Retirement Financing with Private Pension and Housing Assets

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21st Society for the Advancement of Economic Theory (SEAT) Conference at ANU, Canberra

16-24 July 2022

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Objectives

- Quantify the economy-wide effects of changes to
  - Mandatory Superannuation Guarantee (SG) rate (examining alternative SG rates)
  - In a framework that captures interactions between superannuation, age pension and housing
- Economy-wide effects = Implications for household welfare, lifecycle behaviour, macroeconomic aggregates & government budget
- Searching for optimal SG rate (maximizing average welfare) in the long run steady state

Methodology

- Stochastic overlapping generations (OLG) model with tenure choice – a macroeconomic model that
  - incorporates lifecycle behaviour of heterogenous households facing stochastic labour productivity and survival
  - features tenure choice (renting or owning a house), 3 sources of wealth – housing, liquid financial and superannuation assets, and bequest motive
  - is calibrated to Australia, using HILDA data, ABS demographic and national account data and Australian Government data
  - includes a detailed representation of Australian income tax, means-tested public pension and mandatory superannuation policies
  - captures general equilibrium effects via endogenous factor prices, house & rental prices, redistribution of bequests and govt. budget-balancing instrument

Literature

- Literature on public pension/social security, using OLG models:
  - International – e.g., Kitao (2014), Hosseini & Shourideh (2019)
  - Australian – e.g., Kudrna, Tran & Woodland (2019, 2021)
- Literature on tax-favored private pensions (retirement accounts), using OLG models:
  - International – e.g., Imrohoroglu et al. (1989), Fuster et al. (2007), Fehr & Kindermann (2010), Nishiyama (2011), Ho (2017)
  - Australian – e.g., Creedy & Guest (2008), Kudrna & Woodland (2013, 2018), Kudrna (2022)
- (Housing) Literature (on taxation), using OLG models with housing:
  - International – e.g., Floetotto et al. (2016); Sommer & Sullivan (2018); Nakajima (2020), Karlman et al. (2021), Kaas et al. (2021), Fehr, Hofmann & Kudrna (2021)
  - Australian – e.g., Cho & Sane (2013); Cho et al. (2021)

Outline of the talk

- Model description
- Calibration and model performance
- Simulation results
- Conclusions and future research

Simulation model: Key features

- Type: Stochastic general equilibrium with overlapping generations, tenure choice and (illiquid) private pensions
- Sectors: Household, firm, government, rental and construction sectors
- Market structure: Closed economy (CE) with endogenous factor prices
- Demographic structure: Stationary demographics with constant population growth rate and survival rates

Household sector: Key features

- Household structure: Overlapping generations (16 cohorts = 20-24, .., 95-99) of 5 skill types (income quintiles), facing labour income and survival uncertainty
- Tenure choice and housing: Homeownership subject to housing market frictions (i.e., minimum house size, loan to value ratio and transaction costs)
- Optimization problem: Renting/owning (a house) and consumption/saving decisions over the lifecycle, to maximize lifetime utility (derived also from intended bequests), subject to budget and housing constraints
    - Household behaviour impacted by government policy (and general equilibrium effects)

Household sector: Lifetime utility

Agents have preferences over ordinary consumption c_j and housing consumption $f(h_j)$, and bequest $\overline{b}$ (left up on death) and maximize expected lifetime utility:

$$E\left[\sum_{j=1}^{J}\beta^{j-1}\left(\prod_{s=1}^{j}\psi_s\right)\left\{u(c_j,f(h_j))+\beta(1-\psi_{j+1})\mathcal{B}(\overline{b}_{j+1})\right\}\right]$$

where

ψ_j : survival probabilities with $\psi_{j-1}=1$
β : subjective discount factor
$u(c_j,f(h_j))$: annual utility (non-separable Cobb-Douglas form)
$\mathcal{B}(\overline{b}_{j+1})$: bequest function (De Nardi (2004) luxury good type)

Note that there is a state index $z=(j,a_l,h,sa,i,\eta_j)$ before tenure decision and $\widetilde{z}=(j,a^+,h,sa,i,\eta,o^+)$ after tenure decision, with agents only distinguished by age j above.

Household sector: Constraints

Expected lifetime utility above maximized subject to per-period budget constraint:

$$\begin{aligned} a_{j+1} &= (1+r)(a_{l_j} + \zeta sa_j) + (le_j - sc_j) + b_j + st_j \\ &\quad + (1-\delta_o)p_h h_j + pen_j - T(\widetilde{y}_j) - p_c c_j - p_r c_{h_j}, \end{aligned}$$

where

a_j : total savings	le_j : labor income $= w \cdot e_j \exp\left[\eta_j\right]$
a_{l_j} : liquid assets	pen_j : public pension
$p_h h_j$: housing assets	$T(\widetilde{y}_j)$: income taxes
sa_j : superannuation	$p_c c_j$: consumption
b_j : bequest receipts	$p_r c_{h_j}$: rent (if $h = 0$)
st_j : social transfers	sc_j : superannuation contributions

For all constraints faced by households, including housing market frictions see the paper

Policy settings: Age pension

We assume a non-contributory, needs-based and means-tested age pension pen_j paid to those aged $j \geq j_R$ (same as superannuation access age), with the benefit subject to binding income or asset test:

$$pen_j = \begin{cases} 0 & \text{for } j < j_R \\ \max\ [\ p^m(h_j) - \max\ (in_j;\ as_j);\ 0] & \text{for } j \geq j_R \end{cases},$$

where

$p^m(h_j)$: maximum pension (depends on tenure)
in_j : deduction due to income test
as_j : deduction due to asset test

Note that each test includes assessable income/assets, taper (withdrawal) rate and threshold (to which $p^m(h)$ is paid).

Policy settings: Mandatory superannuation

- We incorporate compulsory superannuation system funded by mandatory contributions at the SG rate τ^p, with superannuation assets sa_j accumulate (and decumulate after the access age j_R) as:

$$sa_{j+1} = \begin{cases} (1 + r(1 - \tau^r))sa_j + sc_j - sct_j & \text{for } j < j_R \\ (1 - \zeta_j)(1 + r)sa_j & \text{for } j \geq j_R \end{cases}$$

where

τ^r : effective fund earnings tax rate
sc_j : mandatory super contributions $= \min[\tau^p le_j; \overline{sc}]$
sct_j : contribution tax $= \tau^s sc_j$, iff $le_j > y_{\min}$
ζ_j : drawdown fractions of private pension balance
sp_j : drawdowns $= \zeta_j(1 + r)sa_j$

Policy settings: Personal income tax

- Household's taxable income is taxed under the 2017-18 progressive income tax schedule $T(\widetilde{y}_j)$. The taxable income (or income tax base) $\widetilde{y}_j$ is given as

$$\widetilde{y}_j = (le_j - sc_j) + r \ \max(a_{l_j}; 0) + pen_j.$$

Construction sector

- Following Sommer & Sullivan (2018) and Rotberg (2022) we assume a construction sector with supply of housing facing convex construction cost:

Rental agency

- The supply of housing for the rental market is provided by a two period-lived rental agency, facing following maximization problem:

Rest of the model

- Production sector – Perfectly competitive, profit maximizing firms that demand capital and labour to produce output

- Government – Detailed with total tax revenues collected from households ($T^Y + T^S + T^C + T^{LS}$) and firms ($T^F + \Pi_h$) financing government expenditures (with a budget-equilibrating tax instrument – mostly τ^c):

$$T^Y + T^S + T^C + T^F + T^{LS} + \Pi_h = G + ST + AP + (r - n)B_G$$

- Market clearing – Goods market must clear:

$$Y = C + (n + \delta_k)K + C(I^H) + G + TR$$

where expenditures include private and public consumption ($C + G$), investment in capital stock $I = (n + \delta_k)K$, construction expenditure $C(I^H)$ and transaction costs TR.

Calibration approach

- The benchmark economy assumed to be in a stationary steady state equilibrium, calibrated to Australia
- Target macro-level and fiscal policy data averaged over 5 years ending in June 2018
- And use micro-level data from the HILDA surveys 2001-2018 to calibrate household economic behaviour
- Stationary demographic structure fitted to ABS demographic data – with inputs for population growth rate and survival rates
- Detailed representation of Australian tax-transfers and superannuation policy

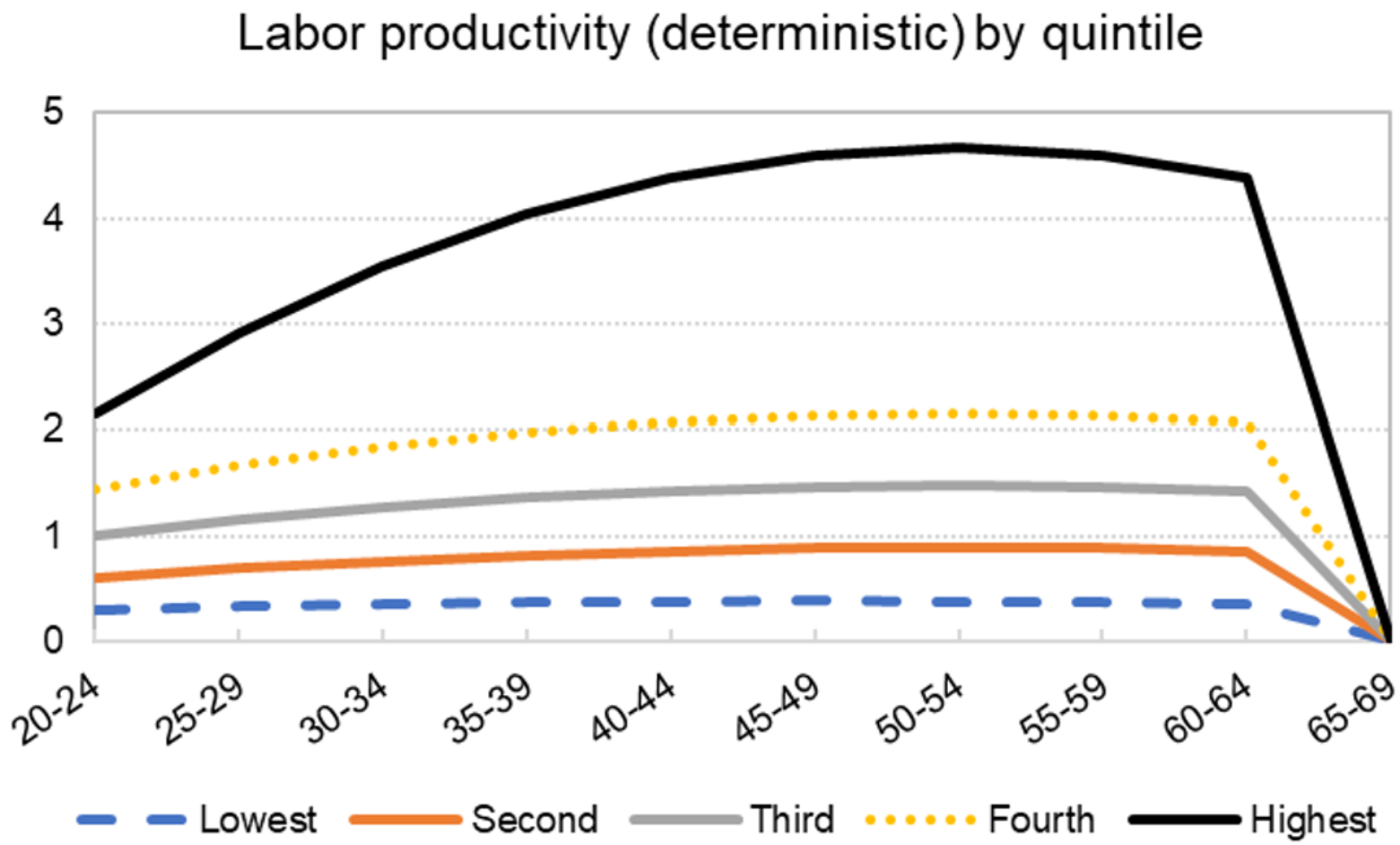
Model parameters

Table: Parameter values of the benchmark model

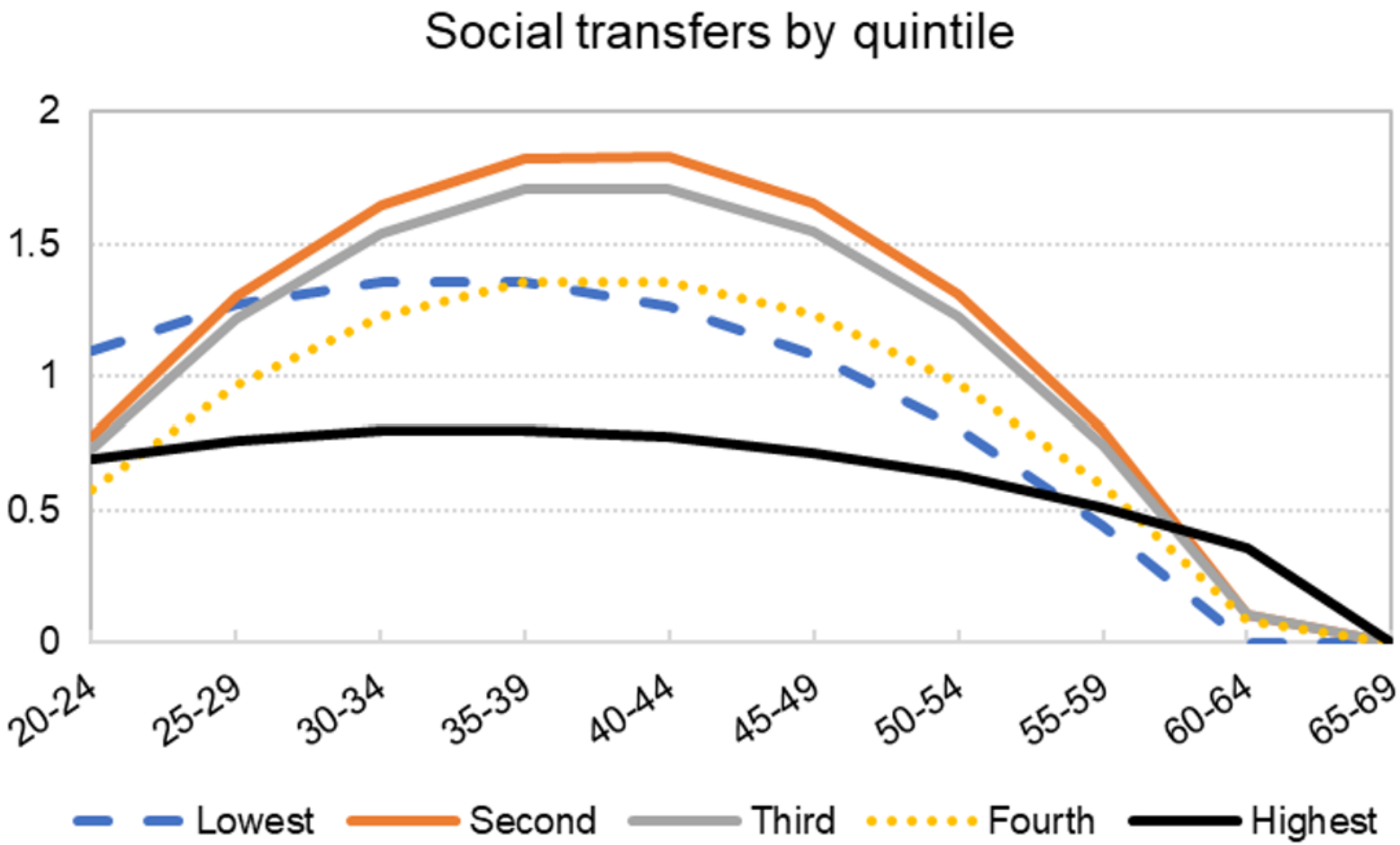
Definition	Value	Source
Demographics		
Survival probabilities	-	ABS (2019)
Population growth rate	0.016	Calibrated
Skill distribution	[0.19,0.5,0.31]	HILDA18
Household preferences		
Intertemporal elasticity of subs.	0.5	Kudrna et al (2021)
Ordinary consumption share	0.724	Kaas et al (2021)
Time discount factor	0.983	Calibrated
Homeownership preference parameter	1.53	Calibrated
Bequest motive parameter	-7	De Nardi (2004)
Bequest luxury good parameter	11.6	De Nardi (2004)

Labor productivity		
Deterministic productivity profile	-	HILDA18
AR(1) correlation	0.95	Freestone (2018)
Transitory variance	0.017	Freestone (2018)
Production sector		
Capital share	0.35	Calibrated
Capital depreciation rate	0.038	Calibrated
Production constant	1.47	Calibrated
Housing market		
Depreciation rate - residential housing	0.013	Calibrated
Depreciation rate - rental housing	0.026	Calibrated
Maximum loan-to-value ratio	0.7	Data
Transaction cost - selling house	0.03	Data
Transaction cost - buying house	0.05	Data
Minimum house size	3y	Calibrated
Housing supply elasticity parameter	0.9	SommerSullivan(2018)

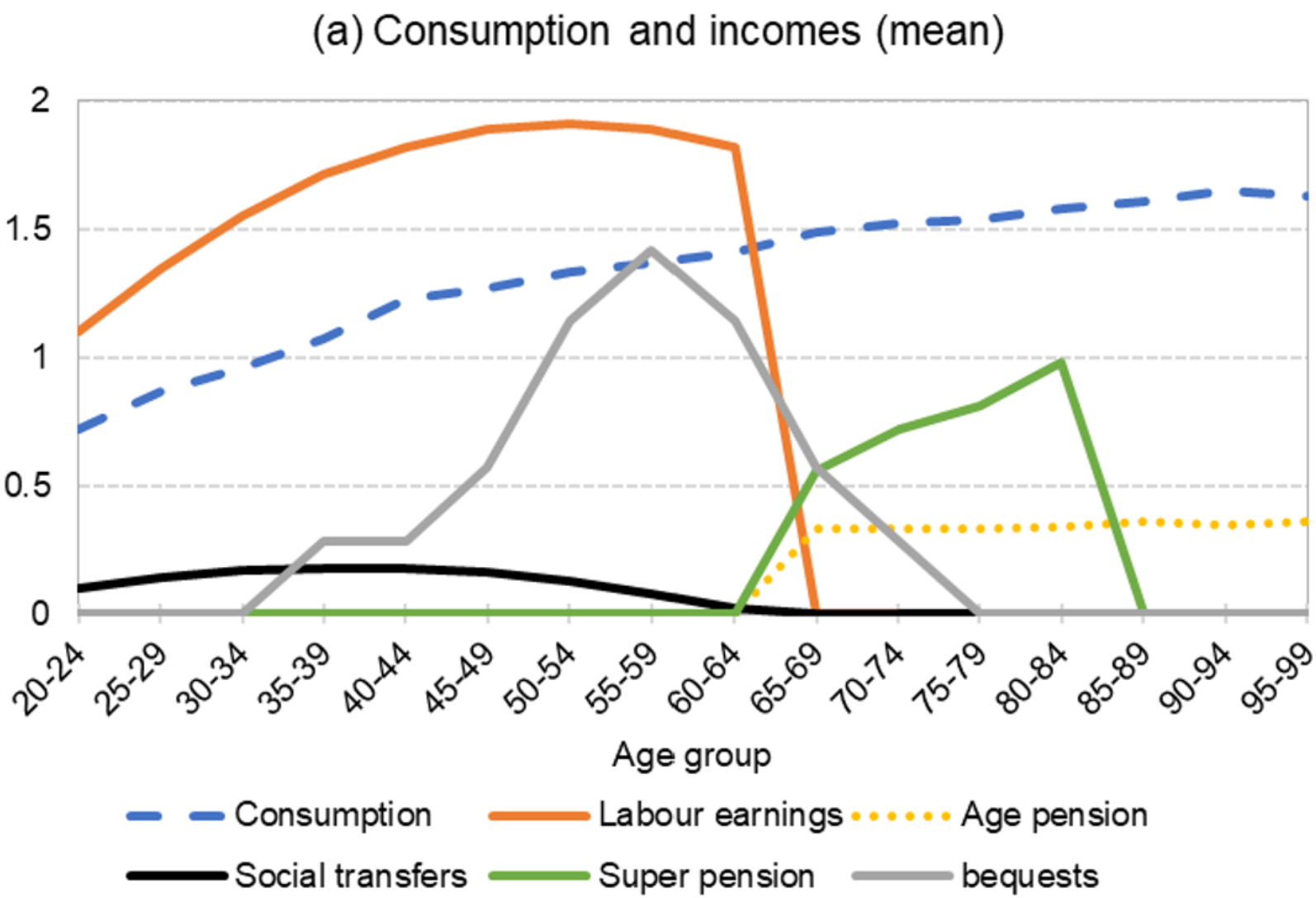
Labour productivities (deterministic part)



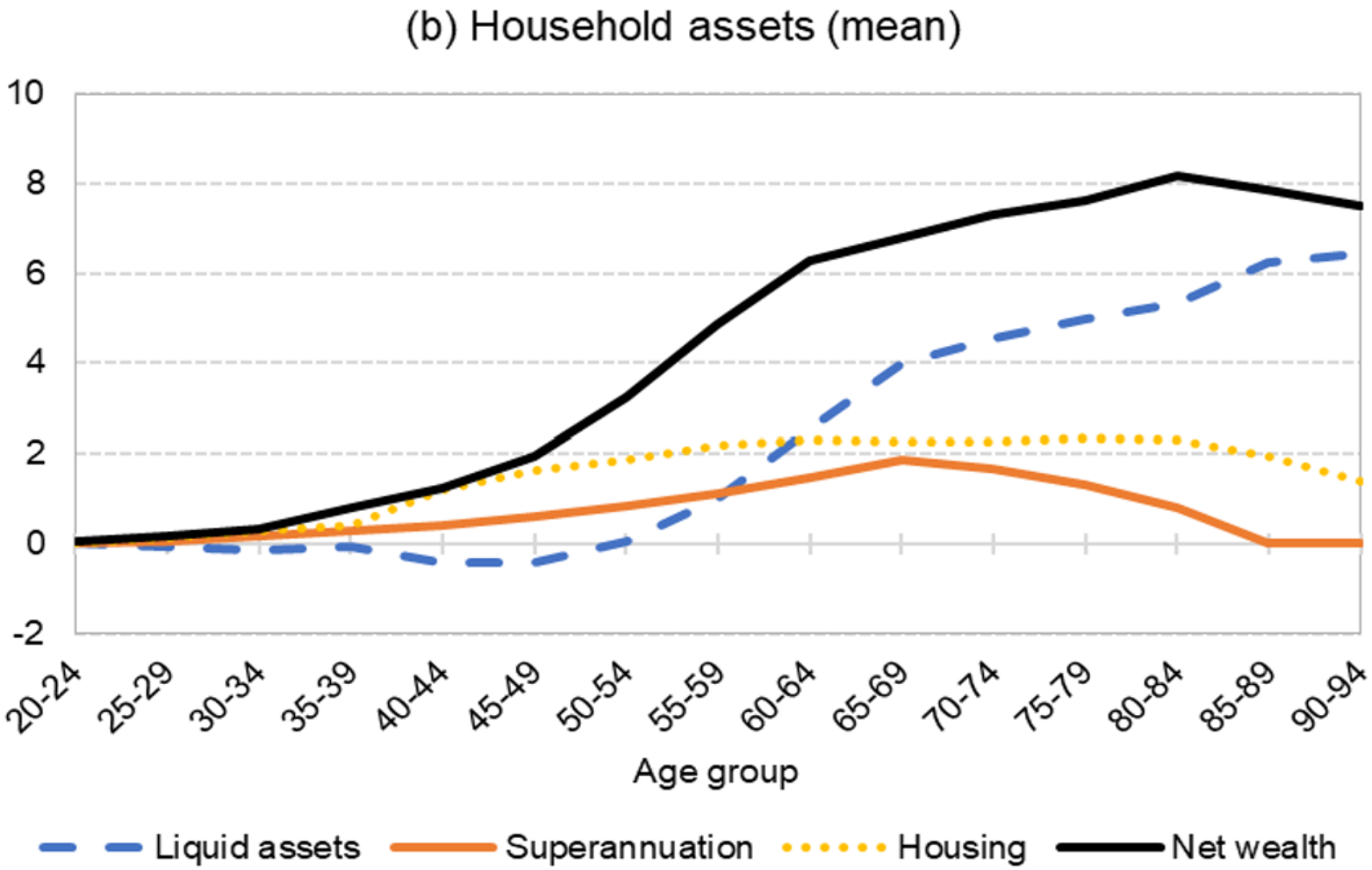
Social transfers



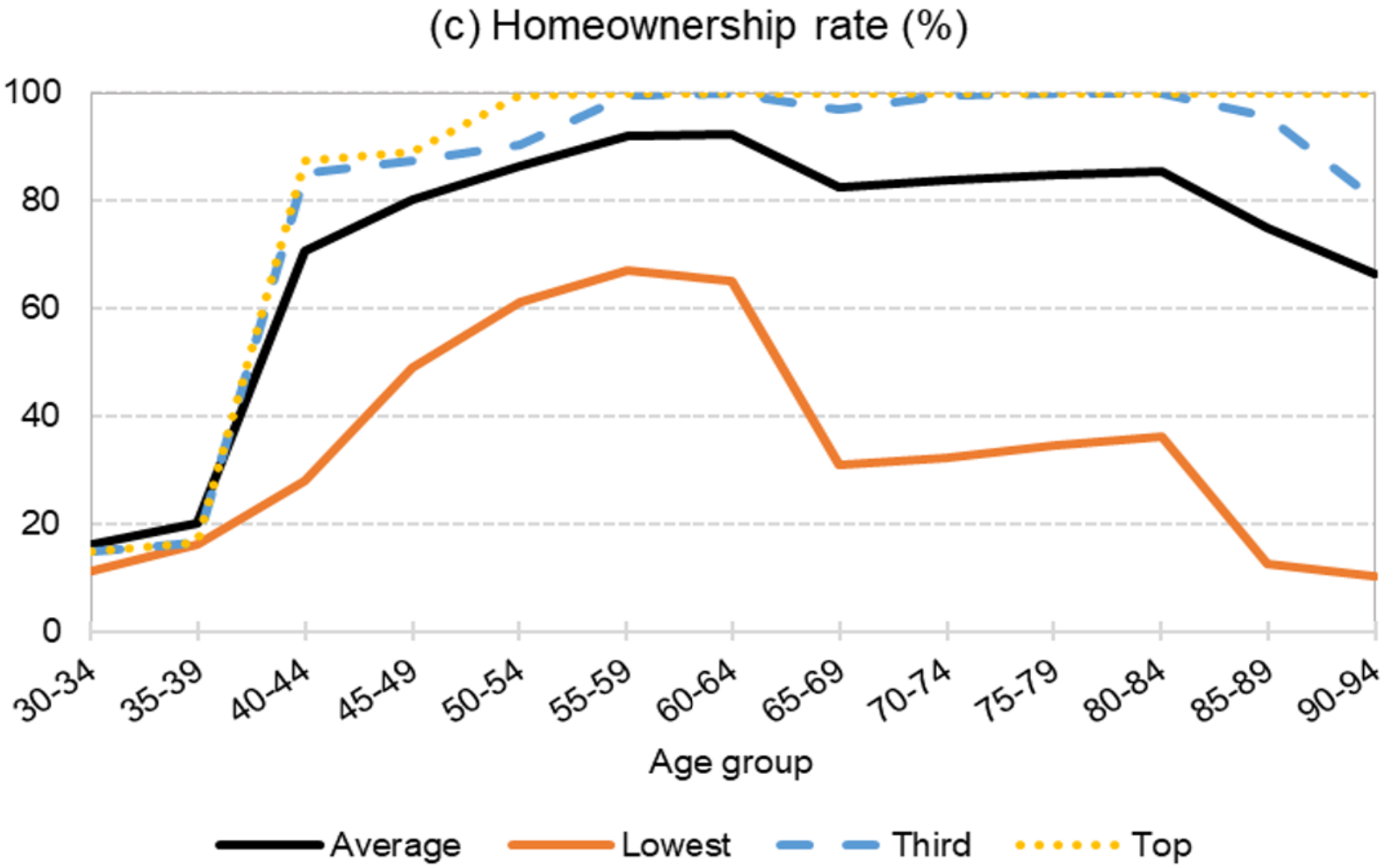
Lifecycle solution: Consumption & incomes



Lifecycle solution: Household wealth



Lifecycle solution: Homeownership



Model performance: Aggregate solutions

Table: Benchmark model solution and macroeconomic targets*

Variable	Model	Data
Expenditures on GDP		
Private consumption	52.3	49.0
Government consumption	21.0	21.5
Investment	26.7	30.3
in capital stock	19.9	20.8
in housing (construction cost)	6.8	9.0
Net export	0.0	-0.8
Capital and housing markets		
Capital stock	384.6	385.2
Housing assets	422.3	415.2
Owner occupied	316.9	315.5
Rental	105.4	99.6

Homeownerhip (25+) (%)	66.1	66.2
Homeownerhip (25-64) (%)	60.4	61.2
Homeownerhip (65+) (%)	82.2	84.5
Superannuation assets	161.0	
Net public debt	21.0	21.1
Government policy		
Consumption tax revenue	7.3	7.3
Income tax revenue	13.4	13.4
Superannuation tax revenue	0.9	0.5
Corporate tax revenue	4.9	4.9
Other tax revenue	3.9	1.7
Pension expenditure	3.5	3.5
Social transfers	5.4	5.4
Interest on net debt	0.6	

*Values are expressed as % of output (measured net of real estate sector and at basic prices), if not stated otherwise.

SG RATE COUNTERFACTUALS

- Examine long run effects of alternative SG rates
  - Focus on $SG = 0\%$, $SG = 12\%$ and optimal SG rate (compared to benchmark $SG = 7\%$)
  - Consumption tax rate to balance government budget

(I) Use the means tested age pension (as describe above)

(II) Assume an universal age pension (remove the means test)

Lifecycle implications (I)

To be completed

Macro and welfare implications (I)

Table: Macroeconomic and welfare effects of alternative SG rates in long run*

Variable	SG = 0%	SG = 12%	Optimal SG[a]
Output (GDP)	-3.84	3.17	14.94
Private consumption	-2.56	1.86	6.64
Investment	-7.65	6.38	33.88
Capital stock	-10.70	9.19	48.65
Household net wealth	-7.84	6.72	34.76
Liquid private assets	29.12	-17.38	-59.53
Superannuation assets	-100.00	65.56	280.77
Housing assets	0.22	-0.06	0.07
Interest rate (p.p.)	0.46	-0.35	-1.40
Wage rate	-4.00	3.00	15.00
Homeownership rate (p.p.)	4.97	-4.42	-13.02
Mortgage rate (p.p.)	-7.59	4.47	19.49
House price	-3.82	3.96	13.27
Welfare effects[b]			
Average	-1.10	0.72	2.65
Lowest quintile	-1.07	0.53	2.74
Third quintile	-1.39	0.81	2.97
Highest quintile	-0.77	0.72	0.79

Notes: *% changes relative to benchmark equilibrium, if not stated otherwise; [a]SG=30%; [b]%change in utility levels.

Fiscal implications (I)

Table: Fiscal effects of alternative SG rates in long run*

Variable	SG = 0%	SG = 12%	Optimal SG[a]
Total tax revenue	3.4	-2.9	-11.8
- Total (personal) income	8.5	-3.0	-7.2
- Progressive income	15.9	-8.2	-30.0
- Superannuation	-100.0	73.3	326.7
- Company profits	1.3	-1.3	-6.3
- Total consumption	-5.8	-2.5	-19.2
Construction profit	-6.8	7.7	27.4
Consumption tax rate[b] (p.p.)	-0.5	-0.5	-3.3
Age pension expenditure	3.5	-1.8	-14.0
Distribution of those aged 65+ (%)[c]			
- No age pension	33.1	36.4	40.9
- Full age pension	38.1	45.8	52.1
- Part age pension	28.8	17.8	7.1

Notes: *% change relative to benchmark, if not stated otherwise; [a]SG=30%; [b]Budget-equilibrating consumption tax rate as a percentage point (p.p.) difference from benchmark; [c]% of those 65+ on no, full or part age pensions.

Lifecycle implications (II)

Macro and welfare implications (II)

Table: Macroeconomic and welfare effects of alternative SG rates in long run*

Variable	SG = 0%	SG = 12%	Optimal SG[a]
Output (GDP)	-3.78	3.17	11.59
Private consumption	-2.22	1.87	5.26
Investment	-7.64	6.91	26.36
Capital stock	-10.45	9.35	36.68
Household net wealth	-8.50	7.04	27.38
Liquid private assets	29.55	-16.15	-48.62
Superannuation assets	-100.00	65.90	224.03
Housing assets	-0.07	0.02	0.32
Interest rate (p.p.)	0.46	-0.34	-1.12
Wage rate	-4.00	3.00	12.00
Homeownership rate (p.p.)	3.68	-3.91	-9.72
Mortgage rate (p.p.)	-7.56	3.71	16.26
House price	-4.71	3.30	10.71
Welfare effects[b]			
Average	-1.04	0.82	2.09
Lowest quintile	-1.20	0.94	2.61
Third quintile	-0.91	0.79	1.92
Highest quintile	-0.58	0.35	0.30

Notes: *% changes relative to benchmark equilibrium, if not stated otherwise; [a]SG=30%; [b]%change in utility levels.

Fiscal implications (II)

Table: Fiscal effects of alternative SG rates in long run*

Variable	SG = 0%	SG = 12%	Optimal SG[a]
Total tax revenue	3.1	-2.1	-5.9
- Total (personal) income	8.2	-3.3	-7.4
- Progressive income	15.3	-8.3	-24.5
- Superannuation	-100.0	73.3	253.3
- Company profits	1.3	-1.3	-5.0
- Total consumption	-6.7	0.0	-3.4
Construction profit	-9.4	6.0	20.5
Consumption tax rate[b] (p.p.)	-0.6	-0.3	-1.2
Age pension expenditure	-1.0	0.0	0.0
Distribution of those aged 65+ (%)[c]			
- No age pension	0.0	0.0	0.0
- Full age pension	100.0	100.0	100.0
- Part age pension	0.0	0.0	0.0

Notes: *% change relative to benchmark, if not stated otherwise; [a]SG=30%; [b]Budget-equilibrating consumption tax rate as a percentage point (p.p.) difference from benchmark; [c]% of those 65+ on no, full or part age pensions.

Conclusions

- We have examined changes to SG rate, using a stochastic OLG model with tenure choice, accounting for:
  - Behaviour responses of households to a policy change
  - Interactions between superannuation, age pension and income taxation
  - General equilibrium effects

Results qualifications and future research

- The model only assume mandatory superannuation and account for long run steady state effects (and this version abstracts from elastic labor and endogenous retirement)

Thank you

Thank you for your attention!

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Paper (and other recent research) available at:
sites.google.com/site/georgekudrna/research