Macroeconomic and welfare implications of different pension benefit arrangements

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The link between pension contributions and pension benefits in pay-as-you-go (PAYG) systems

The focus of the paper is the link between pension contributions and pension benefits:

- this has important macroeconomic and welfare implications
- this is the main determinant of pension benefit progressivity (ratio between pension benefit and life-time earnings decreases with earnings).

Examples:

- Flat benefit (FL) systems: pension contributions are proportional to earnings, but benefits do not depend on life-time earnings → high progressivity: UK, Netherlands
- Notional Defined Contribution (NDC) and points pension systems: perfect link between life-time earnings and pension benefits → zero progressivity: Italy, Germany, Sweden, Romania, Poland

Research question

Can a reform of the pension system towards no progressivity of benefits be welfare improving?

Pensions systems with *no progressivity* (eg. NDC system):

- distort labor supply less, so individuals will work longer

but

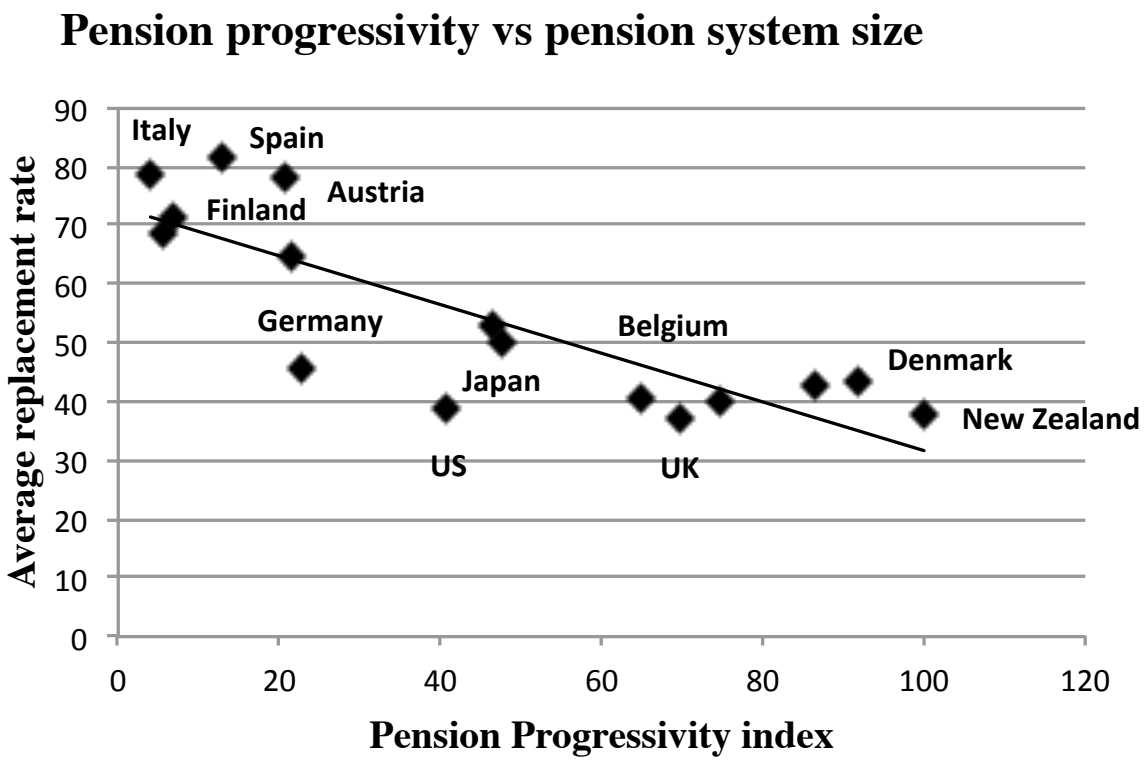
- offer no insurance against idiosyncratic earnings shocks, so consumption inequality will be higher
- decrease agents' savings and hence capital available in the economy - this lowers welfare in a dynamically efficient economy in general equilibrium

Stylized facts (1)

Pension reforms of the past 20 years involved most of the times changes in pension benefit progressivity:

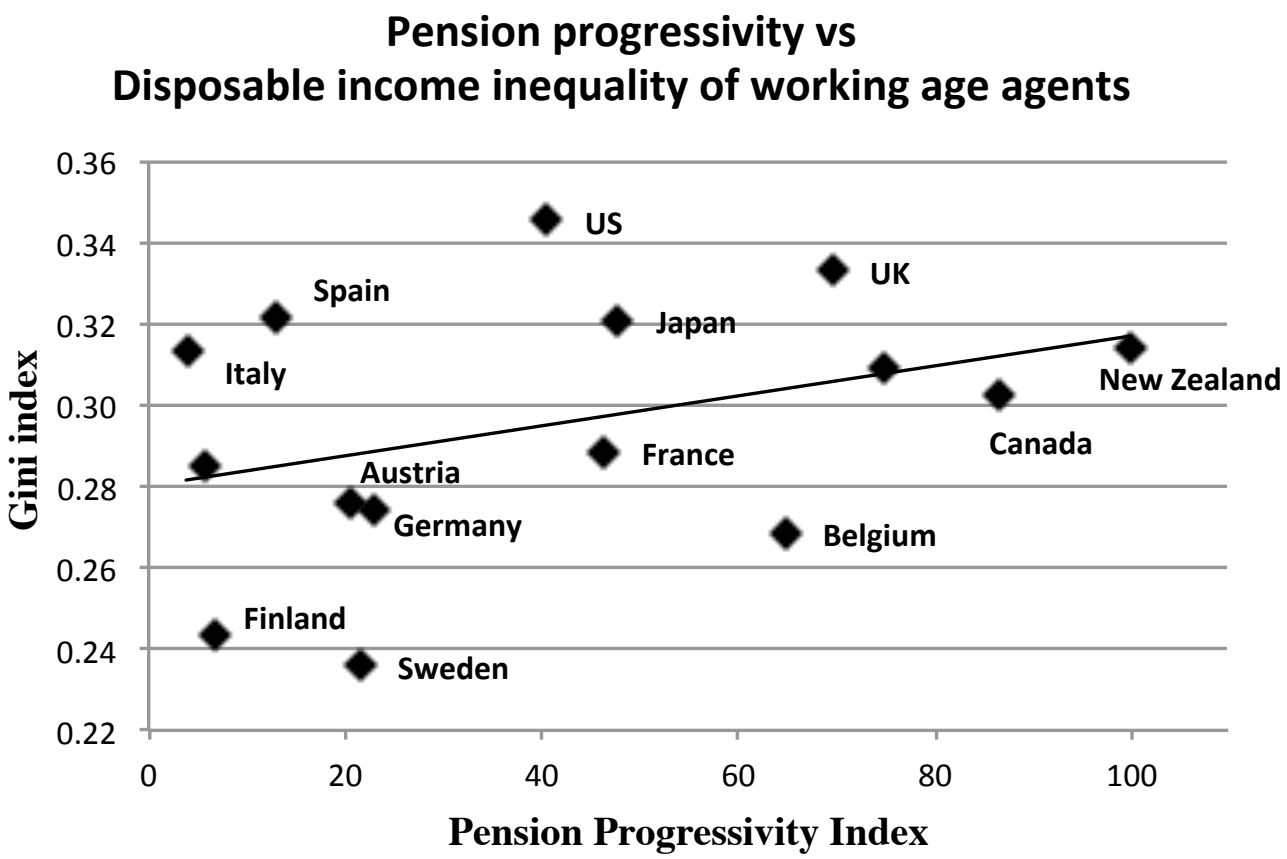
- countries like Italy, Sweden, Germany, Poland, Romania switched to points or NDC systems in order to improve labor supply incentives of agents;
- countries like UK eliminated the earnings related part of their pension, keeping only the flat benefit part.

Stylized facts (2)



- Pension progressivity is **negatively** related with the size of the pension system.

Stylized facts (3)



- Pension progressivity is **positively** related with income inequality among working age agents.

Preview of results

We focus on two extreme types of pension benefit arrangements:

- a Notional Defined Contribution (NDC) system - zero progressivity;
- a flat benefit (FL) system - high progressivity.

If we abstract from general equilibrium effects:

- the NDC system brings a higher welfare than the FL system only when the pension system is large: welfare gains from low labor supply distortions dominate the welfare losses from less insurance against idiosyncratic earnings shocks.

In general equilibrium, as long as the capital is below its first best level, FL pensions provide higher welfare at all levels of pension contributions because they promote higher savings (capital).

Model (1)

Infinite horizon model with two overlapping generations: young (y) and old (o) agents

Preferences: $\theta ln(c^y) + \beta E(\theta ln(c^o) + (1-\theta)ln(1-l^o))$

Young agents are homogeneous, supply labor inelastically, consume and save.

$$c^y + a = w\bar{z}(1-\tau)$$

Old agents are hit by idiosyncratic earnings shocks: $z \sim F(\bar{z}, \sigma)$.

$$c^o(z) = a(1+r) + wzl(z)(1-\tau) + b(z)$$

Agents cannot insure against shocks in any other way than saving (incomplete markets).

Model (2)

Endogeneous labor supply of old agents: labor supply differs across agents due to their earnings shocks.

PAYG pension system: both young and old agents pay contributions (τ); old agents receive benefits ($b(z)$); system balances in the steady state.

Pension benefits:

- constant across agents in a FL system

$$b(z) = b \tag{1}$$

- depends on previous earnings in NDC system

$$b(z) = w\bar{z}\tau(1 + r^P) + wzl(z)\tau \tag{2}$$

Technology: $F(K, L) = AK^{\alpha}L^{1-\alpha}$

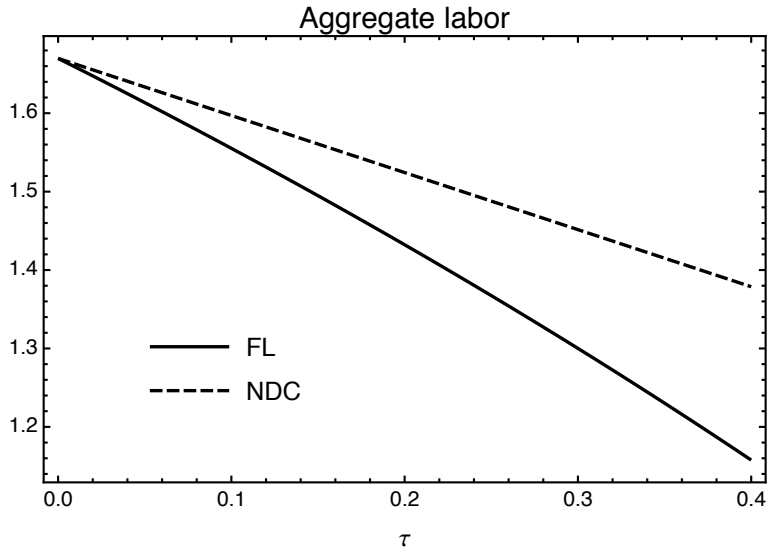
We focus on the steady state of the model under the two types of benefit arrangements.

Labor supply

The NDC pension system promotes higher labor supply l than the FL system, i.e. $l^{NDC} > l^{FL}$:

- NDC system does not distort the intratemporal leisure - consumption decision of old agents

Figure 1: Labor supply



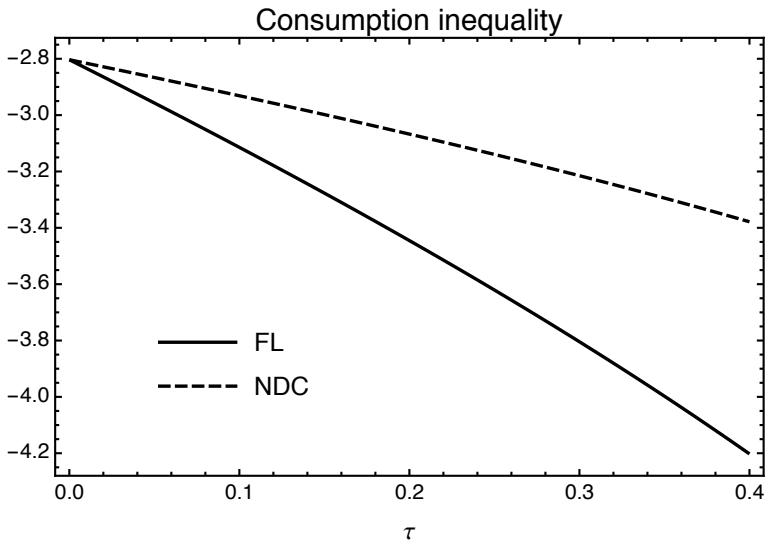
Calibration Labor supply distortions

Consumption inequality

The NDC system leads to higher consumption inequality than the FL system:

- benefits are perfectly linked to life-time contributions, so the NDC system does not insure against earnings shocks.

Figure 2: Consumption inequality

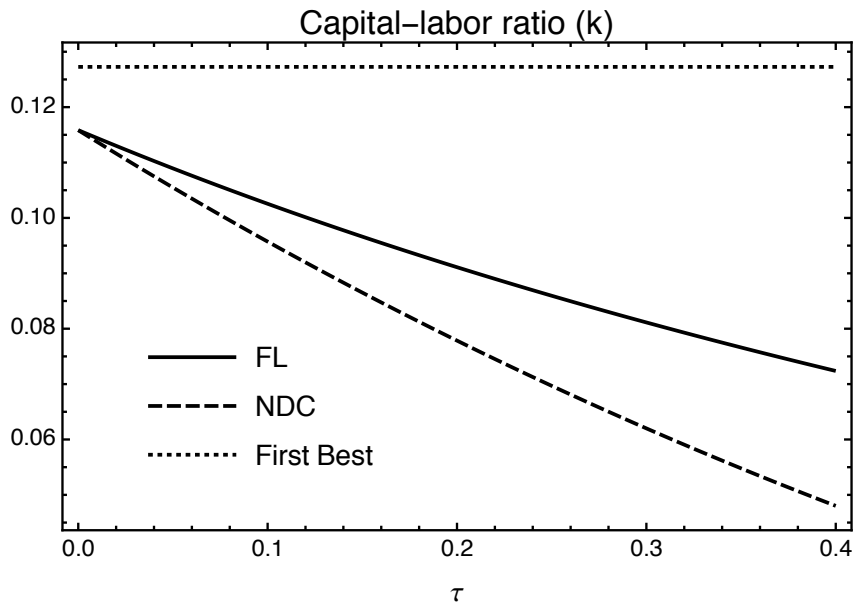


Savings

The NDC system crowds out capital formation more than the FL pension system, i.e. $k^{NDC} < k^{FL}$. Two opposing effects:

- because old agents work more, they need to save less when young;
- people make higher precautionary savings because the pension system offers no insurance;
- first effect dominates the second effect around $\sigma = 0$.

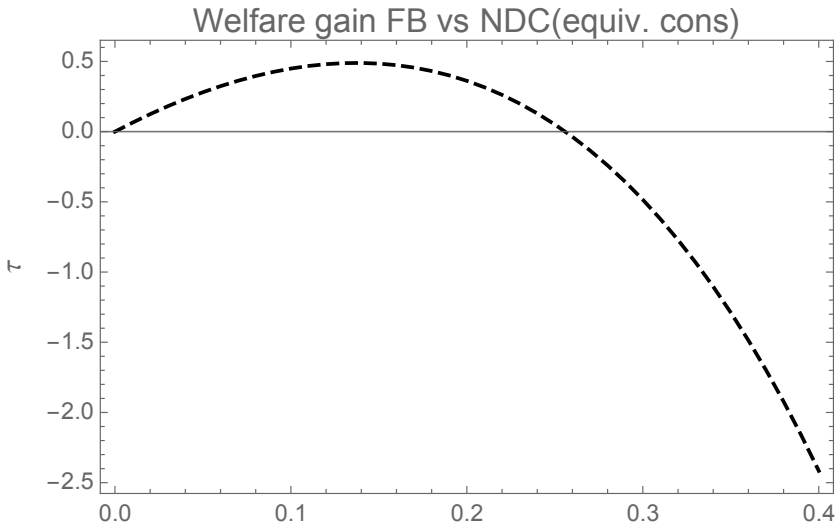
Figure 3: Capital to labor ratio



Welfare comparison in partial equilibrium

If changes in pension contribution do not affect prices (wages and return on capital), i.e. small open economy:

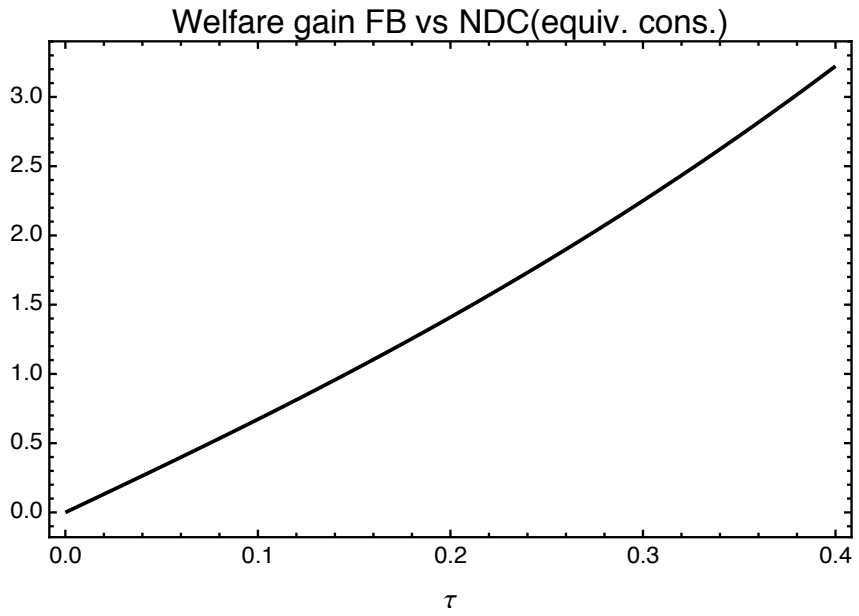
- FL system brings a higher welfare at low levels of pension contributions (τ): welfare gains from insurance dominate welfare losses from labor supply distortions;
- labor supply distortions increase quadratically in τ and welfare gains from insurance reach a peak after which they decline: the NDC pension system brings a higher welfare at high levels of τ.



Welfare comparison in general equilibrium

If changes in pension contribution affect prices (wages and return on capital), the FL system brings a higher welfare at all levels of τ:

- FL system crowds out capital less than the NDC system;
- if capital is below its first best level (economy is dynamically efficient in the sense of Cass (1972)), the system that crowds out capital less brings a higher welfare through general equilibrium effects.



Policy implications

Pension reforms involving changes in progressivity can be substantiated from a welfare point of view:

- large pension systems like the ones in Italy, Germany, Sweden, Romania and Poland transited towards low progressivity;
- small pension systems like the one in UK transited towards higher progressivity.

However, pure NDC systems cannot be optimal in general equilibrium:

- they do not provide any insurance against earnings shocks;
- they may promote lower savings than pension systems with some progressivity - welfare decreasing in general equilibrium.

Thank you!

Extra Slides: Calibration

With *log* utility, the model can be solved analytically. Implications for macroeconomic variables and welfare can be mathematically shown.

For illustrative purposes we use the following calibration:

Parameter	Description	Calibrated value
$\bar{z}$	Mean of earnings risk	1
σ^2	Variance of earnings risk	0.014 per year
β	Time preference	0.99 per year
θ	Consumption share in utility	0.42
α	Capital share in production	0.3
n	Population growth rate	0.8% per year

The idiosyncratic earnings risk:

$$z \sim logN(\bar{z}, \sigma^2)$$

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Extra Slides: First order conditions

FL system:

$$\frac{-u_l(c^o_{t+1}(z), l^o_{t+1}(z))}{u_c(c^o_{t+1}(z), l^o_{t+1}(z))} = w_{t+1} z (1 - \tau_{t+1}) \tag{3}$$

NDC system:

$$\frac{-u_l(c^o_{t+1}(z), l^o_{t+1}(z))}{u_c(c^o_{t+1}(z), l^o_{t+1}(z))} = w_{t+1} z \tag{4}$$

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