Optimal Delayed Taxation in the Presence of Financial Frictions

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Delayed Taxation

- We propose the following hypothesis:

  When workers are financially constrained, delaying the *payment* of a labor income tax will reduce distortionary behavioral responses

  Think of a tax that accrues today but is payable in 10–20 years..

- Based on simple life-cycle model (with borrowing frictions) reasoning
  - A worker that is financially constrained discounts future cash flows at some high $r_b >>$ return on savings
  - Hence, a tax that is payable in the future is equivalent to a lower (ordinary) tax that is payable today

1. We study delayed taxation in a dynamic optimal tax model

2. We calibrate the model to numerically illustrate welfare implications

3. We test this hypothesis using a de-facto delayed taxation scheme affecting young workers in Norway

Delayed Taxation: Simple example to fix ideas

- Risk-free rate in two-period economy is $r = 3\%$
- Agent saves at r or borrows at $r_b = 10\% > r = 3\%$, due to financial frictions in *private credit markets*
- There are no financial frictions between agents and the government

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- There are no financial frictions between agents and the government
- Agent chooses labor supply and is subject to a nominal tax rate of 50%
- Government allows agent to delay tax payment 20 years, financed at $r = 3\%$

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- Government allows agent to delay tax payment 20 years, financed at $r = 3\%$

- A **net-borrowing** agent now chooses period-1 labor supply as if the tax rate was

$$50\% \times \frac{(1+3\%)^{20}}{(1+10\%)^{20}} = 26.8\%$$

- The **government** receives an effective tax rate of

$$50\% \times \frac{(1+3\%)^{20}}{(1+3\%)^{20}} = 50\%$$

(Non)Variants of Delayed Taxation

1. Non-withheld taxes
   - Absent tax withholding, taxes accrued in, e.g., January, are paid 14-16 months later
2. Installment plans
   - IRS allows you to enter into installment plans for taxes you owe (in excess of whats withheld)
   - Only similar to delayed taxation if workers *expect* to enter into an installment plan
3. Social Security Contributions
   - Forcing workers to save a % of earnings is equivalent to *negatively delayed taxation*
   - If my marginal tax rate is 27% and SSC is 6.2%, I'm effectively paying 123% of my taxes today

Implementing Delayed Taxation in a Simple Optimal Tax Model

Agents live for two periods, EIS $= 1/\sigma$, Frisch elasticity $= \varepsilon$.

$$\begin{aligned}
&\max_{\ell_1,\ell_2,s} && u(c_1) - v(\ell_1) + \beta\big[u(c_2) - v(\ell_2)\big], && (1)\\
&\text{s.t. } c_1 &=\;& w_1\ell_1(1-\delta\tau_1) - s + G && (2)\\
&\text{and } c_2 &=\;& R(s) + (1-\tau_2)w_2\ell_2 - (1-\delta)(1+r_{dtax})\tau_1 w_1\ell_1 + G, && (3)
\end{aligned}$$

where u and v are strictly increasing and concave,
G is govt transfers,
and $1-\delta$ is share of period-1 taxes payable in period 2,

When indifferent between a set of $1-\delta^i$, agents choose smallest value.

Financial frictions: $R(s)$ is kinked: agents borrow at r_b and save at $r_{gov} < r_b$.

Delayed taxation lowers the effective period-1 tax rate

The first-order conditions for the agent's optimization problem are

$$(\ell_1): u'(c_1^i)w_1^i[1-\delta\tau_1] - \beta(1+r)u_2'(c_2^i)[1-\delta]\tau_1 w_1^i = v'(\ell_1^i) \tag{4}$$

$$(\ell_2): u'(c_2^i)w_2^i[1-\tau_2] = v'(\ell_2^i) \tag{5}$$

$$(s): u'(c_1^i) = \beta u'(c_2^i)R'(s^i). \tag{6}$$

- Assume that Euler equation (6) holds (i.e., $s^i \neq 0$).
- Inserting Euler equation into FOC for ℓ_1 (4) yields:

$$u'(c_1^i)w_1^i\left(1-\underbrace{\tau_1\left[\delta+[1-\delta]\frac{1+r}{R'(s^i)}\right]}_{\text{effective period 1 tax rate}}\right) = v'(\ell_1^i). \tag{7}$$

- We can do a similar exercise for the life-time budget constraint: only $\tau_1\left[\delta+[1-\delta]\frac{1+r}{R'(s^i)}\right]$ enters

Lemma 1. Starting with no delayed taxation ($1-\delta=3$) and $s^i \neq 0$, and $1-\delta=0$, then

$$\frac{d\ell_t^i}{d(1-\delta)} = \tau_1 \left[1 - \frac{1+r}{R'(s^i)}\right] \frac{d\ell_t^i}{d(1-\tau_1)}, \tag{8}$$

- When the Euler equation holds, labor supply responses to marginally delayed taxation is proportional to the responses to changing the period-1 tax rate

- For borrowers, $d(1-\delta)$ is equivalent to $d\tau_1 = -\tau_1 \left[1 - \frac{1+r}{1+r_b}\right]$
- For savers, $d(1-\delta)$ has no effect

- This allows us to characterize optimal delayed tax policy in terms of standard tax elasticities

- **Government maximizes welfare, W** (average life-time utility),

  by choosing tax rates, τ, and transfers, G subject to govt budget constraint:

$$G + \frac{G}{1+r} + M \leq \sum_i (l_{i,1} w_{i,1} \tau_1 \delta) + \frac{1}{1+r} \sum_i (l_{i,2} w_{i,2} \tau_2 + (1-\delta)(1+r) l_{i,1} w_{i,1} \tau_1)$$

- **Partial eqm.** in the sense that r, r_b, w_1, w_2 are exogenous

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- **Partial eqm.** in the sense that r, r_b, w_1, w_2 are exogenous

- We assume that govt discounts delayed taxes at $r < r_b$ (borrowing rate)

$\rightarrow$ There are frictions in private credit markets, but not between agents and government

- This can be relaxed: we just need a wedge, driven by, e.g., govt having better collection technology

0. **Benchmark**
   - Govt chooses age-independent τ and G to maximize welfare, with $1 - \delta = 0$ and $\tau = \tau_1 = \tau_2$.
1. **Delayed taxation**
   - Govt chooses fraction $1 - \delta \in [0, 1]$ of labor income taxes $(\tau_1 \ell_1 w_1)$ that are delayed
   - We fix the interest rate of delayed taxes to $r_{dtax} = r_{gov}$ $\rightarrow \delta$ disappears from govt budget constraint
2. **Age-dependent taxation**
   - (Marginal) tax rates $\tau_1, \tau_2 \geq 0$ may differ
   - Unlike other work, we constraint G to be equal across periods
3. **Uniform lending**
   - Offer to lend some amount, x to all agents
   - at an interest rate of r

Starting from no delayed taxation ($\delta = 1$), and keeping all other policies constant,
The welfare effects of marginally delaying taxation $d(1-\delta) > 0$ has four components.

(1.) Positive welfare effect from allowing intertemporal smoothing

(2.) Positive effect on period 1 tax revenues (substitution effect)

(3.) Negative effect on period 1 + 2 tax revenues (income/wealth effect)

(4.) Negative effect on period 2 tax revenues (intertemporal substitution effect)

These effects operate through **borrowers** whose $R'(s^i) = 1 + r_b > 1 + r_{gov}$.

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High-level theoretical results: Welfare effects of delayed taxation

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These effects operate through **borrowers** whose $R'(s^i) = 1 + r_b > 1 + r_{gov}$.

- If govt were to **just lend to households at** r_{gov}, we'd miss effects (2.) + (4.)
- If govt instead did **age-dependent taxation**, that is, fix τ_2 and decrease τ_1, we'd have (1)–(4), **but also a negative "mechanical" effect on tax revenues** and a different set of agents would be affected

The money-metric welfare effects of marginally delaying taxation is given by

$$\frac{dW}{\lambda d(1-\delta)} = \underbrace{\sum_i \pi^i y_1^i \tau_1 \left[\frac{1-\frac{1+r}{R'(s^i)}}{\delta+(1-\delta)\frac{1+r}{R'(s^i)}}\right] u'(c_1^i)}_{\text{from increased intertemp. smoothing}}$$

$$+ \underbrace{\sum_i \pi^i \tau_1 \left[\frac{1-\frac{1+r}{R'(s^i)}}{\delta+(1-\delta)\frac{1+r}{R'(s^i)}}\right] \left(\frac{\tau_1}{1-\tau_1} y_1^i \varepsilon^{i,c}_{1,1-\tau_1} + \frac{1}{1+r}\frac{\tau_2}{1-\tau_1} y_2^i \varepsilon^{i,c}_{2,1-\tau_1} + y_1^i \rho^i\right)}_{\text{from increasing life-time govt. tax revenues}}, \quad (9)$$

- where $\varepsilon^{i,c}$ are compensated labor supply elasticities,
- $\rho^i = \frac{d}{dG_1}\left(\tau_1 y_1^i + \frac{\tau_2 y_2^i}{1+r}\right)$ are tax revenue income effect parameters.
- $\left[1-\frac{1+r}{R'(s^i)}\right]$ terms imply that welfare effects operate through borrowers $(R'(s^i) > r)$

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$$+ \underbrace{\sum_i \pi^i \tau_1 \left[1 - \frac{1+r}{R'(s^i)}\right] \left(\frac{\tau_1}{1-\tau_1} y_1^i \varepsilon_{1,1-\tau_1}^{i,c} + \frac{1}{1+r}\frac{\tau_2}{1-\tau_1} y_2^i \varepsilon_{2,1-\tau_1}^{i,c} + y_1^i \rho^i\right)}_{\text{from increasing life-time govt. tax revenues}}, \qquad (10)$$

- where $\varepsilon^{i,c}$ are compensated labor supply elasticities,
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Contrast welfare effects to that of offering everyone a loan of $dx > 0$ at the government rate, r.

$$\frac{1}{\lambda}\frac{dW}{d(1-\delta)}\frac{1}{\tau_1\Delta_r} = \underbrace{\frac{1}{\lambda}\frac{\bar{y}_1}{\Delta_r}\frac{dW}{dx}}_{\text{Govt lending } (+)} + \underbrace{\sum_{i:s^i<0}\pi^i\left(\frac{\tau_1}{1-\tau_1}y_1^i\varepsilon_{1,1-\tau_1}^{i,c} + \frac{1}{1+r}\frac{\tau_2}{1-\tau_1}y_2^i\varepsilon_{2,1-\tau_1}^{i,c}\right)}_{\text{Behavioral revenue effect of compensated tax cut } (+)} \tag{11}$$

$$+ \underbrace{\sum_{i:s^i<0}\pi^i\left(y_1^i-\bar{y}_1\right)\rho^i}_{COV(y_1^i,\rho^i|s^i<0)\ (++)} + \underbrace{\sum_{i:s^i<0}\pi^i\left(y_1^i-\bar{y}_1\right)u'(c_1^i)}_{COV(y_1^i,u'(c_1^i))\ (--)}$$

- where $\Delta_r = 1 - \frac{1+r}{1+r_b} > 0$ is the interest rate wedge
- $\bar{y}_1 = \sum_i \pi^i y_1^i$ is average income among borrowers.

Numerical Solutions

Calibration: Wages

- $N = 100$ agents
  - Each decile of the 1990 wage distribution
  - × conditional decile of the 2011 distribution (21 years later)
- We assign wages to each agent based on (realized) computed wages for non-students aged 20–30 in 1990
- We assume that all agents know their future wages
  - This can be relaxed: we just want heterogeneity in whether agents are borrowers

	mean	p10	p50	p90
w_1^i	1.09	0.67	1.00	1.72
w_2^i	3.63	1.66	2.89	7.53
$\frac{w_2^i - w_1^i}{w_1^i}$	372%	140%	288%	700%

Life-time utility for an agent is given by

$$\frac{c_1^{1-1/\sigma}}{1-1/\sigma} - \xi\frac{\ell_1^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}} + \beta\left(\frac{c_2^{1-1/\sigma}}{1-1/\sigma} - \xi\frac{\ell_2^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}}\right),$$

- $\sigma = 0.2$, (low EIS consistent with Best et al. (2020), Ring (2020), Ring and Thoresen (2022))
- $\varepsilon = 0.5$,
- $\xi = 1$,
- $\beta = 0.97^{21}$,

  $1 + r_{gov} = 1.03^{21}$.

Partially-unconstrained Reforms

- We first consider optimal tax policies subject to
- $1 - \delta \in [0, 1]$ (DT) and $\tau_t \in [0, 1]$ (AD)
- But with no constraints on how much the *government* can borrow

$\mathbf{r_b = 10\%,\ \varepsilon = 0.5}$	Benchmark	Delayed taxation		
τ_1	0.63	0.64		
τ_2	0.63	0.64		

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τ_1	0.63	0.64		
τ_2	0.63	0.64		
G	0.63	0.62	$\leftarrow$ Govt transfers	

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$1-\delta$	0	1.00	$\leftarrow$ Max delayed tax share	

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$1-\delta$	0	1.00	$\leftarrow$ Max delayed tax share	
PV($l_1 w_1$,$l_2 w_2$)	2.12	2.04	$\leftarrow$ PV Labor Earnings	
PV($l_1 w_1 \tau_1$,$l_2 w_2 \tau_1$)	1.34	1.31	$\leftarrow$ PV Taxes	
l_1	0.70	0.57		
l_2	0.69	0.79		
$(1-\delta^i) l_1 w_1 \tau_1$	0.00	0.22	$\leftarrow$ Avg. amount of delayed taxes	
s	-0.05	0.17	$\leftarrow$ Avg. net saving	
Welfare diff. rel to baseline	-16%	-4%	$\leftarrow$ Money-metric welfare (rel. to baseline, % of GDP)	

Baseline: Benchmark economy with $r_b = r = 3\%$

$\mathbf{r_b = 10\%,\ \varepsilon = 0.5}$	Benchmark	Delayed taxation	Age-dependent taxation	AD + DT
τ_1	0.63	0.64	0.00	0.47
τ_2	0.63	0.64	0.73	0.72
G	0.63	0.62	0.36	0.62
$1-\delta$	0	1.00	0	1.00
PV($l_1 w_1$,$l_2 w_2$)	2.12	2.04	2.09	2.02
PV($l_1 w_1 \tau_1$,$l_2 w_2 \tau_1$)	1.34	1.31	0.90	1.28
l_1	0.70	0.57	0.81	0.63
l_2	0.69	0.79	0.65	0.72
$(1-\delta^i)l_1 w_1 \tau_1$	0.00	0.22	0.00	0.12
s	-0.05	0.17	0.11	0.22
Welfare diff. rel to baseline	-16%	-4%	-9%	-2%

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PV($l_1 w_1$,$l_2 w_2$)	2.12	2.04	2.09	2.02
PV($l_1 w_1 \tau_1$,$l_2 w_2 \tau_1$)	1.34	1.31	0.90	1.28
l_1	0.70	0.57	0.81	0.63
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$(1-\delta^i) l_1 w_1 \tau_1$	0.00	0.22	0.00	0.12
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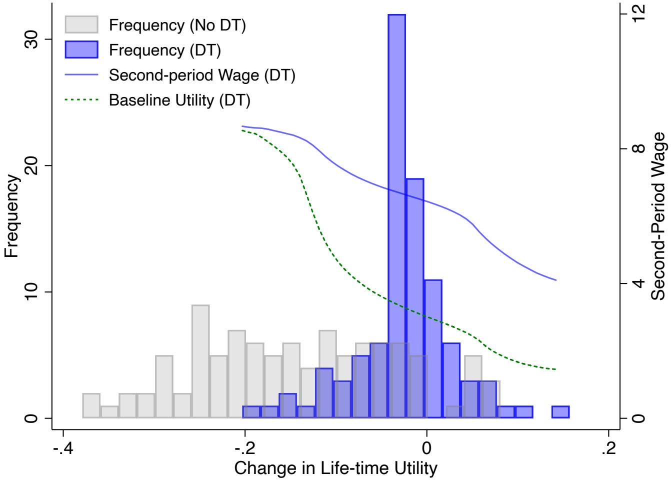
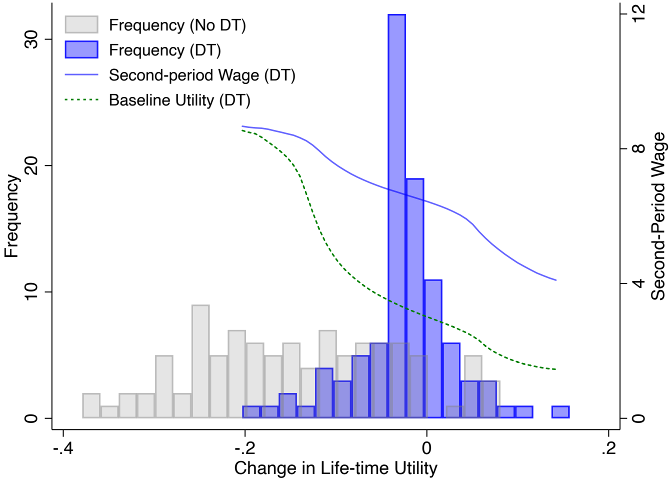


- Increase fin. frictions by increasing r_b to 10%

With delayed taxation, many agents better off with higher borrowing rates



- Increase fin. frictions by increasing r_b to 10%

- Low w_2 households are net savers
- Don't care about r_b
  - But benefit from reduced distortions ($G \nearrow$)

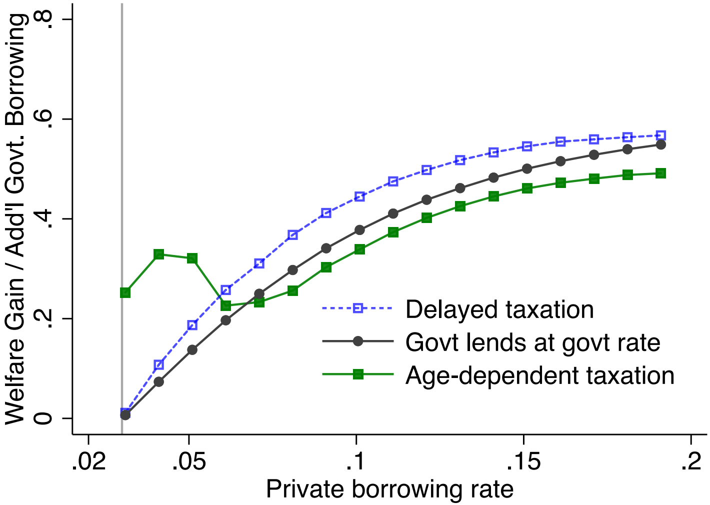
- Those who benefit have low baseline life-time utility

- Conjecture: with inequality aversion, welfare increasing in r_b

- Policies like Delayed Taxation and Age-Dependent Taxation require government to borrow

- If government is borrowing constrained (e.g., due to politics), may be interested in

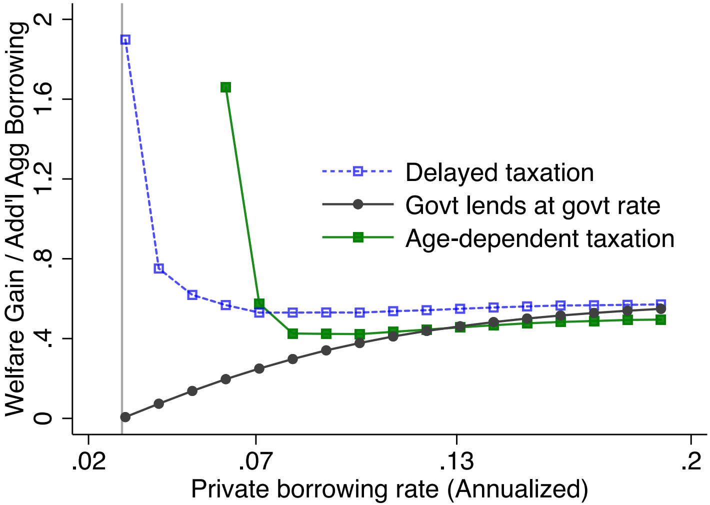
  "bang-for-your-buck": welfare gains per unit of govt borrowing



- Welfare gain = Monetary equiv of welfare gain relative to Benchmark

- Alternative policy: Govt just lends at r_{gov}
  - Worse than DT: doesn't reduce income tax distortions

Welfare gains per unit of additional **aggregate** debt



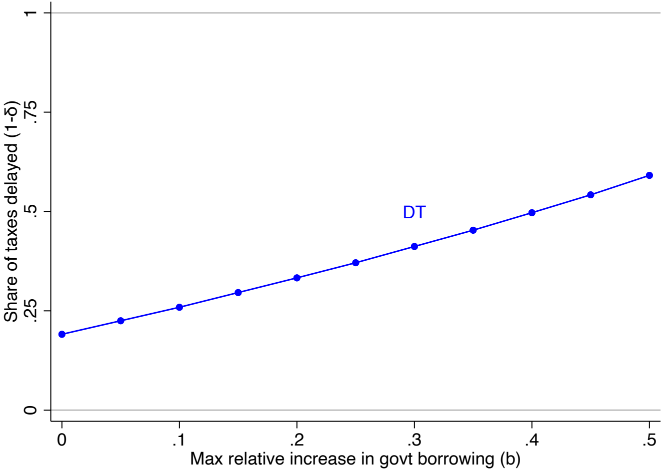
- Welfare gain = Monetary equiv of welfare gain relative to neither DT or AD
- Alternative policy: Govt just lends at r_{gov}

- We will consider "marginal" reforms
  - "marginal" in the sense that they require limited govt borrowing
- The idea is that these are more (politically) feasible:
  - Without any constraints, social planner (govt) would often implement extreme policies
    E.g., delay 1000% of period-1 taxes
    Or, with age-dependent taxation, set $\tau_1 < 0$ (for all young workers).
- When implementing DT or AD, government may only increase relative borrowing (B) by

$$\frac{B - B^*}{B^*} \leq b,$$

where B^* is the amount of government borrowing in the benchmark economy at some r_b

Share of delayed taxes, $1 - \delta$, when $r_b = 10\%$



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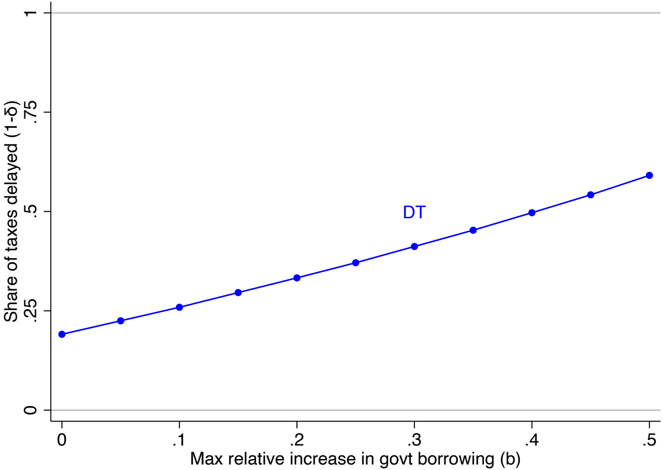

- Even with no additional borrowing, $1 - \delta > 0$

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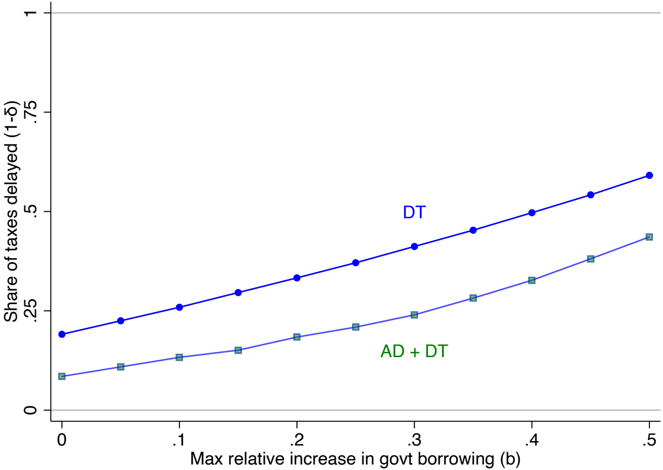
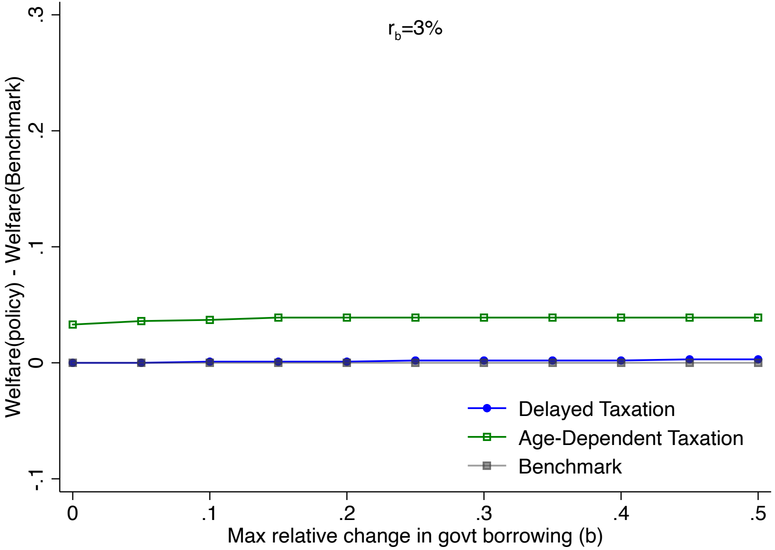


- Even with no additional borrowing, optimal $1 - \delta > 0$
- Even if we're doing AD, optimal $1 - \delta > 0$

Change in welfare relative to benchmark



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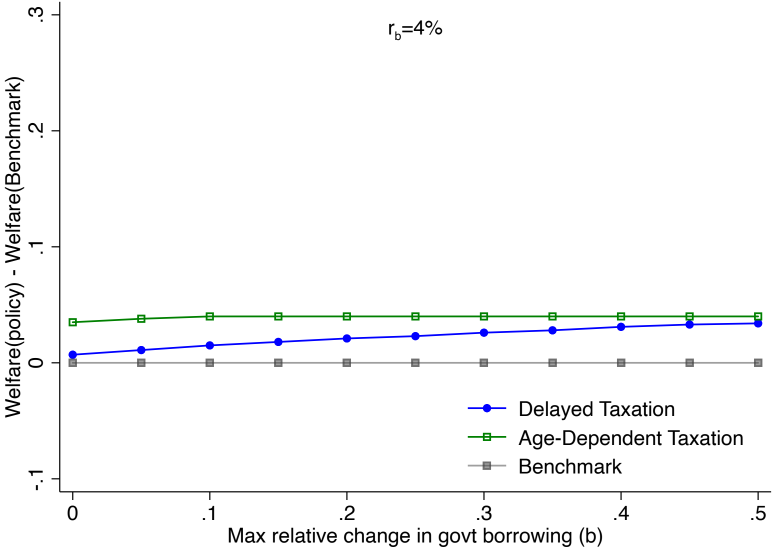

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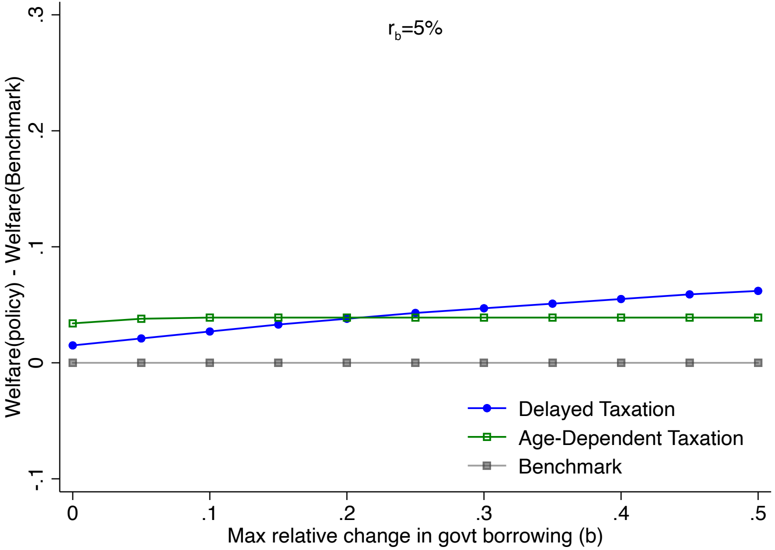

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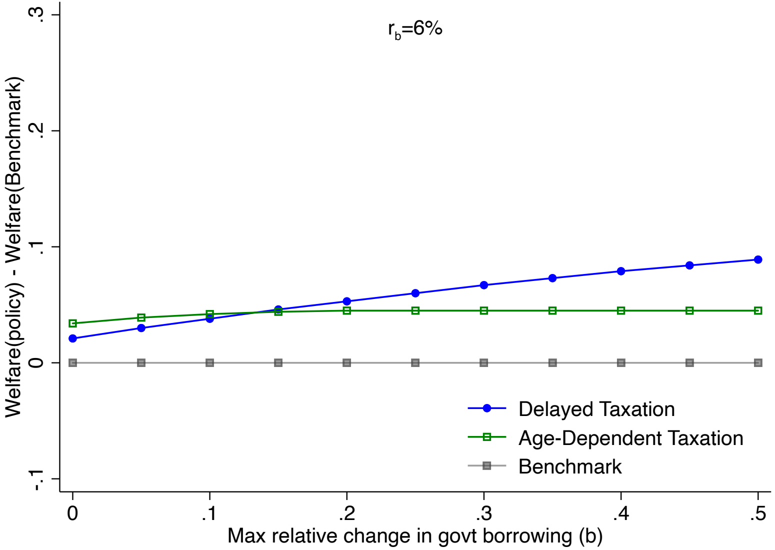

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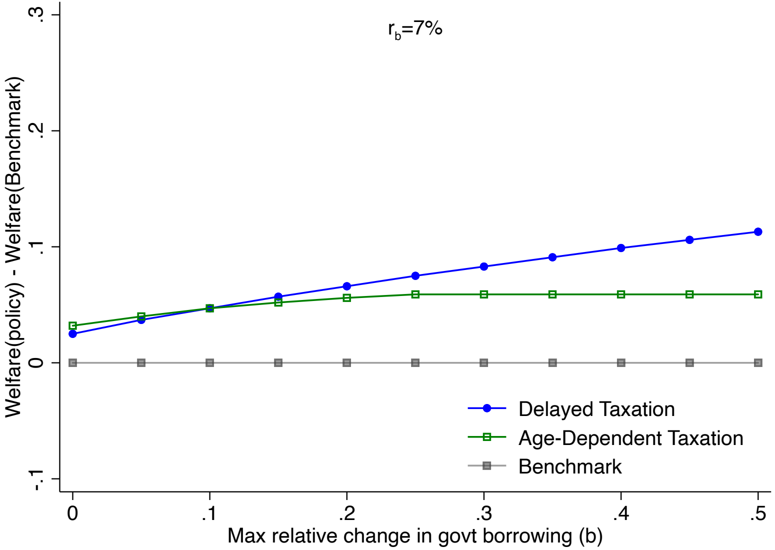

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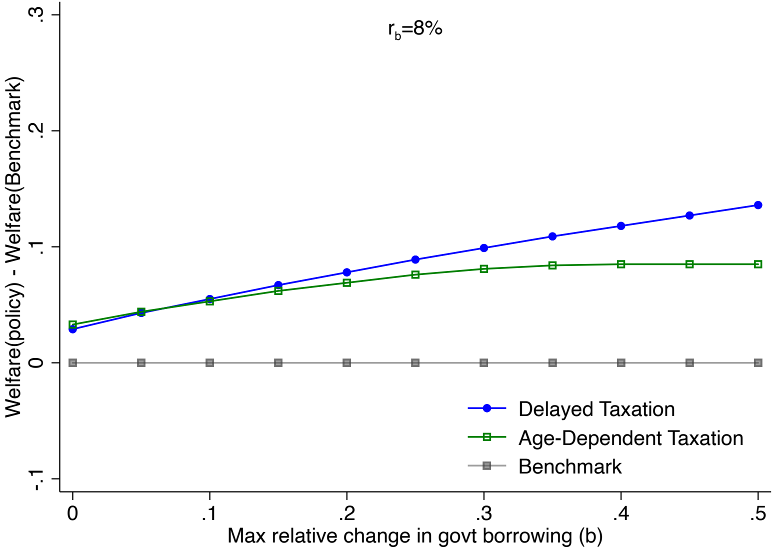

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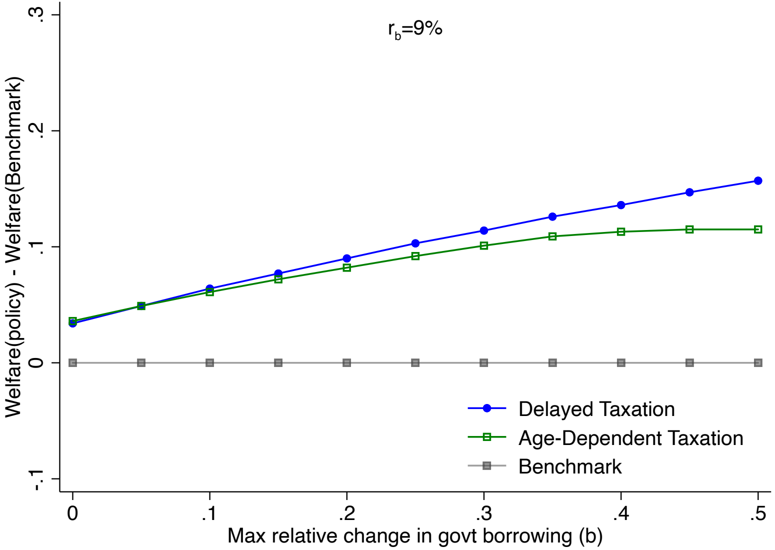

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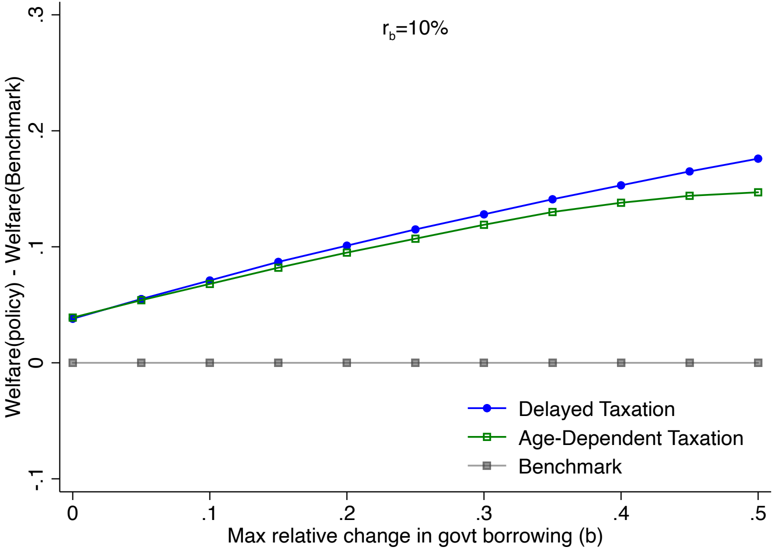

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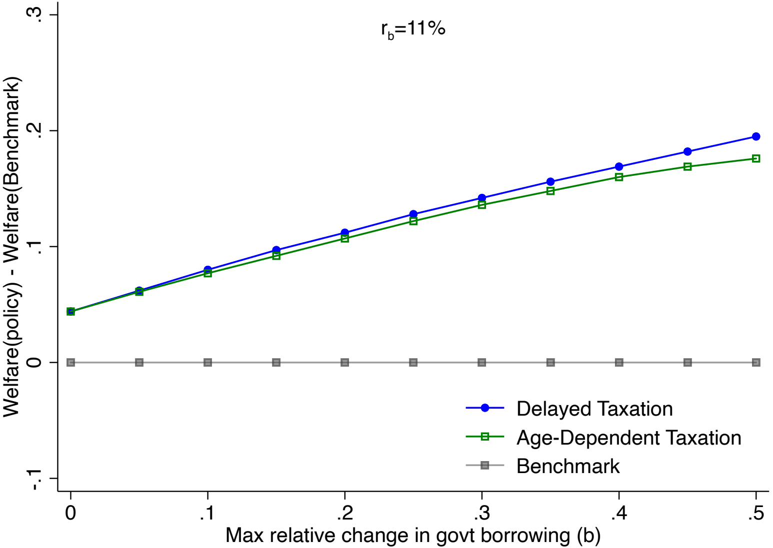

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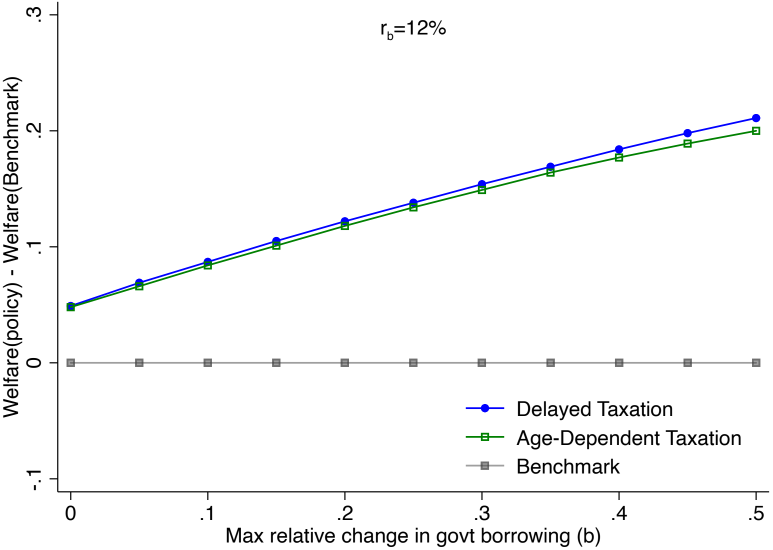
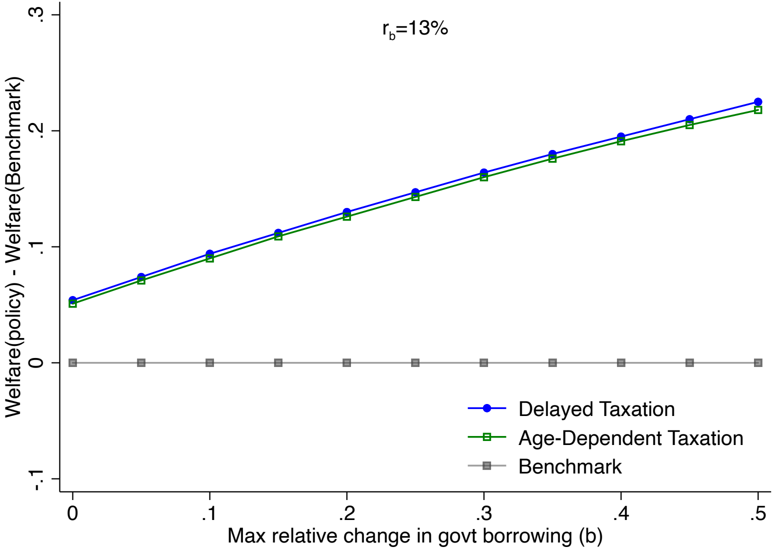
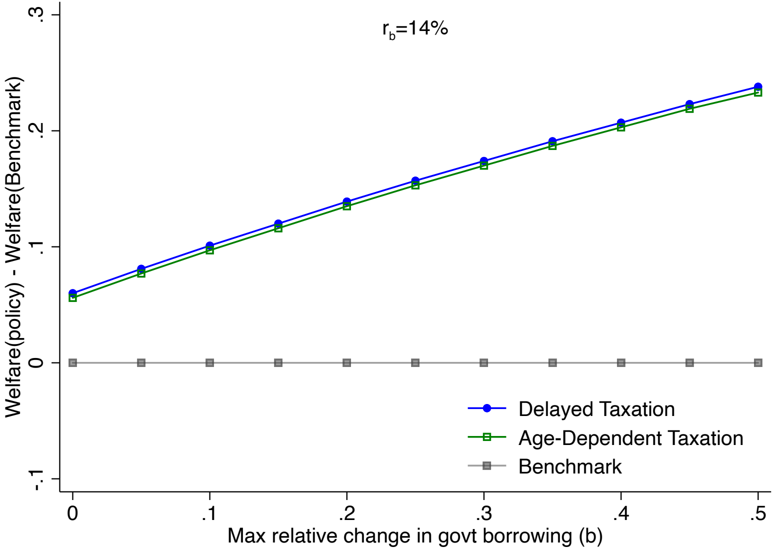


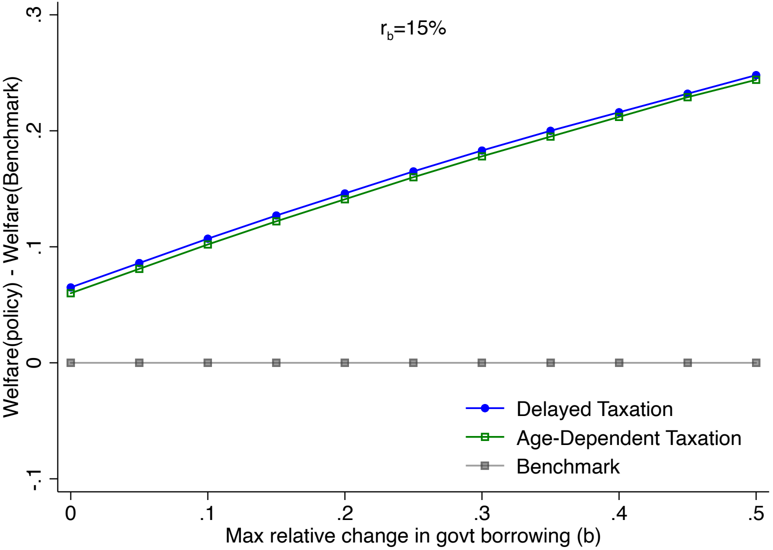
Change in welfare relative to benchmark



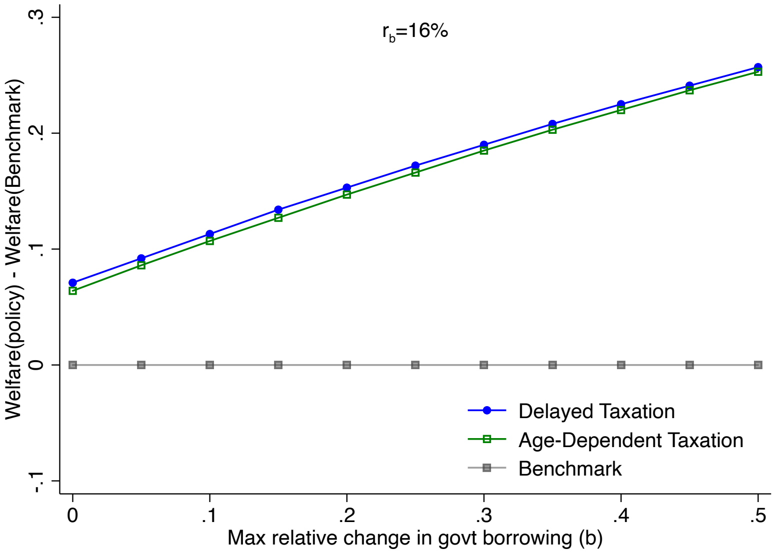
Change in welfare relative to benchmark



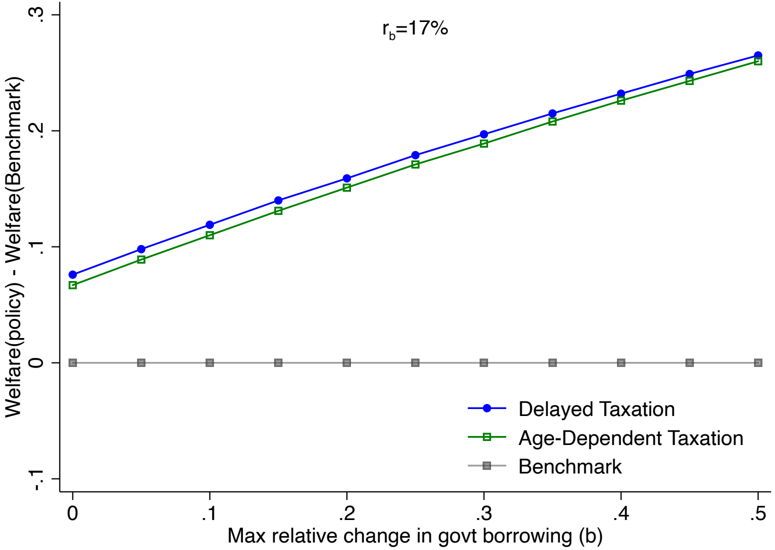
Change in welfare relative to benchmark



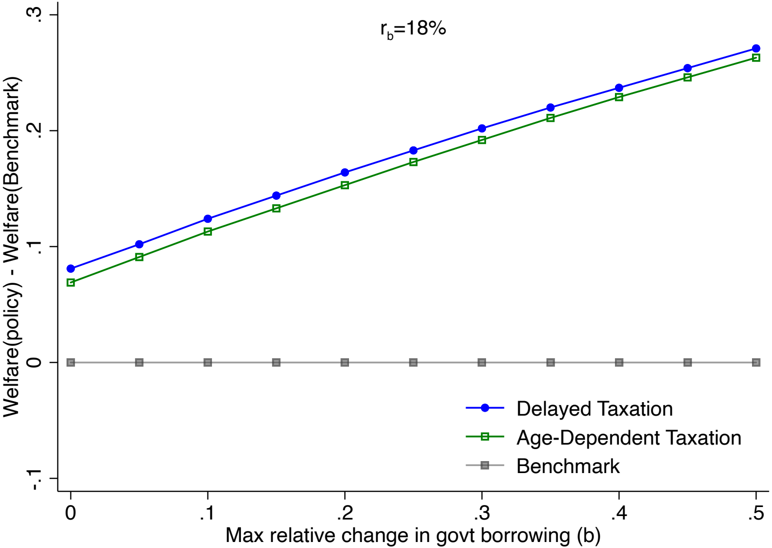
Change in welfare relative to benchmark



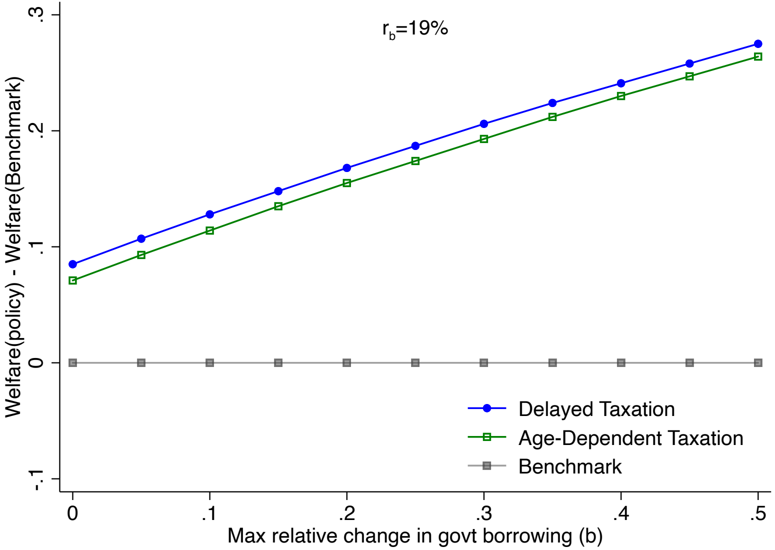
Change in welfare relative to benchmark



Change in welfare relative to benchmark



Change in welfare relative to benchmark



Empirical part

In a standard life-cycle model, financially constrained agents would be less responsive to a delayed tax

- This is one of the major sources of welfare gains from delayed taxation
- But does it work in practice?
- Hard to test, since there's no de-jure delayed taxation schemes

Empirical setting

- Norwegian students face a **de-facto** delayed taxation scheme
  - effective marginal income tax rate of 50% on earnings about ≈$15,000
  - where accrued taxes are paid ≈10 years later
  - financed at market/risk-free rate

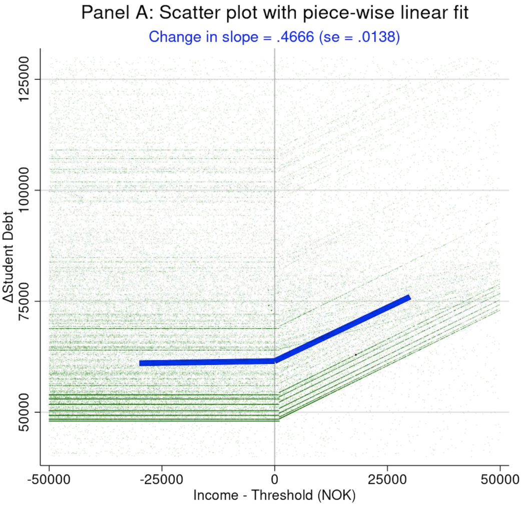
Empirical setting

- Norwegian students face a **de-facto** delayed taxation scheme
  - effective marginal income tax rate of 50% on earnings about ≈\$15,000
  - where accrued taxes are paid ≈10 years later
  - financed at market/risk-free rate

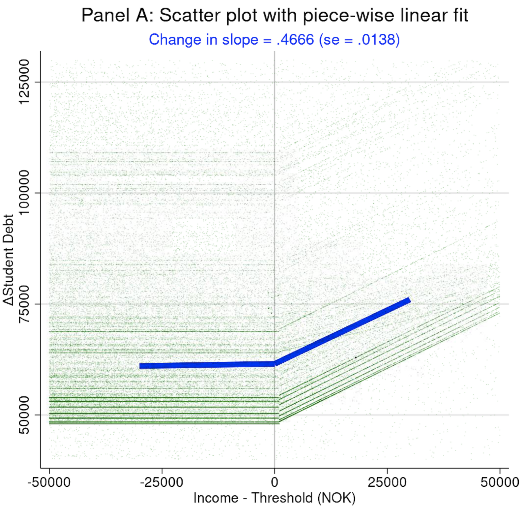
- This is caused by a government-sponsored student financing scheme
  - Affects students pursuing higher education (bachelors, masters)
  - Students receive a financing mix that includes about \$5,000 in stipends to pay for consumption
  - But stipends are converted to debt if (3rd-party-reported) earnings while in school exceed a given threshold

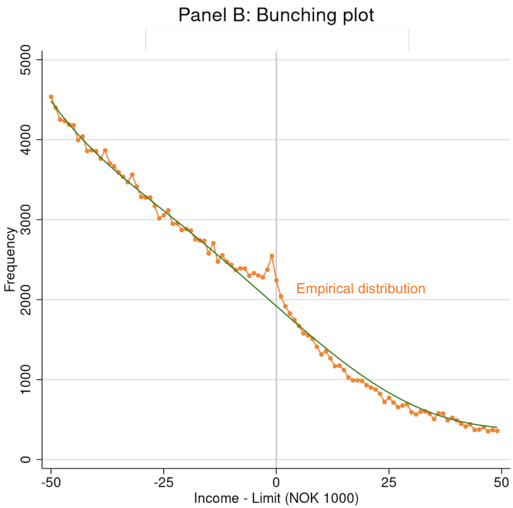
    These earnings are third-party reported via the Tax Authorities

⇒ Each \$1 of earnings above threshold increases student debt by \$0.50



- Panel A: Verify first-stage in raw data

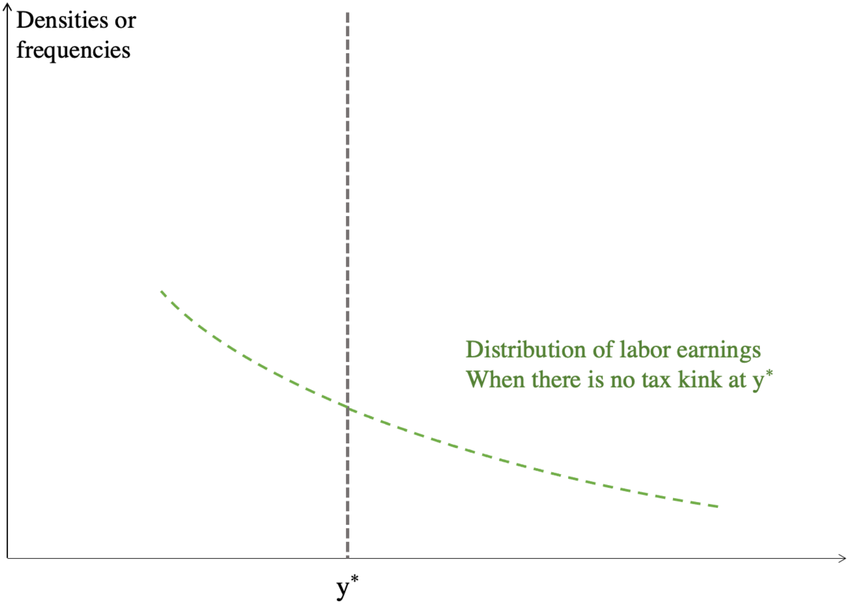


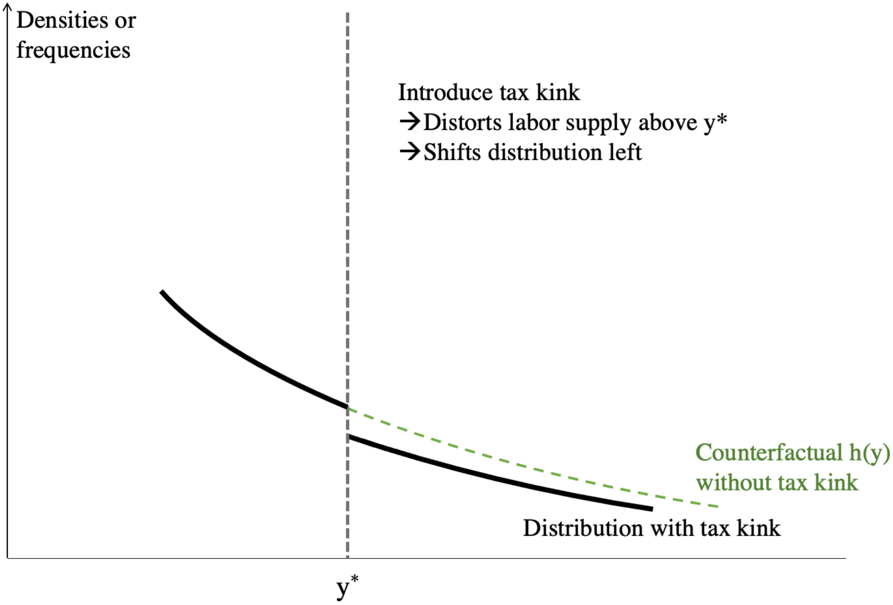


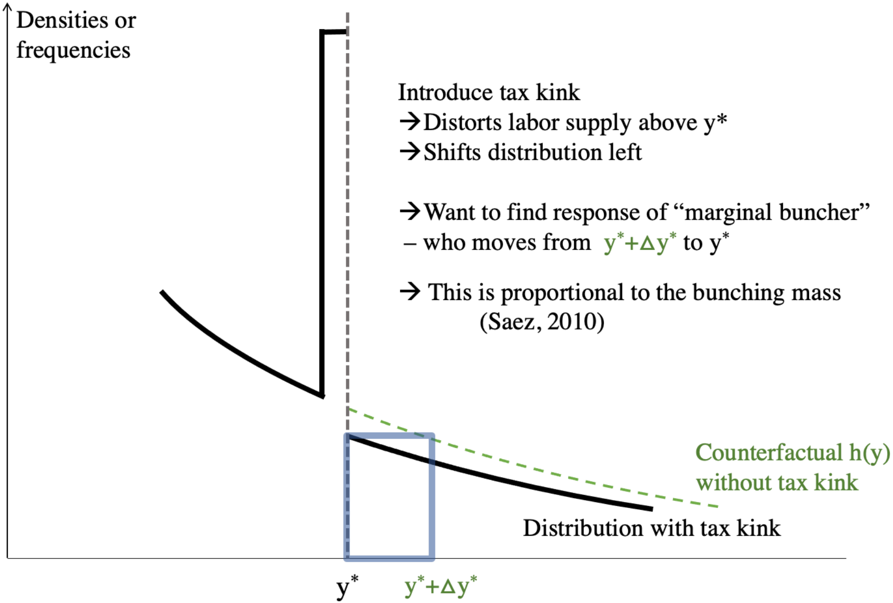
- Panel A: Verify first-stage in raw data
- Panel B: Examine behavioral response

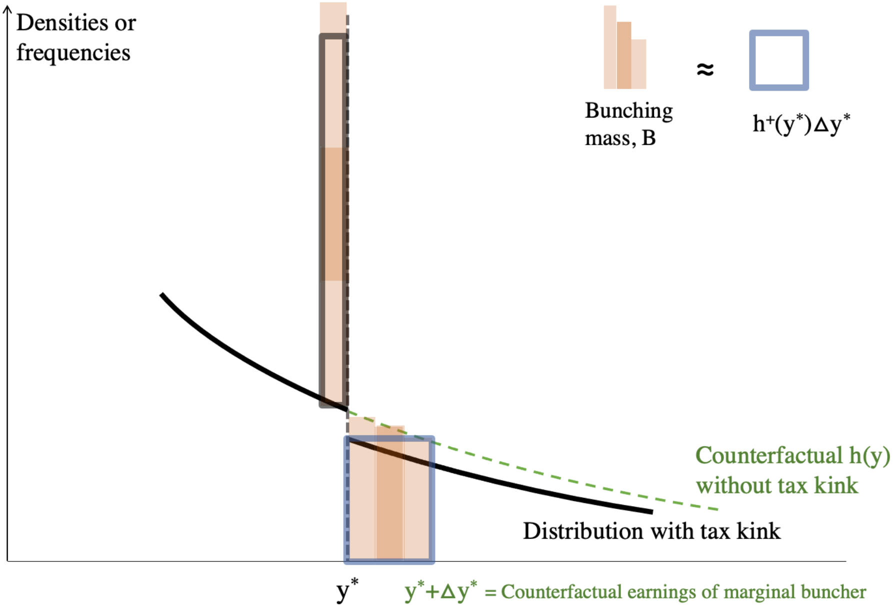
Now, need to map bunching into a labor supply elasticity

Quick review of bunching methodology

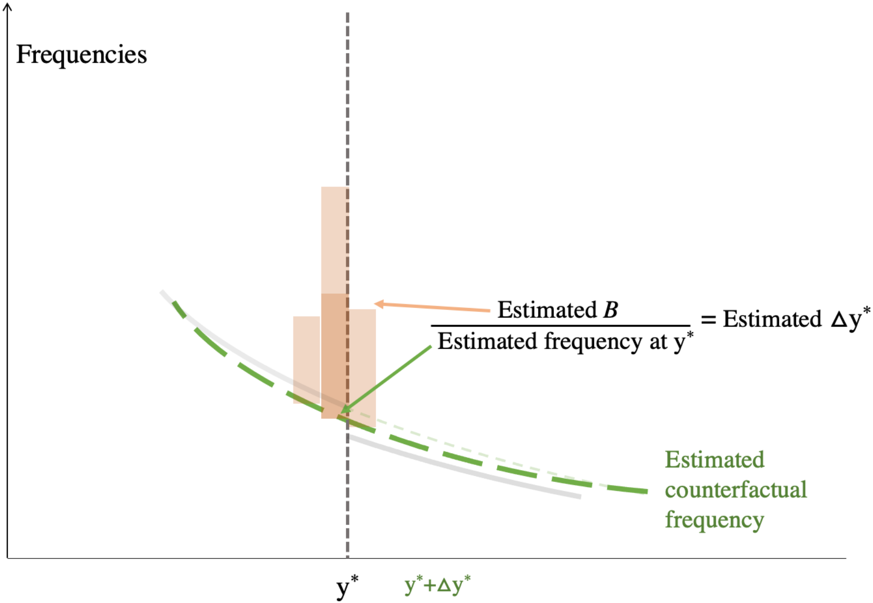

Densities or frequencies
Distribution of labor earnings
When there is no tax kink at y*
y*


Densities or frequencies
Introduce tax kink
→Distorts labor supply above y*
→Shifts distribution left
Counterfactual h(y) without tax kink
Distribution with tax kink
y*

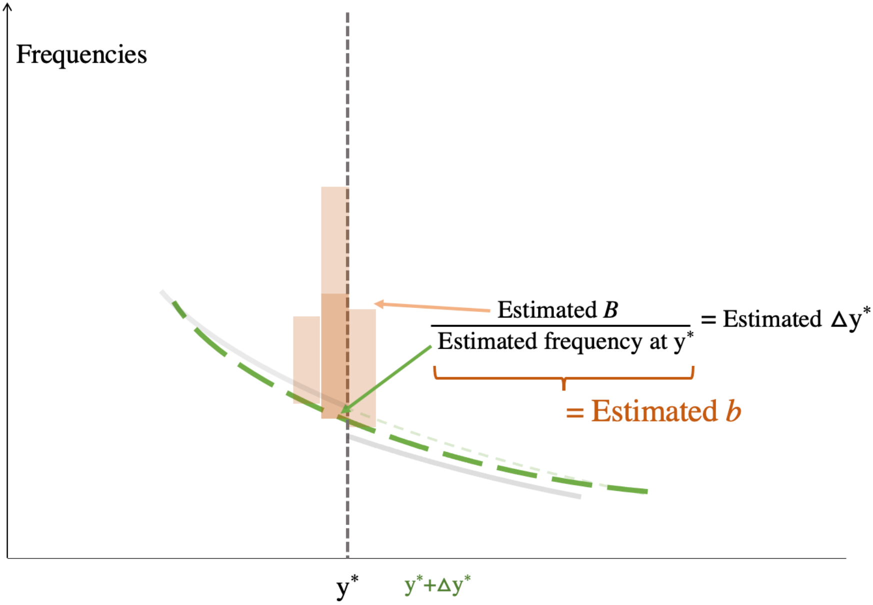

Densities or frequencies
Introduce tax kink
→Distorts labor supply above y*
→Shifts distribution left
→Want to find response of "marginal buncher" – who moves from $y^*+\Delta y^*$ to y^*
→ This is proportional to the bunching mass (Saez, 2010)
Counterfactual h(y) without tax kink
Distribution with tax kink
y^*
$y^*+\Delta y^*$

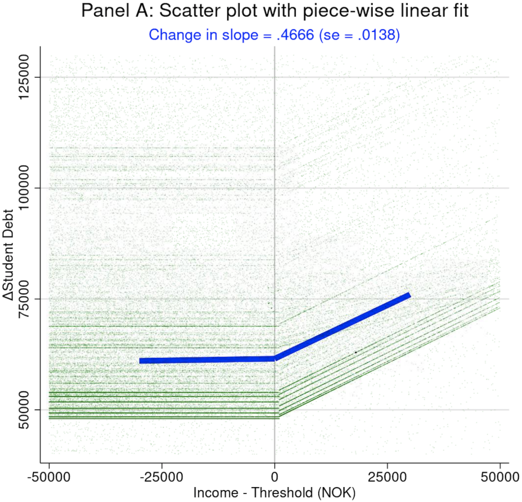


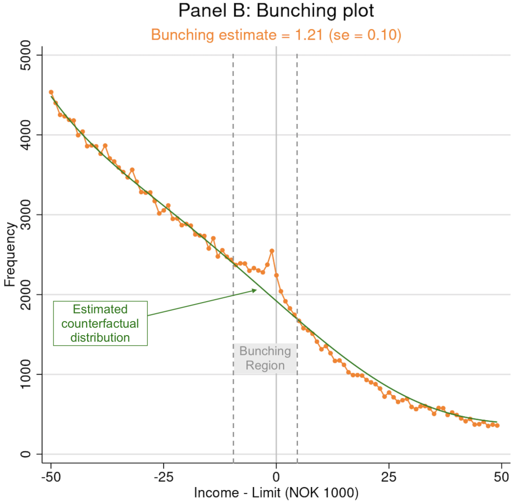
Densities or frequencies
Bunching mass, B
≈
h+(y*)Δy*
Counterfactual h(y) without tax kink
Distribution with tax kink
y*
y*+Δy* = Counterfactual earnings of marginal buncher



Frequencies
Estimated B
Estimated frequency at y^*
= Estimated Δy^*
Estimated counterfactual frequency
y^*
$y^*+\Delta y^*$


Frequencies
Estimated B
Estimated frequency at y*
= Estimated Δy*
= Estimated b
y*
y*+Δy*





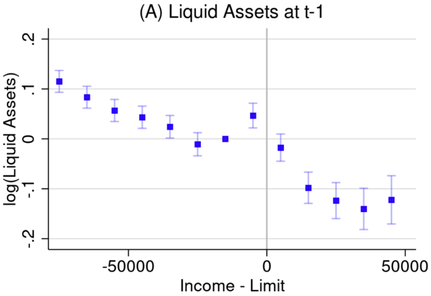
- Panel A: Verify first-stage in raw data
- Panel B: Examine behavioral response

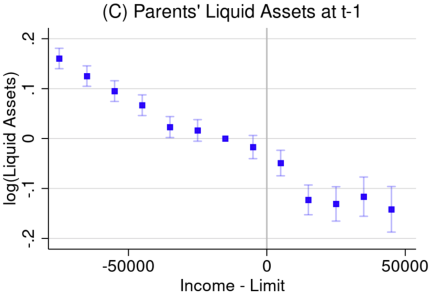
$$\Rightarrow \hat{e} = \frac{\Delta y^* / y^*}{\Delta \tau / (1-\tau)} = \frac{1.21 \cdot 1{,}000 / 120{,}162}{0.4666 / 0.75} = 0.0162$$

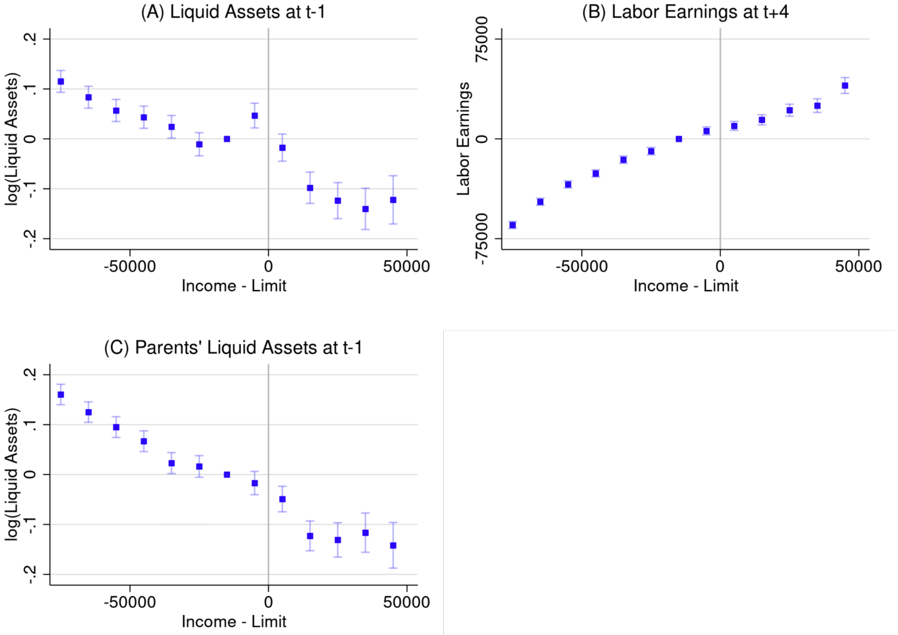
- Plot how student characteristics vary around the threshold
- Our hypothesis: bunchers should be more constrained / have less savings
  - Bunching estimates considered to identify the Frisch elasticity (Saez 2010, Kleven 2016)
  - In our setting, the quasi-Frisch elasticity we identify is (the local average of):

$$\varepsilon^i_{1,1-\tau_1} = \left(\delta + (1-\delta)\frac{1+r}{R'(s^i)}\right)\kappa \quad = \quad \frac{1+r}{R'(s^i)}\kappa, \tag{12}$$

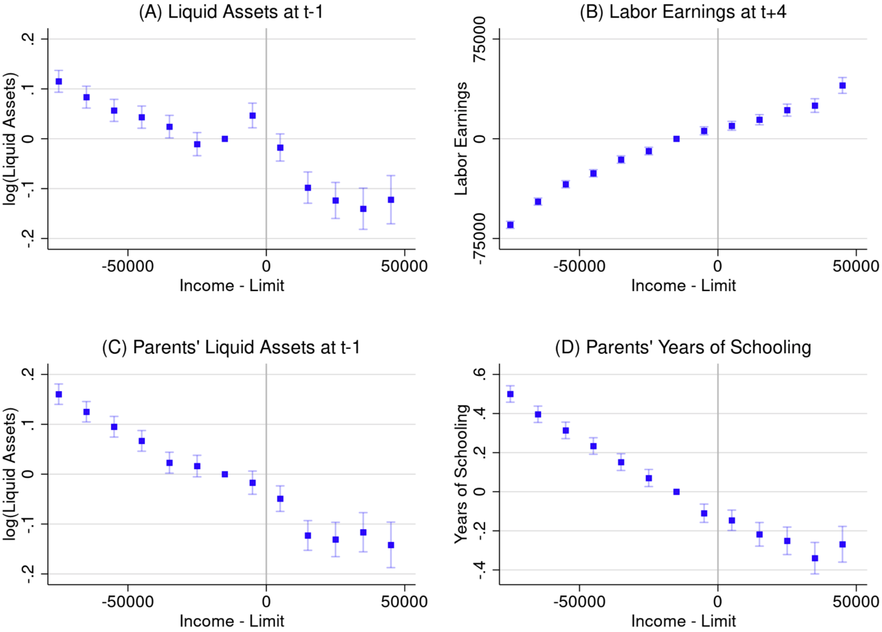
  - where $\delta = 0$, i.e, tax is fully delayed
  - and κ is the "structural" no-delayed-taxation Frisch elasticity


(A) Liquid Assets at t-1
log(Liquid Assets)
.2
.1
0
-.1
-.2
-50000
0
50000
Income - Limit


(C) Parents' Liquid Assets at t-1
log(Liquid Assets)
.2
.1
0
-.1
-.2
-50000
0
50000
Income - Limit

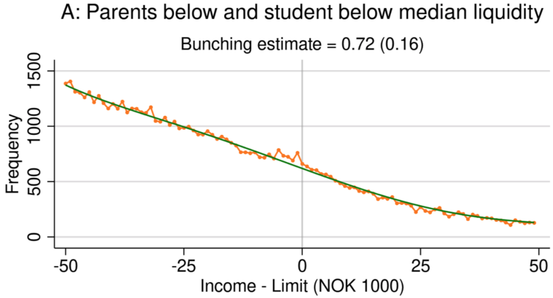


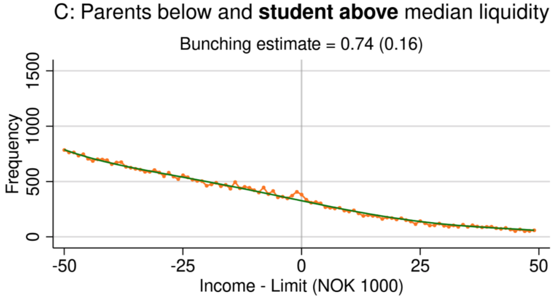
(A) Liquid Assets at t-1
log(Liquid Assets)
.2
.1
0
-.1
-.2
-50000
0
50000
Income - Limit
(B) Labor Earnings at t+4
Labor Earnings
75000
0
-75000
-50000
0
50000
Income - Limit
(C) Parents' Liquid Assets at t-1
log(Liquid Assets)
.2
.1
0
-.1
-.2
-50000
0
50000
Income - Limit

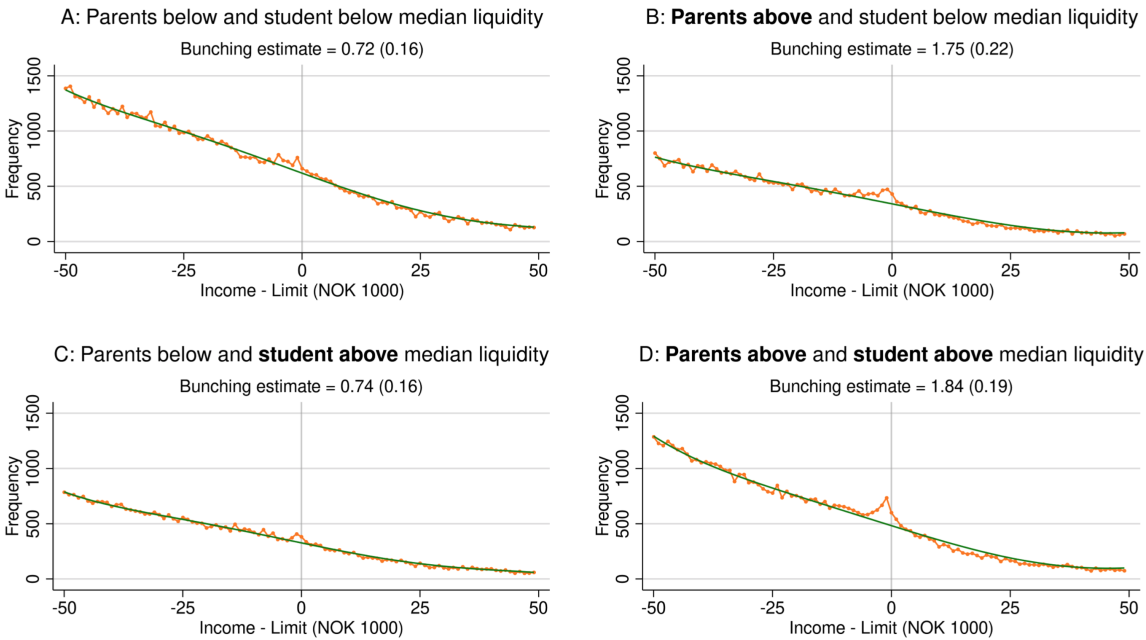

(A) Liquid Assets at t-1
log(Liquid Assets)
.2
.1
0
-.1
-.2
-50000
0
50000
Income - Limit
(B) Labor Earnings at t+4
Labor Earnings
75000
0
-75000
-50000
0
50000
Income - Limit
(C) Parents' Liquid Assets at t-1
log(Liquid Assets)
.2
.1
0
-.1
-.2
-50000
0
50000
Income - Limit
(D) Parents' Years of Schooling
Years of Schooling
.6
.4
.2
0
-.2
-.4
-50000
0
50000
Income - Limit

Split sample in 4 based on own and parental liquidity

- Expectation is that less-liquidity students bunch less

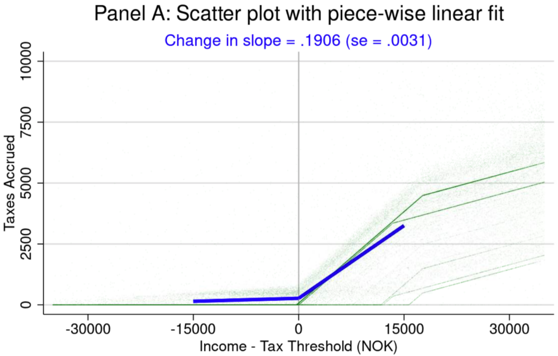

A: Parents below and student below median liquidity
Bunching estimate = 0.72 (0.16)
Frequency
0
500
1000
1500
-50
-25
0
25
50
Income - Limit (NOK 1000)

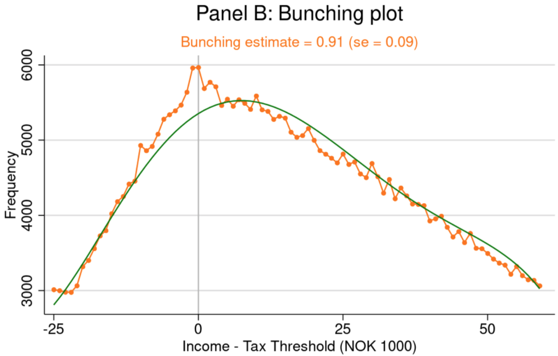

C: Parents below and **student above** median liquidity
Bunching estimate = 0.74 (0.16)
Frequency
0
500
1000
1500
-50
-25
0
25
50
Income - Limit (NOK 1000)


A: Parents below and student below median liquidity
Bunching estimate = 0.72 (0.16)
B: Parents above and student below median liquidity
Bunching estimate = 1.75 (0.22)
C: Parents below and student above median liquidity
Bunching estimate = 0.74 (0.16)
D: Parents above and student above median liquidity
Bunching estimate = 1.84 (0.19)
Frequency
0
500
1000
1500
-50
-25
0
25
50
Income - Limit (NOK 1000)

Benchmark elasticity from students' responses to a regular tax kink

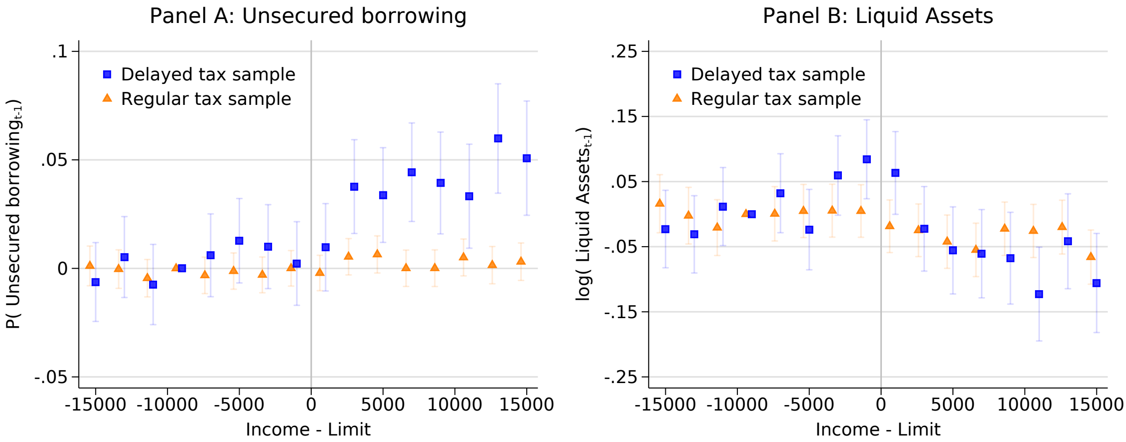
Comparison to responsiveness to ordinary tax kink





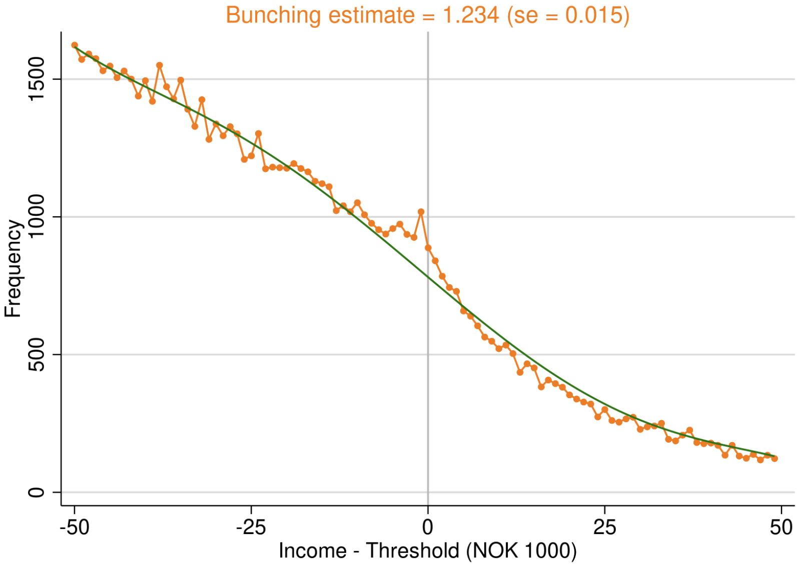
- Marginal income taxes first kick in at about 30,000-40,000 NOK (≈$5,000)
- Implied elasticity $= \frac{0.91*/36.706}{19.06\%/100\%} = 0.13$
- about **8x larger** than elasticity from debt-conversion threshold (0.016)

Borrowing and liquidity around tax thresholds

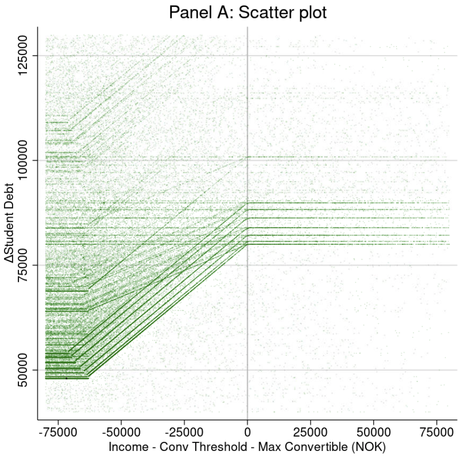


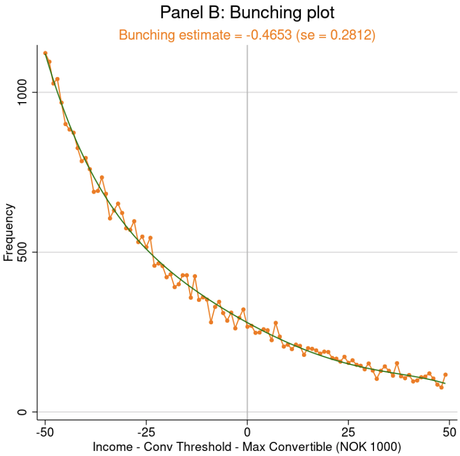
Empirical Appendix

Same response for high-flexibility student occupations (hospitality, sales)



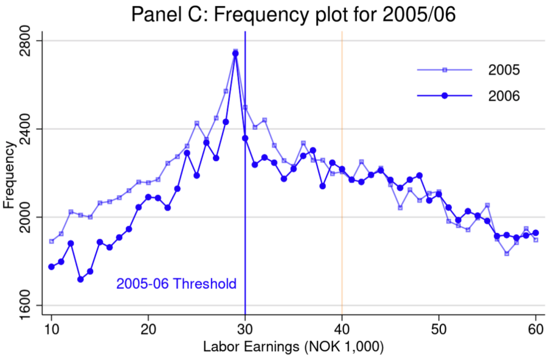
Also no response to the phase-out

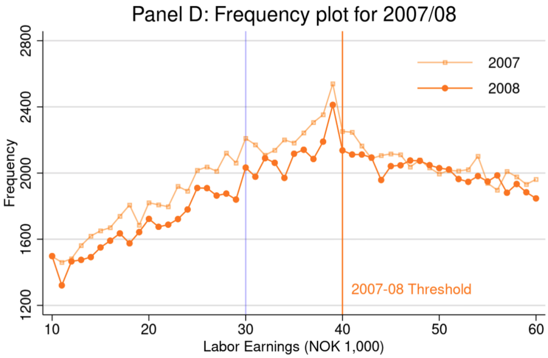




- For high enough earnings no loans are converted to stipend; marginal $\Delta Debt \rightarrow 0$
- Should see **negative bunching** if students are responsive

Implied elasticity at regular tax threshold might be even larger





A new approach (to literature *and* paper)

- Define individual-level elasticity as

$$\tilde{e}_i = \underbrace{\frac{1[y_i \in BR_s] - \hat{P}^{cf}(y_i \in BR_s)}{\hat{P}^{cf}(y_i \in BR_s)/N_s^{bins}}}_{\text{estimated } b_s} \cdot (\text{Bin width}_s/\text{Threshold}_s) \Big/ (\hat{d}\tau_s/(1-\tau_s)), \tag{13}$$

  - $\mathbb{E}[e_i | s = \text{delayed tax sample}] = 0.0155 \approx 0.0160$ found earlier

- Regress $\tilde{e}_i$ on a dummy for being in regular tax sample, and observable characteristics
  - For example, higher-earning students may be more likely to have marginal income come from an internship and thus have lower flexibility in optimizing hours worked

Qualitatively similar results: 6-7 × higher elasticity for regular tax

	(1)	(2)
$\widehat{\frac{e_{regular}-e_{delayed}}{e_{delayed}}}$	7.20	6.10
	(.59)	(.61)
Underlying Regression Coefficients		
1[regular tax sample]	0.0969***	0.0787***
Male	0.0360***	0.0414***
Age	-0.0434***	-0.0410***
College, parents	0.0501**	0.0442**
Years of schooling, parents	0.0056	0.0070**
$\widehat{E}[\tilde{e}_i \mid s = regular]$	0.2031	0.2032
$\widehat{E}[\tilde{e}_i \mid s = delayed]$	0.0156	0.0154
FEs	4-Digit Occ	4-Digit Occ × NACE2