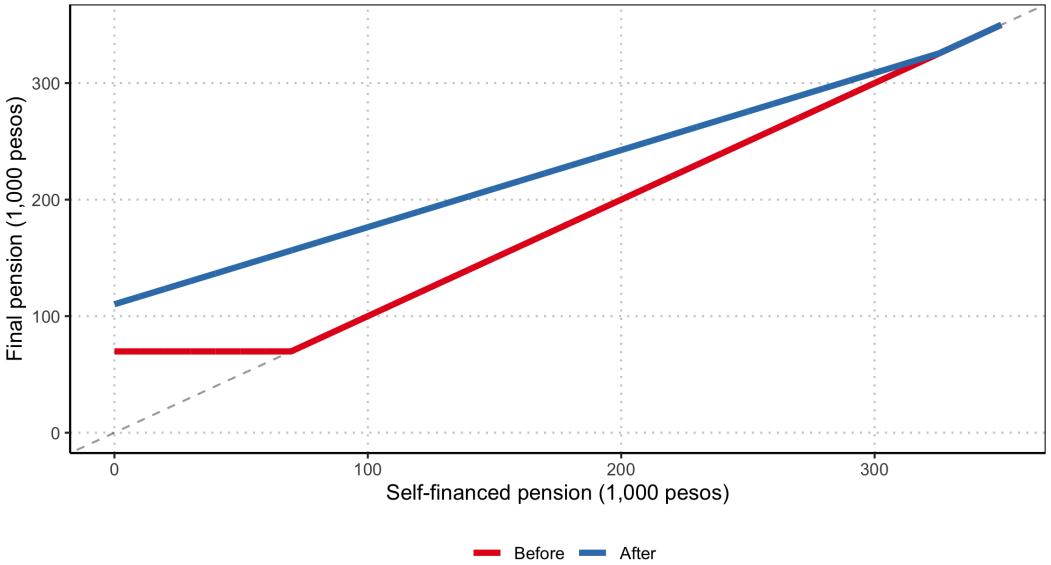


Counterfactuals I — 2008 Pension Reform: No disincentive effects



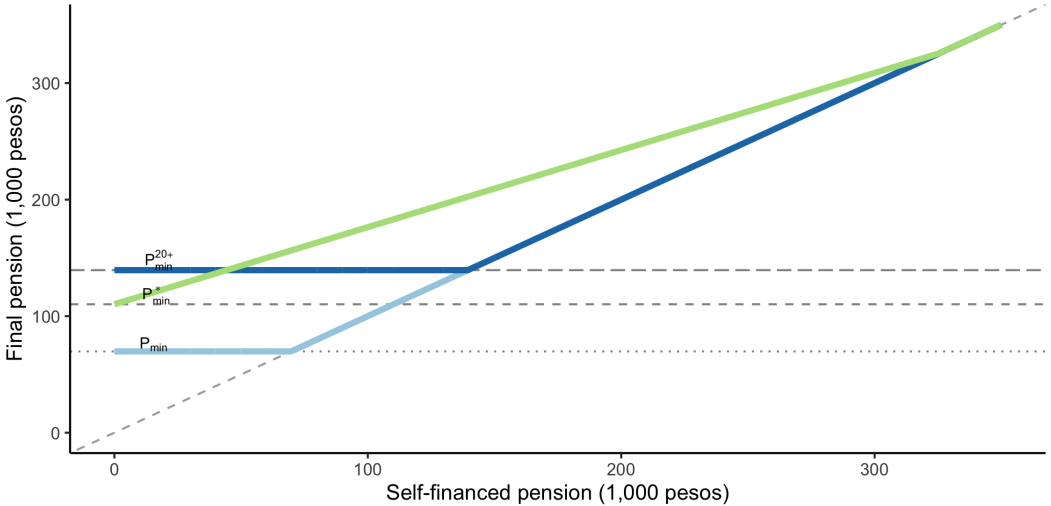
2008 Reform: New budget constraint

Full BC Back

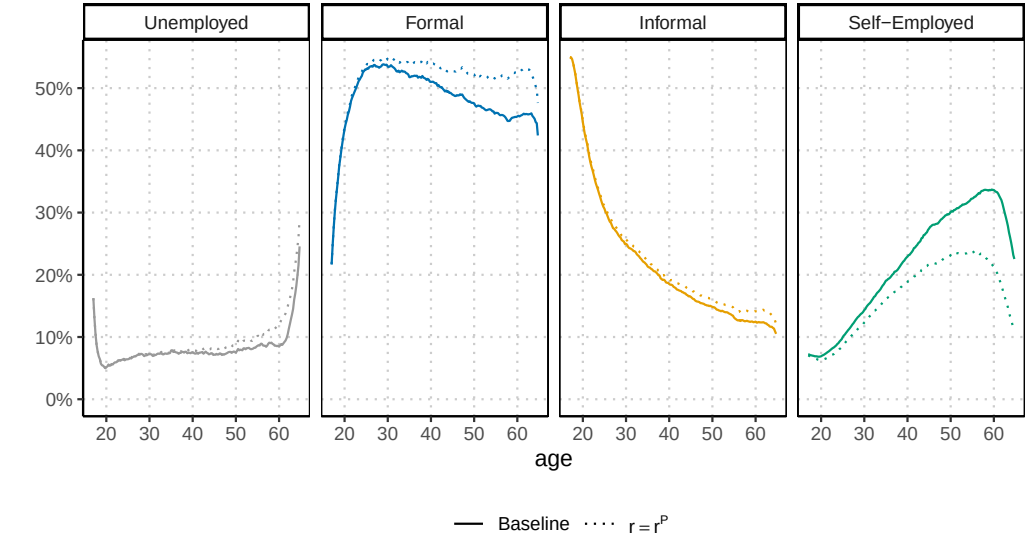


2008 Reform - New Budget Constraint

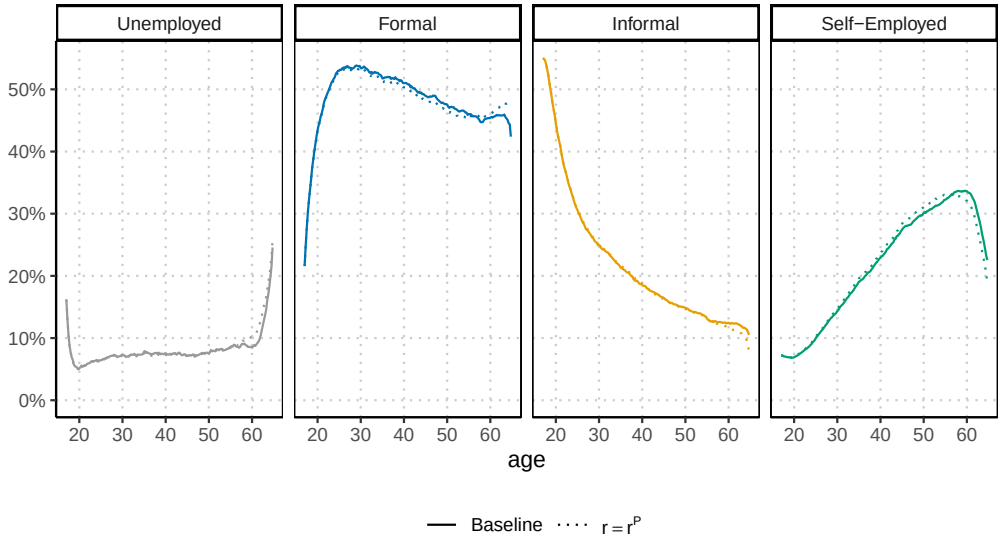
Back



No amenities

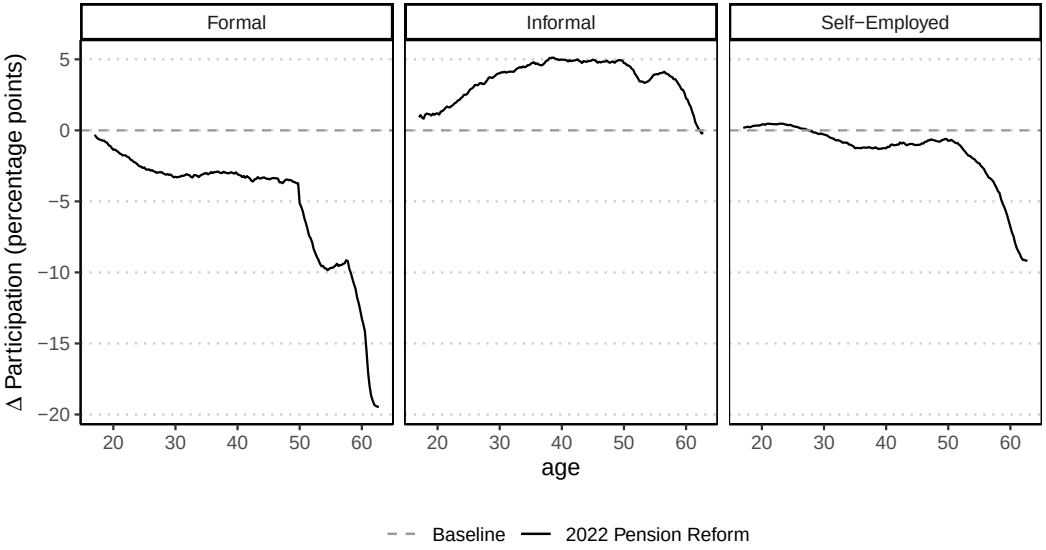


$r = r^P$


Unemployed
Formal
Informal
Self−Employed
50%
40%
30%
20%
10%
0%
20
30
40
50
60
age
Baseline
r = r^P

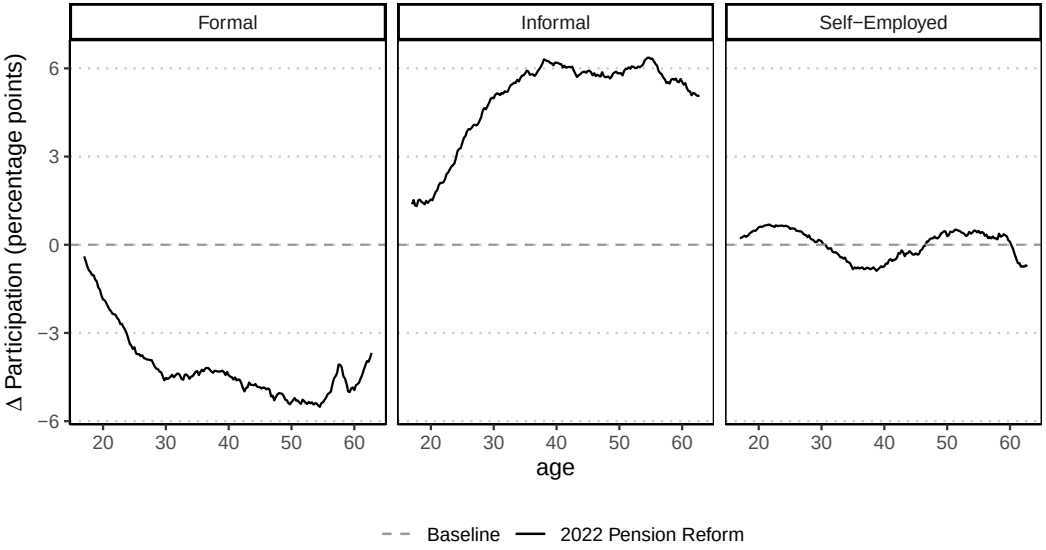
Counterfactuals II: 2022 Pension Reform

Back



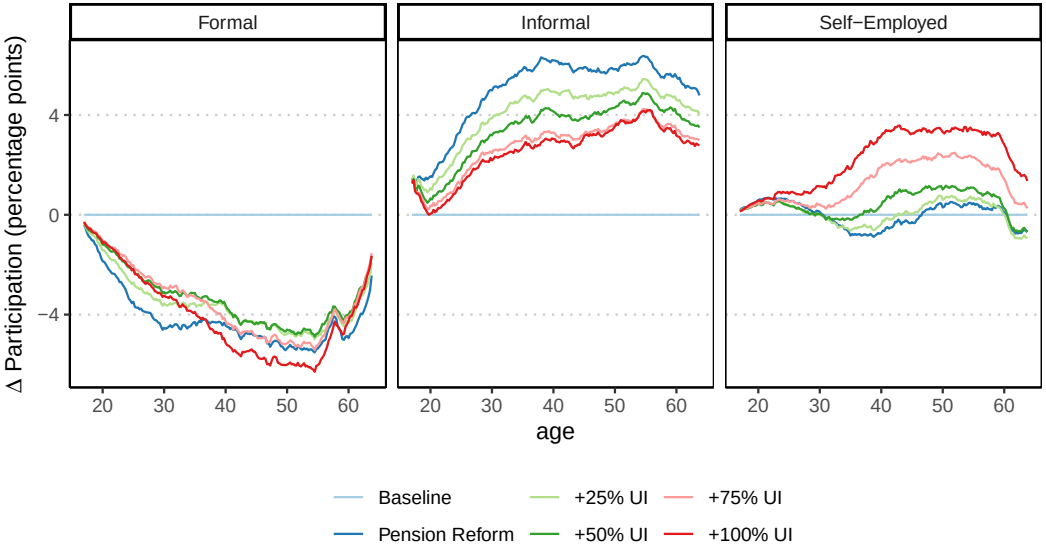
Counterfactuals II: 2022 Pension Reform

Back



Counterfactuals II: 2022 Pension Reform

Back



Counterfactuals — Welfare results

	Δ Cons Eqv	Consumption		
		Mean	90th/10th	Var-log
Baseline	-	171.0	2.295	0.102
2022 Pension Reform	-0.037	165.3	2.226	0.094
2022 Pension Reform (Individual)	-0.026	165.4	2.170	0.090
2022 Pension Reform + 100% UI	-0.010	167.9	2.149	0.085

Welfare measures

- Get the expected welfare according to the policy κ_1

$$V(\kappa_1) = \mathbb{E}_0 \left[\sum_{t=0}^{T} \beta^t V_t \left(c_t^*(\kappa_1), \ell_t^*(\kappa_1), a_t^*(\kappa_1) \right) \right]$$

- We can obtain the same welfare measure, depending on the parameter Δ for the baseline policy κ_0

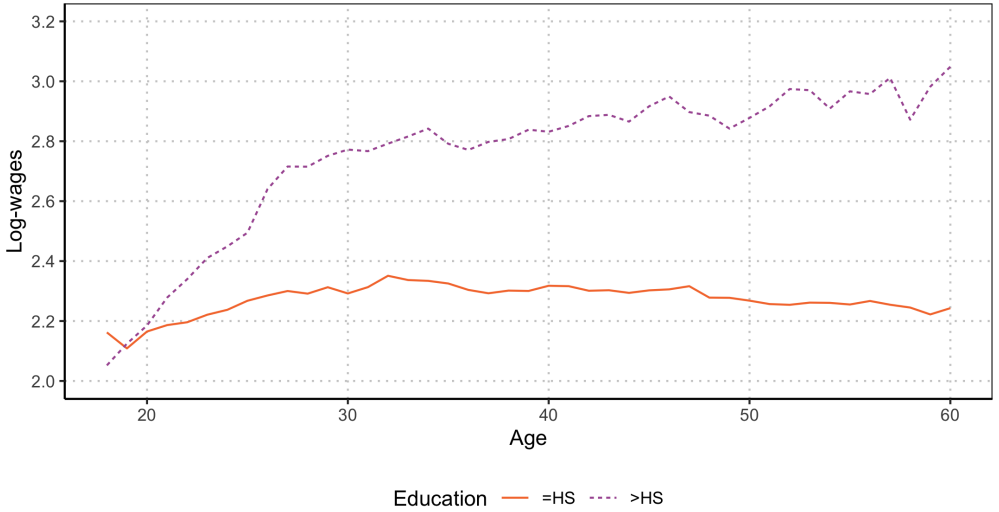
$$\tilde{V}(\kappa_0, \Delta) = \mathbb{E}_0 \left[\sum_{t=0}^{T} \beta^t V_t \left((1+\Delta) c_t^*(\kappa_0), \ell_t^*(\kappa_0), a_t^*(\kappa_0) \right) \right]$$

- I define Δ^* such as

$$\tilde{V}(\kappa_0, \Delta^*) = V(\kappa_1)$$

Additional

Modest wage growth for High School or less

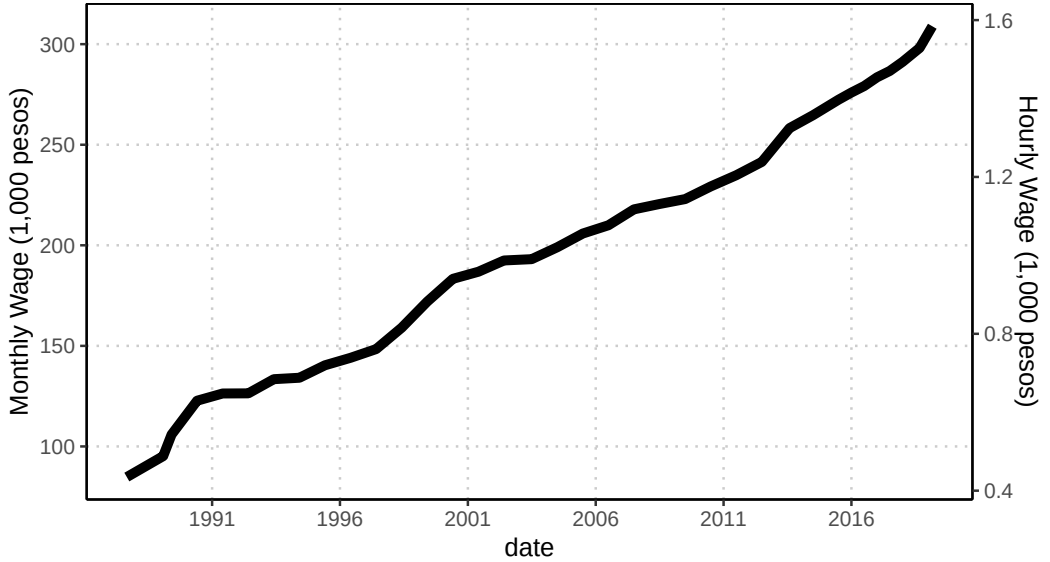


Log-Monthly Wages, for those working full time, de-trended using a linear trend.

Modest wage growth for High School or less

Log-Monthly Wages, for those working full time, de-trended using a linear trend.

Minimum Wage



Spouses' working sector

Own sector	Spouse's sector:				
↓	Out Labor Force	Unemployed	Formal	Informal	Self-Employed
Informal	-0.0026 (0.0227)	0.0419*** (0.0132)	-0.0429*** (0.0152)	0.0013 (0.0082)	0.0003 (0.0096)
Self-Employed	-0.0857*** (0.0218)	0.0114 (0.0095)	-0.0300** (0.0142)	-0.0051 (0.0071)	0.1068*** (0.0146)
Observations	2,771	2,771	2,771	2,771	2,771
Age FE	✓	✓	✓	✓	✓

Family composition

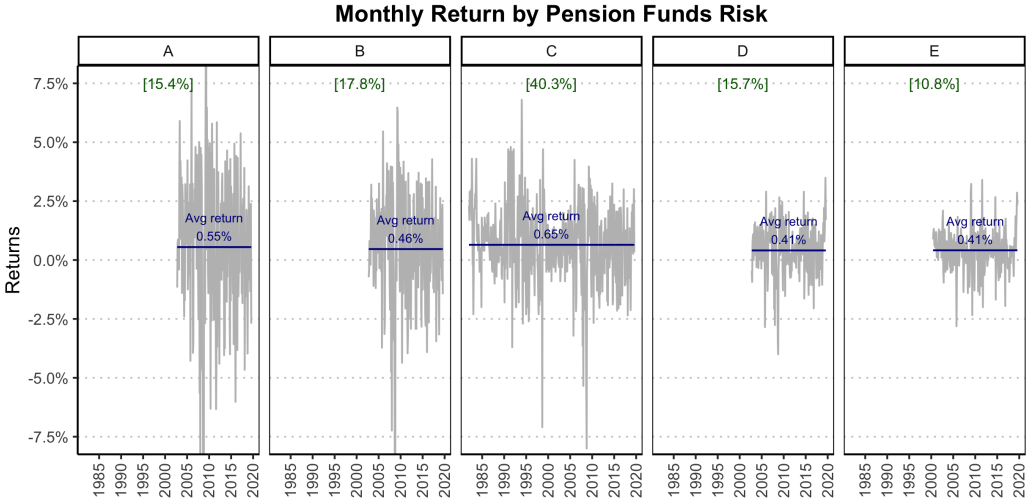
	Sector:					
	Out Labor Force	Unemployed	Formal	Informal	Self-Employed	Retired
Married	-0.0473***	-0.0289***	0.0973***	-0.0254***	-0.0101	0.0019
	(0.0060)	(0.0046)	(0.0092)	(0.0056)	(0.0080)	(0.0031)
Children 0–6	-0.0343***	-0.0146**	0.0382***	-0.0077	0.0172*	-0.0083***
	(0.0053)	(0.0063)	(0.0124)	(0.0072)	(0.0096)	(0.0025)
Children 7–18	-0.0287***	-0.0176***	0.0377***	-0.0025	0.0104	-0.0081***
	(0.0053)	(0.0051)	(0.0100)	(0.0058)	(0.0081)	(0.0026)
Observations	28,010	28,010	28,010	28,010	28,010	28,010
Age FE	✓	✓	✓	✓	✓	✓

Pension returns risk

- Pension returns' risk:
  - Estimate an AR(1) model with the monthly pension returns
  - Simulate accrued pension wealth for a fixed wage profile
  - Ratio of 10%-90% is 2.56

- Longevity risk:
  - Mortality tables imply that the 10%-90% survival gap for those alive at age 50 is 26 years

Pension returns risk

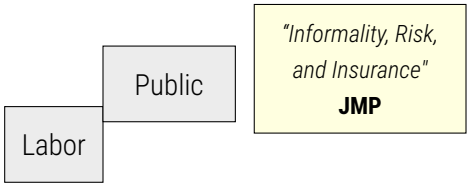


Note: HPA. A is the riskiest fund and E the safest one. The blue lines and blue numbers represent the average monthly return for each fund. The greeen numbers in brackets are the proportion of pension wealth allocated in each fund.

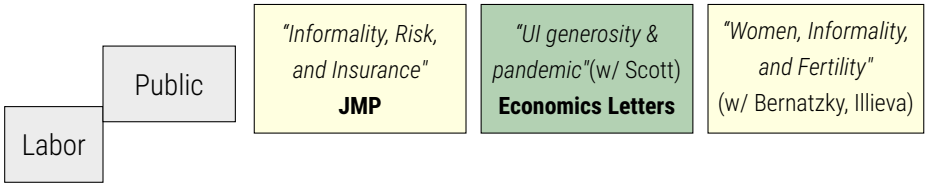
Risk aversion and sector of employment

	Formal	Informal	Self-employed
(Intercept)	0.417	0.123	0.189
	(0.006)	(0.004)	(0.005)
Risk 1	0.035	0.013	0.013
	(0.017)	(0.012)	(0.014)
Risk 2	0.0007	-0.005	0.010
	(0.015)	(0.010)	(0.012)
Risk 3	-0.041	0.008	0.054
	(0.010)	(0.007)	(0.009)
Observations	15,885	15,885	15,885

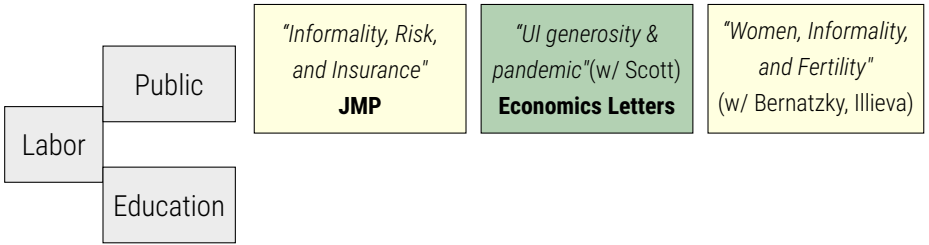
Agenda



Agenda


Public
Labor
"Informality, Risk, and Insurance"
JMP
"UI generosity & pandemic"(w/ Scott)
Economics Letters
"Women, Informality, and Fertility"
(w/ Bernatzky, Illieva)

Agenda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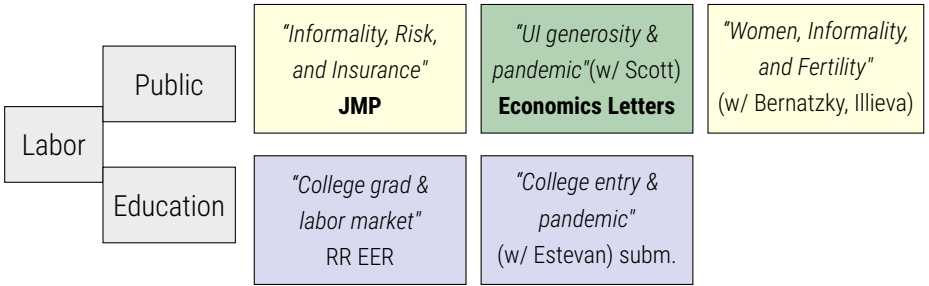
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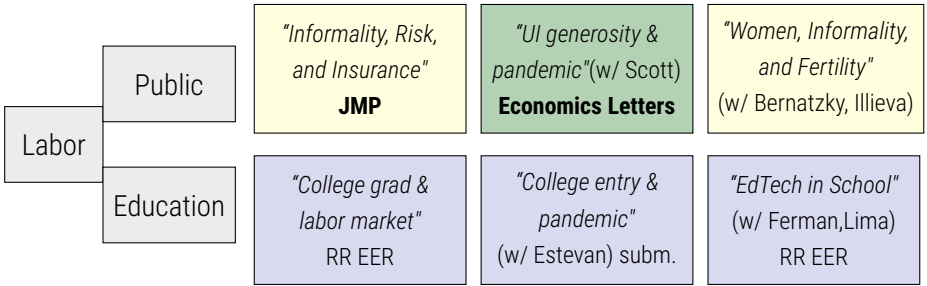
Economics Letters
"Women, Informality, and Fertility"
(w/ Bernatzky, Illieva)
"College grad & labor market"
RR EER
"College entry & pandemic"
(w/ Estevan) subm.

Agenda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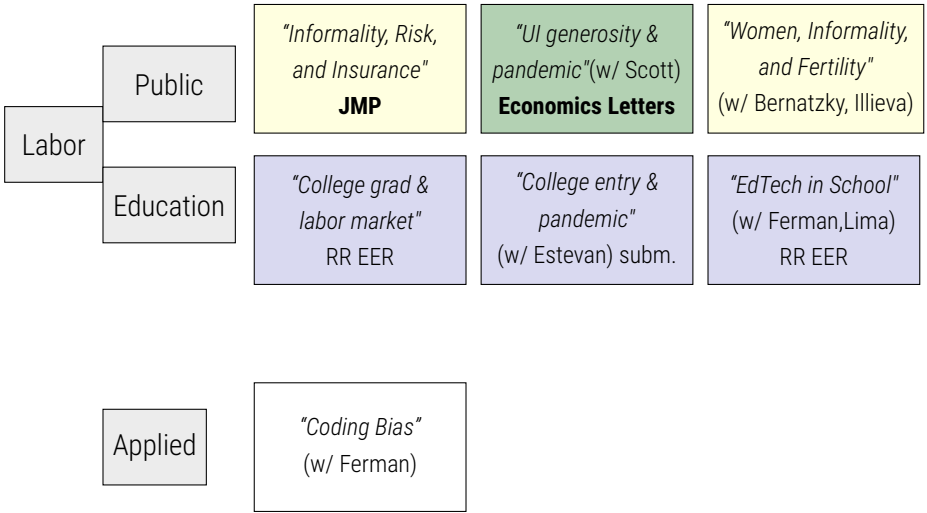
"College grad & labor market"
RR EER
"College entry & pandemic"
(w/ Estevan) subm.
"EdTech in School"
(w/ Ferman,Lima)
RR EER

Agenda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Applied
"Informality, Risk, and Insurance"
JMP
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RR EER
"College entry & pandemic"
(w/ Estevan) subm.
"EdTech in School"
(w/ Ferman,Lima)
RR EER
"Coding Bias"
(w/ Ferman)