The impact of reducing pension generosity on schooling and inequality

Miguel Sánchez-Romero[1,2] and Alexia Prskawetz[1,2]

[1] Wittgenstein Centre (IIASA, VID/ÖAW, WU)
[2] Institute of Statistics and Mathematical Methods in Economics, Research Unit Economics, TU Wien, Austria

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Motivation:
Expected reductions in the generosity of pension systems

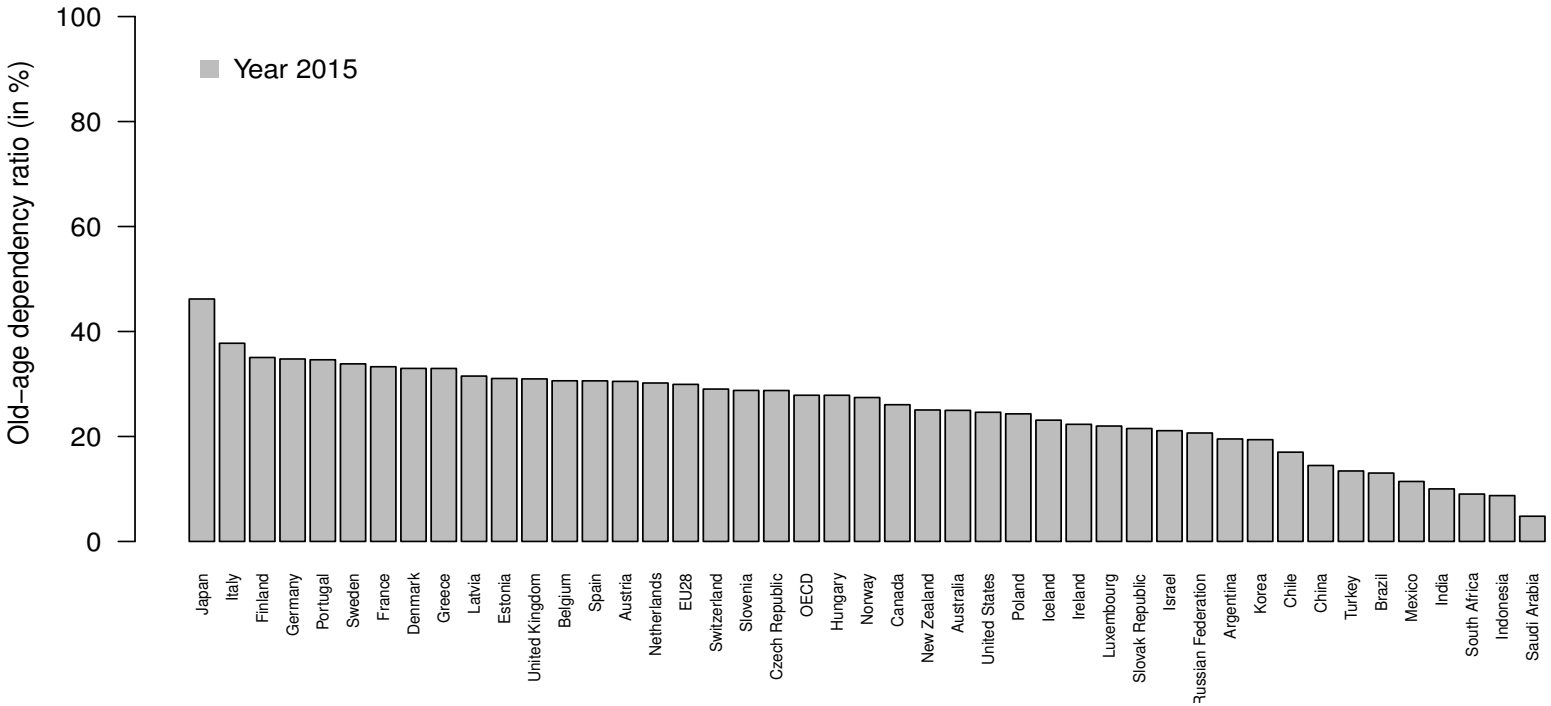

Figure 1: Old-age dependency ratio across OECD countries

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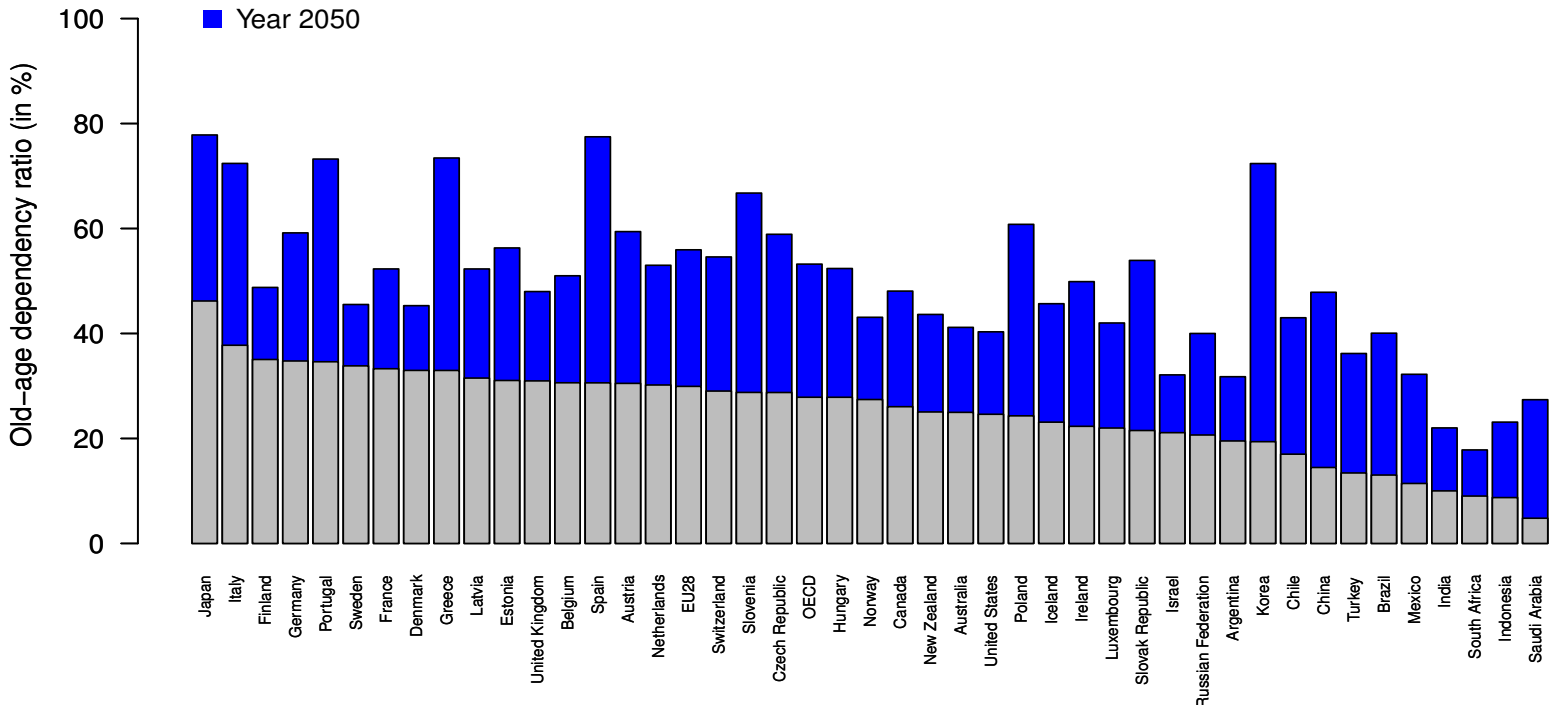

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Motivation:
Increasing longevity gap across socio-economic groups

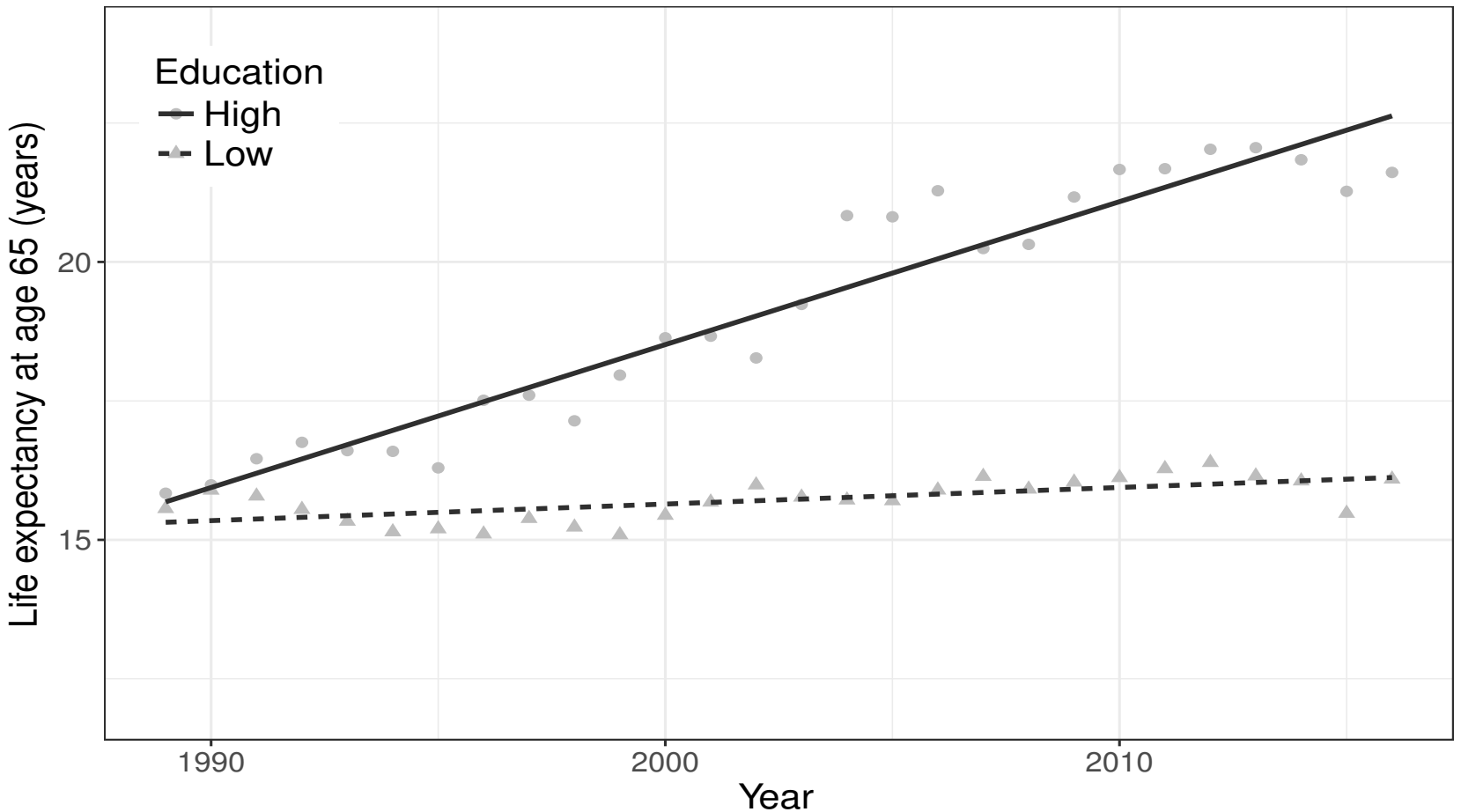

Figure 2: Life expectancy at age 65, US males

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 worker (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

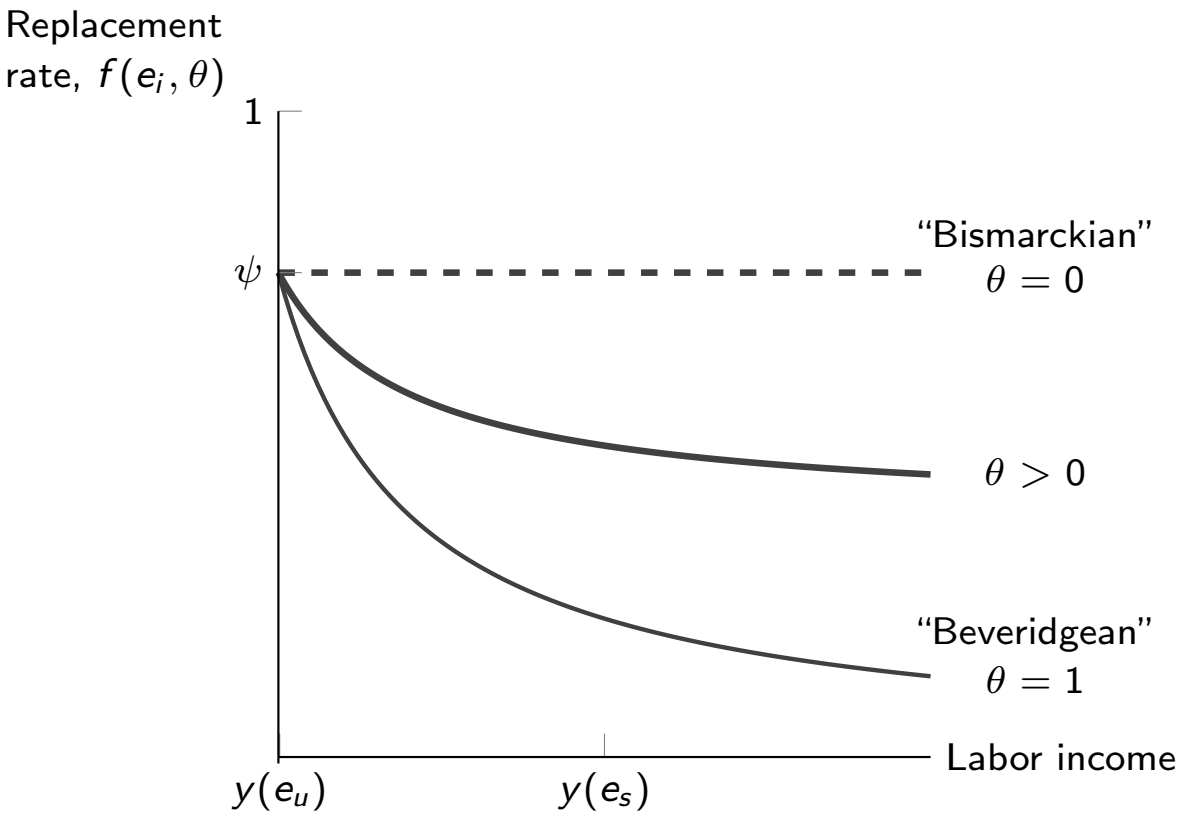

Figure 3: Stylized replacement rate function

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 of continued 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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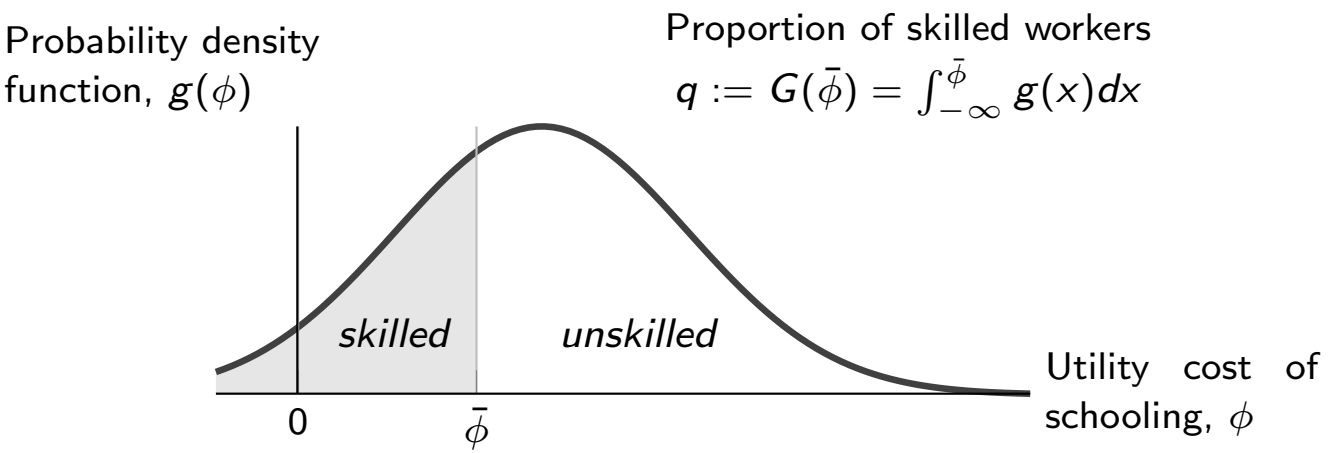

Figure 4: Stylized probability density function of the utility cost of schooling

The impact of pensions on inequality

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

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

The implicit tax on work

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

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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 $\theta < p$*

The implicit tax on work

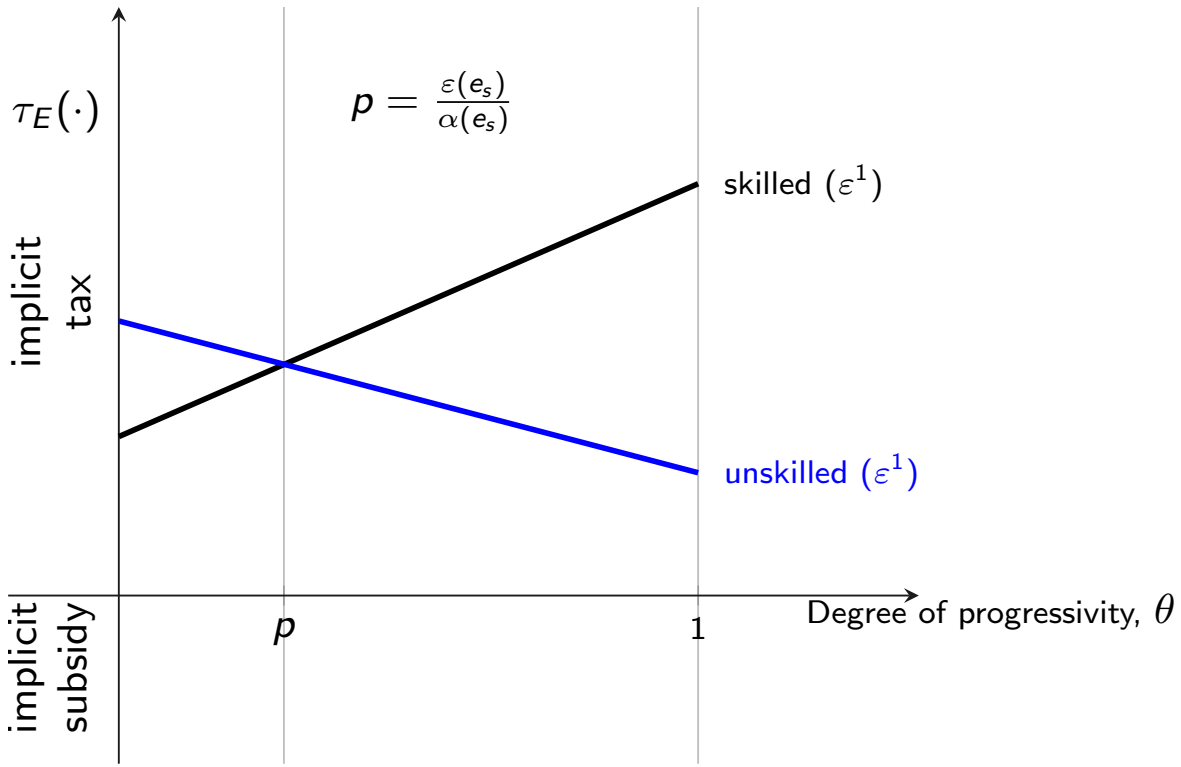

Figure 5: Effective social security tax/subsidy rate (τ_E) for each educational group by degree of progressivity (θ)

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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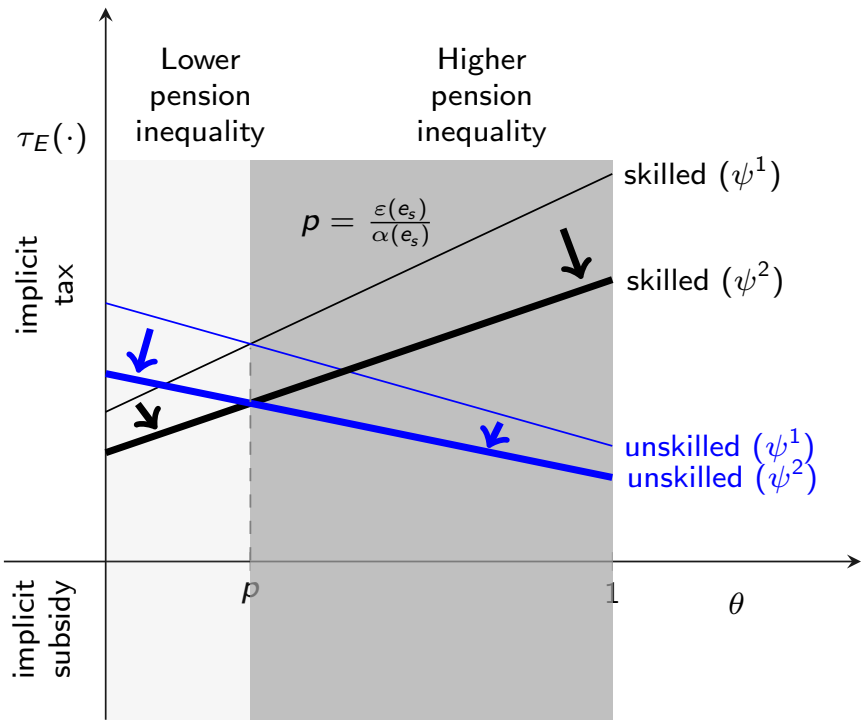

Figure 6: Impact of a fall in the replacement rate ($\psi^1 > \psi^2$) on the effective social security tax/subsidy rate (τ_E) for each educational group by degree of progressivity (θ)

Impact of reducing the pension replacement rate on pension inequality

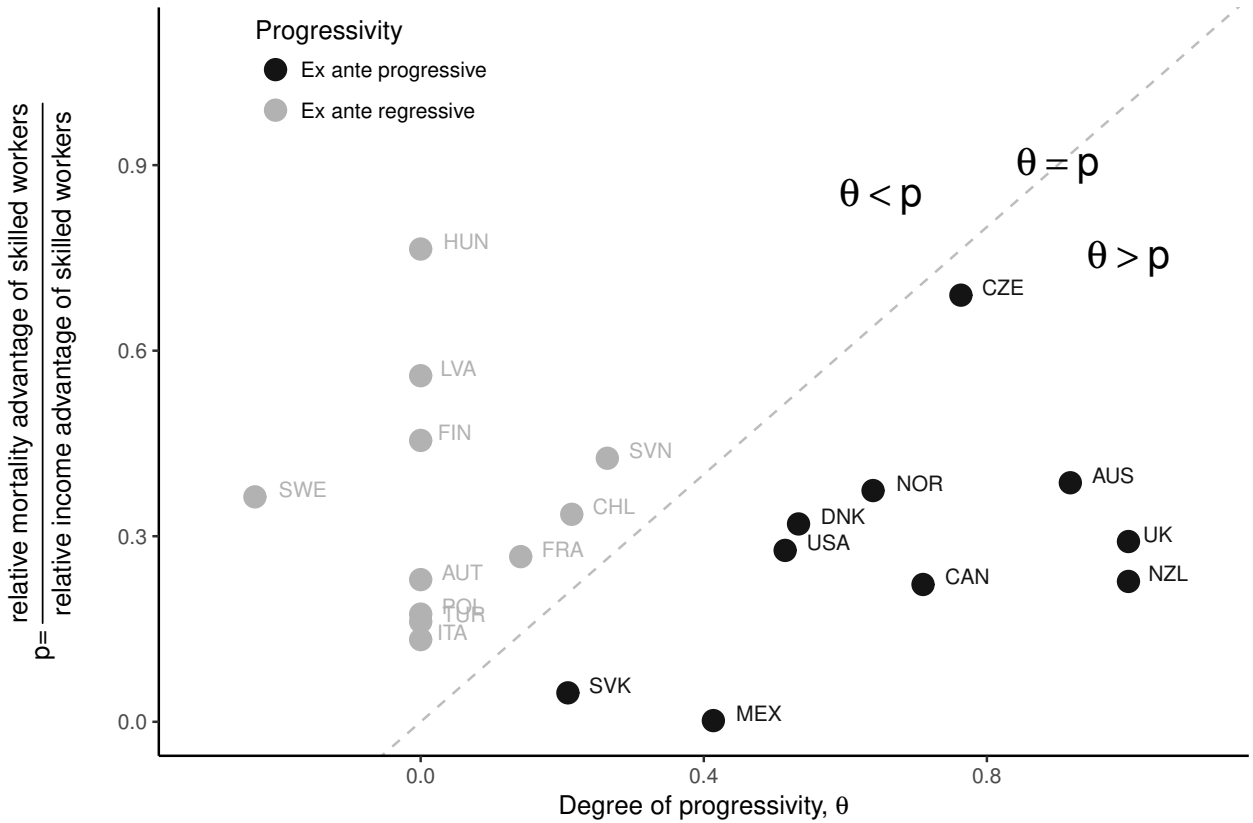

Figure 7: Empirical values of $p = \varepsilon(e_s)/\alpha(e_s)$ and θ for 21 selected OECD countries

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

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

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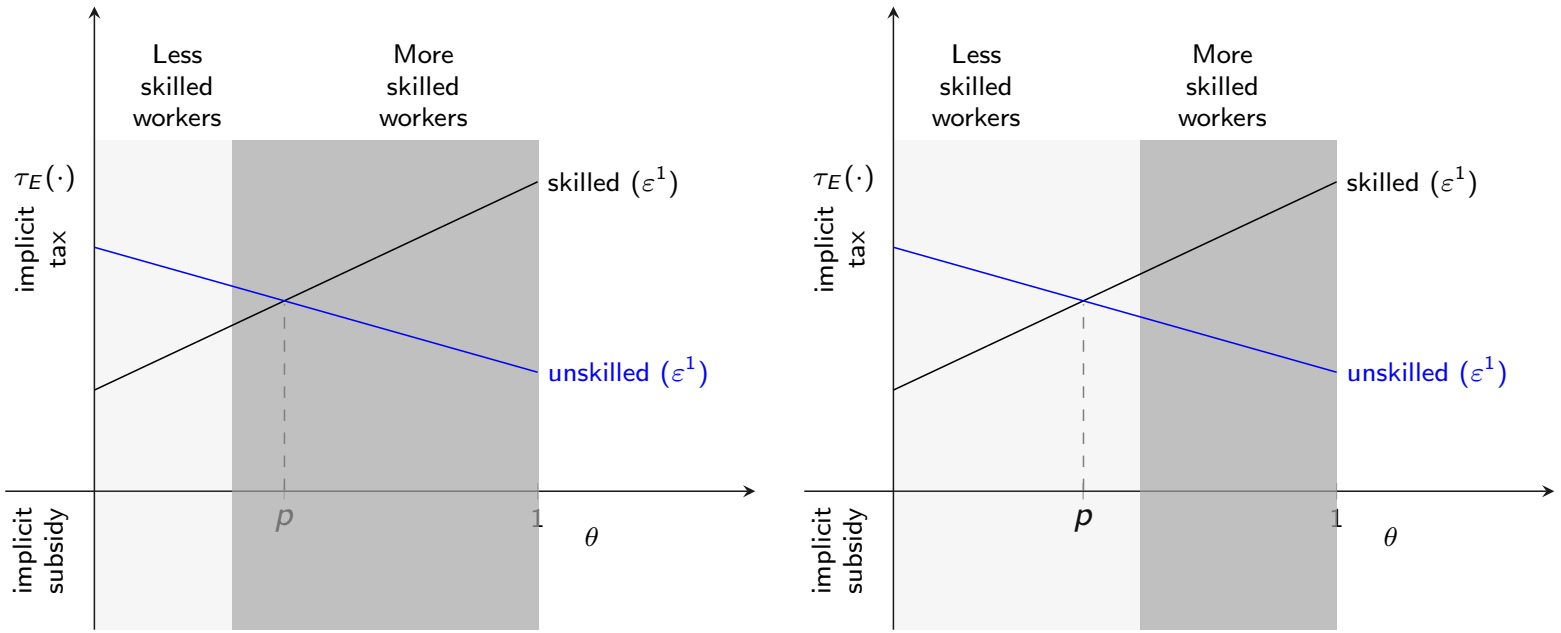
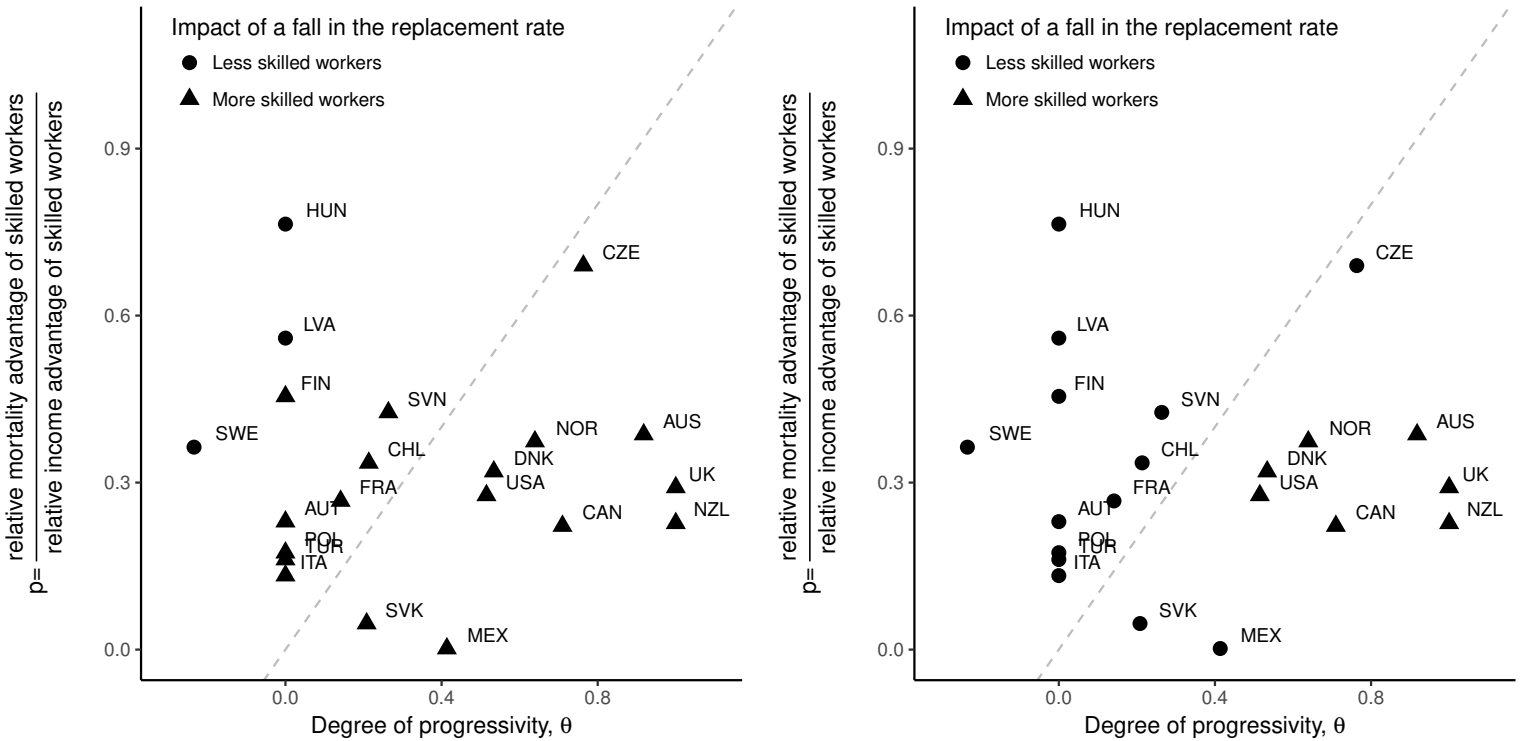


(a) Case: $\Phi < 1$ (b) Case: $\Phi > 1$

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)

Impact of reducing the pension replacement rate on education

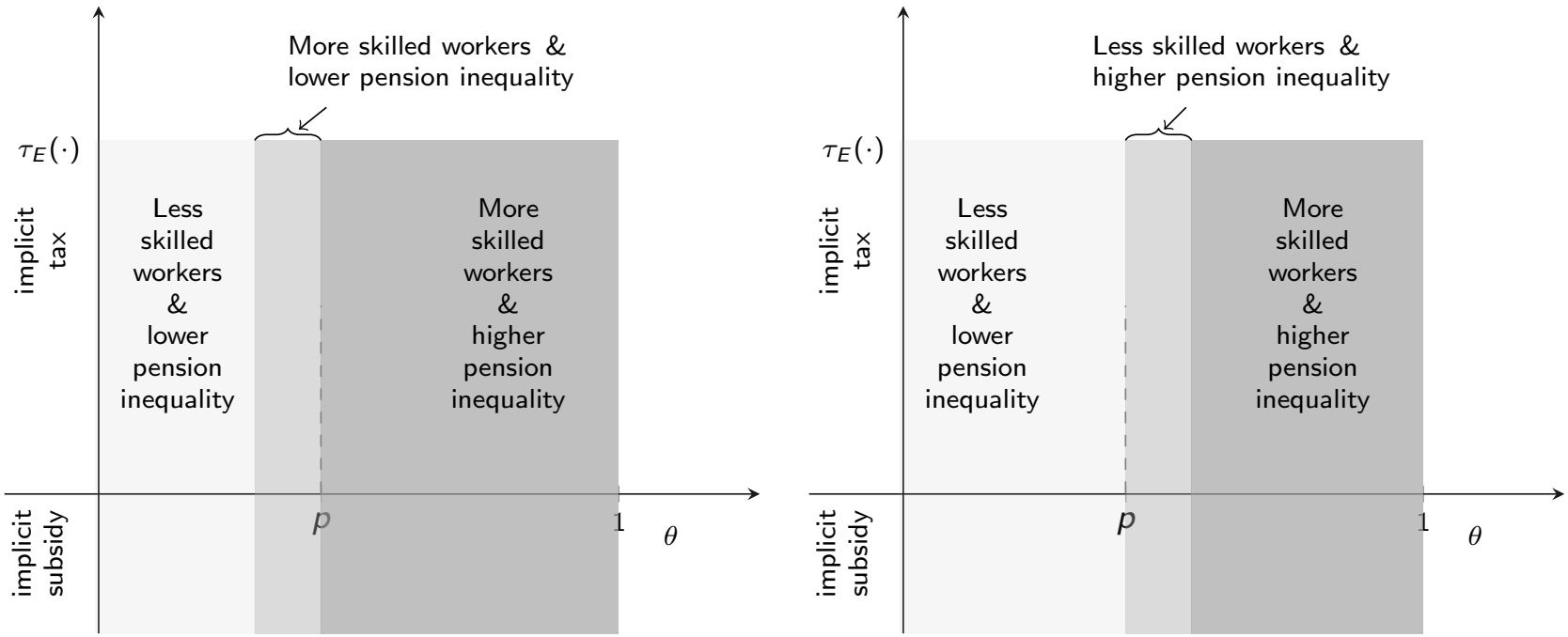


(a) Relative risk aversion $= 0.5 \Rightarrow \Phi < 1$ (b) Relative risk aversion $= 1.5 \Rightarrow \Phi > 1$

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.

The combined effect of a reduction in pension generosity



(a) Case: $\Phi < 1$ (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

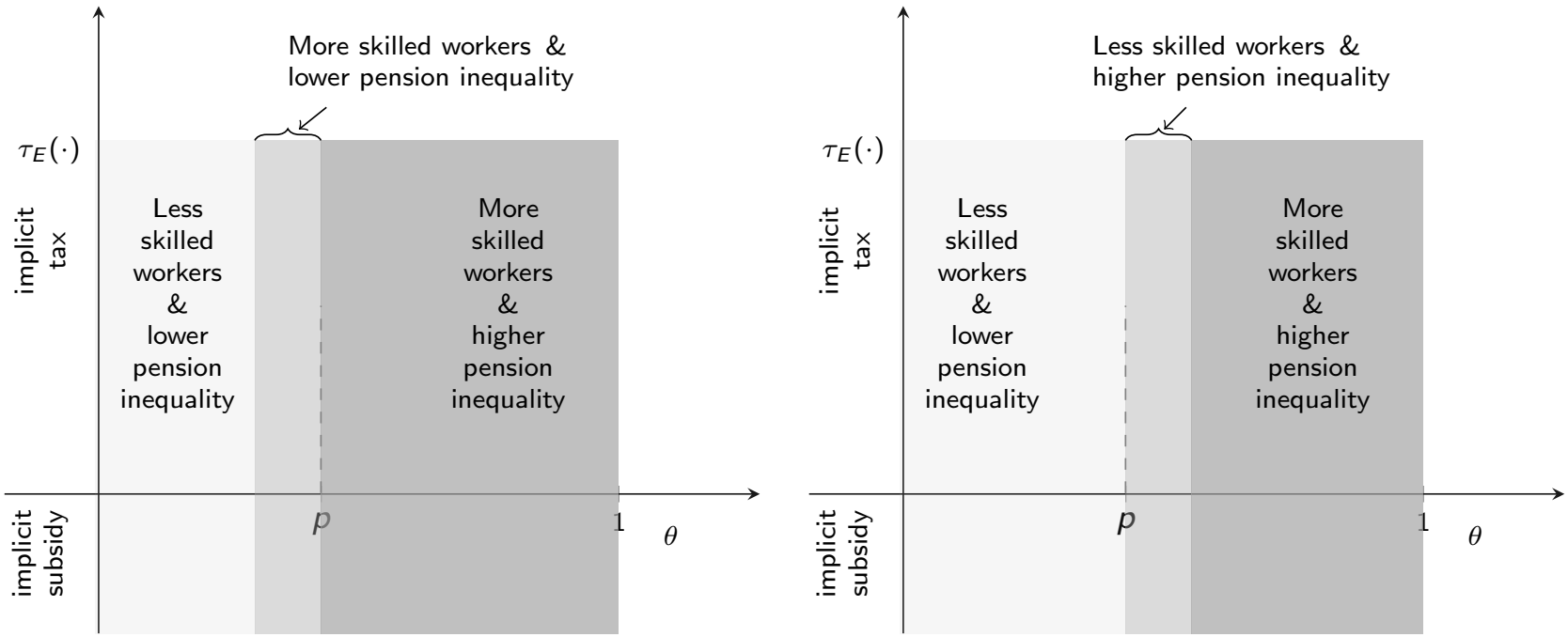


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Figure 10: Impact of a reduction in the replacement rate (ψ) on the proportion of skilled workers (q) and on pension inequality (Δ_τ) by degree of progressivity of the pension system (θ)

- 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

The combined effect of a reduction in pension generosity

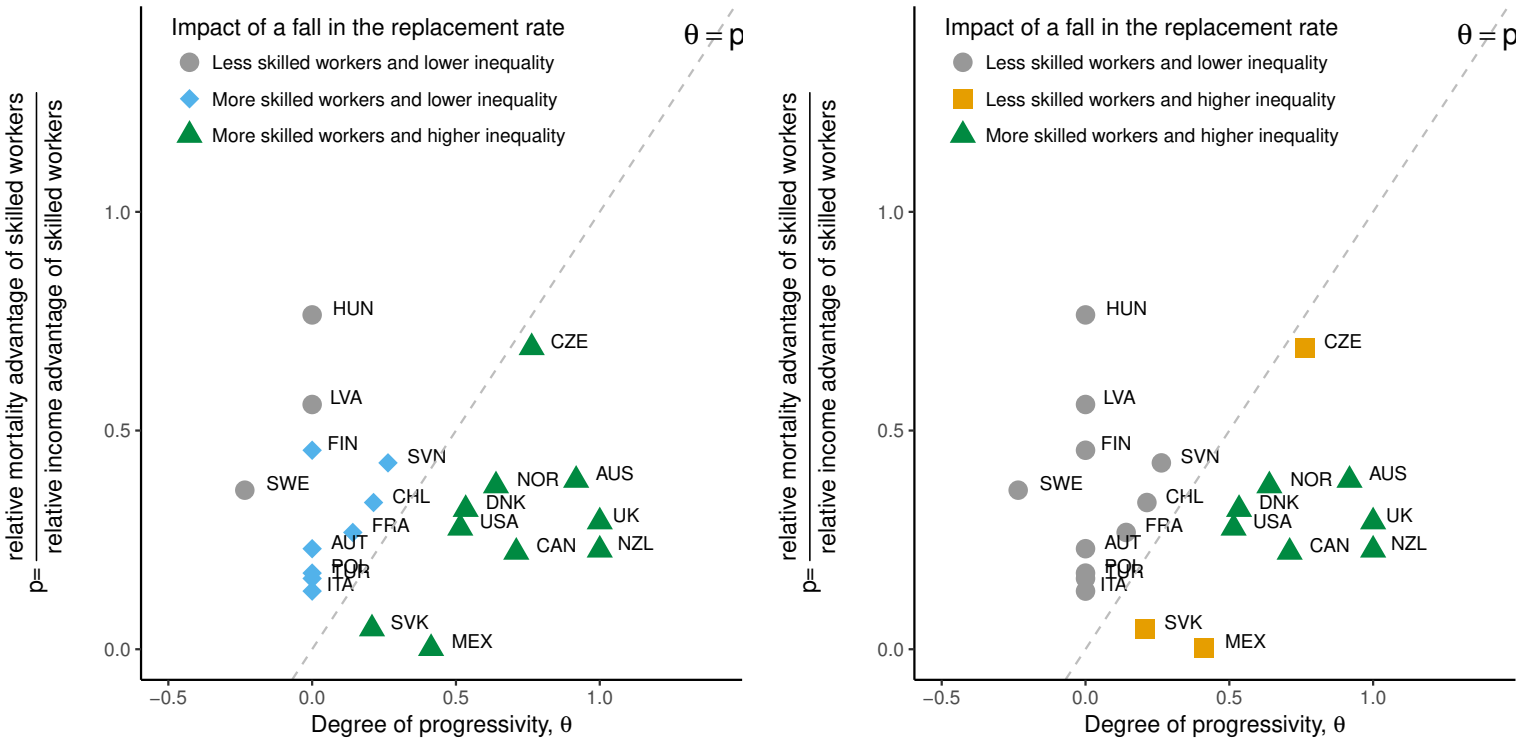

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Figure 11: Impact of a reduction in the replacement rate (ψ) on the proportion of skilled workers (q) and on pension inequality (Δ_τ) by degree of progressivity of the pension system (θ) in 21 selected OECD countries

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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US OAI pension system (DB-II)

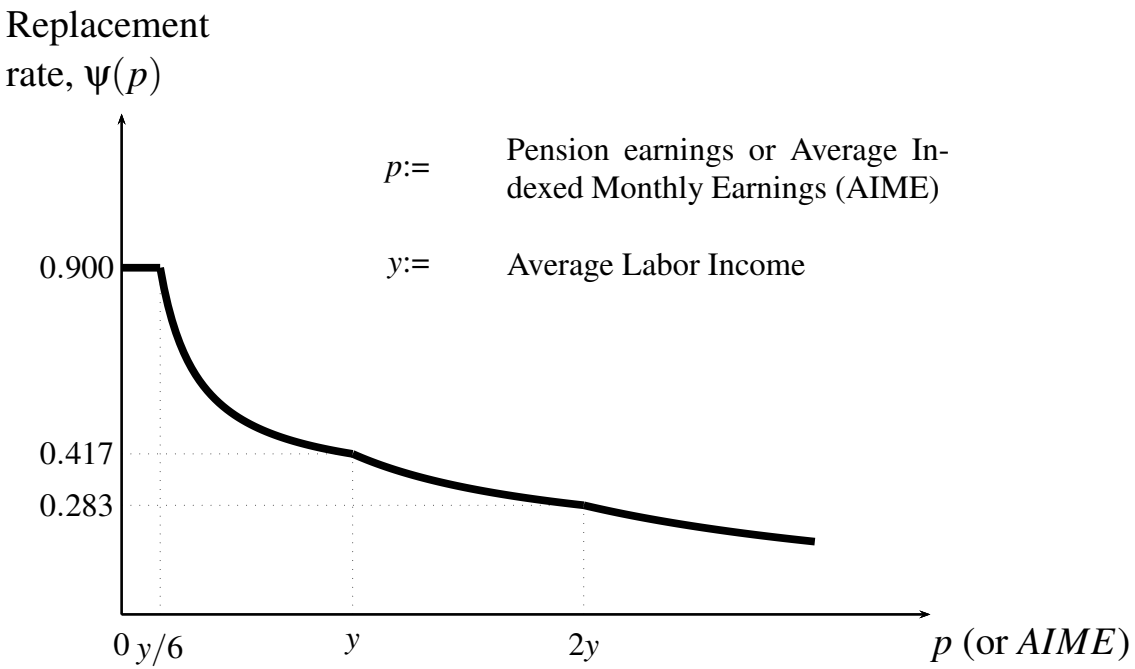
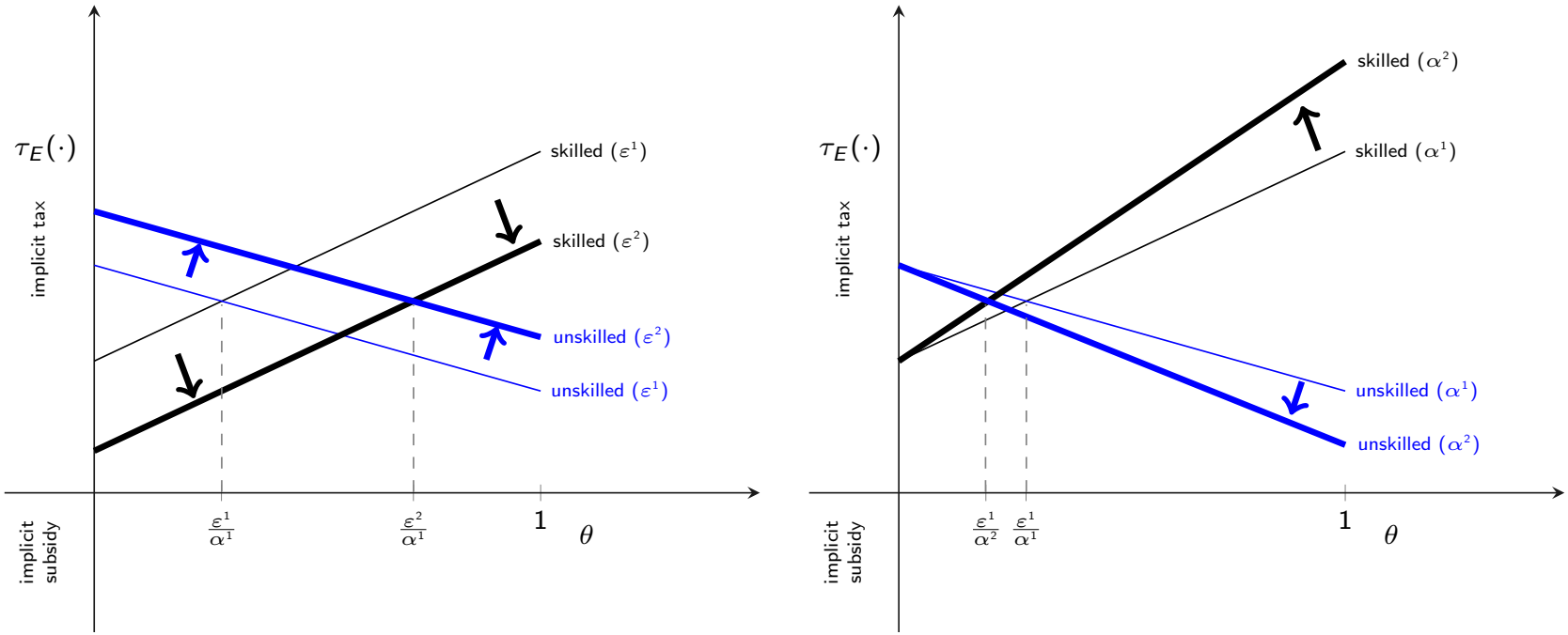


Figure 12: Old-Age Insurance replacement rate in the US

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

The impact of an increase in Δ_π and in α_e on the implicit tax on work



(a) Increasing longevity gap ($\varepsilon^1 < \varepsilon^2$)

(b) Increasing income gap ($\alpha^1 < \alpha^2$)

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