# Intended and Unintended Consequences of Retirement Income Policies

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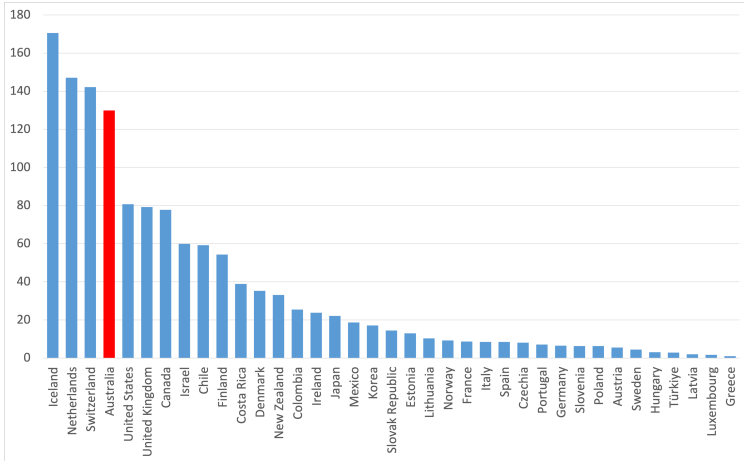
# Grown to Become One of Largest Retirement Systems

## Retirement Assets as a % of GDP by 2023




Source: OEDC. Assets earmarked for retirement are assets accumulating to back future benefit payments. These assets may accumulate in pension funds, pension insurance contracts, bank or investment company managed funds. They may be in occupational or personal plans, defined benefit (DB) or defined

# Retirement Income System in Australia

- Objective of retirement income system

  *"to deliver adequate standards of living in retirement in an equitable, sustainable and cohesive way"* Retirement Income Review (2020)

- Three pillars:
  - Private voluntary savings
  - Compulsory employer-contributed superannuation
  - Means-tested age pension

- Superannuation goal: reduce reliance on public pension by encouraging saving

- Three primary encouragement devices:
  1. Mandatory contributions: super guarantee
  2. Concessional tax treatment of contributions
  3. Concessional tax treatment of investment earnings

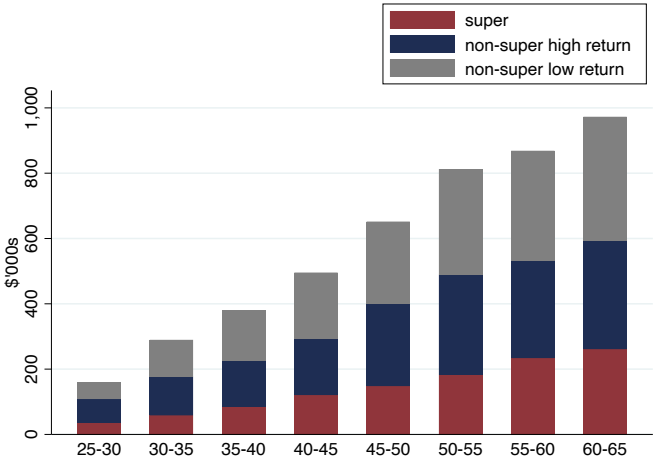
# Aims and Questions

1. Main objective: quantify how each encouragement device of the superannuation system – compulsory contributions and tax concessions – contributes to wealth accumulation and age pension reliance.

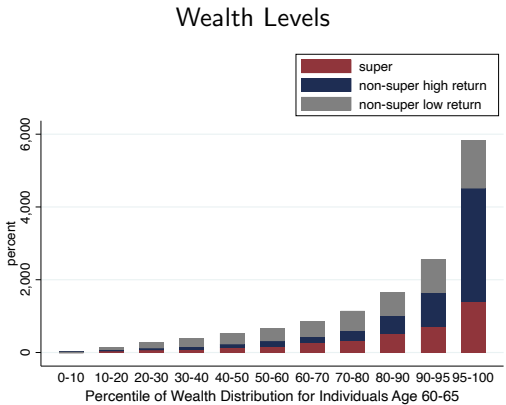
2. What are the distributional implications of tax concessions and of compulsory contributions? Who are the winners and losers?

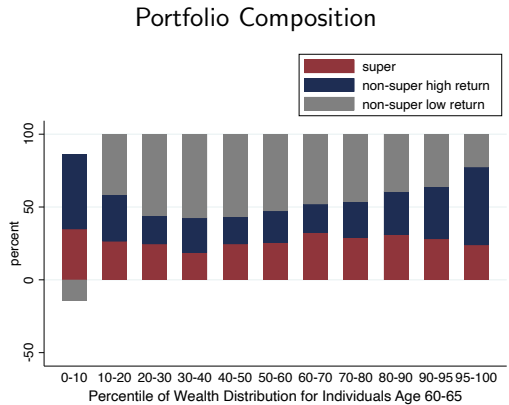
3. What are the fiscal costs?

# Fact 1: Wealth Accumulation and Composition by Age



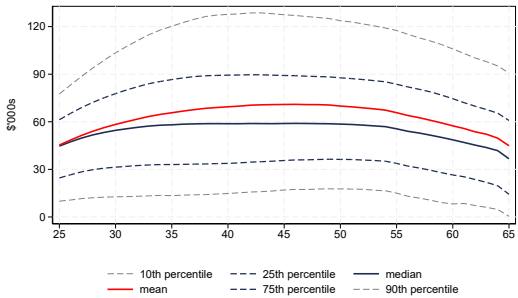
# Fact 2: Dispersion in Wealth and Heterogeneity in Portfolio Composition



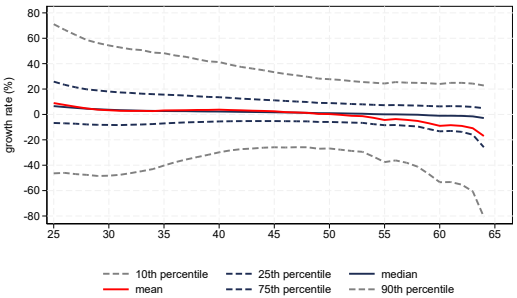



# Fact 3: Earnings and Earnings Growth are Dispersed

## Annual Earnings




## Annual Earnings Growth Rates

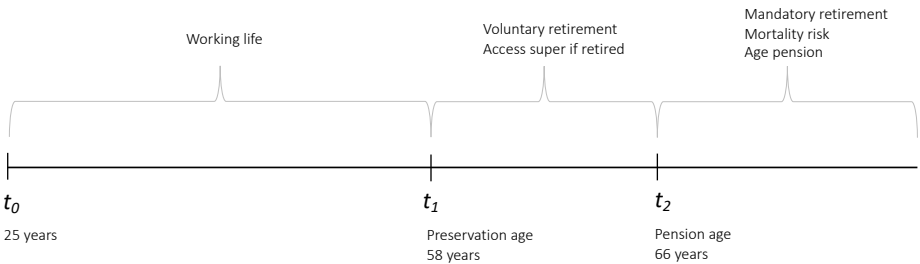


# Model Overview

- Heterogeneous agent lifecycle model in continuous time
- Labor market: idiosyncratic income risk when working, choose when to retire
- Savings motives: lifecycle, precautionary, transactions:
  - Super $(a)$: high return, preferential tax treatment, contribution and withdrawal limits
  - Non-super $(x)$: $\begin{cases} \text{high return} & e = (1-p)\,x \\ \text{low return plus utility flow} & b = px \end{cases}$
- Key features of Australian age-pension and superannuation

# Demographics

- Enter labor market at age $t = t_0$
- Choose to retire from age $t_1 \leq t \leq t_2$
- Mandatory retirement at age $t \geq t_2$
- Age specific mortality risk $\delta(t)$



# Working Agents – Hamilton-Jacobi-Bellman equation

$$\rho V_t^w(x,a,z) = \max_{c,p,d_c,d_{nc}} \underbrace{u(c,px)}_{\substack{\text{flow utility from} \\ \text{consumption and housing}}} - \underbrace{\phi}_{\substack{\text{disutility} \\ \text{from work}}}$$

$$+ \underbrace{\frac{\partial V_t^w}{\partial x}\dot{x}}_{\substack{\text{continuation value} \\ \text{non-super assets}}} + \underbrace{\frac{\partial V_t^w}{\partial a}\dot{a}}_{\substack{\text{continuation value} \\ \text{super assets}}} + \underbrace{\frac{\partial V_t^w}{\partial t}}_{\substack{\text{continuation value} \\ \text{from aging}}}$$

$$+ \underbrace{\sum_{z' \neq z} \lambda_{z,z'} \left[V_t^w(x,a,z') - V_t^w(x,a,z)\right]}_{\substack{\text{continuation value} \\ \text{income risk}}} + \underbrace{\delta_t \left[V^{bq}(x+a) - V_t^w(x,a)\right]}_{\substack{\text{continuation value} \\ \text{bequests mortality} \\ \text{risk}}}$$

# Working Agents

- Evolution of non-super assets:

$$\dot{x} = \underbrace{(1-\xi)y_t z}_{\substack{\text{income net of} \\ \text{super mandatory} \\ \text{contributions}}} - \underbrace{d_c - d_{nc}}_{\substack{\text{voluntary} \\ \text{super} \\ \text{contributions}}} - \underbrace{\mathcal{T}_y\left(y_t z, \xi, d_c\right)}_{\text{labor taxes}} + \underbrace{(1-\tau_x)}_{\substack{\text{capital} \\ \text{tax}}} \underbrace{\left(r^b p x + r^e\left(1-p\right)x\right)}_{\substack{\text{non-super capital} \\ \text{income depends} \\ \text{portfolio } p}} + \underbrace{T_t}_{\substack{\text{govt} \\ \text{trans-} \\ \text{fers}}} - \underbrace{c}_{\text{cons}}$$

- Evolution of super assets:

$$\dot{a} = \underbrace{\xi y_t z}_{\substack{\text{gross super} \\ \text{contributions}}} + \underbrace{d_c + d_{nc}}_{\substack{\text{voluntary super} \\ \text{contributions}}} + \underbrace{\varphi^m\left(y_t z, d_{nc}\right)}_{\substack{\text{super} \\ \text{co-contributions}}} - \underbrace{\mathcal{T}_s\left(y_t z, \xi, d_c\right)}_{\substack{\text{taxes on super} \\ \text{contributions}}} + \underbrace{(1-\tau_a)}_{\substack{\text{super capitl} \\ \text{income tax}}} \underbrace{r^a a}_{\substack{\text{super capital} \\ \text{income}}}$$

- Constraints:
  - No borrowing ($a, x \geq 0$), no short sales ($0 < p < 1$), no withdrawals from super: $d_c, d_{nc} \geq 0$
  - Non-concessional contribution limit: $d_{nc} \leq \bar{d}^{nc}$
  - Concessional contribution limit: $0 \leq d_c \leq \max\left\{\bar{d}_c - \xi y_t z, 0\right\}$

# Taxes

- Labor income tax:

$$\mathcal{T}_y\left(y_t z, \xi, d_c\right) = \left[(1-\xi) y_t z - d_c\right] - \lambda_y \left[(1-\xi) y_t z - d_c\right]^{1-\tau_y}$$

- Super contributions taxes:

$$\mathcal{T}_s\left(y_t z, \xi, d_c\right) = \begin{cases} \tau_s(\xi y_t z + d_c) & \text{if} \quad y_t z < \bar{y}_{293} \\ \tau_s(\xi y_t z + d_c) + \tau_{293} \cdot \min\left\{y_t z - \bar{y}_{293}, \xi y_t z + d_c\right\} & \text{if} \quad y_t z \geq \bar{y}_{293} \end{cases}$$

- Division 293 tax: Additional 15% tax on contributions beyond Div293 threshold if $y_t z > \$250,000$

# Retired Agents

- Hamilton-Jacobi-Bellman equation:

$$\rho V_t^r(x,a) = \max_{\{c,p,d_r\}} \underbrace{u(c,px)}_{\text{flow utility from consumption and money}} + \underbrace{\frac{\partial V_t^r}{\partial x}\dot{x}}_{\text{continuation value non-super assets}} + \underbrace{\frac{\partial V_t^r}{\partial a}\dot{a}}_{\text{continuation value super assets}}$$

$$+ \underbrace{\delta_t\left[V^{bq}(x+a) - V_t^r(x,a)\right]}_{\text{continuation value bequests mortality risk}} + \underbrace{\frac{\partial V_t^r(x,a)}{\partial t}}_{\text{continuation value from aging}}$$

$$\text{subject to} \quad \text{(i)}\ a_t \geq 0,\ x_t \geq 0 \text{ and } p_t \in (0,1)$$
$$\text{(ii)}\ \xi_{r,t} a \leq d_r \leq \bar{d}_r$$

# Retired Agents

- Evolution of non-super assets:

$$\dot{x} = (1 - \tau_x)\left[r^b p x + r^e (1 - p) x\right] + m_t (x + a) + d_r - c$$

- Evolution of super assets:

$$\dot{a} = (1 - \tau_a) r^a a - d_r$$

- Age pension with asset-based means test with $\kappa \in [0, 1]$

$$m_t(x, a) = \begin{cases} \overline{pen} & \kappa x + a \leq \underline{s} \\ \overline{pen} \cdot \left(\frac{\bar{s} - (\kappa x + a)}{\bar{s} - \underline{s}}\right) & \underline{s} \leq \kappa x + a \leq \bar{s} \\ 0 & \kappa x + a > \bar{s} \end{cases}$$

# Parameterization strategy

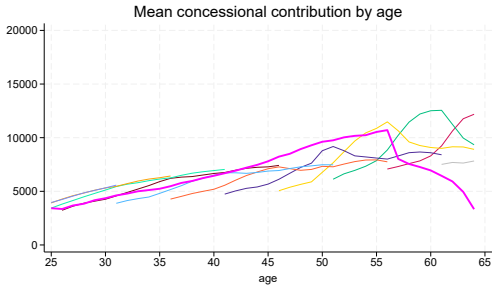
- Externally calibrated parameters:
  - Utility function:
$$u(c, b) = \log c + \psi_b \frac{b^{1-\sigma_b} - 1}{1 - \sigma_b}$$
  - Asset returns: $r^a = 5\%$ and $r^b = 0\%$
  - Tax, superannuation and pension parameters (ATO rules)
- Estimate age-specific income process on Alife data.
- Internally calibrated parameters:
  1. Discount factor $\rho$: match mean wealth at age 50 of \$835,155 (SIH 2017/18).
  2. Weight on owner-occupied housing, $\psi_b$: match average portfolio share of housing (.47) at age 50 (SIH 2017/18)
  3. High return non-super asset, $r^e$: match average porfolio share of super (.21) at age 50 (SIH 2017/18)
  4. Disutility from work, $\phi$: match fraction of retired individuals between 60 and 64.
  5. Income tax function, $\lambda_y$: match mean marginal tax rate.

# Model Fit: Targeted Moments

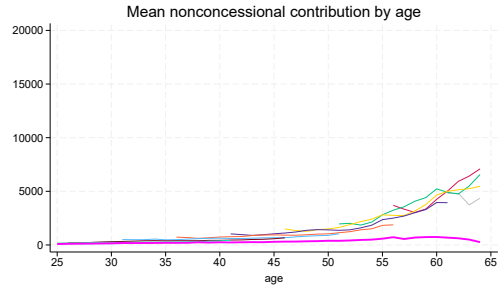
| Parameter | Targeted Moment | Model | Data | Source |
|---|---|---|---|---|
| $e^{-\rho}$ | Total assets at age 50 | \$826,214 | \$835,155 | Wealth at age 50 inc. owner-occupied housing, Alife 2017-18 |
| $\phi$ | Frac. 60–64 year olds retired | 0.34 | 0.32 | ABS Retirement and Retirement Intentions 2018-2019. |
| $\psi^b$ | Frac. wealth in housing at age 50 (%) | 45.5 | 47 | frac. wealth in owner-occupied housing at in SIH 2017-18 |
| $\psi^b$ | Frac. wealth in super at age 50 (%) | 22.8 | 21 | frac. wealth in super at age 50 in SIH 2017-18 |
| $\lambda$ | Mean marg. labor income tax rate (%) | 31.3 | 31 | Marginal tax rate on labour income ATO Tax-Stats 2018-19 |

# Model Fit: Non-targeted Concessional and Non-Concessional Contributions

## Concessional

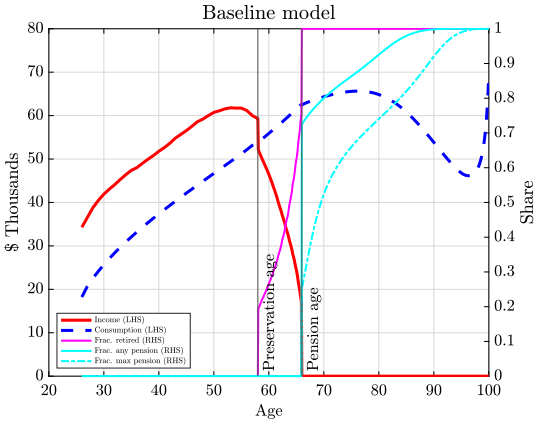


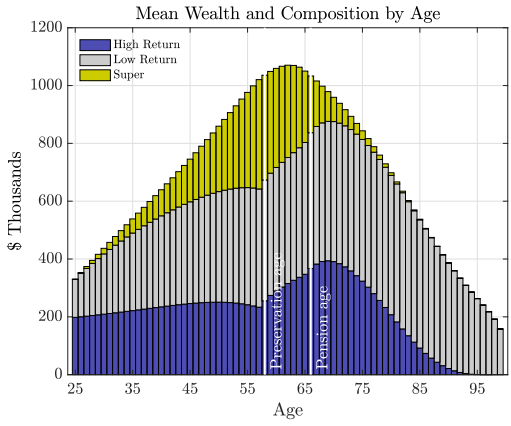

## Non-Concessional




- Older cohorts had no limits on non-concessional contributions

# Baseline Model: Lifecycle Profiles



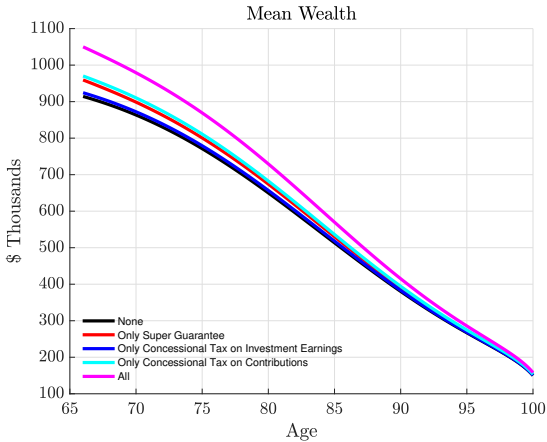

- Model generates basic lifecycle profiles of key economic variables

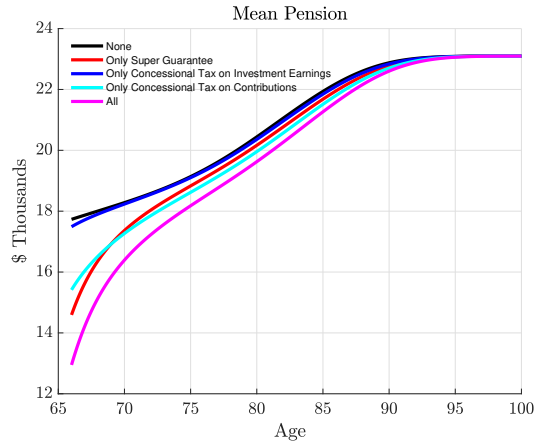
# Disentangling the Effects of Superannuation Policy into Mandatory and Voluntary Levers

| Parameter | Baseline | Only M | Only C | Only E | None |
|---|---|---|---|---|---|
| $\xi$ | 0.095 | 0 | 0 | 0 | 0 |
| $\xi_{\text{nc}}$ | 0 | $0.095 \times (1-0.15)$ | 0 | 0 | 0 |
| $d_{\text{con max}}$ | $\$25,000$ | $\$0$ | $\$25,000$ | $\$0$ | $\$0$ |
| $d_{\text{nc max}}$ | $\$100,000$ | $\$125,000$ | $\$100,000$ | $\$125,000$ | $\$125,000$ |
| $\tau_a$ | 0.15 | 0.30 | 0.30 | 0.15 | 0.30 |

**Notes:**
Baseline: All – Super Guarantee and Concessional Tax on Contributions and on Super Earnings;
Only M: Only Super Guarantee;
Only C: Only Concessional Tax on Contributions
Only E: Only Concessional Tax on Super Investment Earnings
None: no super guarantee and no concessional tax.

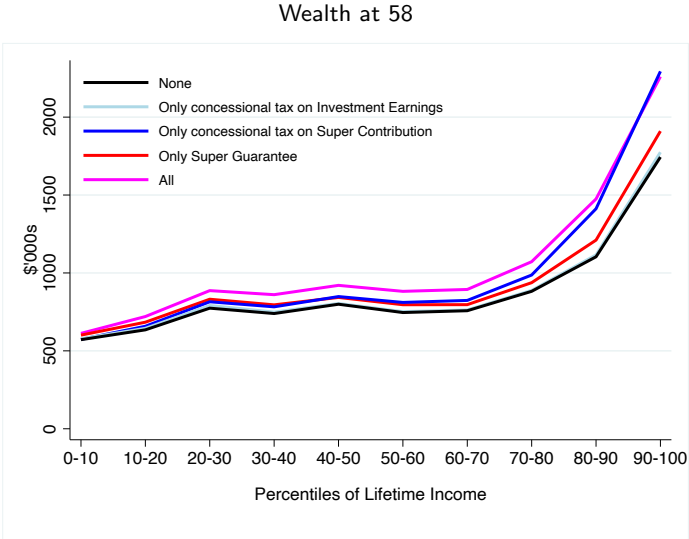
# Effects of Superannuation Policy on Wealth Accumulation and Age Pension Reliance



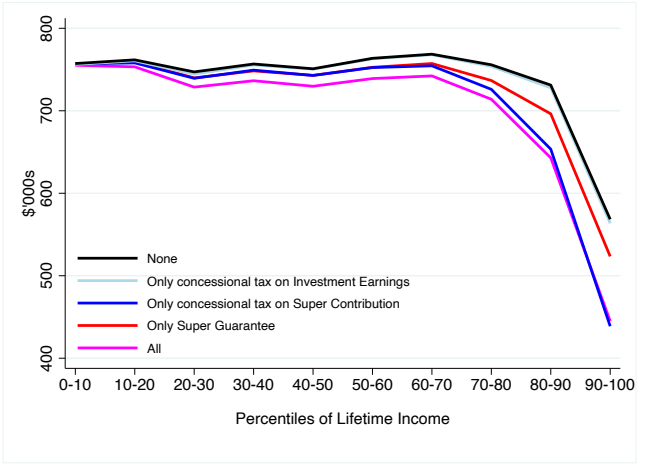

- Concessional tax treatment of contributions has significant effect!

# Distributional Impact of Superannuation Policy (at preservation age)




Tax concessions drive wealth accumulation at the top.

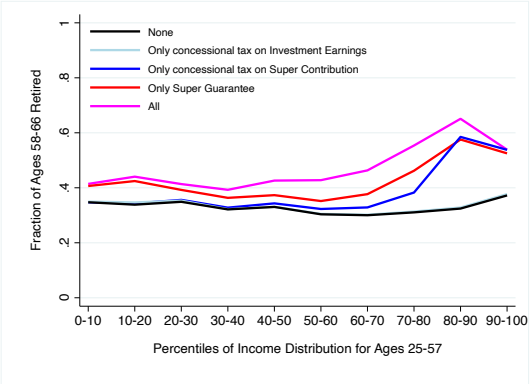
# Age Pension Reliance and Superannuation Policy



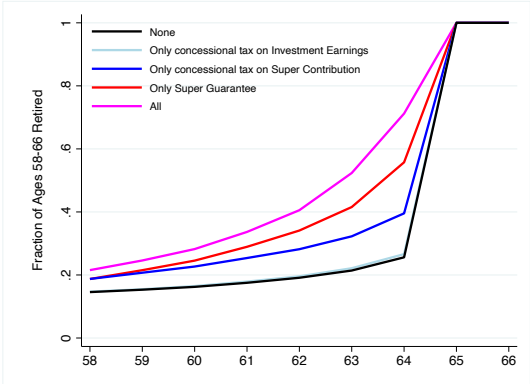

- Super reduces age-pension reliance; tax concessions more relevant at the top.

# Labour Supply Responses of Superannuation Policy

## Retirement Rates by Lifetime Income

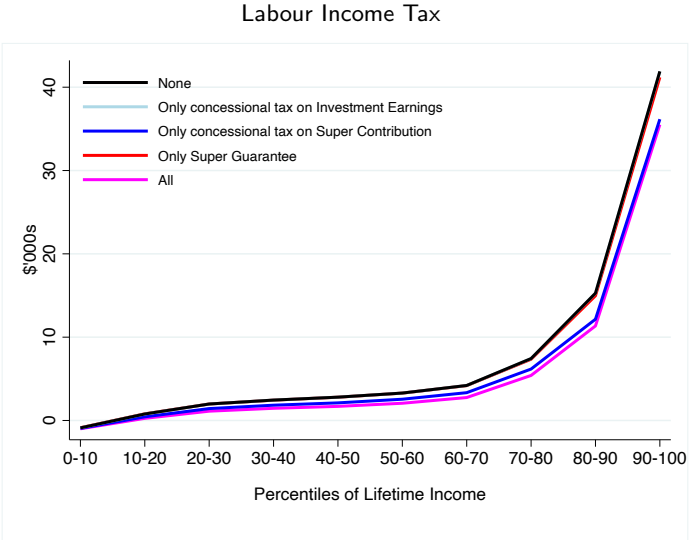



## Retirement Rates by Lifetime Income by Age




- Superannuation policies encourage wealth accumulation and increase retirement rates.

# Which Individuals Benefit from Super Tax Concessions?




Tax concessions benefit mostly high income earners.

# Fiscal Impact of Superannuation Policy

| | Baseline All | None | None minus Baseline |
|---|---|---|---|
| **Per capita total tax revenue (a)** | **$15,433** | **$17,481** | **$2,048** |
| Labour income tax | $7,818 | $10,210 | $2,392 |
| Super contributions tax | $656 | ($59) | ($715) |
| Non-super interest income tax | $6,280 | $7,244 | $964 |
| Super interest income tax | $679 | $86 | ($593) |
| **Per capita age pension expenditure (b)** | **$6,202** | **$6,611** | **$409** |
| **Per capita net revenue (c) = (a) – (b)** | **$9,231** | **$10,870** | **$1,639** |

- The fiscal impact of Super estimated at $\mathbf{2.16}\%$ of GDP ($= \$1,639 \times$ population/GDP).
- Super increases wealth by $\mathbf{106.9}\%$ of GDP ($= \$81,293 \times$ population/GDP ).

# Conclusion

- Super boosts wealth: most of the accumulation is driven by tax concessions, concentrated at the top of the distribution. Wealth increases by $107\%$ of GDP.
- Super shifts behaviour: it encourages earlier retirement and lowers age-pension reliance among higher-income groups.
- Fiscal implications are large: The system costs roughly $2\%$ of GDP in foregone revenue, mostly from reduced labour-income tax.

# Spares

# Estimated Income Process

Income, $yz$, has two components:

- $y_t$ is a deterministic age-efficiency profile (age dummies on a regression of log of individual labour income)
- And $z_t$ is a stochastic age dependent process given by

$$\begin{aligned} \log z_t &= z_{1,t} + z_2 \\ dz_{1,t} &= -\beta_1 z_{1,t} + \varepsilon_{1t} dJ_1 \\ dz_2 &= -\beta_2 z_2 + \varepsilon_2 dJ_2 \end{aligned}$$

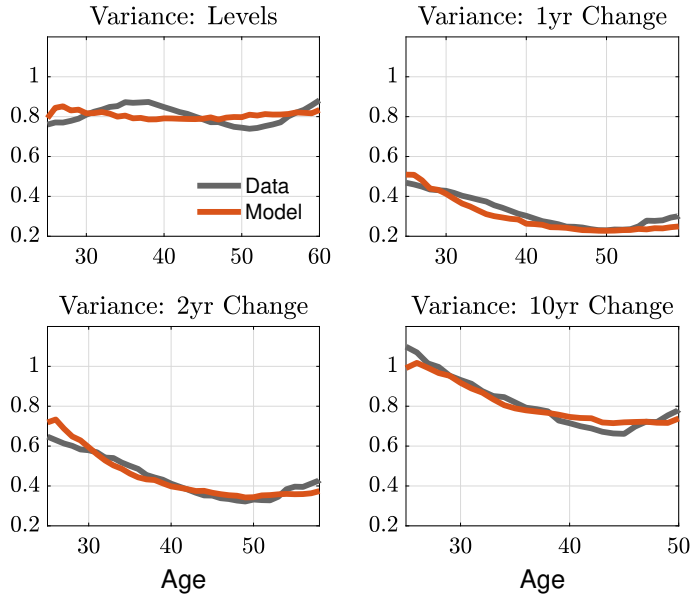
- where $z_{1,t}$ is the transitory age-dependent component and $z_2$ is the persistent component.
- The jumps $dJ_1$ and $dJ_2$ are Poisson processes with arrival rates $\lambda_1$ and $\lambda_2$. Given a jump, the innovations are

$$\varepsilon_{1t} \sim N\left(0, \sigma^2_{\varepsilon,1}(t)\right) \quad \text{and} \quad \varepsilon_2 \sim N\left(0, \sigma^2_{\varepsilon,2}\right)$$

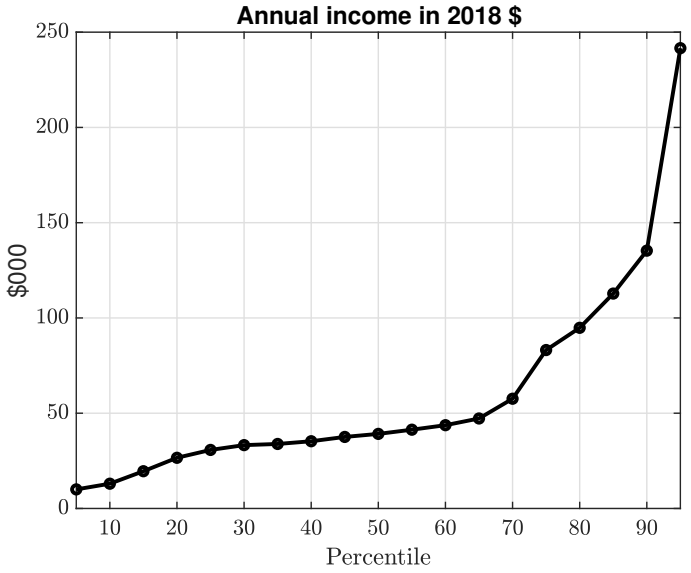
with age-dependent variance

$$\sigma^2_{\varepsilon,1}(t) = \exp(a_0 + a_1 t + a_2 t^2)$$

# Fit of Estimated Income Process



# Income Percentiles



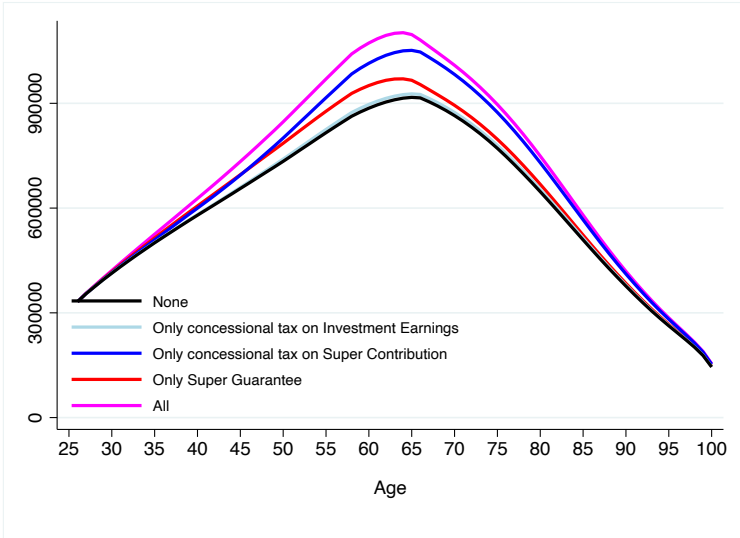
# Calibrated Parameter Values

| Description | | Value | Target/Source |
|---|---|---|---|
| **Lifecycle** | | | |
| $t_0$ | Enter labor market | 25 | |
| $t_1$ | Preservation age | 58 | super preservation age for cohort born FY 1962/63 |
| $t_2$ | Mandatory retirement/Age pension | 66 | for people born from 1 July 1955 to 31 December 1956. |
| **Preferences** | | | |
| $e^{-\rho}$ | discount rate (internally calibrated) | 0.962 | mean wealth at age 50, inc. owner-occupied dwelling ($), Alife 2017-18 |
| $\sigma_b$ | IES-housing services | 1.6 | |
| $\psi^b$ | weight on housing (internally calibrated) | 1.678 | share in owner occ. housing at age 50 (.47), SIH 2017-18 |
| $\phi$ | disutility from work (internally calibrated) | 0.4752 | fraction retired at age 60-64, ABS Retirement & Retirement Intensions 2018-19, (0.32) |
| **Asset returns** | | | |
| $r^a$ | return on super | 5.0% | |
| $r^e$ | high-return non-super (internally calibrated) | 8.5% | portfolio share in super at age 50 (.21), SIH 2017/18 |
| $r^b$ | low return non-super | 0.0% | |
| **Tax Function** | | | |
| $\tau$ | labor income tax function progressivity | 0.15 | Heathcote, Storesletten, and Violante US tax function |
| $\lambda$ | labor income tax function parameter (internally calibrated) | 0.7473 | mean MRT on labor income, ATO Tax-Stats 2018-19 |

# Calibrated Parameter Values

| Description | | Value | Target/Source |
|---|---|---|---|
| **Taxes and Concessions** | | | |
| $\tau_s$ | tax on super contributions | $15\%$ | ATO rules for before-tax super contributions |
| $\tau_x$ | tax on non-super capital income | $30\%$ | mean MRT on labor income, ATO Tax-Stats 2018-19 |
| $\tau_a$ | tax on super capital income | $15\%$ | ATO tax rules |
| $\tau_{293}$ | Division 293 concessional Super contributions surcharge | $15\%$ | Division 293 tax rules |
| $\bar{d}^{nc}$ | non-concessional Super contributions cap | $\$100,000$ | ATO rules from July 2017 to June 2021 |
| $\bar{d}^{man}$ | Super maximum mandatory contributions | $\$52,760$ | ATO 2017-18, income per quarter |
| $\bar{y}_{293}$ | Division 293 income threshold | $\$250,000$ | Division 293 tax rules |
| **Superannuation and Pension** | | | |
| $\xi$ | Superannuation guarantee rate | $9.5\%$ | SG rate from 1 July 2014 – 30 June 2021 |
| $\bar{pen}$ | max. pension | $\$23,096$ | maximum pension, single pensioner (March 2017) |
| $\underline{s}$ | start of pension phase out range | $\$250,000$ | Jan 2017, individual homeowner |
| $\bar{s}$ | end of pension phase out range | $\$542,500$ | Jan 2017, individual homeowner |
| **Super Co-contributions** | | | |
| $\underline{y}_m$ | lower income eligibility threshold | $\$36,813$ | ATO rules 2017-18 |
| $\bar{y}_m$ | upper income eligibility threshold | $\$51,813$ | ATO rules 2017-18 |
| $\bar{\varphi}_m$ | maximum super co-contribution | $\$500$ | ATO rules 2017-18 |

# Total Wealth Accumulation and Superannuation Policy

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Super boosts wealth, mainly through concessional contributions.

# Fiscal Impact of Superannuation Policy – All Cases

| | Baseline All | Only Super Guarantee | Only Concessional Tax on Super Contributions | Only Concessional Tax on Super Earnings | None | None minus Baseline |
|---|---|---|---|---|---|---|
| **Per capita total tax revenue (a)** | **$15,433** | **$17,300** | **$16,202** | **$17,348** | **$17,481** | **$2,048** |
| Labour income tax | $7,818 | $10,024 | $8,483 | $10,203 | $10,210 | $2,392 |
| Super contributions tax | $656 | ($42) | $447 | ($88) | ($59) | ($715) |
| Non-super interest income tax | $6,280 | $6,344 | $6,680 | $7,142 | $7,244 | $964 |
| Super interest income tax | $679 | $974 | $592 | $91 | $86 | ($593) |
| **Per capita age pension expenditure (b)** | **$6,202** | **$6,418** | **$6,389** | **$6,590** | **$6,611** | **$409** |
| **Per capita net revenue (c) = (a) – (b)** | **$9,231** | **$10,882** | **$9,813** | **$10,758** | **$10,870** | **$1,639** |

- The fiscal impact of Super estimated at $\mathbf{2.16}\%$ of GDP ($= \$1,639 \times$ population/GDP).
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