

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

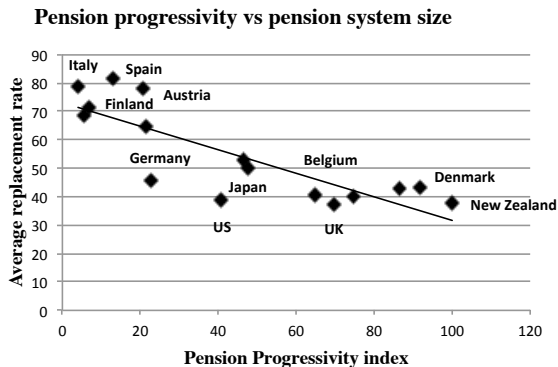
- ▶ offer no insurance against idiosyncratic earnings shocks, so **consumption inequality** will be higher
- ▶ decrease agents' **savings** and hence capital available in the economy - this lowers welfare in a dynamically efficient economy in general equilibrium

Stylized facts (1)

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

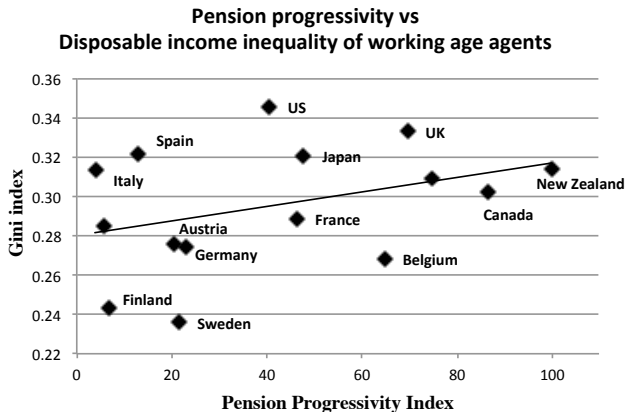
- ▶ countries like Italy, Sweden, Germany, Poland, Romania switched to points or NDC systems in order to improve labor supply incentives of agents;
- ▶ countries like UK eliminated the earnings related part of their pension, keeping only the flat benefit part.

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

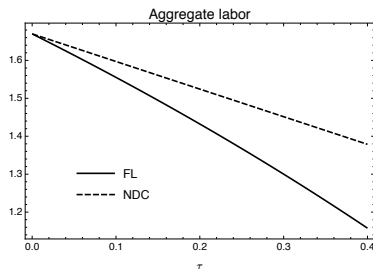
We focus on the **steady state** of the model under the two types of benefit arrangements.

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

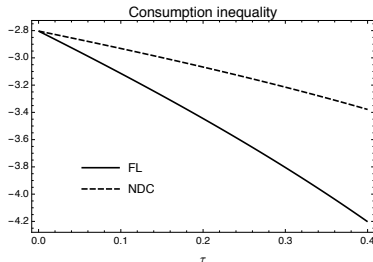


Consumption inequality

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

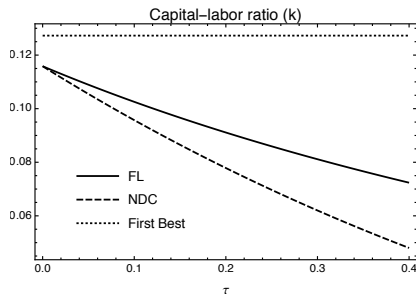


Savings

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 $\sigma = 0$.

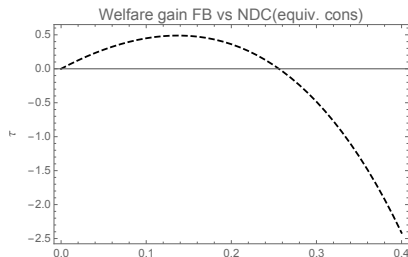
Figure 3: Capital to labor ratio



Welfare comparison in partial equilibrium

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

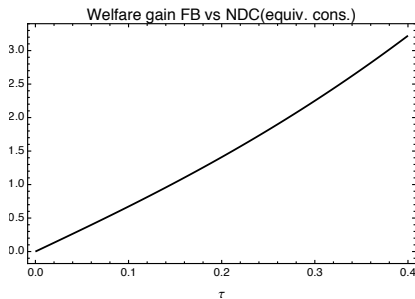
- ▶ FL system brings a **higher welfare at low levels of pension contributions (τ)**: welfare gains from insurance dominate welfare losses from labor supply distortions;
- ▶ labor supply distortions increase quadratically in τ and welfare gains from insurance reach a peak after which they decline: the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

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

Extra Slides: First order conditions

FL system:

$$\frac{-u_l(c_{t+1}^o(z), l_{t+1}^o(z))}{u_c(c_{t+1}^o(z), l_{t+1}^o(z))} = w_{t+1}z(1 - \tau_{t+1}) \quad (3)$$

NDC system:

$$\frac{-u_l(c_{t+1}^o(z), l_{t+1}^o(z))}{u_c(c_{t+1}^o(z), l_{t+1}^o(z))} = w_{t+1}z \quad (4)$$

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