Inequality in an OLG economy with heterogeneous cohorts and pension systems

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Motivation

- Wealth inequality increases due to:
  - Demographic transition
  - Pension reform: defined benefit $\rightarrow$ defined contribution
- Effects for consumption inequality: unclear

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- Can policy instruments help?
  - minimum pensions: $\uparrow$ pensions; $\downarrow$ labor supply incentives
  - contribution caps : obligatory savings replaced with private savings
- Intuition insufficient

Literature review

- Distributional effects of pension systems: OLG models with *ex post* heterogeneity:
  - Castaneda et al. (2003, JPE); Fehr et al. (2008, RED); Song (2011, RED); Bucciol (2011, MD); Cremer and Pestieau (2011, EER); Kumru and Thanopoulos (2011, JPubE); Fehr and Uhde (2014, EM); St-Amant and Garon (2014, ITPF)

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- *Ex ante* + *ex post* heterogeneity: education affects mortality rates
  - Hairault and Langot (2008, JEDC):
  - McGrattan and Prescott (2013, NBER)
  - Kindermann and Krueger (2014, NBER)

Our approach

- Question 1: distributional effects of a pension system reform
- Question 2: are standard instruments effective in reducing the increase in inequality

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Ex ante heterogeneous agents: age + _within cohort_

- endowments + preferences ← not a stand
- separate endowments from preferences
- most countries: no data on mortality by education / income groups

Results preview

- DB $\rightarrow$ DC reform: both wealth and consumption inequalities $\uparrow$

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- Minimum pensions:
  - reduce inequality from the reform by 40-50%
  - work on the endowments margin, but not on preferences
- Effects of the contribution cap: negligible

Outline

Method

- Model
  - Deterministic
  - OLG
  - *ex ante* heterogeneity: endowments + preferences

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  - OLG
  - *ex ante* heterogeneity: endowments + preferences
- Calibrate to Poland in 1999
- Solved by Gauss-Seidel algorithm (iterative convergence on a problem with closed form solution)

Households I

- "Born" at age 20 ($j = 1$) and live up to 100 years ($J = 80$)
- Subject to time and cohort dependent survival probability π
- Belong to a type k:
  - productivity level ω
  - time discounting δ
  - relative leisure preference ϕ
- Choose labor supply l endogenously
- Maximize remaining lifetime utility derived from consumption c and leisure $1 - l$:

$$U_{j,k,t} = \sum_{s=0}^{J-j} \left[\delta_k^s \frac{\pi_{j+s,t+s}}{\pi_{j,t}} \left[c_{j+s,k,t+s}^{\phi_k} \left(1 - l_{j+s,k,t+s}\right)^{1-\phi_k} \right] \right]$$

Households II

- Subject to the budget constraint

$$
\begin{aligned}
(1+\tau_t^c)c_{j,k,t} + s_{j,k,t} = {} & (1-\tau_t^l)(1-\tau)w_t\omega_k l_{j,k,t} && \leftarrow \text{ labor income} \\
& + (1+(1-\tau_t^k)r_t)s_{j-1,k,t-1} && \leftarrow \text{ capital income} \\
& + (1-\tau_t^l)b_{j,k,t} && \leftarrow \text{ pension income} \\
& + beq_{j,k,t} && \leftarrow \text{ bequests} \\
& - \Upsilon_t && \leftarrow \text{ lump-sum tax}
\end{aligned}
$$

- There *exists* a closed-form solution to this problem

Producers

- Perfectly competitive representative firm
- Standard Cobb-Douglas production function

$$Y_t = K_t^{\alpha}(z_t L_t)^{1-\alpha}$$

- Profit maximization implies

$$w_t = z_t(1-\alpha)\hat{k}_t^{\alpha}$$
$$r_t = \alpha \hat{k}_t^{\alpha-1} - d$$

where d is the capital depreciation rate
and $\hat{k}$ is capital per effective unit of labor

Government

- Spends a fixed share of GDP (g) on government consumption
- Collects taxes T
- Closes the gap between pension system contributions and benefits
- Can take on debt D

$$T_t + D_t = (1 + r_t)D_{t-1} + gY_t + subsidy_t$$

We fix debt at constant 45% debt to GDP ratio.
Consumption tax varies to satisfy the government constraint.

Pension System

- Pay As You Go Defined Benefit (PAYG DB)

$$b_{\bar{J},k,t} = \rho \cdot \text{gross wage}_{\bar{J}-1,k,t-1}$$

- Pay As You Go Defined Contribution (PAYG DC)

$$b_{\bar{J},k,t} = \frac{\text{accumulated sum of contributions}_{\bar{J},k,t}}{\text{expected remaining lifetime}_{\bar{J},t}}$$

- Pensions indexed by the rate of annual payroll growth

Instrument 1: minimum pensions

- Definition

$$b_{j,k,t} \geq \rho_{\min} \cdot \text{gross average wage}_t$$

We set $\rho_{\min} = 0.2 \rightarrow$ 4% coverage (consistent with the data)

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- Expectations
  - Directly affects only the left tail of income distribution
  - Increases lifetime incomes of targeted group $\rightarrow$ consumption inequality should decrease
  - Lower incentives to work $\rightarrow$ possible reduction in hours worked
  - Lower incentives for private savings $\rightarrow$ possible increase in consumption

Instrument 2: contribution cap

- Definition:

$$\tau^{\text{eff}}_{j,k,t} = \min\left\{\tau, \frac{\tau_{\text{cap}} \cdot \text{gross average wage}_t}{w_t \omega_k l_{j,k,t}}\right\}$$

To replicate 2% coverage, $\tau_{\text{cap}} = 1.7$ (lower than *de iure* 2.5)

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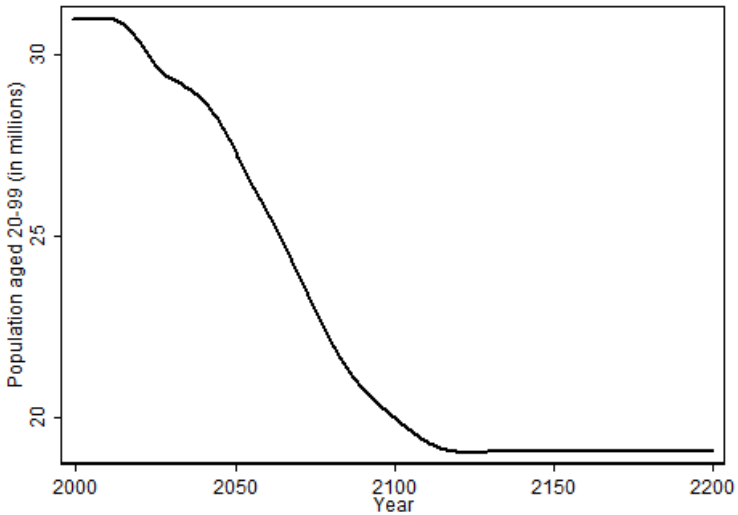
- Expectations
  - Affects directly only the right tail of income distribution
  - Lower contributions of targeted group $\rightarrow$ higher voluntary saving rates $\rightarrow$ wealth inequalities $\uparrow$
  - Matters because market interest rates and social security indexation differ

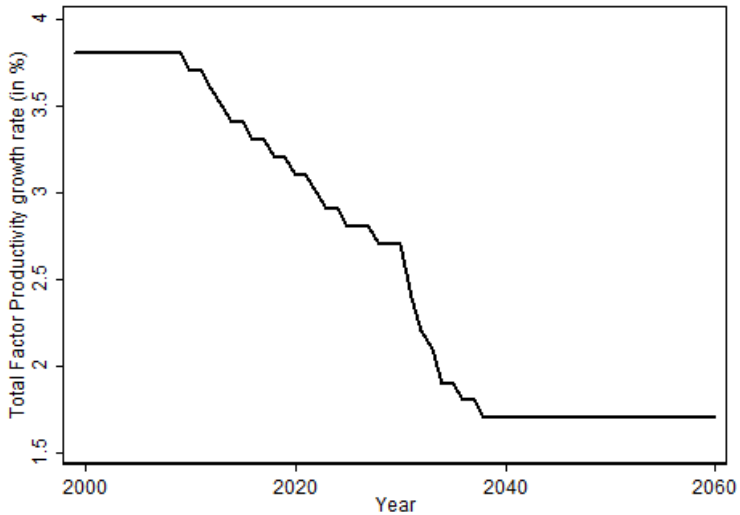
Exogenous assumptions

Projections for Poland provided by the European Commission

Population Size



TFP Growth



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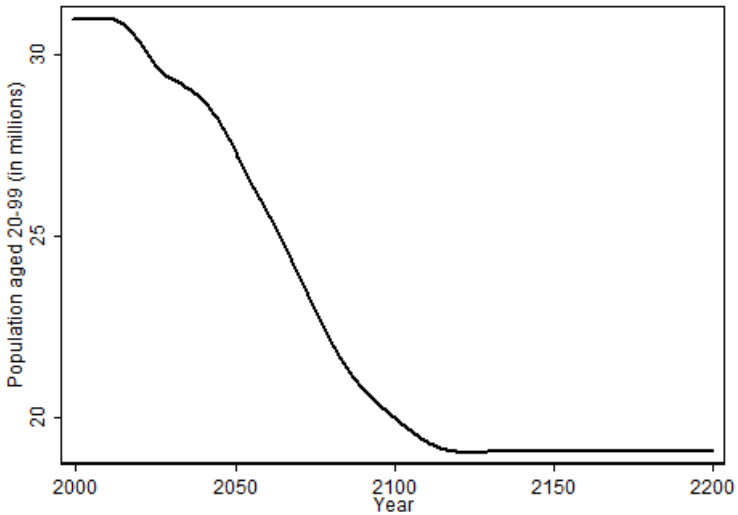
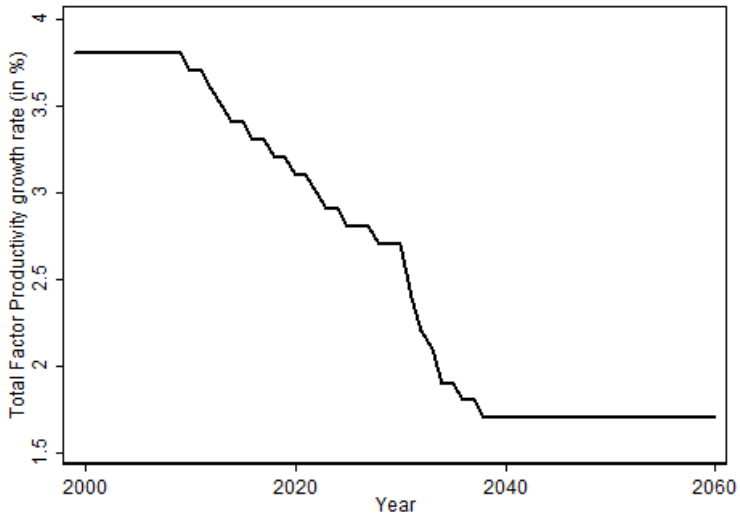


TFP Growth



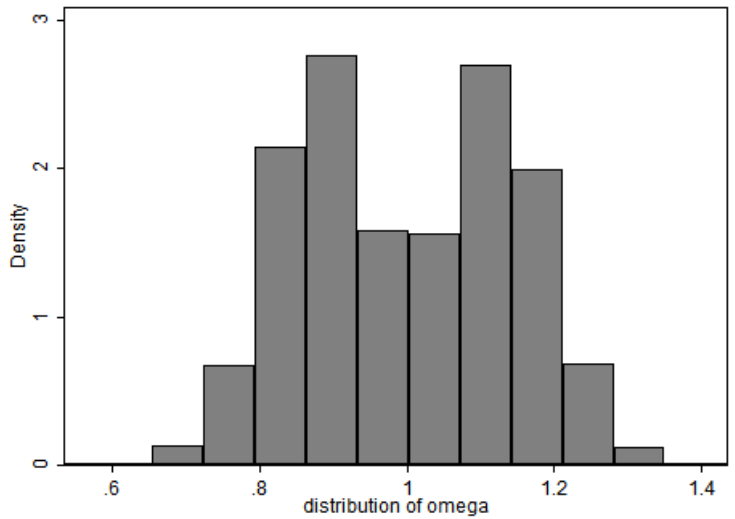
Kept constant across scenarios, don't affect results

GRAPE

Within cohort heterogeneity - endowments

Structure of Earnings Survey, 1998, Poland

Productivity ω

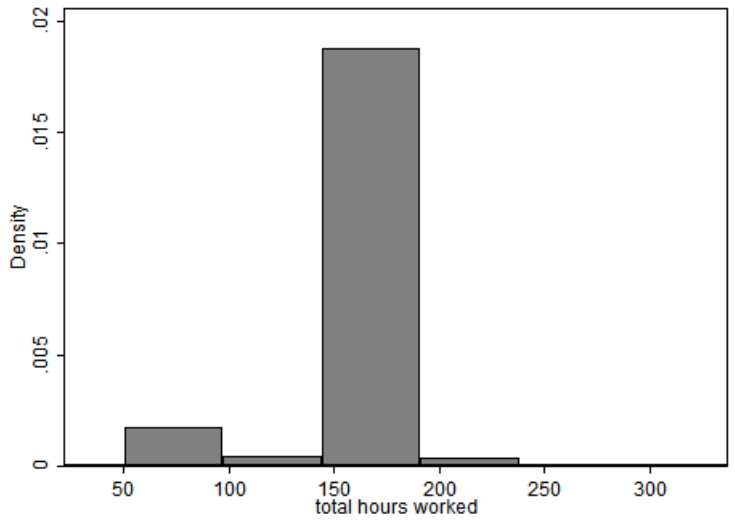


Resulting: 10 values for ω

Within cohort heterogeneity - leisure preference

Structure of Earnings Survey, 1998, Poland

Leisure Preference ϕ



Resulting: 4 values for ϕ

Within cohort heterogeneity - time preference

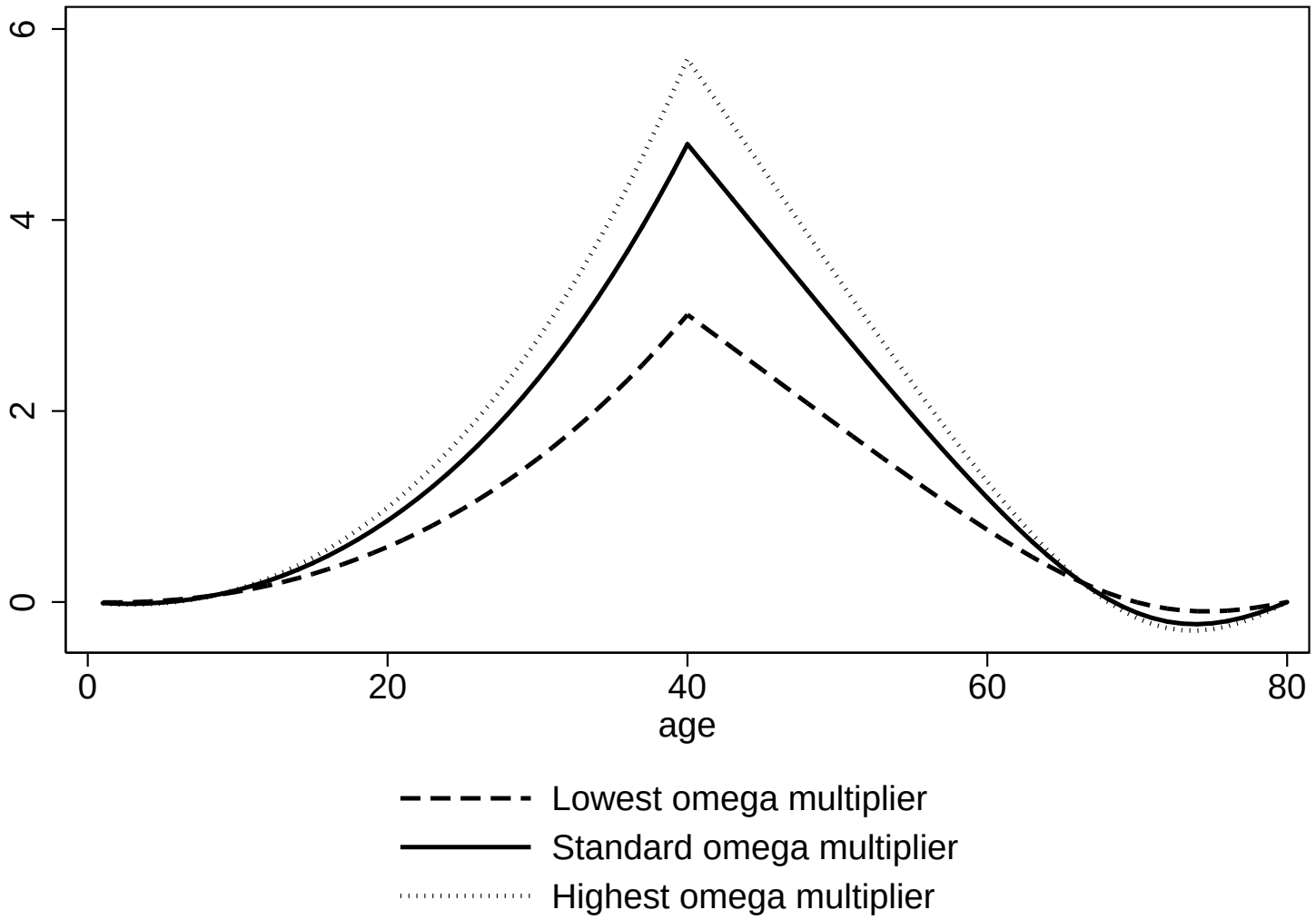
- No data on mortality rates or wealth by income or education groups

- Calibrate the central value of δ to match the investment rate
- Split population *ad hoc* to 3 groups:
  - to match the wealth inequality Gini (HFCN)
  - discount factors are $(0.98\delta, \delta, 1.02\delta)$

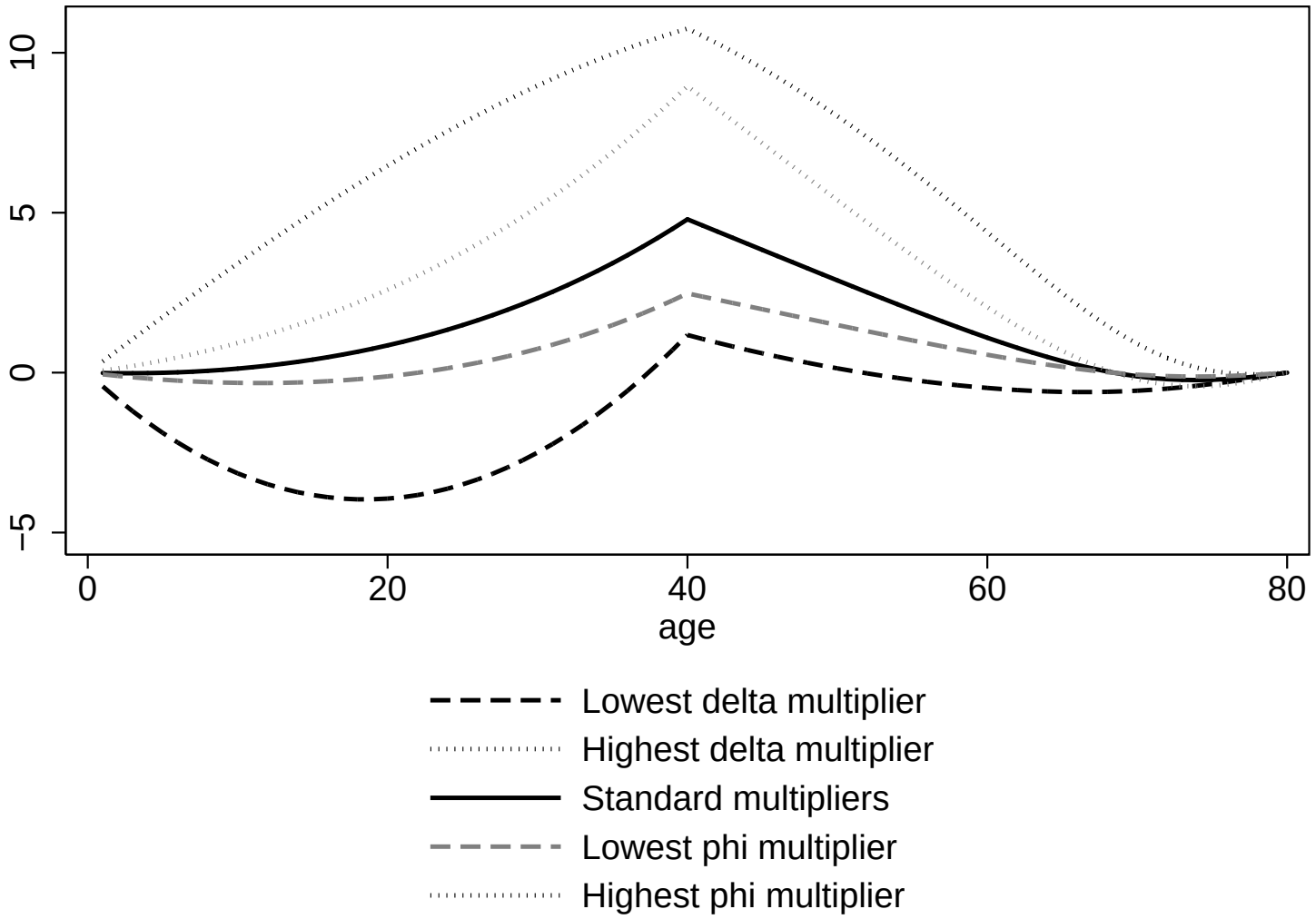
Within cohort heterogeneity – summary outcomes in initial SS – I

- In total we have 120 types within each cohort
- The resulting consumption Gini index in the initial steady state is 25.5, consistent with Brzezinski (2011)

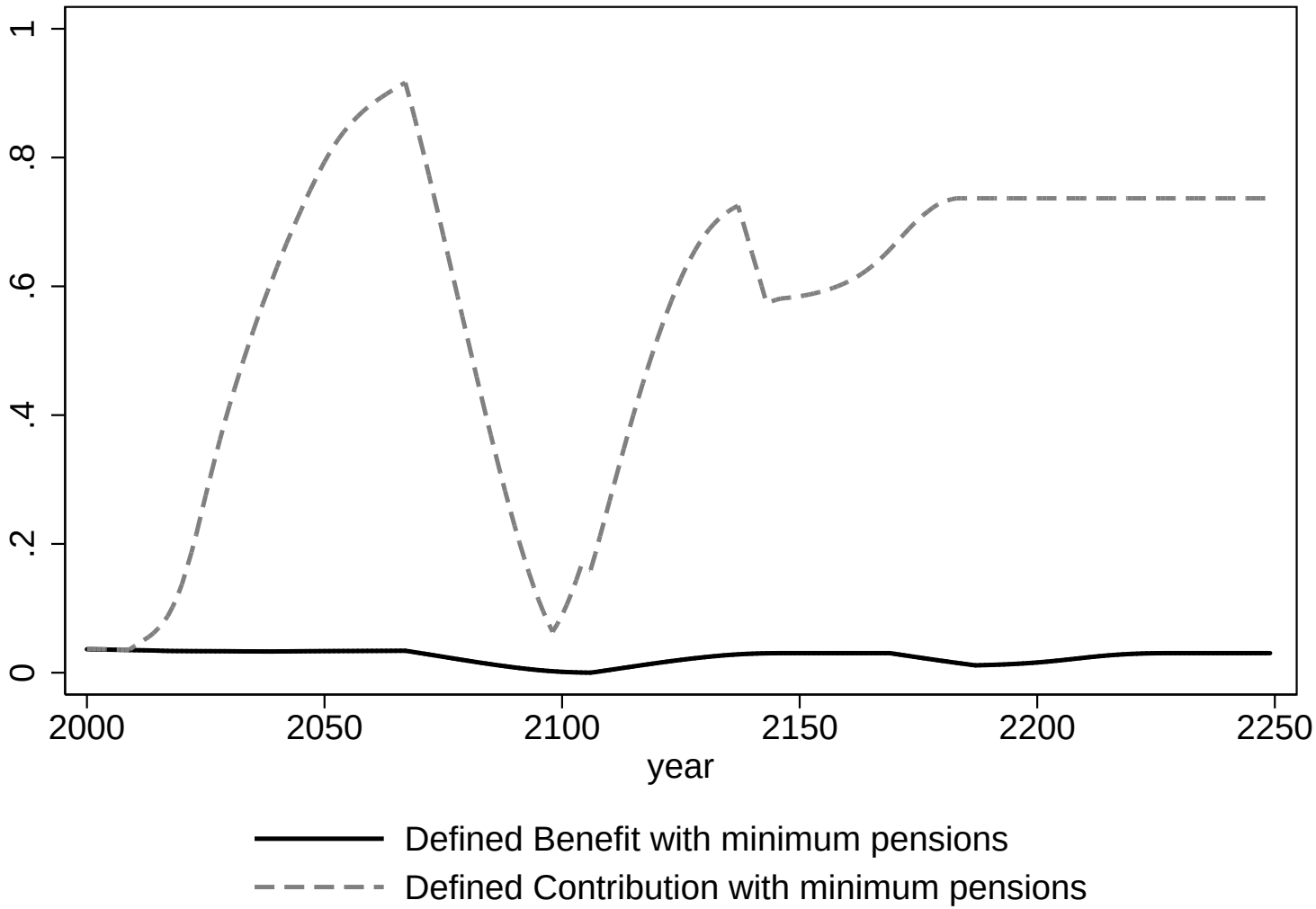
Within cohort heterogeneity – summary outcomes in initial SS – II



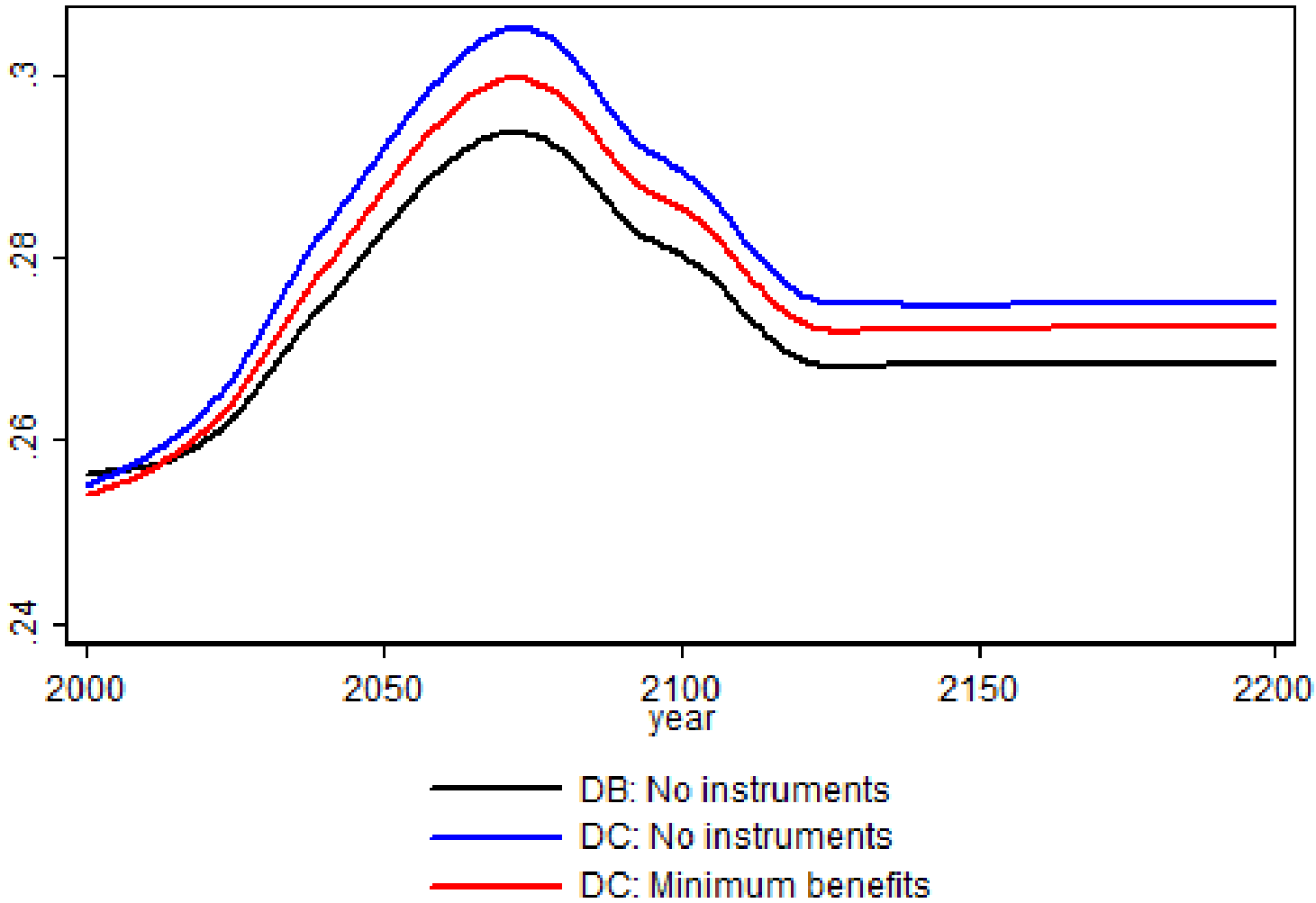
Within cohort heterogeneity - summary outcomes III



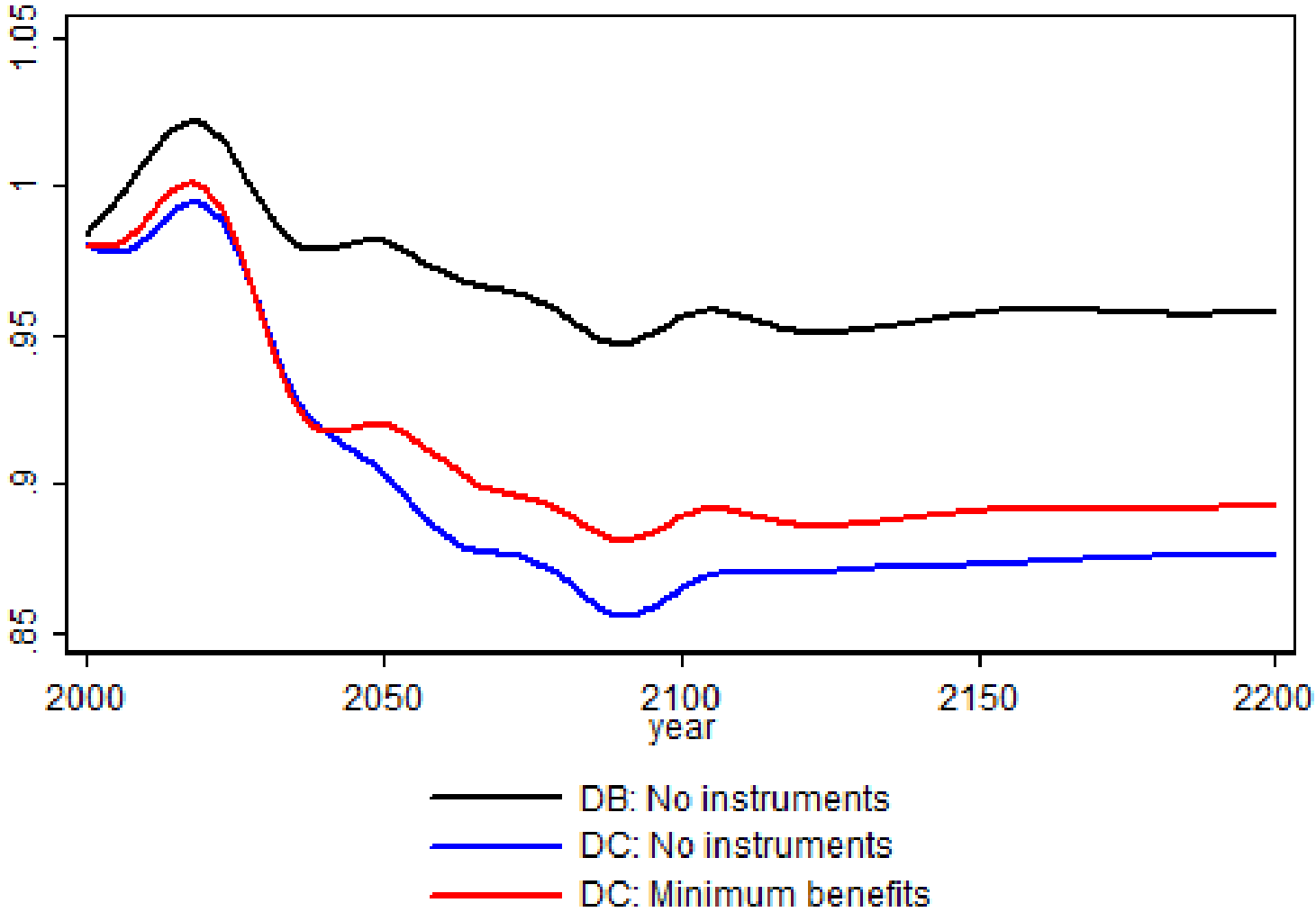
Minimum pensions coverage (longevity vs fixed retirement age)



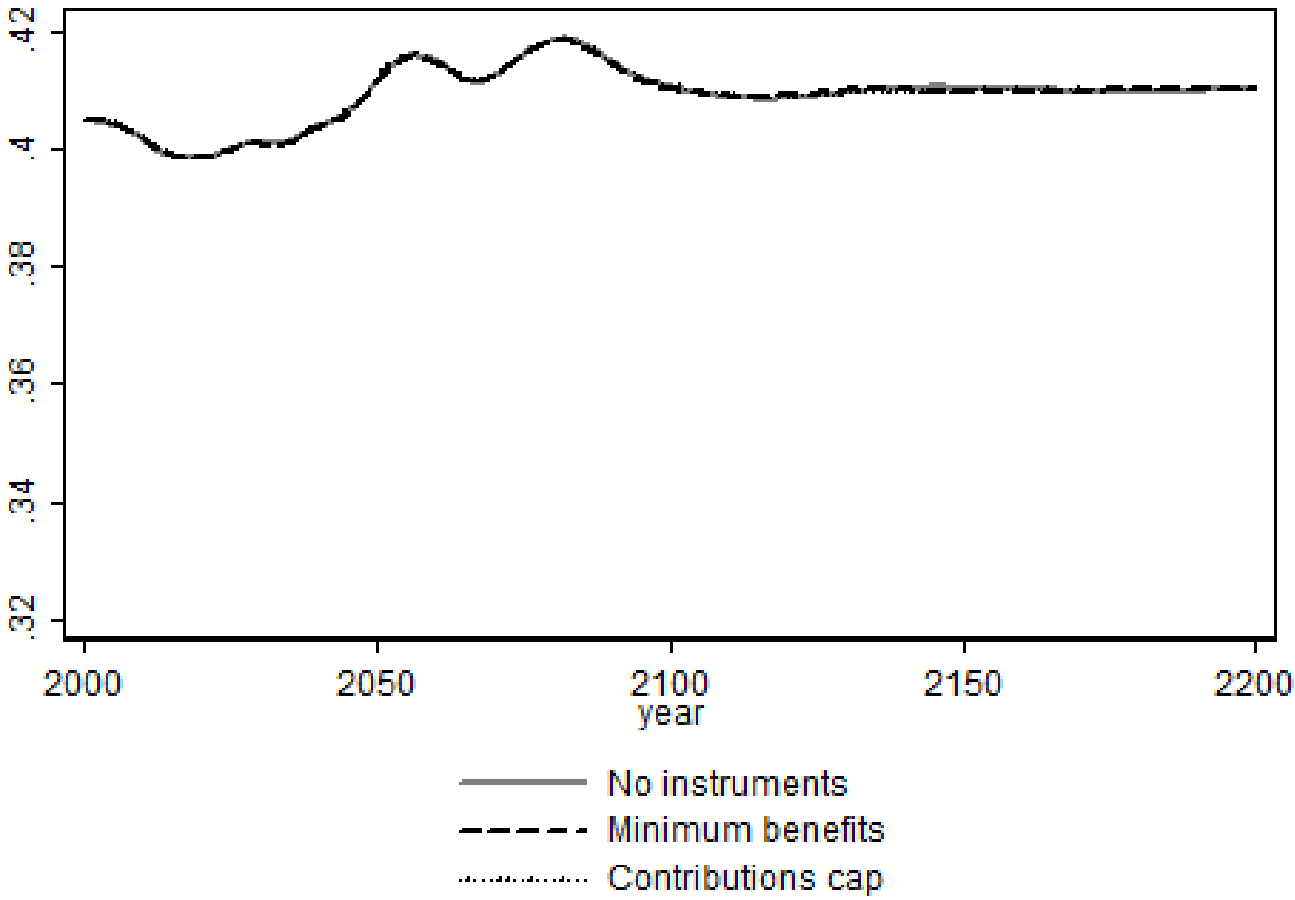
Consumption Gini index



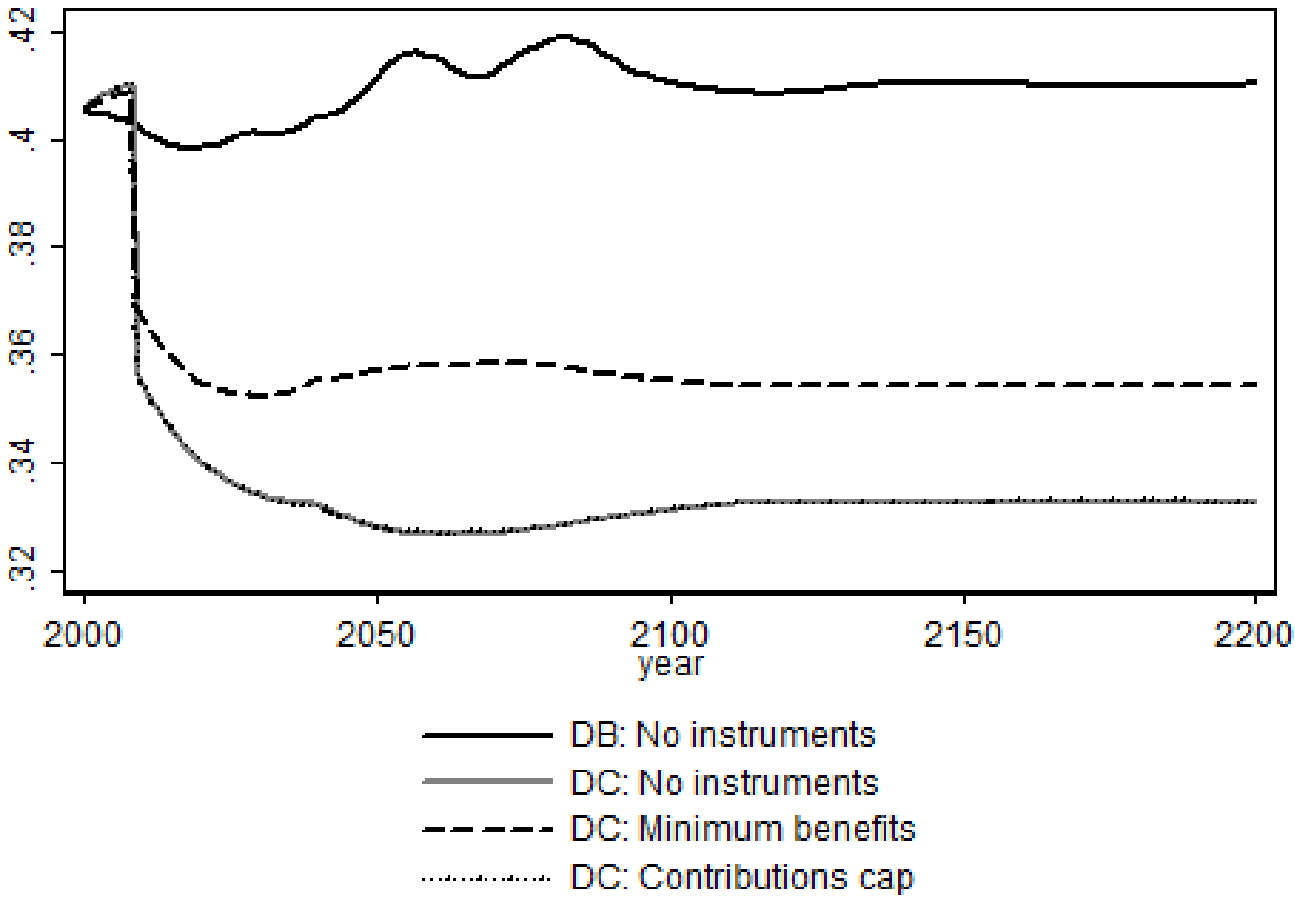
Wealth Gini index



Wealth Gini index at retirement I



Wealth Gini index at retirement II

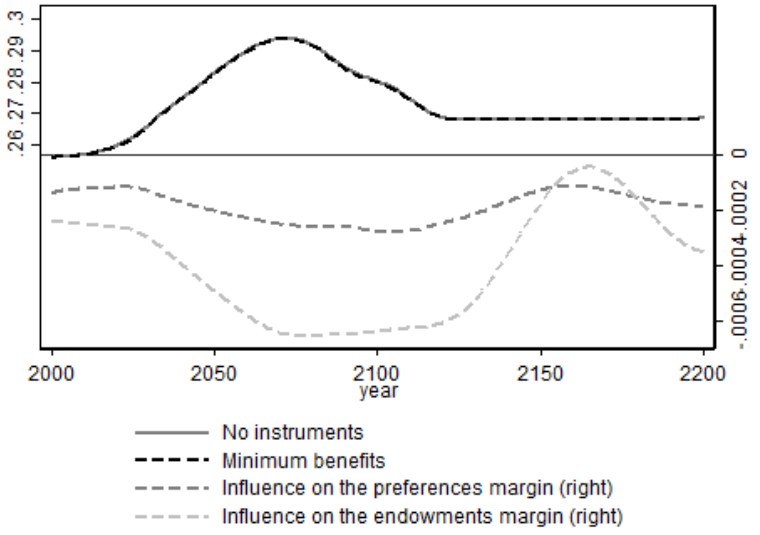


Inequality decomposition – endowments vs preferences

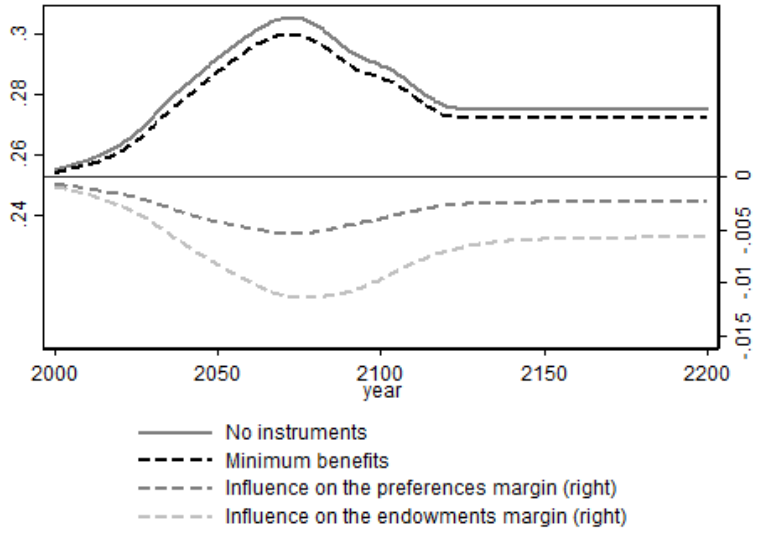
- Social justice: instruments should reduce inequality stemming from endowments (luck) but not from preferences
- To isolate the effects of the two sources:
  - Shut down each channel separately
  - Keep prices constant from the full model to avoid GE effects
  - Solve for decisions of households in partial equilibrium

Consumption inequality decomposition - minimum pensions

DB



DC



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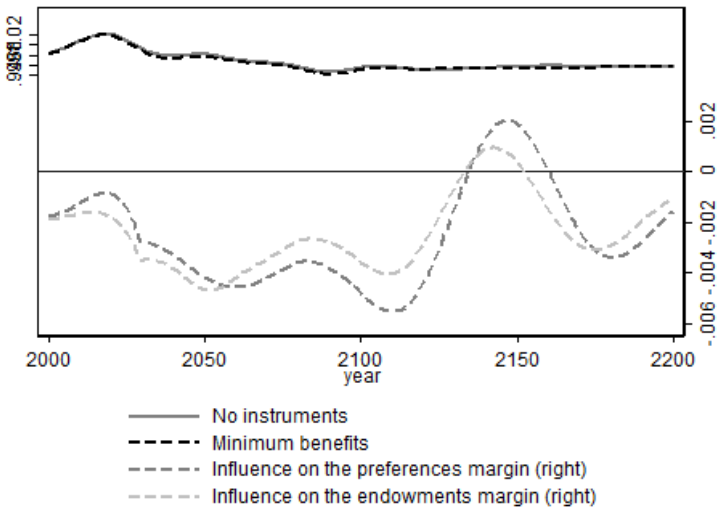

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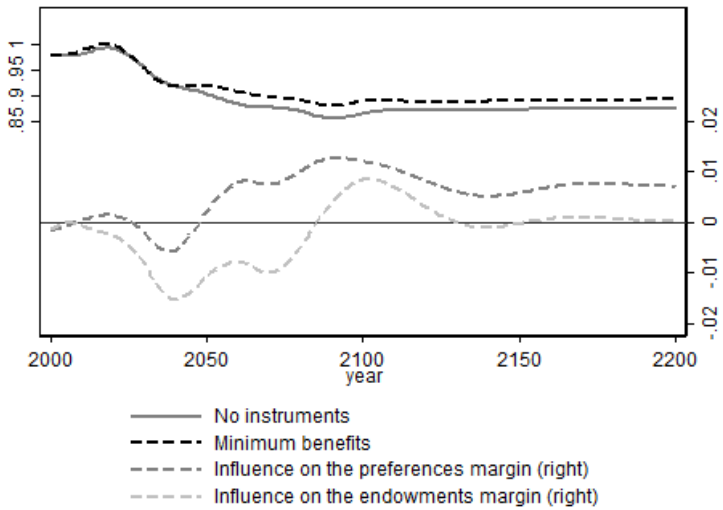

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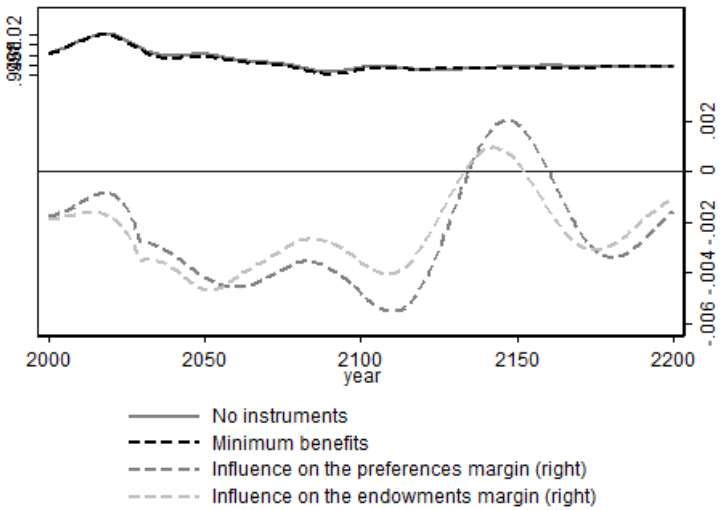
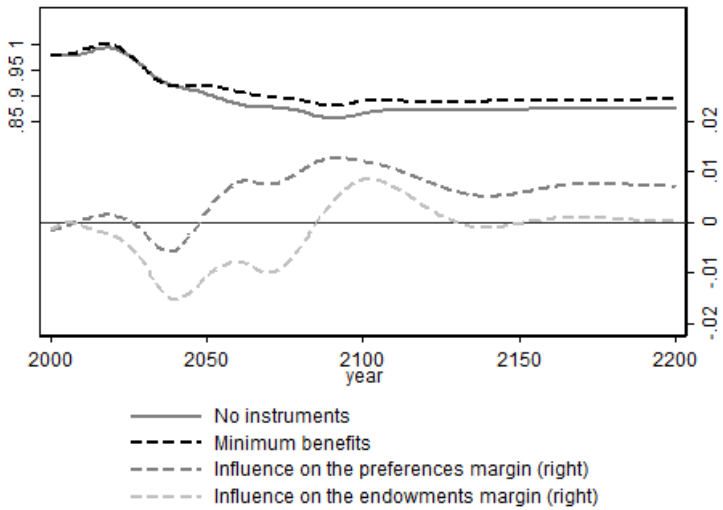
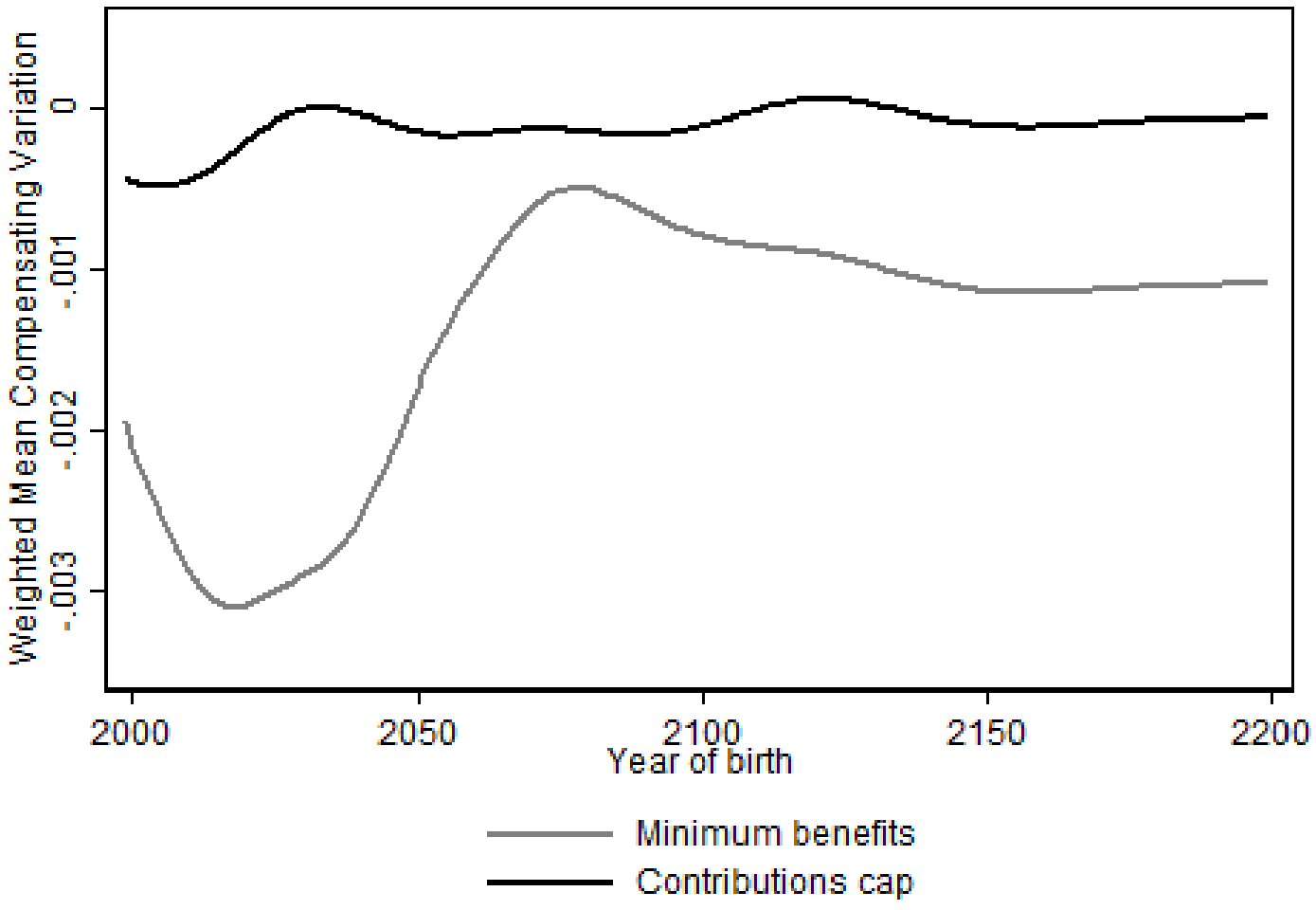


DC



Welfare effects minuscule



Conclusions

- Consumption inequality increase due to
  - aging processes
  - DB→DC reform
- Minimum pensions
  - effective in reducing consumption inequality resulting from the DB→DC reform by 40-50%
  - with 80% coverage minimum pension costs appox 1 pp higher consumption tax (transfer of about 0.9% GDP)
  - wealth inequality increases
- Contribution cap has virtually no effects

Questions?

Thank you for your attention!

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