Financial Frictions and the Non-distortionary Effects of Delayed Taxation

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Oct 2023

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 10–15 years..

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

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

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

3. We calibrate the model to Norway to numerically illustrate welfare implications

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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- Agent chooses labor supply and is subject to a nominal tax rate of 50%
- Government allows agent to delay tax payment to next year, financed at $r = 3\%$

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

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

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

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

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

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

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

An alternative view on delayed taxation

- Tax authorities likely have an advantage in lending to workers vs. private lenders
- E.g., can collect more efficiently
- [⇒] Governments discount tax liabilities less than (net-borrowing) workers do
- So by delaying taxes, we're effectively lowering the effective tax rate
- [⇒] We get the full positive behavioral responses
- [⇒] But more modest negative mechanical effects of tax cuts

... Implying that delaying taxes increase tax revenues → transfers → equity → welfare

...... Additionally, we increase welfare directly by enhancing intertemporal smoothing

(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 $= \varepsilon$.

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

$$\text{s.t. } c_1 = w_1\ell_1(1-\delta\tau_1) - s + G \tag{2}$$

$$\text{and } c_2 = R(s) + (1-\tau_2)w_2\ell_2 - (1-\delta)(1+r_{dtax})\tau_1 w_1\ell_1 + G, \tag{3}$$

where G is govt transfers and $1-\delta$ is share of period-1 taxes payable in period 2.

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

Partial eqm. in the sense that r_{gov}, r_b, w_1, w_2 are exogenous

Government's optimization problem

- Government maximizes welfare (average life-time utility) by choosing tax rates, τ, and transfers, G subject to govt budget constraint:

$$\sum_i (l_{i,1} w_{i,1} \tau_1 \delta - G) + \frac{1}{1 + r_{gov}} \sum_i (l_{i,2} w_{i,2} \tau_2 + (1-\delta)(1 + r_{dtax}) l_{i,1} w_{i,1} \tau_1 - G) = 0$$

1. **Delayed taxation**
   - Govt chooses fraction $\delta \in [0, 1]$ of labor income taxes $(\tau_1 \ell_1 w_1)$ must be paid in period 1
   - 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 τ_1, $\tau_2 \geq 0$ may differ
   - Unlike other work, we constraint G to be equal across periods
   - If agents are constrained, this typically entails $\tau_1 < \tau_2$

High-level theoretical results: Welfare effects of delayed taxation

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 five 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 effect)

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

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

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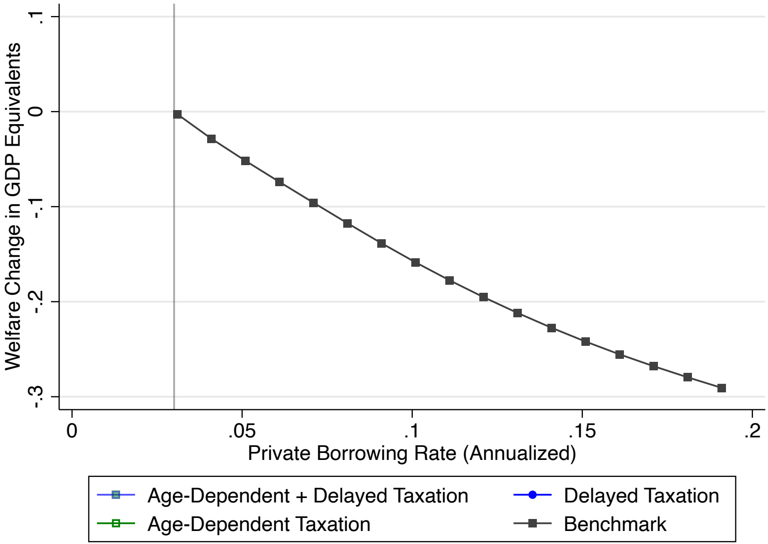
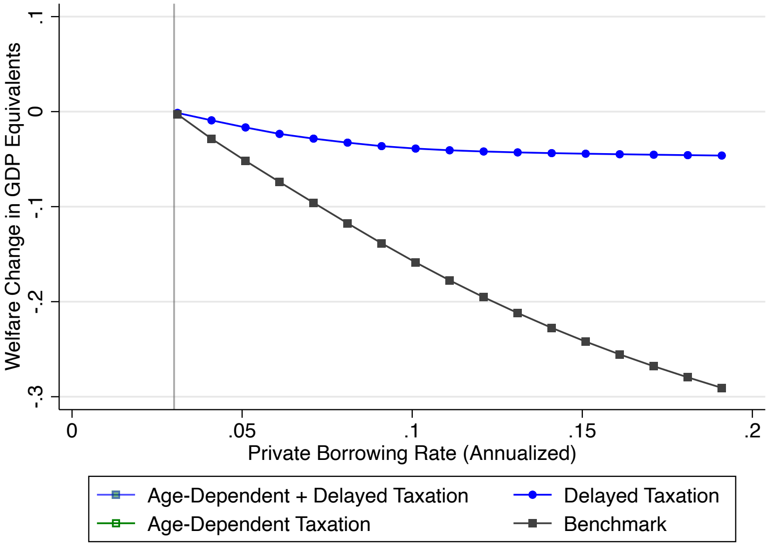
- If govt were to **just lend to households at** r_{gov}, we'd miss effects (2.) + (4.) > 0 b/c $|SE| > |ISE|$
- If govt instead did **age-dependent taxation**, that is, fix τ_2 and decrease τ_1, we'd have (1)–(4), but they'd be "poorly targeted": Theoretical result in progress

Calibration

- $\sigma = 5$,
- $\varepsilon = 0.5$,
- $\xi = 1$,
- $\beta = 0.97^{21}$, $1 + r_{gov} = 1.03^{21}$.
- $N = 100$ agents
  - agent (k,j) is in the kth decile of the 1990 wage distribution
  - and the jth decile of the 2011 distribution
- We assign wages to each agent based on (realized) computed wages for non-students aged 20–30 in 1990
- In the model, we assume that all agents know their future wages
  - This can be relaxed: we just want heterogeneity in whether agents are borrowers



- Welfare declines when $r_b \nearrow$
- ...
- ...
- ...



- Welfare declines when $r_b \nearrow$
- But much less so with Delayed Taxation
- ...
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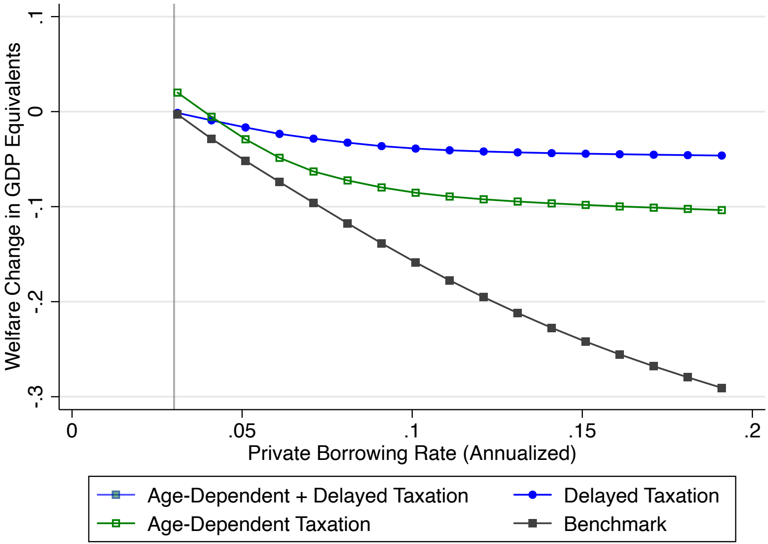

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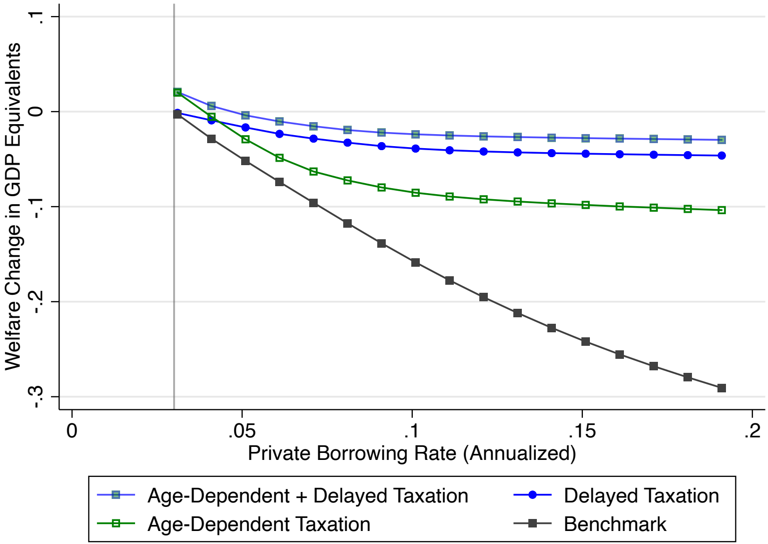
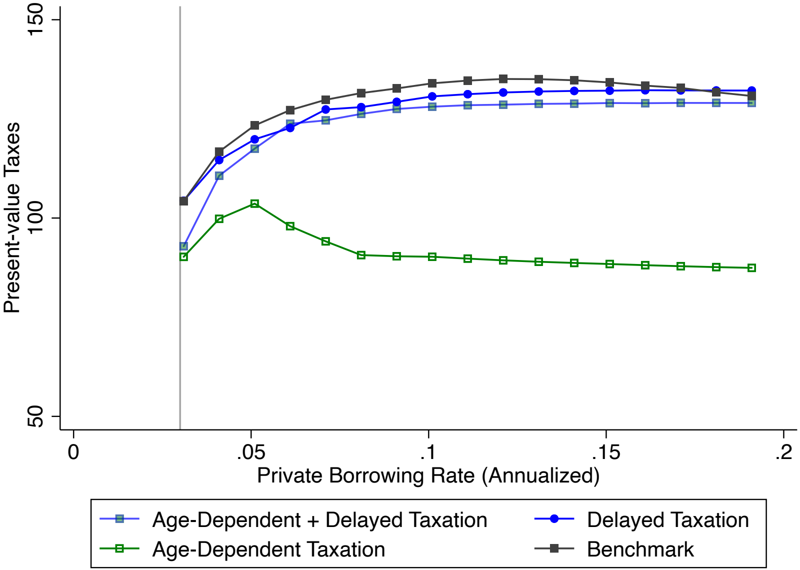
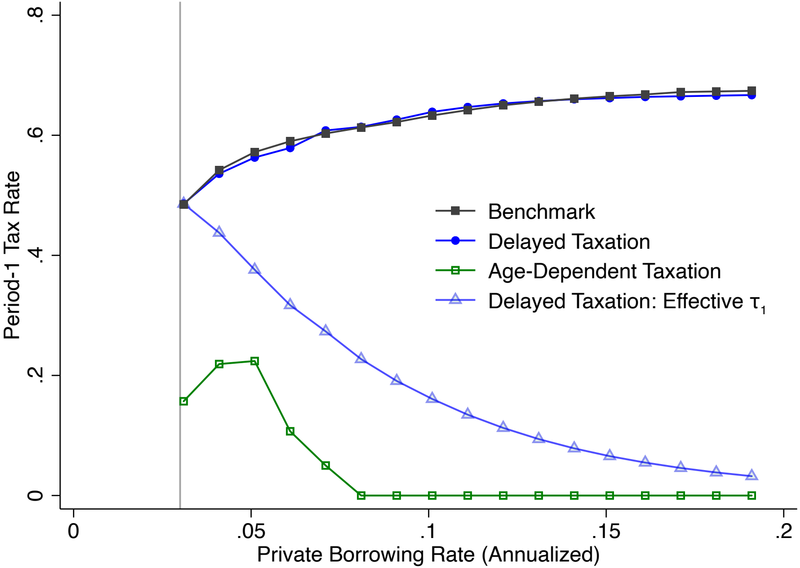


- Welfare declines when $r_b \nearrow$
- But much less so with Delayed Taxation
- Significant welfare gains also from Age-dep
- And modest gains from AD on top of DT

Present-value of Taxes



Period-1 Tax Rate



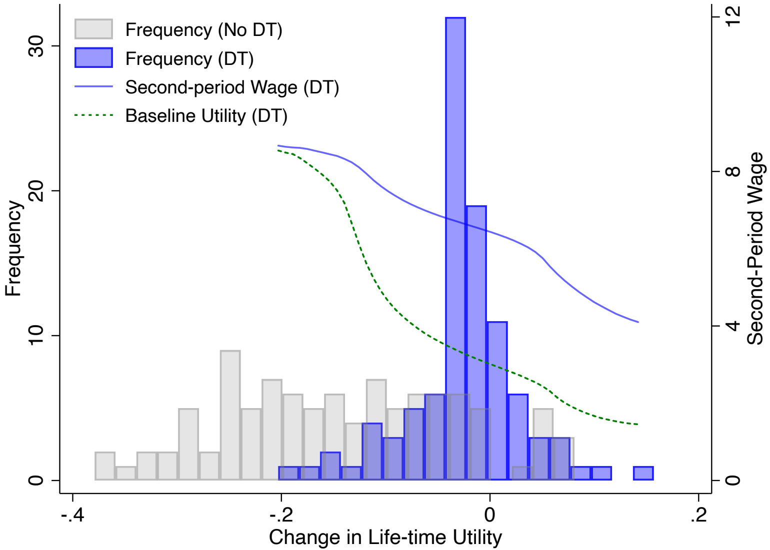
$\mathbf{r_b = 10\%},\ \varepsilon = \mathbf{0.5}$	Benchmark	Delayed taxation	Age-dependent taxation	AD + DT
τ_1	0.63	0.64	0.00	0.47
τ_2	0.63	0.64	0.73	0.72
G_1	0.63	0.62	0.36	0.62
G_2	0.63	0.62	0.36	0.62
δ	1.00	0.00	1.00	0.00
$l_1 w_1$	0.76	0.62	0.85	0.69
$l_2 w_2$	2.36	2.02	2.83	2.20
PV($l_1 w_1$,$l_2 w_2$)	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
$(1-\delta) l_1 w_1 \tau_1$	0.00	0.22	0.00	0.12
s	-0.05	0.17	0.11	0.22
Welfare diff. (GDP)	-16%	-4%	-9%	-2%

$\mathbf{r_b = 10\%}$, $\varepsilon = \mathbf{2.0}$	Benchmark	Delayed taxation	Age-dependent taxation	AD + DT
τ_1	0.54	0.65	0.00	0.51
τ_2	0.54	0.65	0.63	0.71
G_1	0.49	0.56	0.22	0.57
G_2	0.49	0.56	0.22	0.57
δ	1.00	0.00	1.00	0.00
$l_1 w_1$	0.73	0.47	0.90	0.55
$l_2 w_2$	2.72	2.71	2.15	2.44
PV($l_1 w_1$,$l_2 w_2$)	2.16	1.89	2.03	1.84
PV($l_1 w_1 \tau_1$,$l_2 w_2 \tau_1$)	1.16	1.23	0.71	1.20
l_1	0.68	0.44	0.86	0.50
l_2	0.68	0.83	0.57	0.71
$(1-\delta) l_1 w_1 \tau_1$	0.00	0.23	0.00	0.14
s	-0.08	0.07	0.10	0.16
Welfare diff. (GDP)	-29%	-16%	26%	15%

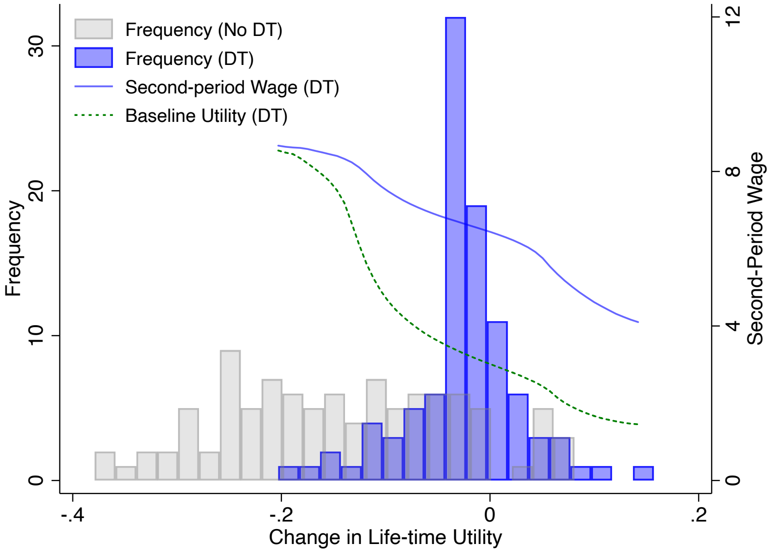
τ_1, τ_2 insensitive to ε under DT

Interest rate on borrowing $\nearrow$ means Welfare $\searrow$

Is anyone better off when borrowing rates increase?



- Increase fin. frictions by increasing r_b to 10%

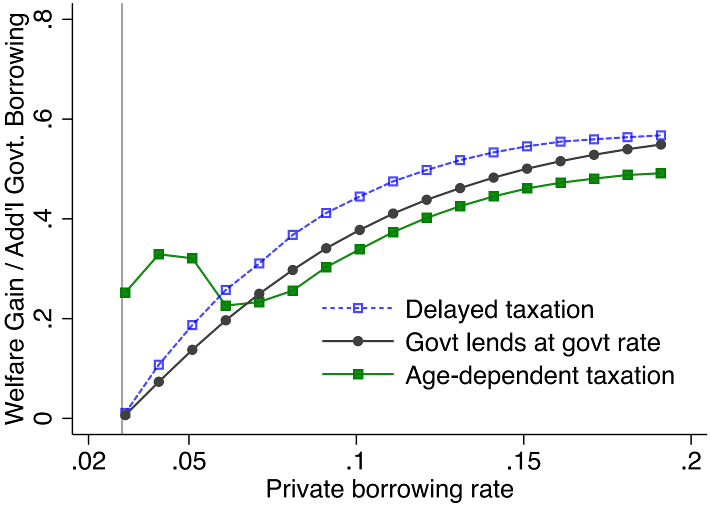


- Increase fin. frictions by increasing r_b to 10%
- Low w_2 households are net savers
- Don't care about r_b
  - But benefit from reduced distortions ($G \nearrow$)

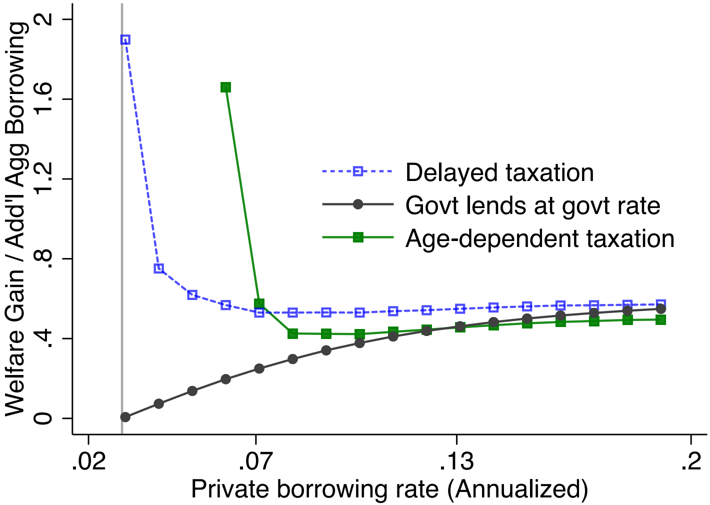
Bang for your buck:

$$\frac{\text{Monetary-equivalent increase in welfare}}{\text{Additional debt by undertaking policy}}$$

Welfare gains per unit of additional government debt



- Welfare gain = Monetary equiv of welfare gain relative to neither DT or AD
- Alternative policy: Govt just lends at r_{gov}
  - Always worse than DT: doesn't reduce income tax distortions



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Summary

- We propose the intuitive but novel hypothesis that delaying the payment of income taxes reduce their distortionary effects when some agents are borrowing constrained
- We demonstrate this empirically
- And explore the implications for optimal taxation
- Our findings highlight *Delayed Taxation* as a promising new avenue for optimal taxation

Preview of empirical results

We study bunching at a Norwegian labor-income tax threshold, where marginal tax is substantially delayed

- We estimate a small implied labor supply elasticity (0.0162)
  - This number assumes that the interest rate on taxes = borrowing rate (i.e., no financial frictions)
- These are particularly small for low-liquidity agents
- And a magnitude smaller than what we find at a regular tax kink

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

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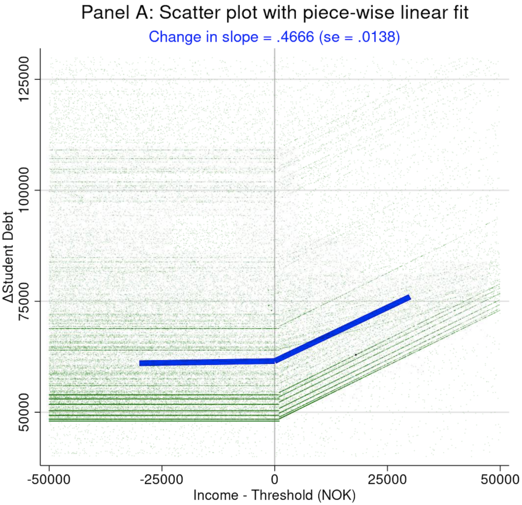
- This is caused by a government-sponsored student financing scheme
  - Affects students pursuing higher education (bachelors, masters)
  - Students receive a financing mix that includes about $5,000 in stipends to pay for consumption
  - But stipends are converted to debt if (3rd-party-reported) earnings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

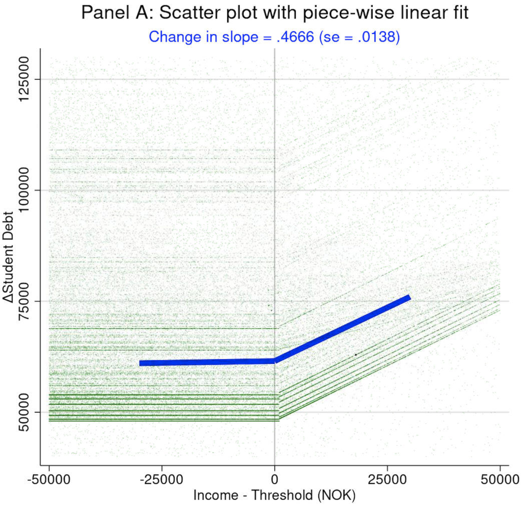
    These earnings are third-party reported via the Tax Authorities

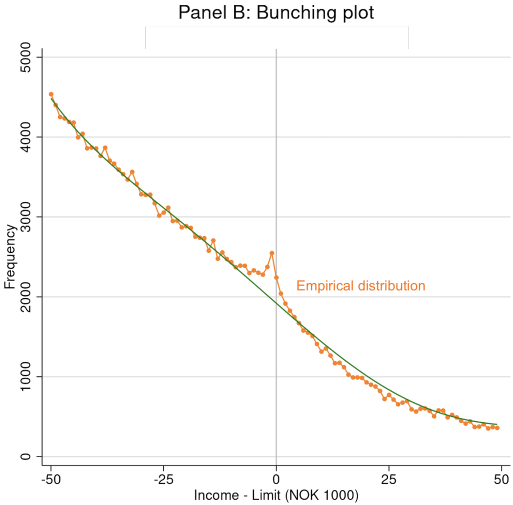
    In Denmark and Sweden, students need to repay the amount immediately (?)

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

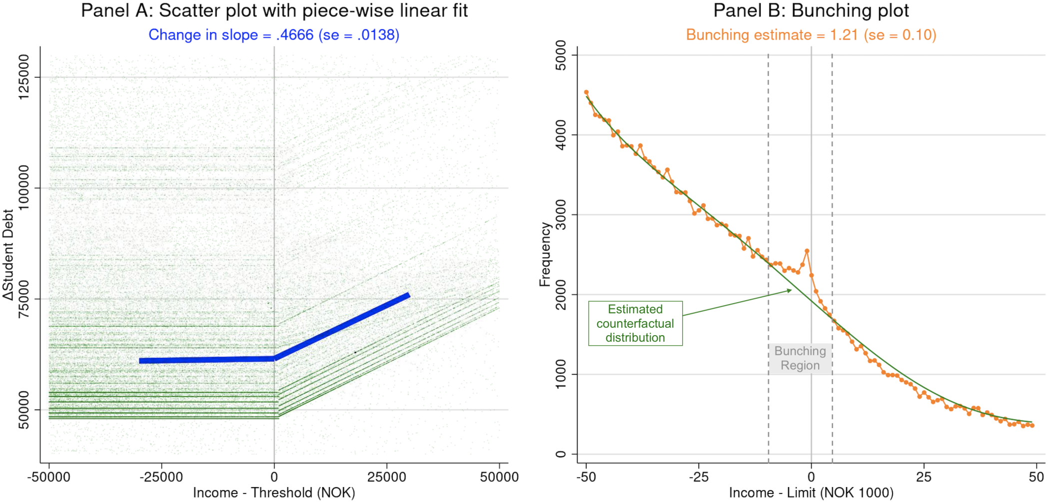


- Panel A: Verify first-stage in raw data





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



- Panel A: Verify first-stage in raw data
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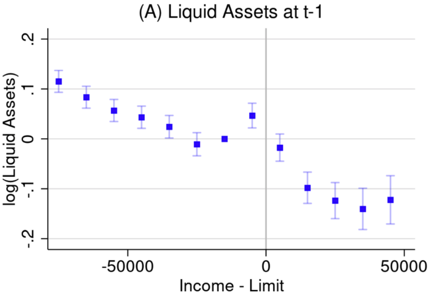
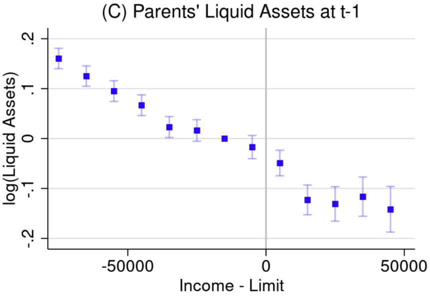
$$\Rightarrow \hat{e} = \frac{\Delta y^*/y^*}{\Delta\tau/(1-\tau)} = \frac{1.21\cdot 1{,}000/120{,}162}{0.4666/0.75} = 0.0162$$

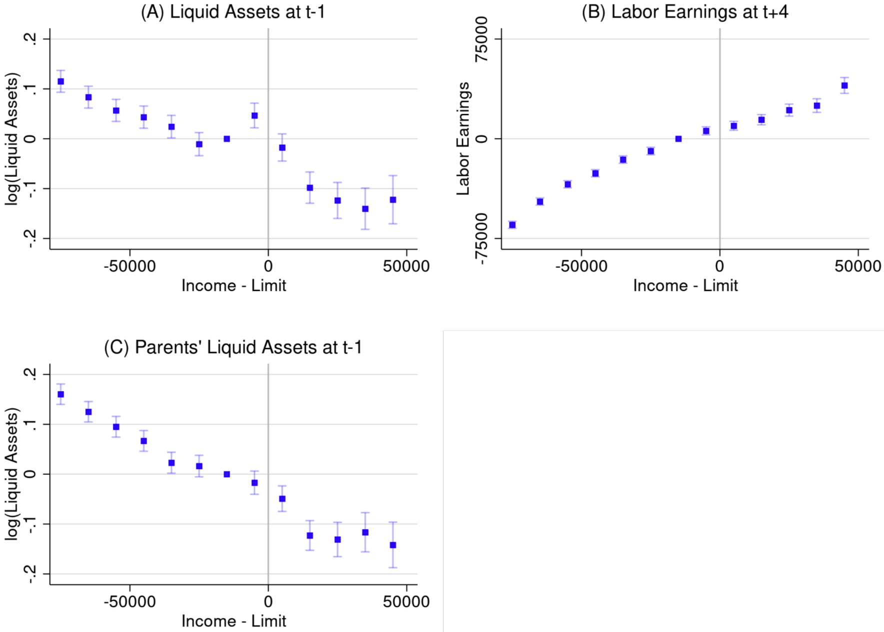
Heterogeneity

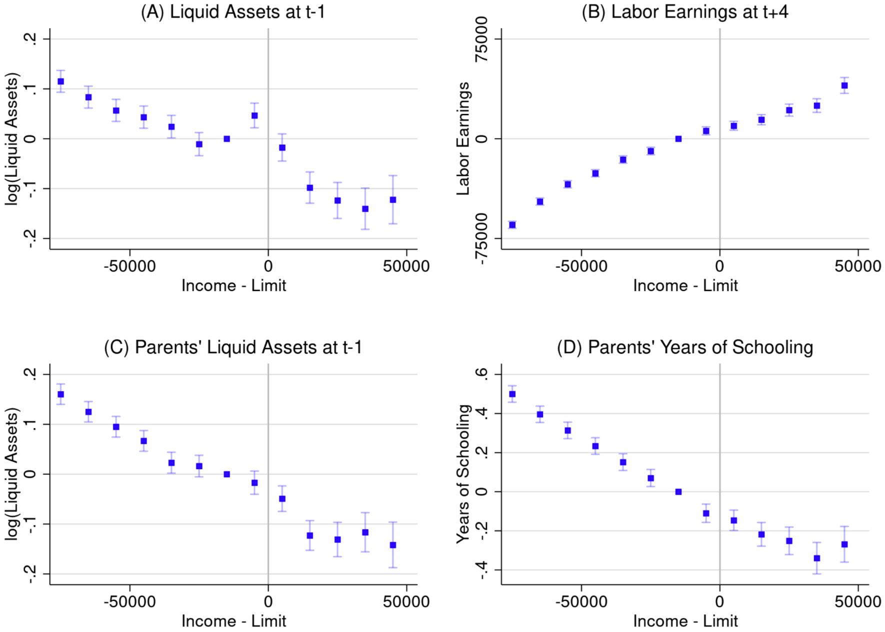
- Plot how student characteristics vary around the threshold
- Our hypothesis: financial frictions lowers responsiveness

  $\rightarrow$ bunchers should have more liquidity


(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

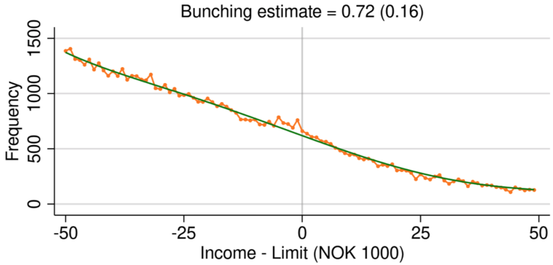

(A) Liquid Assets at t-1
log(Liquid Assets)
.2
.1
0
-.1
-.2
-50000
0
50000
Income - Limit
(B) Labor Earnings at t+4
Labor Earnings
75000
0
-75000
-50000
0
50000
Income - Limit
(C) Parents' Liquid Assets at t-1
log(Liquid Assets)
.2
.1
0
-.1
-.2
-50000
0
50000
Income - Limit


(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

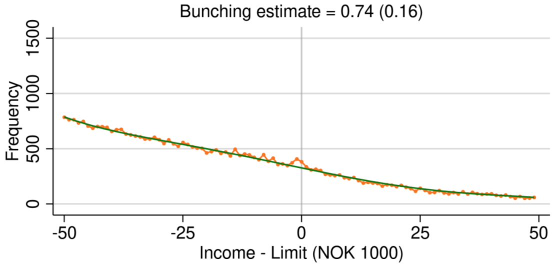
Split sample in 4 based on own and parental liquidity

- Expectation is that less-liquidity students bunch less

A: Parents below and student below median liquidity

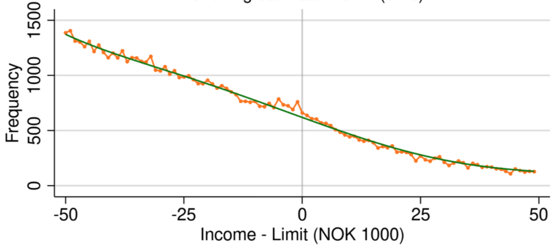


C: Parents below and **student above** median liquidity



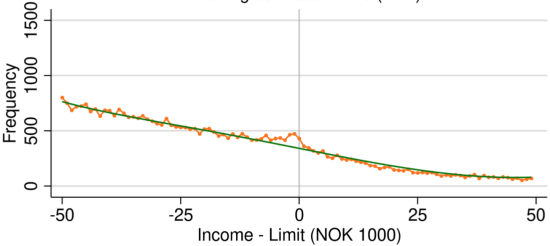
A: Parents below and student below median liquidity

Bunching estimate = 0.72 (0.16)



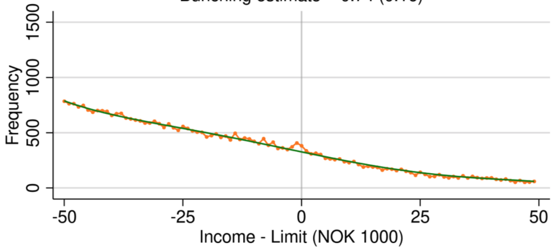
B: **Parents above** and student below median liquidity

Bunching estimate = 1.75 (0.22)



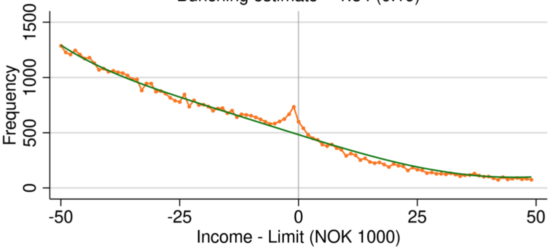
C: Parents below and **student above** median liquidity

Bunching estimate = 0.74 (0.16)



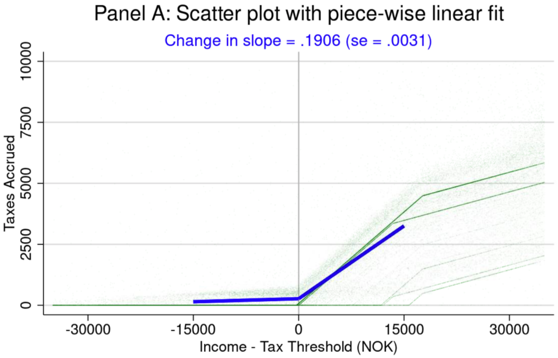
D: **Parents above** and **student above** median liquidity

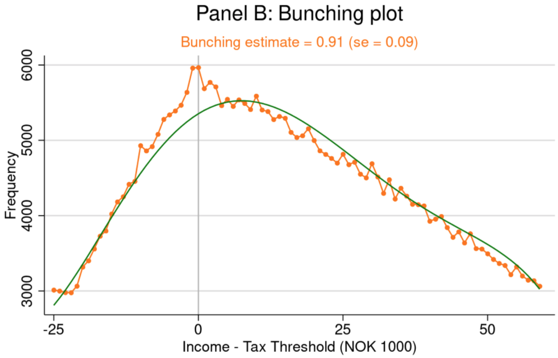
Bunching estimate = 1.84 (0.19)



Benchmark elasticity from students' responses to a regular tax kink

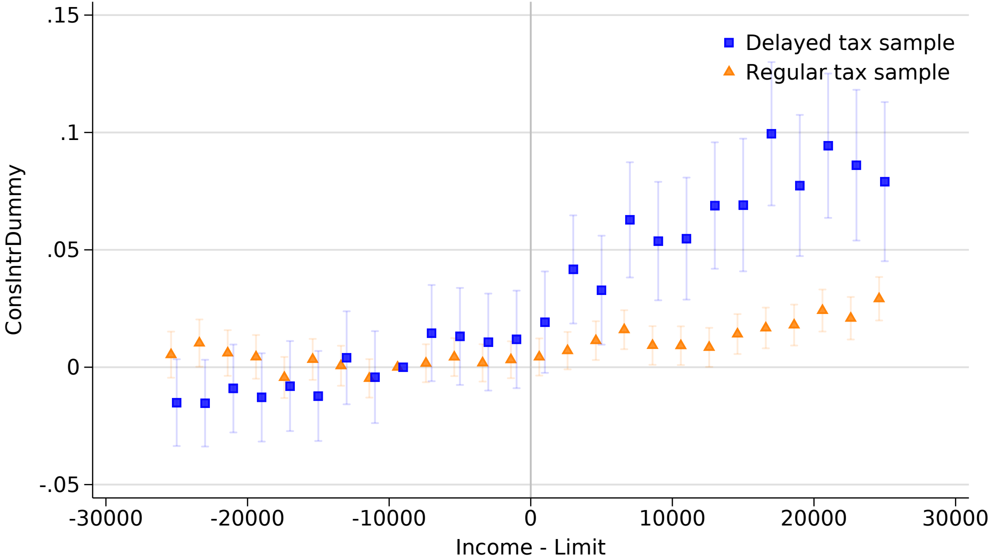
Comparison to responsiveness to ordinary tax kink



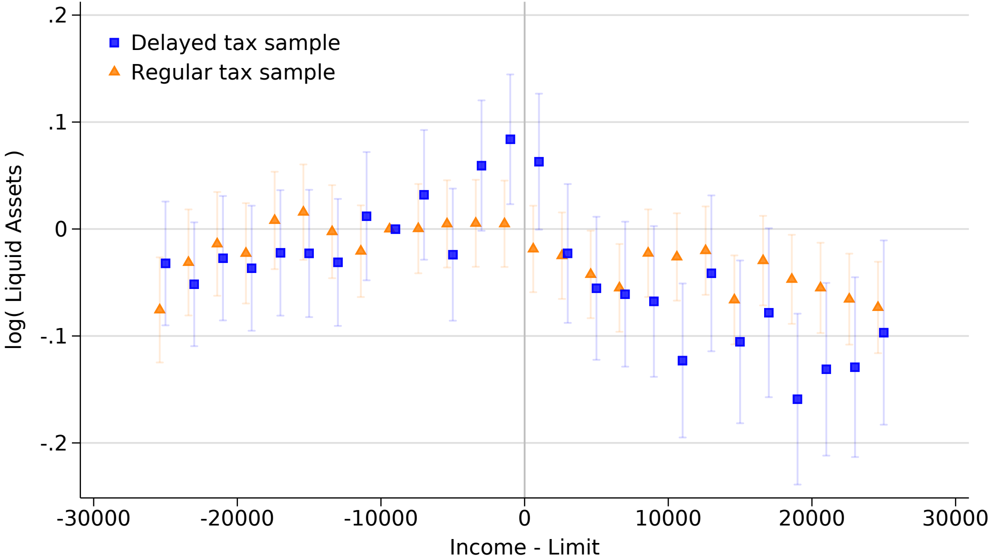


- Marginal income taxes first kick in at about 30,000-40,000 NOK (≈\$5,000)
- Implied elasticity $= \frac{0.91*/36.706}{19.06\%/100\%} = 0.13$
- about **8x larger** than elasticity from debt-conversion threshold (0.016)

P(unsecured borrowing) around the kink

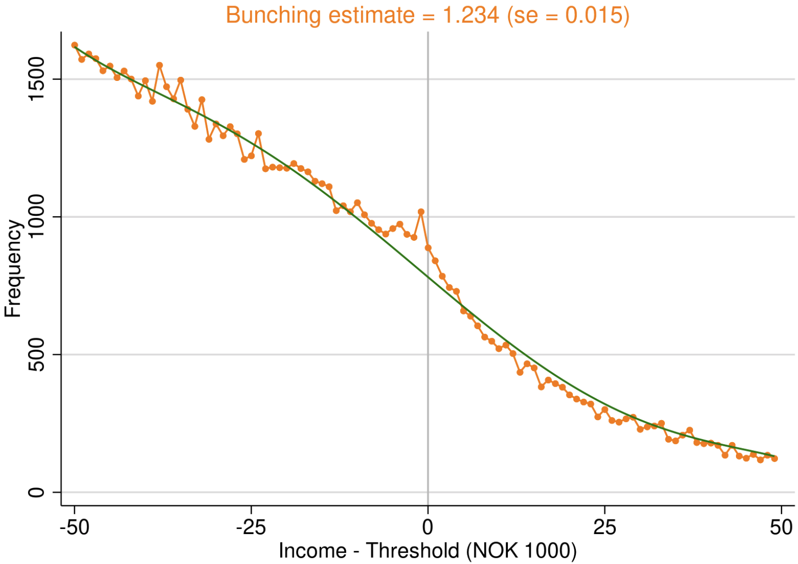


Liquid assets around the kink

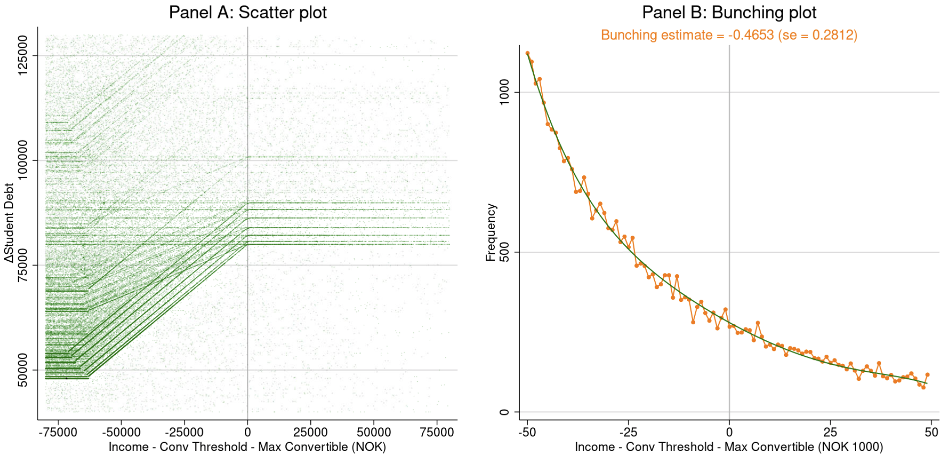


Appendix

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

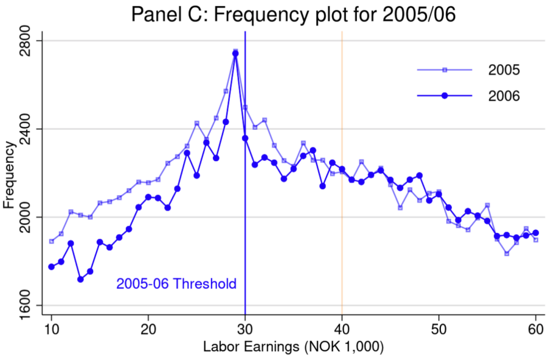


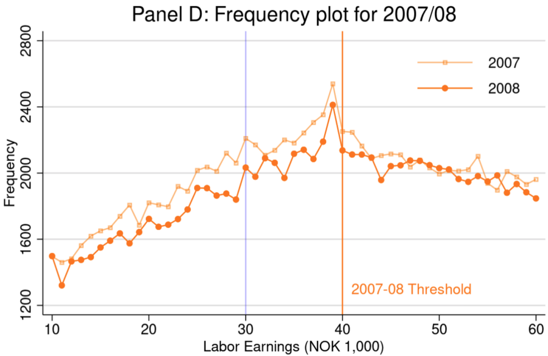
Also no response to the phase-out



- 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





Robust to adjusting for different characteristics across samples

A new approach (to literature *and* paper)

- Define individual-level elasticity as

$$\tilde{e}_i = \underbrace{\frac{1[y_i \in BR_s] - \hat{P}^{cf}(y_i \in BR_s)}{\hat{P}^{cf}(y_i \in BR_s)/N_s^{bins}}}_{\text{estimated } b_s} \cdot (\text{Bin width}_s/\text{Threshold}_s) \Big/ (\hat{d}\tau_s/(1-\tau_s)), \tag{4}$$

  - $\mathbb{E}[e_i | s = \text{delayed tax sample}] = 0.0155 \approx 0.0160$ 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 $\times$ 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 $\times$ NACE2