

The Economic Impacts of Superannuation in a General Equilibrium Model with Housing

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Motivation

- A tale of two assets.
- **Superannuation** ('Super') and **Housing** are the main components of the household wealth in Australia.¹
 - **Owner occupied** properties were the largest asset held by households, accounting for 43% of total assets.
 - Super is the largest component of financial wealth (50% of financial assets and 15% of total).
- Rare to consider both super and housing. Yet, it may be important since they have interacting effects.
 - Super delays raising of downpayment for housing.
 - Super is compulsory saving while housing allows for borrowing through mortgages.

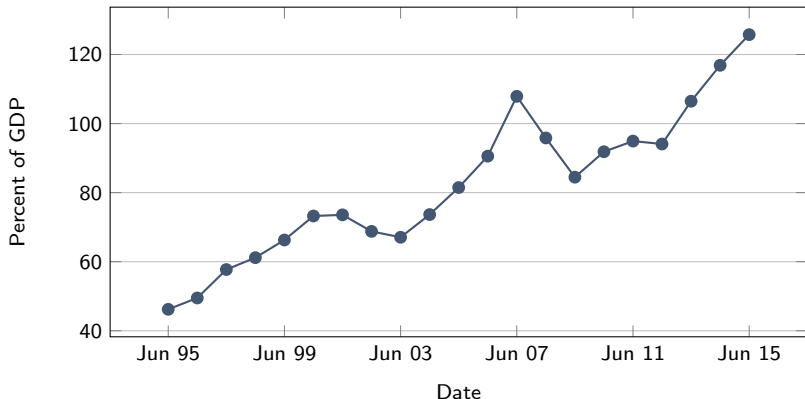
¹ABS 6554.0 - Household Wealth and Wealth Distribution, Australia, 2011-12.

Background

- The **Superannuation Guarantee** is a compulsory savings scheme established over 1984-92.
 - Partly to address fiscal concerns for supporting retirement incomes.
 - Contribution rate grew from 3% in 1992 to 9.5% for 2015-2021, then to 12% by 2025.
- Earnings are compounded across entire working life → predicted to reach 160% of GDP by 2050 Gruen and Soding (2011).

Background (cont.)

Figure: Superannuation assets in Australia²



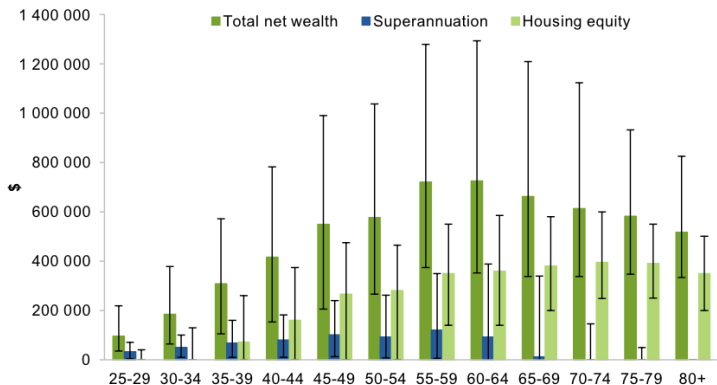
²Data source: Australian Prudential Regulation Authority

Background (cont.)

- High **home ownership rate** by retirement age in Australia (approx. +80% of households).
- Owner occupied housing accounts for 43% of total assets, more if including investment housing assets.
- **Age pensions** are **means-tested** on assets and incomes.
 - Owner occupied housing is exempt from means-testing.

Background (cont.)

Figure 2.1 **Median values for superannuation balances and net household wealth^a**
2011-12



Source: Productivity Commission (2015), Superannuation Policy for Post-Retirement, pg. 35, based on ABS (Survey of Income and Housing 2011-12)

Literature

- Portfolio composition in presence of housing (Chetty and Szeidl 2010; Cocco 2005; Yao and Zhang 2005).
- Policy impacts on housing (Chambers, Garriga, and Schlagenhaut 2009; Cho and Francis 2011; Cho and Sane 2013; Gervais 2002).
- Implications of housing assets for age pension (Cho and Sane 2013; Ding 2013).
- Impact of super on net saving (Connolly and Kohler 2004; Connolly 2007) and on age pension (Kudrna and Woodland 2010; Ding 2013).

Literature (cont.)

- Guest (2004) showed that compulsory superannuation reduced consumption and housing purchases, which resulted in a non-positive effect on utility.
- Ding (2013) modelled that super funds will be used to buy housing purchases which inflates pension payments through means-testing.

Objective

Aim

- To examine how superannuation impacts on personal wealth (including housing asset holdings) over the life-cycle in **general equilibrium** for Australia.
 - Aggregate and distributional outcomes.
- To examine the implications on government pension liability.

Method

- Life-cycle general equilibrium model following Cho and Sane (2013) and Yang (2009).

Main features

- **Tenure decision** between renting and owning housing.
- Compulsory savings through super.
 - **Endogenous withdrawal** during retirement.
- Three types of **assets**:
 - Financial asset, a ,
 - Housing asset, h ,
 - Super fund, z .
- Three skill-types.
- Progressive income tax system.
- Idiosyncratic income risk (uninsured).
- Mortality risk.
- Age pensions are based on financial wealth but not (owner occupied) housing assets.
- **Bequest** motive.
- **Small Open Economy General Equilibrium model**.

Renting vs. Owning

- Reasons for owning:
 - Bring forward consumption by leveraging off downpayment.
 - After borrowing and transaction costs, owning is cheaper per unit.
Rental price is $r + \delta^h$ while owning costs $\frac{r + \delta^h}{1+r}$.
 - Higher utility from consuming owned housing.
 - Bequest motive.
 - Age pension means-testing.
- Reasons for renting:
 - No need to raise downpayment.
 - No transaction costs in adjusting level of housing.
 - No minimum level of housing.

Superannuation

- In each working period, households contribute a fixed portion $\xi = 9.5\%$ of their pre-tax income to their superannuation account.
- The contributions generate a return at the common world interest rate, $r = 4\%$.
- Once they reach the retirement age j^* , households can gradually withdraw from their superannuation funds.

Housing & Tenure Choice

- Households may either live in a house they own or rent a house from the rental agency.
- Rental price is $\mathbf{p} = \mathbf{r} + \delta^h$, following Gervais (2002).
- Collateral constraint for households is

$$a' \geq -\kappa h'. \quad (1)$$

- Housing assets have minimum size of \mathbf{H} to capture the lumpiness and indivisibility.
- Transaction costs to buying and selling a house as a fraction $\phi^b = 3.75\%$ and $\phi^s = 3\%$ (Cho, May Li, and Uren 2017) respectively.

Preferences

- The **instantaneous utility** is

$$U(c, \tilde{h}') = \frac{(c^\omega \tilde{h}'^{1-\omega})^{1-\sigma}}{1-\sigma} \quad (2)$$

where coefficient of risk aversion is $\sigma = 2$.

Housing services \tilde{h} comes in either from owning housing assets h or renting s , which is discounted by factor $\lambda = 0.9$ (Cho and Sane 2013).

- Bequest 'warm glow' utility** is

$$\varphi(q) = \varphi_1 \left[1 + \frac{q}{\varphi_2} \right]^{1-\sigma_q}, \quad (3)$$

where coefficient of risk aversion $\sigma_q = \sigma = 2$, $\varphi_1 = -2$ to match the bequest–GDP ratio, and 'luxury good' parameter $\varphi_2 = 2.32$ (De Nardi 2004).

Household Recursive Problem

- State space is a vector $\mathbf{x} = \{\theta, j, a, h, z, v\}$, where θ is the skill type, j is the age of the household, h is the level of owner-occupied housing asset, z is the superannuation accumulation, a is the level of voluntary savings, and v is the productivity shock
- Households choose either to rent or own in the next period. The value function $V(\mathbf{x})$ is given as $V(\mathbf{x}) = \max\{V^o(\mathbf{x}), V^r(\mathbf{x})\}$, where V^o and V^r is the value of owning and renting respectively

Household Recursive Problem (cont.)

For example, the $V^o(\mathbf{x})$ for working households is given by

$$V^o(\theta, j, a, h, z, v) = \max_{c, a', h'} [U(c, h') + \nu\beta \mathbf{E}V(\theta, j+1, a', h', z', v') + (1-\nu)\varphi(a' + h' + z')]]$$

subject to

$$p_c c + a' + h' + \phi(h, h') \leq (1-\xi)w\epsilon v - T_y + (1+r)a + (1-\delta^h)h + Beq_{\theta, j}, \quad (4)$$

$$z' = (1-\tau_z)(1+r)z + (1-\tau_z)\xi w\epsilon v, \quad (5)$$

$$h' \geq \underline{H}, \quad (6)$$

$$a' \geq -\kappa h', \quad (7)$$

$$c > 0. \quad (8)$$

Household Recursive Problem (cont.)

While, the $V^r(\mathbf{x})$ for working households is given by

$$V^r(\theta, j, a, h, z, v) = \max_{c, a', s'} \left[U(c, s') + \nu \beta \mathbf{E} V(\theta, j+1, a', 0, z', v') \right. \\ \left. + (1 - \nu) \varphi(a' + 0 + z') \right]$$

subject to

$$p_c c + a' + p s' + \phi(h, 0) \leq (1 - \xi) w \epsilon v - T_y + (1 + r) a + (1 - \delta^h) h + \text{Beq}_{\theta, j}, \quad (9)$$

$$z' = (1 - \tau_z) (1 + r) z + (1 - \tau_z) \xi w \epsilon v, \quad (10)$$

$$h' = 0, \quad (11)$$

$$c, s' > 0, a' \geq 0. \quad (12)$$

Calibration

	Parameter	Value ³
α	Share of capital	0.264
δ^k	Capital depreciation	0.05
δ^h	Housing depreciation	0.02
σ	Coefficient of risk aversion	2
ϕ_1	Bequest utility magnitude	-2
ϕ_2	Bequest luxury good factor	2.32
σ_q	Coefficient of risk aversion (bequest)	2
ϕ_b	Housing buying transaction cost	0.037
ϕ_s	Housing selling transaction cost	0.030
λ	Renter utility discount	0.9
ξ	Superannuation contribution rate	0.095
κ	Loan-to-value ratio	0.8
r	World interest rate	0.04

³annualised

Calibration (cont.)

- The rest of parameters $\beta = 0.975$ (annualised), $\underline{H} = 1.75$ of average yearly income and $\omega = 0.91$, were jointly chosen to match the following moments:
- Net foreign borrowing-capital ratio $\frac{K_d - K_s}{K_d} = 20\%$.
- Home Ownership ratio of 66%.
- Housing capital-to-income ratio of 0.137 (Cho, May Li, and Uren 2017).

Figure: Life-cycle profile of aggregates

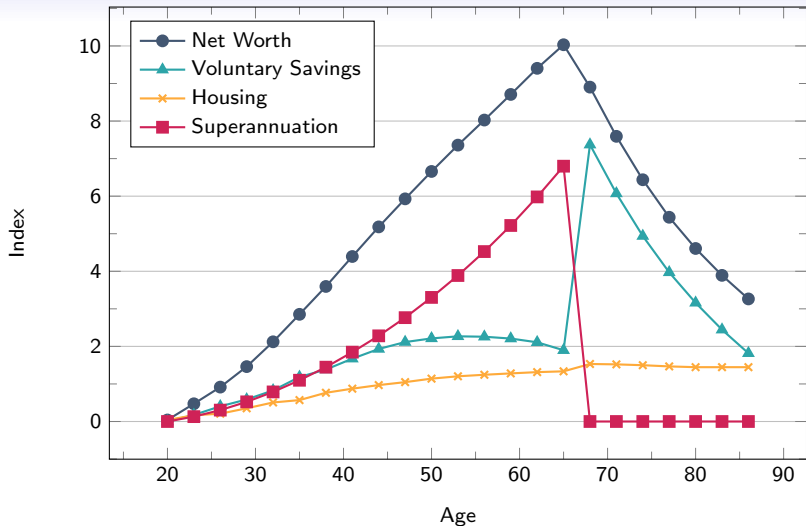


Figure: Life-cycle of Wealth Aggregates (Data vs. Model Without Super)

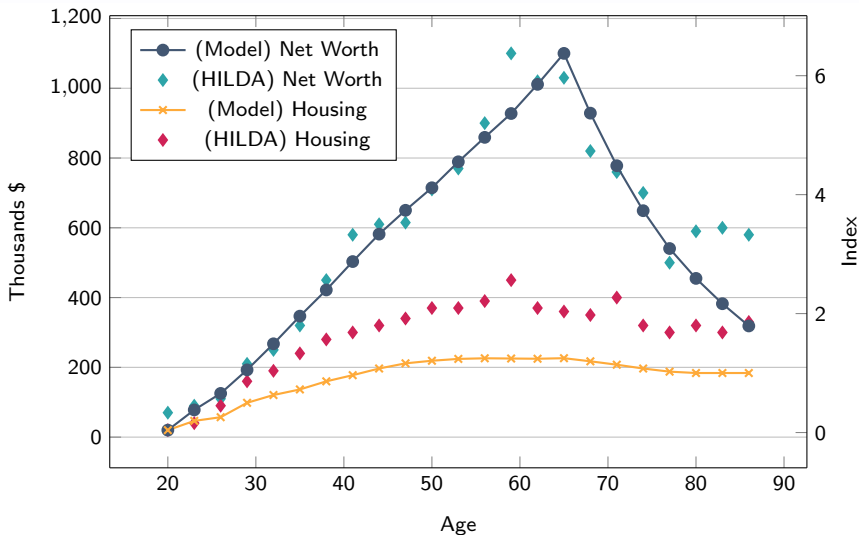


Figure: Home Ownership (Data vs. Model)

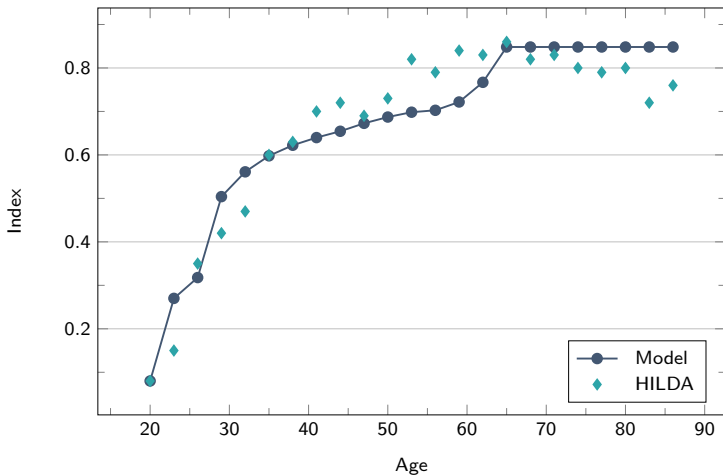


Table: Aggregate outcomes

	No Super	Super
Interest rate	9.6%	9.6%
Labour tax rate	10.7%	10.1%
Total savings-to-output ratio	2.288	4.274
Housing asset-to-output ratio	0.962	0.989
Home ownership ratio	0.661	0.666
Consumption-output ratio	0.692	0.711
Fraction of pensioners receiving		
more than 90% of max benefit	0.773	0.681
less than 25% of max benefit	0.076	0.095

Figure: Total Savings

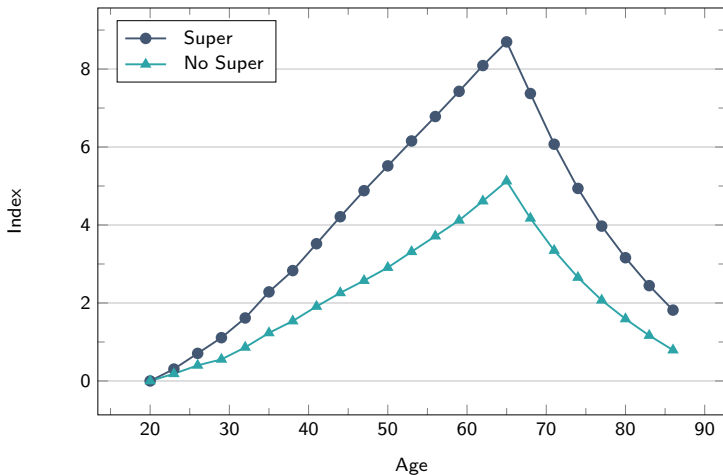


Figure: Housing Stock

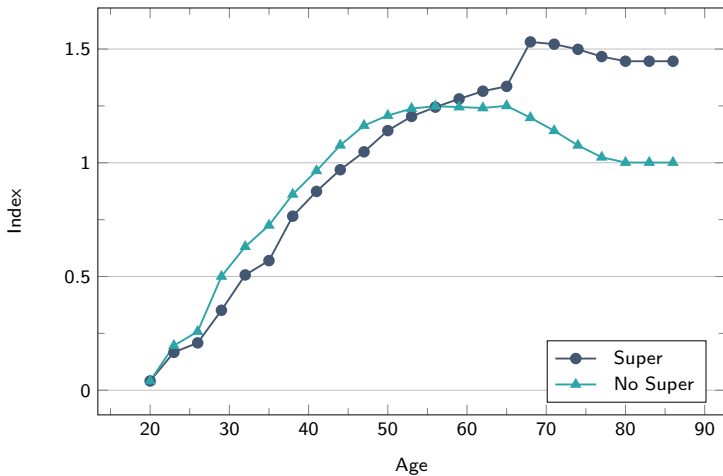


Figure: Average Home Size

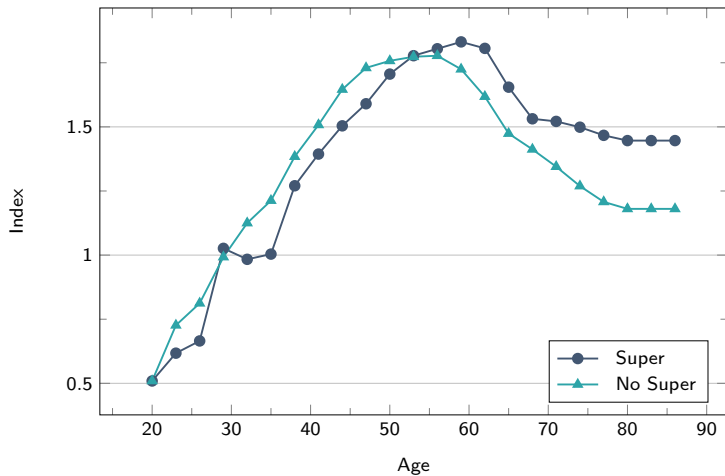


Figure: Home Ownership Ratio

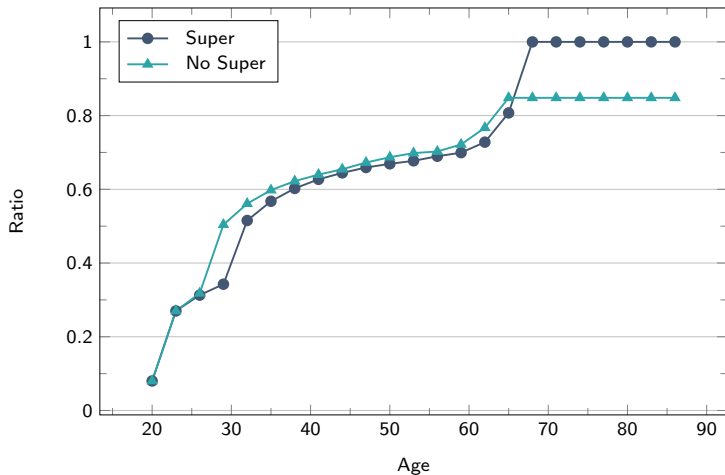


Figure: Net Worth

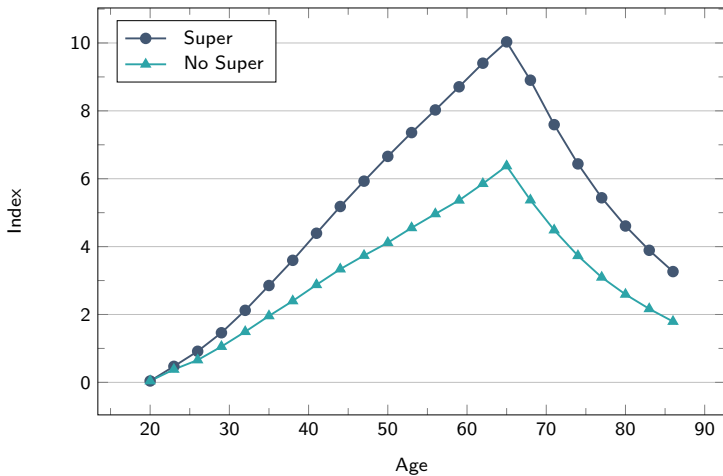


Figure: Utility

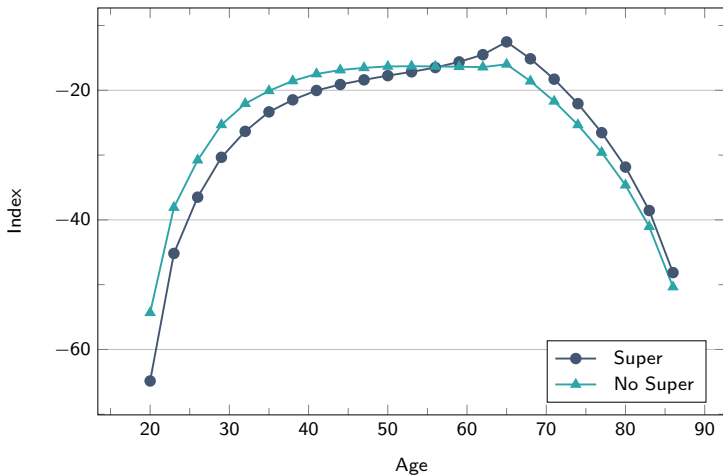


Table: Distribution of wealth

	No Super	Super
Percentage wealth held by top		
10%	42.3%	33.6%
20%	65.5%	54.6%
40%	88.8%	80.2%
Gini Total Savings	0.690	0.545
Gini Housing	0.584	0.574
Gini Net Worth	0.645	0.536
Percentile ratios		
p10/p50	0.000	0.099
p25/p50	0.159	0.345
Avg/p50	2.382	1.579
p75/p50	3.398	2.346

Discussion

- Super can generate a significantly higher level of wealth and a more equal distribution (flat tax).
- Super delays the purchasing of homes, however the greater wealth ultimately results in a higher aggregate level of housing stock.
- Under SOE, pension payments are lower and the tax rate is reduced.

Discussion (cont.)

- Under ICM, super improves productivity and wages.
- Higher wages allow housing assets to be bought sooner, and increases their aggregate levels.
- Upon retirement, households divest their financial savings instead of housing assets, and since super returns are diminished → pension liabilities and tax rate go up.
 - Housing assets has transaction costs and do not count in pension means tests.

Future Work

- Comparative statics, e.g. estimate the effects from age pension on housing purchases.
- Housing prices would allow housing to be treated as a 'risky asset'.
- Voluntary superannuation, and its tax advantages.

Thank you

- Work still at early stages
- Any advice or suggestions are appreciated
- Contact: xu.xiaochun86@gmail.com

Preview of Results

- Even though super delays housing purchases, it increases the aggregate.
- Super also evens the distribution of both housing and wealth.

Demographics

- Each model period spans five years and the economy is populated by a continuum of households of measure one.
- The first period ($j = 1$) represents the start of a household's working life at age 20, all of who do not own any financial or housing assets.
- Each household retires at age j^* , when they start to receive (means-tested) pension payments for the rest of their lives.
- Population growth rate 1.55% per annum.
- Age-dependent probability of death is v_j .

Technology

- There is a representative firm that produces aggregate output Y under the Cobb-Douglas production function,

$$Y = AK_d^\alpha L^{1-\alpha}. \quad (13)$$

where $\alpha = 26.4\%$ using national accounts data for 1960-2007, A is TFP parameter set to normalise *effective* wage to be $w = 1$.

- Physical capital and housing assets depreciate at rates $\delta^k = 5\%$ and $\delta^h = 2\%$ (Cho, May Li, and Uren 2017) respectively.

Income Dynamics

- Households under the retirement age j^* inelastically supply one unit of labour, subject to an age-efficiency profile ϵ_j .
- Three skill types based on education level.
- Stochastic productivity levels, v , are positively correlated over time (Markov process).
- Working households are taxed at progressive tax system in Australia for the 2014-15 financial year.
- **Bequests** based on skill-type.
- Age pension is asset means-tested

$$b(j, a, h) = \max \{0, \min \{ \bar{b}, \bar{b} - b(a - \bar{a}_i) \} \}. \quad (14)$$

where for singles in 2015 $\bar{b} = 0.337$, $b = 0.039$, $\bar{a}_o = 3.367$, and $\bar{a}_r = 5.808$ (Centerlink).

Taxation

- **Superannuation tax** at 15% at contribution, then 15% on benefits.
- **Progressive tax structure for income (post-super contribution)**

Taxable income	Tax on this income
0 - \$18,200	Nil
\$18,201 - \$37,000	19c for each \$1 over \$18,200
\$37,001 - \$80,000	\$3,572 plus 32.5c for each \$1 over \$37,000
\$80,001 - \$180,000	\$17,547 plus 37c for each \$1 over \$80,000
\$180,001 and over	\$54,547 plus 45c for each \$1 over \$180,000

- **Progressivity of tax system** has implications for distributional impacts of superannuation.
- **Consumption tax** at τ_c , which balances the government fiscal balance.

Government

Government achieves budget balance by finding consumption tax rate that equates both sides of the ledger:

Government receipts	Government expenses
Income tax	Government expenditure (18% of GDP)
Superannuation tax	Pensions
Consumption tax	

Small Open Economy

- Domestic interest rate equals the exogenous world interest rate $r = r^* = 4\%$.
 - Means the capital used by domestic firms are fixed, and hence the domestic output as well.
- Determines the capital-GDP ratio $\frac{K_d}{Y} = 2.981$.
- Use discount factor β to calibrate to the net foreign borrowing $\frac{K_d - K_s}{K_d} = 20\%$.

Definition of Stationary Equilibrium

A stationary equilibrium is represented by a set of government policy arrangements $\{\tau, b\}$; prices $\{p, r, w\}$; value functions V, V^o, V^r ; allocations c, a', h', z' ; a time-invariant distribution of agents over the state variables $\mathbf{x} = \{\theta, j, a, h, z, v\}$, $m^*(\mathbf{x})$; and aggregate quantities $\{Y, C, H, K_s, K_d, L, S, D, Z\}$, such that, given the prices and the government policies,

- 1 The allocations c, a', h' , solve the maximisation problem of the households
- 2 Factor prices are equal to their marginal products:

$$r = F_K(K_d, L) - \delta^k, \quad (15)$$

$$w = F_L(K_d, L). \quad (16)$$

- 3 The government budget is balanced:

$$\tau w L = \int_{j \geq j^*} b(j, a, h) m^*(dx). \quad (17)$$

Definition of Stationary Equilibrium (cont.)

- 4 m^* denotes the invariant distribution for the economy.
- 5 All the markets clear:

$$C = \int c m^* (dx), \quad (18)$$

$$H = \int h m^* (dx), \quad (19)$$

$$S = \int s m^* (dx), \quad (20)$$

$$L = \int \epsilon v m^* (dx), \quad (21)$$

$$Z = \int z m^* (dx), \quad (22)$$

$$K_s = \int (a + z) m^* (dx) - S. \quad (23)$$

Definition of Stationary Equilibrium (cont.)

- Goods market clearance: $Y = C + I + G + NX + TC$
- Government budget balance