Optimal collective defined contribution (CDC) pension schemes

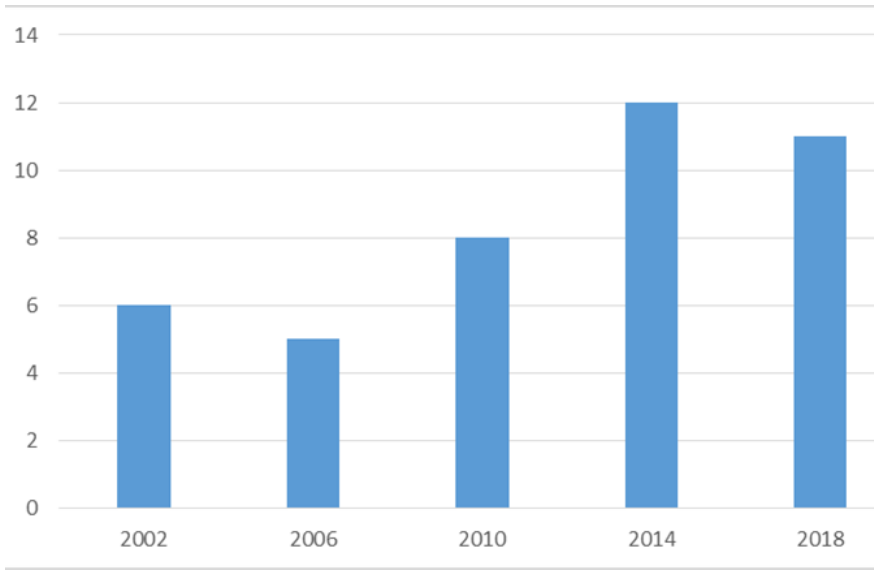
Ilja Boelaars[a], Dirk Broeders[b,c], **Annick van Ool[b,c]**

ING[a]
De Nederlandsche Bank[b]
Maastricht University[c]

Netspar Pension Day, 29th October, 2020

CDC pension schemes become increasingly popular

Number of OECD countries with a hybrid pension scheme*



*Hybrid is defined as mixed DB schemes and protected DC schemes.
Source: `https://stats/oecd.org/`

Motivation research

Economic problem

From a sustainability perspective CDC schemes should have the following design features:

- No ex-ante wealth distributions
- Optimal life-cycle market exposure

Why is it important to analyse this problem?

- By collectively investing for retirement, participants benefit from risk-sharing and economies of scale.
- Discontinuity risk arises if participants can get a better risk-return trade-off outside the CDC scheme.
- The CDC scheme should be designed **fair** (no ex ante wealth transfers) and **efficient** (optimal life-cycle market exposure).
- Relevant for Dutch pension debate

Contribution to literature

Paper: define a general class of fair and efficient CDC schemes in the presence of equity market risk and interest rate risk.

Related literature:

- Fairness: no ex-ante value transfers between generations
  - CDC pension schemes (*Boelaars and Broeders (2019)*)
  - Life-insurance contracts (*Grosen et al. (2002)*)
- Efficiency: optimal exposure to market risks
  - Optimal exposure to risky assets decreases with age (*Bodie et al. (1992)*, *Bovenberg et al. (2007)*)
  - Optimal interest rate hedge increases with age (*van Bilsen et al. (2020)*, *Mehlkopf and van Bilsen (2020)*)

CDC schemes combine features of DB and DC schemes

We define a CDC scheme in the following way

- Single collective pool of **assets**
- Participants accrue pension **benefits**
- **Liabilities** are the present discounted value of benefits using a **regulatory** discount rate
- Participants share collectively the **mismatch risk** between assets and liabilities via a predefined benefit adjustment rule

We allow for 'smoothing' of benefit adjustments

Advantages of smoothing benefit adjustments over time:

- Reduce year-to-year volatility pension benefits
- Create age-dependent market exposure
  (Guillén et al. (2006) and Mehlkopf et al. (2013))
- Allow for intergenerational risk sharing (*Gollier (2008)*)

- **Closed smoothing**: all value allocated to current pension benefits
- **Open complete smoothing**: all value allocated to current pension benefits and future pension contributions

Model specification

- Financial model with equity market risk and interest rate risk
- Asset allocation:
  - $x_1 = 50\%$ in equity
  - $x_2 = 15\%$ in long-term bonds (time to maturity $= 50$)
  - $1 - x_1 - x_2 = 35\%$ in short-term bonds (time to maturity $= 1$)
- Each period benefits are adjusted up or downward based on
  - Development assets and liabilities (regulatory funding ratio)
  - The smoothing policy

Adjustment factor for different smoothing policies

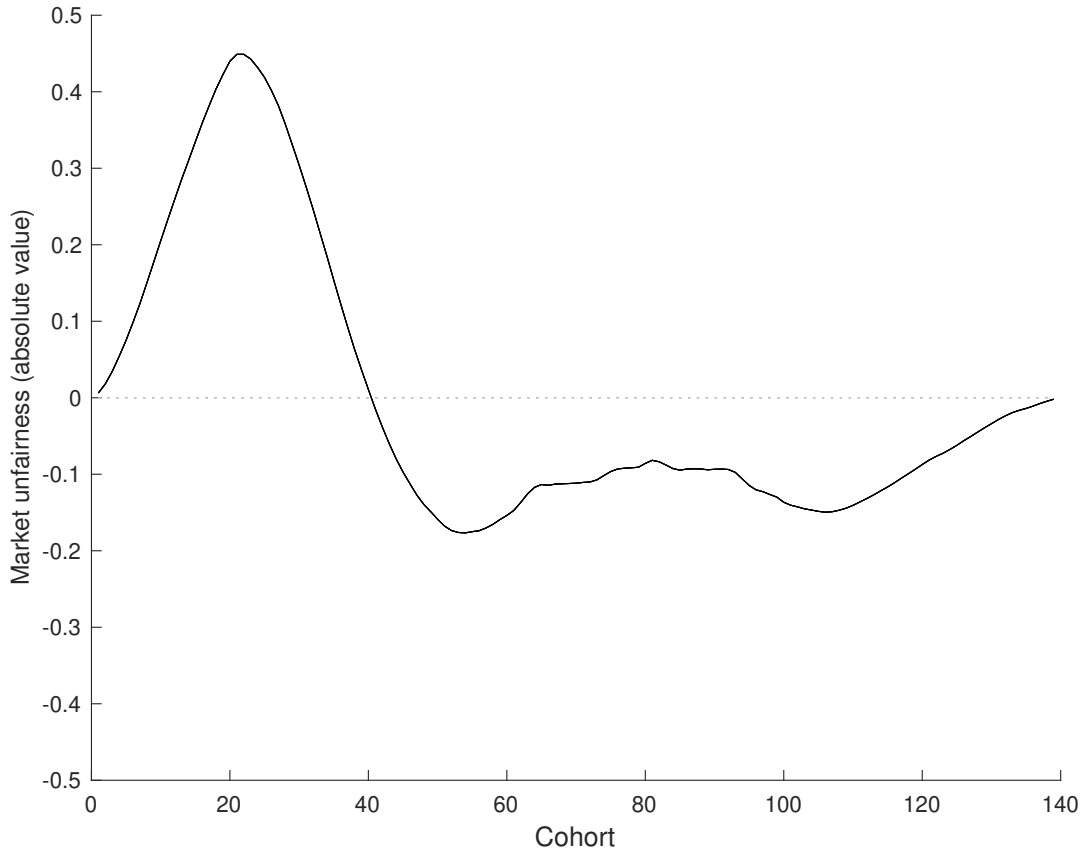
1. No smoothing	$\delta_{j,t}^{m} = \frac{A_t}{\tilde{L}_t}$
2. No smoothing fair	$\delta_{j,t}^{m} = 1 + \left(\frac{A_t}{A_{t-1}} - \frac{\tilde{L}_t}{L_{t-1}} \right) \frac{P(m+1, r_{t-1})}{P(m, r_t)}$
3. Closed smoothing	$\delta_{j,t}^{m} = 1 + \alpha^m \frac{A_t - \tilde{L}_t}{\sum_{m=1}^{T_w+T_p} \tilde{L}_t^m \alpha^m}$
4. Closed smoothing fair	$\delta_{j,t}^{m} = 1 + \alpha_m \frac{L_{t-1}}{\sum_{m=1}^{T_p+T_w} L_{t-1}^m \alpha_m} \left(\frac{A_t}{A_{t-1}} - \frac{\tilde{L}_t}{L_{t-1}} \right) \frac{P(m+1, r_{t-1})}{P(m, r_t)}$
5. Open complete smoothing	$\delta_{j,t}^{m} = 1 + \alpha^m \frac{A_t - \tilde{L}_t}{\sum_{m=1}^{T_w+T_p} \tilde{L}_t^m \alpha^m + \sum_{m=2}^{T_w+T_p+n} \pi_t^m \alpha^m}$

We present the following results

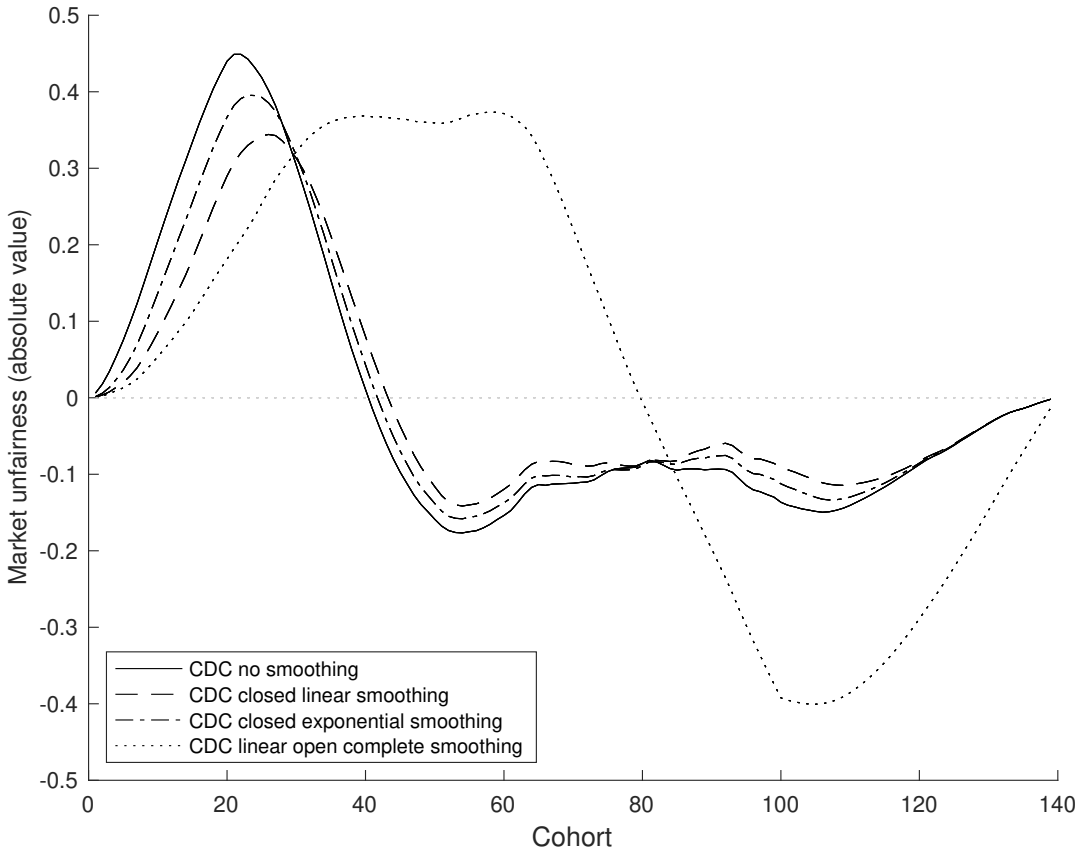
- **Fairness**: difference market value pension payments and pension contributions for each cohort (absolute amount)
- **Efficiency**: certainty equivalent consumption for each cohort
- **Implied exposure** to market risks for each age

Fairness: value transfer from young to old if mismatch risk is not fully hedged

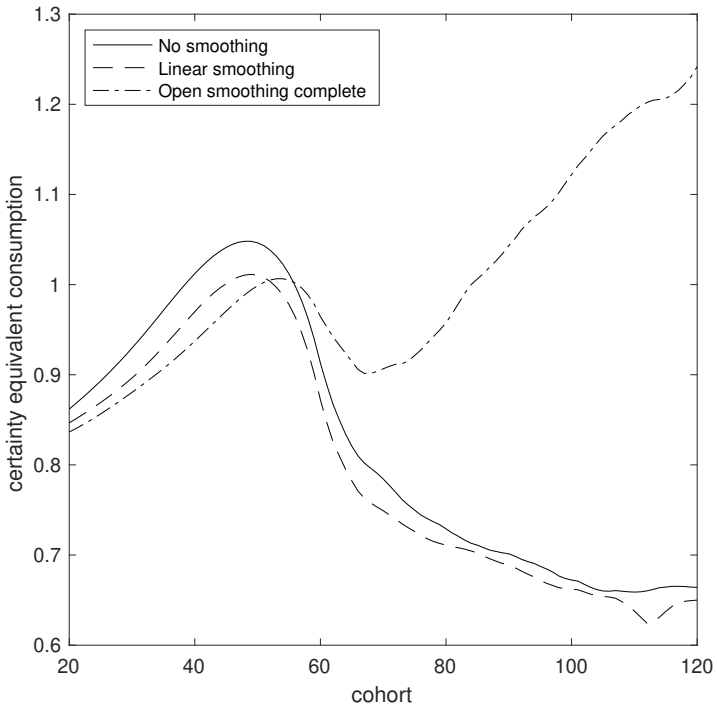
Unfairness simple CDC scheme without benefit smoothing



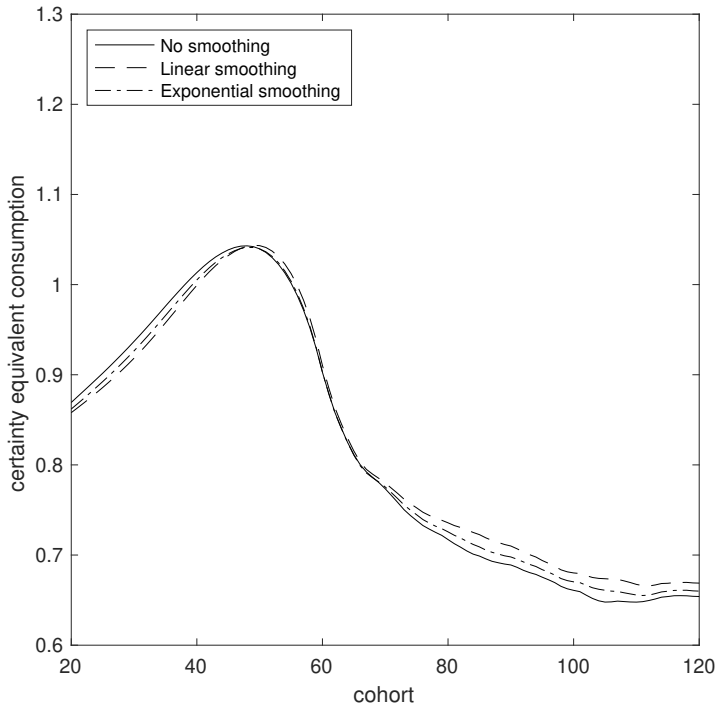
Fairness: negative market unfairness of young cohorts is bigger in case of open complete smoothing



Efficiency: open complete smoothing increases welfare significantly

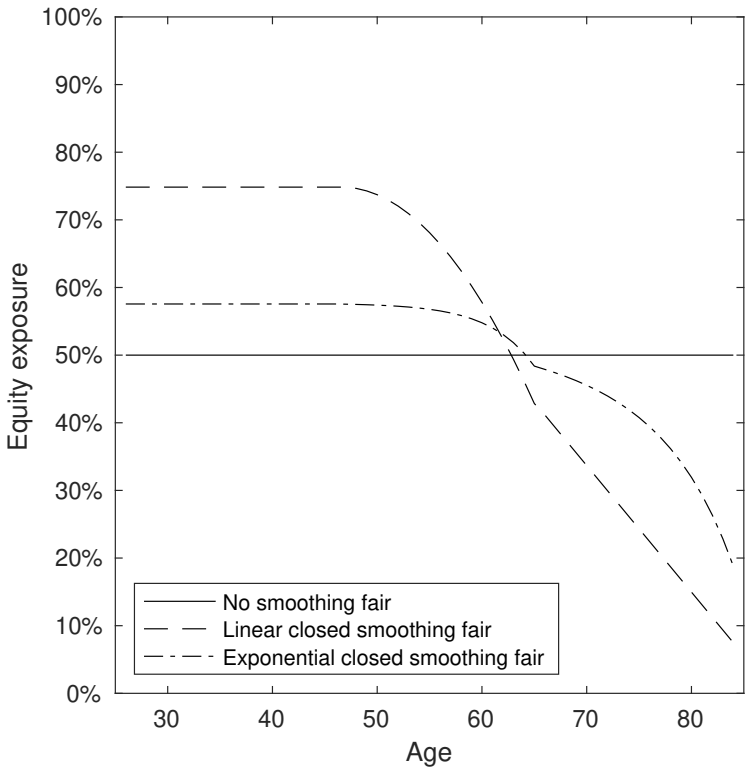


unfair CDC schemes

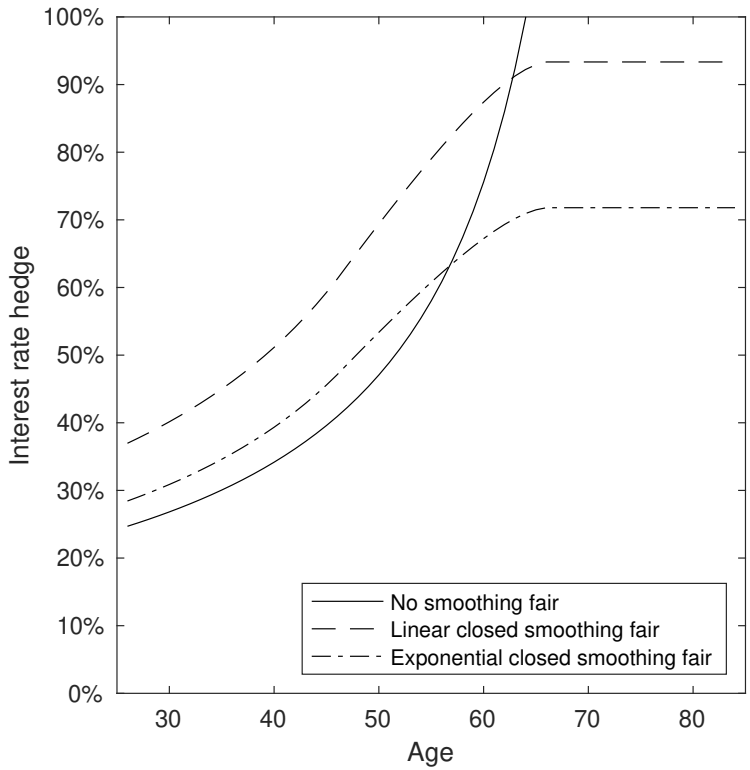


fair CDC schemes

Implied exposure to market risks is more in line with the optimal allocation in case of smoothing



equity exposure



interest rate hedge

Conclusion

- In simple CDC schemes there are **value transfers** between generations
- CDC pension schemes can be made fair as long as it is **complete** and **appropriate horizon-dependent** benefit adjustments are used
- Fairness does **not have a negative impact** on social welfare
- Open complete smoothing **increases welfare significantly** in the long run compared to closed CDC schemes

Further research

- Comparison investment policy and implied market exposure in CDC schemes with optimal IDC investment life-cycle
  - Theoretical optimal life-cycle
  - Optimal life-cycle with short-selling and borrowing constraints
- Open complete fair CDC scheme
- Robustness checks