Welfare effects of fiscal policy in reforming the pension system

Oliwia Komada

(with Krzysztof Makarski and Joanna Tyrowicz)

FAME|GRAPE, NBP, University of Warsaw & Warsaw School of Economics

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Motivation

Longevity $\Uparrow$

- Pay-As-You-Go Defined Benefits (**PAYG DB**) $\Rightarrow$ fiscally unstable if not reformed (Feldstein: deficit $+1.4$pp of GDP share)

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Reform : PAYG DB $\Longrightarrow$ (partially) funded DC

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shift of contributions to funded pillar $\Rightarrow$ short run financing?

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  - efficiency
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But:

- fiscal policy counteracts / reinforces redistribution
- affecting also economic efficiency (scope of distortions)

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Is Nishiyama & Smetters (2007) result universal?

- compare variants of fiscal closures (accompanying the reform)
- introduce new fiscal closures

Literature differs in terms of fiscal closures

Table A1: Modeling options taken in the earlier literature

Paper	Problem	Solution	Soc. sec. parameters	Introducing	Fiscal closures	Implicit tax	Idiosyncratic shocks
Belan and Pestieau (1999)	aging	p and s	τ_I	FF	debt	NO	NO
Fehr (2000)	aging	p	$\tau_I, \bar{J}, \tau_b$		τ_c	YES	NO
Imrohoroglu et al. (2003)	aging	p and s	τ_I	DC		NO	YES
Lindbeck and Persson (2003)	aging	s		DC, DC+FF	debt	NO	NO
?	risk	PAYG DB	τ_I			NO	NO
Keuschnigg et al. (2012)	aging	p	$\bar{J}, \tau_I, \tau_b$		τ_c, τ_l, τ_k	NO	NO
Sanchez-Marcos and Sanchez-Martin (2006)	dem. uncert.	PAYG DB	τ_l			NO	YES
Verbič et al. (2006)	aging	p	τ_I		τ_c, τ_l	NO	NO
Aglietta et al. (2007)	aging	p	$\bar{J}, \tau_I, \tau_b$			NO	NO
Nishiyama and Smetters (2007)	aging	s		PRIV	τ_c	NO	YES
Verbič (2007)	aging	p	τ_l		τ_c	NO	YES
Andolfatto and Gervais (2008)	aging	p	τ_I			NO	NO
Bassi (2008)	aging	p	$\bar{J}, \tau_I$			NO	NO
Heer and Irmen (2014)	aging	p	$\tau_b, \tau_I, \bar{J}$	M	Υ	NO	NO
Díaz-Giménez and Díaz-Saavedra (2009)	aging	p	$\tau_I, \bar{J}$		τ_c	YES	NO
Fehr and Kindermann (2010)	aging	s		FF	τ_c	YES	YES
Kuhle (2010)	aging	s		PRIV	debt	NO	NO
Kumru and Piggott (2010)	aging	s		M, PRIV	τ_c	NO	YES
Kumru and Thanopoulos (2011)	aging	s		FF, PRIV	τ_I	NO	YES
De la Croix et al. (2012)	aging	s	$\bar{J}$	FF	τ_c	NO	NO
Vogel et al. (2012)	aging	p	$\tau_I, \tau_b, \bar{J}$			NO	NO
Wright et al. (2012)	aging	p	τ_I		DEBT	NO	NO
Cipriani and Makris (2012)	aging	p and s	τ_I	FF		NO	NO
Bruce and Turnovsky (2013)	aging	p	τ_I		τ_I	NO	NO
Börsch-Supan et al. (2014)	aging	p or s	$\tau_b, \tau_I, \bar{J}$			YES	NO
Kitao (2014)	aging	p or s	$\tau_b, \tau_I, \bar{J}$	M	τ_I	NO	YES
Song et al. (2015)	aging	s		FF	debt	NO	NO
Kitao (2015)	aging	s		FF	τ_c	NO	NO
Chen et al. (2016)	aging, risk	p or s	τ_b, τ_I	COL		NO	NO

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Literature differs in terms of fiscal closures

- Pension system parameters
  - contribution rates (20 papers)
    e.g. Kumru & Thanopoulos (2011, JPE), Bruce & Turnovsky (2013, JPE)
  - replacement rate (8 papers)
    e.g. Boersch-Supan et al. (2014, AER), Kitao (2014, RED)

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- Fiscal closure
  - labor tax (3 papers)
    e.g. Bouzahzah et al. (2002, JEDC)
  - consumption tax (10 papers)
    e.g. Nishiyama & Smetters (2007, QJE), Diaz-Gimenez & Diaz-Saavedra (2009, RED)
  - debt (5 papers)
    e.g. Song, et al. (2015, AEJ) Lindbeck & Persson (2003, JEL)

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$\Rightarrow$ Studies do not compare across fiscal closures (except for within pension system)

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What we do

- **Challenge the view** that in stochastic framework pension system privatization is welfare deteriorating

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- **Challenge the view** that in stochastic framework pension system privatization is welfare deteriorating
- Provide a **systematic overview** of the interaction between the pension system reform and fiscal closure
- Consider **new ways of financing** the pensions system reform
  - tax on capital income
  - labor tax progression

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Preview of the results

- Nishiyama & Smetters (2007) result is **NOT** universal $\Leftrightarrow$ fiscal closure matters
- Depending on the fiscal closure in stochastic framework:
  - welfare effect of the same reform can be positive or negative
  - with political support or not

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- Depending on the fiscal closure in stochastic framework:
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- Welfare gains and political support only sometimes overlap
  - there are many combinations of fiscal policy that make pension system reform welfare improving
  - public debt often "buys" political support for the reform (both improving and deteriorating)

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Competitive producers

- Cobb-Douglas production function
- capital depreciation rate d

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Pension system

Baseline scenario PAYG DB

- equal benefit for whole cohort (provides insurance)

$$b_{\bar{J},t} = \rho \cdot w_{avg,t}$$

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- contributions go into PAYG and funded pillar: $\tau_t = \tau_t^I + \tau_t^{II}$

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$$b_{\bar{J},t} = \frac{\text{accrued 'savings'}}{\text{life expectancy}_t} + \frac{\text{accrued savings}}{\text{life expectancy}_t}$$

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- Reform generates a *deficit* in the pension system ⇒ need for **fiscal closure**.

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Government

- Collects taxes

$$T_t = \tau_{l,t}(1-\tau_t)w_t L_t + \tau_{k,t} r_t A_t + \tau_{c,t} C_t + \Upsilon_t \sum_{j=1}^{J} N_{j,t}$$

- Finances government spending $G_t = gz_t \sum_{j=1}^{J} N_{j,t}$,
- Balances pension system $subsidy_t$
- Services debt $\Delta D_t = D_t - D_{t-1}$

$$G_t + subsidy_t + r_t D_t = T_t + \Delta D_t$$

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Fiscal closures

- Three new closures details
  - progressive labor tax $\Rightarrow$ working cohorts with favorable shocks $\Rightarrow$ labor supply
  - capital tax ($+$ debt) $\Rightarrow$ cohorts with more wealth $\Rightarrow$ savings & investment
- Two closures within pension system details
  - contributions $\Rightarrow$ working cohorts $\Rightarrow$ labor supply
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- In total: 9 closures (and a 81 possible combinations of fiscal policy in baseline and reform)

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Model solving

- Gauss-Seidel iterative algorithm
  - Guess an initial value for $k = K/(zL)$ and compute prices
  - Solve individual problem and aggregate it to find new $K^{'}$ and $L^{'}$, thus $k^{'}$
  - iterate until convergence

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  - implicit tax to reduce state space, Butler (2002)
  - policy function iterations with picewise linear interpolation
  - within period problem solved with Newton-Raphson
  - given initial distribution at age $j = 1$, transition matrix for idiosyncratic productivity and the policy functions compute the distribution in any successive age j.
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  - aggregation done with Gaussian quadrature
- Transition path, goes between the initial and final steady state

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Calibration to replicate 2015 US economy

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- Preference for leisure ϕ matches average hours 33%
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- Contribution rate balances pension system in the initial steady state
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Taxes $\{\tau_c, \tau_l, \tau_k\}$ match revenue as % of GDP {9.2%, 3.8%, 3.6%}

Depreciation rate d matches investment rate of 25%

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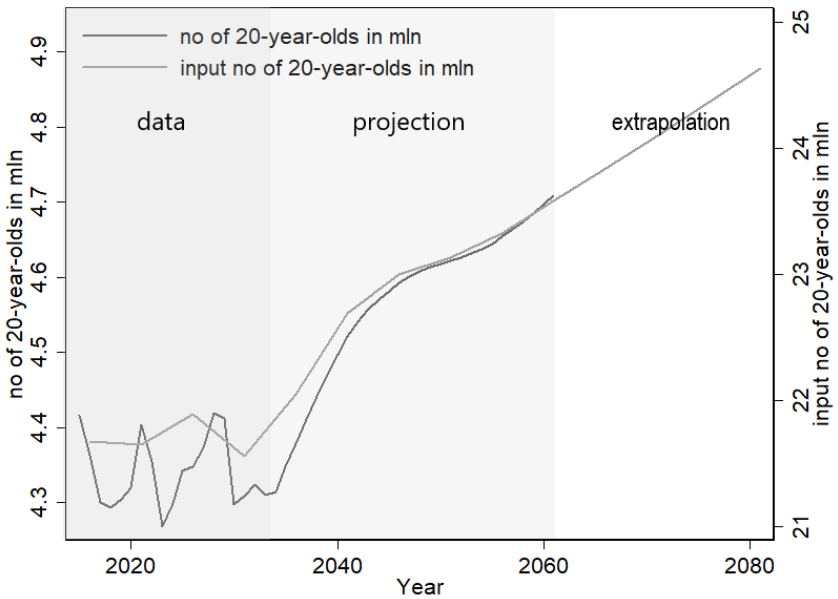
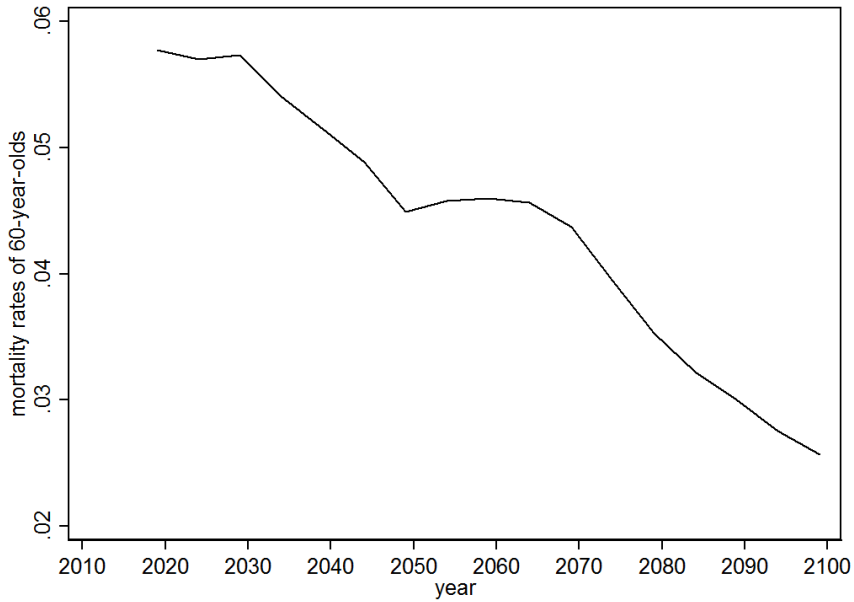
Calibration to replicate 2015 US economy

Demography is based on the projection by The United Nations.

number of 20-year-olds



mortality rates



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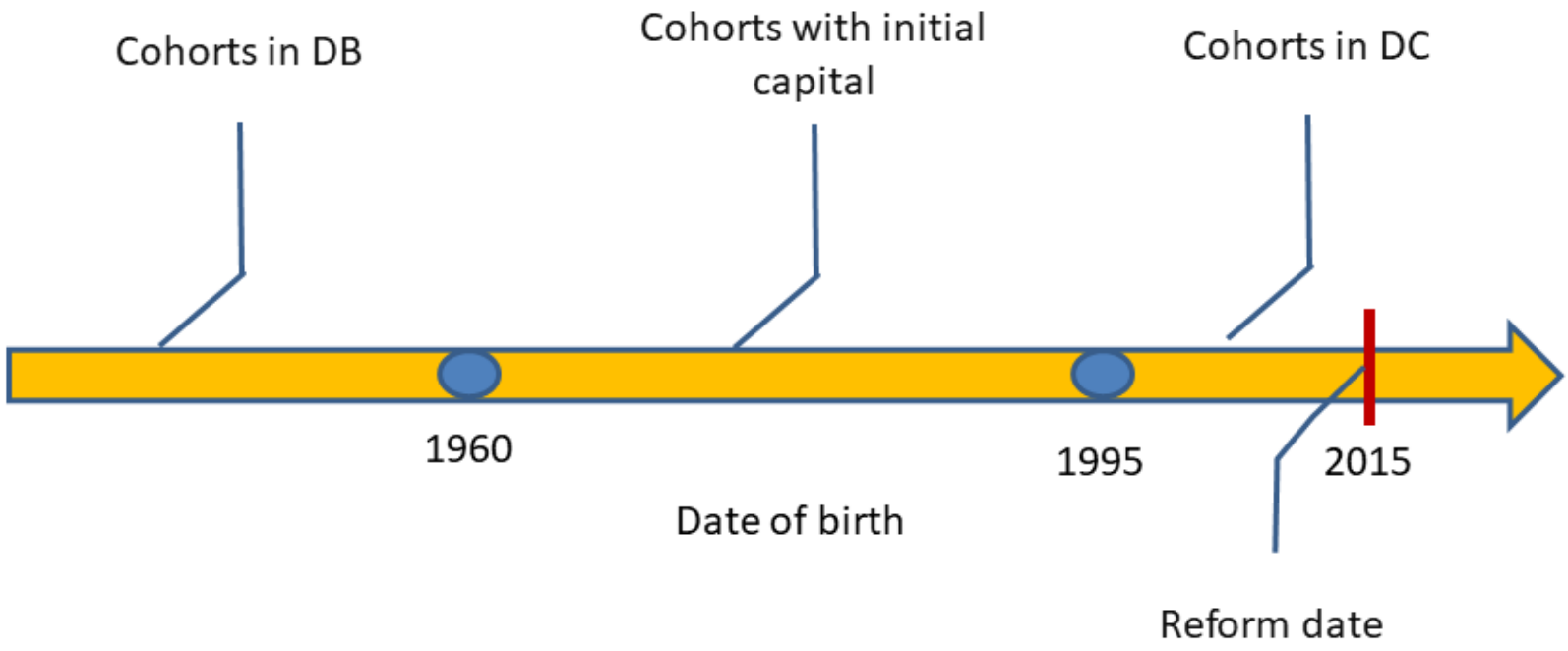
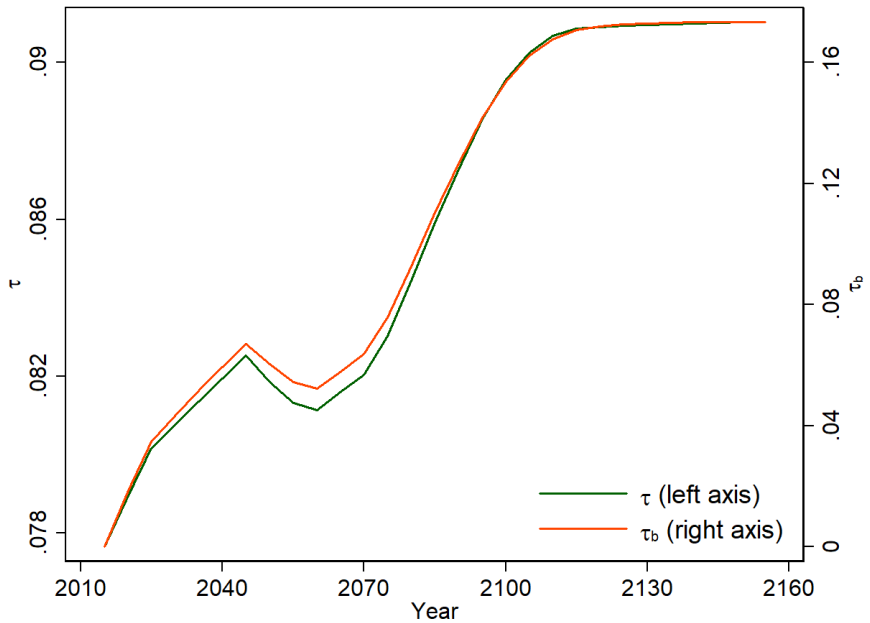
Reform: gradually replace PAYG DB ...

... with a partially funded define contribution (DC)



Contents

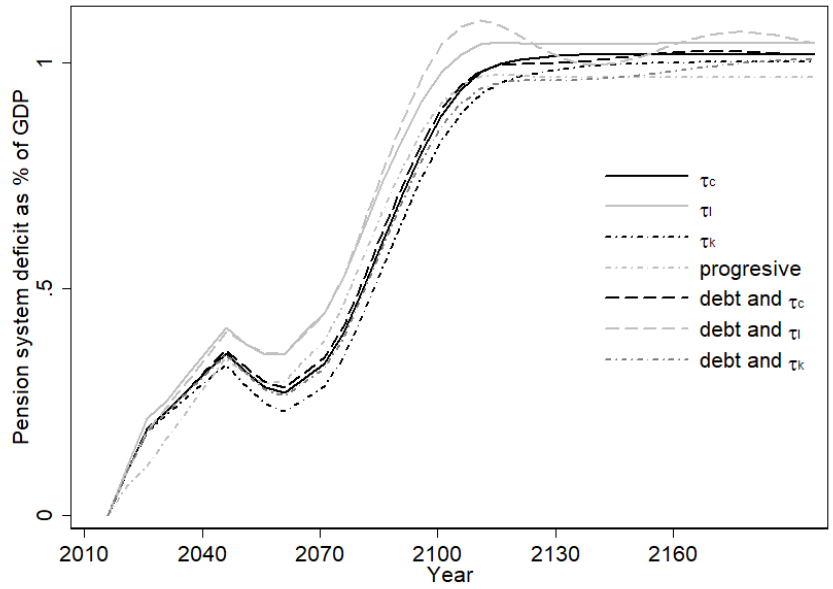
Baseline: PAYG DB with aging and thus deficit



Adjustment in pension parameters

contribution rate ↑ from 7.8% to 9%

tax on pensions ↓ from 0.0% to 17.3%



Adjustment in fiscal parameters

pension system deficit ↑ by 1pp of GDP

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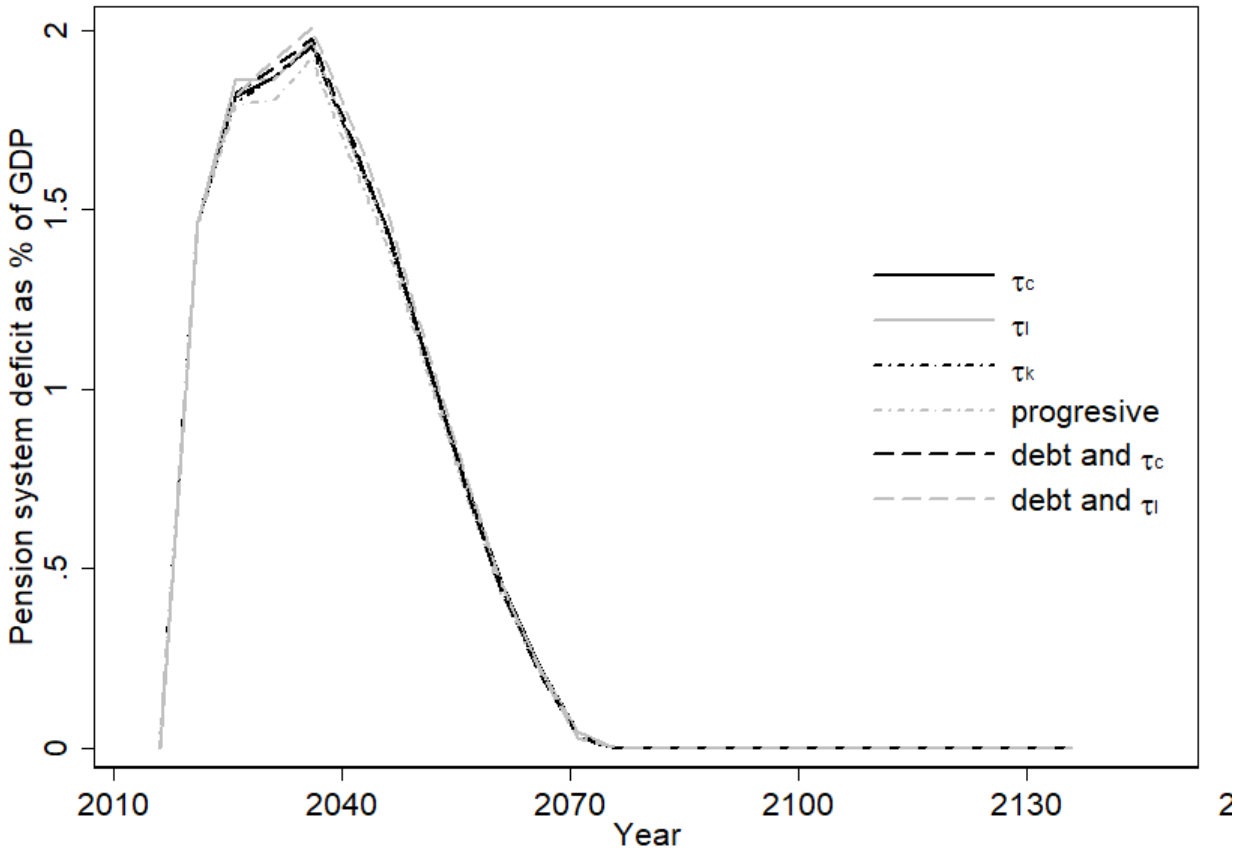
Reform: partially funded DC

capital labor

Pension system deficit temporary ↑ from 0% to 2% of GDP



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Major effects of the reform

Links pensions to contributions

1. Efficiency gain
2. Loss of insurance

Necessitates fiscal adjustment

1. Affects degree of efficiency gain
2. Affects degree of insurance loss

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Welfare analysis - like Nishiyama & Smetters (2007)

What happens within each experiment?

1. Run no policy reform scenario $\Rightarrow$ baseline
2. Run policy reform scenario $\Rightarrow$ reform
3. For each cohort compare utility, compensate the losers from the winners
4. If net effect positive $\Rightarrow$ reform efficient

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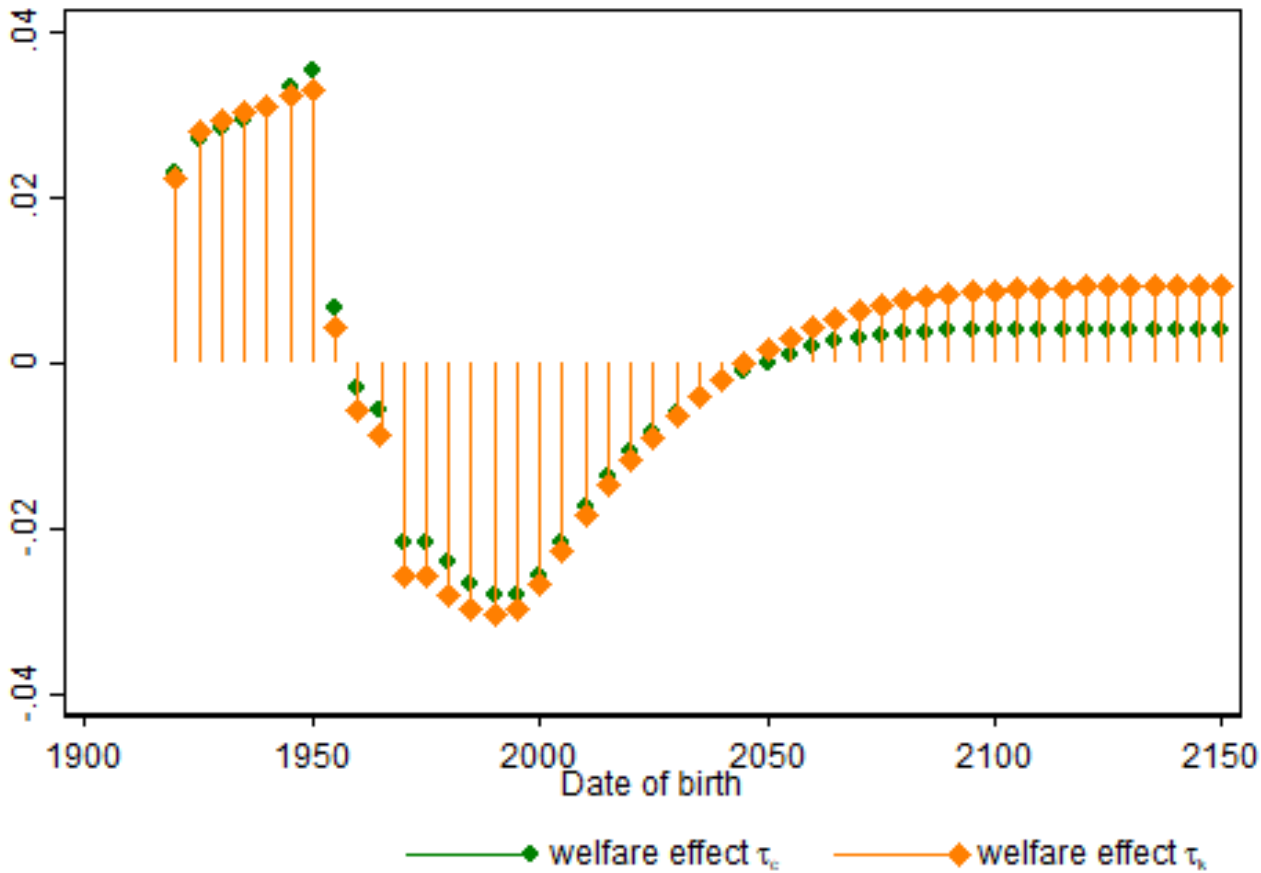
Compare two different tax closures, τ_c and τ_k

other closure τ_k has larger gain than τ_c towards the end,

$\rightarrow$ positive overall welfare effect



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Welfare effect - transition

Fiscal closure		Baseline								
		τ_k	$d\tau_k$	prog.	τ	τ_b	τ_c	τ_l	$d\tau_c$	$d\tau_l$
Reform	τ_k	0.57								
	$d\tau_k$		0.54							
	prog.			0.02						
	τ				0.09					
	τ_b					0.13				
	τ_c						-0.04			
	$d\tau_c$								-0.07	
	τ_l							-0.35		
	$d\tau_l$									-0.35

Welfare effect - transition

Fiscal closure		Baseline								
		τ_k	$d\tau_k$	prog.	τ	τ_b	τ_c	τ_l	$d\tau_c$	$d\tau_l$
Reform	τ_k	0.57	0.56	1.01	0.59	0.5	0.65	0.65	0.65	0.66
	$d\tau_k$	0.54	0.54	0.99	0.56	0.47	0.63	0.63	0.63	0.64
	prog.	-0.45	-0.45	0.02	-0.13	-0.07	-0.35	-0.35	-0.36	-0.34
	τ	-0.13	-0.12	0.35	0.09	0.14	-0.03	-0.02	-0.03	-0.01
	τ_b	-0.15	-0.14	0.33	0.07	0.13	-0.05	-0.04	-0.05	-0.03
	τ_c	-0.14	-0.14	0.33	0.11	0.17	-0.04	-0.03	-0.05	-0.03
	$d\tau_c$	-0.16	-0.16	0.31	0.09	0.15	-0.07	-0.06	-0.07	-0.05
	τ_l	-0.46	-0.46	0.01	-0.11	-0.03	-0.36	-0.35	-0.37	-0.35
	$d\tau_l$	-0.45	-0.45	0.01	-0.1	-0.02	-0.36	-0.35	-0.36	-0.35

% of consumption in the reform scenario which you are willing to give up to ensure that the reform take place

- τ_k is always a good idea
- little effect of $debt$ on welfare
- prog. (almost) always better then τ_l in the reform

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Welfare effect - final steady state

Fiscal closure		Baseline								
		τ_k	$d\tau_k$	prog.	τ	τ_b	τ_c	τ_l	$d\tau_c$	$d\tau_l$
Reform	τ_k	0.95								
	$d\tau_k$		0.95							
	prog.			0.65						
	τ				0.71					
	τ_b					0.54				
	τ_c						0.41			
	τ_l							0.26		
	$d\tau_c$								0.41	
	$d\tau_l$									0.26

Welfare effect - final steady state

Fiscal closure		Baseline								
		τ_k	$d\tau_k$	prog.	τ	τ_b	τ_c	τ_l	$d\tau_c$	$d\tau_l$
Reform	τ_k	0.95	0.95	1.36	1.09	0.85	1.02	1.02	1.02	1.02
	$d\tau_k$	0.95	0.95	1.36	1.09	0.85	1.02	1.02	1.02	1.02
	prog.	0.24	0.24	0.65	0.58	0.43	0.31	0.31	0.31	0.31
	τ	0.47	0.47	0.88	0.71	0.54	0.54	0.53	0.54	0.53
	τ_b	0.47	0.47	0.88	0.71	0.54	0.54	0.53	0.54	0.53
	τ_c	0.34	0.34	0.75	0.65	0.49	0.41	0.40	0.41	0.4
	τ_l	0.20	0.20	0.61	0.56	0.43	0.27	0.26	0.27	0.26
	$d\tau_c$	0.34	0.34	0.75	0.65	0.49	0.41	0.40	0.41	0.4
	$d\tau_l$	0.20	0.20	0.61	0.56	0.43	0.26	0.26	0.26	0.26

- τ_k brings large welfare improvement
- no long run effect of $debt$
- $prog.$ always better that τ_l

GRAPE

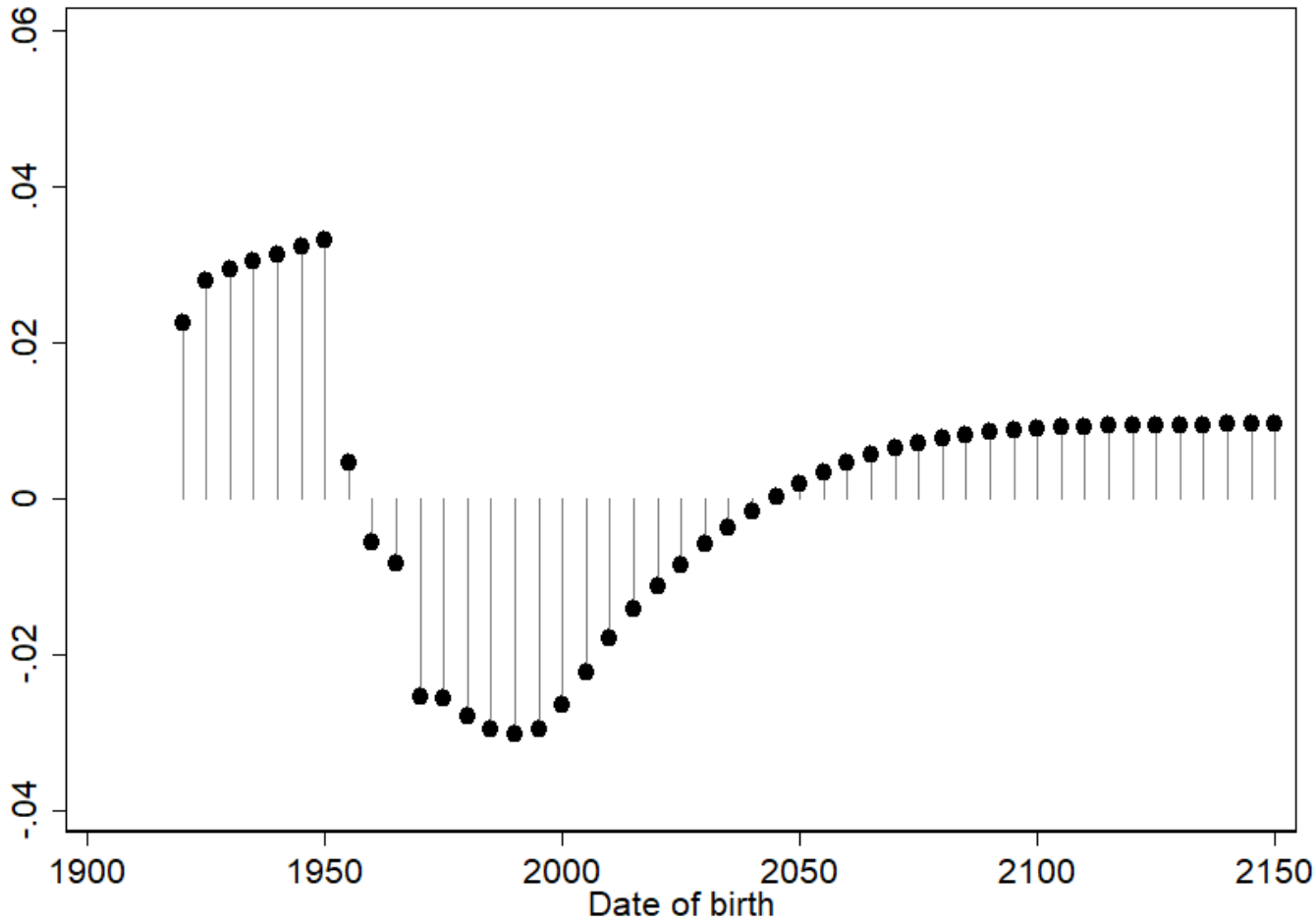
Welfare effects: why public debt can help gaining political support?

- It helps pensioners (who gain anyway)
- Young always loose ($\rightarrow$ are against the reform)
- With debt we sway some working who remain in the old system $\rightarrow$ majority

GRAPE

Welfare effect – τ_k

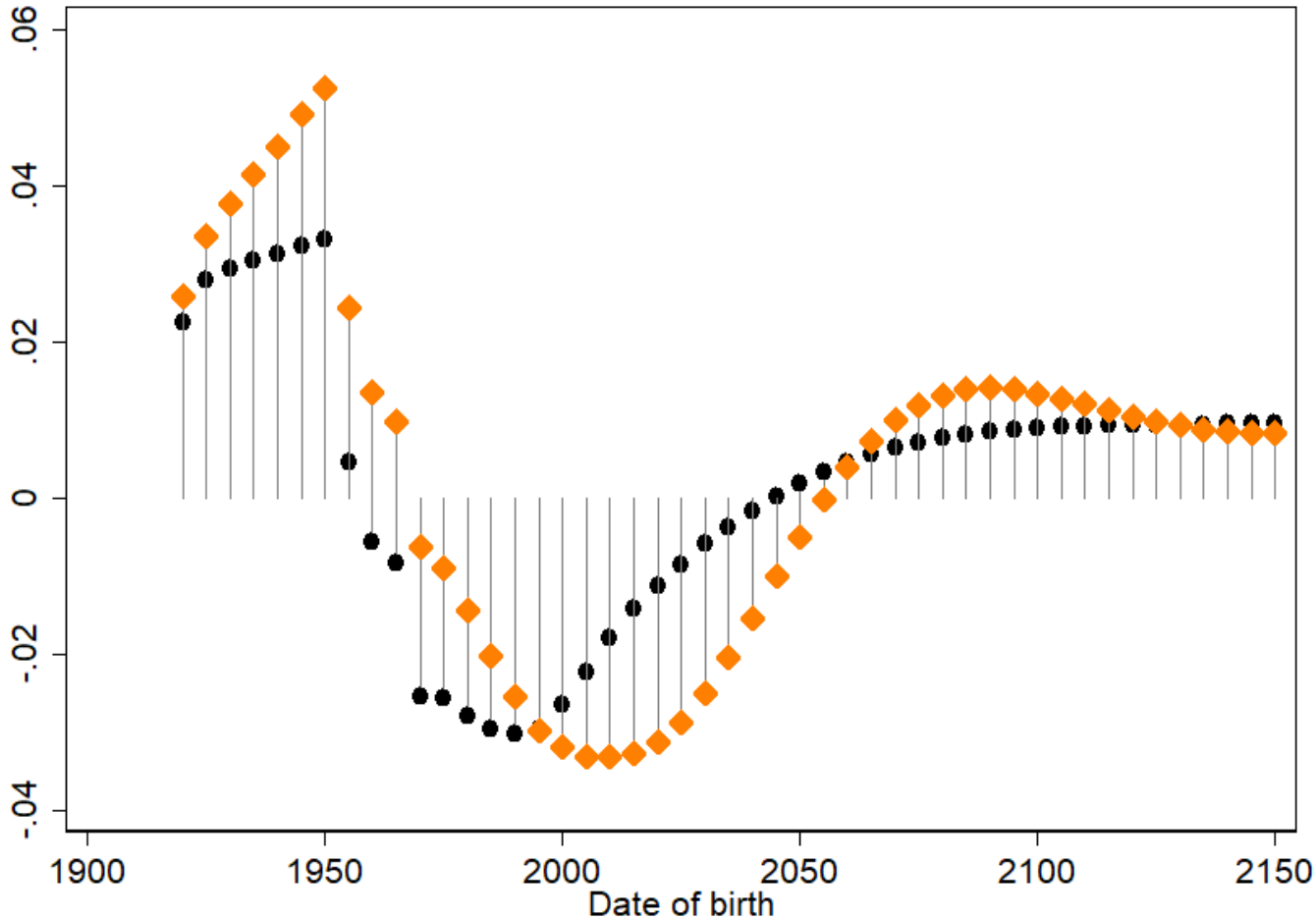
Why debt can help gain political support



GRAPE

Welfare effect - transition - τ_k & $debt + \tau_k$

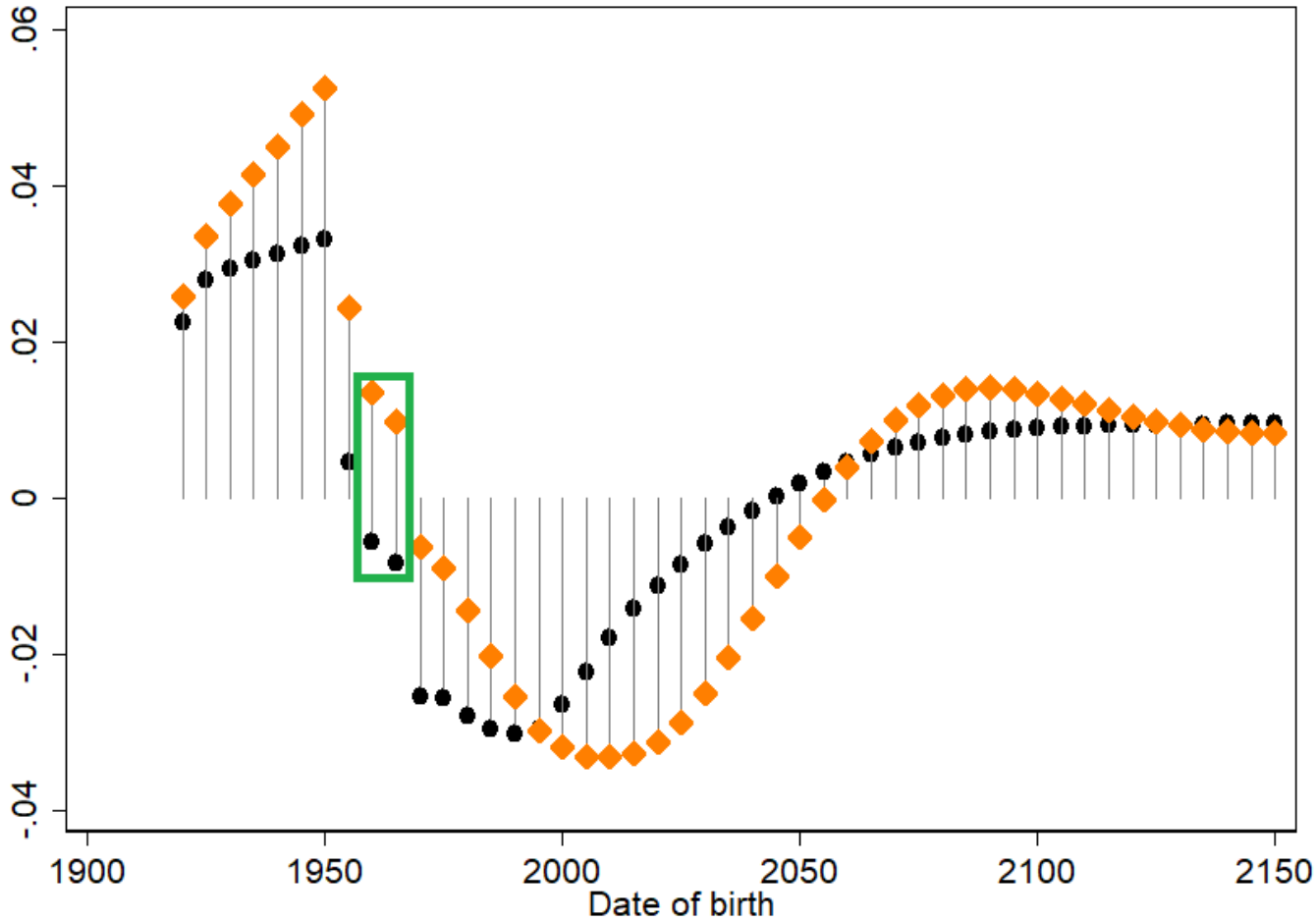
Why debt can help gain political support



GRAPE

Welfare effect - transition - τ_k & $debt + \tau_k$

Why debt can help gain political support



GRAPE

Political support

green area denotes welfare gain, green font denotes political support

Fiscal closure		Baseline								
		τ_k	$d\tau_k$	prog.	τ	τ_b	τ_c	τ_l	$d\tau_c$	$d\tau_l$
Reform	τ_k	43	43	58	43	50	43	43	43	43
	$d\tau_k$	58	58	74	58	58	58	58	58	58
	prog.	43	43	43	43	43	43	43	43	43
	τ	58	58	66	58	66	58	58	58	58
	τ_b	0	0	0	0	0	0	0	0	0
	τ_c	43	50	58	43	50	43	50	43	58
	τ_l	43	43	50	43	50	43	43	43	43
	$d\tau_c$	50	58	58	50	58	50	58	58	58
	$d\tau_l$	50	58	58	58	58	50	58	58	58

GRAPE

Nishiyama & Smetters, 2007: stochastic vs deterministic?

Compare the effects of pension system reform in a stochastic and deterministic framework

Nishiyama & Smetters, 2007: stochastic vs deterministic?

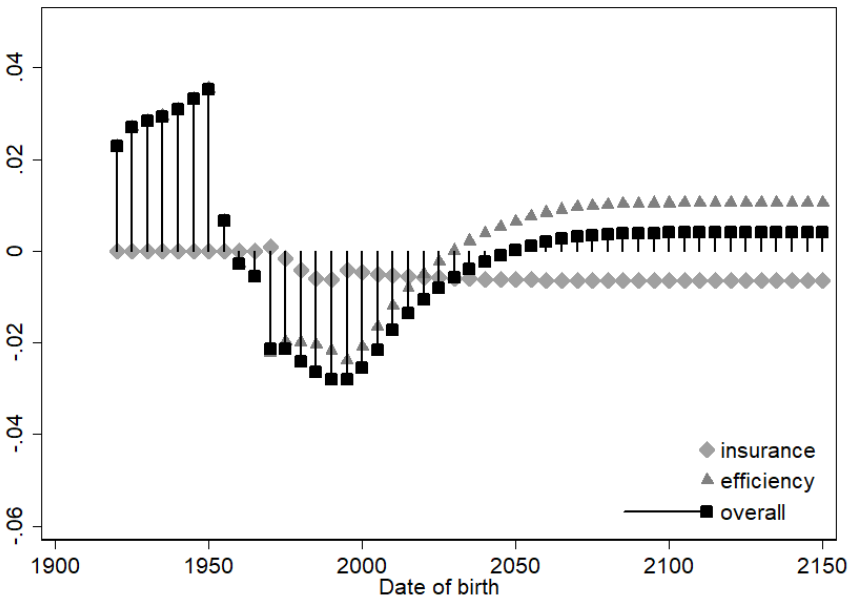
Compare the effects of pension system reform in a stochastic and deterministic framework

- large role for the insurance motive *per se*
- but there are closures with positive outcomes despite stochastic setup

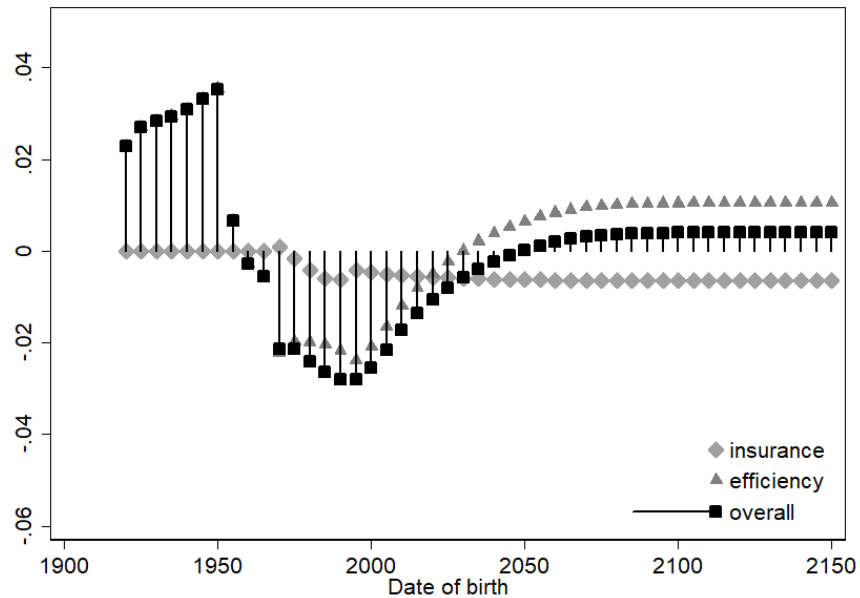
GRAPE

Decomposition

τ_c



τ_c

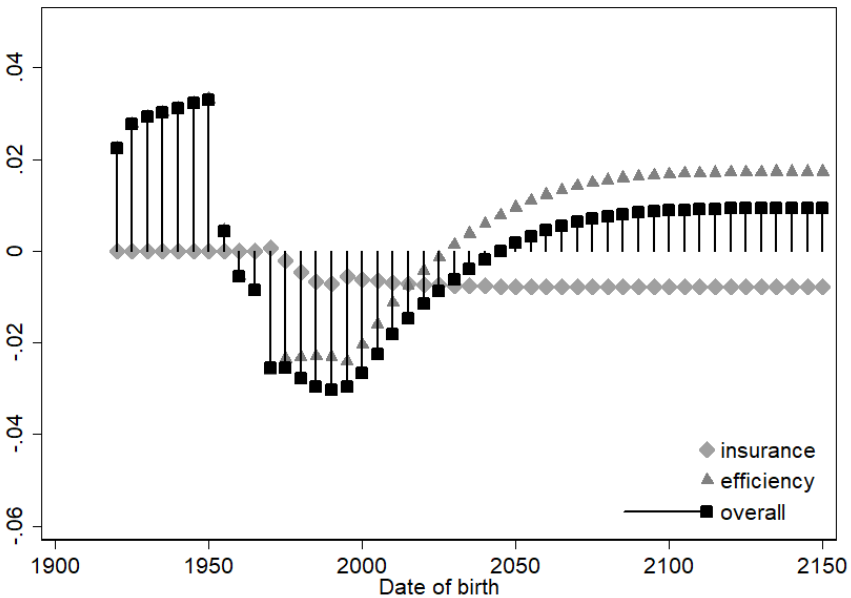


- capital tax: the highest welfare gain due to efficiency
- progression: the smallest welfare loss due to insurance

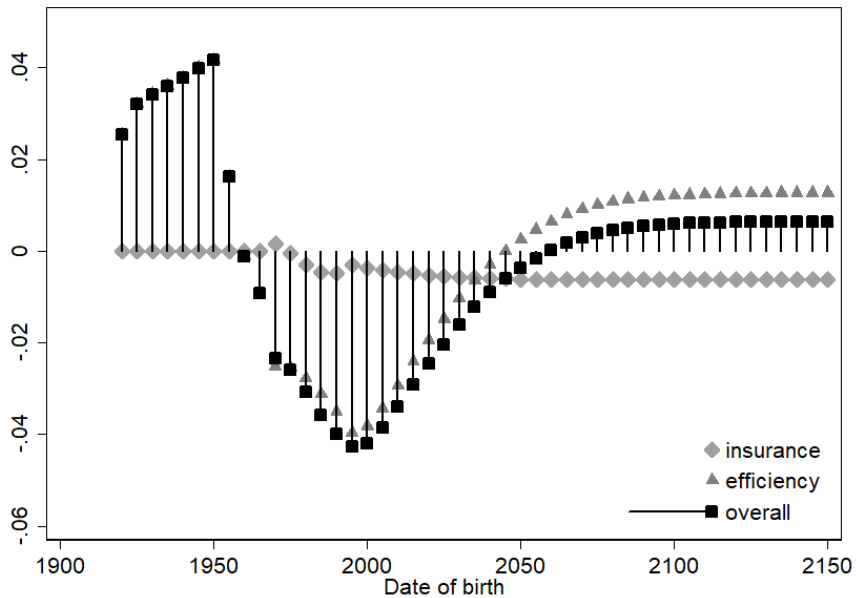
GRAPE

Decomposition

τ_k



prog



- capital tax: the highest welfare gain due to efficiency
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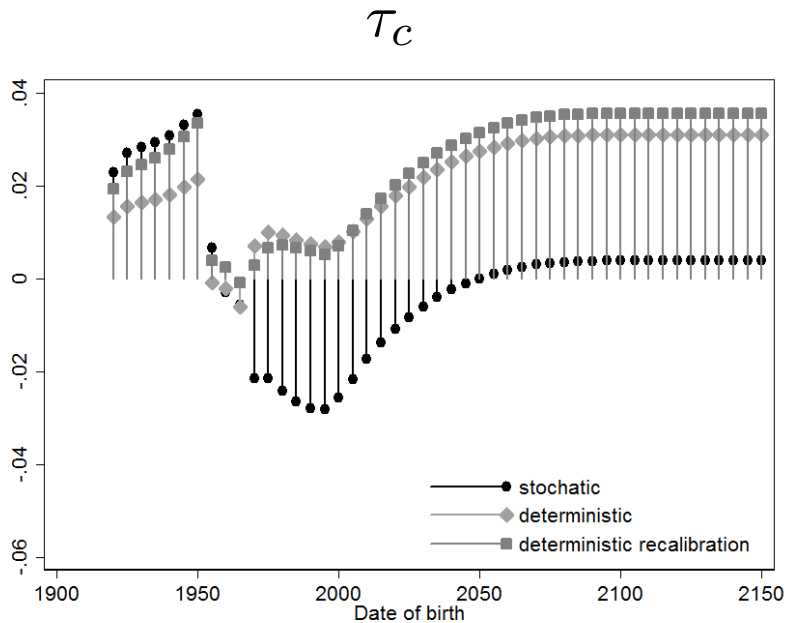
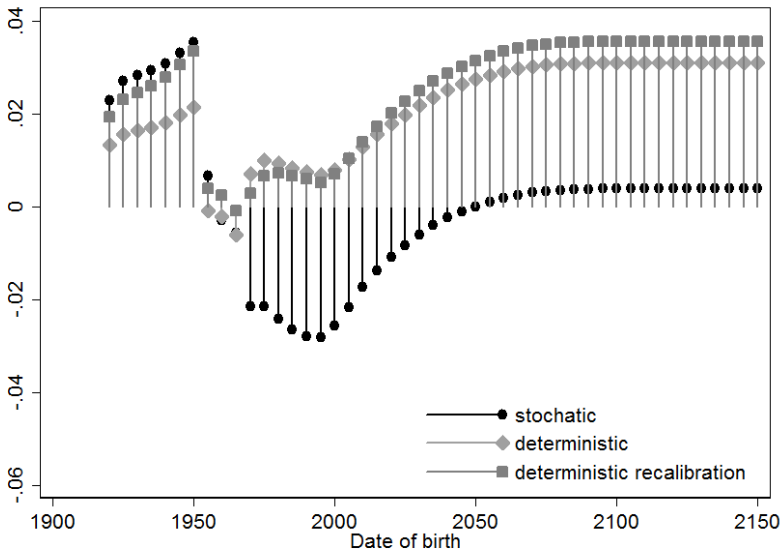
GRAPE

Nishiyama & Smetters, 2007: stochastic vs deterministic?

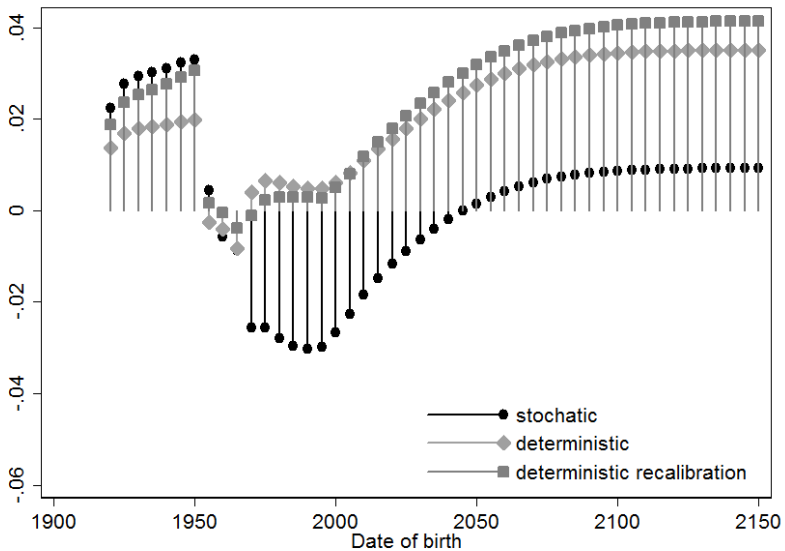


Nishiyama & Smetters, 2007: stochastic vs deterministic?

τ_c



τ_k



Conclusions

- **Social security reform requires fiscal adjustment**
- **Fiscal closures redistribute and affect efficiency**, therefore matter a lot (unnoticed in earlier literature)
- **Loss of Insurance important but not necessarily decisive** for evaluation of (partial) privatization
- Preferred policy options
  - Debt closures: allow to smooth the transition burden on more cohorts
  - Tax on capital income
- Good but never favored policy options
  - Adjustment in pensions
  - Labor tax progression (puzzling)

GRAPE

Questions or suggestions?
Thank you!

w: grape.org.pl
t: grape_org
f: grape.org
e: kmakarski@grape.org.pl

New fiscal closures

GO BACK

- capital tax tax, $\tau_{k,t}$

$$T_t = \tau_{l,t}(1-\tau_t)w_t L_t + \tau_{k,t} r_t A_t + \tau_{c,t} C_t + \Upsilon_t \sum_{j=1}^{J} N_{j,t}$$

$$G_t + subsidy_t + r_t D_t = T_t + \Delta D_t$$

- smoothing tax adjustments with public debt
- part of the costs of the reform shifted to the future generations
- fiscal rule

$$\tau_{k,t} = (1-\varrho)\tau_k^{final} + \varrho\tau_{k,t-1} + \varrho_D \left(\left(\frac{D_t}{Y_t} \right) - \left(\frac{D}{Y} \right)^{final} \right)$$

- debt in the final steady state the same as in the initial steady state

Fiscal new closures

GO BACK

- tr_1 the lowest income threshold
- tr_n is the highest income threshold
- n is the number of income brackets
- m is a tax multiplier such that $\tau^i_{l,t} = \tau^0_{l,t} * m^i$

GRAPE

Fiscal new closures

GO BACK

- tr_1 the lowest income threshold
- tr_n is the highest income threshold
- n is the number of income brackets
- m is a tax multiplier such that $\tau^i_{l,t} = \tau^0_{l,t} * m^i$
- Income threshold is multiple of average labor income, $(1 - \tau_t)w_t\bar{l}_t$.
- In the initial steady state $m = 1$
- In the transition path $m = 1.15$ and $n = 4$

GRAPE

Fiscal closures new in the literature

Total gross labor income $(1-\tau_t)w_t L_t$ is a sum of $n+1$ components: earnings taxed by one of $n+1$ tax rate.

$$L_t^0 = \sum_{j=1}^{\bar{J}} N_{j,t} \int_{\Omega} \min(\omega_{j,t}(s_{j,t}) l_{j,t}(s_{j,t}), tr_1) d\mathbb{P}_{j,t}$$

$$L_t^i = \sum_{j=1}^{\bar{J}} N_{j,t} \int_{\Omega} \max(\min(\omega_{j,t}(s_{j,t}) l_{j,t}(s_{j,t} - tr_1), tr_i - tr_{i-1}), 0) d\mathbb{P}_{j,t} \forall i = 1, ..., n$$

$$\tau_{l,t}^0 = \frac{G_t + subsidy_t + \Delta D_t - \Upsilon_1 \sum_{j=1}^{J} N_{j,t} - \tau_{c,1} C_t - \tau_{k,1} r_t A_t - \sum_{i=0}^{n} L_t^i \tau_l^i}{\sum_{i=0}^{n} L_t^i}$$

$$\tau_{l,1}^i = m^i * \tau_{l,1}^0$$

Fiscal closures within pension system

GO BACK

To keep pension system balanced government may adjust:

- contribution rate τ
- benefits b_j (as a tax on benefits)

$$\sum_{j=\bar{J}_t}^{J} N_{j,t}(1-\tau_{b,t})b_{j,t} = \tau_t \bar{w}_t L_t \quad \text{and} \quad subsidy_t = 0$$

GRAPE

Fiscal closures outside pension system, $subsidy_t \neq 0$

GO BACK

- consumption tax, $\tau_{c,t}$
- labor tax, $\tau_{l,t}$

$$T_t = \tau_{l,t}(1-\tau_t)w_t L_t + \tau_{k,t} r_t A_t + \tau_{c,t} C_t + \Upsilon_t \sum_{j=1}^{J} N_{j,t}$$

$$G_t + subsidy_t + r_t D_t = T_t + \Delta D_t$$

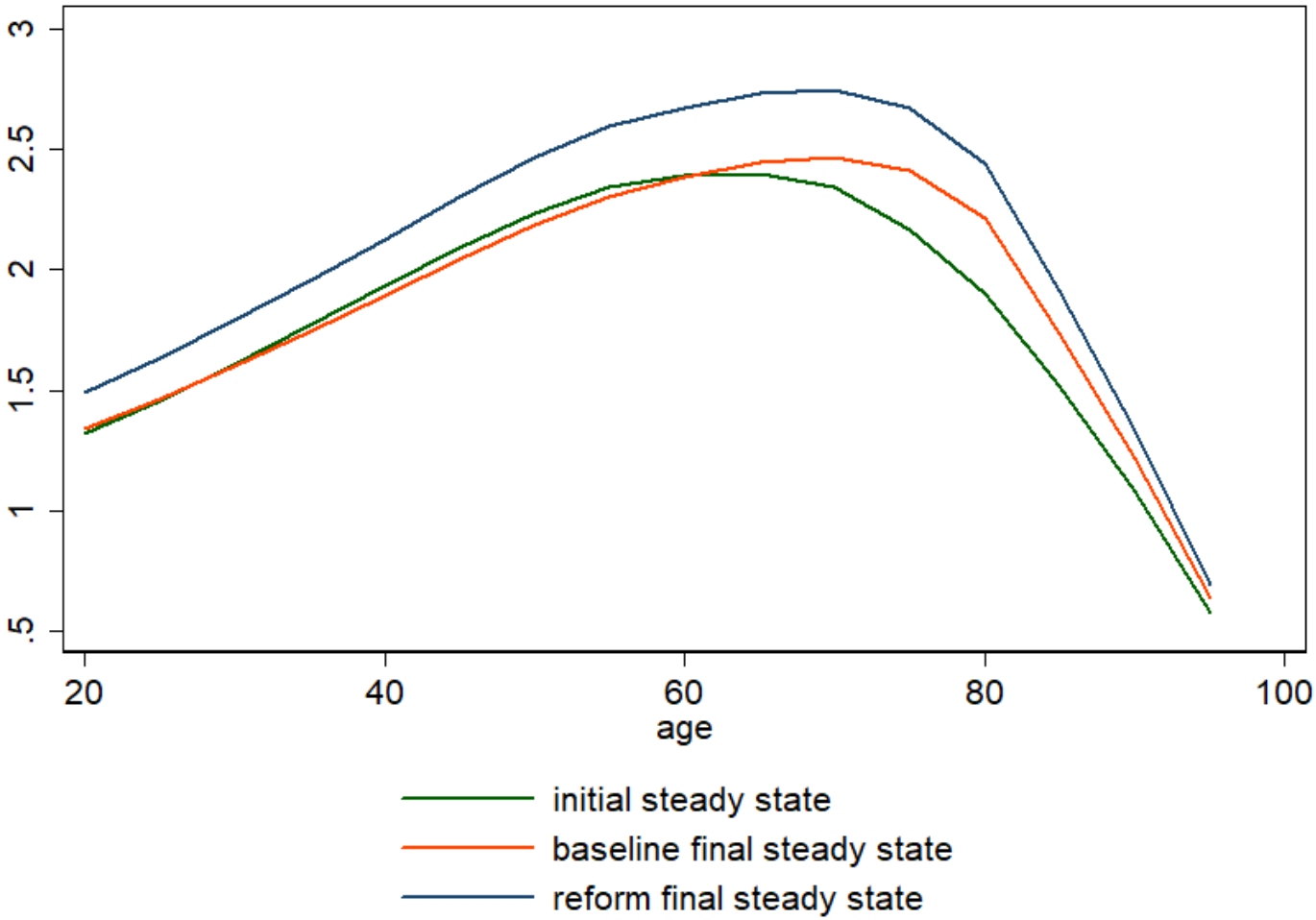
- smoothing tax adjustments with public debt
- part of the costs of the reform shifted to the future generations
- fiscal rule $\forall\ tax \in \{l, c\}$

$$\tau_{tax,t} = (1-\varrho)\tau_{tax}^{final} + \varrho\tau_{tax,t-1} + \varrho_D \left(\left(\frac{D}{Y} \right)_t - \left(\frac{D}{Y} \right)^{final} \right)$$

- debt in the final steady state the same as in the initial steady state

Profile of average consumption for τ_k closure

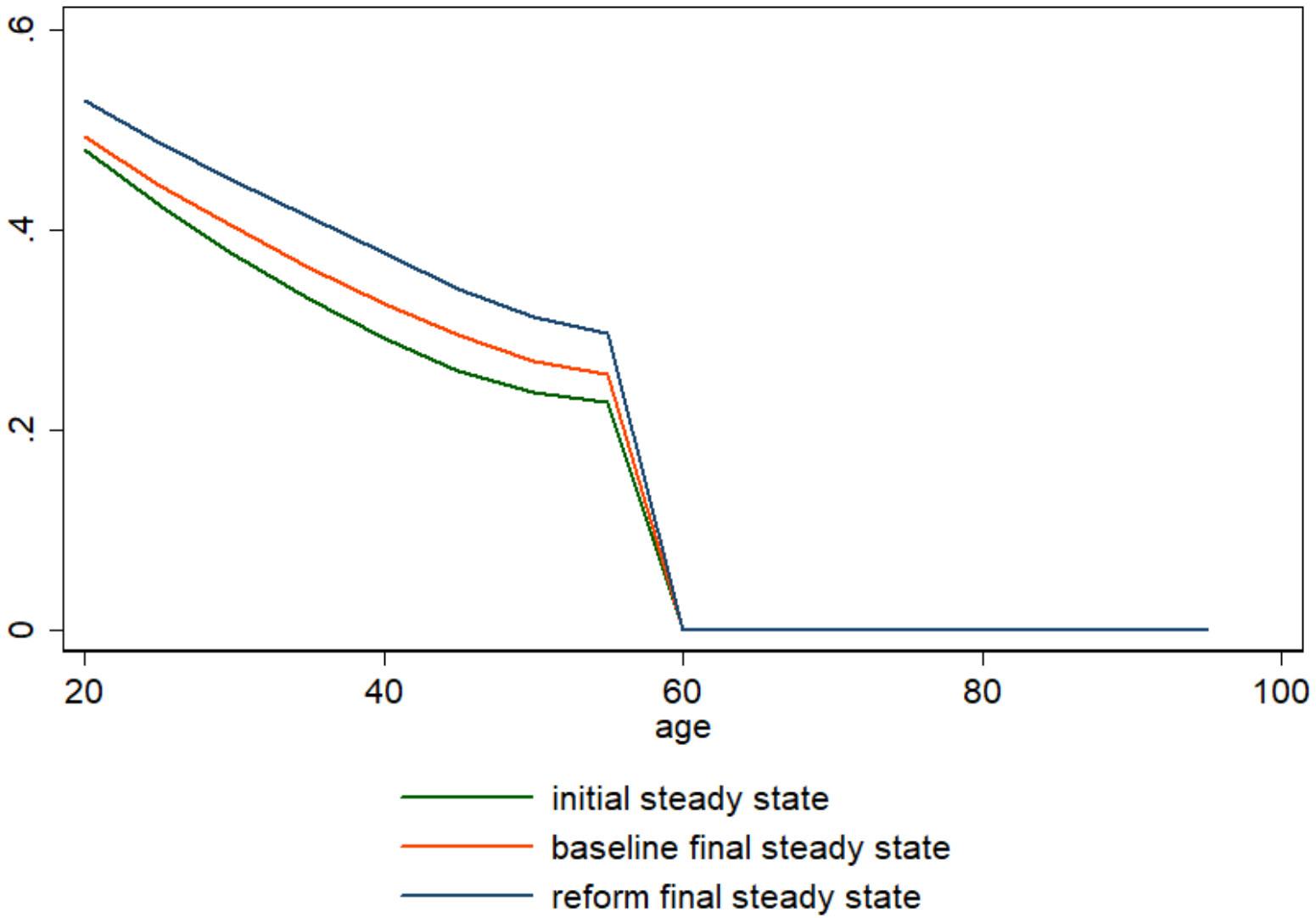
other closures



in line with Gourinchas & Parker (2002, Econometrica)

Profile of average labor for τ_k closure

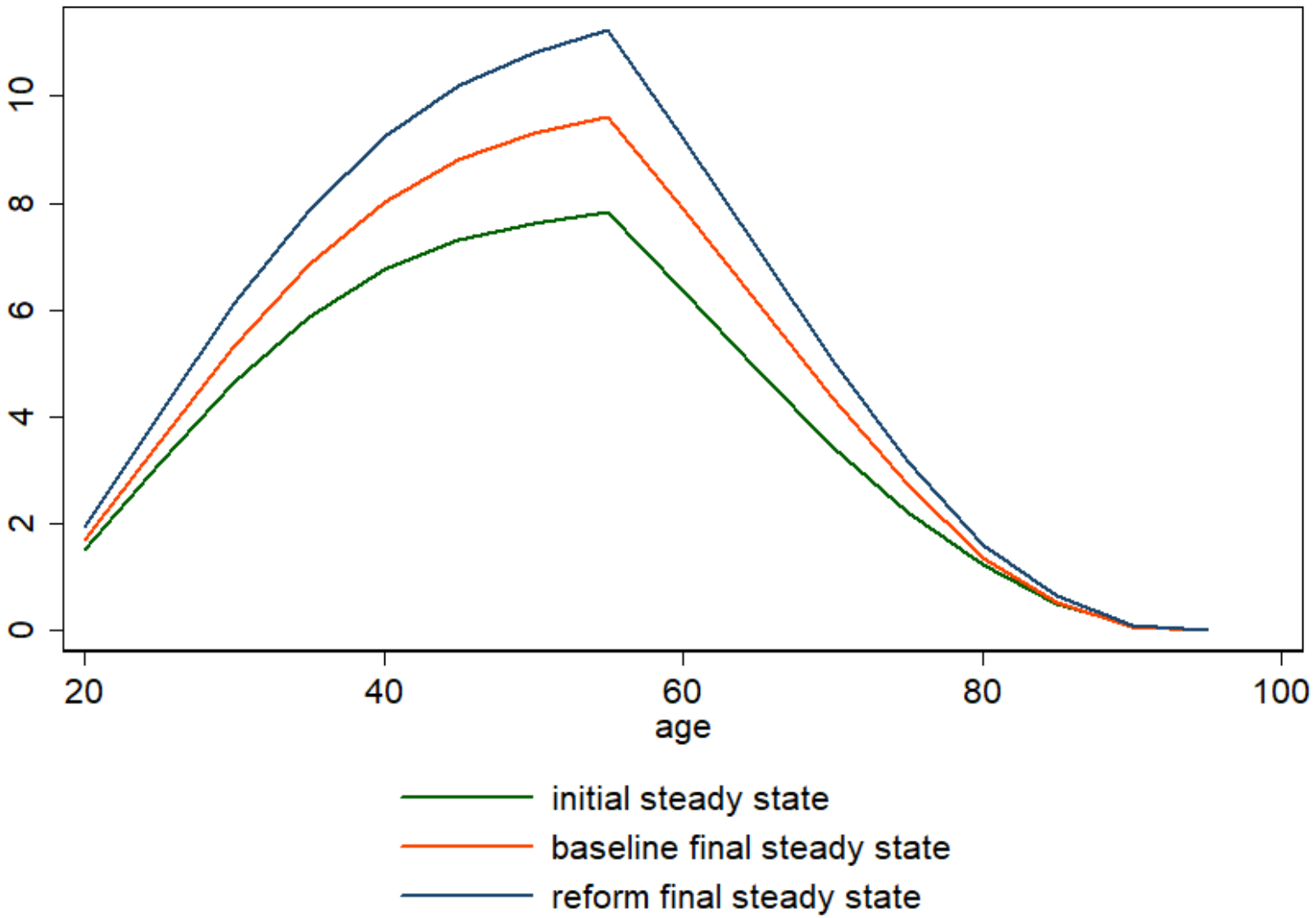
other closures



RAPE

Profile of average savings for τ_k closure

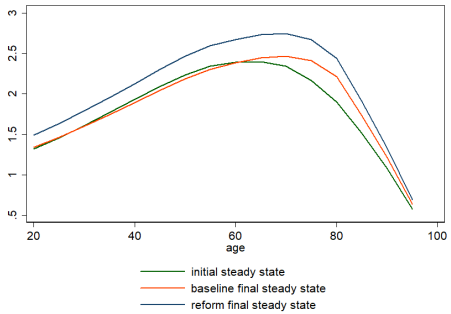
other closures



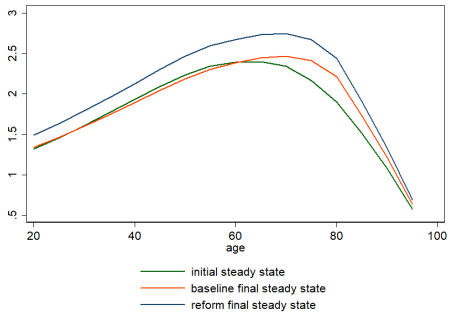
RAPE

GO BACK

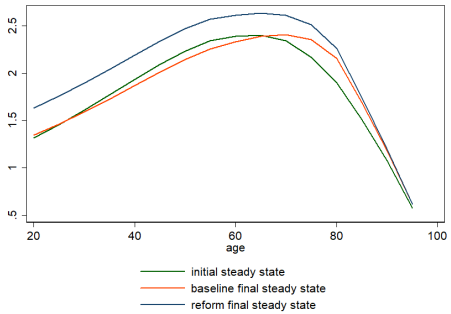
τ_k



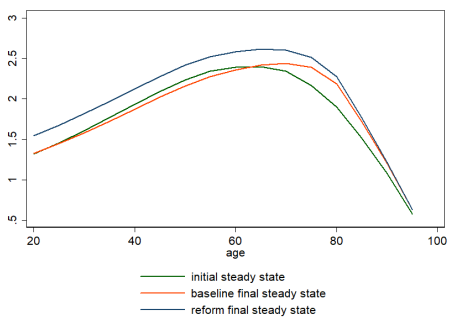
debt + τ_k



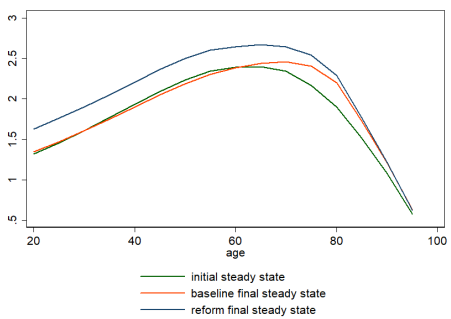
$progression$



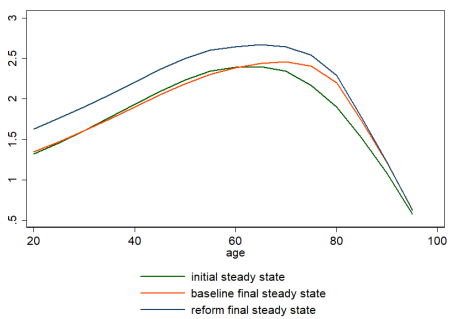
τ



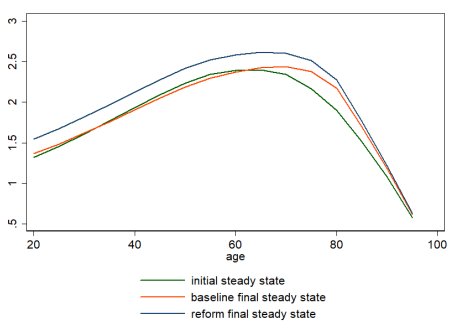
τ_l



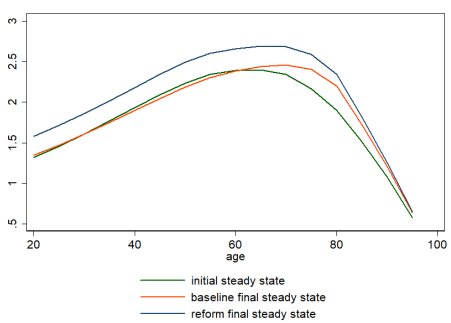
debt + τ_l



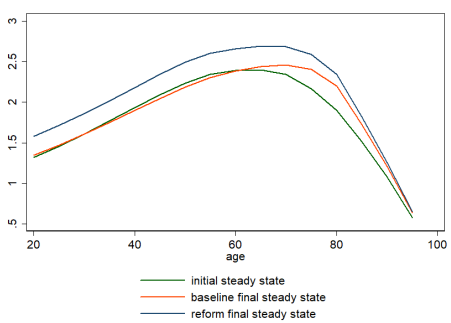
τ_b



τ_c debt +



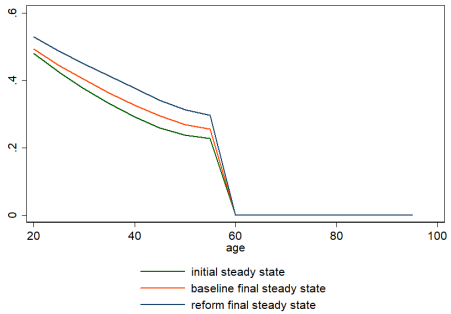
τ_c



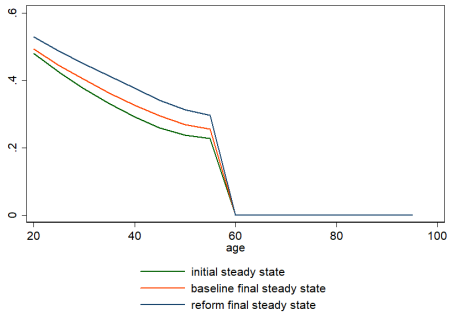
GRAPE

GO BACK

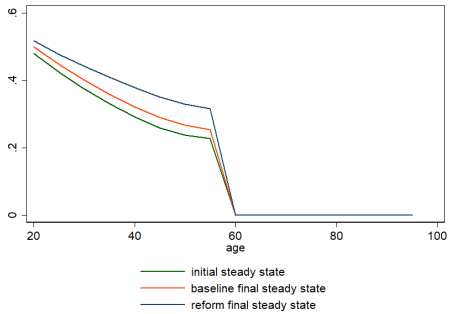
τ_k



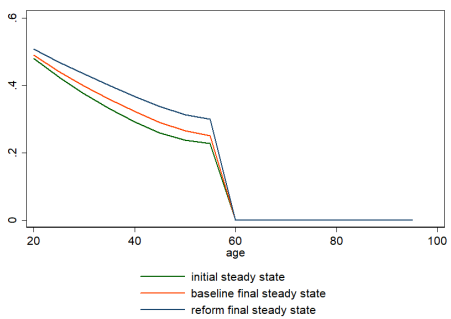
debt + τ_k



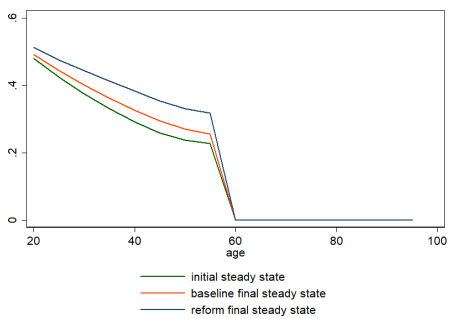
$progression$



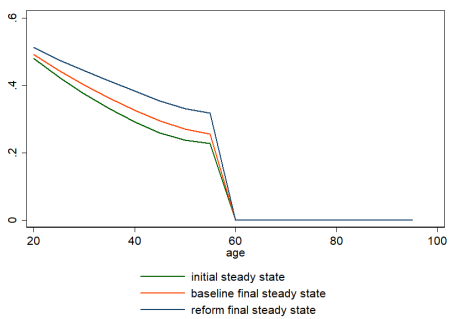
τ



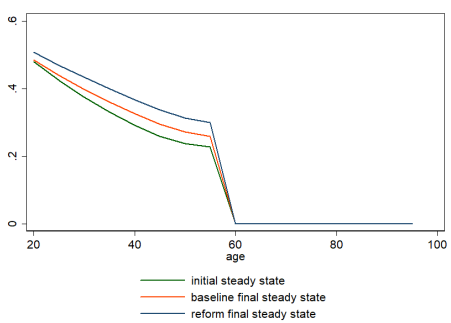
τ_l



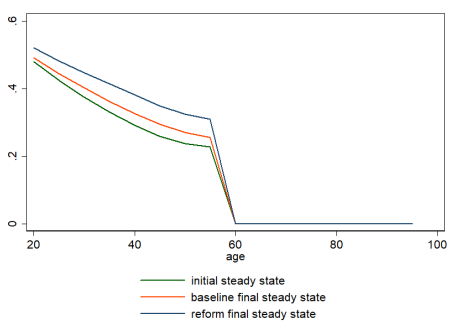
debt + τ_l



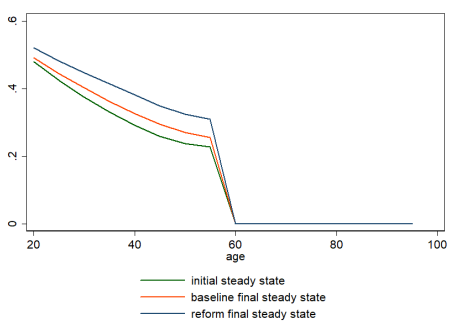
τ_b



τ_c



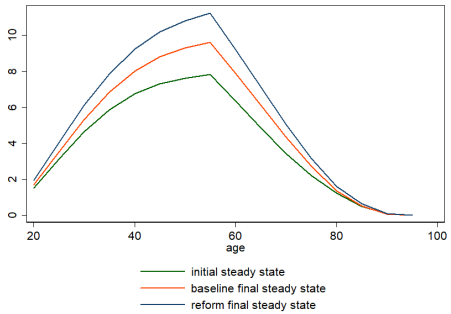
debt $+\tau_c$



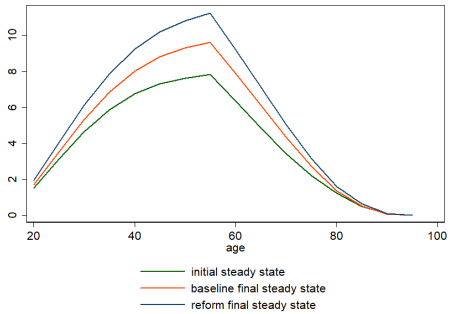
GRAPE

GO BACK

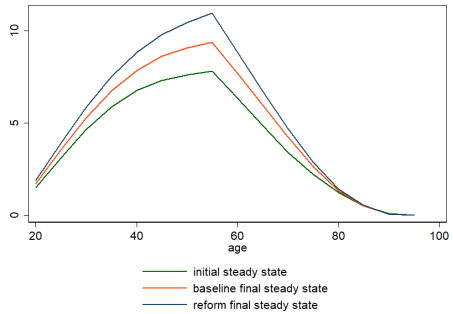
τ_k



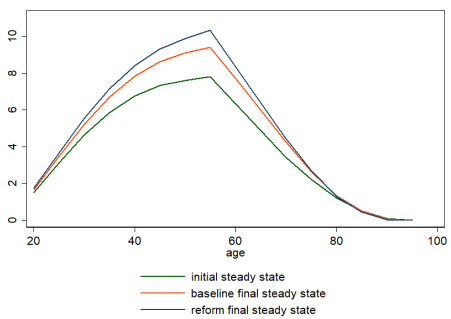
debt + τ_k



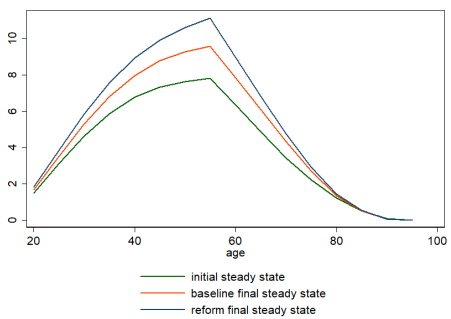
$progression$



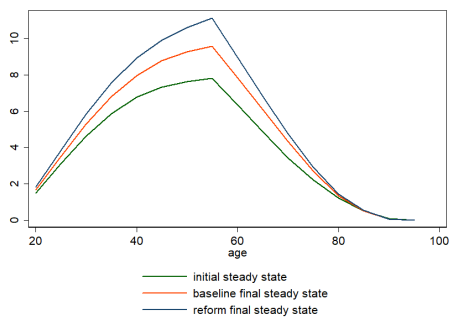
τ



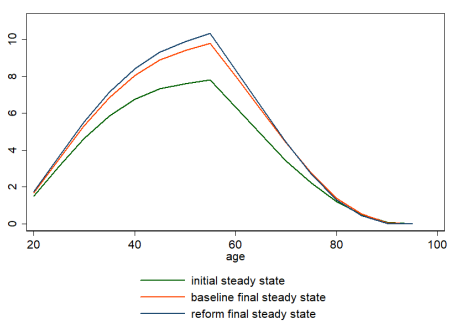
τ_l



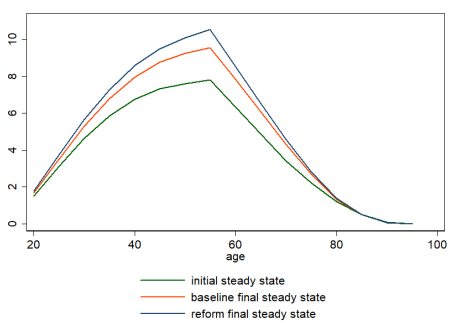
debt + τ_l



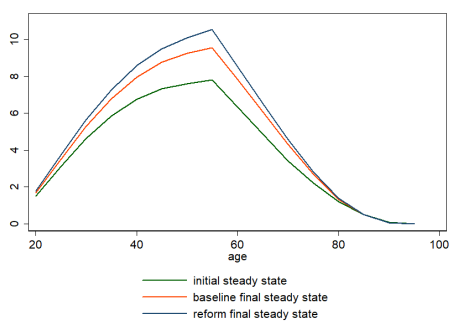
τ_b



τ_c



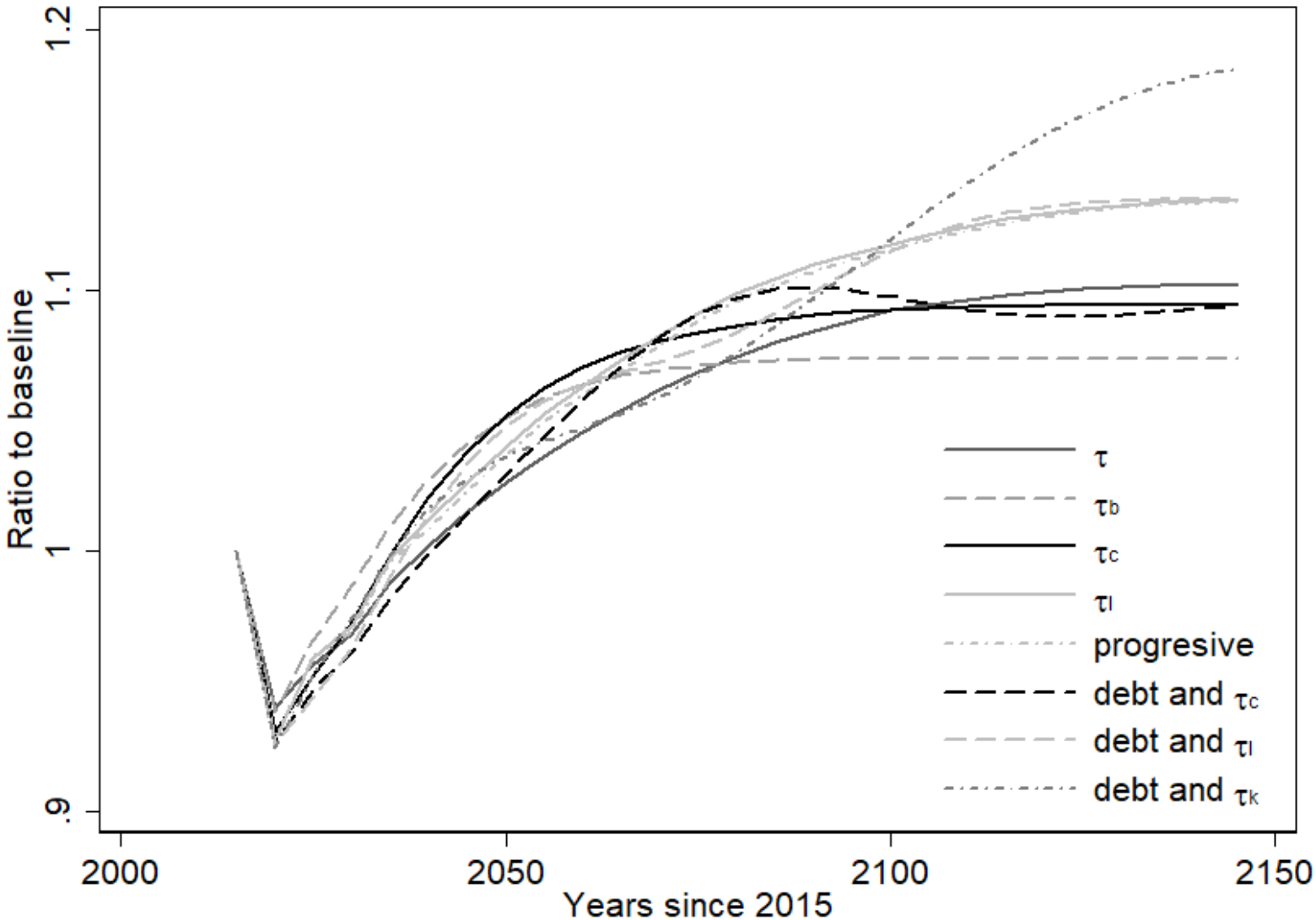
debt +τ_c



GRAPE

Capital

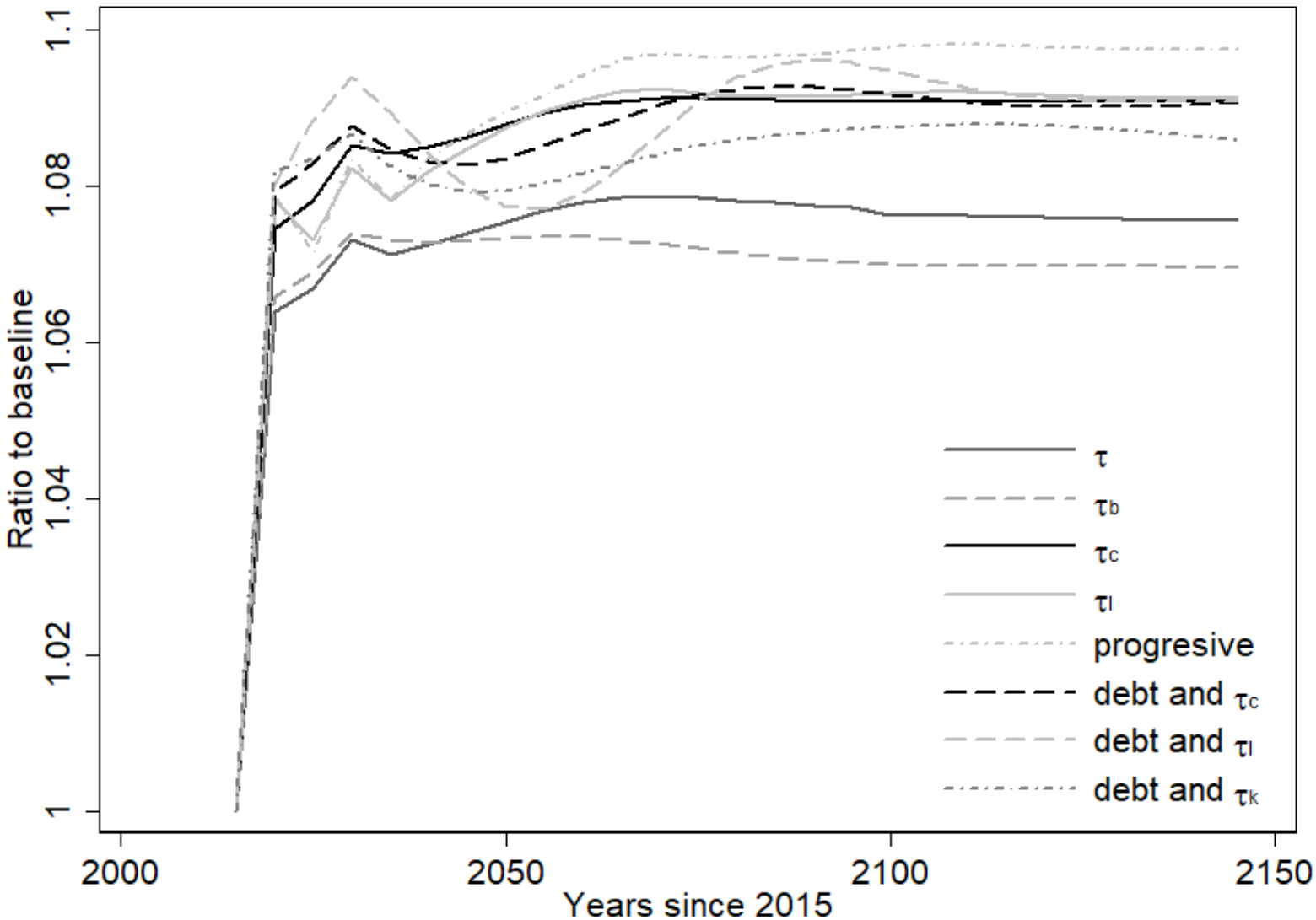
GO BACK



RAPE

Labor

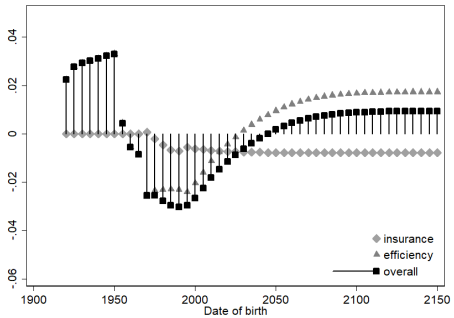
GO BACK



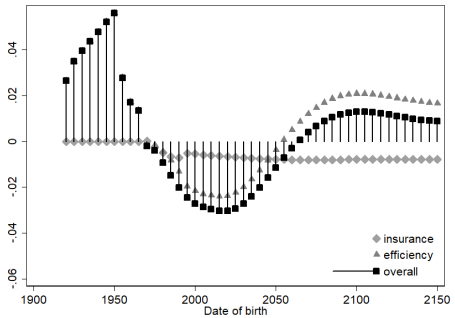
RAPE

GO BACK

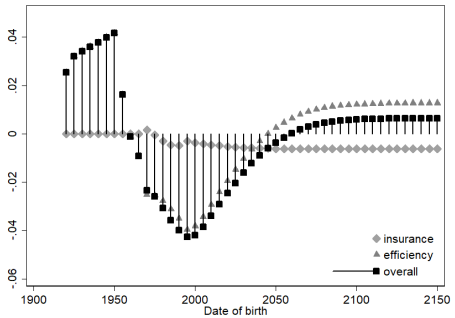
τ_k



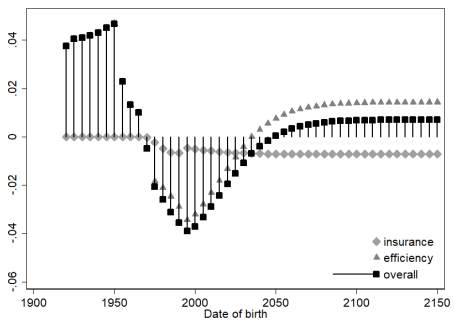
debt + τ_k



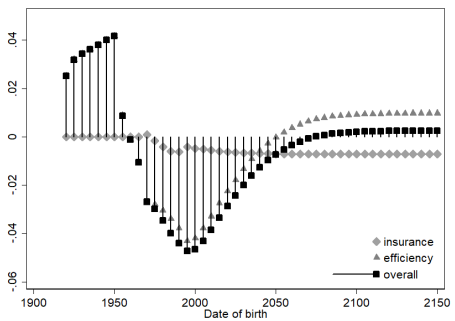
$progression$



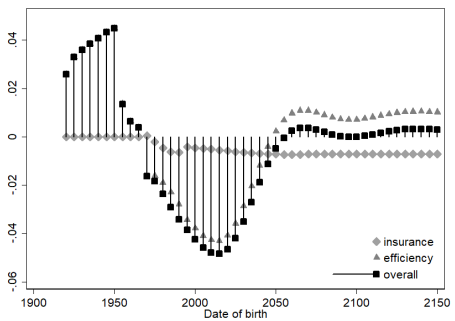
τ



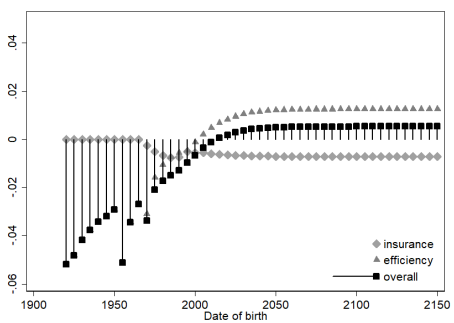
τ_l



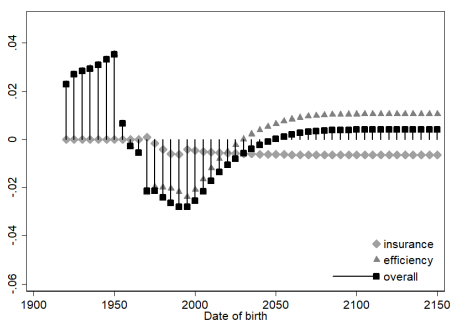
debt + τ_l



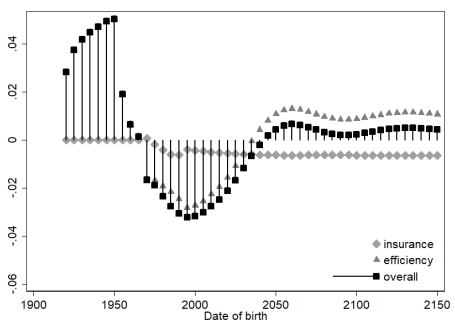
τ_b



τ_c



debt +τ_c



GRAPE