Macroeconomic and welfare implications of different pension benefit arrangements

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Pension benefit arrangements

Focus of the paper: the link between pension contributions and pension benefits in pay-as-you-go (PAYG) pension systems

Examples:

- Flat benefit (FL) systems: pension contributions are proportional to earnings, but benefits are constant across agents: UK, Netherlands
- Notional Defined Contribution (NDC) and points pension systems: one-to-one relation between life-time earnings and pension benefits: very popular in the past 25 years, implemented in Italy, Germany, Sweden, many eastern European countries

This paper

- points out the trade-off among labor supply distortions, insurance against idiosyncratic earning shocks and capital crowding out arising in the arrangement of pension benefits
- shows how this trade-off impacts on welfare (*ex-ante* utility of agents)

Compared to flat benefit systems, NDC pensions systems:

- distort labor supply less, so individuals work more hours and longer - *higher welfare*

but

- offer no insurance against idiosyncratic earnings shocks, so consumption inequality is higher - *lower welfare*
- reduce the capital to labor ratio - *lower welfare* in a dynamically efficient economy in general equilibrium

Stylized facts

Contrasting pension reforms implemented in the past 25 years:

- Some pension systems switched to a NDC or points system (Italy, Sweden, Germany, eastern European countries):
  - main aim was to restore labor supply incentives of agents close to retirement
  - pension systems with large contributions
- Some pension systems switched to a FL system (UK)
  - pension system with no separate contribution

Preview of results

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 and
- the size of the idiosyncratic risk is low.

General equilibrium effects:

- favor the FL pension system;
- have a sizable impact on the relative welfare: *in an economy with no idiosyncratic shocks*, the NDC pension system brings a higher welfare than the FL pension system only for contribution rates above 10%.

Related literature

- Nishiyama and Smetters (2007) - a 50% privatization of the US pension system is welfare improving only if it is accompanied by an increase in the progressivity of pension benefits (more insurance against idiosyncratic productivity shocks)
- Huggett and Parra (2010) - the optimal pension benefit function for the US entails more progressivity than the one currently in place
- Fehr and Habermann (2008) and Fehr et al. (2013) - reforming the German pension benefit system towards more progressivity (combination of flat benefit and points system) is welfare improving

The intuition in a stylized model (1)

- T=2 overlapping generations - *young* and *old*
- *young agents*: are homogeneous, supply labor inelastically, choose how much to consume and save;
- *old agents* are hit by an idiosyncratic earnings shocks at the beginning of the period, choose how much to work.

Closed form solution of the model indicates that, compared to a FL system, under the NDC system:

- labor supply is higher - no distortions on labor supply
- consumption inequality is higher - no insurance against idiosyncratic shocks
- capital to labor ratio is lower as long as the level of idiosyncratic risk is not very high

The intuition in a stylized model (2)

Why is the capital to labor ratio (k) lower under the NDC pension system?

- labor supply is higher due to lack of distortions - lower k
- agents work more when they are old so they need to make lower savings when young in order to achieve the same consumption level when old - lower k
- agents make more precautionary savings than under the FL system because the NDC system offers no insurance - higher k

First two effects dominate the third as long as the size of idiosyncratic risk is not too high.

The intuition in a stylized model (3)

In a partial equilibrium framework, the FL pension system brings a higher welfare at low levels of pension contributions.

Figure 1: Partial equilibrium

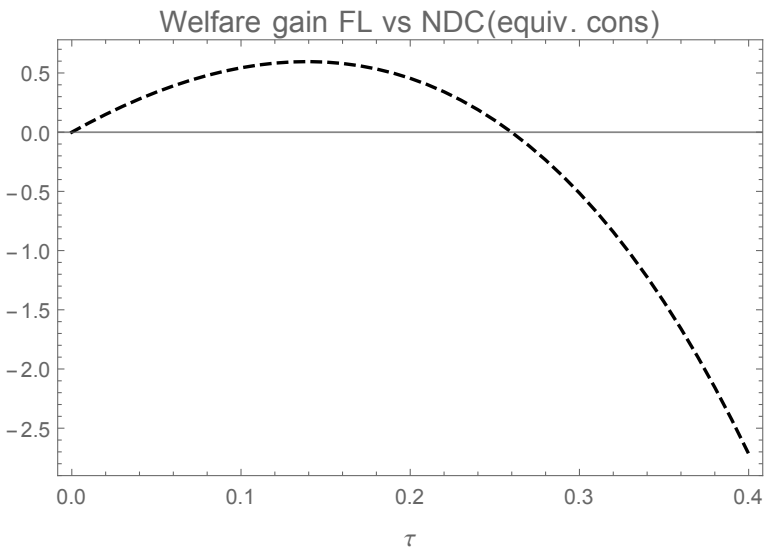
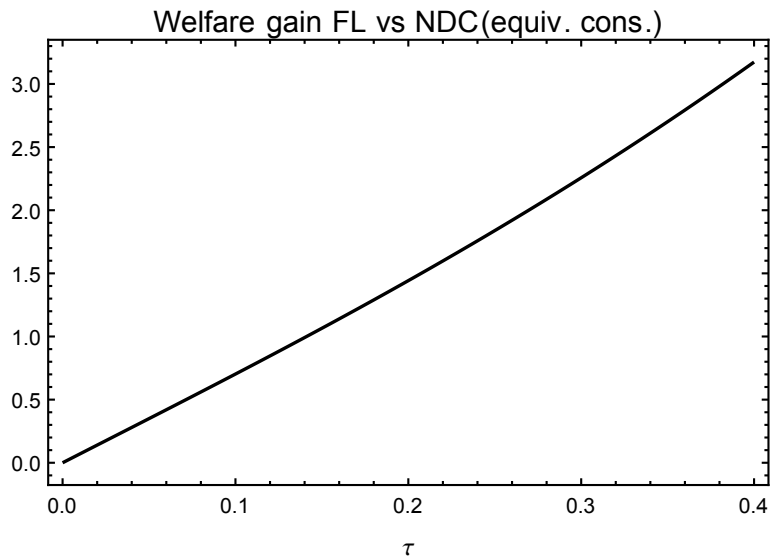


Figure 2: General equilibrium



General equilibrium effects favor FL systems.

Large scale model (1)

Population:

- 80 overlapping generations, agents start working at 20, live until at most 100 years
- probability to survive from age j to $j+1$ is s_{j+1}
- population grows at rate n

Households of age j maximize expected utility:

$$V(x) = \max_{c,l,a'} u(c,l) + \beta s_{j+1} V(x')$$
$$c(1+\tau_c) + a' = a(1 + r(1-\tau_k)) + y(x)$$

where $x = (j, z, pa, a)$ is the state of the agent, z is a persistent idiosyncratic earnings shock, pa is pension assets, a is savings in capital, $y(x)$ is the net labor income, τ_c is the consumption tax and τ_k is the tax on the return on capital.

Large scale model (2)

Environment:

- markets are incomplete - agents can only self-insure
- assume tight borrowing constraint, i.e. $a \geq 0$

Preferences:

$$u(c,l) = \frac{\left(c^{\eta}(1-l-\theta_P P)^{1-\eta}\right)^{1-\sigma}}{1-\sigma} \tag{1}$$

- disutility from participating to the labor market increasing with age θ_P: $P = 1$ if $l > 0$

Large scale model (3)

Net labor income:

$$y(x) = wl(x)k_j z_j(1 - \tau - \tau_l) + TL$$
$$logz_j = \rho logz_{j-1} + \epsilon_j, \epsilon_j \sim N(0, \sigma_\epsilon^2)$$

where w is the average wage, z_j is the idiosyncratic earnings shock, k_j is a deterministic age-specific part of the productivity process, τ_l is the tax on labor income, τ is the social security contribution rate and TL is a lump sum transfer.

Large scale model (4)

Government:

- revenues: labor income tax ($\tau_l l$), consumption taxes ($\tau_c C$), tax on the return on capital ($\tau_k r K$), accidental bequests (Bq)
- expenditures: wasteful government spending (G), lump sum transfers (TL)
- budget balanced by lump sum transfers

$$\tau_l l + \tau_c C + \tau_k r K + Bq = G + TL \tag{2}$$

Large scale model (5)

Pension system:

- contribution rate τ
- benefits modeled according to 3 different systems:
  1. US system: earnings related system with progressive replacement rates:
  $$b(j, z, a, pa) = rep(pa)pa$$
  2. Flat benefit (FL):
  $$b(j, z, a, pa) = b$$
  3. NDC:
  $$b(j, z, a, pa) = pa/sp \tag{3}$$

  where sp represents the expected survival period (in years) at retirement, rep is the replacement ratio (depends on life-time earnings in the US system)

Large scale model (6)

Pension system:

- system balances in the steady state
- pensions are paid starting with the early retirement age of 62.

Pension assets:

1. US system: average of life-time earnings
   $pa(j) = (pa(j-1) + wlz)/j$
2. FL system: no pension assets
3. NDC system: contributions are accrued at rate $rp = n$
   $pa(j) = pa(j-1)(1+rp) + \tau wlz$

Calibration (1)

Param.	Description	Value	
α	Capital share in output	0.35	
ρ	Autoregressivity of earnings process	0.97	
σ_ϵ^2	Variance of earnings process	0.02	
G/Y	Government expenditure to GDP	0.18	
τ_c	Consumption tax	0.05	
τ_k	Return on capital tax	0.36	
τ_l	Labor income tax	0.17	
Param.	Description	Value	Target
δ	Depreciation rate	0.06	I/Y=0.21
β	Time preference	0.998	K/Y=3
σ		4	$\sigma_c = 2$
η	Consumption share	0.55	Hours worked across lifecycle
$\theta_P(j)$	Disutility of labor participation	$0.1 + 0.2j^2$	Participation rate across lifecycle
τ	Contribution to PAYG pensions	0.108	Balanced budget

Calibration (2)

Labor force participation and hours worked: match the lifecycle profile from the data (March CPS 1962-2016, men, not self-employed and with completed high-school)

Figure 3: Participation rate

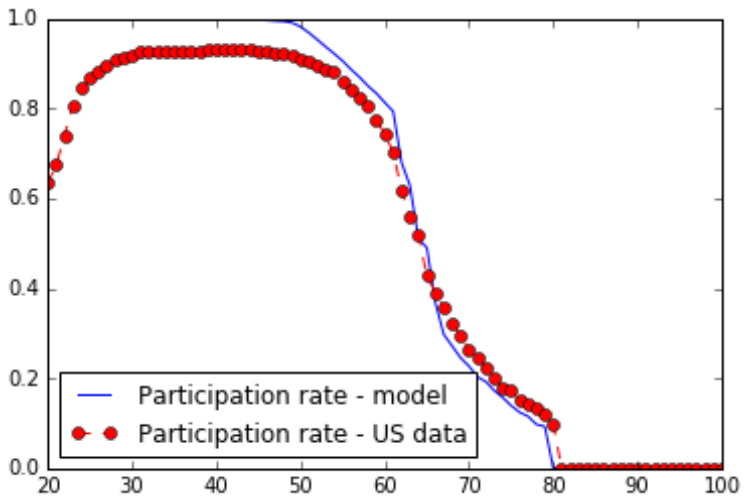
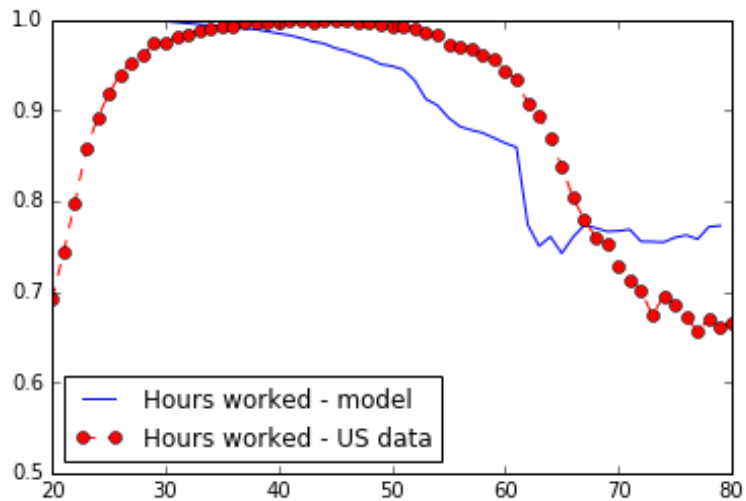


Figure 4: Hours worked



Results (1)

Figure 5: Participation rate

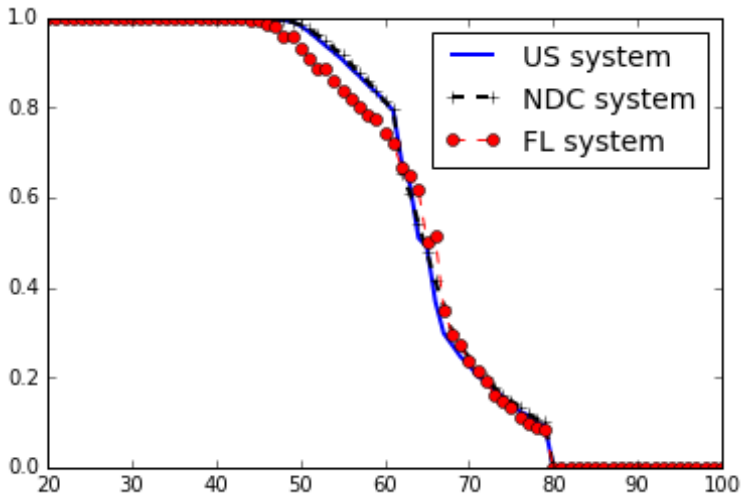
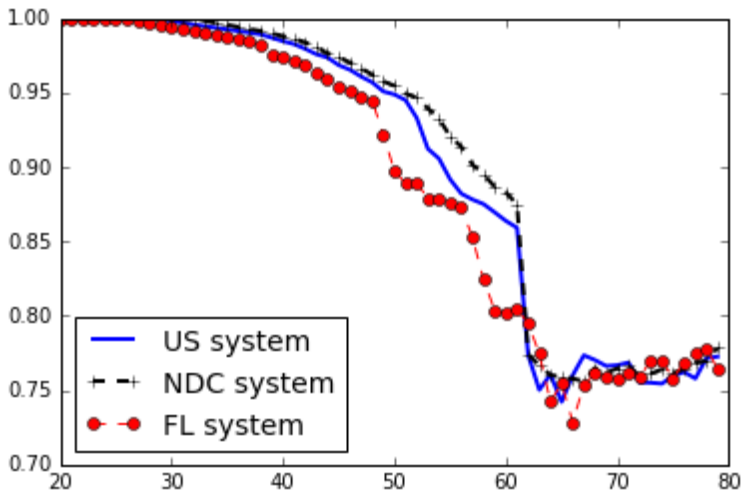
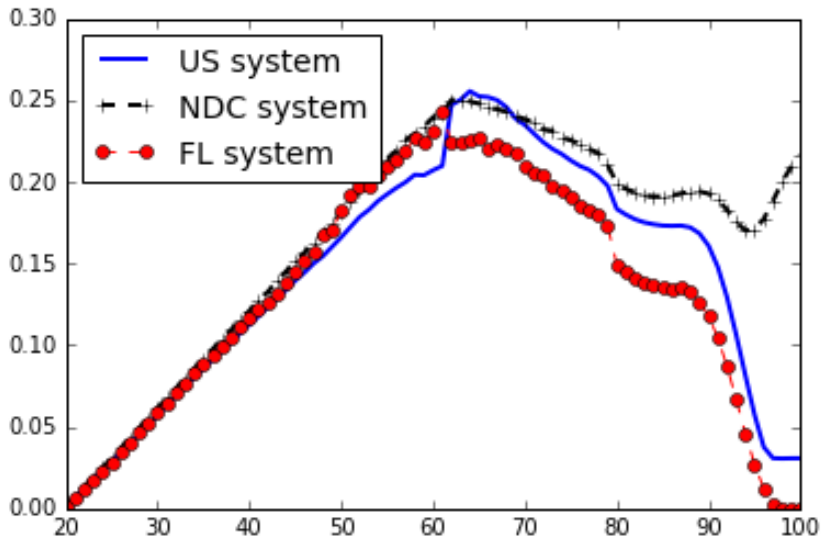


Figure 6: Hours worked



Results (2)

Figure 7: Consumption inequality



Results (3)

	Benchmark (US system)	NDC	FL
Interest rate	5.7%	5.6%	5.5%
Capital per labor	-	0.9%	1.2%
Labor	-	0.4%	-1.3%
Welfare - consumption eq.	-	0.9%	-1.4%

The results obtained with the small model hold. Compared to the FL pension system, the NDC system promotes:

- higher labor supply
- higher consumption inequality
- lower savings

Overall, the NDC system brings a lower welfare than both the US and FL system.

Results (4)

An economy with no idiosyncratic shocks: general equilibrium effects ensure that the FL system brings a higher welfare for contribution rates below 10%.

Contribution rate	1%	5%	8%	10%
Consumption equivalent FL vs NDC	-0.3	-0.23	-0.2	0.05

Conclusions

The arrangement of pension benefits involves a trade-off among labor supply distortions, insurance against idiosyncratic earnings shocks and capital crowding out.

The NDC system brings a higher welfare than the FL system when:

- the pension system is large
- the size of the idiosyncratic risk is low.

General equilibrium effects:

- favor the FL pension system;
- have a sizable impact on the relative welfare of the two pension systems $\rightarrow$ the FL system can bring a higher welfare than the NDC system even in the absence of idiosyncratic earnings shocks.

Thank you!