The impact of reducing the pension generosity on schooling and inequality

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Motivation:
Expected reductions in the generosity of pension systems

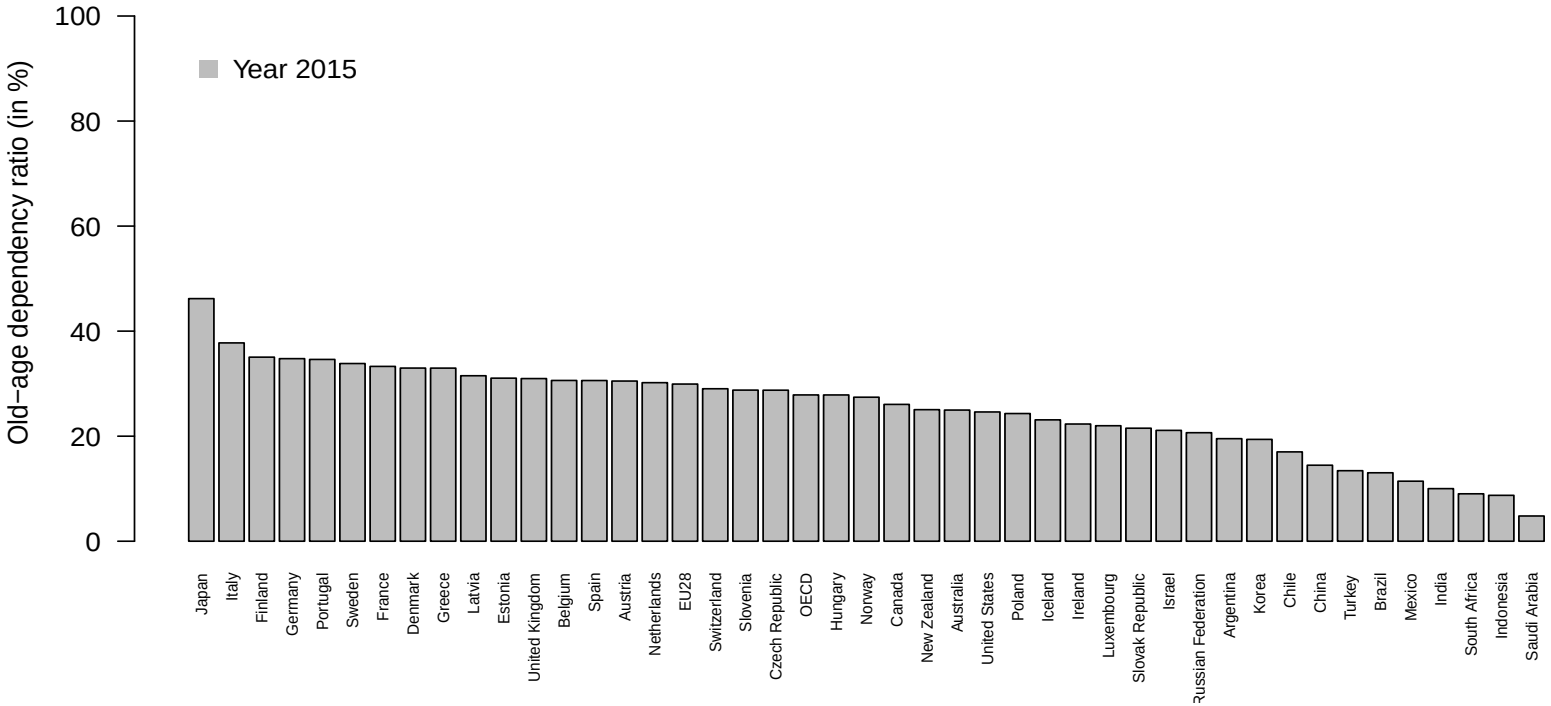

Figure 1: Old-age dependency ratio across OECD countries

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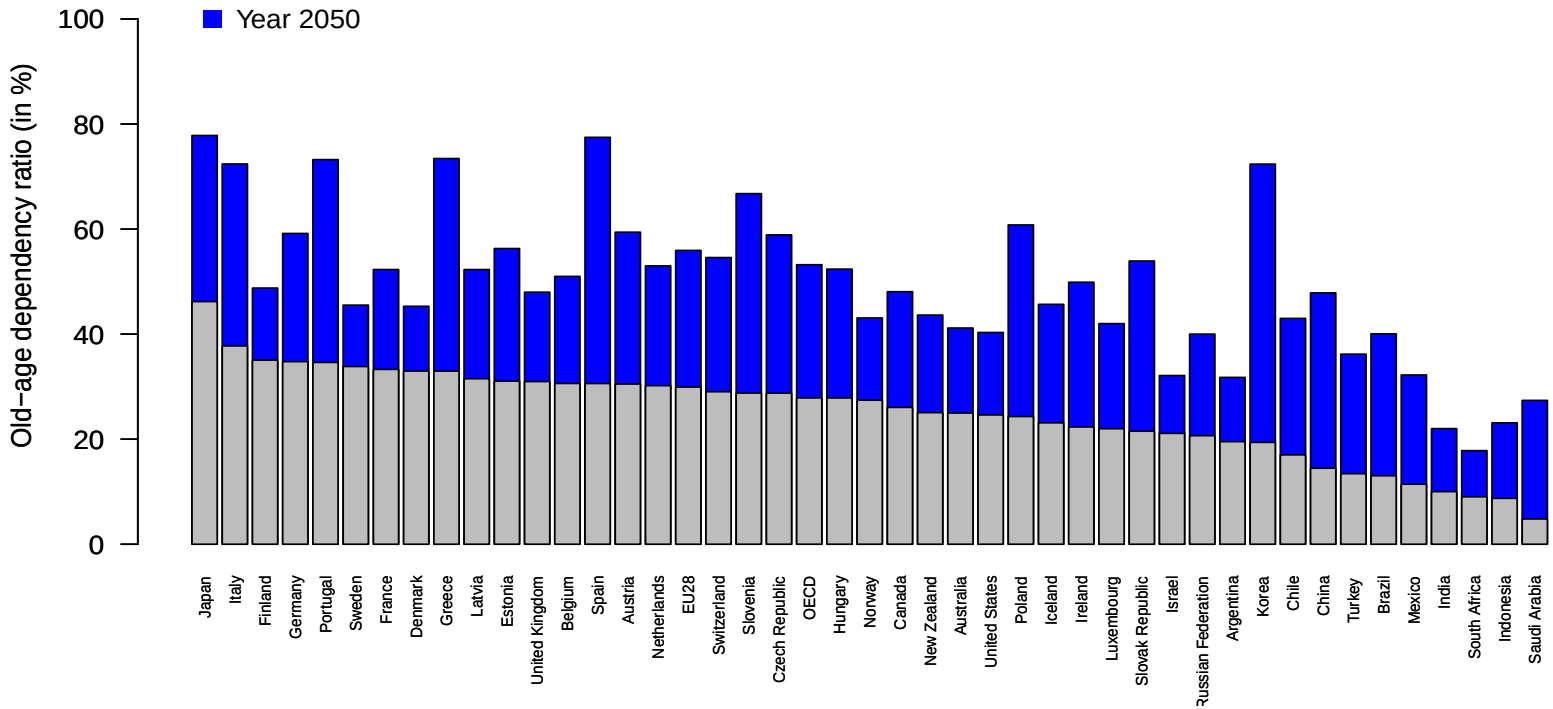

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Motivation:
Increasing longevity gap across socio-economic groups

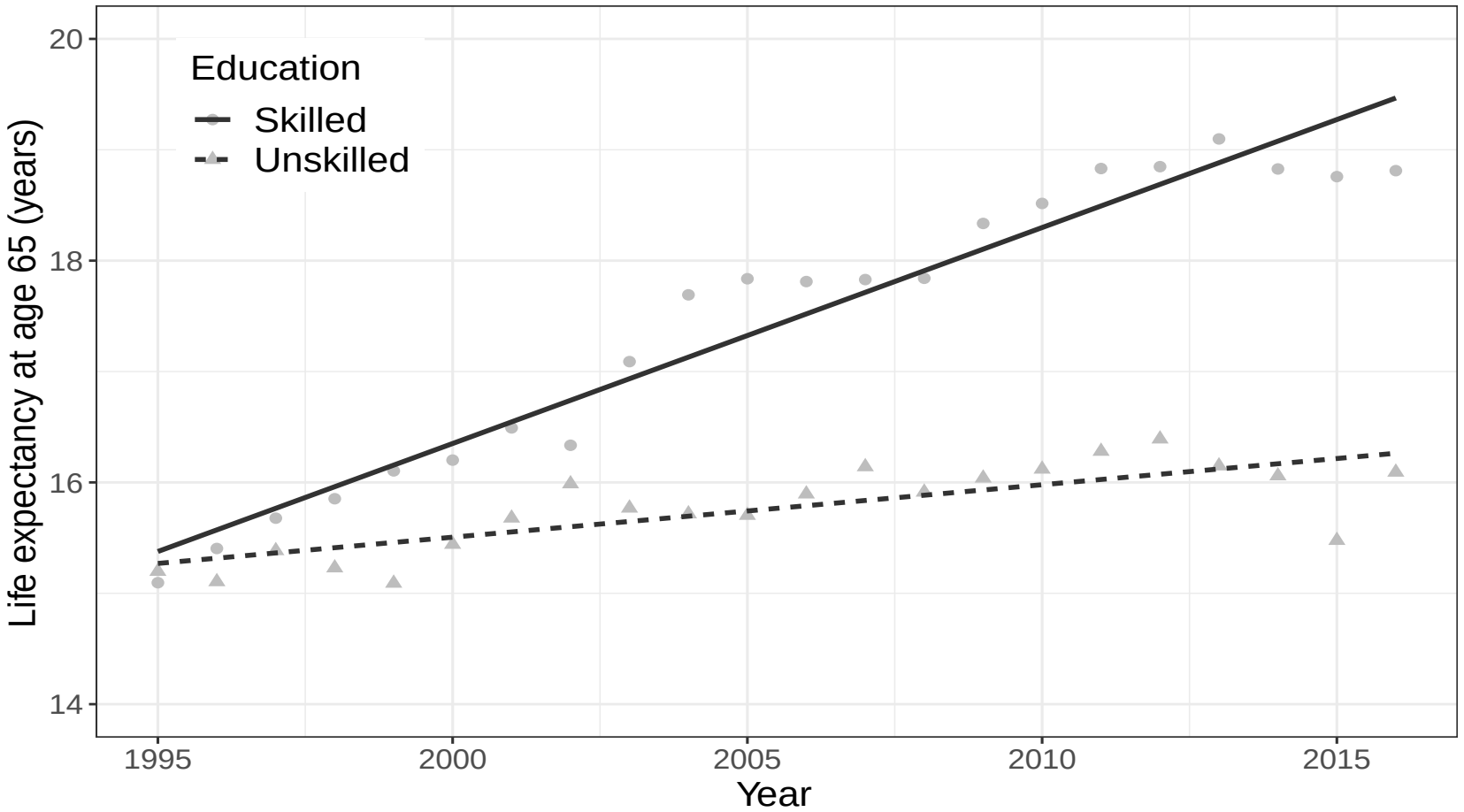

Figure 2: Life expectancy at age 65, US males

Source: Own calculations.

Introduction

- challenges for welfare state due to increasing length of life

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- **Research interest:**
  What is the impact of reducing the generosity of the pension system on inequality when individuals differ by longevity? How will individuals react w.r.t. educational decisions?

Introduction

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

- **Framework:**
  small, open economy populated by overlapping generations
  heterogeneous individuals in each generation
  assume population is stationary

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.

Replacement rate

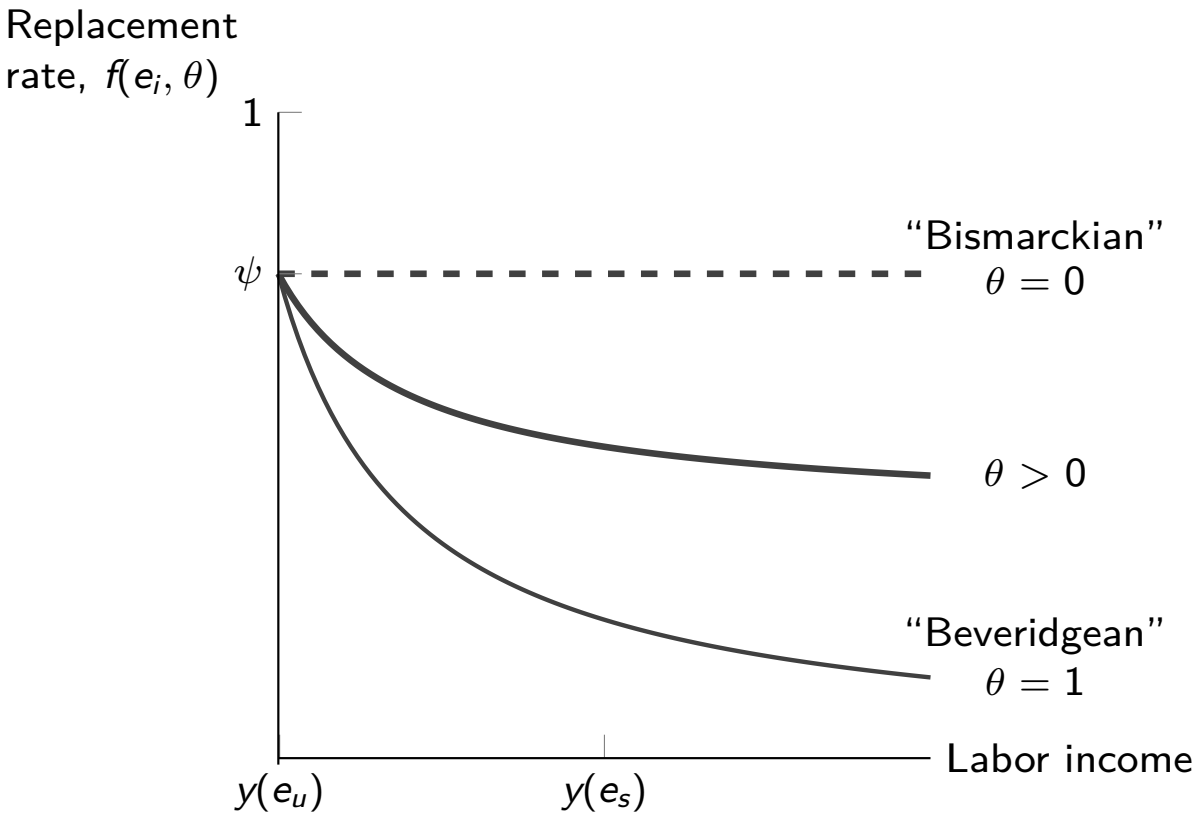

Figure 3: Stylized replacement rate function

OASI, US system

Individuals' preferences

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

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

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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Assumptions 1 and 3 guarantee that a marginal increase in the longevity gap leads to a marginal increase in the benefit to continue schooling.

Optimal consumption and savings

assuming a utility $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$ individuals with education e_i

- optimally choose in the first period **to consume**

$$c^*(e_i) = m(e_i)(1 - \tau_E(e_i))y(e_i), \tag{5}$$

  where $(1 - \tau_E(e_i))y(e_i)$ is the individual's human wealth, and $m(e_i) = (1 + R\pi(e_i)(\beta/R)^{\frac{1}{\gamma}})^{-1}$ is the individual's marginal propensity to consume with respect to human wealth.

- optimally choose in the first period **to save**

$$\frac{s^*(e_i)}{y(e_i)} = (1 - m(e_i)) - ((1 - m(e_i))\tau + m(e_i)R\pi(e_i)f(e_i, \theta)) . \tag{6}$$

Optimal schooling and the proportion of skilled workers

The **optimal schooling decision** satisfies

$$e_i^* = \begin{cases} e_u & \text{if } \bar{\phi} \leq \phi, \\ e_s & \text{if } \bar{\phi} > \phi, \end{cases} \tag{7}$$

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, $V(e_u; \bar{\phi}) = V(e_s; \bar{\phi})$,

$$\bar{\phi} = u(c^*(e_s)) - u(c^*(e_u)) + \beta[\pi(e_s)u(d^*(e_s)) - \pi(e_u)u(d^*(e_u))]. \tag{8}$$

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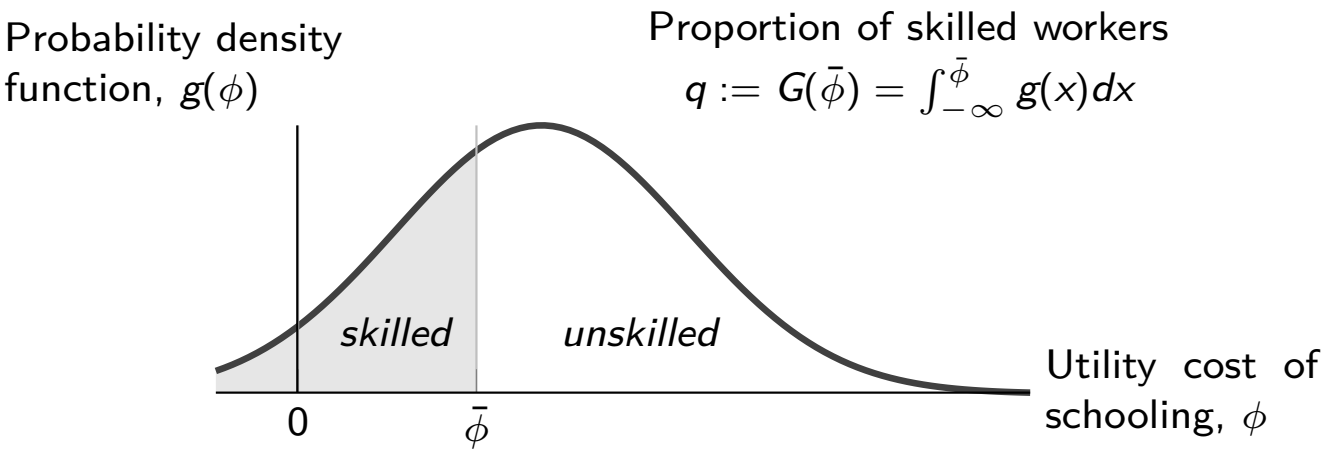

Figure 4: Stylized probability density function of the utility cost of schooling

The impact of pension on inequality

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

$$c + R\pi(e_i)d = (1 - \tau_E(e_i))y(e_i). \tag{9}$$

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:

$$\tau_E(e_i) = \tau - f(e_i, \theta)R\pi(e_i). \tag{10}$$

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

The implicit tax on work

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- If the effective social security tax rate is different for skilled vs. unskilled workers, the pension system will change the wealth position between both skill groups.

- We define *pension inequality* as any positive or negative difference between the effective taxes of unskilled and skilled workers.

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

$$\Delta_\tau(\theta) = \psi\pi(e_s)\left[\varepsilon(e_s) - \theta\alpha(e_s)\right] R. \tag{11}$$

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

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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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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

$$\begin{aligned}\Delta_\tau(\theta) &= \psi\pi(e_s)\left[\varepsilon(e_s) - \theta\alpha(e_s)\right] R \\ &= \psi\pi(e_s)\alpha(e_s)\left[p - \theta\right] R. \end{aligned} \tag{11}$$

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

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

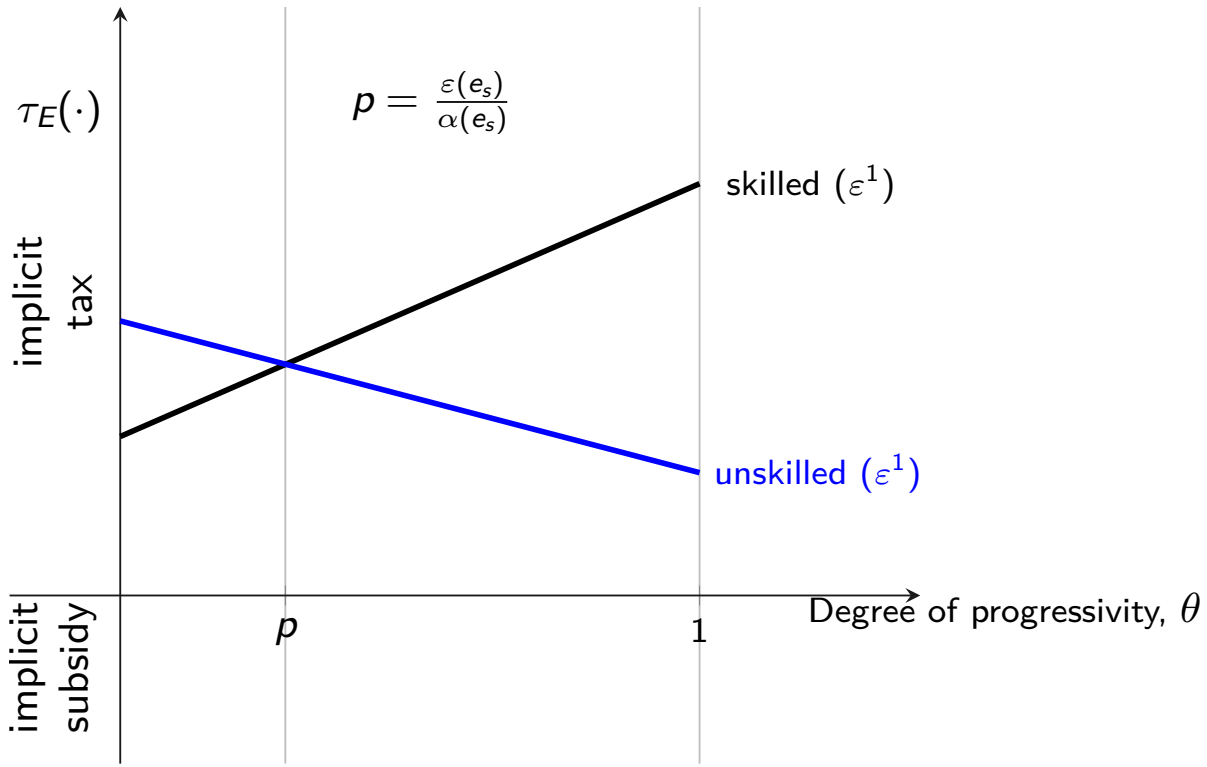

Figure 5: Effective social security tax/subsidy rate (τ_E) for each educational group by degree of progressivity (θ)

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. (11) with respect to ψ

$$\frac{-\partial \Delta_\tau}{\partial \psi} = \pi(e_s)\alpha(e_s)\,(\theta - p)\,R \begin{cases} > 0 & \text{if } \theta > p, \\ < 0 & \text{if } \theta < p. \end{cases} \tag{12}$$

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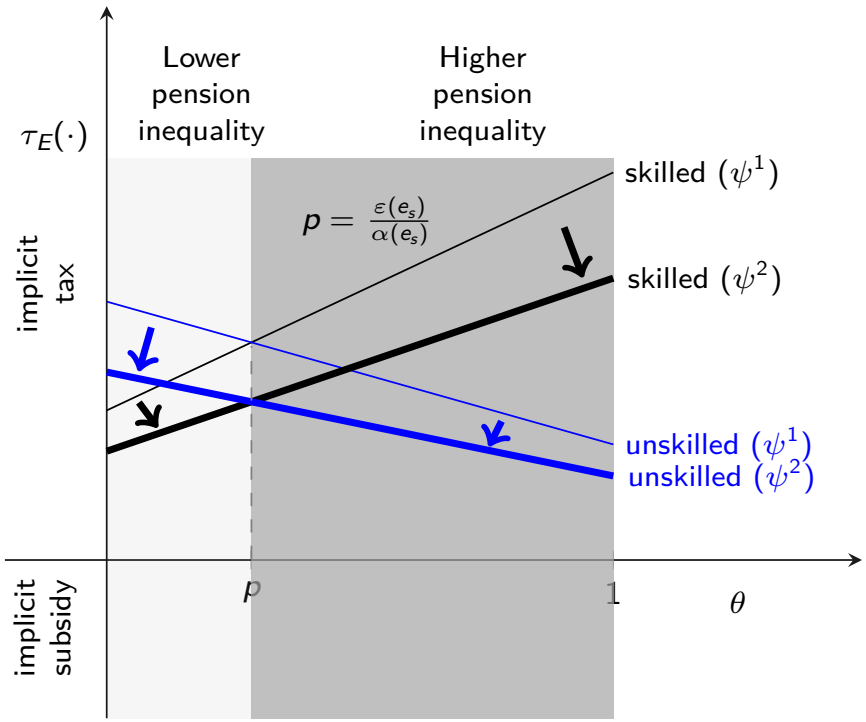

Figure 6: Impact of a fall in the replacement rate ($\psi^1 > \psi^2$) on the effective social security tax/subsidy rate (τ_E) for each educational group by degree of progressivity (θ)

Impact of reducing the pension replacement rate on pension inequality

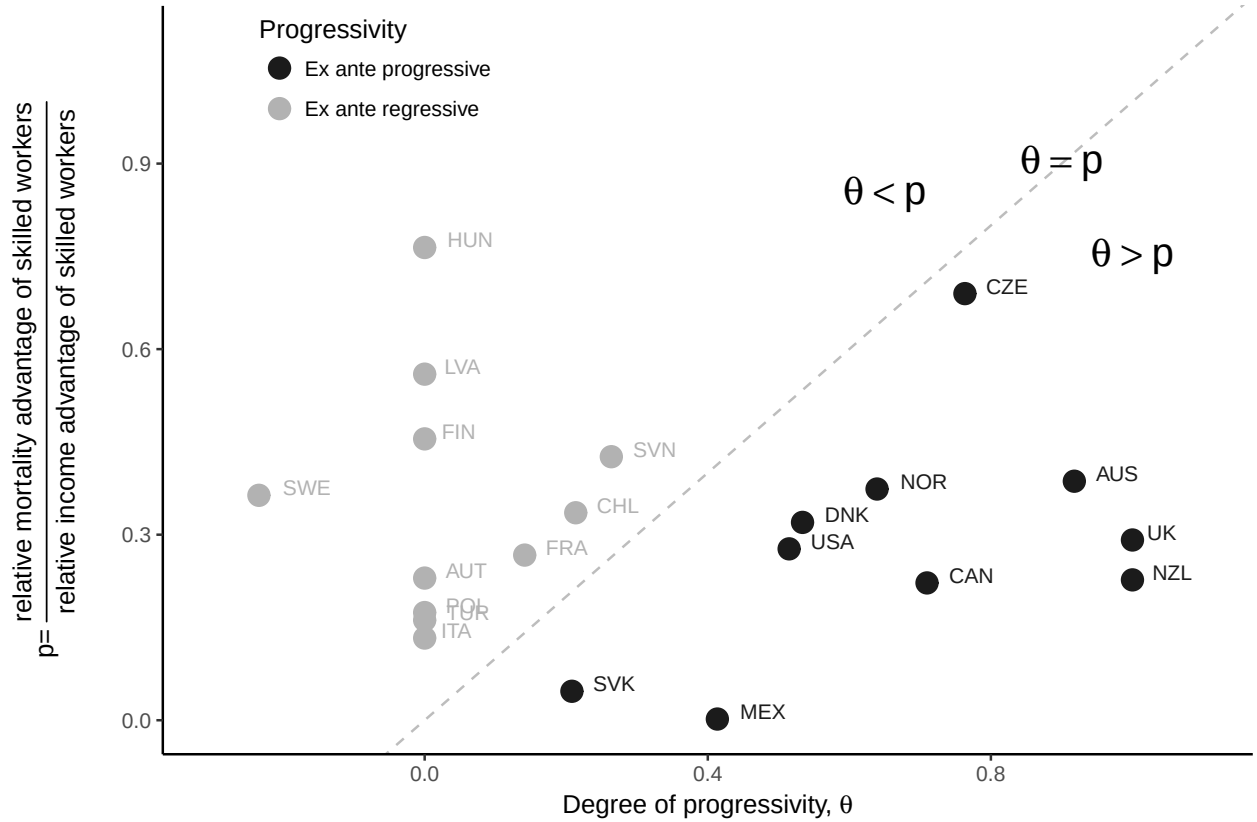

Figure 7: Empirical values of $p = \varepsilon(e_s)/\alpha(e_s)$ and θ for 21 selected OECD countries

Source: Values obtained combining information on (men) relative earnings by educational attainment from OECD (2017) for years 2012–2015, gross pension replacement rates from mandatory pension schemes (public and private) by percentage of individual earnings from OECD(2017b), and on (men) life expectancy at age 65 by educational attainment from Murtin et al. (2017) and authors' calculations for USA combining death records with census data for the year 2015. *Notes*: Calculations done assuming that unskilled workers are comprised of individuals with "below upper secondary education" and skilled workers are formed by individuals with "tertiary education". All data values are based on period information, which may bias the value of p downwards.

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

$$\frac{-\partial q}{\partial \psi} = g(\bar{\phi}) u'(c^*(e_s)) y(e_s) \left[\frac{-\partial \Delta_\tau}{\partial \psi} + (\Phi - 1) \frac{-\partial \tau_E(e_u)}{\partial \psi} \right], \tag{13}$$

with $\Phi = \frac{u'(c^*(e_u)) y(e_u)}{u'(c^*(e_s)) y(e_s)}$ as the ratio of the marginal utility of work between unskilled and skilled workers.

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with $\Phi = \frac{u'(c^*(e_u))y(e_u)}{u'(c^*(e_s))y(e_s)}$ as the ratio of the marginal utility of work between unskilled and skilled workers.

$(\Phi - 1)\frac{-\partial \tau_E(e_u)}{\partial \psi}$: represents the income/substitution effect caused by the increase in disposable income during the working period

income effect: individuals use the increase in disposable income to avoid the effort of attending school

substitution effect: since a fall in ψ reduces the effective tax rate and hence raises the disposable income, it becomes more attractive to become a skilled worker

- $\Phi = 1$: substitution effect $=$ income effect
- $\Phi > 1$: income effect dominates
- $\Phi < 1$: substitution effect dominates

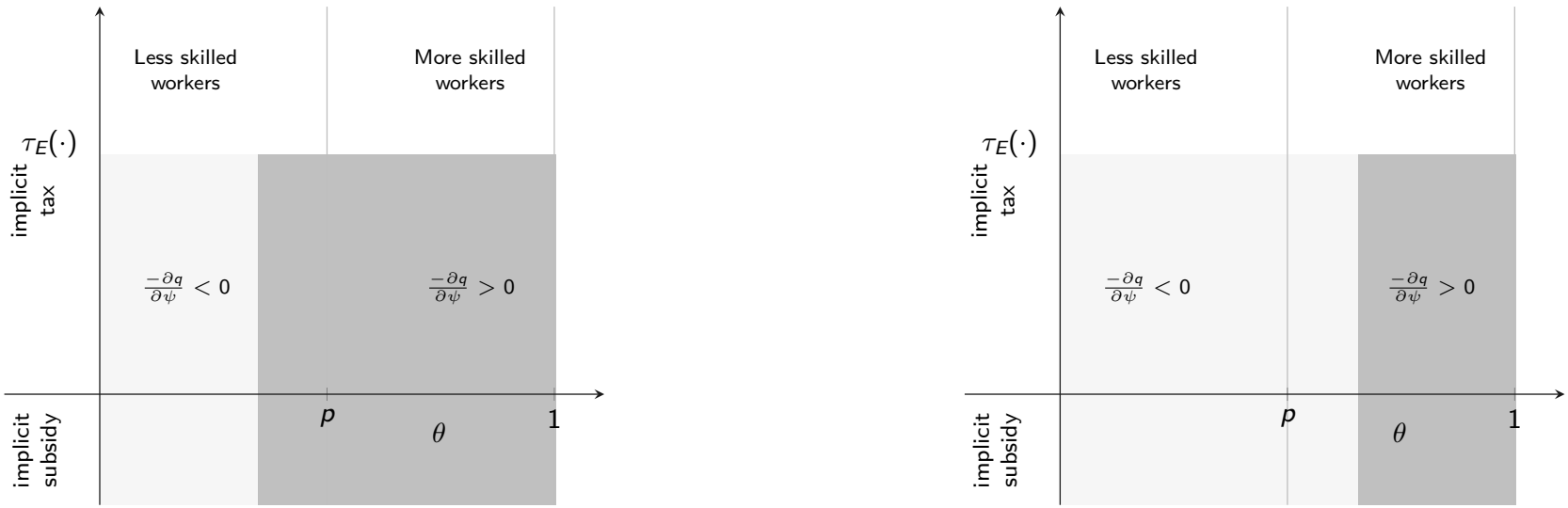
Impact of reducing the pension replacement rate on education

$\Phi = 1$:

- $\theta < p$: a decrease in the replacement rate makes the pension system less regressive and hence less individuals will invest in education (since the unskilled are now better off)

- $\theta > p$: a decrease in the replacement rate makes the pension system less progressive and hence more individuals will have an incentive to become skilled (since the skilled are now better off)

Impact of reducing the pension replacement rate on education

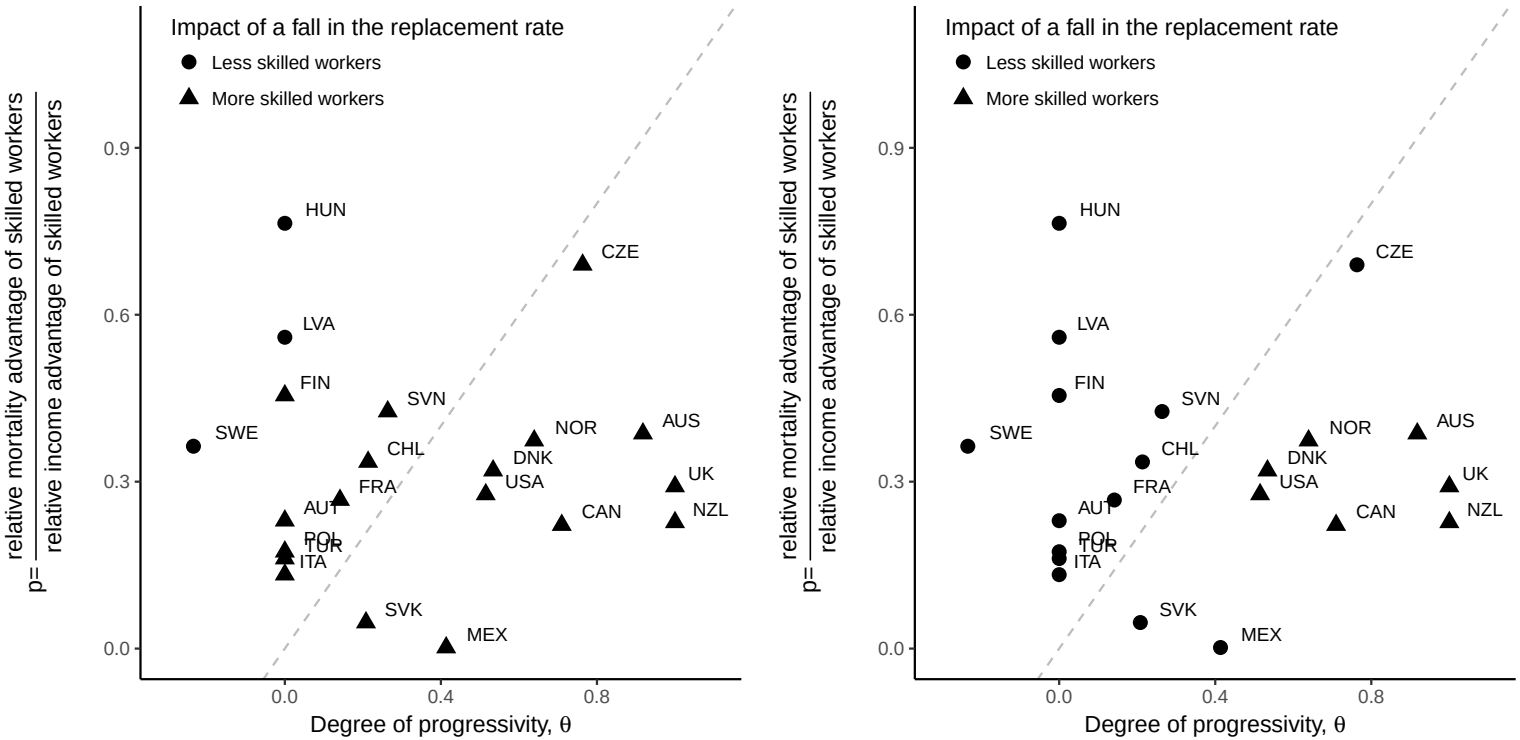


(a) Case: $\Phi < 1$ (*Substitution effect*)

(b) Case: $\Phi > 1$ (*Income effect*)

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

Impact of reducing the pension replacement rate on education

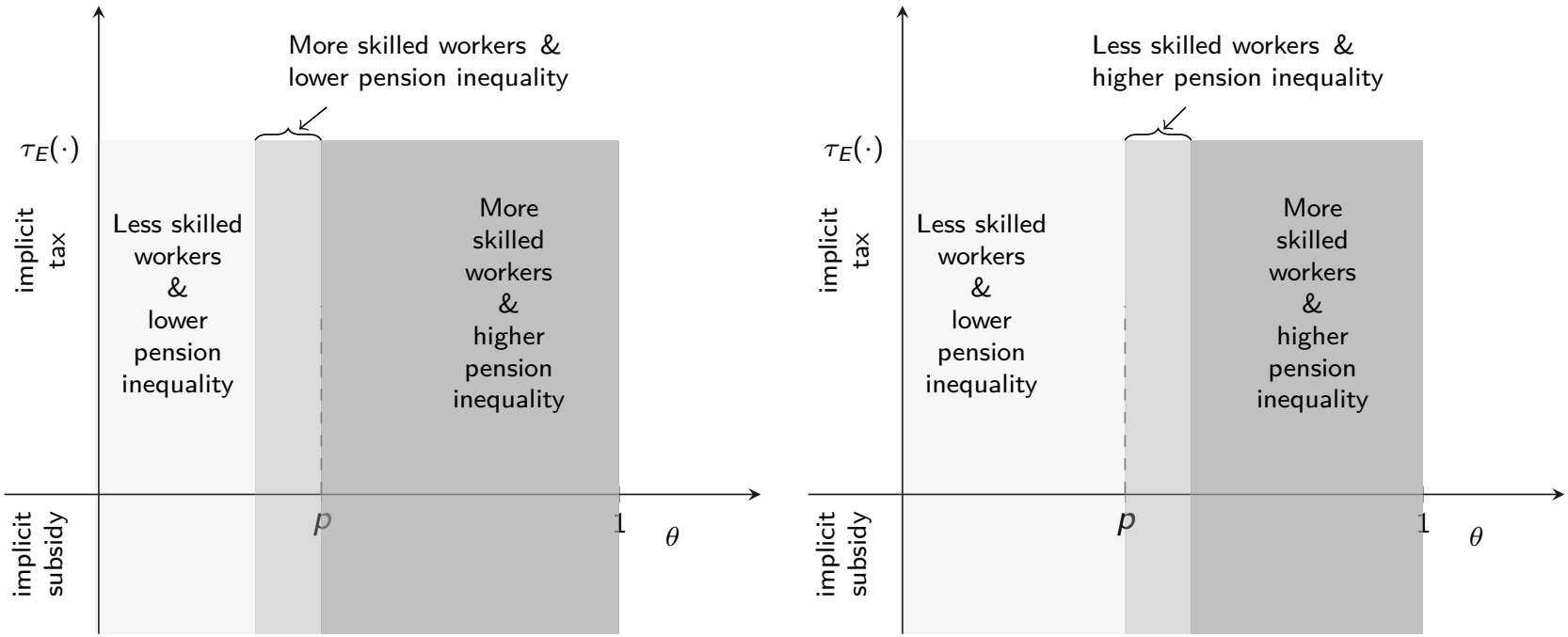


(a) Relative risk aversion $= 0.5 \Rightarrow \Phi < 1$ (b) Relative risk aversion $= 1.5 \Rightarrow \Phi > 1$

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

Source: The information collected in Fig. 7 is complemented with the share of total labor income earned by skilled workers. This additional variable is calculated combining information on the share of men aged 55–64 by educational attainment with the relative earnings of men aged 55–64 by educational attainment from OECD (2017a). 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 the 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)

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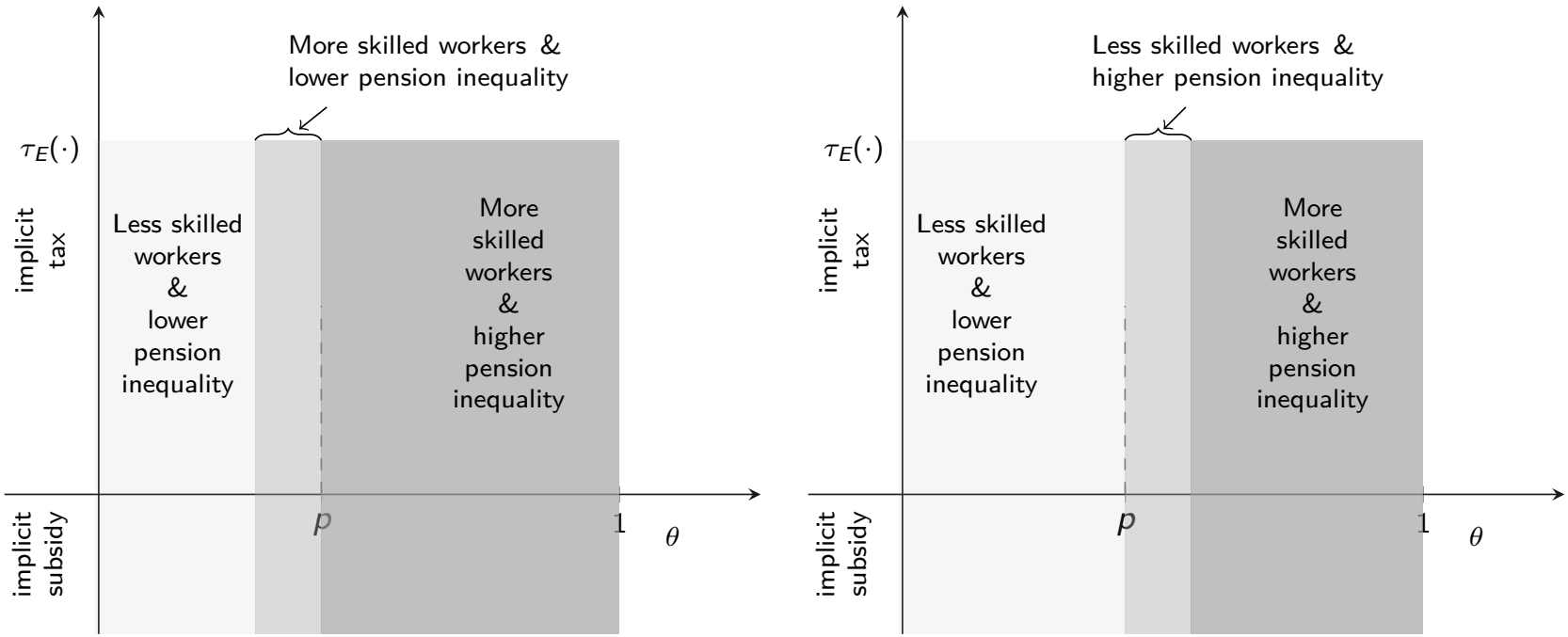

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- If we pursue avoiding pension inequality, then a reduction in the generosity of the pension system will lead to an ambiguous result on the number of skilled workers

The combined effect of a reduction in the pension generosity

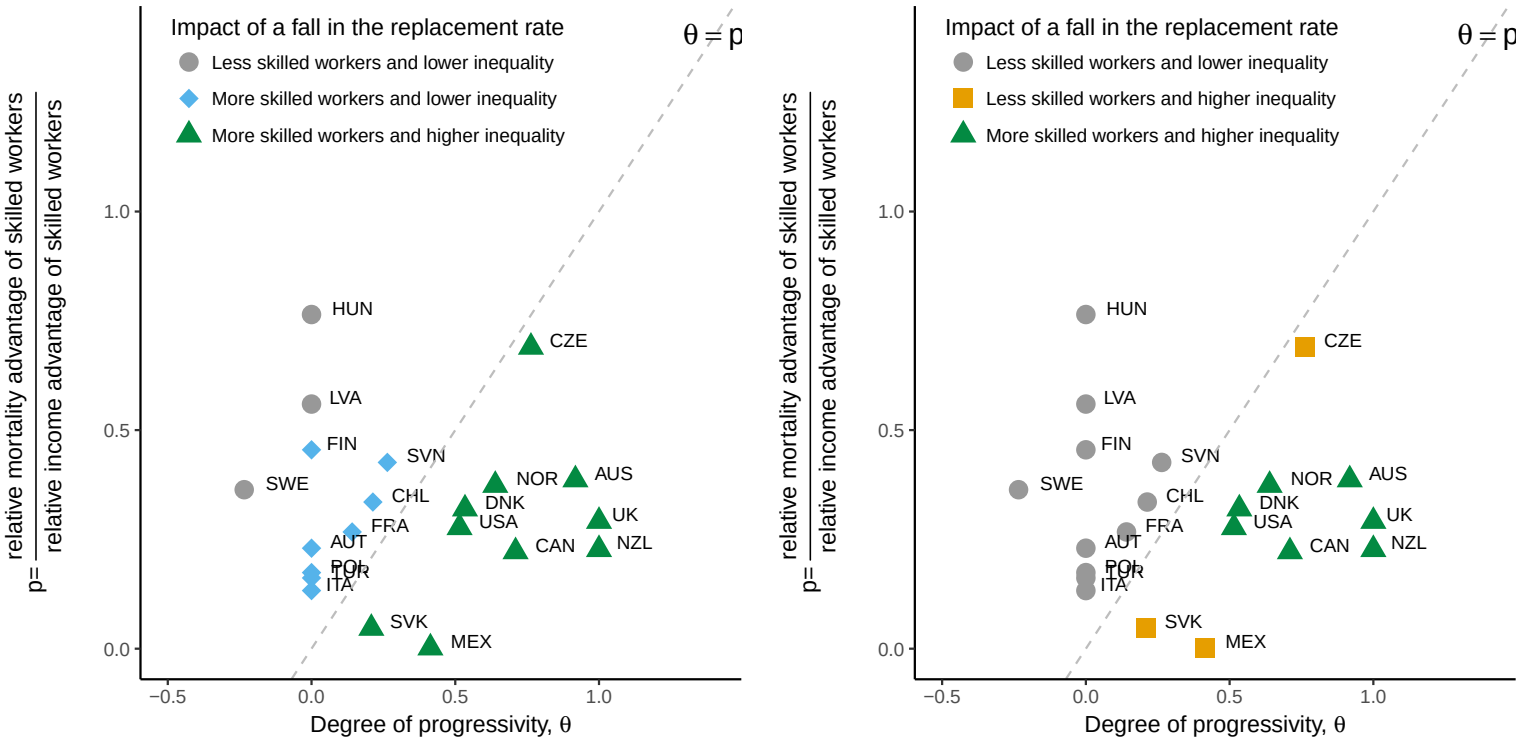

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Figure 11: Impact of a reduction in the replacement rate (ψ) on the proportion of skilled workers (q) and on pension inequality (Δ_τ) by degree of progressivity of the pension system (θ) in 21 selected OECD countries

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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Thank you!

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US OASI pension system (DB-II)

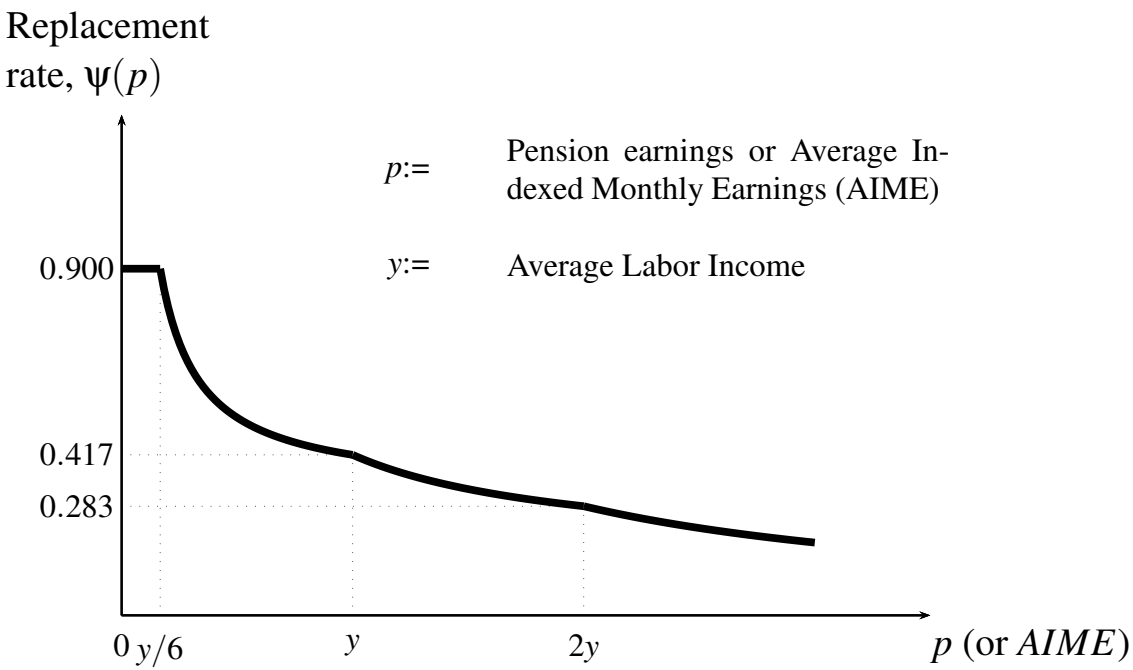

Figure 12: Old-Age Insurance replacement rate in the US

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

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