

Effects of pension benefits on pre-retirement labor supply: Evidence from Chile

Oscar Becerra

Universidad de los Andes

May 28, 2018

Question

- Do **future** pension benefits affect workers **current** labor supply decisions?
- Pension contributions are a special kind of mandated benefit. Workers contribute today to receive a benefit in the future
- Pension contributions are an implicit tax on labor. Net tax rate depends on the strength of the link between current pension contributions (tax) and future pension benefits
- Overall effects of pension reforms should account for labor supply responses

In this paper

- I estimate the causal link between future pension benefits and labor supply in Chile by exploiting an unanticipated permanent change of the distributive component of the system (2008)
- Effects of future pension benefits on
 - ▶ Labor force participation
 - ▶ Contributory-sector participation
 - ▶ Monthly earnings
 - ▶ Hours worked
- Unique source of data (LSPS, 2004-15)
 - ▶ Analyze responses of younger workers (30 to 64)
 - ▶ Responses along contributory-sector participation
 - ▶ Comprehensive analysis of heterogeneous responses across groups
 - ▶ I can control for individual heterogeneity and current pension savings

Preview of the results

- Future pension benefits affect pre-retirement labor supply. Effect is concentrated on the probability that a worker contributes to the pension system
- Change in contributory sector participation is related to an allocation of labor supply between salaried (contributory) and self-employed jobs (non contributory)
- Partial evidence that effect is heterogeneous across workers. Effects are concentrated on
 - ▶ Men, workers between 40 and 59 years, and less-educated workers
 - ▶ Population with no savings
 - ▶ Population with higher financial literacy

Agenda

- 1 The idea
- 2 Institutional background
- 3 Empirical approach
- 4 Estimation results
 - Baseline
 - Regressions by labor force status
 - Heterogeneity analysis
- 5 Final remarks

The idea

- Standard life-cycle model setting (Fieldstein and Liebman, 2002). Pension system affects labor supply through two mechanisms
 - ▶ Pension wealth. Negative income effect on labor supply
 - ▶ Pension accrual. Positive effect on labor supply
- Critique to life-cycle approach: workers may not have the knowledge and capability to make such a complex trade-off (Lusardi and Mitchell, 2009)
- Empirical literature has found that pension accrual has a positive effect on labor supply. Effect of pension wealth on labor supply is not conclusive (Gruber and Wise, 1998)

Chilean pension system

Sources of variation

- Three pillars:
 - ▶ Distributive (solidarity)
 - ▶ Contributory (Defined contribution system with individual accounts)
 - ▶ Voluntary
- Contributory pillar is mandatory for salaried workers. For self-employed workers is on a voluntary basis
- Pension contribution rate 10 percent of taxable income
- Minimum retirement age: 65 men, 60 women

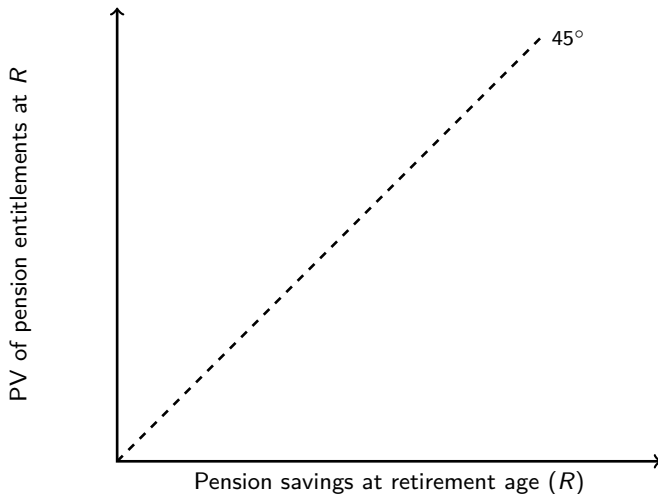
Chilean pension reform of 2008

Sources of variation

- Change of distributive pillar. Changed pension wealth and accrual
- Before 2008
 - ▶ Minimum pension (PMG) for workers with at least 20 years of contributions
 - ▶ Assistance pension (PASIS), targeted to low income population not eligible for other type of pension
- After 2008
 - ▶ Pension becomes the sum of a non-contributory pension (PBS) plus additional benefits depending on pension savings (APS)
- Workers older than 50 in 2008 get the maximum between the pre-reform and post-reform pension benefits

Chilean pension reform of 2008

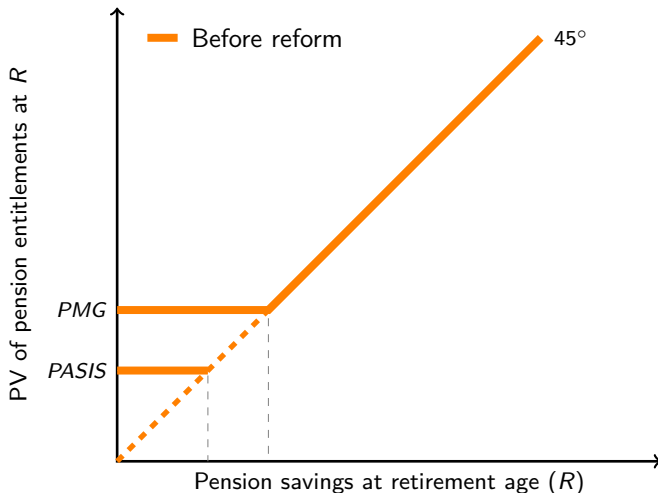
Effects of the reform on expected pension wealth and pension accrual



Note: Figure adapted from Attanasio et. al. (2011,2014)

Chilean pension reform of 2008

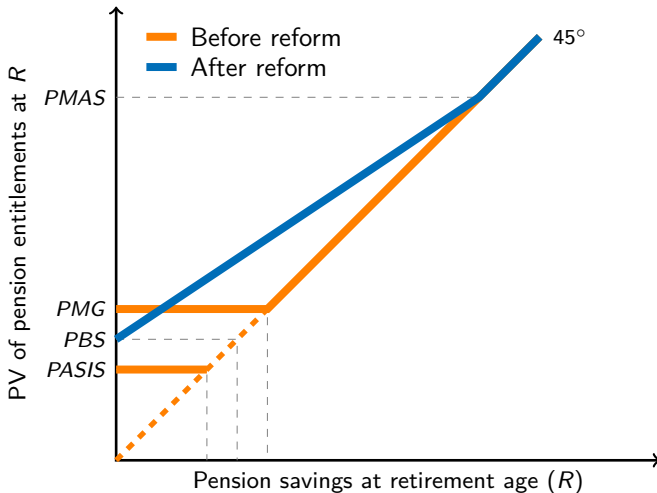
Effects of the reform on expected pension wealth and pension accrual



Note: Figure adapted from Attanasio et. al. (2011,2014)

Chilean pension reform of 2008

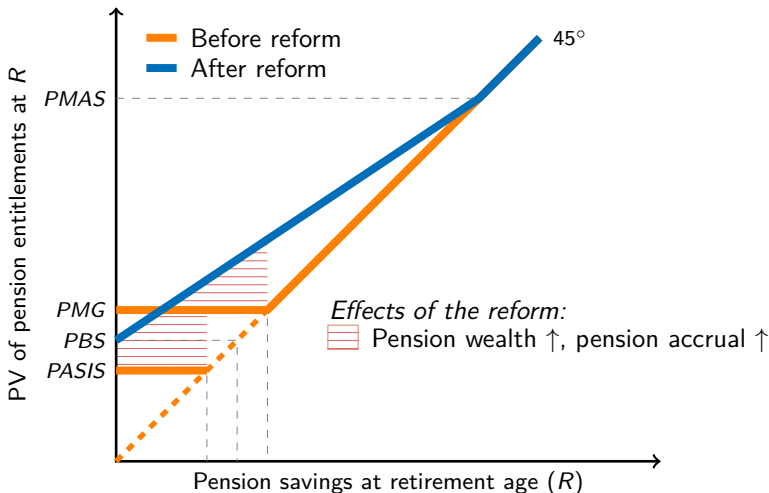
Effects of the reform on expected pension wealth and pension accrual



Note: Figure adapted from Attanasio et. al. (2011,2014)

Chilean pension reform of 2008

Effects of the reform on expected pension wealth and pension accrual



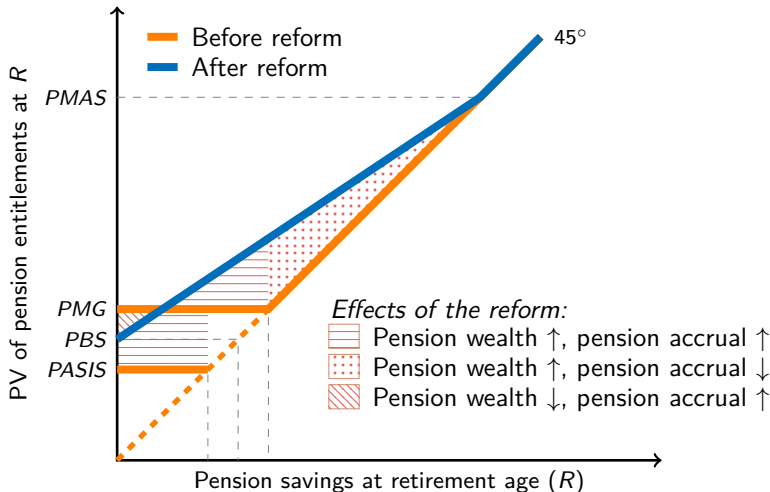
Note: Figure adapted from Attanasio et. al. (2011,2014)

Effects of the reform on expected pension wealth and pension accrual



Chilean pension reform of 2008

Effects of the reform on expected pension wealth and pension accrual



Note: Figure adapted from Attanasio et. al. (2011,2014)

The data

- Longitudinal Social Protection Survey - LSPS
- Representative sample of Chilean population
 - ▶ About 16,000 individuals
 - ▶ 2002, **2004**, **2006**, **2009**, 2012, **2015**
 - ▶ Information of employment history, earnings, pension contributions, demographic characteristics, savings and financial literacy
- Linked with administrative data from pension system (contribution history and accumulated savings by December 2016). About 70 percent of individuals are in admin data
- Sample: Population aged 30 to 64 (men) and 30 to 59 (women) in 2004, 2006, 2009, 2015

Expected pension wealth algorithm

- Expected pension wealth: present value of pension entitlements minus pension contributions

$$\mathbb{E}_a PW_R = \left(\frac{1}{1+r} \right)^{R-a} \left(\widehat{PE}_R - \widehat{PS}_R \right)$$

- Pension accrual: Change in pension entitlements for contributing one more month to pension system

$$AR = \frac{\mathbb{E}_a (PE_R | \text{contribution}) - \mathbb{E}_a (PE_R | \text{no contribution})}{w_a^f}$$

Typically, AR takes three values: 0, 0.069, 0.1

► Details

Identification strategy

- I estimate the relationship between pre-retirement labor supply and pension variables by running the regression

$$Y_{it} = \alpha_1 AR_{it} + \alpha_2 \log(\mathbb{E}_a PW_R)_{it} 1_{\{\mathbb{E}_a PW_R > 0\}} + \alpha_3 1_{\{\mathbb{E}_a PW_R = 0\}} \\ + X'_{it}\delta + \theta_i + \theta_t + u_{it}.$$

- Y_{it} : labor force participation indicator; contributory-sector job indicator; log monthly earnings; log hours worked per week
- X_{it} : Control variables. Cubic polynomial on age by gender, educational attainment and marital status; current pension savings and current time of contribution; time and individual fixed effects

Estimation results

Full sample

	Labor force participation indicator	Contributory sector job indicator	Monthly earnings (logs)	Hours worked (logs)
Pension accrual	0.167 [0.146]	0.630 [0.205]***	0.424 [0.309]	-0.176 [0.218]
Expected pension wealth (logs)	0.00302 [0.00405]	0.0107 [0.00571]*	-0.00388 [0.00671]	-0.00195 [0.00495]
Individuals	14,353	11,705	11,278	11,549
Observations	38,817	26,916	24,929	25,860
Mean dependent variable	0.7849	0.7089	12.5711	3.7576

Notes: Standard errors clustered by person in brackets. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Results by labor force status

	Salaried job indicator	Self-employed job indicator	Unemployed indicator
Pension accrual	0.688 [0.232]***	-0.570 [0.201]***	-0.0773 [0.172]
Expected pension wealth (logs)	0.00478 [0.00615]	0.000870 [0.00502]	-0.00686 [0.00454]
Individuals	12,754	12,754	12,754
Observations	30,864	30,864	30,864
Mean dependent variable	0.5863	0.2403	0.1248

Notes: Standard errors clustered by person in brackets. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Results by gender

	Labor force participation indicator	Contributory sector job indicator	Monthly earnings (logs)	Hours worked (logs)
<i>Effect of pension accrual</i>				
Men	-0.121 [0.159]	0.687 [0.244]***	0.553 [0.374]	-0.140 [0.256]
Women	0.390 [0.209]*	0.563 [0.300]*	0.0498 [0.409]	-0.162 [0.354]
<i>Effect of expected pension wealth (logs)</i>				
Men	0.00315 [0.00368]	0.0143 [0.00669]**	-0.0121 [0.00789]	0.00107 [0.00557]
Women	0.00533 [0.00874]	0.00439 [0.0106]	0.0151 [0.0127]	-0.00780 [0.00990]
Individuals	14,353	11,705	11,278	11,549
Observations	38,817	26,916	24,929	25,860
<i>Mean dependent variable</i>				
Men	0.9255	0.7134	12.6760	3.8170
Women	0.6454	0.7019	12.4074	3.6656

Notes: Standard errors clustered by person in brackets. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Results by age groups

	Labor force participation	Contributory sector job	Monthly earnings	Hours worked
<i>Effect of pension accrual</i>				
Age 30-39	0.225 [0.291]	-0.162 [0.430]	0.0695 [0.662]	-0.477 [0.481]
Age 40-49	0.150 [0.202]	0.568 [0.271]**	0.488 [0.361]	-0.00827 [0.304]
Age 50-59	0.0683 [0.202]	0.979 [0.271]***	0.485 [0.389]	-0.117 [0.313]
Age 60-64	0.00916 [0.377]	0.752 [0.549]	-0.312 [0.680]	0.519 [0.566]
<i>Effect of expected pension wealth (logs)</i>				
Age 30-39	0.00325 [0.00601]	0.0182 [0.00866]**	-0.00494 [0.00979]	-0.00247 [0.00893]
Age 40-49	0.00233 [0.00467]	0.0107 [0.00631]*	-0.00661 [0.00739]	-0.00155 [0.00561]
Age 50-59	-0.0166 [0.00530]***	-0.00611 [0.00759]	-0.00429 [0.00956]	-0.0105 [0.00680]
Age 60-64	-0.0331 [0.00867]***	-0.0161 [0.0115]	-0.00220 [0.0128]	0.00340 [0.00944]

Notes: Standard errors clustered by person in brackets. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Results by educational attainment

	Labor force participation	Contributory sector job	Monthly earnings	Hours worked
<i>Effect of pension accrual</i>				
Primary	-0.0752 [0.210]	0.715 [0.289]**	0.983 [0.383]**	-0.0684 [0.348]
High School	0.272 [0.189]	0.590 [0.265]**	0.465 [0.409]	-0.183 [0.283]
More than HS	0.0963 [0.311]	0.374 [0.402]	-0.950 [0.648]	-0.0921 [0.438]
<i>Effect of expected pension wealth (logs)</i>				
Primary	0.0119 [0.00825]	0.0138 [0.0101]	-0.0125 [0.0105]	-0.00201 [0.00834]
High School	-0.00408 [0.00571]	0.0148 [0.00818]*	-0.000123 [0.00988]	-0.00316 [0.00764]
More than HS	0.0107 [0.00719]	-0.00257 [0.0121]	-0.00485 [0.0142]	-0.00434 [0.00885]
Individuals	14,353	11,705	11,278	11,549
Observations	38,817	26,916	24,929	25,860
<i>Mean dependent variable</i>				
Primary	0.7026	0.5632	12.1570	3.7310
High School	0.7933	0.7164	12.5229	3.7731
More than HS	0.9019	0.8599	13.1808	3.7552

Notes: Standard errors clustered by person in brackets. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Results by saving behavior

	Labor force participation indicator	Contributory sector job indicator	Monthly earnings (logs)	Hours worked (logs)
<i>Effect of pension accrual</i>				
No savings	0.243 [0.154]	0.682 [0.218]***	0.422 [0.316]	-0.138 [0.234]
Savings	-0.161 [0.225]	0.439 [0.302]	0.395 [0.473]	-0.326 [0.370]
<i>Effect of expected pension wealth (logs)</i>				
No savings	0.00208 [0.00407]	0.0113 [0.00584]*	-0.00361 [0.00710]	-0.00298 [0.00504]
Savings	0.00682 [0.00492]	0.00870 [0.00684]	-0.00600 [0.00773]	0.00123 [0.00639]
Individuals	14,353	11,705	11,278	11,549
Observations	38,817	26,916	24,929	25,860
<i>Mean dependent variable</i>				
No assets	0.7624	0.6791	12.5100	3.7555
Assets	0.8560	0.7893	12.7354	3.7630

Notes: Standard errors clustered by person in brackets. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Results by financial literacy

	Labor force participation	Contributory sector job	Monthly earnings	Hours worked
<i>Effect of pension accrual</i>				
Low	0.242 [0.271]	0.540 [0.385]	0.686 [0.543]	-0.429 [0.532]
Medium	0.0492 [0.187]	0.471 [0.262]*	-0.0210 [0.357]	-0.0785 [0.281]
High	0.356 [0.255]	0.756 [0.312]**	0.776 [0.509]	-0.345 [0.376]
<i>Effect of expected pension wealth (logs)</i>				
Low	0.00353 [0.0142]	0.00489 [0.0147]	0.00621 [0.0177]	0.00174 [0.0139]
Medium	0.00194 [0.00518]	0.00880 [0.00833]	0.00527 [0.00882]	-0.00179 [0.00746]
High	0.00348 [0.00647]	0.0187 [0.00859]**	-0.0188 [0.0117]	-0.000476 [0.00711]
Individuals	12,749	10,450	10,120	10,325
Observations	36,384	25,162	23,353	24,176
<i>Mean dependent variable</i>				
Low	0.6874	0.6399	12.2368	3.7266
Medium	0.7744	0.6899	12.4900	3.7498
High	0.8598	0.7640	12.8328	3.7756

Notes: Standard errors clustered by person in brackets. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Final remarks

- I find evidence supporting the existence of a link between future pension benefits and labor supply before retirement
- Consistent with forward-looking behavior, future pension benefits do affect pre-retirement labor supply and this effect is concentrated along the contributory-sector participation margin
- Results indicate that pension taxes causes labor supply reallocation between salaried and self-employed jobs
- Results highlight importance of working in the contributory sector as a way of saving, and the role of financial literacy as a determinant of labor supply responses to future pension benefits

Thanks!

The mechanism

Life-cycle model with non-contributory job opportunities

- Representative agent lives for two periods 1 (worker) and 2 (retiree)
- Agent chooses consumption plan (C_1, C_2) , and the fraction of time he works in the contributory sector $(H \in (0, 1))$ to maximize

$$\begin{aligned} \max_{C_1, C_2, H} \quad & u(C_1) + v(C_2) + \theta\psi(1 - H) \\ \text{s.t.} \quad & C_1 + \frac{C_2}{1+r} = \frac{B_0}{1+r} + w^i + \left(\left(1 - t + \frac{1+\gamma}{1+r} t \right) w^f - w^i \right) H \end{aligned}$$

- t : contribution rate; θ : contributory-sector participation shock; w^i and w^f wage rate by sector; B_0 : **Non-contributory pension**; $1 + \gamma$: **accrual rate**

The mechanism

Life-cycle model with non-contributory job opportunities

- Define \tilde{w} as $\tilde{w} = \left(1 - t + \frac{1+\gamma}{1+r}t\right) w^f - w^i$. Then,

Optimal contributory-sector labor supply allocation

$$\tilde{w} u'(C_1) = \theta \psi'(1 - H)$$

- Comparative statics
 - ▶ Contributory-sector participation is an increasing function of the accrual rate $1 + \gamma$
 - ▶ Contributory-sector participation is a decreasing function of non-contributory pension B_0

Expected pension wealth algorithm

36 37 38 39 ... 62 63 64 65



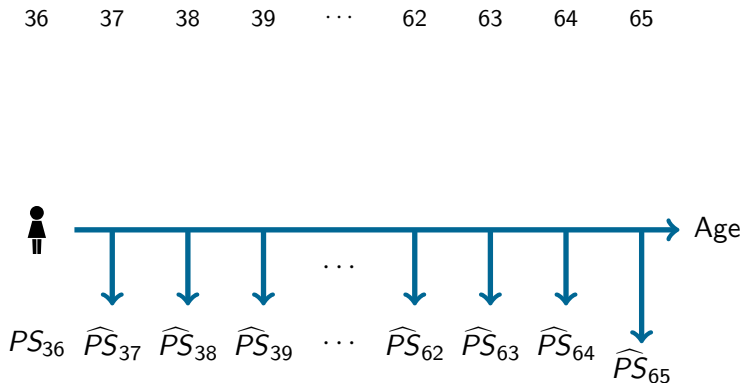
Expected pension wealth algorithm

36 37 38 39 ... 62 63 64 65



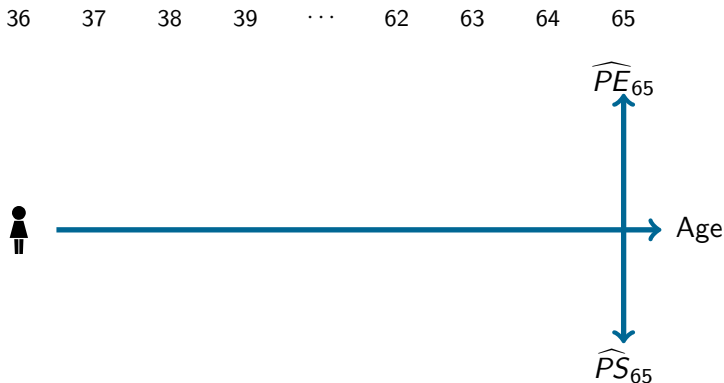
- 1 Given a person's age a , predict contributions for $a + 1, \dots, R - 1$. To account for differences in propensity to contribute, I use contribution patterns by education and gender in 2006

Expected pension wealth algorithm



- 2 Based on the expected contributions profile, use observed pension savings to compute expected pension savings at retirement age

Expected pension wealth algorithm



- Based on expected pension savings, compute the present value of pension entitlements at retirement age. Pension wealth is the present value of pension entitlements minus pension contributions (savings)

Expected pension wealth

Assumptions

- Assumptions

- ▶ Age profiles of contribution density and of wages in the contributory sector are stable over time
- ▶ Retirement age (all workers): 65 years
- ▶ Real interest rate: 4%
- ▶ Workers retire using life annuity (renta vitalicia)
- ▶ Values of *PASIS*, *PMG*, *PBS*, and *PMAS* constant in 2015 CLP

◀ back

Expected pension wealth

Algorithm

- 1 Expected pension savings and time of contribution at retirement age

$$\mathbb{E}_a PSav_{a'+1} = (1 + r) \mathbb{E}_a PSav_{a'} + d_{a'} \times 0.1 w_{a'}^f$$

$$\mathbb{E}_a H_{a'+1} = (1 + r) \mathbb{E}_a H_{a'} + d_{a'}$$

- 2 Expected self-financed pension benefits

$$\mathbb{E}_a P_R^{sf} = \frac{\mathbb{E}_a PSav_R}{12 \cdot CNU_R}$$

◀ back

Expected pension wealth

Algorithm

3 Expected final pension benefits

► Before reform

$$\mathbb{E}_a P_R = \begin{cases} PASIS & \text{if } \mathbb{E}_a P_R^{sf} \leq PASIS \wedge \mathbb{E}_a H_R < 240 \wedge p = 1 \\ PMG & \text{if } \mathbb{E}_a P_R^{sf} \leq PMG \wedge \mathbb{E}_a H_R \geq 240 \\ \mathbb{E}_a P_R^{sf} & \text{otherwise,} \end{cases}$$

► After reform

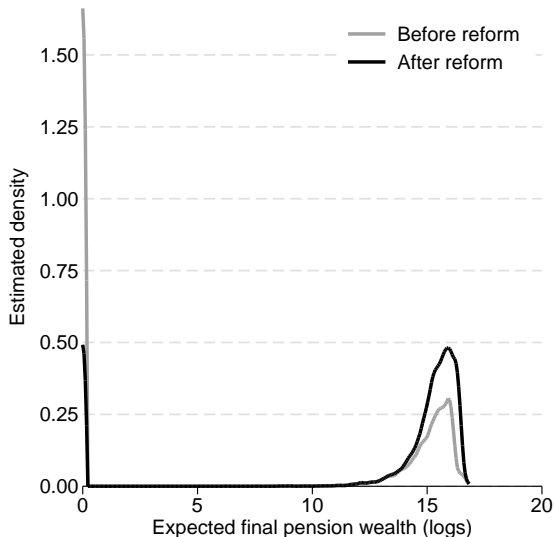
$$\mathbb{E}_a P_R = \begin{cases} PBS + (1 - \frac{PBS}{PMaS}) \mathbb{E}_a P_R^{sf} & \text{if } \mathbb{E}_a P_R^{sf} \leq PMAS \wedge p = 1 \\ \mathbb{E}_a P_R^{sf} & \text{otherwise,} \end{cases}$$

4 Expected pension wealth

$$\mathbb{E}_a PW_R = \left(\frac{1}{1+r} \right)^{R-a} (12 \times CNU_R \times \mathbb{E}_a P_R - \mathbb{E}_a PSav_R)$$

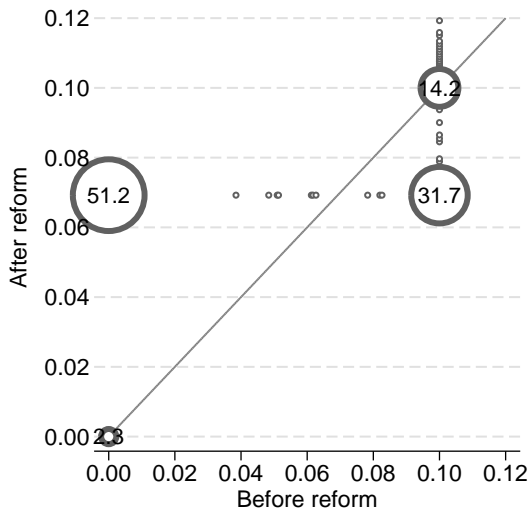
Simulated expected pension wealth

Distribution of expected pension wealth before and after the reform, 2009



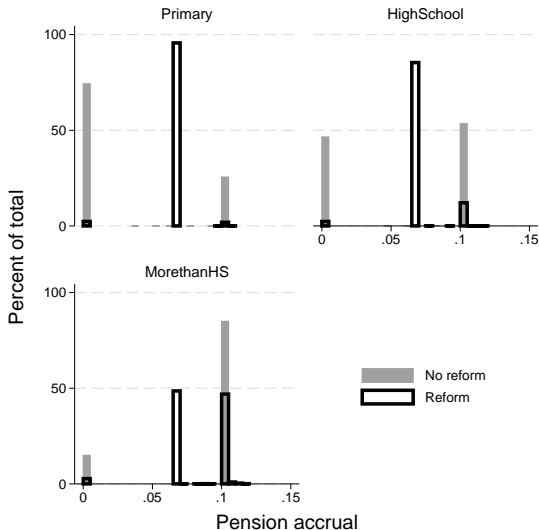
Simulated expected pension wealth

Pension accrual before and after pension reform, 2009



Simulated expected pension wealth

Distribution of pension accrual rate with and without pension reform, 2009



Summary statistics

Variable	N	Mean	Std. Dev.	Min	Max
<i>Dependent variables</i>					
Labor force participation	38,817	0.7849	0.4109	0	1
Cont-sector participation	26,916	0.7089	0.4543	0	1
Monthly earnings (logs)	24,929	12.5711	0.7199	10.2229	14.8451
Hours worked per week (logs)	25,860	3.7576	0.3848	0	4.5643
<i>Pension system variables</i>					
Pension accrual	26,916	0.0637	0.0397	0	0.1193
EPW (logs), only positive	16,158	15.1470	1.0148	5.2767	16.8564
EPW equals zero	26,916	0.3936	0.4886	0	1
Current pension savings (log)	26,916	12.6640	6.2614	0	19.2539
Pension savings equal zero	26,916	0.1885	0.3911	0	1
Current years of contribution	26,916	9.5600	8.2595	0	34.1667
<i>Demographic characteristics</i>					
Age	26,916	44.9784	8.8320	30	64
Married	26,916	0.6557	0.4751	0	1
Female	26,916	0.3876	0.4872	0	1
Primary	26,916	0.2695	0.4437	0	1
High School	26,916	0.4947	0.5000	0	1
More than HS	26,916	0.2358	0.4245	0	1

Summary statistics, 2009

<i>N</i> = 10,043	Share of total	Labor market outcomes			
		Labor force participation	Contributory sector workers	Monthly earnings (log)	Hours worked per week
Total	–	0.76	0.68	12.51	44.63
<i>Gender</i>					
Men	0.51	0.91	0.68	12.63	46.48
Women	0.49	0.61	0.67	12.30	41.48
<i>Age group</i>					
30-39	0.32	0.84	0.75	12.60	44.41
40-49	0.34	0.78	0.69	12.49	44.72
50-59	0.29	0.67	0.59	12.43	44.69
60+	0.06	0.71	0.53	12.39	45.34
<i>Educational attainment</i>					
Primary	0.33	0.67	0.52	12.06	43.62
High School	0.49	0.77	0.69	12.46	45.47
More than HS	0.17	0.91	0.83	13.18	43.99
<i>Class of worker (employed only)</i>					
Salaried	0.73	–	0.85	12.68	45.30
Self-employed	0.22	–	0.18	12.10	43.77
Other/unpaid	0.05	–	0.39	11.75	38.02

Summary statistics, 2009

<i>N</i> = 10,043	Share of total	Pension system variables (labor force only)				
		Pension savings	Exp. Pension wealth No reform	Pension wealth Reform	Pension accrual	
					No reform	Reform
(CLP 2015 millions)						
Total	–	4.821	0	3.812	0.10	0.069
<i>Gender</i>						
Men	0.51	6.547	0	2.896	0.10	0.069
Women	0.49	2.915	0.682	4.952	0	0.069
<i>Age group</i>						
30-39	0.32	5.568	0	1.710	0.10	0.069
40-49	0.34	6.588	0	4.144	0.10	0.069
50-59	0.29	2.361	4.717	8.555	0	0.069
60+	0.06	0.039	9.784	12.920	0	0.069
<i>Educational attainment</i>						
Primary	0.33	1.454	2.885	6.391	0	0.069
High School	0.49	5.236	0	3.536	0.10	0.069
More than HS	0.17	11.901	0	0	0.10	0.10
<i>Class of worker (employed only)</i>						
Salaried	0.73	8.453	0	2.325	0.10	0.069
Self-employed	0.22	0.158	3.202	6.791	0	0.069
Other/unpaid	0.05	0.550	4.079	7.126	0	0.069