The impact of reducing the pension generosity on schooling and inequality

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Motivation:
Expected reductions in the generosity of pension systems

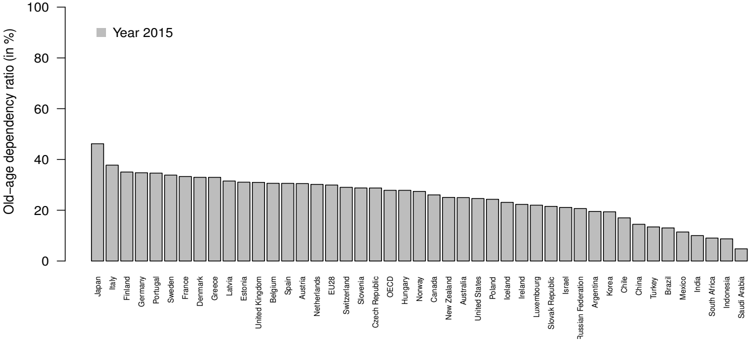

Figure 1: Old-age dependency ratio across OECD countries

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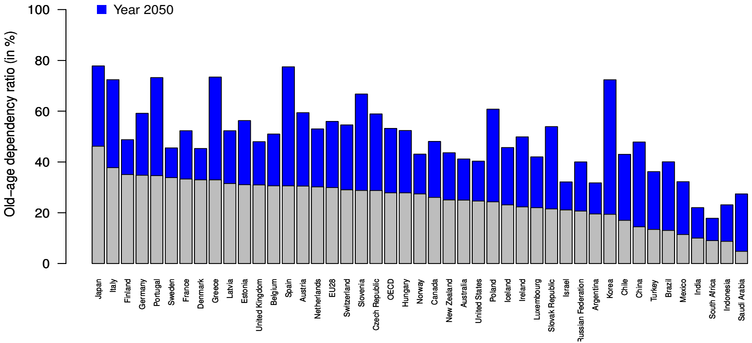

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Motivation:
Increasing longevity gap across socio-economic groups

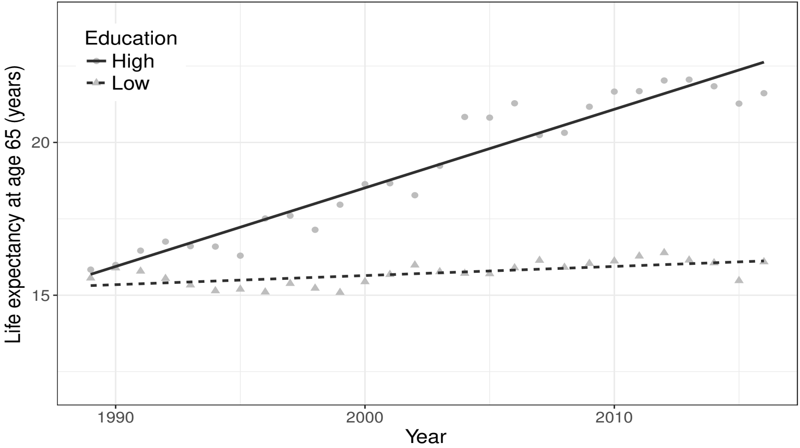

Figure 2: Life expectancy at age 65, US males

Source: Own calculations.

Introduction

- **Research interest:**
  What is the impact of reducing the generosity of the pension system on inequality and schooling when individuals differ by longevity?

- **Model:**
  To study this problem, we propose an extension of Pestieau and Ponthiere (2016) by introducing heterogeneity in schooling effort.

Individuals' budget constraint

- First period:
  - stay unskilled (e_u) or become skilled workers (e_s) $\rightarrow y(e_s) > y(e_u)$
  - pay social security contributions $\tau y(e_i)$
  - consumption c
  - save for retirement s

$$c + s = (1 - \tau) y(e_i) \tag{1}$$

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- Second period:
  - For $e_i \rightarrow \pi(e_i)$
  - consumption d

$$d = \frac{s}{R\pi(e_i)} + f(e_i, \theta)y(e_i) \tag{2}$$

where $f(e_i, \theta)$ is the pension replacement rate

$$f(e_i, \theta) = \begin{cases} \psi & \text{if } e_i = e_u, \\ \psi[1 - \theta\alpha(e_s)] & \text{if } e_i = e_s, \end{cases} \tag{3}$$

where $\alpha(e_s) = \frac{y(e_s) - y(e_u)}{y(e_s)}$ is the relative income advantage of a skilled worker and θ represents the degree of progressivity.

Replacement rate

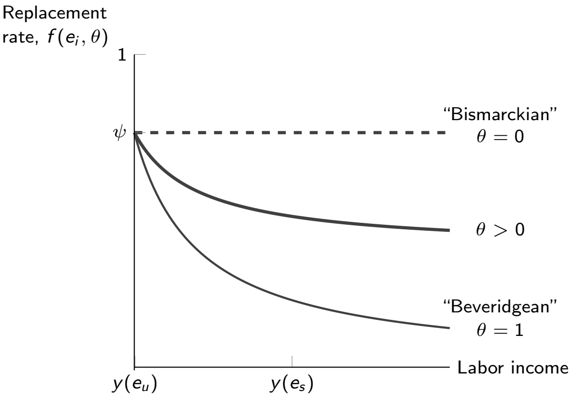

Figure 3: Stylized replacement rate function

Individuals' preferences

The preferences of an individual of type ϕ are described by the following utility function:

$$V(e_i;\phi) = u(c) - \phi\ e_i + \beta\pi(e_i)u(d), \tag{4}$$

where $\phi \in \mathbb{R}$ is the effort of attending school and differs across individuals (Oreopolous, 2007; Restuccia and Vandenbroucke, 2013; Le Garrec, 2015; Sánchez-Romero, d'Albis and Prskawetz, 2016)

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Assumption 1: The survival probability positively depends on being a skilled worker, with $\pi(e_s) - \pi(e_u) = \Delta_\pi > 0$.

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Assumption 2: The elasticity of utility with respect to consumption is between zero and one; i.e. $\eta = xu'(x)/u(x) \in (0,1)$ (Hall and Jones, 2007)

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Assumptions 1 and 2 guarantee that a marginal increase in the longevity gap leads to a marginal increase in the benefit to continue schooling.

Optimal schooling and the proportion of skilled workers

The **optimal schooling decision** satisfies

$$e_i^* = \begin{cases} e_u & \text{if } \bar{\phi} \leq \phi, \\ e_s & \text{if } \bar{\phi} > \phi, \end{cases} \tag{5}$$

where the parameter $\bar{\phi}$ denotes the threshold utility cost of schooling for which an individual is indifferent between continuing unskilled and becoming a skilled worker —i.e, $V(e_u; \bar{\phi}) = V(e_s; \bar{\phi})$,

$$\bar{\phi} = u(c^*(e_s)) - u(c^*(e_u)) + \beta[\pi(e_s)u(d^*(e_s)) - \pi(e_u)u(d^*(e_u))]. \tag{6}$$

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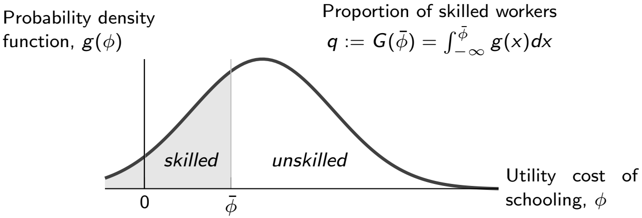

Figure 4: Stylized probability density function of the utility cost of schooling

The impact of pension on inequality

Combining (1) and (2), the intertemporal budget constraint is

$$c + R\pi(e_i)d = (1 - \tau_E(e_i))y(e_i). \tag{7}$$

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Implicit tax on work

the **effective social security tax/subsidy rate on work**, $\tau_E(e_i)$, is given by:

$$\tau_E(e_i) = \tau - f(e_i, \theta)R\pi(e_i). \tag{8}$$

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Individuals with different educational attainment face different $\tau_E(e_i)$!!

The implicit tax on work

The difference of the effective social security tax rate between unskilled and skilled workers, $\Delta_\tau(\theta) = \tau_E(e_u) - \tau_E(e_s)$, is

$$\Delta_\tau(\theta) = \psi\pi(e_s)\left[\varepsilon(e_s) - \theta\alpha(e_s)\right] R. \tag{9}$$

with $\varepsilon(e_s) = \frac{\pi(e_s) - \pi(e_u)}{\pi(e_s)}$.

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with $\varepsilon(e_s) = \frac{\pi(e_s)-\pi(e_u)}{\pi(e_s)}$.

Proposition 1: *Assuming a constant longevity across skill groups, $\pi(e_s) = \pi(e_u)$, a pension system with*

- **(a)** *a flat replacement ($\theta = 0$) does not redistribute resources among skill groups*
- **(b)** *a progressive replacement rate ($\theta > 0$) redistributes resources from skilled workers to unskilled workers*

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Proposition 2: *Assuming that $\pi(e_s) > \pi(e_u)$ and defining $p = \frac{\varepsilon(e_s)}{\alpha(e_s)}$ as the ratio of the relative mortality to the relative income advantage of skilled workers, a pension system with*

- **(a)** *a flat replacement rate ($\theta = 0$) transfers resources from short-lived and unskilled workers to long-lived and skilled workers.*
- **(b)** *a progressive replacement rate ($\theta > 0$) redistributes income (i) from skilled workers to unskilled workers when $\theta > p$ and (ii) from unskilled workers to skilled workers when $\theta < p$.*

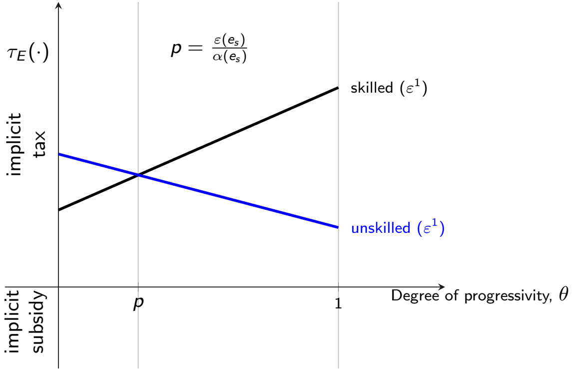

Figure 5: Effective social security tax/subsidy rate (τ_E) for each educational group by degree of progressivity (θ)

Impact of reducing the pension replacement rate on pension inequality

To study the effect of a decrease in the replacement rate (ψ) on pension inequality, we calculate the sign of the derivative of Eq. (9) with respect to ψ

$$\frac{-\partial \Delta_\tau}{\partial \psi} = \pi(e_s)\alpha(e_s)\,(\theta - p)\,R \begin{cases} > 0 & \text{if } \theta > p, \\ < 0 & \text{if } \theta < p. \end{cases} \tag{10}$$

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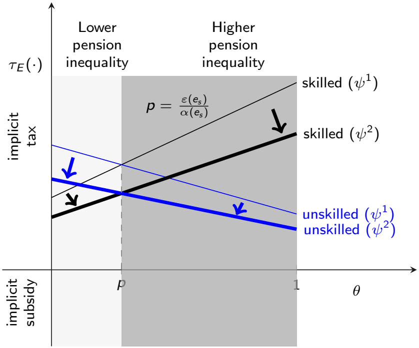

Figure 6: Impact of a fall in the replacement rate ($\psi^1 > \psi^2$) on the effective social security tax/subsidy rate (τ_E) for each educational group by degree of progressivity (θ)

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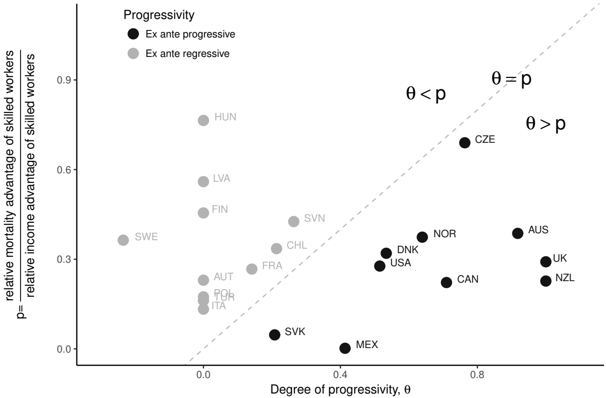

Figure 7: Empirical values of $p = \varepsilon(e_s)/\alpha(e_s)$ and θ for 21 selected OECD countries

Source: Values obtained from OECD (2017), Murtin (2017), and authors' calculations.

Impact of reducing the pension replacement rate on education

To study the impact of a decrease in ψ on education, we differentiate the proportion of skilled workers, q, with respect to ψ

$$\frac{-\partial q}{\partial \psi} = g(\bar{\phi})u'(c^*(e_s))y(e_s)\left[\frac{-\partial \Delta_\tau}{\partial \psi} + (\Phi - 1)\frac{-\partial \tau_E(e_u)}{\partial \psi}\right], \qquad (11)$$

with $\Phi = \frac{u'(c^*(e_u))y(e_u)}{u'(c^*(e_s))y(e_s)}$.

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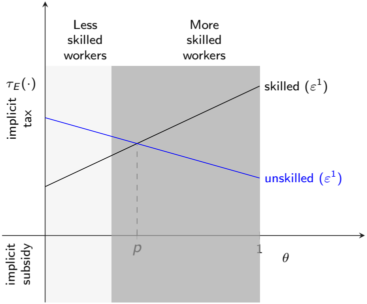
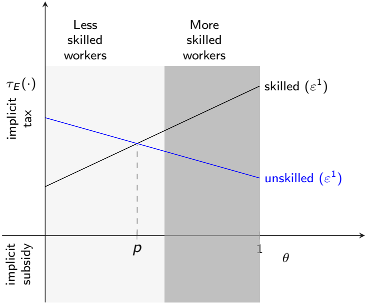
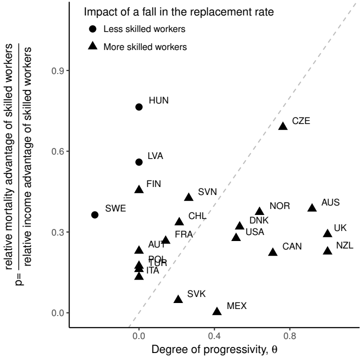


(a) Case: $\Phi < 1$

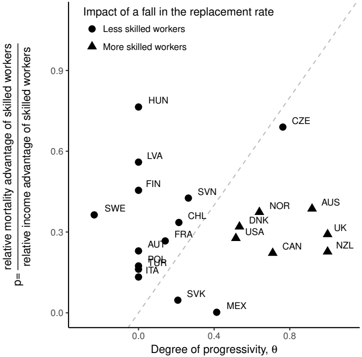


(b) Case: $\Phi > 1$

Figure 8: Impact of a reduction in the replacement rate on the proportion of skilled wokers by degree of progressivity of the pension system (θ)



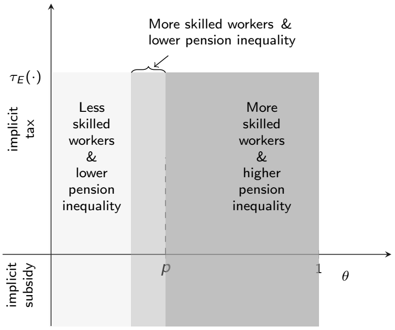
(a) Relative risk aversion $= 0.5 \Rightarrow \Phi < 1$



(b) Relative risk aversion $= 1.5 \Rightarrow \Phi > 1$

Figure 9: Impact of a reduction in the replacement rate on the proportion of skilled workers by degree of progressivity of the pension system (θ) in 21 selected OECD countries

Source: OECD (2017), Murtin (2017), and authors' calculations. Calculations done assuming each period lasts forty years, a power marginal utility function $u'(x) = x^{-\gamma}$, where γ is the relative risk aversion coefficient, a constant annual real interest rate of 3 percent, a productivity growth rate of 1.5 percent, and a subjective discount factor of 1 percent.



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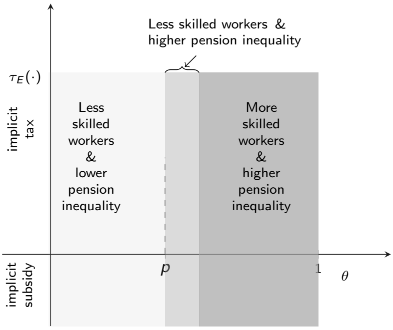


(b) Case: $\Phi > 1$

Figure 10: Impact of a reduction in the replacement rate (ψ) on the proportion of skilled workers (q) and on pension inequality (Δ_τ) by degree of progressivity of the pension system (θ)

The combined effect of a reduction in the pension generosity

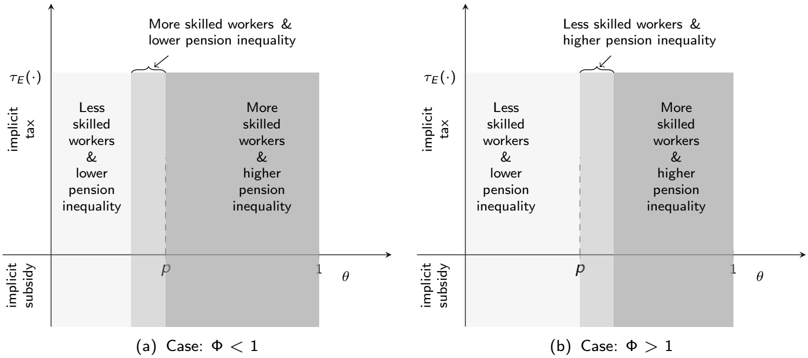
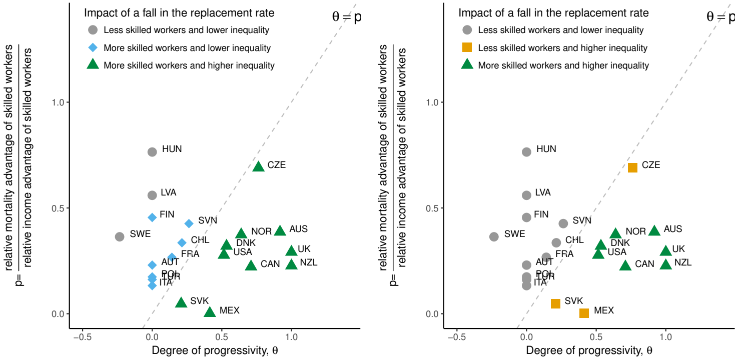


Figure 10: Impact of a reduction in the replacement rate (ψ) on the proportion of skilled workers (q) and on pension inequality (Δ_τ) by degree of progressivity of the pension system (θ)

- If we pursue avoiding pension inequality, then a reduction in the generosity of the pension system will lead to an ambiguous result on the number of skilled workers



(a) Relative risk aversion = 0.5 ⇒ $\Phi < 1$

(b) Relative risk aversion = 1.5 ⇒ $\Phi > 1$

Figure 11: Impact of a reduction in the replacement rate (ψ) on the proportion of skilled workers (q) and on pension inequality (Δ_τ) by degree of progressivity of the pension system (θ) in 21 selected OECD countries

Source: See figs. 7 and 9.

Conclusions

- We have developed a model for analyzing the impact of a reduction in the generosity of the pension system on inequality and schooling

- Within this framework we study the impact of a reduction in the generosity of the pension system on schooling and inequality when there exists differential mortality across groups

- We show that when there exists ex ante mortality differences, it is necessary to introduce a progressive pension system to avoid that pension system becomes regressive

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Thank you!

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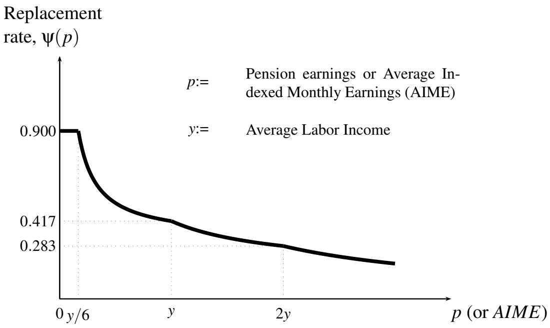

Figure 12: Old-Age Insurance replacement rate in the US

Note: AIME is calculated as 1/12 of the mean of the 35 highest labor incomes over the working life, measured in real terms.

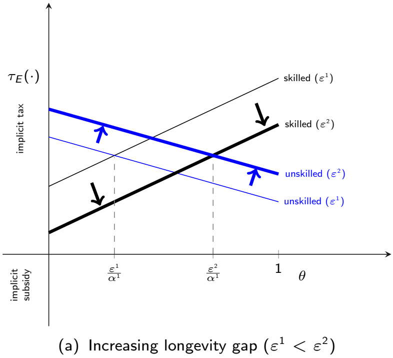

Figure 13: Effective social security tax/subsidy rate (τ_E) for each educational group by degree of progressivity (θ)