Progressive Income-Contingent Student Loans

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Background

- ICLs play dual roles:
  1. Relax borrowing constraints;
  2. Insure against income risks.
- Income-contingent loans (ICLs) adopted in US, UK, Canada, Australia, etc.
  - Only Australia has explicitly progressive ICL.
- Past reforms have made ICLs more progressive in Australia.

What we do

Research question: How does ICL progressiveness affect:

1. Earnings risks,
2. Education choice,
3. Consumption, savings, and welfare?

Our approach:

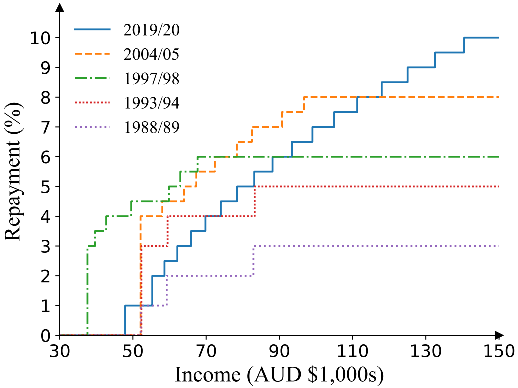
- Earnings risk → estimate earnings process directly
- Education, consumption, & welfare → heterogeneous-agent life-cycle model

Main results:

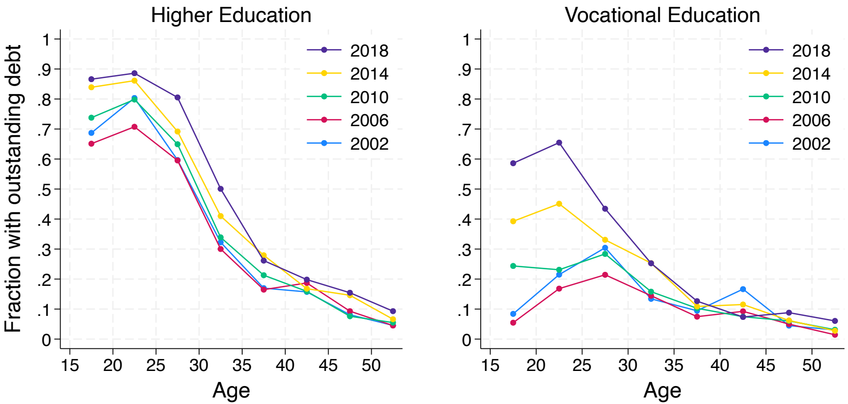
- More progressive ICL reduces risk in early repaying years
- Progressive ICL outperforms non-ICLs, but not linear ICLs.

Australian student loan system – HECS-HELP

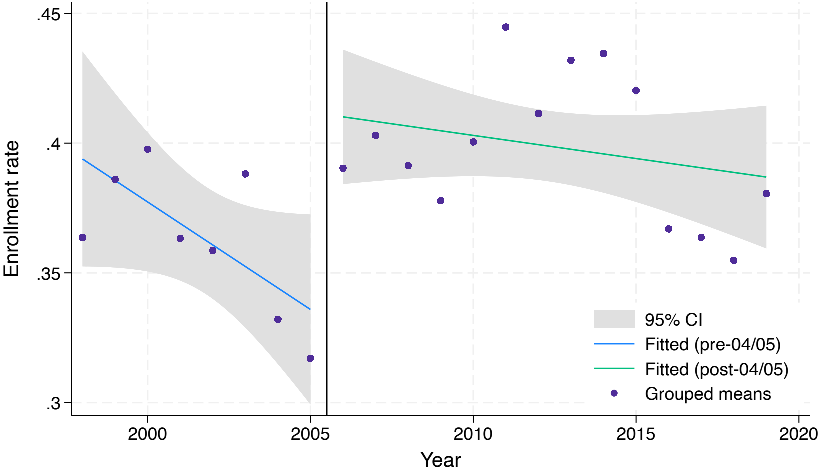
- 1989: Gov't student loans established
  - Income contingent repayment since beginning
  - Automatic take-up and repayment
- 2007: Expanded to vocational education (VET)
- Multiple reforms over the years



High & increasing coverage levels



Enrollment responds to reform

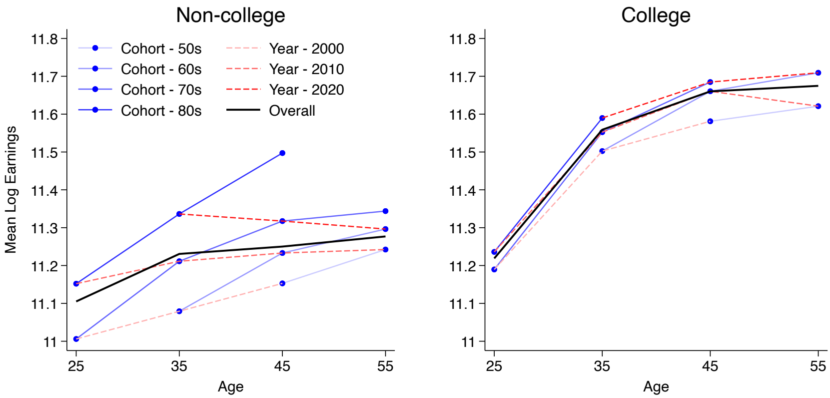


Income process

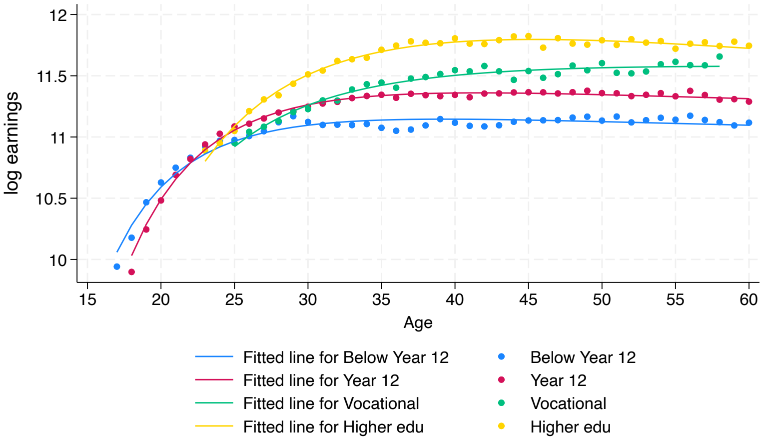
- We first study how repayment plan translates to repayment.
- We directly estimate income process from HILDA waves 1–20.
- Individual i of tenure t, cohort s, and edu e receives income $y^e_{i,t,s}$:

$$\ln y^e_{i,t,s} = \underbrace{\alpha_s}_{\text{cohort dummies}} + \underbrace{\ln \bar{y}^e_t}_{\text{age- \& edu-specific profiles}} + \underbrace{\nu_{i,t}}_{\text{AR(1) residuals}} \tag{1}$$

1. Cohort effects



2. Age- & education-specific earnings profiles



3. AR(1) residuals

We estimate education-specific AR(1) processes for
$e \in \{\text{Below Year 12}, \text{Year 12}, \text{Vocational}, \text{Higher edu}\}$:

$$\nu_{i,0} = \eta, \quad \eta \overset{i.i.d.}{\sim} \mathcal{N}(0, \sigma_\eta^e) \tag{2}$$

$$\nu_{i,t} = \rho^e \nu_{i,t-1} + \epsilon_{i,t}, \quad \epsilon_{i,t} \overset{i.i.d.}{\sim} \mathcal{N}(0, \sigma_\epsilon^e) \tag{3}$$

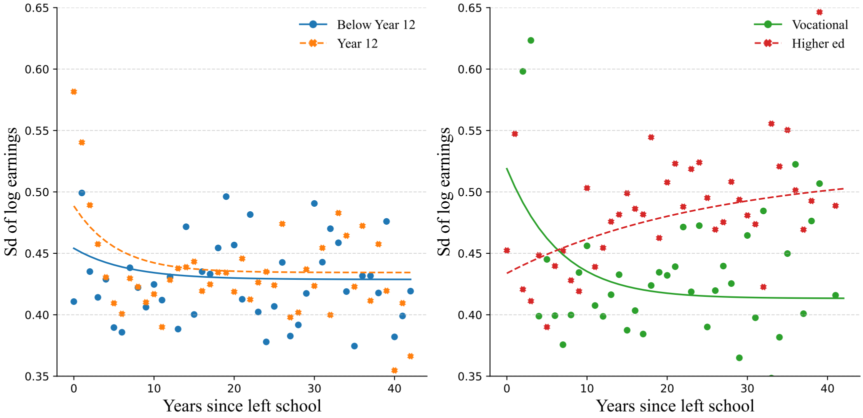
$(\rho^e, \sigma_\epsilon^e, \sigma_\eta^e)$ are jointly estimated using GMM.

Moments & parameter values

	$V(\nu_{0\leq t\leq 5})$	$V(\nu_{25\leq t\leq 35})$	$Cov(\nu_t, \nu_{t-1})$
Below Year 12	0.20	0.18	0.17
Year 12	0.22	0.19	0.18
VET	0.24	0.17	0.17
Higher Ed	0.19	0.24	0.22

	σ_η	σ_ϵ	ρ
Below Year 12	0.45	0.16	0.93
Year 12	0.49	0.18	0.91
VET	0.52	0.16	0.92
Higher Ed	0.43	0.10	0.98

Earnings volatility profile



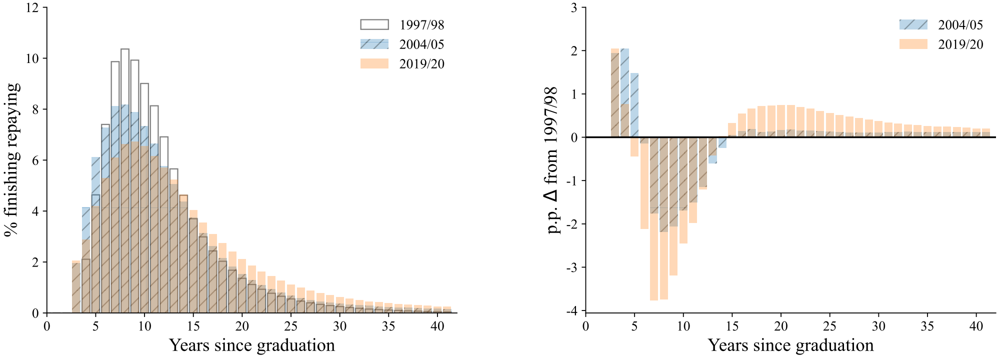
Compare repayment reforms

Using the estimated AR(1) earnings process, we then:

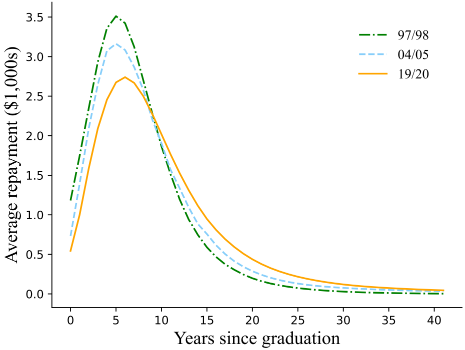
1. Generate repayment dynamics $rp = \tau(y)$.
2. Compare dynamics under 97/98, 04/05, & 19/20 reforms. fig

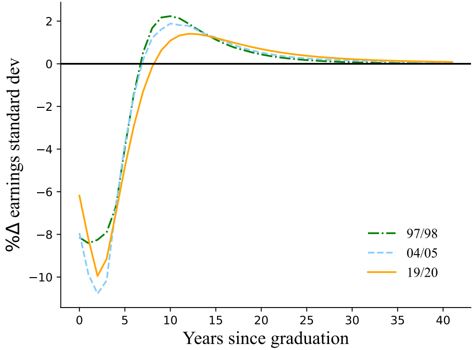
ICLs have become more progressive under the reforms.

Years needed to finish repaying



Mean & volatility of repayment





Comparing key statistics

Policies	97/98	04/05	19/20

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% NPV recovered	76.0	72.1	68.2
NPV deficit	8.6	10.0	11.4
Avg years to start	1.9	4.3	3.4
Avg years to finish	12.4	12.4	13.9

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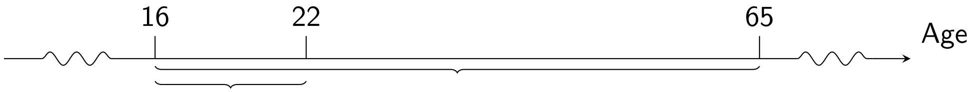
% Δ earnings sd			
Overall	-0.6	-0.7	-0.8
0-5 year	-7.9	-9.1	-8.1
5-10 year	-0.2	-0.5	-1.7
10-15 year	1.8	1.7	1.3

Life-cycle model

We use the full life-cycle model to study effects on education, savings, & welfare.



Student

- Receives transfer & pref shocks
- Chooses edu & private savings
- Accumulates student loans

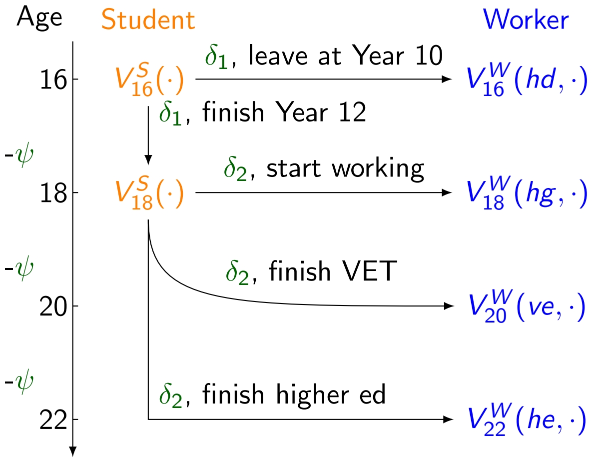
Worker

- Receives stochastic earnings
- Repays loans automatically
- chooses private saving/borrowing w/ constraint

End of model

- Warm glow terminal utility

Education decision



A student aged 16...

Receives:

- Parental transfer;
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Chooses:

- Leave before Y12 or finish Y12;
  - Max the sum of lifetime util and pref shocks
  - Becomes a worker if leaving before Y12
- Consumption/saving.
  - No borrowing allowed

detail

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Receives:

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Chooses:

- Leave at Y12, VET, or higher ed;
  - Max the sum of lifetime util and pref shocks
  - Becomes a worker after graduation
- Consumption/savings
  - No **private** borrowing;

detail

A Worker...

Is identified by {age, edu, private asset, remaining HECS debt}

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Experiences:

- Risky income;
- Automatic HECS repayment;

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- Automatic HECS repayment;

Chooses consumption/savings

- Private borrowing up to fixed limit.

detail

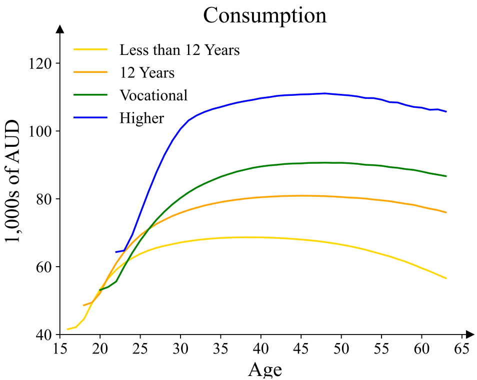
External parameters

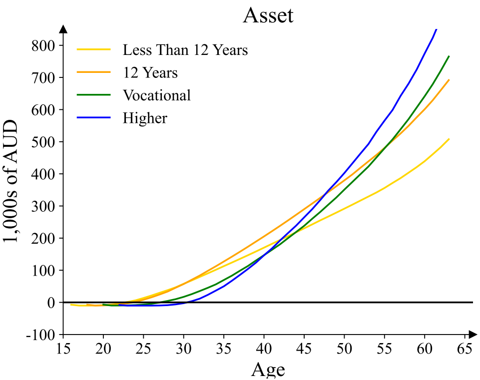
Group	Parameter	Value	Interpretation
Preliminary	σ	2	CRRA risk aversion
	r	4%	Interest rate
	β	0.96	Discount rate
Policy	ϕ^{ve}	15	Fee for vocational education
	ϕ^{he}	36	Fee for higher education
	L	10	Adult borrowing limit
	ω^S	18.2	Transfer, student
	ω^W	35	Transfer, adult
Asset	dist of b_t	-	Asset distribution at age 16

SMM calibrate parameters

Parameter	*Value*	*Description*	*Moments*
δ_1	0.0171	Taste shock at 16	Year 10 share
δ_2	0.0139	Taste shock at 18	Year 12 share
ψ	-0.00438	Util cost of ed	Higher ed share
g_1	-0.481	Size of warm glow	Asset at 65
g_2	1458	Curvature of warm glow	Asset at 65, higher ed

College graduates accumulate assets later

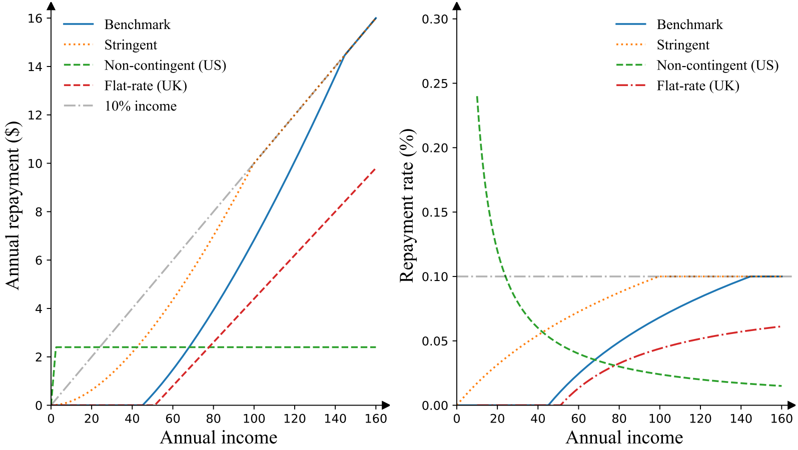




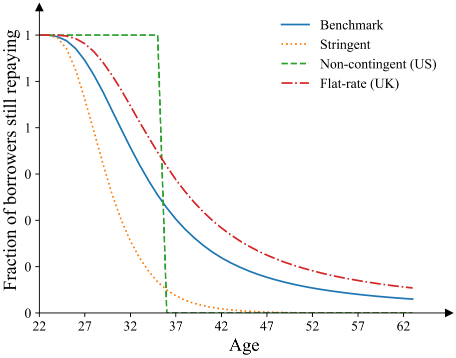
Policy analysis

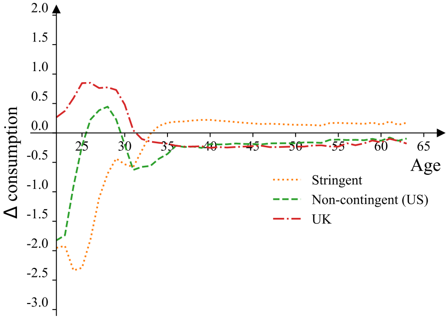
- We compare current HECS with three hypothetical policies
  1. **Stringent**: Lower repayment threshold from \$50,000 to \$0
  2. **Non-contingent (US)**: Fixed **amount** of repayment over 15 years
  3. **Flat-rate (UK)**: Fixed **rate** of repayment = 9%
- Main results:
  - UK plan slight better but more costly;
  - US plan reduces education the most.

Comparing three policies



Debt rundown & consumption





Education is lowest under non-contingent loans

	Benchmark	Counterfactual Δ		
		Stringent	US	UK
	(1)	(2)	(3)	(4)

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Less than Year 12	28.03	+0.71	+0.78	–0.18
Year 12	41.68	+5.80	+6.42	–1.36
VET	4.99	–1.04	–1.90	+0.03
Higher Ed	25.30	–5.48	–5.30	+1.51

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Cost				
NPV ($1,000s)	24.51	+5.06	+3.10	–2.15
% recovered	68.09	+14.04	+8.61	–5.98

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Cost				
NPV ($1,000s)	24.51	+5.06	+3.10	−2.15
% recovered	68.09	+14.04	+8.61	−5.98
Welfare				
C.E. ($1,000s)	68.89	−0.09	−0.10	+0.02
C.E. for HE	66.75	−0.49	−0.29	+0.12

Conclusions

- Australia provides a good case study for ICLs
  - Progressive repayment rates
  - Long history w/ reforms
  - Near-universal coverage
- Our results show:
  1. Progressive ICLs reduce repayment in early years but increase later on;
  2. Not yet clear if progressive ICLs perform better than linear ICLs.
- Future directions of research:
  - Gender + labor supply; spousal joint repayment;
  - Age-contingent repayment could be 2nd best;
  - Repayment scheme may affect major choices.

Appendix

Student's optimization (age 16)

A student at age 16 receives:

- Parental transfer b_t,
- Schooling preference shocks $\epsilon_1 = (\epsilon_{1,1}, \epsilon_{1,2})$,

And chooses education level

$$V^S_{16,t}(b_t, \epsilon_1) = \max \Big\{ \underbrace{\mathbb{E}_y \left[\tilde{V}^W_{16,t}(hd, b_t, y_{16,t}) \right] + \epsilon_{1,1}}_{\text{Leave before Year 12}}, \underbrace{\tilde{V}^S_{16,t}(b_t) + \epsilon_{1,2}}_{\text{finish Year 12}} \Big\}, \tag{4}$$

- $\epsilon_{1,k}$ are Gumbel shocks, i.e. $\epsilon_{1,k} \sim EV(-\gamma, \delta_1)$.

back

Student's optimization (age 16; finishing year 12)

If she chooses to finish Year 12, she maximizes lifetime utility

$$\tilde{V}^S_{16,t}(b_t) = \max_{c,a} \underbrace{[u(c_{16,t}) - \psi] + \beta\,[u(c_{17,t+1}) - \psi]}_{\text{period utility}} + \underbrace{\beta^2 V^S_{18,t+1}(a_{18,t+2})}_{\text{con't value}}, \qquad (5)$$

Subject to

- Budget constraints:

$$\begin{cases} c_{16,t} + a_{17,t+1} = b_t, \\ c_{17,t+1} + a_{18,t+2} = (1+r)a_{17,t+1}, \end{cases} \qquad (6)$$

- No borrowing:

$$a_{17,t+1}, a_{18,t+2} \geq 0. \qquad (7)$$

back

Student's optimization (age 18)

Similarly, a student at age 18 chooses one of three education levels:

$$V^S_{18,t}(a_{18,t}) = \max \Big\{ \underbrace{\mathbb{E}_y \left[\tilde{V}^W_{18,t}(hg, a_{18,t}, y_{18,t}) \right] + \epsilon_{2,1}}_{\text{Year 12}}, \underbrace{\tilde{V}^S_{18,t}(ve, a_{18,t}) + \epsilon_{2,2}}_{\text{vocational}}, \underbrace{\tilde{V}^S_{18,t}(he, a_{18,t}) + \epsilon_{2,3}}_{\text{higher edu}} \Big\}, \quad (8)$$

Where $\epsilon_{2,k}$ are Gumbel shocks:

$$\epsilon_{2,k} \sim EV(-\gamma, \delta_2) \text{ for } k \in \{1, 2, 3\}. \quad (9)$$

back

Student's optimization (age 18, higher edu)

If she chooses higher edu, she maximizes lifetime utility:

$$\tilde{V}^S_{18,t}(he, a_{18,t}, \psi) = \max_{c,a} \underbrace{\sum_{(\alpha,\tau)=(18,t)}^{(21,t+3)} \beta^{\tau-t}\left[u(c_{\alpha,\tau}) - \psi\right]}_{\text{period utility}}$$

$$+ \underbrace{\beta^4 \mathbb{E}_y \left[V^W_{22,t+4}(he, a_{22,t+4}, y_{22,t+4}, d_{22,t+4}) \right]}_{\text{con't value}}, \quad (10)$$

back

Student's optimization (age 18, higher edu)

Subject to

- Budget constraints:
$$c_{\alpha,\tau} + a_{\alpha+1,\tau+1} = (1+r)a_{\alpha,\tau}, \tag{11}$$
- No **private** borrowing:
$$a_{\alpha+1,\tau+1} \geq 0, \tag{12}$$
- Accumulating HECS debt:
$$d_{18,t} = 0, \tag{13}$$
$$d_{\alpha,\tau+1} = d_{\alpha,\tau} + \phi^{he}. \tag{14}$$

back

Worker's optimization

A worker at age α with education e, asset position a_α, and student debt d_α solves

$$V_\alpha^W(e, a_\alpha, y_\alpha, d_\alpha) = \max_{c,a} u(c_\alpha) + \beta \mathbb{E}_y \left[V_{\alpha+1}^W(e, a_{\alpha+1}, y_{\alpha+1}, d_{\alpha+1}) | y_{\alpha,t} \right], \tag{15}$$

Subject to

- Income process (1),
- Budget constraint:

$$a_{\alpha+1} + c_\alpha + \underbrace{(d_\alpha - d_{\alpha+1})}_{\text{HECS repayment}} = (1+r)a_\alpha + y_\alpha, \tag{16}$$

back

Worker's optimization (ctd)

- **Private** borrowing limit:

$$a_{\alpha+1} \geq -L, \tag{17}$$

- Automatic HECS debt repayment:

$$d_{\alpha+1} = d_\alpha - \tau(y_\alpha) y \alpha \tag{18}$$

  - $\tau(y)$ describes repayment plan.

back