Insurance versus Moral Hazard in Income-Contingent Student Loan Repayment

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MIT Sloan

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Government-Financed Higher Education

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This Paper: Insurance vs. Moral Hazard

This Paper

Conditional on borrowing, how does income-contingent repayment affect **labor supply** and welfare?

1. **Setting**: Australia's Higher Education Loan Program
   - **Variation**: discontinuities in repayment rates + policy change to these rates
   - **Identification**: limited room for selection and ex-ante responses
2. **Research design**: bunching at discontinuities before and after policy change
   - **Data**: universe of income tax returns + student debt balances

This Paper

Conditional on borrowing, how does income-contingent repayment affect labor supply and **welfare**?

1. Setting: Australia's Higher Education Loan Program
2. Research design: bunching at discontinuities before and after policy change
3. **Model**: life cycle model with endogenous labor supply + uninsurable wage risk
   - **Positive**: translate responses into estimates of preference parameters
   - **Normative**: characterize optimal amount of income-contingent repayment

Main Results

1. **Empirics**: borrowers adjust labor supply to $\downarrow$ income-contingent repayments
   - Larger responses in occupations with more hourly flexibility
   - Responses increase with liquidity constraints and decrease with **P**(repayment)

2. **Structural estimation**: labor supply elasticity of **0.11** $+$ adjustment frictions

3. **Contract design**: providing insurance with income-contingent loans $\Rightarrow \uparrow$ welfare
   - Moral hazard significantly reduces optimal amount of insurance
   - Fixed repayment $\rightarrow$ optimal income-contingent loan $\Rightarrow \uparrow$ **1.3%** lifetime consumption
   - Forbearance $+$ fixed repayment does worse because of slower repayment

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Takeaway: Income-contingent repayment creates moral hazard that affects contract design, but too small to justify fixed repayment

Related Literature & Contributions

1. Theories of human capital financing Lochner-Monge-Naranjo 2016, Stantcheva 2017

2. Empirical effects of student loans
   - $\uparrow$ Debt $\Rightarrow$ $\uparrow$ delinquencies, $\downarrow$ mobility, $\downarrow$ income Di Maggio et al. 2021, $\downarrow$ homeownership Mezza et al. 2020, Δ occupation Luo-Mongey 2019, Δ major Hampole 2022
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Contributions:

1. Empirical evidence of moral hazard from income-contingent repayment
   Britton-Gruber 2020, Herbst et al. 2023
2. Dynamic model of labor supply that replicates these responses
3. Quantification of how moral hazard affects optimal contract design

Related Literature & Contributions

3. Insurance vs. moral hazard in social insurance: UI Gruber 1997, Chetty 2008, Ganong-Noel 2019, HH bankruptcy Dobbie-Song 2015, Indarte 2023, health insurance Einav et al. 2015
4. State-contingent securities for households Shiller 2004, Caplin et al. 2007, Mian-Sufi 2014, Hartman-Glaser-Hébert 2020, Greenwald et al. 2021, Campbell et al. 2021, Benetton et al. 2022
5. Bunching at discontinuities in tax rates Saez 2010, Chetty et al. 2011, Kleven-Waseem 2013
6. Determinants of labor supply Blundell-MaCurdy 1999, Keane 2011, Chetty 2012, ...

Outline

1. Institutional Background and Data
2. Labor Supply Responses to Income-Contingent Repayment
3. Life Cycle Model with Endogenous Labor Supply
4. Welfare and Fiscal Impacts of Income-Contingent Repayment
5. Conclusion

Outline

Student Loans in Australia: HELP

- Australian citizens eligible for government-provided student loans through **HELP**
- **Initial debt** = tuition – goverment contribution – upfront payment (average $\approx$ \$20K USD)
- Debt grows at CPI net of **income-contingent repayments**:

$$\text{Repayment}_{it} = \text{HELP Rate}_t\left(\text{HELP Income}_{it}\right) \times \text{HELP Income}_{it}$$

$$\text{HELP Income}_{it} = \text{Labor Income}_{it} + \text{Capital Income}_{it} - \text{Deductions}_{it}$$

- Repayments continue until remaining debt balance equals zero or death
  - ✗ Cannot be cancelled or discharged in bankruptcy
  - Note: collection done from individual (not household) tax returns

▸ Variable Definitions

Why Study Income-Contingent Repayment in Australia?

- Benefit #1: only one government contract + no private market
  - Only choice is between borrowing and paying upfront; former heavily subsidized
  - ✓ Limited scope for **adverse selection** (or selection on moral hazard)
- Benefit #2: loans can only be used for tuition
  - Tuition is government-controlled at public universities (94% of enrollment)
  - ✓ Less room for **ex-ante** moral hazard from changes in borrowing
- Benefit #3: first nationwide provider of income-contingent loans in 1989
  - ✓ Borrowers likely **understand** structure of repayment

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▸ Differences from US

Data

1. Universe of individual tax returns from ATO ($\sim$ US Form 1040)
2. Administrative HELP data: debt balances and repayments
3. 2016 Household Census: self-reported hours and mortgage + rent payments
4. Administrative retirement savings data: superannuation balances
5. HILDA: survey data on hours worked and asset holdings

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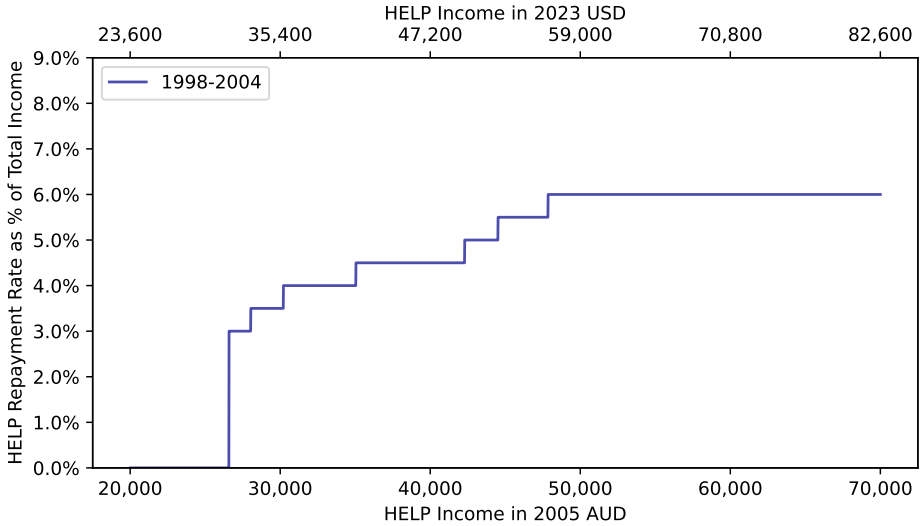
Sample: $\sim$ 4 million unique debtholders between ages 20-64 from 1991-2018

- Means at age 26: HELP Income = \$34K (98% labor income), debt = \$13K

Limitation: no information about borrowing (e.g. degree, institution)

▸ Summary Stats ▸ Debt by Age ▸ Debt Repay

Identifying Variation: Discontinuities in Repayment Rates



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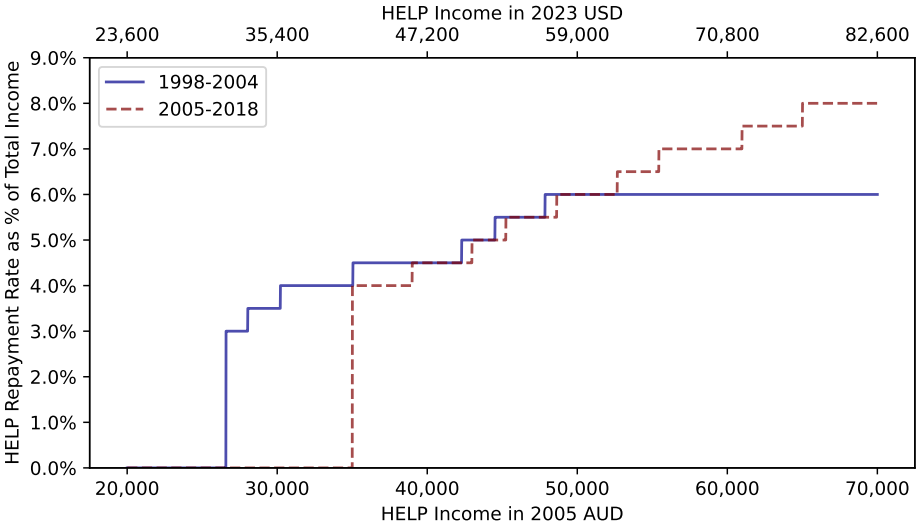

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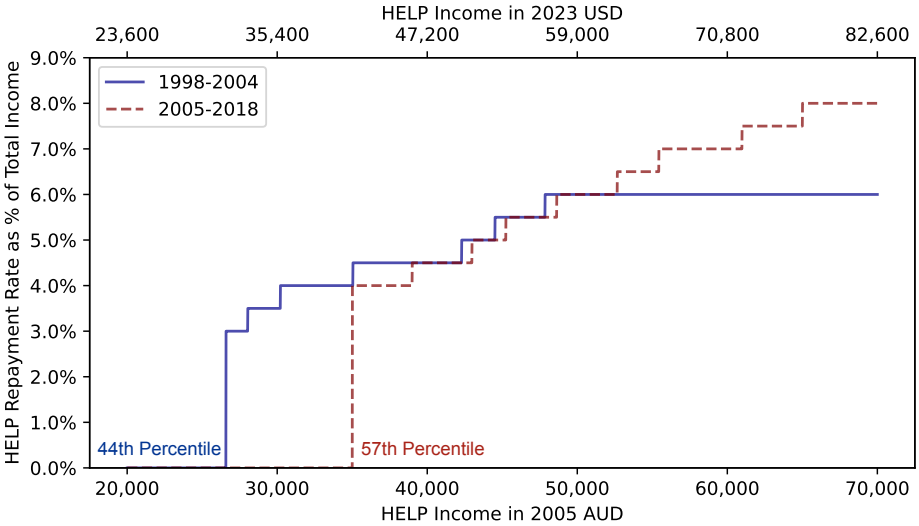
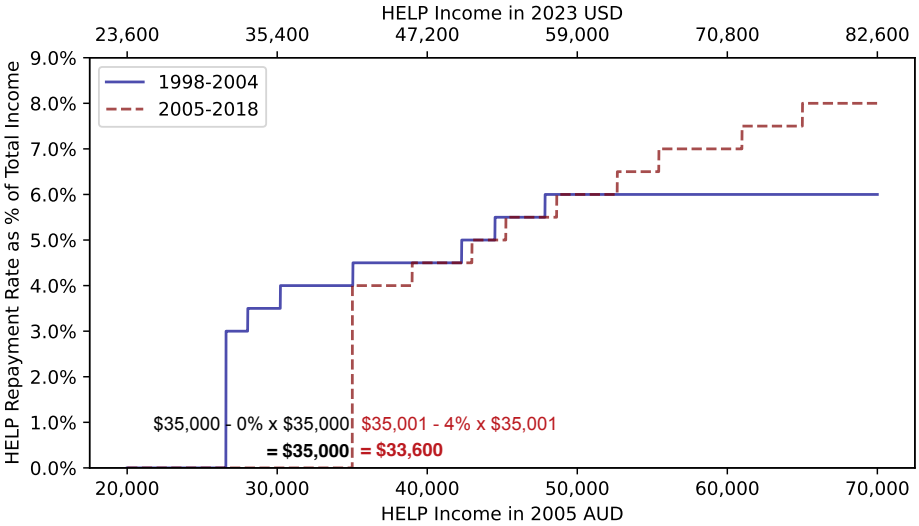


Repayment Threshold Increases **Average** Repayment Rate



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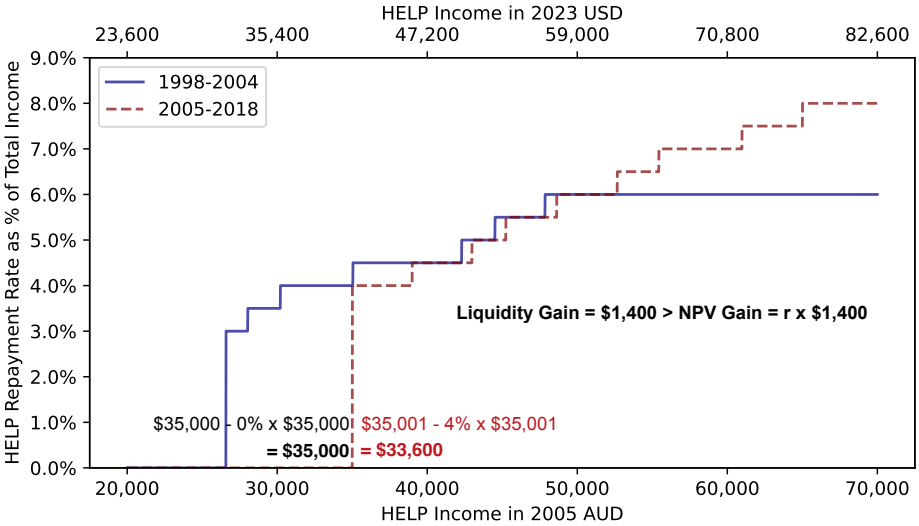

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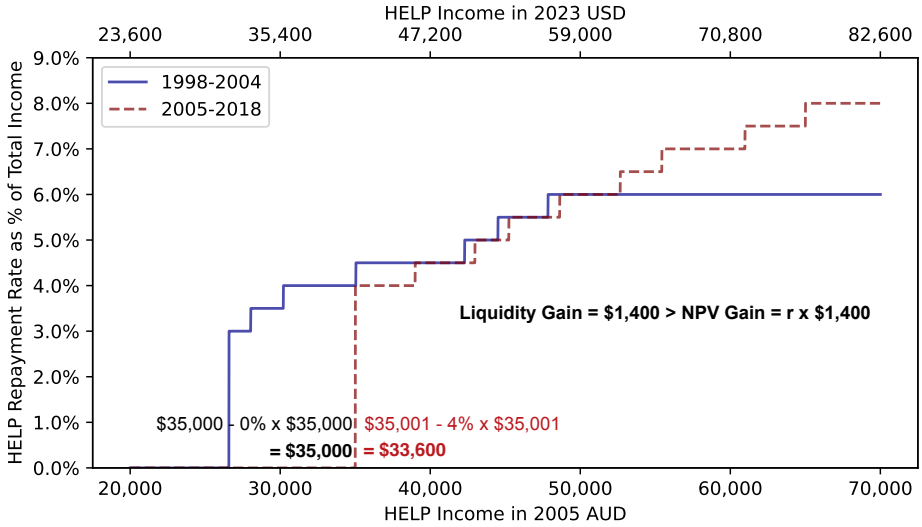
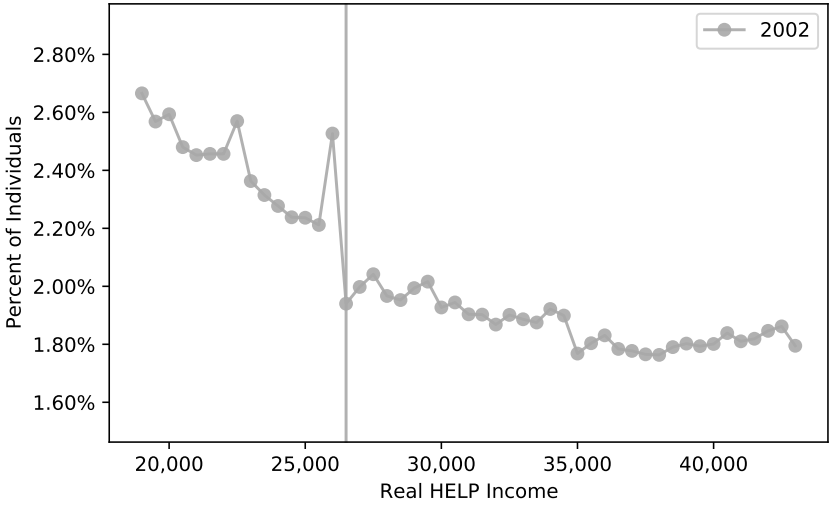


Note: policy change applied to new and existing debtholders

▸ Marginal Rates ▸ Payments ▸ News ▸ Occupations

Outline

Borrowers Adjust Income to Reduce Repayments



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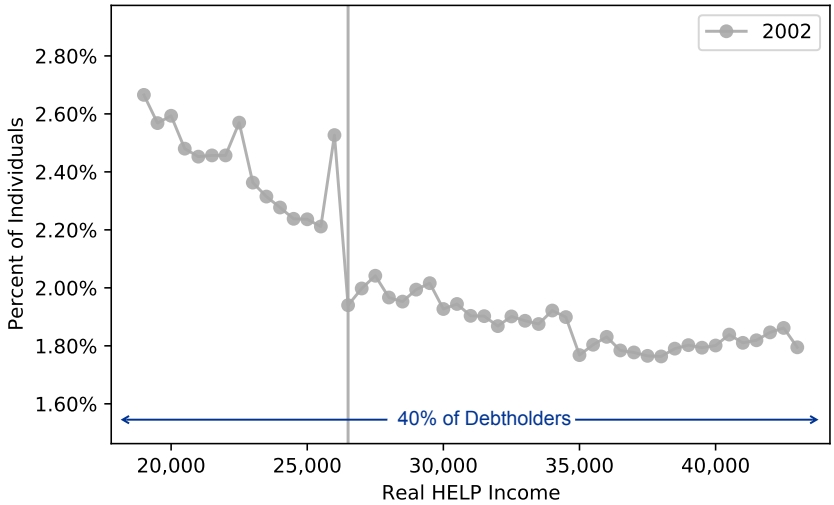

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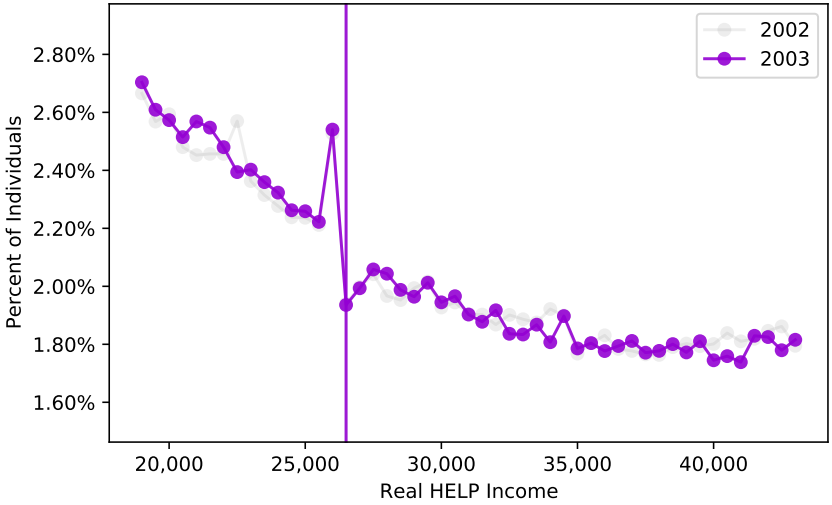

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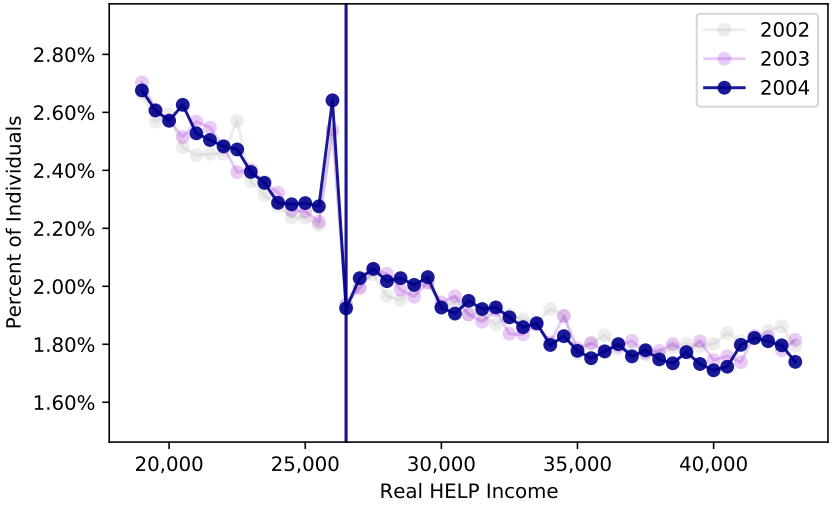

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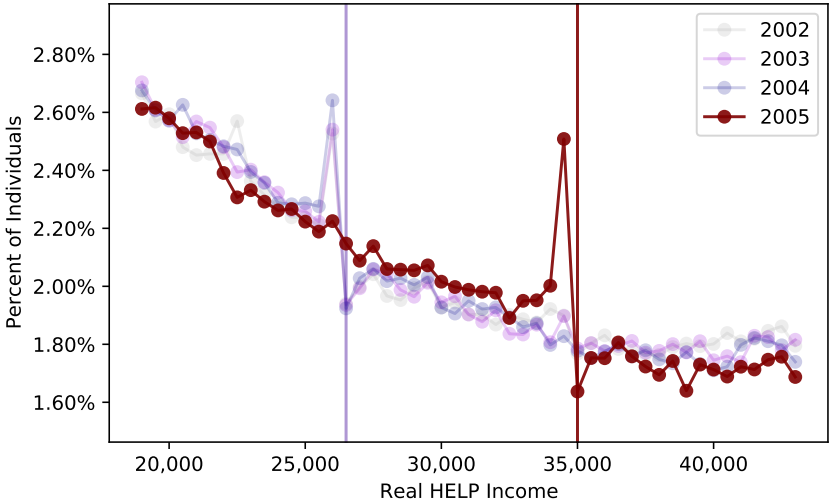

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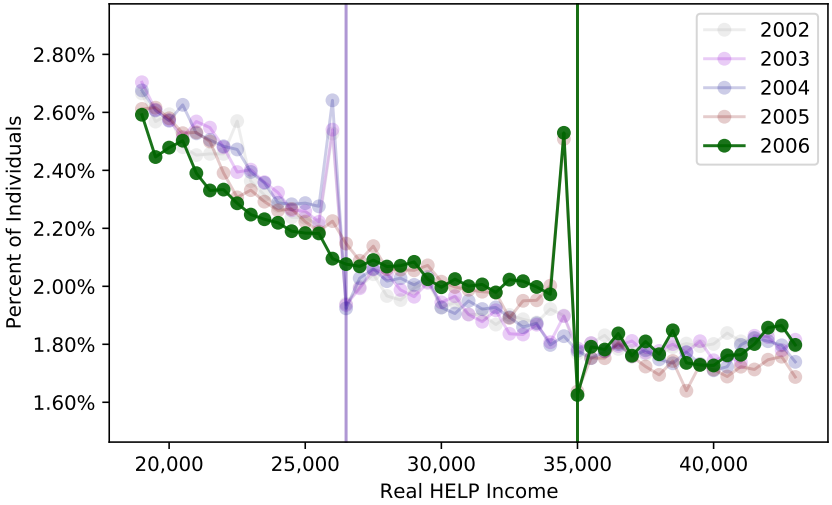

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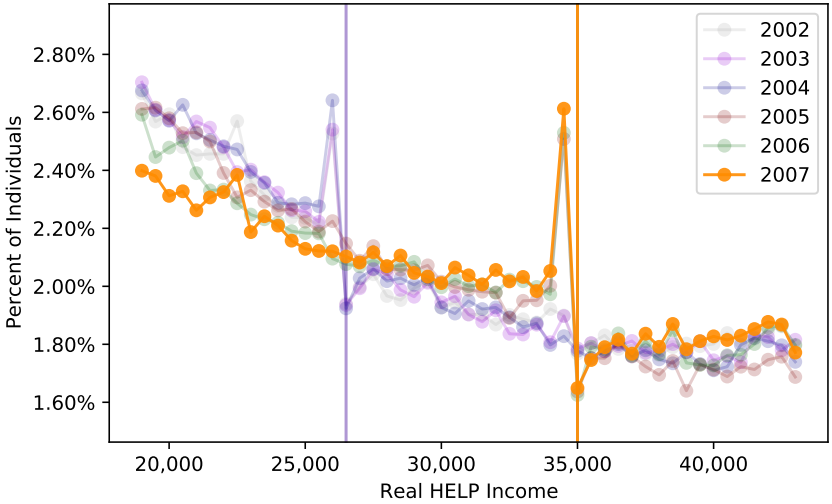

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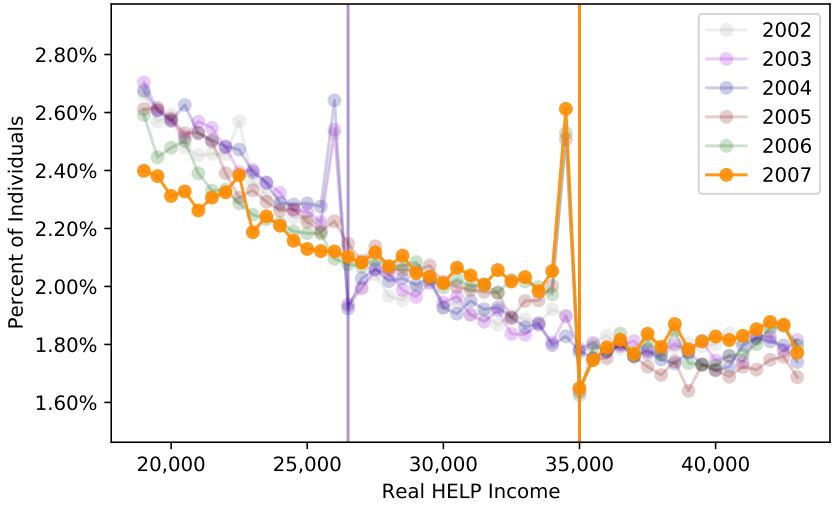
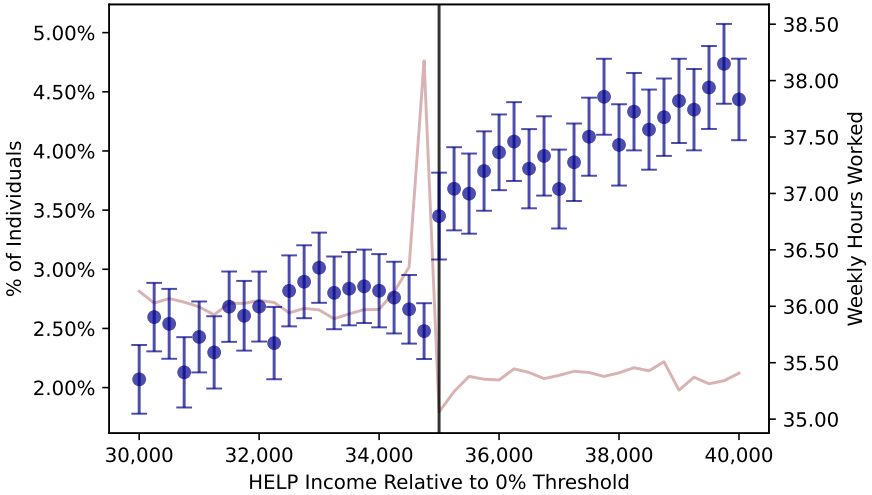


- Next: does bunching reflect labor supply or evasion?

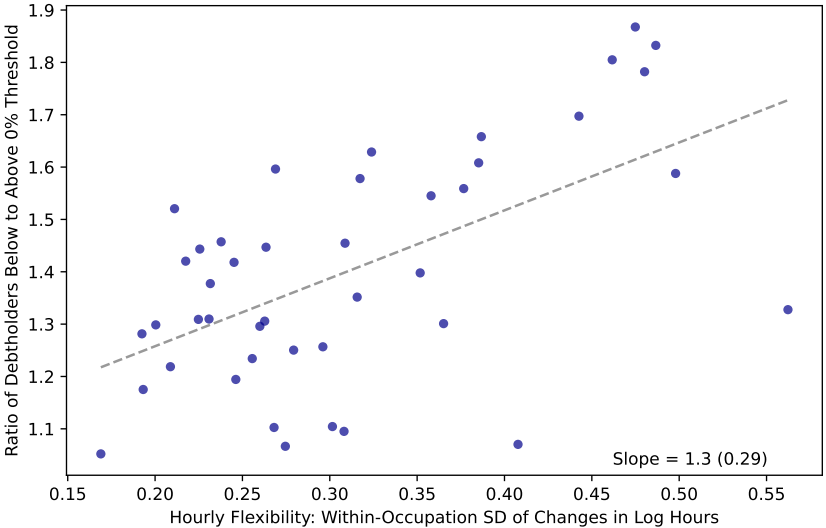
Labor Non-Debt

Borrowers Below Repayment Threshold Work Fewer Hours



- In 2016, reduction is around **1** hour/week = 2.6% of standard workweek

More Bunching in Occupations with Greater Hourly Flexibility



Sample: All wage-earners between 2005-2018

▸ Alt. Measure ▸ Evasion ▸ Table ▸ Profiles

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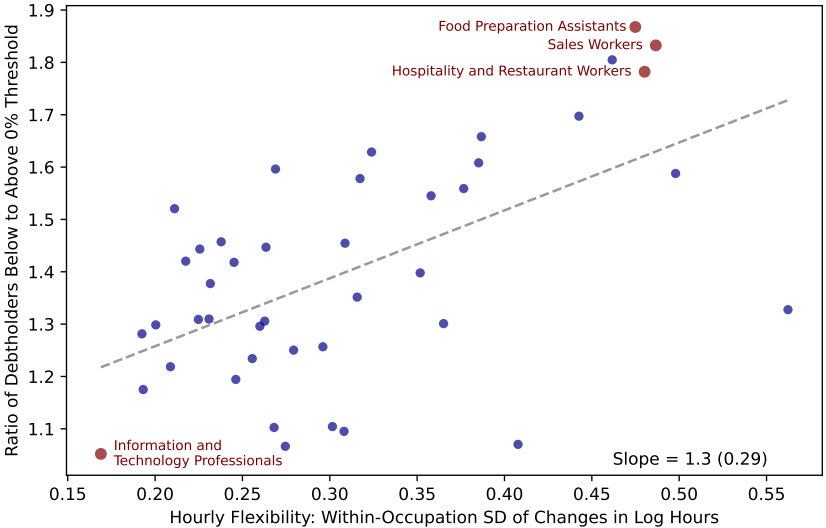

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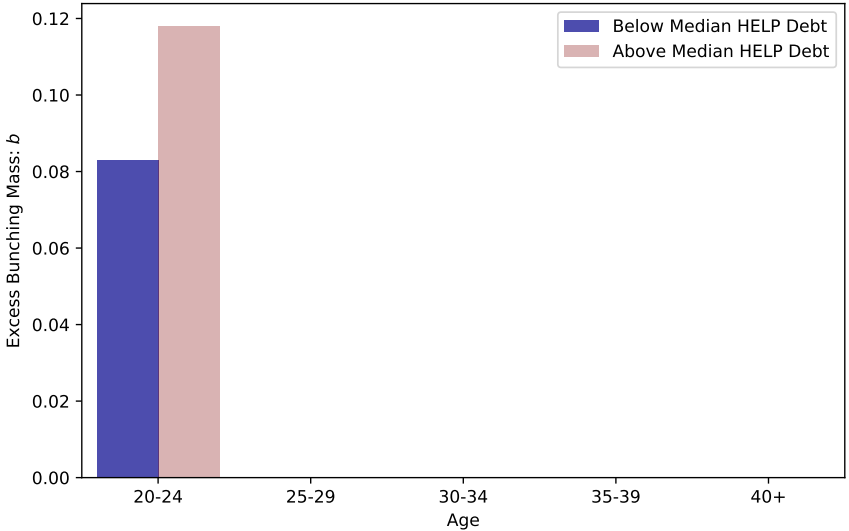
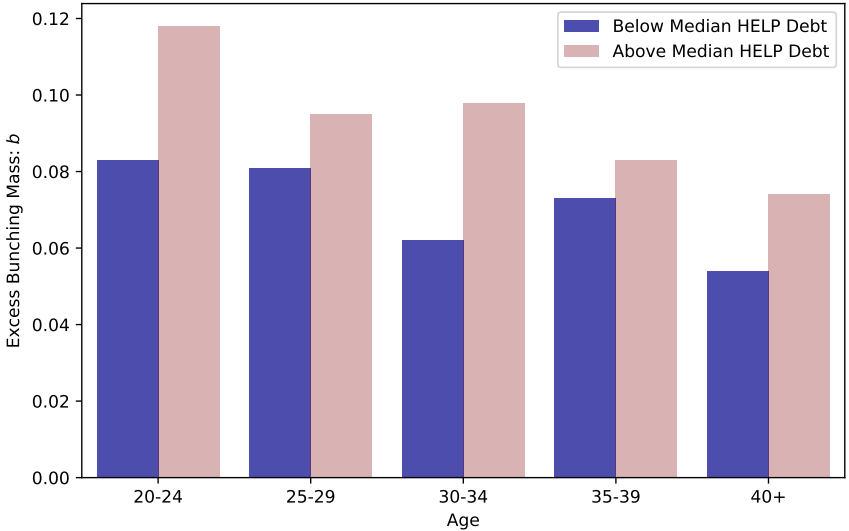


Note: Confidence intervals omitted due to small size

▸ b Details

Bunching Increases with Debt and Decreases with Age



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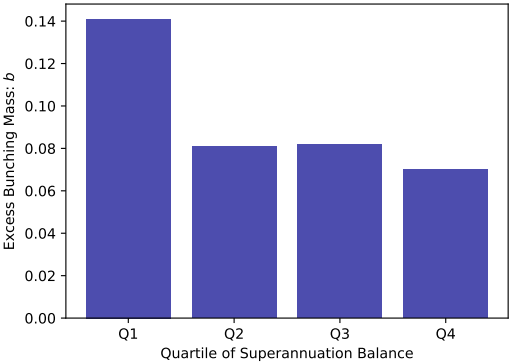

▸ Within Age ▸ House Prices

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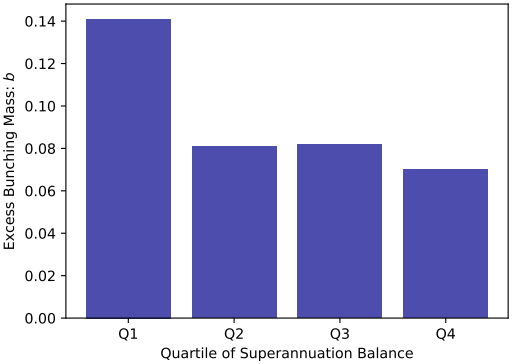

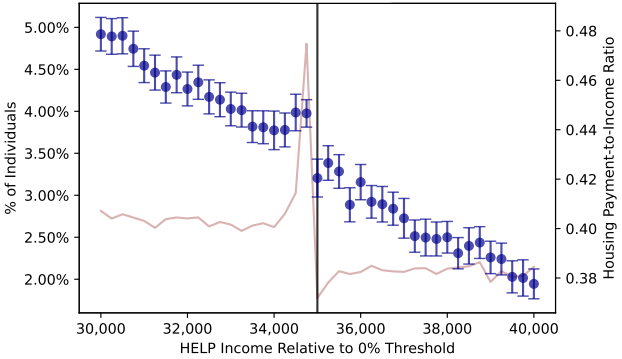

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Facts about moral hazard:

1. Borrowers reduce labor income in response to income-contingent repayment
   - Reflects labor supply: "bunchers" work fewer hours and in more flexible occupations
2. Size of responses depends on
   - Liquidity: increases with liquidity demands, decreases with retirement wealth
   - Dynamics: increases with debt, decreases with lifetime income
3. Limited evidence of future wage reductions from reducing labor supply

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Questions for model:

1. How large are these labor supply responses quantitatively?
2. Do they imply the costs of income-contingent repayment exceed the benefits?

Outline

Model Description

Life cycle model with debt $+$ $\underbrace{\text{incomplete markets}}_{\Rightarrow \text{ demand for insurance}}$ $+$ $\underbrace{\text{endogenous labor supply}}_{\Rightarrow \text{ moral hazard}}$

Life cycle model with debt + incomplete markets + endogenous labor supply

- Overlapping generations born at 22 with heterogeneous assets, wage, and debt
- From 22 to 64, individuals choose consumption, c_a, and labor supply, ℓ_a
  - Wage rate subject to idiosyncratic shocks (no agg. risk, partial eq.)
  - Shocks are uninsurable: borrowing allowed up to age-dependent limit with interest
- After age 64, individuals retire and choose consumption c_a

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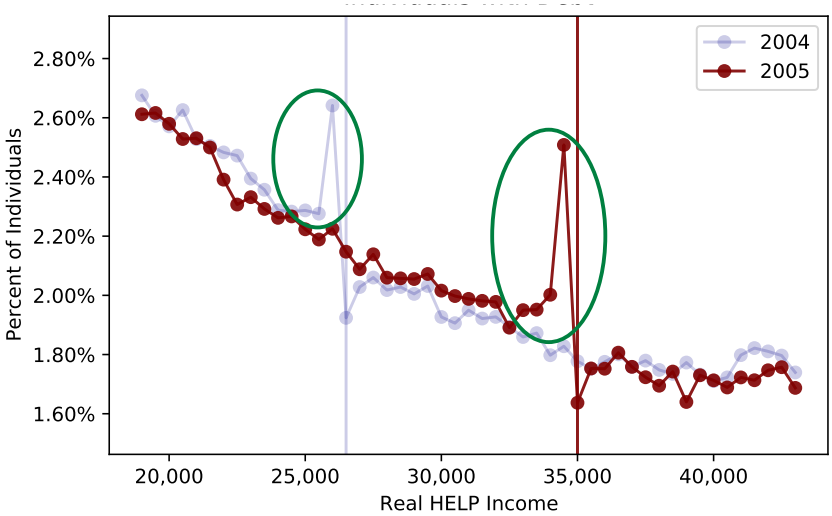
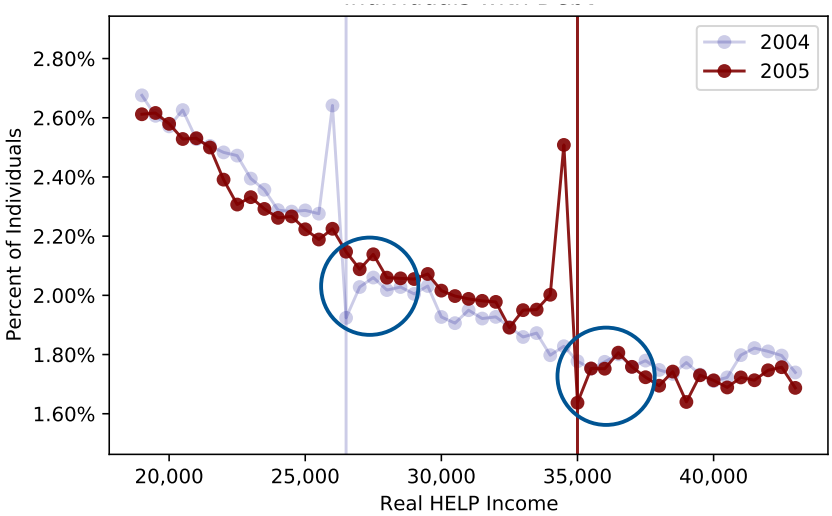
- After age 64, individuals retire and choose consumption c_a
- **Government**
  - Revenues: progressive income taxes, debt repayments
  - Expenses: means-tested unemployment benefits & retirement pension, initial debt

Bunching Consistent with Positive Labor Supply Elasticity



Mass Above Threshold **Inconsistent** with Frictionless Model



- Moving above to below threshold $\Rightarrow$ more leisure **and** \$1400 more cash-on-hand

Labor Supply Optimization Frictions

- Choice of ℓ_a subject to two **optimization frictions** to give mass above threshold
- **Time**-dependent adjustment (Calvo):
  - Fraction λ hit by shock and adjust l_a, other $1 - \lambda$ set $l_a = l_{a-1}$
  - E.g. inattention, arrival of opportunities to change hours/jobs
- **State**-dependent adjustment (sS):
  - Individuals hit by Calvo shock incur utility cost f, **if** they choose $l_a \neq l_{a-1}$
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- Extension: add learning-by-doing to generate long-run cost of bunching

Optimization Problem of Individuals Hit by Calvo Shock

$$V_a(\mathbf{s}_a) =$$

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Optimization Problem of Individuals Hit by Calvo Shock

$$V_a(\mathbf{s}_a) = \max_{\substack{A_{a+1} \geq A_{a+1}, \\ \ell_a}} \underbrace{c_a - \kappa \frac{\ell_a^{1+\phi^{-1}}}{1+\phi^{-1}}}_{\text{utility of consumption \& disutility of labor}} - \underbrace{f * \mathbf{1}_{\ell_a \neq \ell_{a-1}}}_{\text{adjustment cost}} + \beta \left[m_a \mathbf{E}_{\mathbf{a}} \left(\underbrace{V_{a+1}(\mathbf{s}_{a+1})}_{\text{continuation value}}^{1-\gamma} \right) \right]^{\frac{1}{1-\gamma}}$$

Optimization Problem of Individuals Hit by Calvo Shock

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$$c_a + A_{a+1} + \underbrace{d(y_a, D_a, t)}_{\substack{\text{debt} \\ \text{repayment}}} + \underbrace{\tau(y_a)}_{\text{taxes + ui}} = \underbrace{y_a}_{\substack{\text{labor} \\ \text{income}}} + \underbrace{A_a R}_{\substack{\text{capital} \\ \text{income}}}$$

Optimization Problem of Individuals Hit by Calvo Shock

$$V_a(\mathbf{s}_a) = \max_{\substack{A_{a+1} \geq \underline{A}_{a+1}, \\ \ell_a}} \left\{ \left[c_a - \kappa \frac{\ell_a^{1+\phi^{-1}}}{1+\phi^{-1}} - f * \mathbf{1}_{\ell_a \neq \ell_{a-1}} \right]^{1-\sigma} + \beta \left[m_a \mathbf{E_a} \left(V_{a+1}(\mathbf{s}_{a+1})^{1-\gamma} \right) \right]^{\frac{1-\sigma}{1-\gamma}} \right\}^{\frac{1}{1-\sigma}}$$

$$c_a + A_{a+1} + d(y_a, D_a, t) + \tau(y_a) = y_a + A_a R$$

$$y_a = \ell_a w_a, \quad \log w_a = \underbrace{g_a}_{\substack{\text{age} \\ \text{profile}}} + \underbrace{\theta_a}_{\substack{\text{permanent} \\ \text{income}}} + \underbrace{\epsilon_a}_{\substack{\text{transitory} \\ \text{shock}}}$$

Optimization Problem of Individuals Hit by Calvo Shock

$$V_a(\mathbf{s}_a) = \max_{\substack{A_{a+1} \geq \underline{A}_{a+1}, \\ \ell_a}} \left\{ \left[c_a - \kappa \frac{\ell_a^{1+\phi^{-1}}}{1+\phi^{-1}} - f * \mathbf{1}_{\ell_a \neq \ell_{a-1}} \right]^{1-\sigma} + \beta \left[m_a \mathbf{E}_{\mathbf{a}} \left(V_{a+1}(\mathbf{s}_{a+1})^{1-\gamma} \right) \right]^{\frac{1-\sigma}{1-\gamma}} \right\}^{\frac{1}{1-\sigma}}$$

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$$\mathbf{s}_a = \begin{pmatrix} a & t & A_a & D_a & \theta_a & \epsilon_a & \ell_{a-1} & \omega_a \end{pmatrix}$$

Optimization Problem of Individuals Hit by Calvo Shock

$$V_a(\mathbf{s}_a) = \max_{\substack{A_{a+1} \geq \underline{A}_{a+1}, \\ \ell_a}} \left\{ \left[c_a - \kappa \frac{\ell_a^{1+\phi^{-1}}}{1+\phi^{-1}} - f * \mathbf{1}_{\ell_a \neq \ell_{a-1}} \right]^{1-\sigma} + \beta \left[m_a \mathbf{E}_{\mathbf{a}} \left(V_{a+1}(\mathbf{s}_{a+1})^{1-\gamma} \right) \right]^{\frac{1-\sigma}{1-\gamma}} \right\}^{\frac{1}{1-\sigma}}$$

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- a = age
- t = year to keep track of policy change

Optimization Problem of Individuals Hit by Calvo Shock

$$V_a(\mathbf{s}_a) = \max_{\substack{A_{a+1} \geq \underline{A}_{a+1}, \\ \ell_a}} \left\{ \left[c_a - \kappa \frac{\ell_a^{1+\phi^{-1}}}{1+\phi^{-1}} - f * \mathbf{1}_{\ell_a \neq \ell_{a-1}} \right]^{1-\sigma} + \beta \left[m_a \mathbf{E}_{\mathbf{a}} \left(V_{a+1}(\mathbf{s}_{a+1})^{1-\gamma} \right) \right]^{\frac{1-\sigma}{1-\gamma}} \right\}^{\frac{1}{1-\sigma}}$$

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- A_a = savings from previous period
- D_a = debt = $R_d D_{a-1} - d(y_{a-1}, D_{a-1}, t)$

Optimization Problem of Individuals Hit by Calvo Shock

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- θ_a = permanent income = $\rho \theta_{a-1} + \nu_a$ $\qquad$ $\nu_a \sim N(0, \sigma_\nu^2)$
- ϵ_a = transitory shock $\sim N(0, \sigma_\epsilon^2)$

Optimization Problem of Individuals Hit by Calvo Shock

$$V_a(\mathbf{s}_a) = \max_{\substack{A_{a+1} \geq \underline{A}_{a+1}, \\ \ell_a}} \left\{ \left[c_a - \kappa \frac{\ell_a^{1+\phi^{-1}}}{1+\phi^{-1}} - f * \mathbf{1}_{\ell_a \neq \ell_{a-1}} \right]^{1-\sigma} + \beta \left[m_a \mathbf{E_a} \left(V_{a+1}(\mathbf{s}_{a+1})^{1-\gamma} \right) \right]^{\frac{1-\sigma}{1-\gamma}} \right\}^{\frac{1}{1-\sigma}}$$

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- θ_a = permanent income = $\rho \theta_{a-1} + \nu_a + \alpha \log \ell_{a-1}$ $\quad \nu_a \sim N(0, \sigma_\nu^2)$
- ϵ_a = transitory shock $\sim N(0, \sigma_\epsilon^2)$ Extension: learning-by-doing

Optimization Problem of Individuals Hit by Calvo Shock

$$V_a(\mathbf{s}_a) = \max_{\substack{A_{a+1} \geq \underline{A}_{a+1}, \\ \ell_a}} \left\{ \left[c_a - \kappa \frac{\ell_a^{1+\phi^{-1}}}{1+\phi^{-1}} - f * \mathbf{1}_{\ell_a \neq \ell_{a-1}} \right]^{1-\sigma} + \beta \left[m_a \mathbf{E}_{\mathbf{a}} \left(V_{a+1}(\mathbf{s}_{a+1})^{1-\gamma} \right) \right]^{\frac{1-\sigma}{1-\gamma}} \right\}^{\frac{1}{1-\sigma}}$$

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- ℓ_{a-1} = labor supply from previous period
- ω_a = Calvo shock that determines whether ℓ_a can be adjusted $\sim$ Bernoulli(λ)

Optimization Problem of Individuals Hit by Calvo Shock

$$V_a(\mathbf{s}_a) = \max_{\substack{A_{a+1} \geq \underline{A}_{a+1}, \\ \ell_a}} \left\{ \left[c_a - \kappa \frac{\ell_a^{1+\phi^{-1}}}{1+\phi^{-1}} - f * \mathbf{1}_{\ell_a \neq \ell_{a-1}} \right]^{1-\sigma} + \beta \left[m_a \mathbf{E_a} \left(V_{a+1}(\mathbf{s}_{a+1})^{1-\gamma} \right) \right]^{\frac{1-\sigma}{1-\gamma}} \right\}^{\frac{1}{1-\sigma}}$$

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$$\mathbf{s}_a = \begin{pmatrix} a & t & A_a & D_a & \theta_a & \epsilon_a & \ell_{a-1} & \omega_a \end{pmatrix}$$

- Sources of ex-ante heterogeneity:
  - θ_0 = initial permanent income $\sim N(0, \sigma_I^2)$
  - D_0 = initial debt, A_0 = initial assets

ESTIMATION

First-Stage Calibration

- **Interest rates and borrowing**:
  - Interest rate = 1.84%, borrowing rate = CC rate, debt interest rate = 0%
  - Borrowing limit = average CC limit by age
- **Demographics**: cohort birth rates and mortality risk taken from life tables
  - Consumption adjusted for equivalence scale using HH size (Lusardi et al. 2017)
- **Government**: use exact (non-smooth) formulas provided by ATO
- **Initial conditions**: assets and debt distributions taken from data at age 22
- **Baseline RRA and EIS**: $\gamma = \frac{1}{\sigma} = 2.23$ (Choukhmane-de Silva 2023)
  - Welfare analysis: consider alternative values + preference for early resolution

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- **Learning-by-doing extension**: $\alpha = 0.24$ (median value from Best-Kleven 2013)

$$\text{Parameters} = \left(\qquad \right)$$

- **Estimation** via SMM with 47 moments + 14 parameters
  - Find parameters that minimize % difference between data & model moments
- **Simulated policy change**: unanticipated change in HELP formula at $t = 2005$

$$\text{Parameters} = \left(\overbrace{\phi \quad f \quad \lambda}^{\text{labor supply}} \right)$$

- Labor supply elasticity: identified by bunching below repayment threshold
- Frictions: identified by mass above repayment threshold

▸ Elasticities ▸ SMM Objective

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- Separate identification of frictions
  - Moments: heterogeneity in bunching with **debt**, bunching at **0.5%** threshold
  - **Intuition**: with $f = 0$, decision to bunch depends on Calvo shock not incentives

▸ Elasticities ▸ SMM Objective

Second-Stage Simulated Method of Moments: **Identification**

$$\text{Parameters} = \Big(\overbrace{\underbrace{\phi \quad f \quad \lambda}_{\text{labor supply}} \quad \kappa \quad \beta}^{\text{preferences}} \quad \underbrace{\delta_0 \quad \delta_1 \quad \delta_2 \quad \delta_0^E \quad \delta_1^E}_{\text{wage profile}} \quad \underbrace{\rho \quad \sigma_\nu \quad \sigma_\epsilon \quad \sigma_i}_{\text{wage risk}} \Big)$$

- Labor supply elasticity: identified by bunching below repayment threshold
- Frictions: identified by mass above repayment threshold
- Separate identification of frictions
  - Moments: heterogeneity in bunching with **debt**, bunching at **0.5%** threshold
  - **Intuition**: with $f = 0$, decision to bunch depends on Calvo shock not incentives
- Note: wage profile & risk cannot be estimated separately in first-stage

▸ Other Parameters ▸ Elasticities ▸ SMM Objective

Parameter Estimates

Parameter		Estimation: Baseline
Labor supply elasticity	ϕ	0.114
Fixed adjustment cost	f	\$377
Calvo parameter	λ	0.183
Labor supply scaling parameter	κ	0.560
Time discount factor	β	0.973
Wage profile parameters	δ_0	8.922
	δ_1	0.073
	δ_2	-0.001
	δ_0^E	-0.487
	δ_1^E	0.020
Persistence of permanent shock	ρ	0.930
Standard deviation of permanent shock	σ_ν	0.236
Standard deviation of transitory shock	σ_ϵ	0.130
Standard deviation of individual FE	σ_i	0.599

▸ Comparison with Literature ▸ Standard Errors

Parameter Estimates

Parameter		Estimation: Baseline	Estimation: No Frictions
Labor supply elasticity	ϕ	0.114	0.005
Fixed adjustment cost	f	\$377	·
Calvo parameter	λ	0.183	·
Labor supply scaling parameter	κ	0.560	0.030
Time discount factor	β	0.973	0.996
Wage profile parameters	δ_0	8.922	9.862
	δ_1	0.073	0.111
	δ_2	-0.001	-0.002
	δ_0^E	-0.487	-0.294
	δ_1^E	0.020	0.032
Persistence of permanent shock	ρ	0.930	0.914
Standard deviation of permanent shock	σ_ν	0.236	0.076
Standard deviation of transitory shock	σ_ϵ	0.130	0.504
Standard deviation of individual FE	σ_i	0.599	0.101

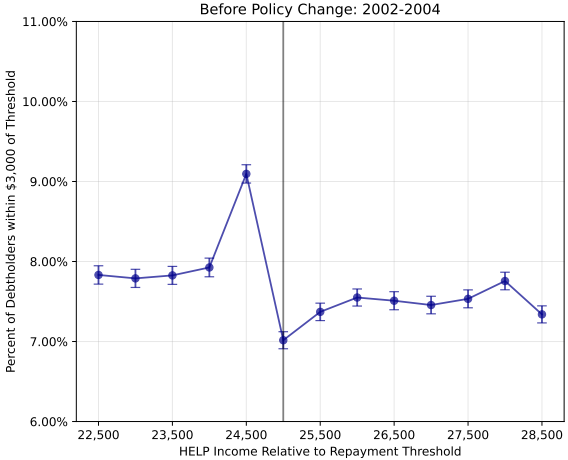
▸ Comparison with Literature ▸ Standard Errors

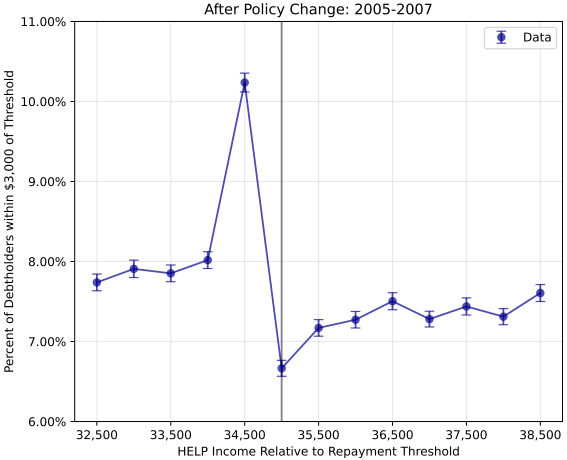
Parameter Estimates

Parameter		Estimation		
		Baseline	No Frictions	LBD
Labor supply elasticity	ϕ	0.114	0.005	0.082
Fixed adjustment cost	f	\$377	·	\$762
Calvo parameter	λ	0.183	·	0.346
Labor supply scaling parameter	κ	0.560	0.030	1.242
Time discount factor	β	0.973	0.996	0.951
Wage profile parameters	δ_0	8.922	9.862	9.197
	δ_1	0.073	0.111	0.070
	δ_2	-0.001	-0.002	-0.001
	δ_0^E	-0.487	-0.294	-0.480
	δ_1^E	0.020	0.032	0.018
Persistence of permanent shock	ρ	0.930	0.914	0.889
Standard deviation of permanent shock	σ_ν	0.236	0.076	0.288
Standard deviation of transitory shock	σ_ϵ	0.130	0.504	0.064
Standard deviation of individual FE	σ_i	0.599	0.101	0.625

▸ Comparison with Literature ▸ Standard Errors

Model Fit: Bunching Before and After Policy Change





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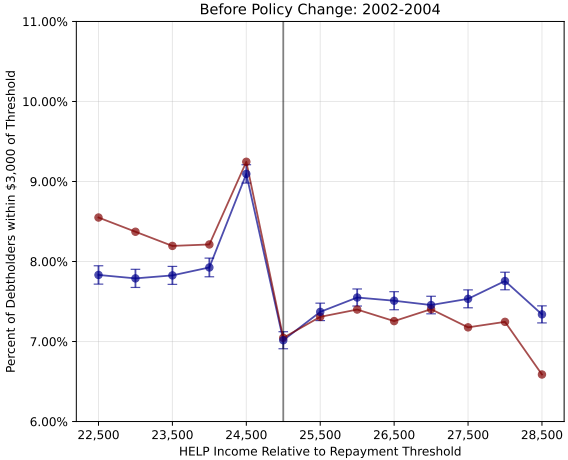
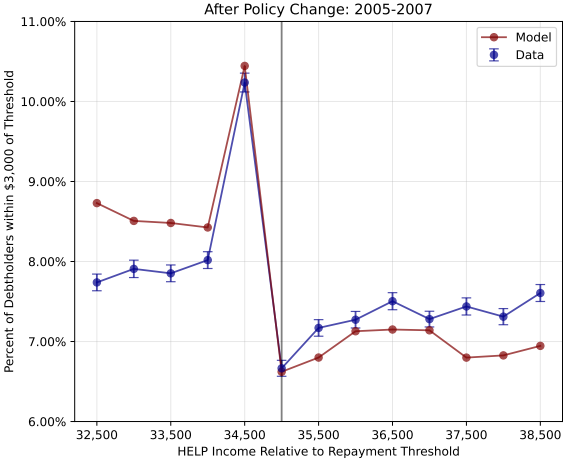
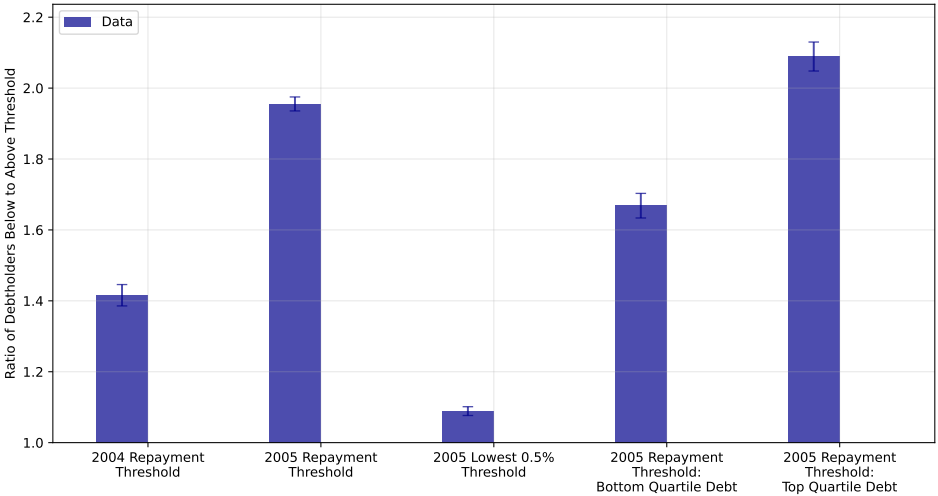


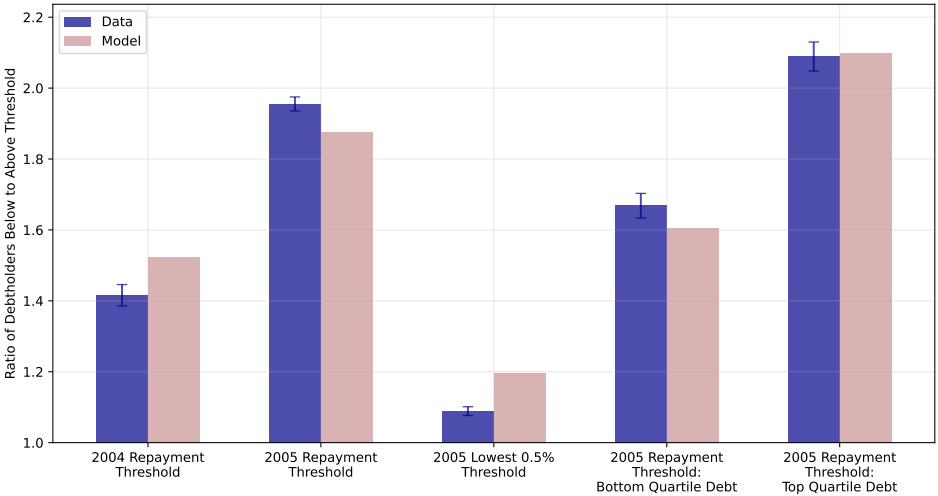


Model Fit: Bunching Heterogeneity



▸ Other Moments ▸ Liquidity ▸ Dynamics

Model Fit: Bunching Heterogeneity



▸ Other Moments ▸ Liquidity ▸ Dynamics

Outline

Normative Perspective

What repayment contract best balances insurance with moral hazard?

- Consider social planner that maximizes borrower welfare with **one** contract
  - Problem faced by governments with one contract (e.g. Australia, UK)
  - Contract is subsidized with zero interest rate, borrowing & prices held fixed

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- Consider social planner that maximizes borrower welfare with **one** contract
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  - Contract is subsidized with zero interest rate, borrowing & prices held fixed
- **Step 1**: **Existing** income-contingent loans vs. fixed repayment (not budget-neutral)
  - Four contracts: HELP 2004, HELP 2005, US Old & New IBR = $\psi * \max\{y - K, 0\}$
- **Step 2**: **Optimal** income-contingent contracts vs. fixed repayment (budget-neutral)

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  - Four contracts: HELP 2004, HELP 2005, US Old & New IBR = $\psi * \max\{y - K, 0\}$
- **Step 2**: **Optimal** income-contingent contracts vs. fixed repayment (budget-neutral)
- Note: consider effect of forgiveness in Step 2

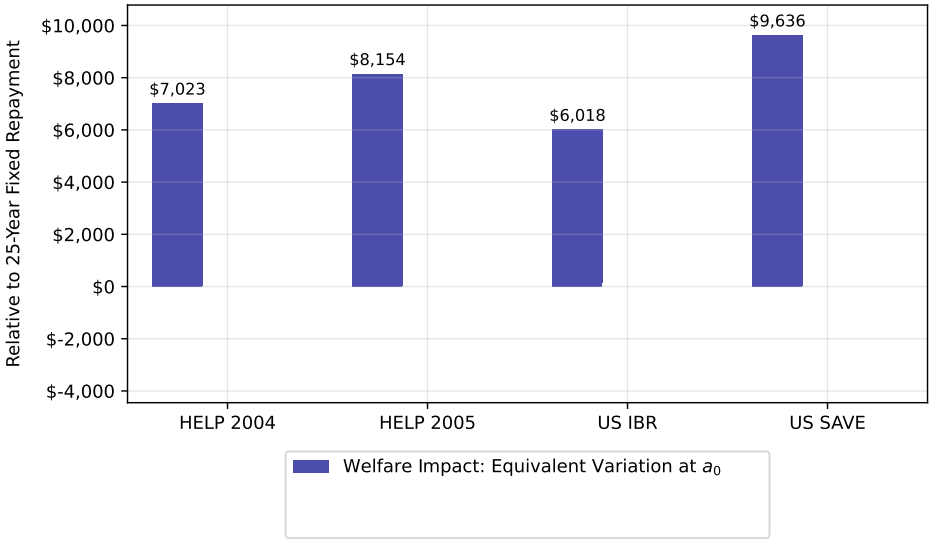
- **Government budget** defined as:

$$\mathcal{G} = \mathbf{E}_0 \sum_{a=a_0}^{a_T} \frac{\text{Repayments}_a + \text{Taxes}_a - \text{Transfers}_a}{\mathcal{R}_a}$$

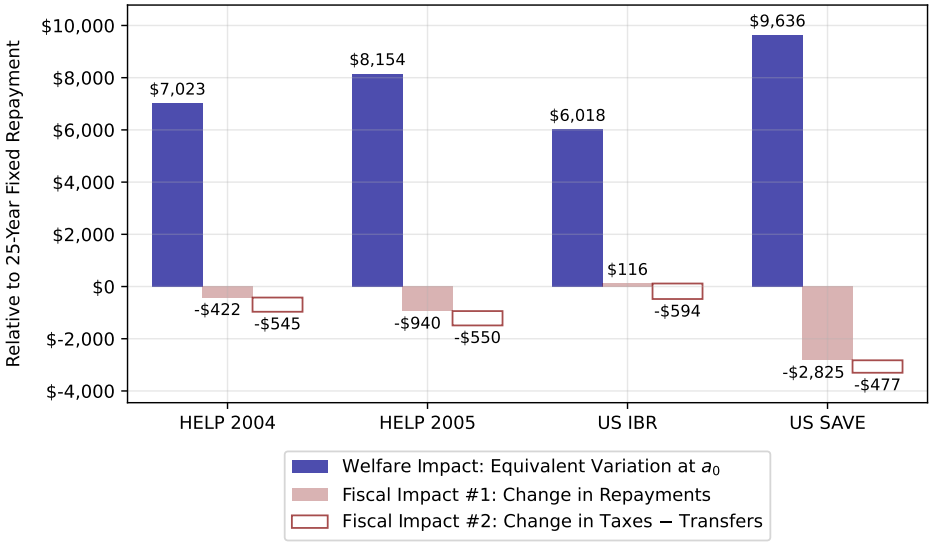
$$\mathcal{R}_a = \underbrace{\beta^{-(a-a_0)}}_{\text{individual time preference}} * \underbrace{\prod_{s=0}^{a-a_0} m_s}_{\text{mortality}}$$

- **Benchmark**: 25-Year Fixed Repayment = similar duration, not income-contingent
- Robustness with $\mathcal{R}_a =$ risk-free rate & $\mathcal{R}_a =$ risk-free rate $+ 4\%$

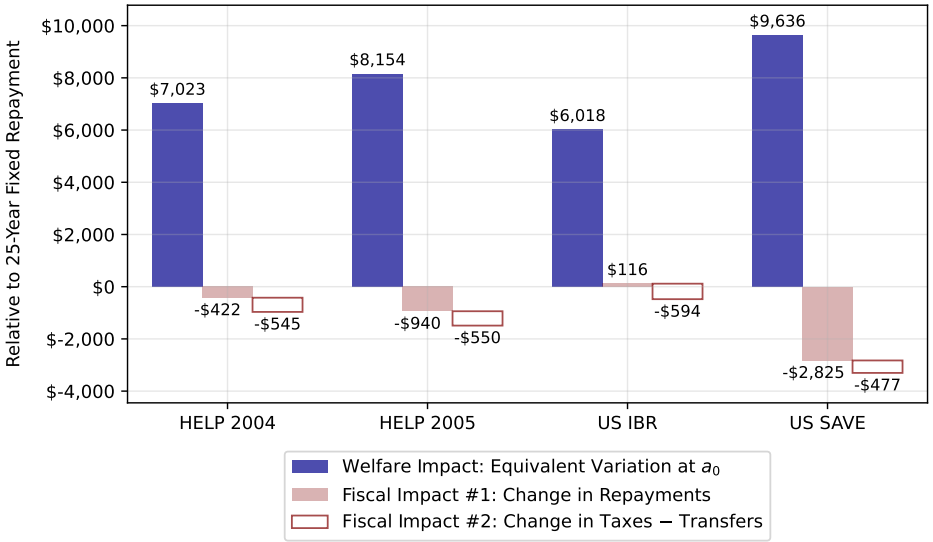
Existing Income-Contingent Loans vs. Fixed Repayment



Existing Income-Contingent Loans vs. Fixed Repayment



Existing Income-Contingent Loans vs. Fixed Repayment



▸ Decomposition ▸ MVPF

- Contracts have different fiscal costs $\Rightarrow$ need to balance government budget
- **Next**: solve **constrained**-planner's problem to construct contracts with same cost

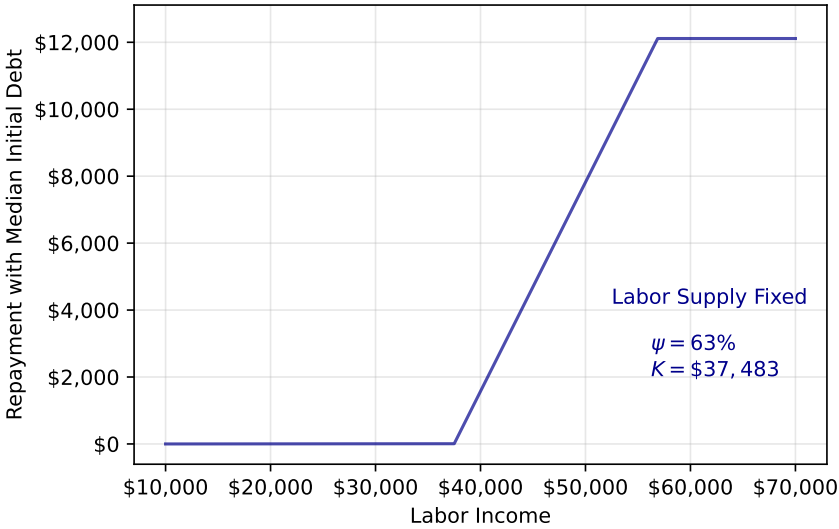
$$\max_{\psi, K} \mathbf{E}_0 \left(V_{a_0}^{1-\gamma} \right)^{\frac{1}{1-\gamma}}$$

subject to:

$$\mathbf{E}_0 \sum_{a=a_0}^{a_T} \frac{\text{Repayments}_a + \text{Taxes}_a - \text{Transfers}_a}{\mathcal{R}_a} \geq \mathcal{G}_{\text{25-Year Fixed}} \tag{1}$$

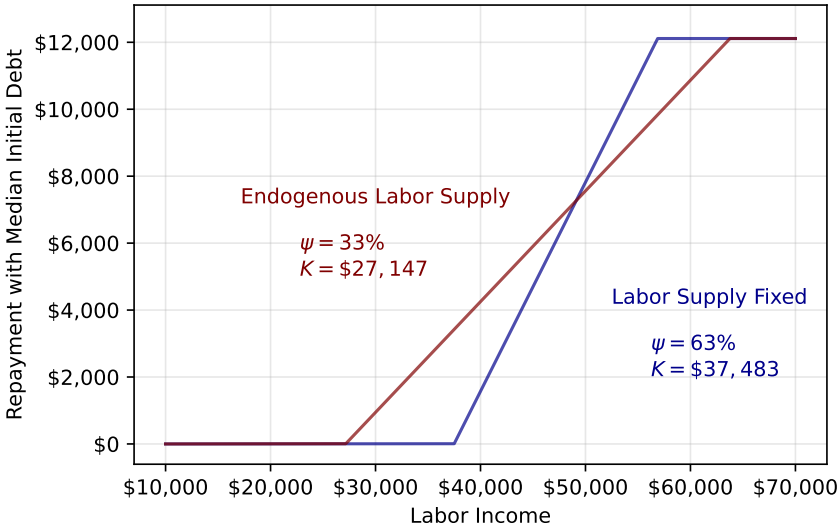
$$\text{Repayments}_a = \min \left\{ \psi * \max \left\{ y_a - K, 0 \right\}, D_a \right\} \tag{2}$$

Solution to Constrained-Planner's Problem



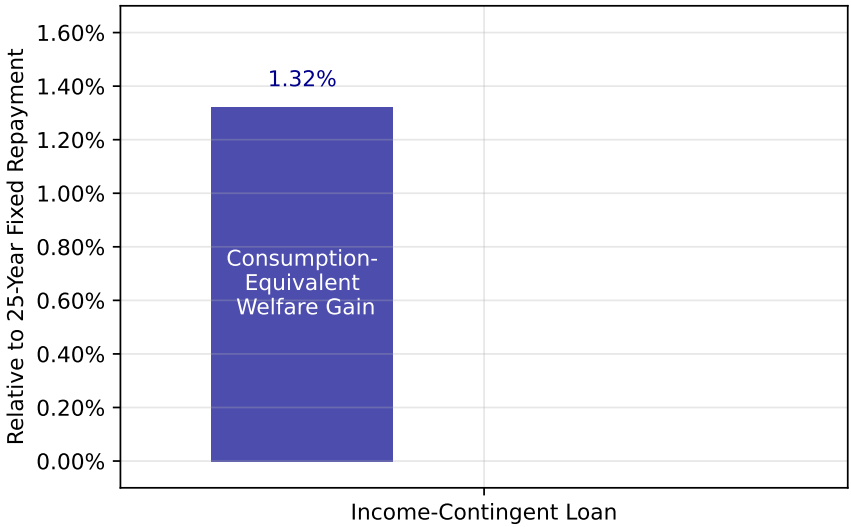
▸ Smooth ▸ vs. Existing

Solution to Constrained-Planner's Problem



▸ Smooth ▸ vs. Existing

Constrained-Optimum = 1.3% Increase in Lifetime Consumption



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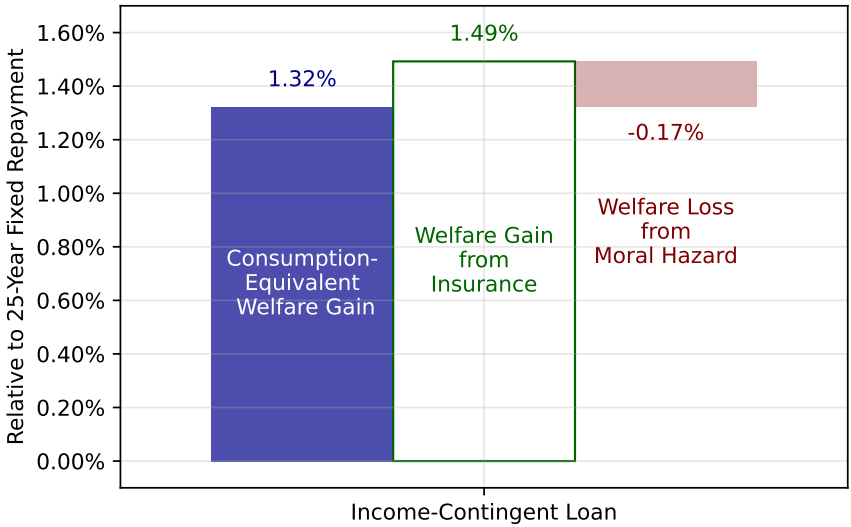
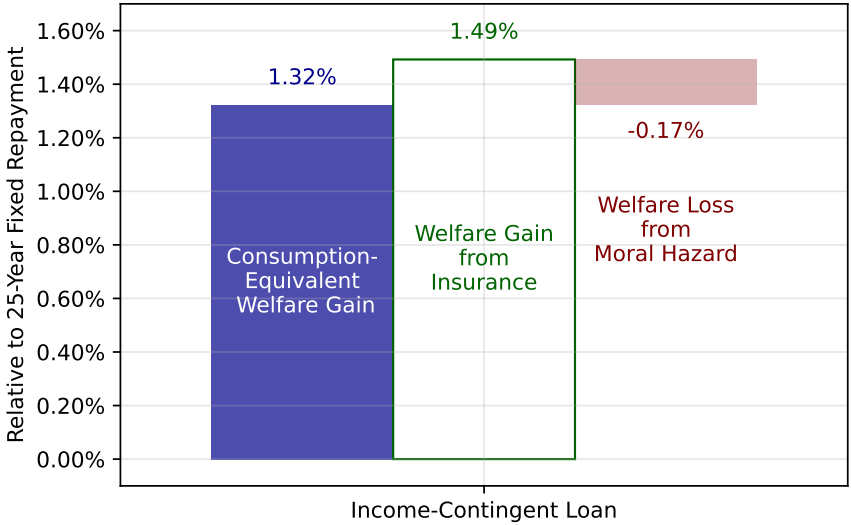
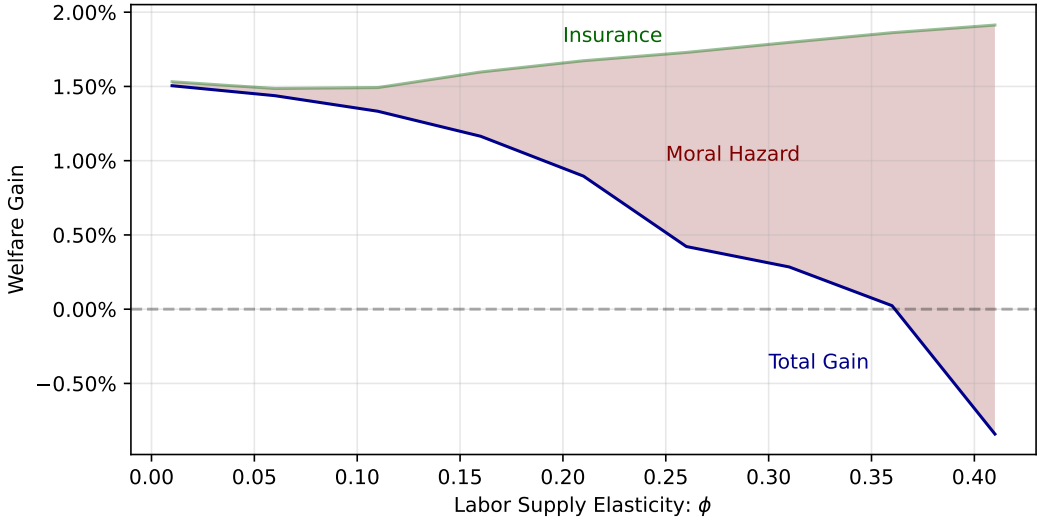


Constrained-Optimum = 1.3% Increase in Lifetime Consumption



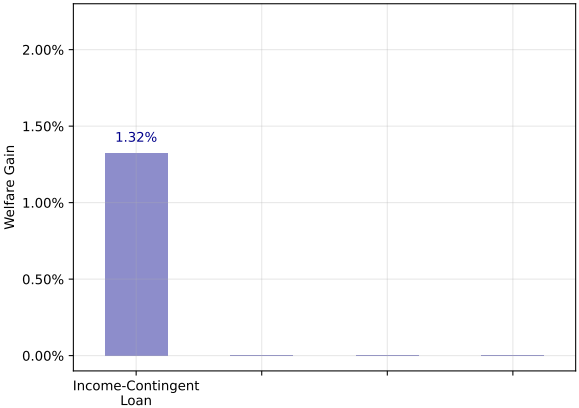
▸ Alt. Models ▸ Distribution ▸ Restrict $\psi \leq 10\%$ ▸ Forgiveness

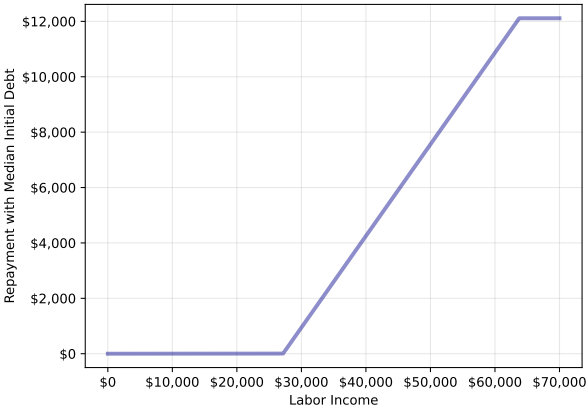
Welfare Gain is Positive as Long as $\phi < 0.37$



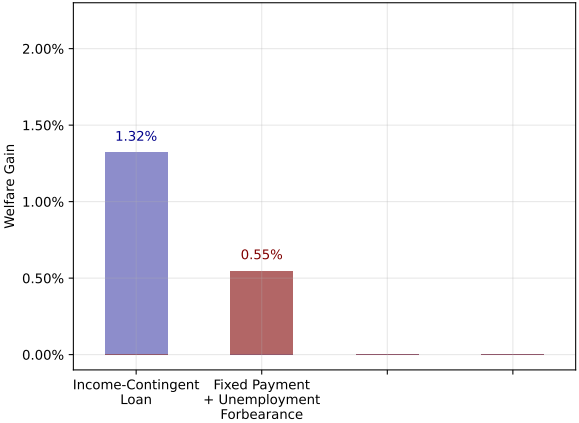
▸ Alt. Models ▸ Implied Bunching ▸ Contracts ▸ Contracts to Reduce MH

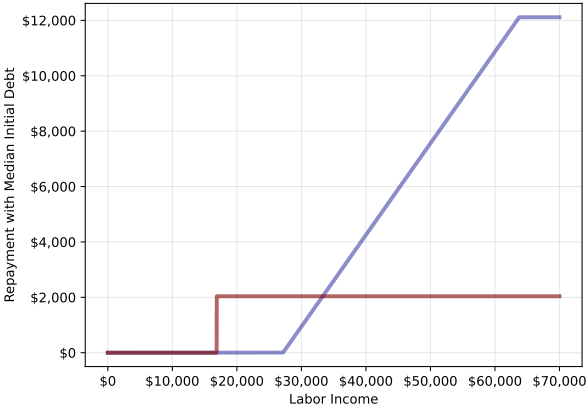
NEXT: OTHER BUDGET-NEUTRAL CONTRACTS...





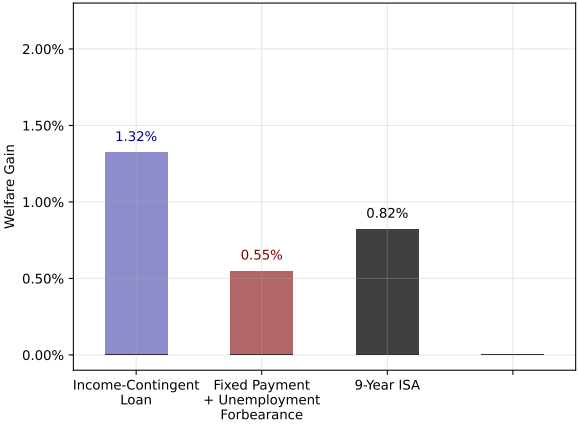
Just Providing Forbearance Gives Smaller Gains

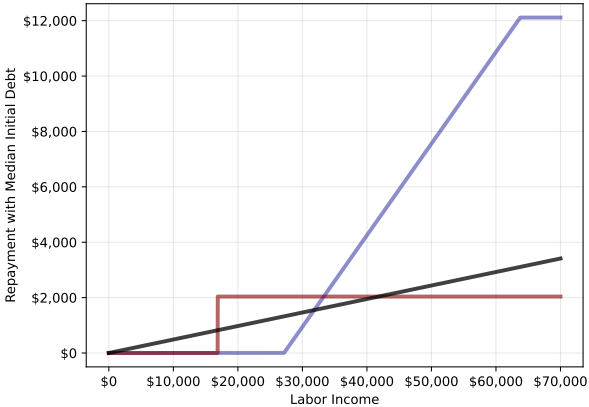




- **Benefit** of income-contingent loan: accelerate payments from high-income ▸ ICL+UI

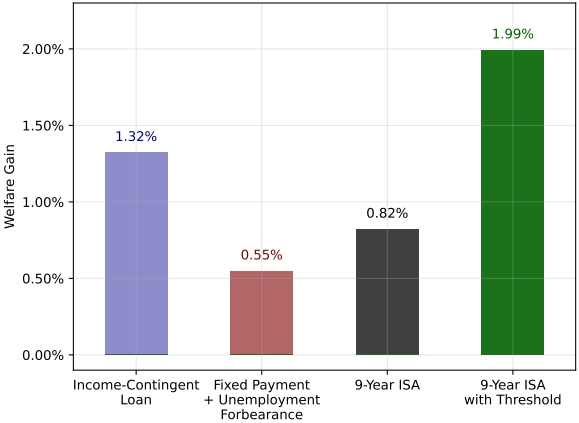
Pure Equity Contract Gives Smaller Gains

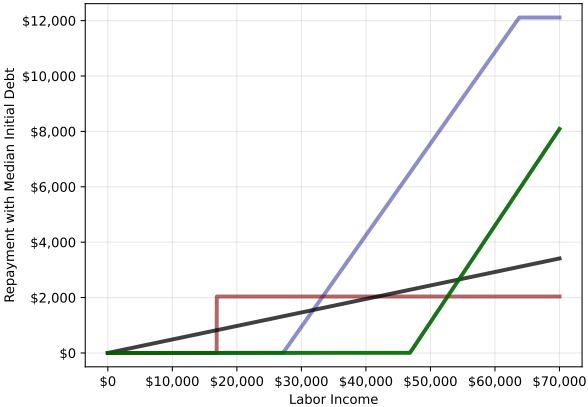




- Losses to transferring payments from (low-income) young $\rightarrow$ (high-income) old

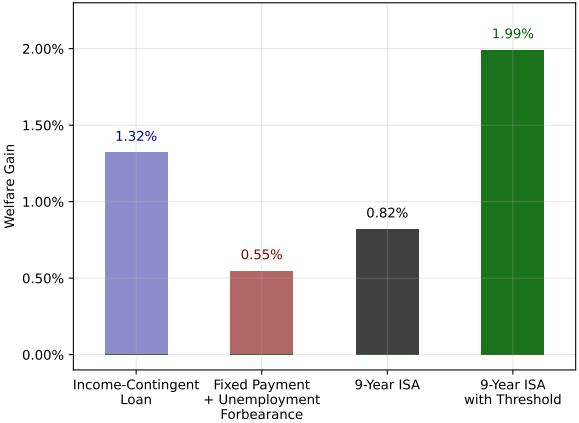
Equity + Threshold Gives Larger Gains

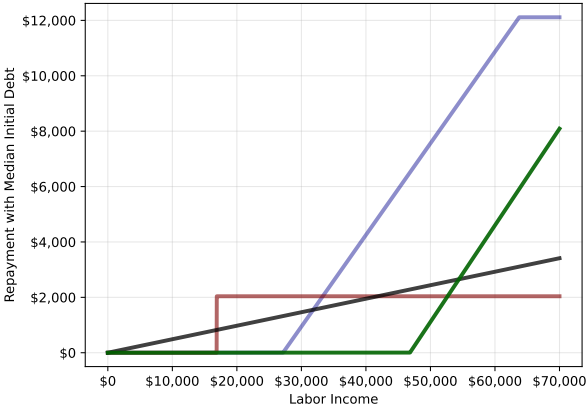




- **Benefit** of ISA: uncapped payments from high-income $\Rightarrow$ **70%** higher threshold

Equity + Threshold Gives Larger Gains, But More **Dispersed**





- **Cost** of ISA: gains more dispersed ⇒ likely to cause **ex-ante** responses ▸ Distribution

Outline

Main Results

1. **Empirics**: borrowers adjust labor supply to $\downarrow$ income-contingent repayments
   - Larger responses in occupations with more hourly flexibility
   - Responses increase with liquidity constraints and decrease with **P**(repayment)

2. **Structural estimation**: labor supply elasticity of **0.11** $+$ adjustment frictions

3. **Contract design**: providing insurance with income-contingent loans $\Rightarrow \uparrow$ welfare
   - Moral hazard significantly reduces optimal amount of insurance
   - Fixed repayment $\rightarrow$ optimal income-contingent loan $\Rightarrow \uparrow$ **1.3%** lifetime consumption
   - Forbearance $+$ fixed repayment does worse because of slower repayment

Main Results

1. **Empirics**: borrowers adjust labor supply to $\downarrow$ income-contingent repayments
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Takeaway: Income-contingent repayment creates moral hazard that affects contract design, but too small to justify fixed repayment

The Big Picture

- US "student debt crisis": **25%** of borrowers default within 5 years of graduation
  - Possible solution = put borrowers on income-contingent repayment (e.g. SAVE)
- **This paper**:
  1. Ex-post moral hazard not a reason to avoid income-contingent repayment
  2. Empirical evidence + model to calibrate effects of different contracts
- **Remaining questions**:
  1. Should income-contingent repayment to be mandated to remove selection?
  2. Effect of income-contingent repayment on borrowing?
- **Broader question**: Is state-contingent repayment useful for other liabilities?
  - HHs: government-provided shared-appreciation mortgages (UK, Canada)
  - Firms: revenue-based financing

THANK YOU!

APPENDIX

START OF APPENDIX

Variable Definitions

- HELP Income = Taxable Income + Fringe Benefits + Foreign Employment Income + Investment or Property Losses + Employer Super Contributions
- Labor Income = Salary/Wages + Allowances & Tips + Self-Employment Income
- Capital Income = Interest and Dividend Income + Annuity Income + Capital Gains + Rental Income + Managed Trust Income
- Net Deductions = Labor Income + Capital Income - HELP Income

Back

AU–US Differences Most Likely to Affect Contract Design

1. More debt in US due to higher tuition, longer degrees, and discretionary items
   - Larger demand for insurance in US, but also more moral hazard
   - Discretionary borrowing in US $\Rightarrow$ possible ex-ante moral hazard
2. Active private market in US cream-skims high-income borrowers Bachas 2019
   - Amount of insurance that can be provided might be lower in US
3. Student loans more subsidized in Australia than US
   - Possibly different moral hazard in US (if there is selection on MH) Karlan-Zinman 2009
4. Tuition and enrollment caps at public universities in Australia
   - Supply-side responses could increase fiscal cost of ICLs in US Kargar-Mann 2023

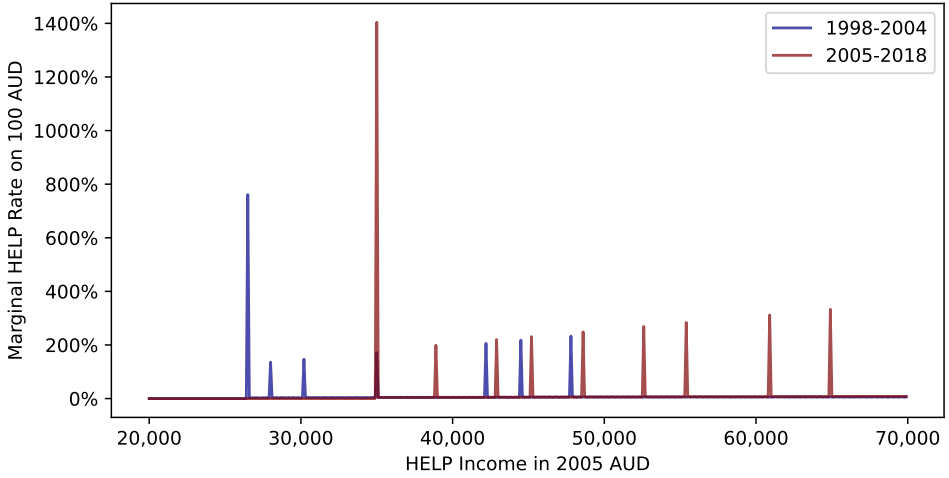
Statistics Back

Differences between Australia and US: Statistics

Feature of Environment	Australia	US
Cost of Higher Education		
Public Undergraduate Tuition Cost	$2,700–$10,100 USD per year for CSPs	$9,500 USD per year for 4-Year In-State $39,000 USD per year for 4-Year Private Nonprofit
Total Cost of Attendance	$15,850 USD per year	$22,700 USD per year
Prevalence of Scholarships	Rare	Common
Initial Student Debt Borrowed	$8,100–$30,300 USD	$51,800 USD (Average)
Student Population		
% of Population with Undergraduate Degree	38%	32%
% of Undergraduates at Private Universities	6%	26%
% of Undergraduates from Abroad	16%	5%
% of Current Students Employed	50%	40%
Income Distribution and Taxes/Transfers		
Median Personal Income	$33,500 USD	$40,500 USD
Poverty Line for Single Individual	$16,200 USD	$14,580 USD
Gini Coefficient for Income	0.32	0.38
Marginal Tax Rate at Average Income	41%	41%
Heathcote et al. (2017) Tax Progressivity	0.133	0.184
1-Month Individual UI Replacement Rate	23%	35%
Union Membership Rate	13.7%	10.3%

◂ Back: Benefits ◂ Back: Differences

Marginal HELP Repayment Rates on 100 AUD



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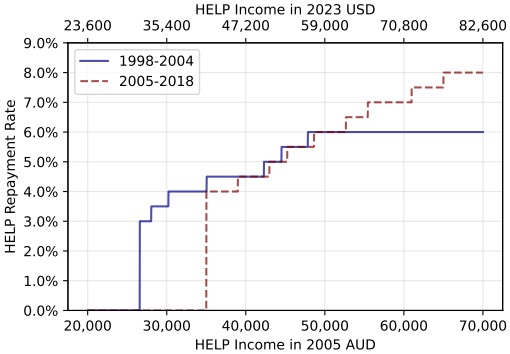
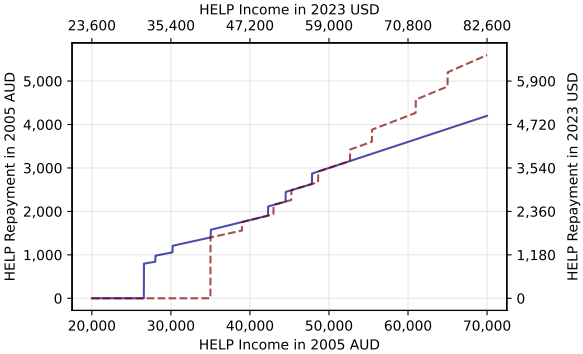
HELP Repayment Rates and Repayments





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FINANCIAL REVIEW

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Politics

Print article

Ease HECS burden on students, say universities

Kate Marshall

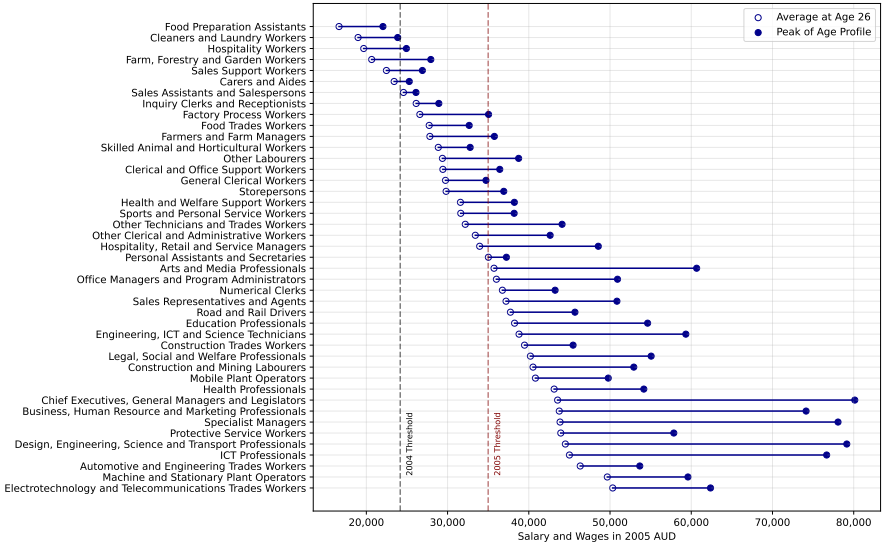
Jan 9, 2003 – 11.00am

Save Share

Australian students owing more than $9 billion of debts to the federal government should be spared financial heartache under a proposal to lift the income threshold for repayments, the Australian Vice-Chancellors Committee said yesterday.

Back

Occupation-Specific Income Profiles Relative to Thresholds



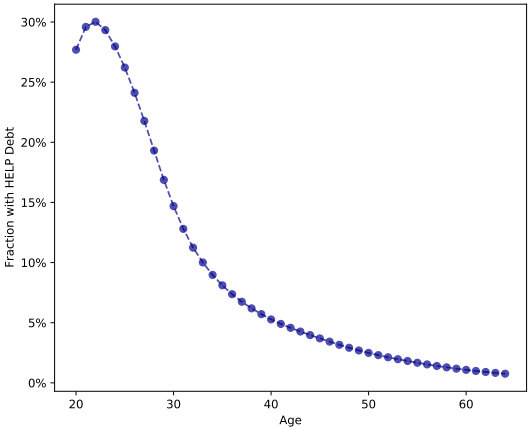
◂ Back: Policy ◂ Back: Hours

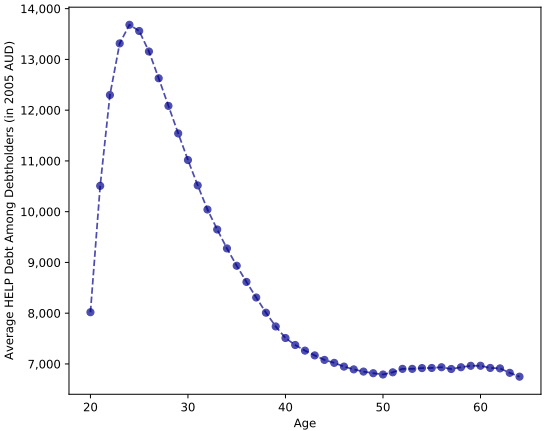
Summary Statistics

	Non-Debtholders (1)	Debtholders (2)
Demographics		
Age	41.1	29.5
Female	0.46	0.60
Wage-Earner	0.85	0.91
Income Totals (in 2005 AUD)		
Taxable Income	37,695	27,796
HELP Income	38,756	28,586
Income Components (in 2005 AUD)		
Salary & Wages	32,415	26,068
Labor Income	35,480	27,136
Interest & Dividend Income	726	242
Capital Income	1,221	324
Net Deductions	-1,548	-1,099
HELP Variables		
HELP Debt (in 2005 AUD)	·	10,830
HELP Payment (in 2005 AUD)	·	991
HELP Debt at Age 26 (in 2005 AUD)	·	13,156
HELP Payment at Age 26 (in 2005 AUD)	·	1,305
HELP Income $<$ 0% Threshold	0.50	0.65
HELP Income $<$ 2004 0% Threshold	0.37	0.51
HELP Income $<$ 2005 0% Threshold	0.52	0.67
Number of Unique Individuals	19,484,517	4,013,382
Number of Individual-Year Observations	247,118,713	27,316,037

Back

Debt Balances by Age





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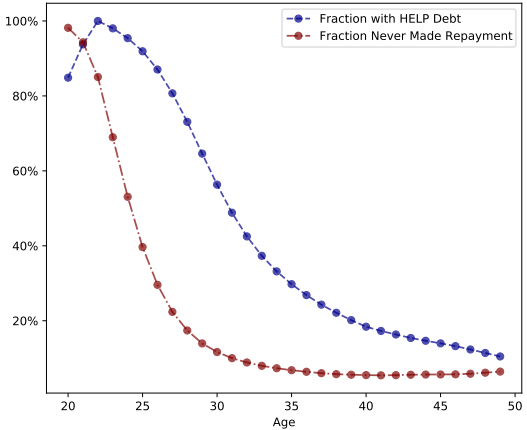
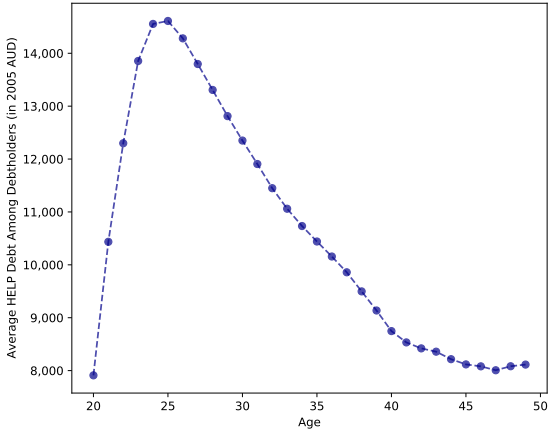
Debt Balances by Age: Individuals with Positive Debt at Age 22





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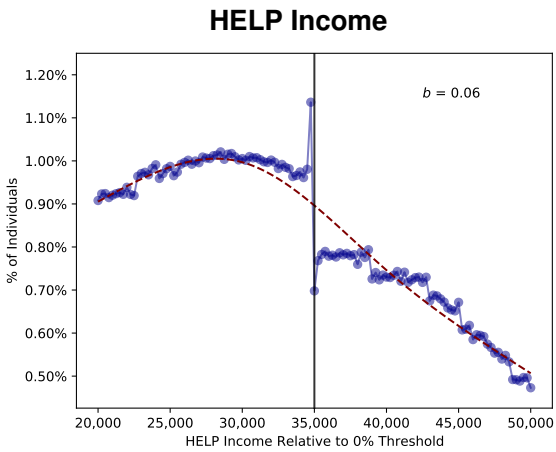
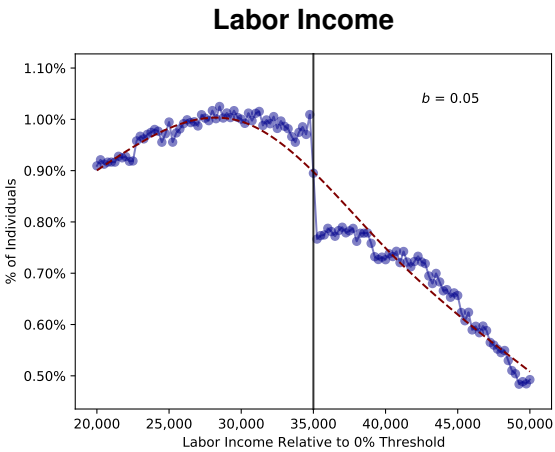
83% of Bunching in HELP Income Present in Labor Income





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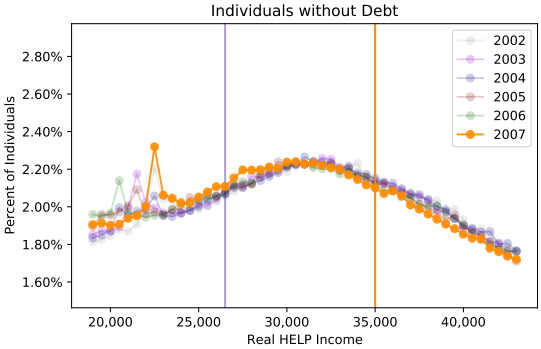
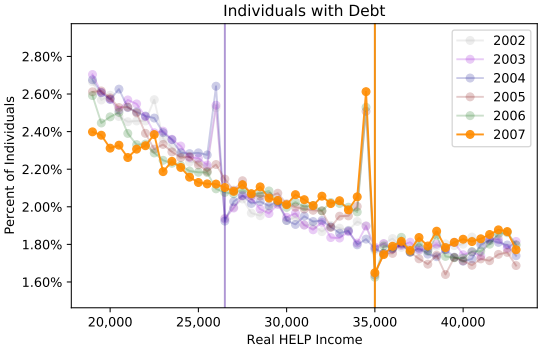
No Bunching at Repayment Threshold for Non-Debtholders





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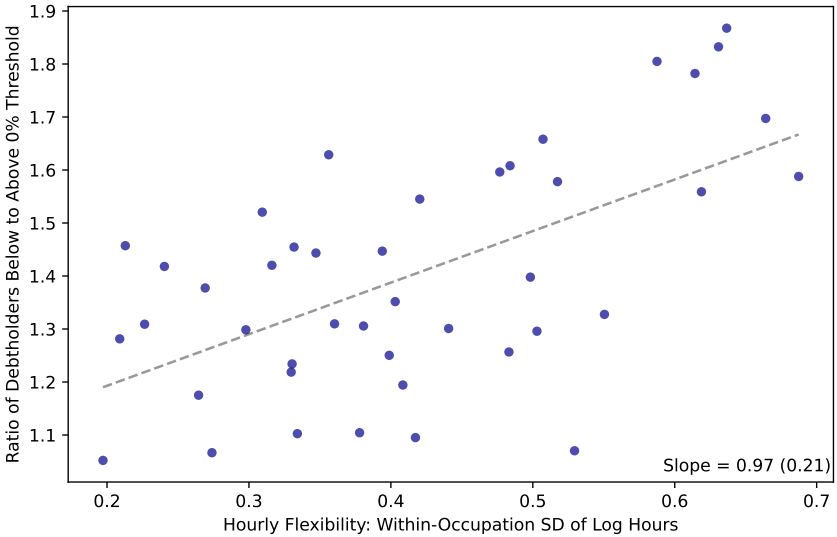
Alternative Measure of Hourly Flexibility



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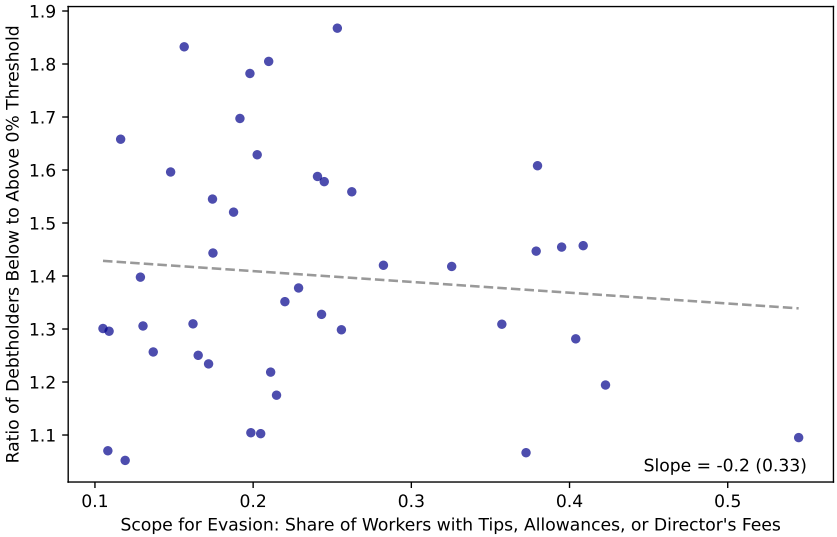
Bunching Uncorrelated with Measure of Evasion



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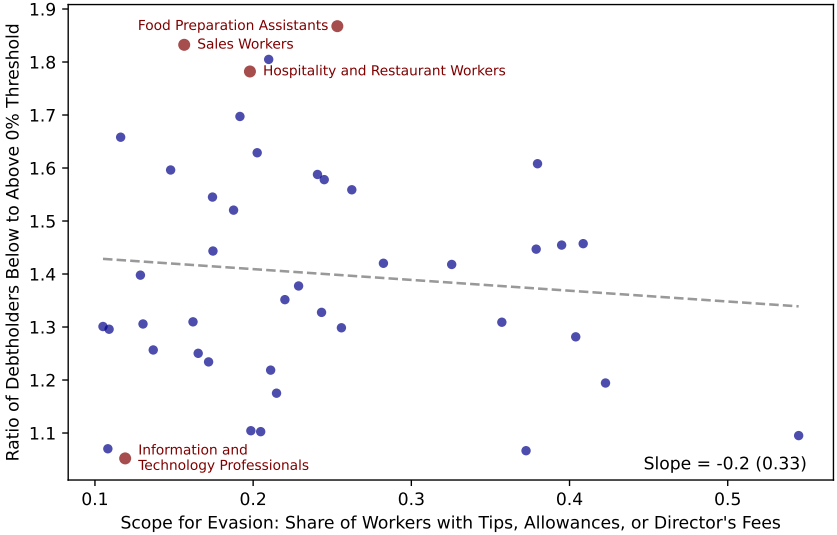
Bunching Uncorrelated with Measure of Evasion



Occupation-Level Regressions

	Ratio of Debtholders Below to Above Threshold						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hourly Flexibility: SD of Changes in Log Hours	1.30	·	·	·	1.30	1.05	0.50
	(0.35)	·	·	·	(0.35)	(0.28)	(0.23)
Evasion: Share with Non-Wage Income	·	−0.20	·	·	−0.02	−0.17	0.05
	·	(0.30)	·	·	(0.30)	(0.30)	(0.25)
Income Slope: Mean Wage at 45 / Mean Wage at 26	·	·	−0.53	·	·	−0.40	·
	·	·	(0.10)	·	·	(0.12)	·
Income Peak: Maximum Wage in Occupation Profile	·	·	·	−0.48	·	·	−0.40
	·	·	·	(0.06)	·	·	(0.07)
R^2	0.34	0.01	0.23	0.58	0.34	0.46	0.62
Number of Occupations	43	43	43	43	43	43	43

◂ Back: Hours ◂ Back: Summary

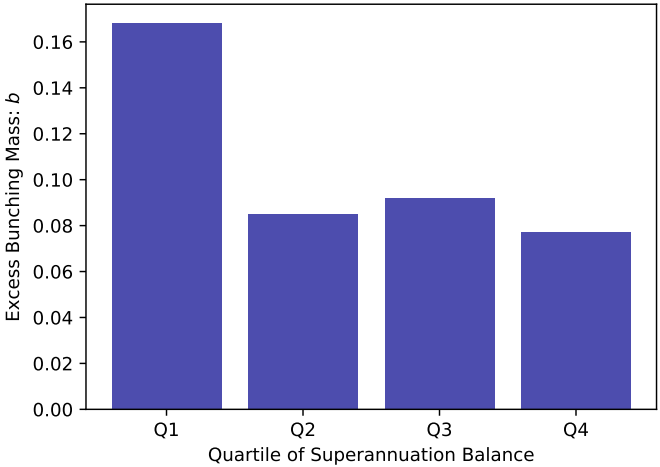
- Bunching statistic calculated as in prior literature (Chetty et al. 2011, Kleven-Waseem 2013)
  1. Fit 5-piece spline leaving out [\$32,500, \$35,000 + X] $\Rightarrow$ **counterfactual density**
  2. Iterate and choose X so that counterfactual density integrates to 1
  3. $$b = \frac{\text{observed mass in [\$32,500, \$35,000]}}{\text{counterfactual mass in [\$32,500, \$35,000]}} - 1$$

- $b = 0.1 \Rightarrow$ 10% more people below threshold than would be absent discontinuity
  - Note: normalization makes b comparable across distributions of different shapes

- **Sample:** All debtholders age 20 to 64 pooled across 2005 to 2018
  - Income deflated to 2005 so 0% threshold constant in real terms at **\$35,000**

Back

Bunching Heterogeneity by Super Wealth: Ages 20-29



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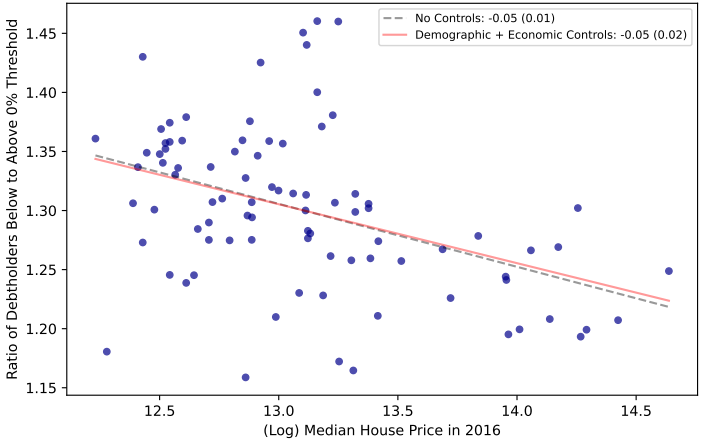
Less Bunching in Regions with More Housing Wealth



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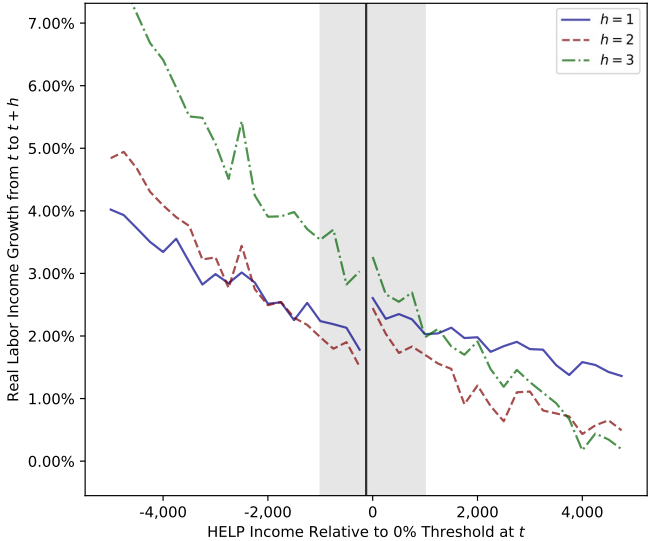
Limited Evidence of Dynamic Cost to Bunching



Bunching Among Wage-Earners vs. Entrepreneurs

Note: Entrepreneur defined as having positive sole trader, partnership, or personal services income

Elasticity of Moments with Respect to Parameters

	ϕ	f	λ
Mass Below 2004 Threshold	0.08	-0.16	0.21
Mass Above 2004 Threshold	-0.03	0.09	-0.13
Mass Below 2005 Threshold	0.12	-0.16	0.28
Mass Above 2005 Threshold	-0.04	0.09	-0.19
Ratio 2005 0%	0.22	-0.34	0.64
Ratio 2005 0.5%	0.13	-0.12	0.16
Ratio 2005 0%, Q1 Debt	0.22	-0.34	0.37
Ratio 2005 0%, Q4 Debt	0.20	-0.33	0.82

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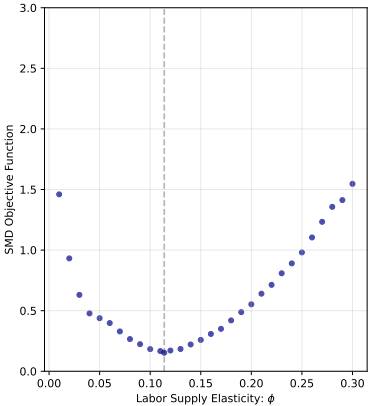
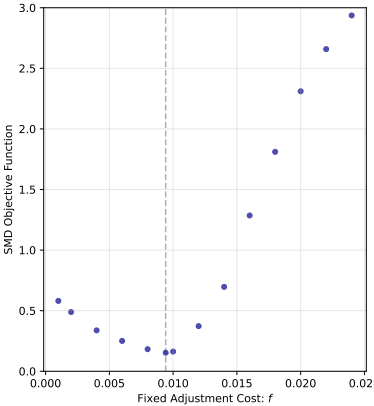
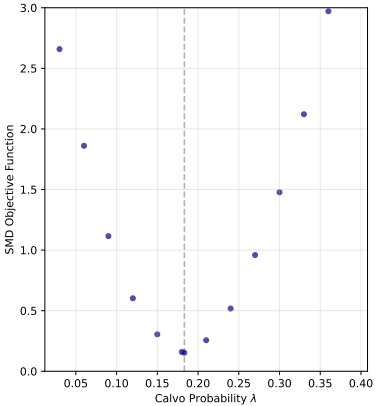
SMM Objective is Smooth in Labor Supply Parameters







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$$\text{Parameters} = \Big(\underbrace{\phi \quad f \quad \lambda \quad \kappa \quad \beta}_{\text{preferences}} \quad \underbrace{\delta_0 \quad \delta_1 \quad \delta_2 \quad \delta_0^E \quad \delta_1^E}_{\text{wage profile}} \quad \underbrace{\rho \quad \sigma_\nu \quad \sigma_\epsilon \quad \sigma_i}_{\text{wage risk}} \Big)$$

- Age profiles of salary & wages $\Rightarrow$ wage profile parameters
- Moments in Guvenen et al. 2022 $\Rightarrow$ wage risk parameters
- Average capital income at ages 40-44 $\Rightarrow \beta$
- Average labor supply $\Rightarrow \kappa$

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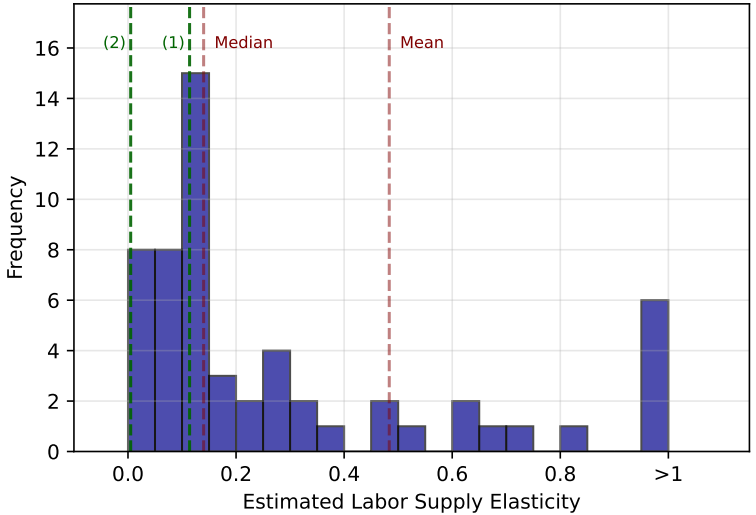
Comparison with Existing Literature on Labor Supply (1/2)



Source: intensive-margin Hicks and Frisch elasticities in Keane (2011) and Chetty (2012)

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Comparison with Existing Literature on Labor Supply (2/2)

Reasons why frictionless elasticity may be smaller/frictions larger:

1. Different sample of college graduates: less flexibility and further from $y_t = w_t l_t$
2. Elasticity is local to threshold: no high-income individuals Gruber-Saez 2002
3. Bunching does not identify extensive margin responses Saez et al. 2012

Contributions:

1. Empirical characterization of responses to income-contingent repayment
   - ℓ_t of indebted households responds to liquidity not wealth, like c_t Ganong-Noel 2020
2. Dynamic model of labor supply with time- and state-dependent adjustment

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Full Estimation Results

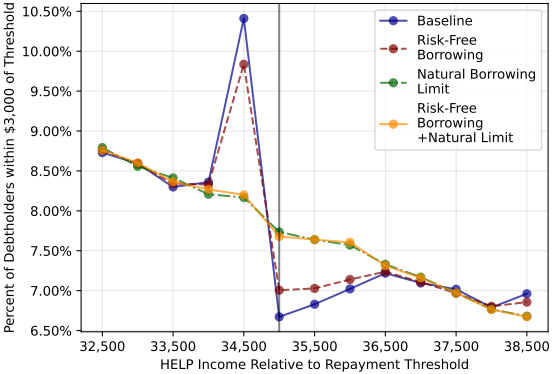
Parameter		Estimation (1)	(2)	(3)	(4)	(5)	(6)	(7)
Labor supply elasticity	ϕ	0.114	0.005	0.188	0.053	0.082	0.111	0.067
		(.004)	(.000)	(.003)	(.002)	(.002)	(.004)	(.002)
Adjustment cost	f	\$377	\$0	\$2278	\$0	\$762	\$513	\$848
		(\$13)	.	(\$21)	.	(\$10)	(\$19)	(\$11)
Calvo probability	λ	0.183	1	1	0.147	0.346	0.191	0.266
		(.003)	.	.	(.002)	(.009)	(.003)	(.005)
Scaling parameter	κ	0.560	0.030	0.059	0.510	1.242	0.593	0.448
		(.007)	(.003)	(.014)	(.012)	(.116)	(.001)	(.001)
Time discount factor	β	0.973	0.996	0.972	0.944	0.951	0.951	0.946
		(.001)	(.000)	(.001)	(.001)	(.001)	(.001)	(.001)
Wage profile parameters	δ_0	8.922	9.862	8.680	9.389	9.197	9.143	9.211
		(.009)	(.002)	(.006)	(.007)	(.007)	(.008)	(.008)
	δ_1	0.073	0.111	0.073	0.063	0.070	0.075	0.074
		(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
	δ_2	−0.001	−0.002	−0.001	−0.001	−0.001	−0.001	−0.001
		(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
	δ_0^E	−0.487	−0.294	−0.450	−0.530	−0.480	−0.478	−0.505
		(.002)	(.000)	(.001)	(.002)	(.002)	(.002)	(.002)
	δ_1^E	0.020	0.032	0.018	0.021	0.018	0.020	0.021
		(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Persistence of permanent shock	ρ	0.930	0.914	0.943	0.922	0.889	0.907	0.931
		(.000)	(.000)	(.000)	(.000)	(.000)	(.001)	(.001)
Standard deviation of permanent shock	σ_ν	0.236	0.076	0.196	0.268	0.288	0.275	0.246
		(.000)	(.000)	(.000)	(.000)	(.000)	(.001)	(.001)
Standard deviation of transitory shock	σ_ϵ	0.130	0.504	0.168	0.077	0.064	0.080	0.116
		(.000)	(.000)	(.000)	(.002)	(.002)	(.002)	(.001)
Standard deviation of individual FE	σ_i	0.599	0.101	0.541	0.654	0.625	0.612	0.632
		(.003)	(.001)	(.003)	(.003)	(.003)	(.003)	(.003)
Learning-by-doing parameter	α	0	0	0	0	0.24	0	0
Adjustment cost function		Fixed	Fixed	Fixed	Fixed	Fixed	Linear	Fixed
Misperception of debt payoff		No	No	No	No	No	No	Yes

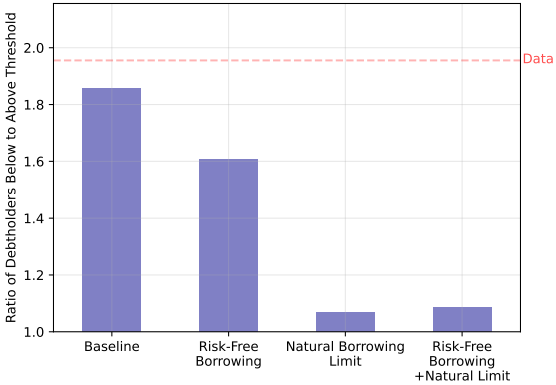
Model Fit: Other Target Moments

Estimation Target	Data	Model
Average Labor Income	$42,639	$45,582
Cross-Sectional Variance of Log Labor Income at Age 22	0.453	0.462
Cross-Sectional Variance of Log Labor Income at Age 32	0.555	0.491
Cross-Sectional Variance of Log Labor Income at Age 42	0.577	0.525
Cross-Sectional Variance of Log Labor Income at Age 52	0.539	0.580
Cross-Sectional Variance of Log Labor Income at Age 62	0.608	0.657
Linear Age Profile Term	0.077	0.080
Quadratic Age Profile Term	−0.001	−0.001
Education Income Premium Constant	−0.574	−0.554
Education Income Premium Slope	0.023	0.023
10th Percentile of 1-Year Labor Income Growth	−0.387	−0.392
10th Percentile of 5-Year Labor Income Growth	−0.667	−0.705
90th Percentile of 1-Year Labor Income Growth	0.415	0.393
90th Percentile of 5-Year Labor Income Growth	0.698	0.710
Average Labor Supply	1.000	0.963
Average Capital Income between Ages 40 and 44	$1,338	$1,332

Back

Liquidity: Borrowing Constraints Amplify Responses





- Model: complete markets $\Rightarrow \downarrow$ value of repayment reduction $\Rightarrow$ bunching $\downarrow$ **90%**
- Data: bunching $\downarrow$ in wealth and $\uparrow$ in liquidity demands

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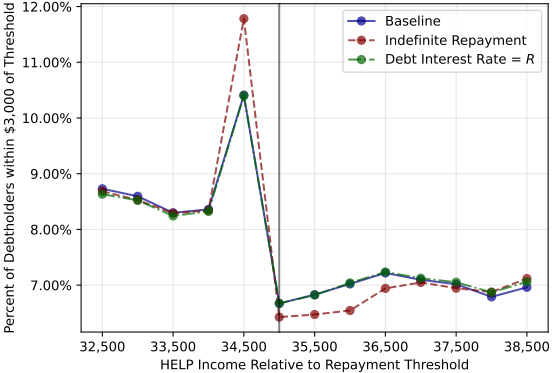
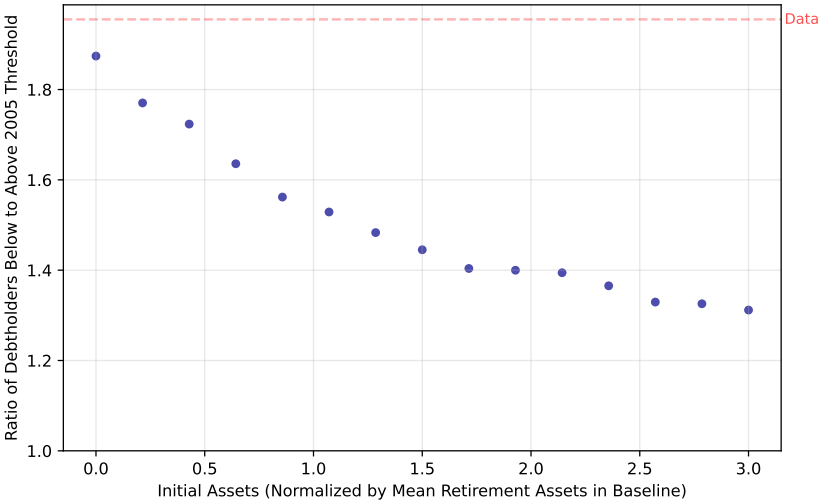
Dynamics: Bunching Depends on Probability of Repayment



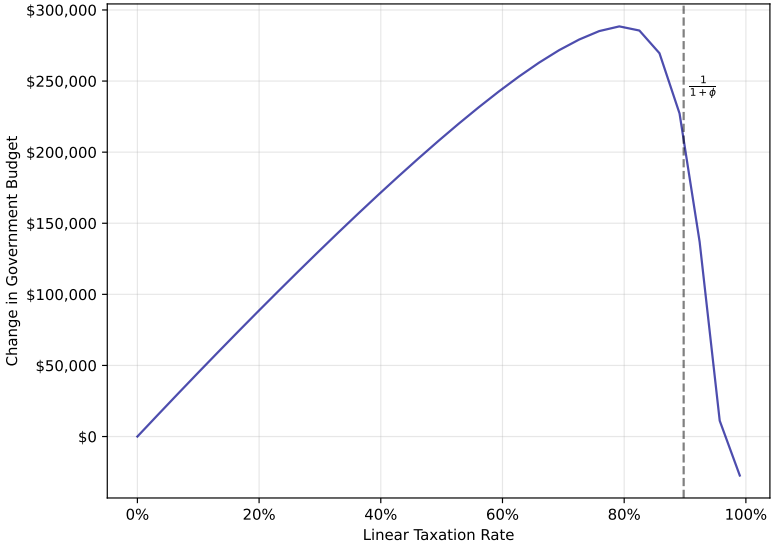
- Model: no repayment limit $\Rightarrow \uparrow$ PDV of repayment reduction $\Rightarrow$ bunching $\uparrow$ **70%**
- Data: bunching increases with debt and decreases with lifetime income

Back

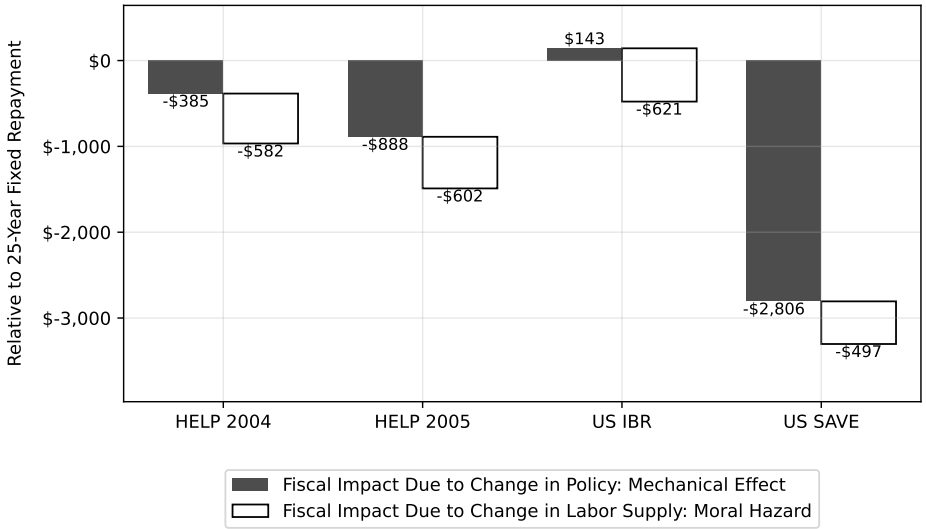
Model: Bunching Decreases in Initial Assets



Laffer Curve from Linear Taxation



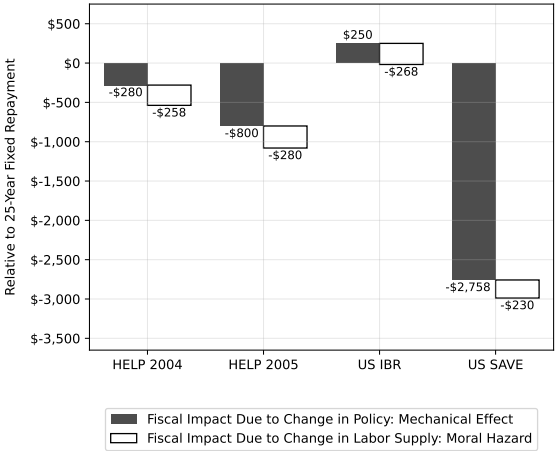
Decomposition of Fiscal Impact: Endogenous Labor Supply



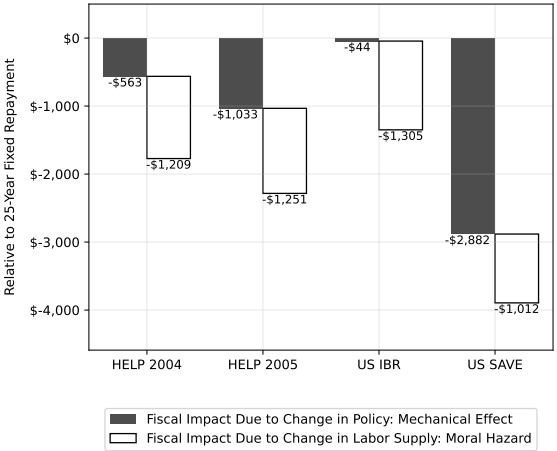
▸ Vary ϕ ◂ Back

Decomposition of Fiscal Impact: Alternative ϕ

$\phi = \mathbf{0.052}$



$\phi = \mathbf{0.21}$



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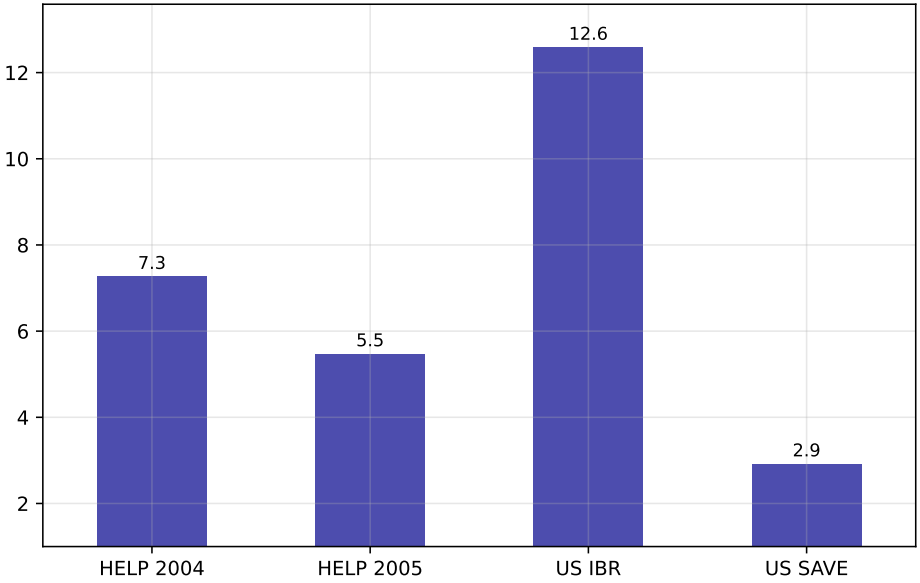
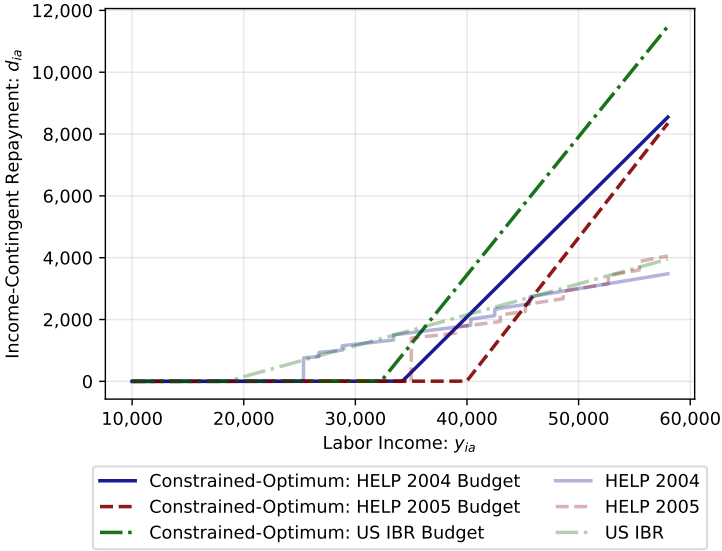
Marginal Value of Public Funds



Solution to Constrained-Planner's Problem: Quadratic

Back

Optimal versus Existing Income-Contingent Loans



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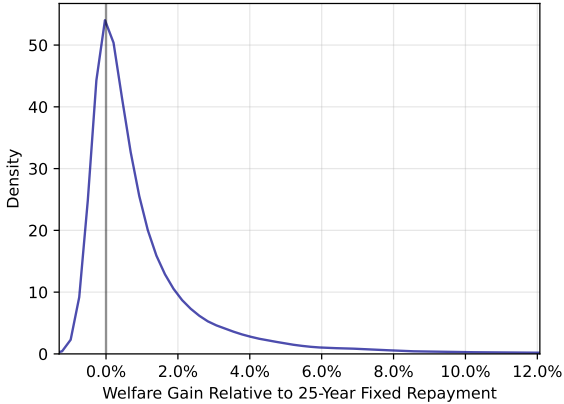
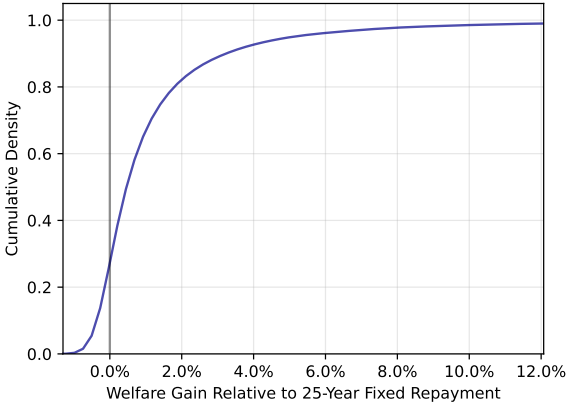
Distribution of Initial Welfare Gains: ICL

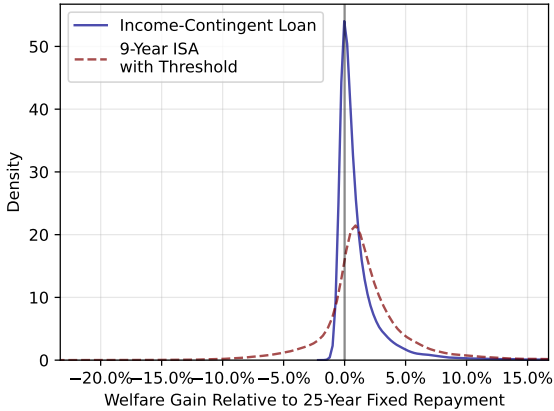


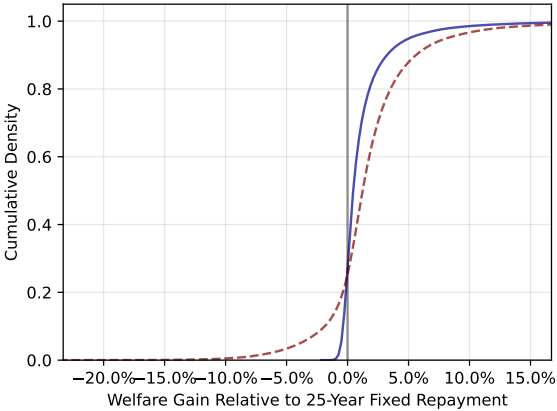


- Only **1.2%** of borrowers have welfare loss above 0.5%

▸ Heterogeneity by States ▸ Losers ▸ Age ◂ Back

Distribution of Initial Welfare Gains: ISA

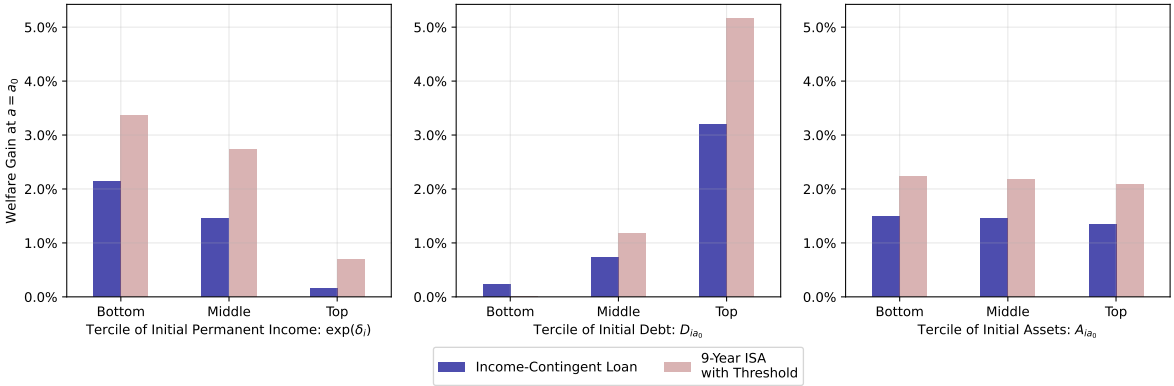




- **18%** of borrowers have welfare loss above 0.5% for ISA vs. **1.2%** for ICL

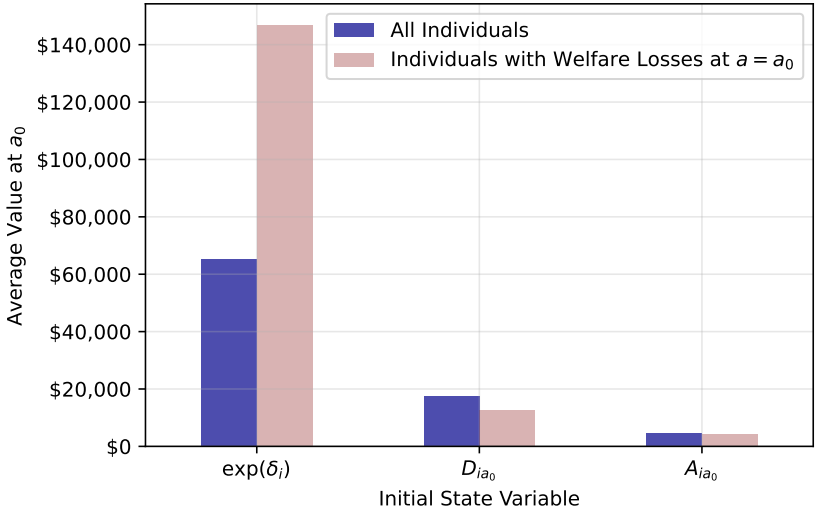
▸ Heterogeneity by States ◂ Back

Heterogeneity in Welfare Gains across Initial States



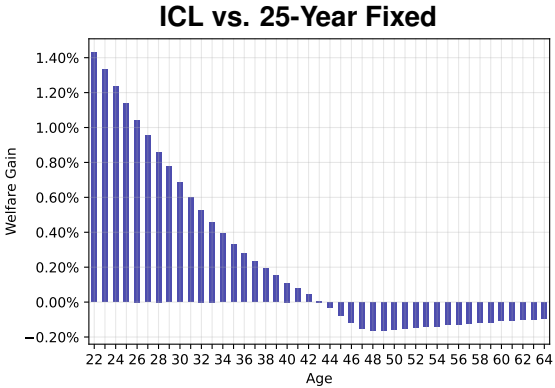
Losers ICL | Age | Initial CEQ | ICL | ISA

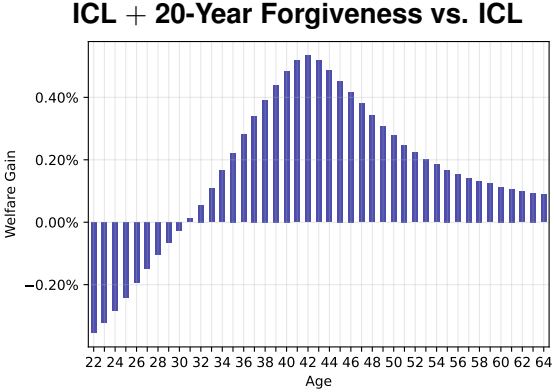
Individuals with Initial Welfare Losses: ICL



Age ICL ISA

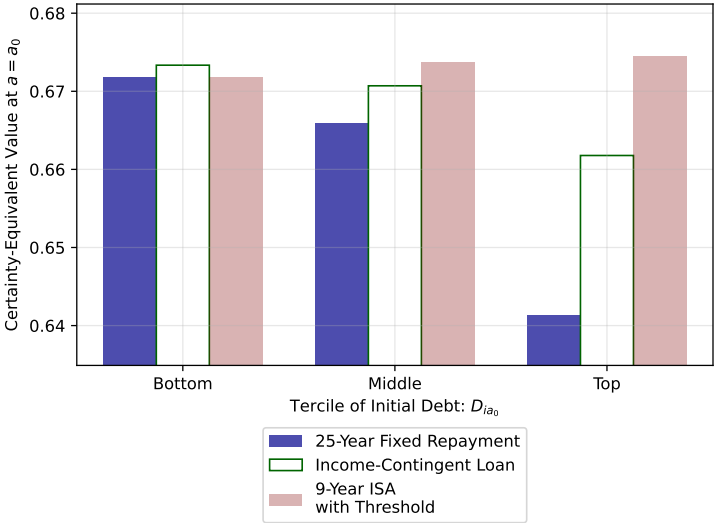
Welfare Gains by Age





◂ ICL ◂ ISA

Certainty-Equivalents across Initial Debt



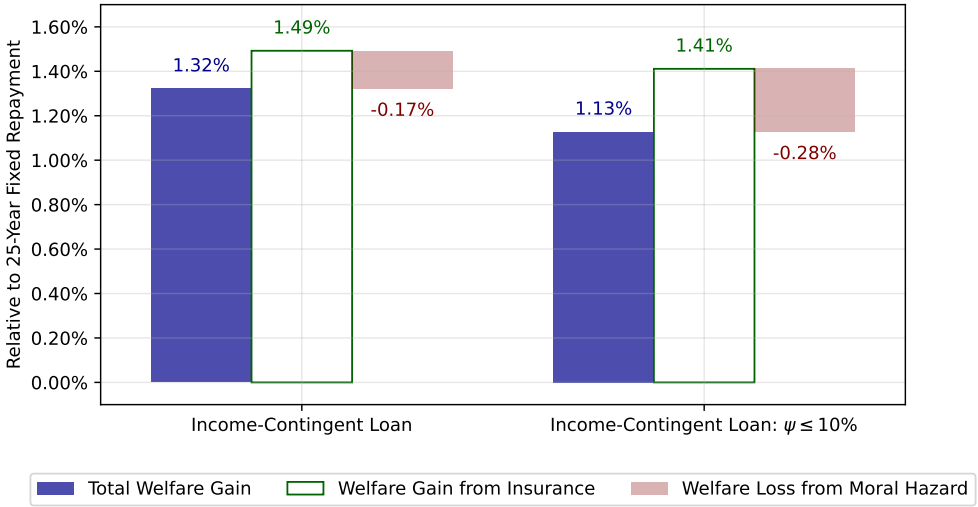
◂ ICL ◂ ISA

Welfare Gains from Income-Contingent Loans: Alt. Models

	Difference from Baseline Model	Welfare Gain	= Insurance	+ Moral Hazard	ψ^*	K^*
(1)	Occupation Heterogeneity	1.32%	1.45%	−0.13%	41%	$28,694
(2)	Learning-by-Doing	1.68%	·	·	35%	$36,615
(3)	Linear Adjustment Costs	1.74%	1.87%	−0.13%	53%	$43,560
(4)	Wealth Effects on Labor Supply	0.82%	1.05%	−0.23%	37%	$30,307
(5)	Less Persistent Shocks: $\rho = 0.8$	0.90%	1.14%	−0.23%	42%	$34,244
(6)	More Persistent Shocks: $\rho = 0.99$	1.35%	1.63%	−0.28%	35%	$18,949
(7)	Non-Normal Permanent Shocks	1.14%	1.43%	−0.30%	28%	$26,933
(8)	Debt Interest Rate = 2%	1.96%	2.14%	−0.18%	38%	$47,731
(9)	Planner Discount Rate = R	1.06%	1.41%	−0.35%	29%	$22,696
(10)	Planner Discount Rate = $R + 4\%$	1.60%	1.65%	−0.05%	46%	$34,441
(11)	US Tax System	1.18%	1.36%	−0.19%	38%	$28,838
(12)	Larger Initial Debt Balances	3.50%	4.72%	−1.22%	36%	$18,867
(13)	No Ex-Post Uncertainty	0.58%	0.76%	−0.17%	27%	$18,098
(14)	No Uncertainty	−0.17%	0.15%	−0.32%	21%	$26,906
	Average	1.33%	1.60%	−0.29%	36%	$29,777
	Baseline Model	**1.32%**	**1.47%**	**-0.15%**	**33%**	**$27,147**

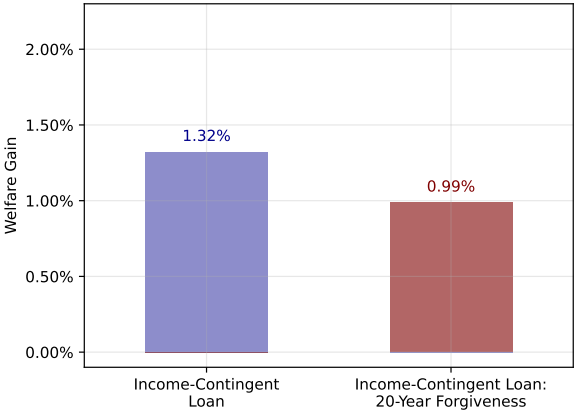
◂ ICL ◂ FP ◂ ISA

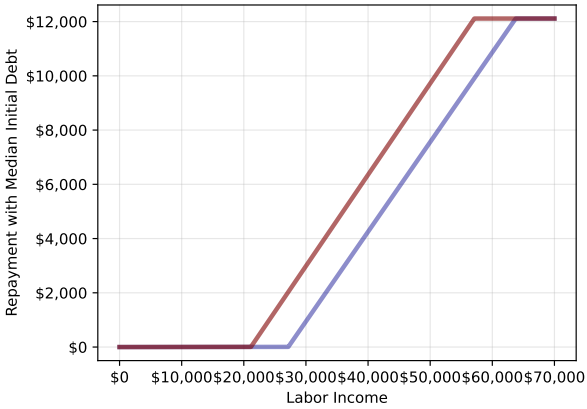
Constraining Repayment Rate Reduces Welfare Gains



Back

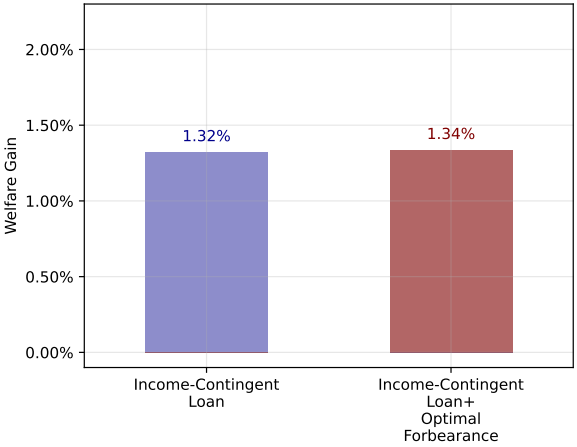
Forgiveness Reduces Welfare Gains

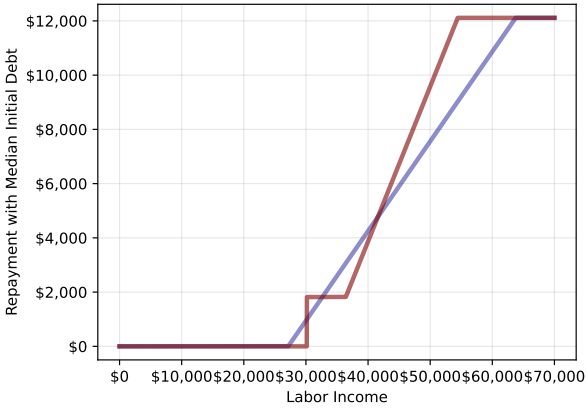




Back

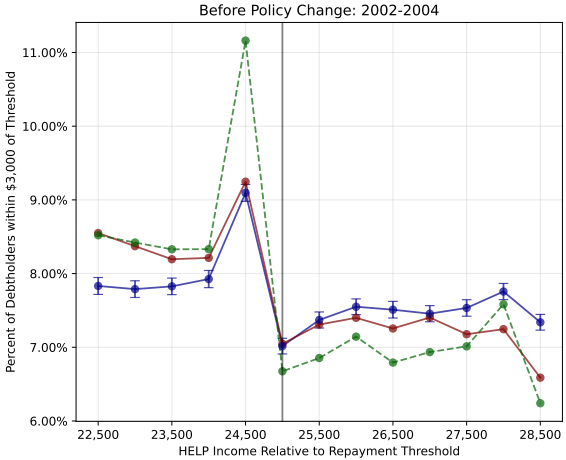
No Gains to Adding Forbearance to Income-Contingent Loans

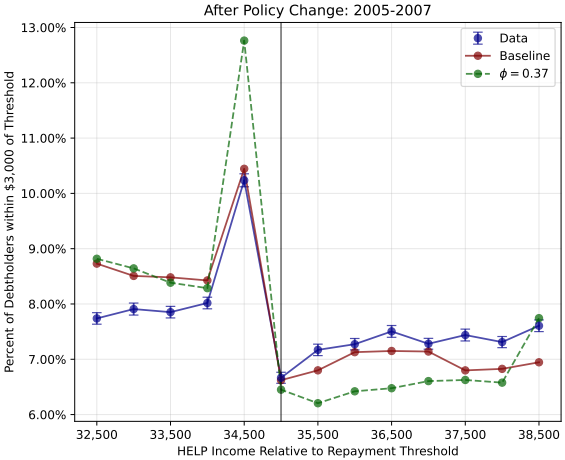




Back

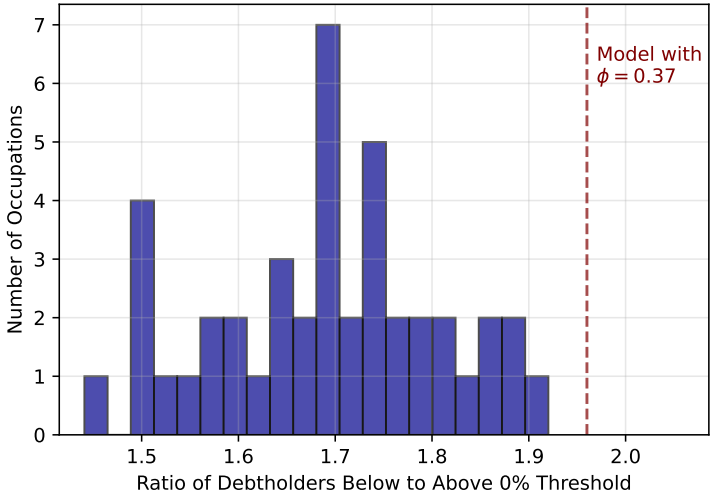
Fit of Model in which Fixed Repayment is Optimal





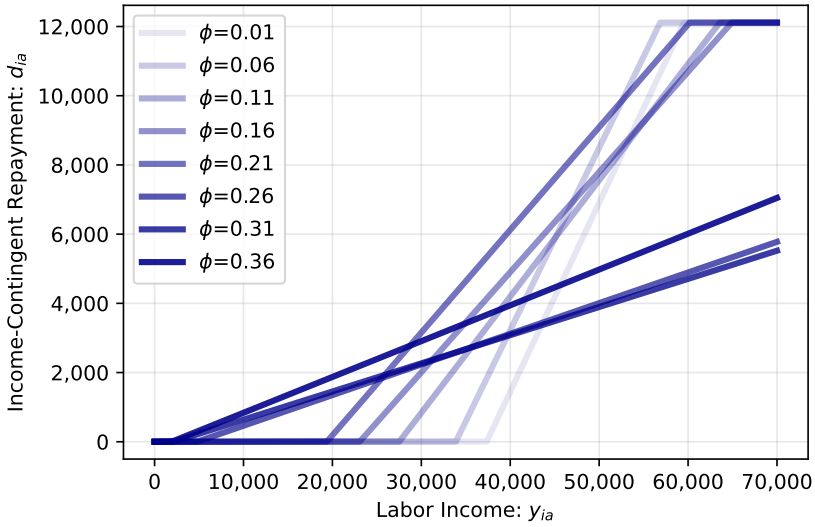
Occupations Back

Bunching when Fixed Repayment is Optimal vs. Occupations



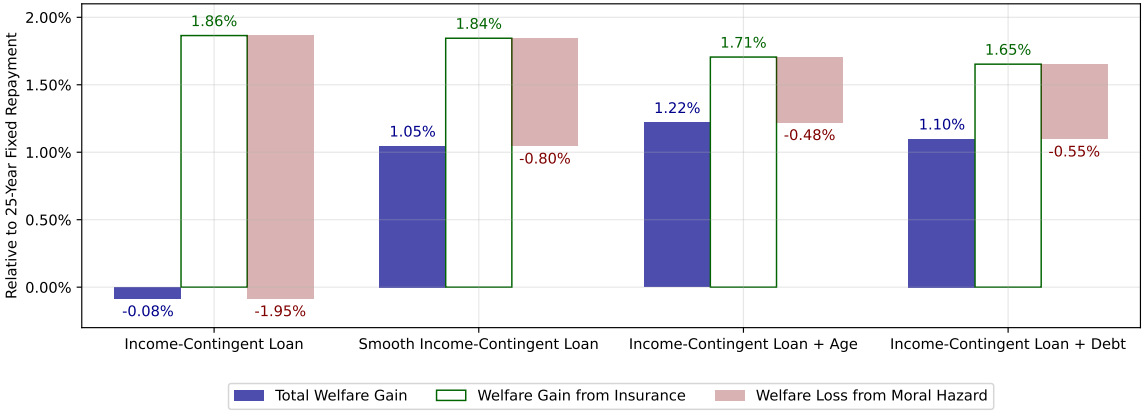
Back

How Income-Contingent Loans Vary with ϕ



Back

Alternative Contracts Reduce Welfare Cost of Moral Hazard



Contracts | Baseline ϕ | Back

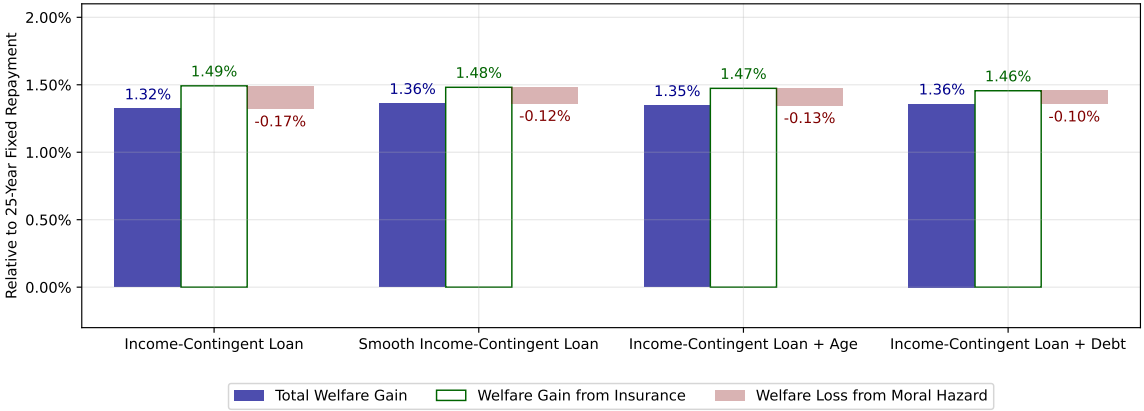
Alternative Forms of Income-Contingent Loans: $\phi = 0.37$

Back

Alternative Forms of Income-Contingent Loans: Baseline ϕ

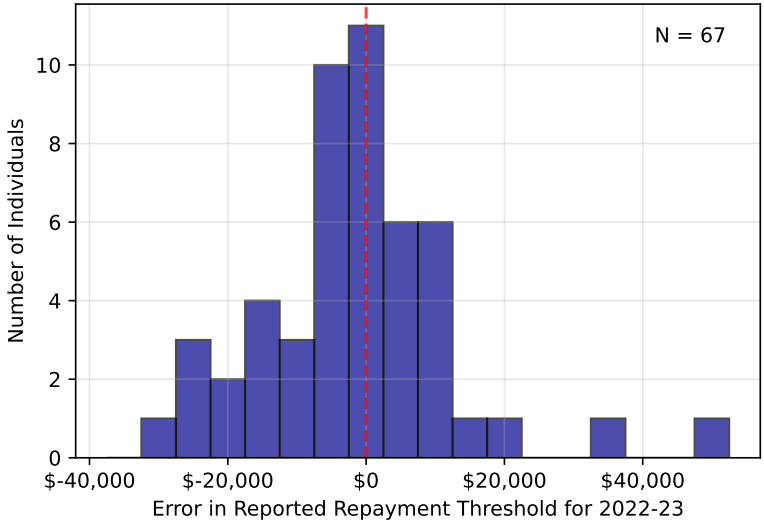
Back

Reducing Welfare Cost of Moral Hazard: Baseline ϕ

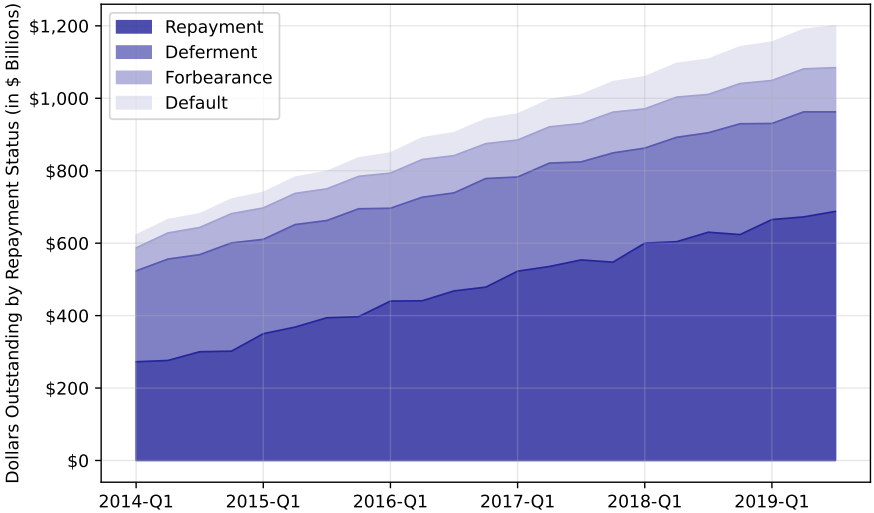


Back

Survey of Threshold Location



Repayment Status of US Student Loans



Physical vs. logical page numbers

- Windows: Ctrl + K, uncheck ”Use Logical Page Numbers”
- Mac: Cmd + K, uncheck ”Use Logical Page Numbers”
- Might have to toggle on/off if it’s off already

Jump to page numbers

- Windows: Ctrl + Shift + N
- Mac: Cmd + Shift + N

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