EC2106 PUBLIC ECONOMICS
LECTURE 5 - Labor income taxes

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Fall 2022

Taxes on Labor Earnings - Motivation

- Swedish government's revenue 2018: 2,111 billion SEK.
- Swedish GDP $= 4,834$ bSEK $\Rightarrow$ Gov't revenue $= 44$ % of GDP.
- Recall: Where are those revenues coming from?
  1. Labor income taxes $= 31$ %
  2. Indirect labor taxes $= 28$ % (payroll taxes, *arbetsgivaravgifter*)

  account for more than half of all gov't revenue.

- What is the total labor cost for paying you after-tax income of 20,000 SEK?
- Roughly speaking, you paid 30% in taxes $\rightarrow$ gross income $= 28,500$ SEK.
- But, employer also paid payroll taxes of 30% on gross-income, or $8,500$ SEK.
- Total cost $\approx 20000 + 8500 + 8500 = 37000$.
  - What would happen if gov't removed all taxes? Who benefits?

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Taxes on Labor Earnings in Sweden

- Swedish income tax is assessed **annually** and **individually based**. Used to be levied on **household** income (as in the US).
  - Household-based taxation not good for gender equality. Why?

1. Sum all annual labor income and taxable fringe benefits (cars / meals etc).
2. Subtract **deductions** from the sum.
3. Calculate income taxes due.
4. Subtract **tax credits** from taxes due. Most common: mortgage interest deductions; ROT; RUT.

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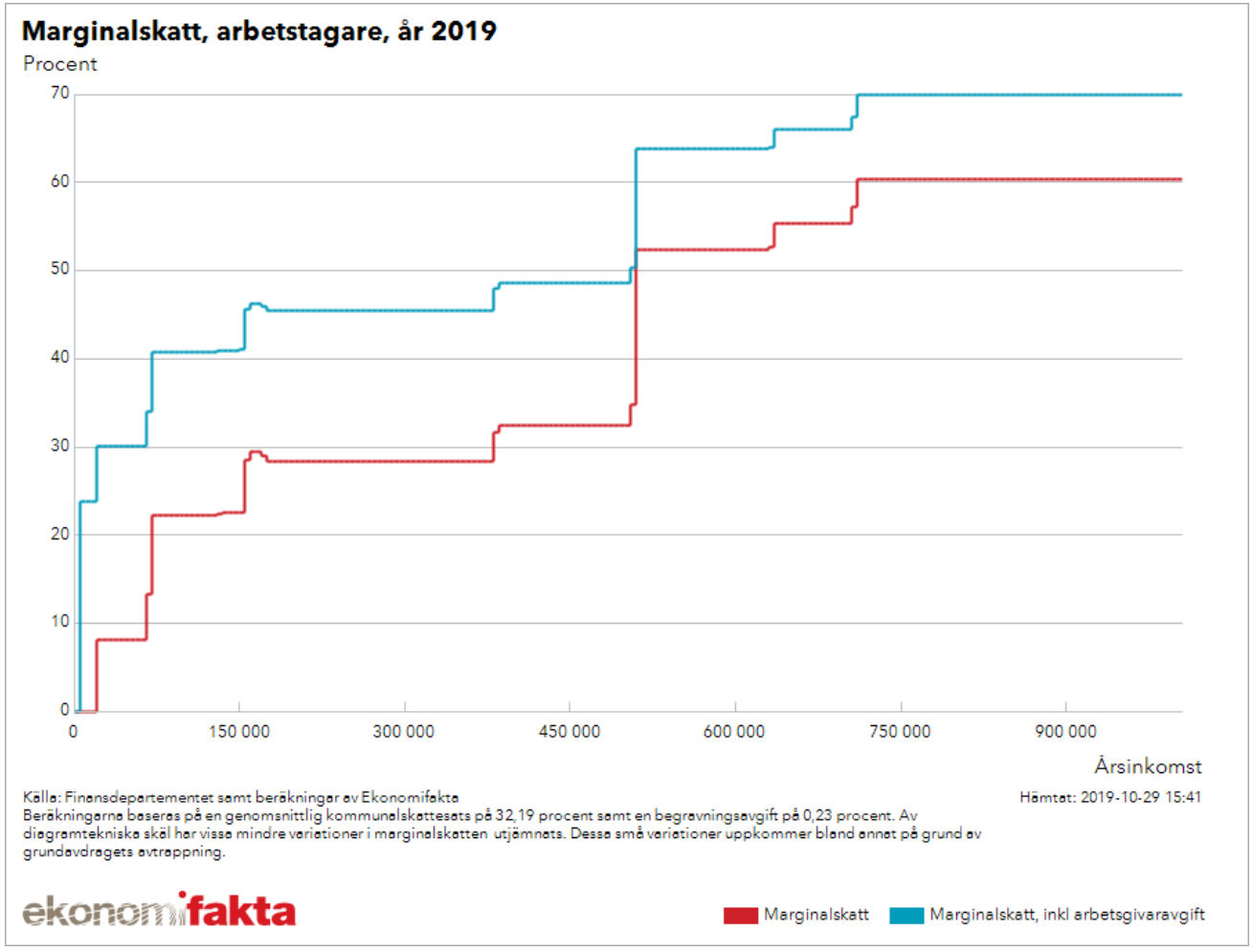
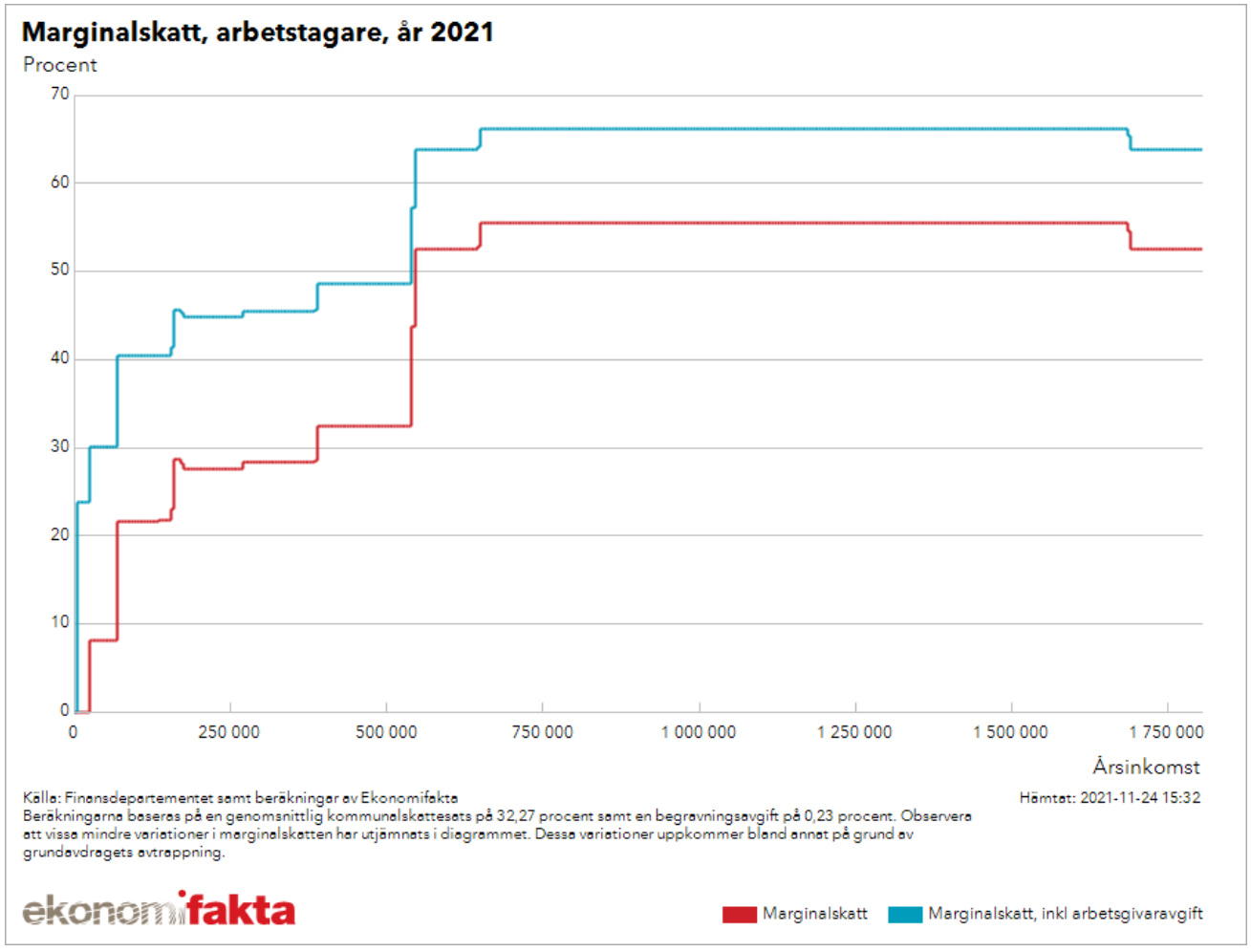
Swedish Income Tax 2019

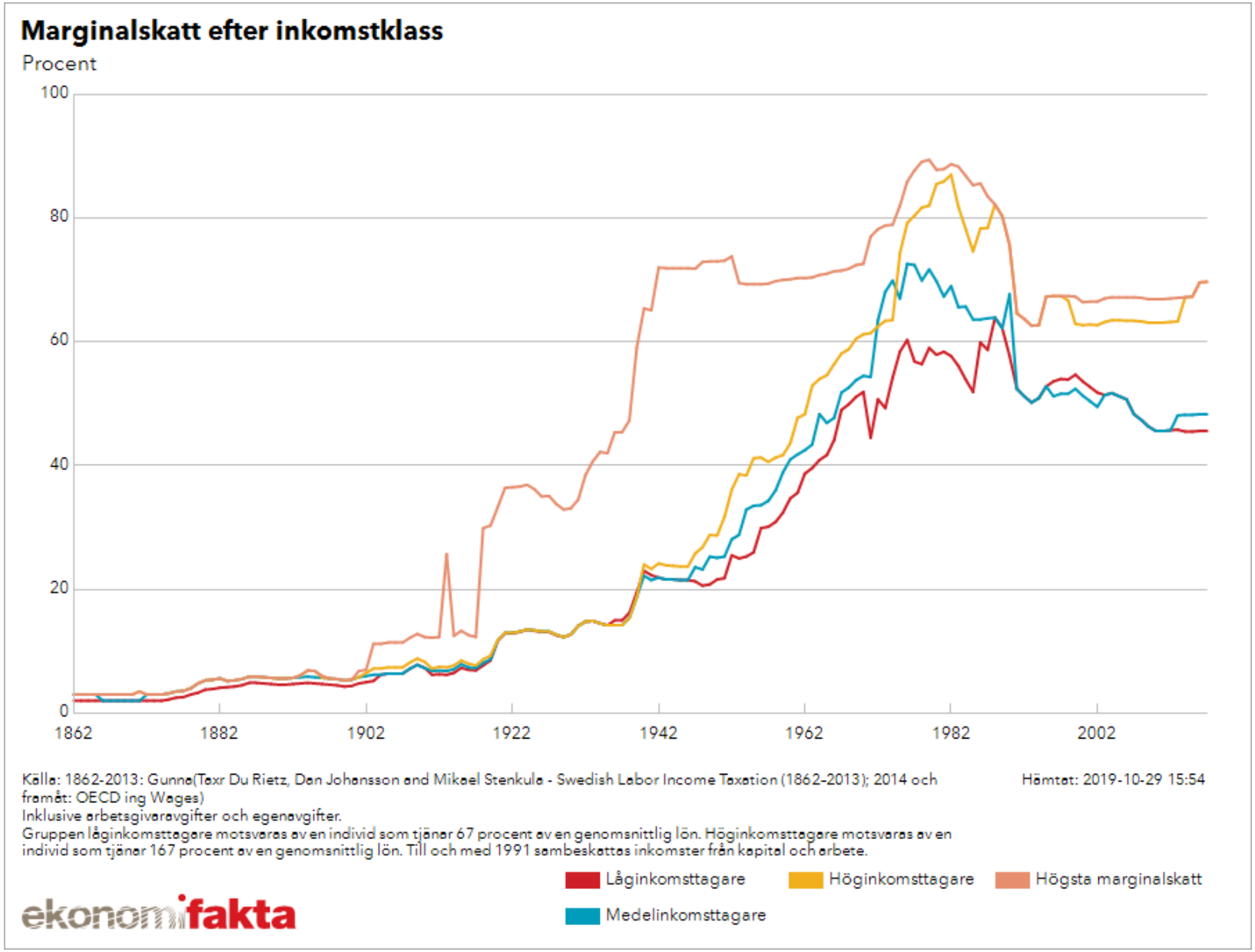


- *Värnskatten* is the last marginal-tax-rate jump. **Was removed as of Jan 1 2020, by left-center-deal.**

Swedish Income Tax

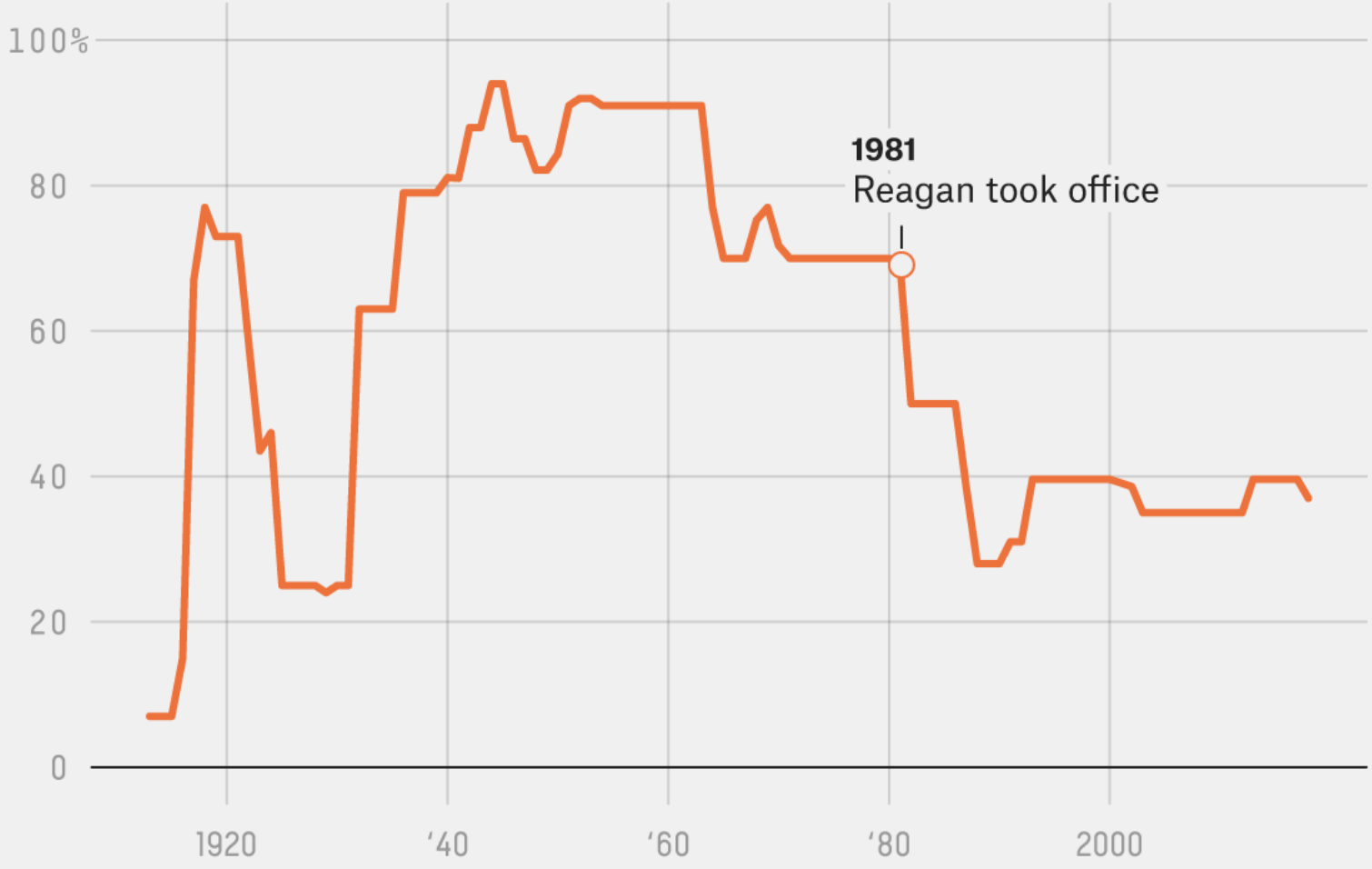


Swedish Income Tax Historically



Historically, a 70 percent marginal tax rate is not unusual

The top marginal income tax rates from 1913 to 2018



FiveThirtyEight

SOURCE: TAX POLICY CENTER

Poll time

- www.menti.com

Labor Supply Theory

Basis for understanding how tax changes affect individual's behavior.

Key for finance minister when thinking about how to change the income tax.

- Individual has utility over labor supply l and consumption c: $u(c, l)$ **increasing** in c and **decreasing** in l [= increasing in leisure]

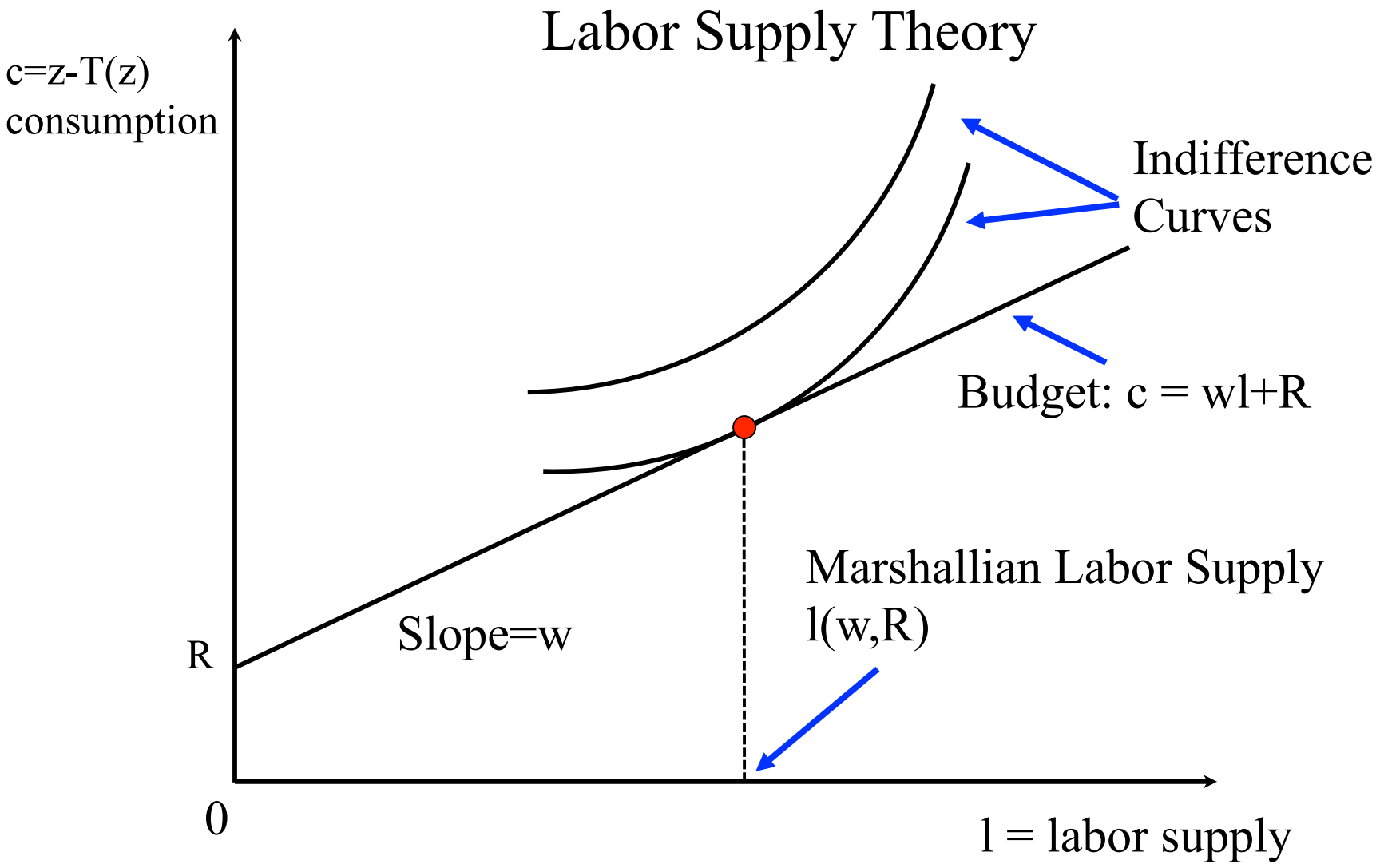
$$\max_{c,l} u(c, l) \quad \text{subject to} \quad c = w \cdot l + R$$

with $w = \bar{w} \cdot (1 - \tau)$ the net-of-tax wage ($\bar{w}$ is before tax wage rate and τ is tax rate), and R non-labor income.

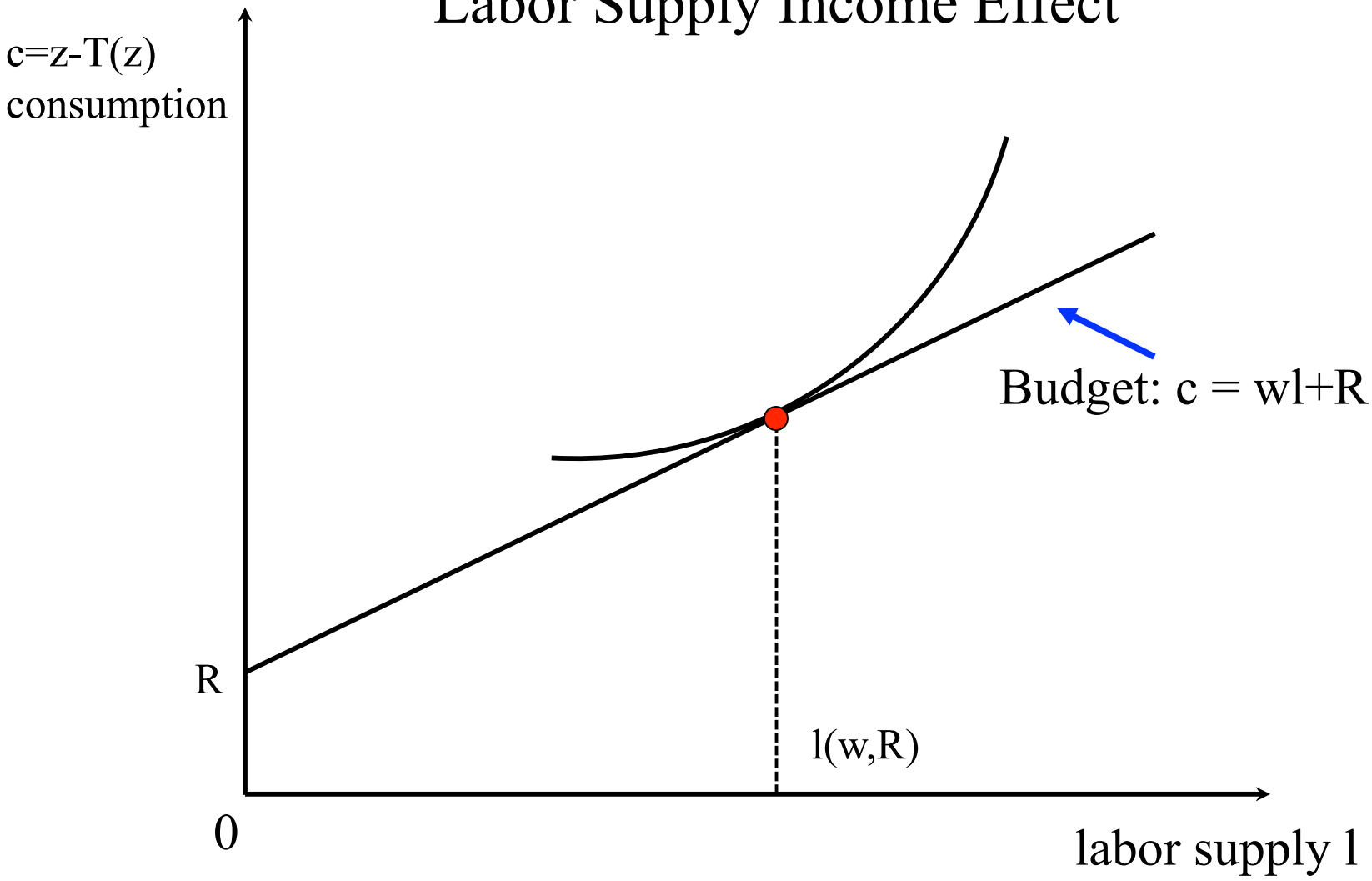
- FOC $w\frac{\partial u}{\partial c} + \frac{\partial u}{\partial l} = 0$ defines Marshallian labor supply $l = l(w, R)$.

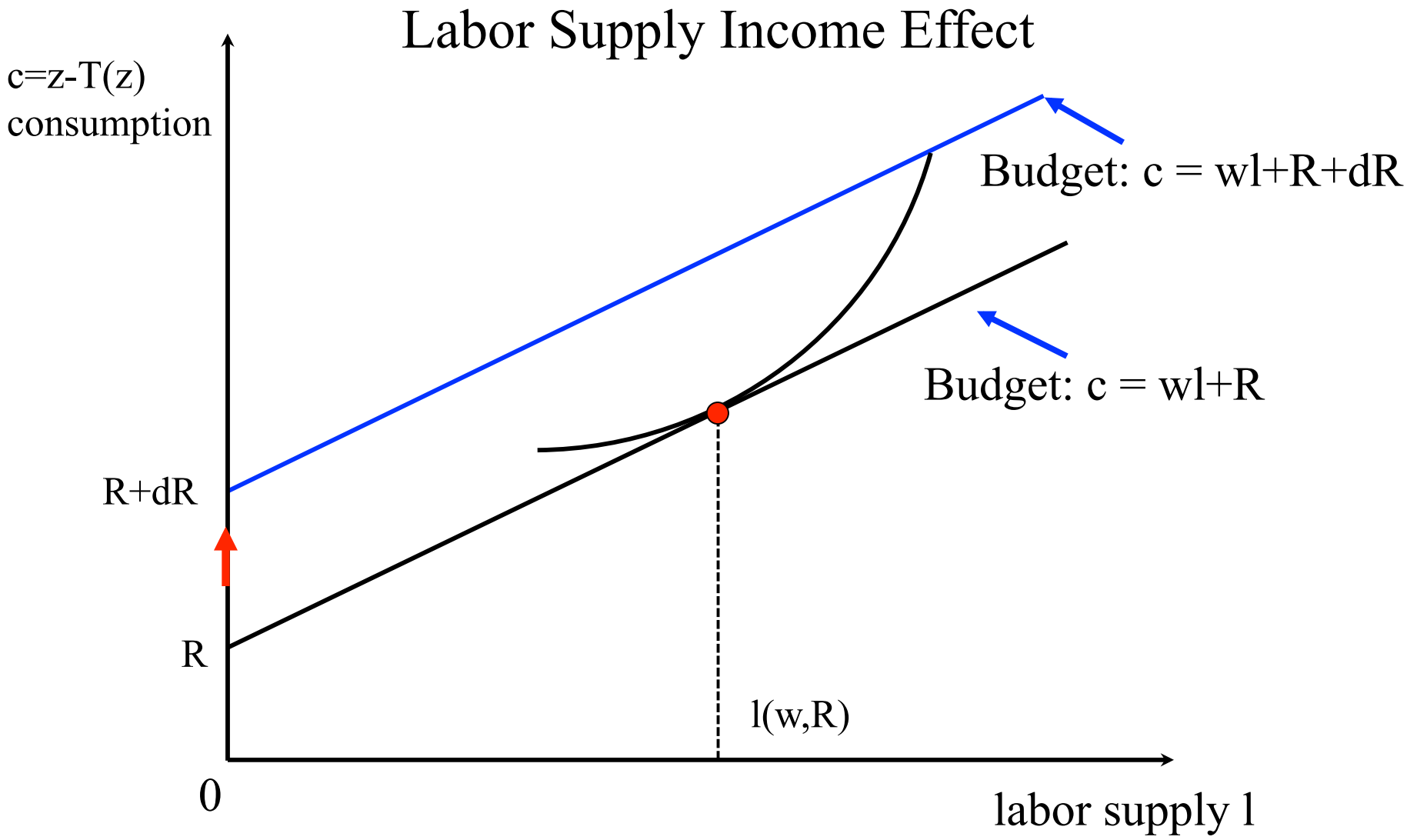
- **Uncompensated labor supply elasticity:** $\varepsilon^u = \frac{w}{l} \cdot \frac{\partial l}{\partial w}$

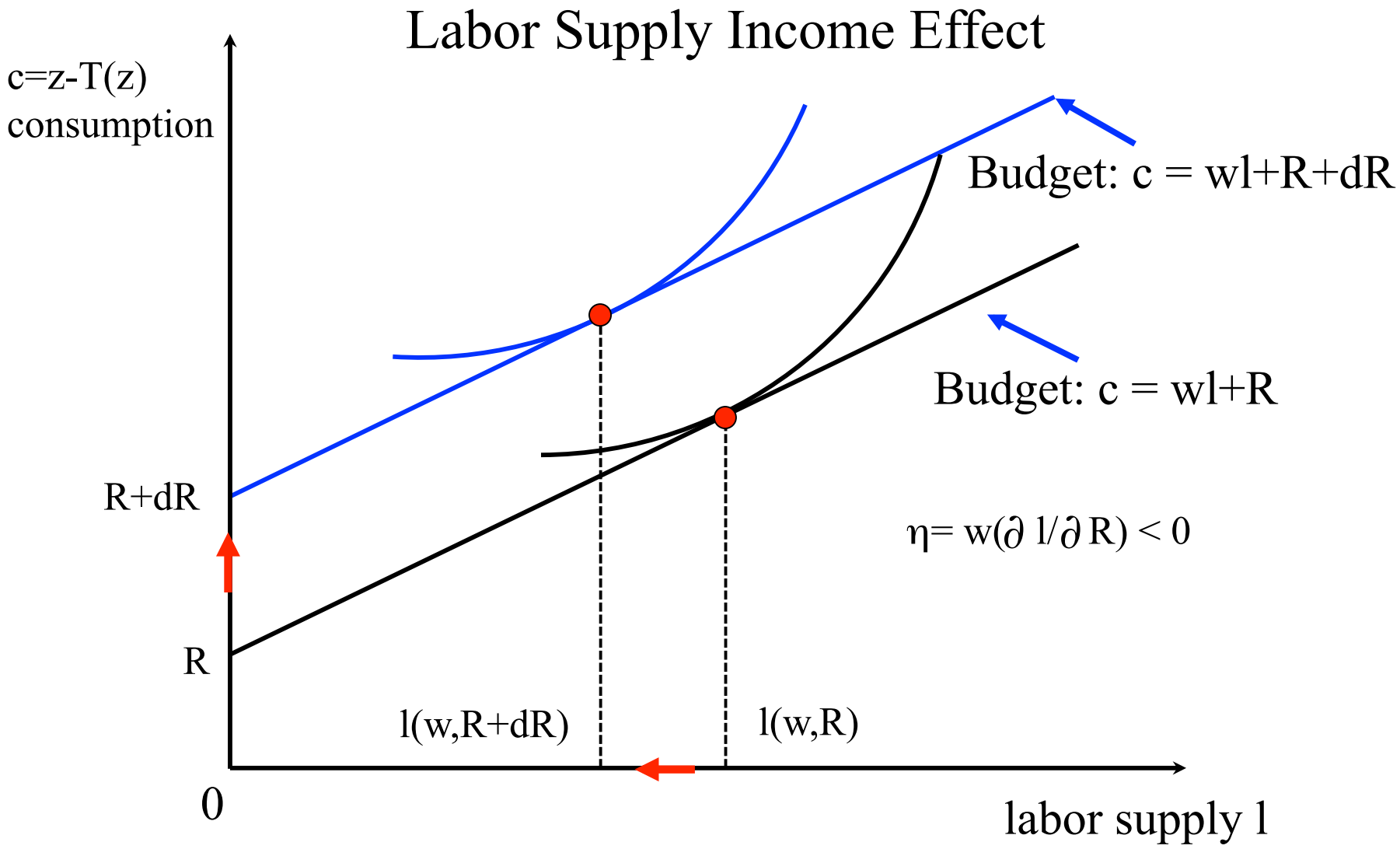
- **Income effects:** $\eta = w\frac{\partial l}{\partial R} \leq 0$ (if leisure is a normal good)

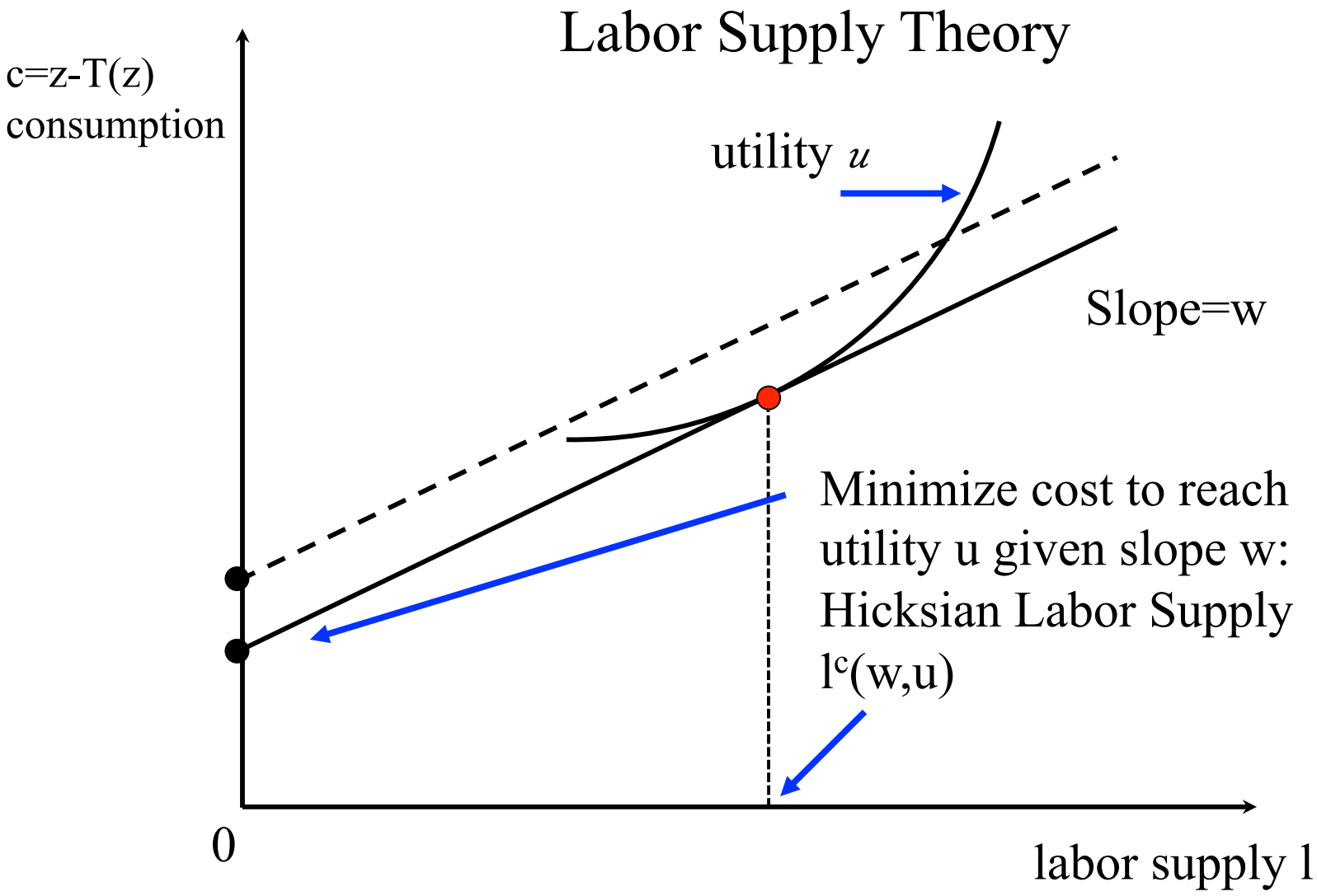

Labor Supply Theory
c=z-T(z)
consumption
Indifference
Curves
Budget: c = wl+R
Marshallian Labor Supply
l(w,R)
Slope=w
R
0
l = labor supply

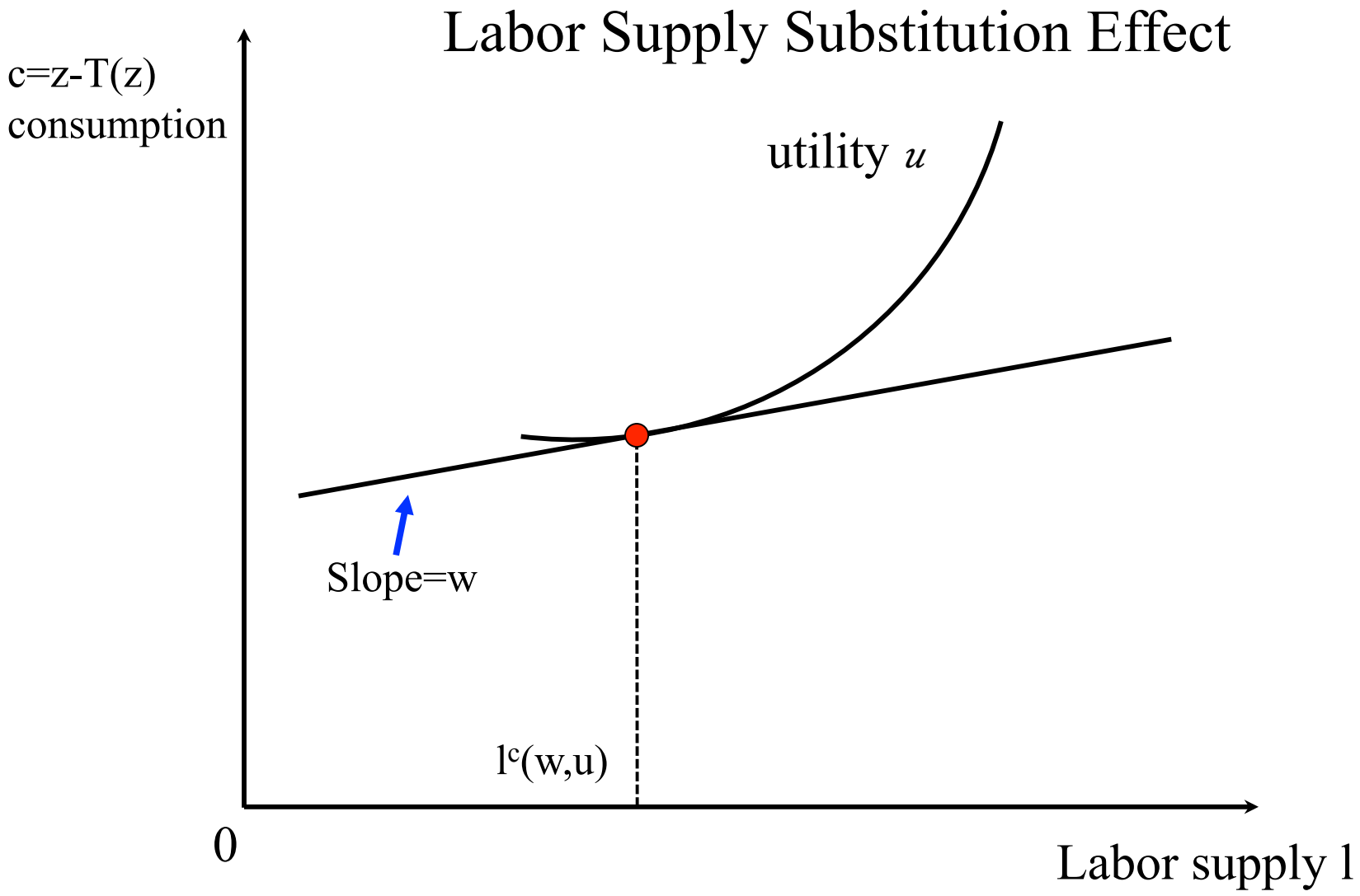
Labor Supply Income Effect

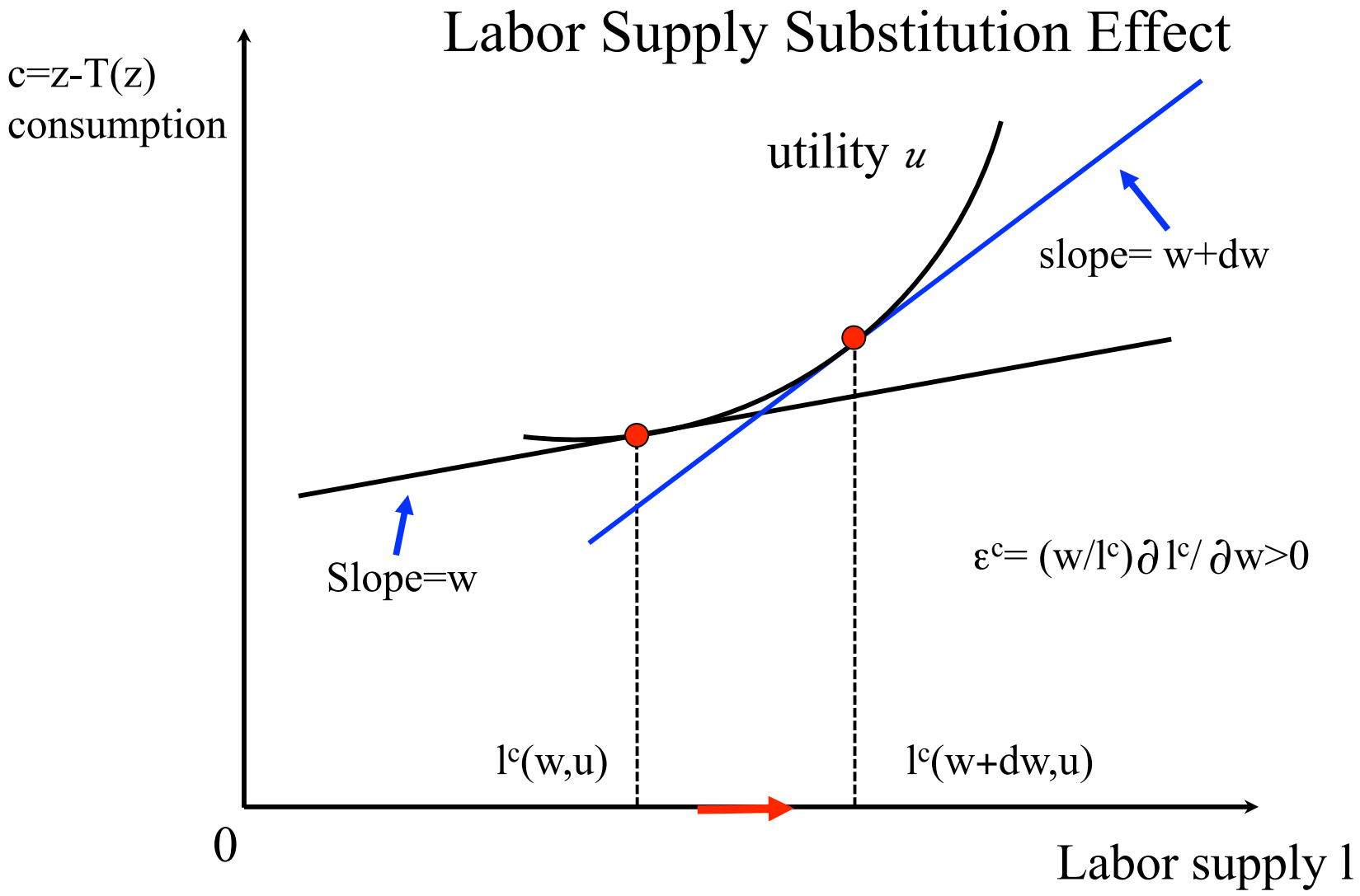



Labor Supply Income Effect
c=z-T(z)
consumption
Budget: c = wl+R+dR
Budget: c = wl+R
R+dR
R
l(w,R)
0
labor supply l


Labor Supply Income Effect
c=z-T(z)
consumption
Budget: c = wl+R+dR
Budget: c = wl+R
R+dR
η= w(∂ l/∂ R) < 0
R
l(w,R+dR)
l(w,R)
0
labor supply l


Labor Supply Theory
c=z-T(z)
consumption
utility u
Slope=w
Minimize cost to reach
utility u given slope w:
Hicksian Labor Supply
l^c(w,u)
0
labor supply l


Labor Supply Substitution Effect
c=z-T(z)
consumption
utility u
Slope=w
l^c(w,u)
0
Labor supply l


Labor Supply Substitution Effect
c=z-T(z)
consumption
utility u
slope= w+dw
Slope=w
$\varepsilon^c = (w/l^c)\partial l^c/\partial w > 0$
$l^c(w,u)$
$l^c(w+dw,u)$
0
Labor supply l

Labor Supply Theory

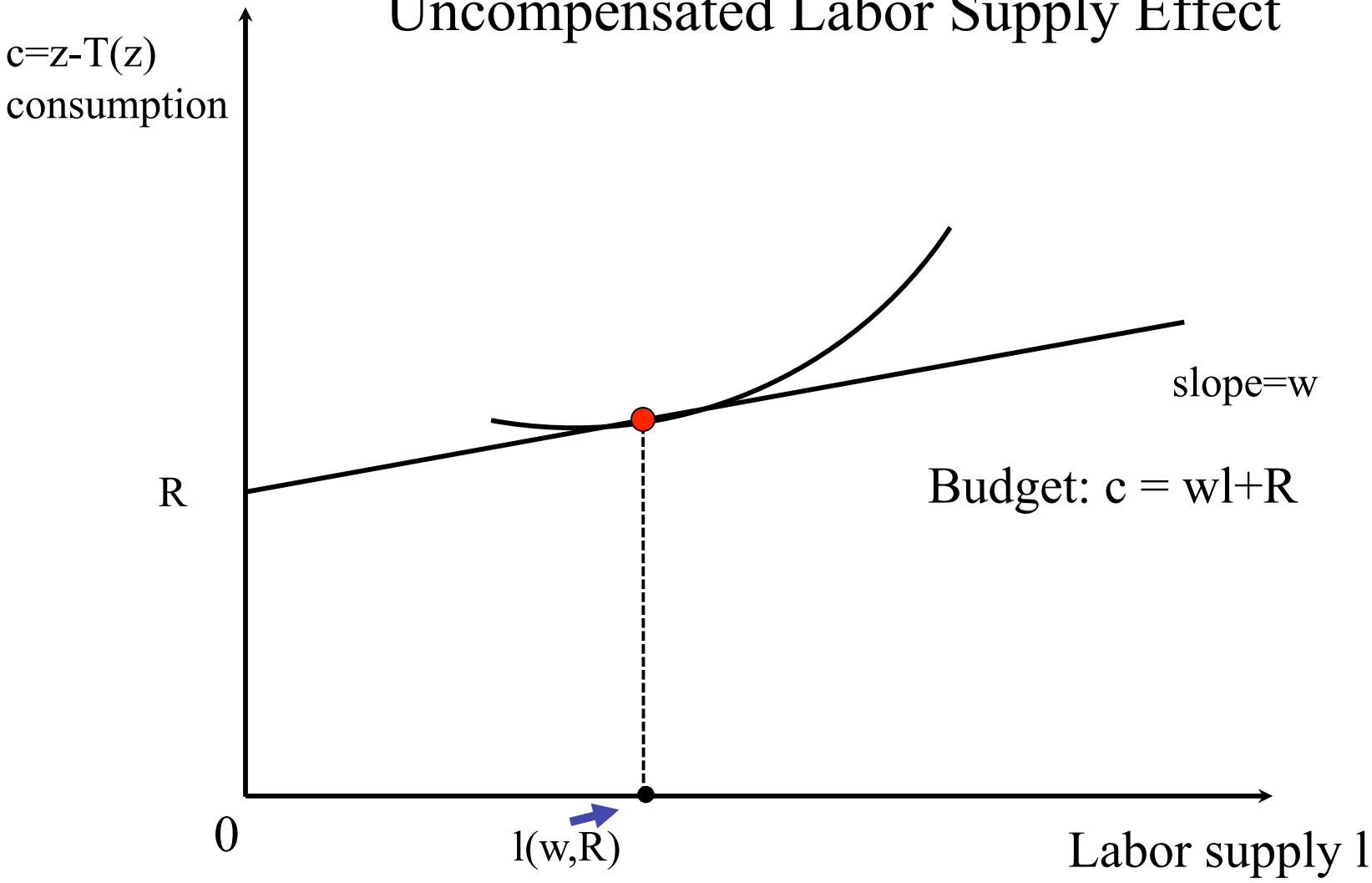
- **Substitution effects:** Hicksian labor supply: $l^c(w, u)$ minimizes cost needed to reach u given slope $w \Rightarrow$

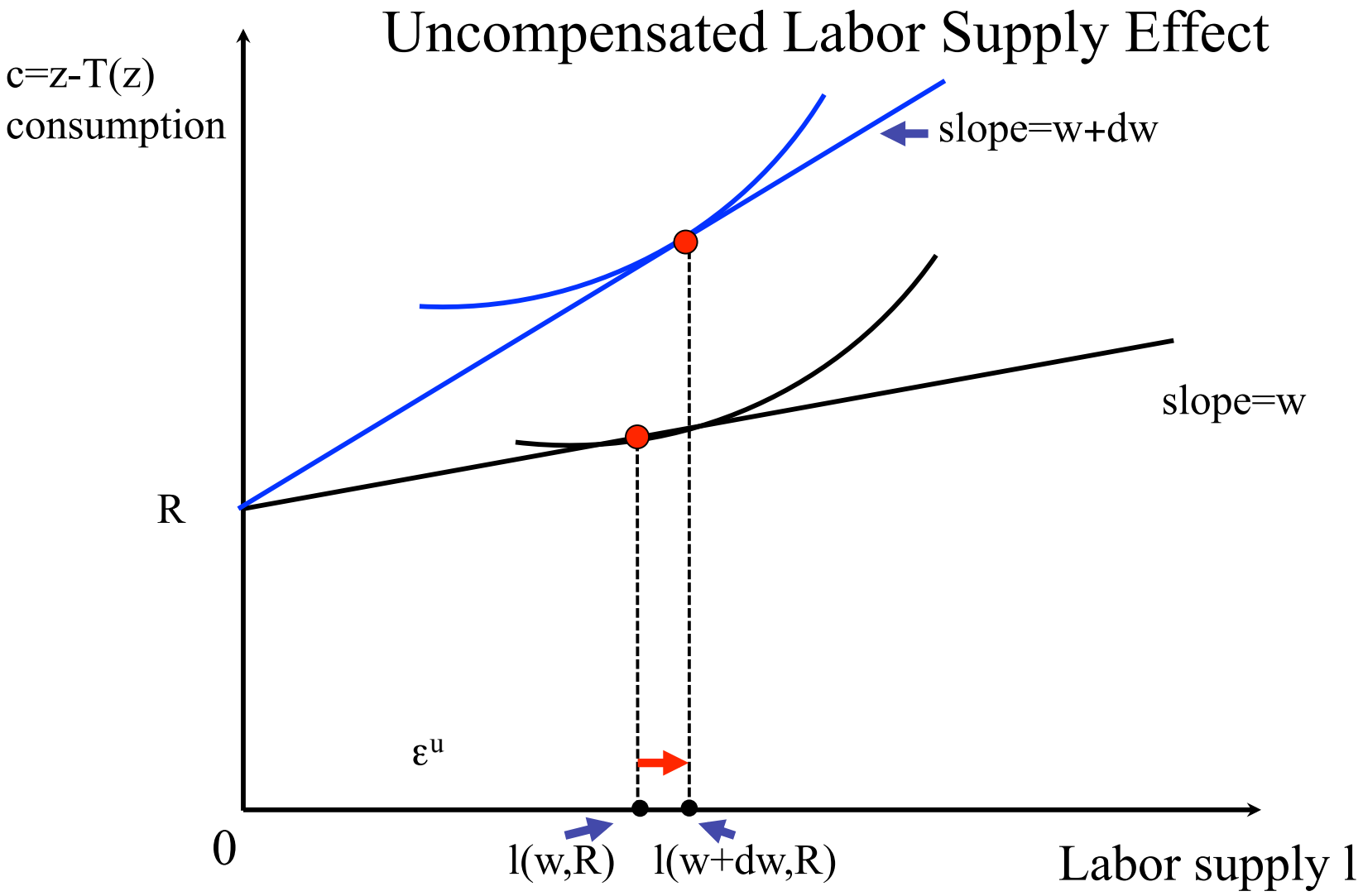
$$\text{Compensated elasticity} \quad \varepsilon^c = \frac{w}{l} \cdot \frac{\partial l^c}{\partial w} > 0$$

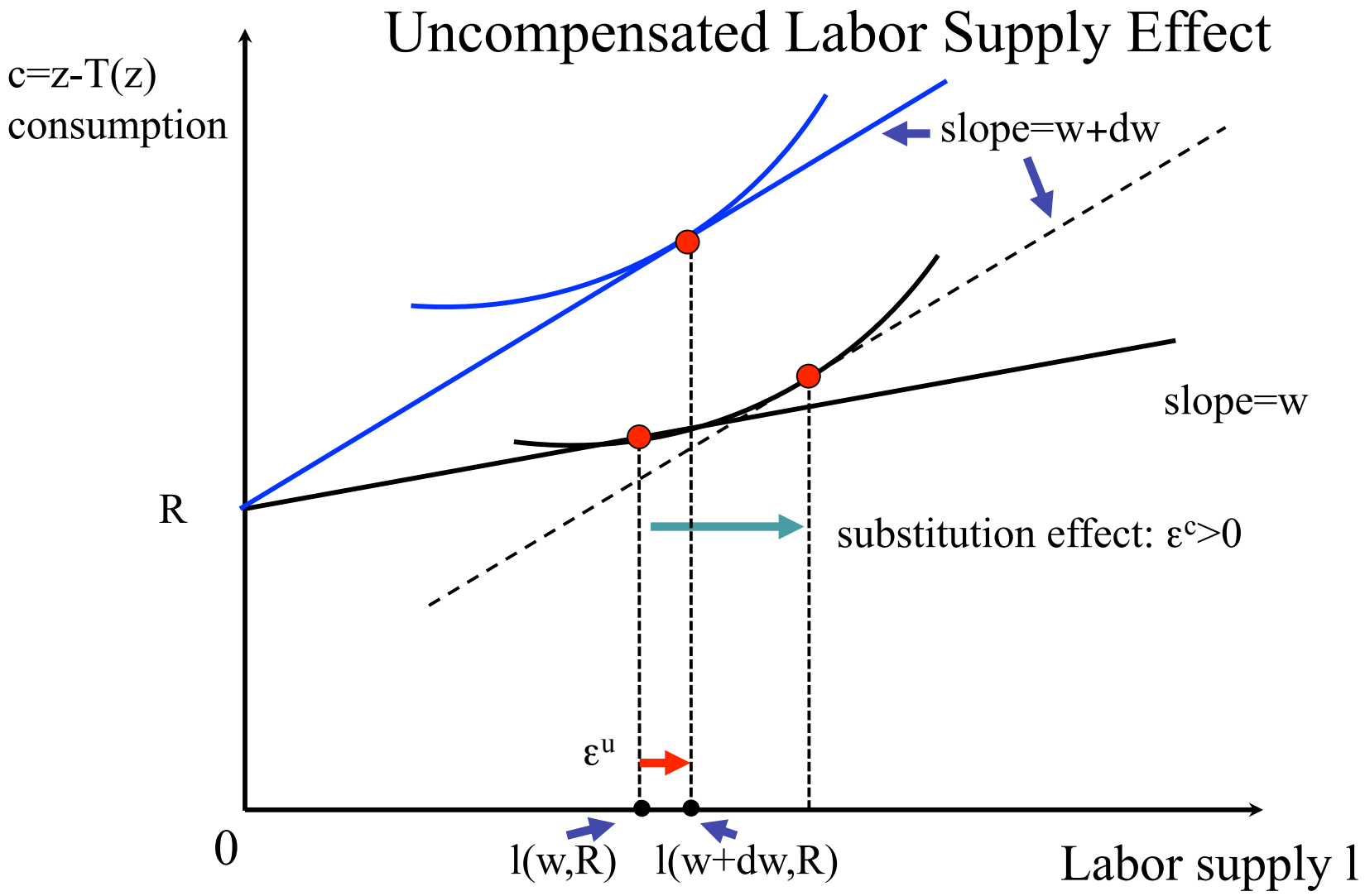
$$\text{Slutsky equation} \quad \frac{\partial l}{\partial w} = \frac{\partial l^c}{\partial w} + l\frac{\partial l}{\partial R} \Rightarrow \varepsilon^u = \varepsilon^c + \eta$$

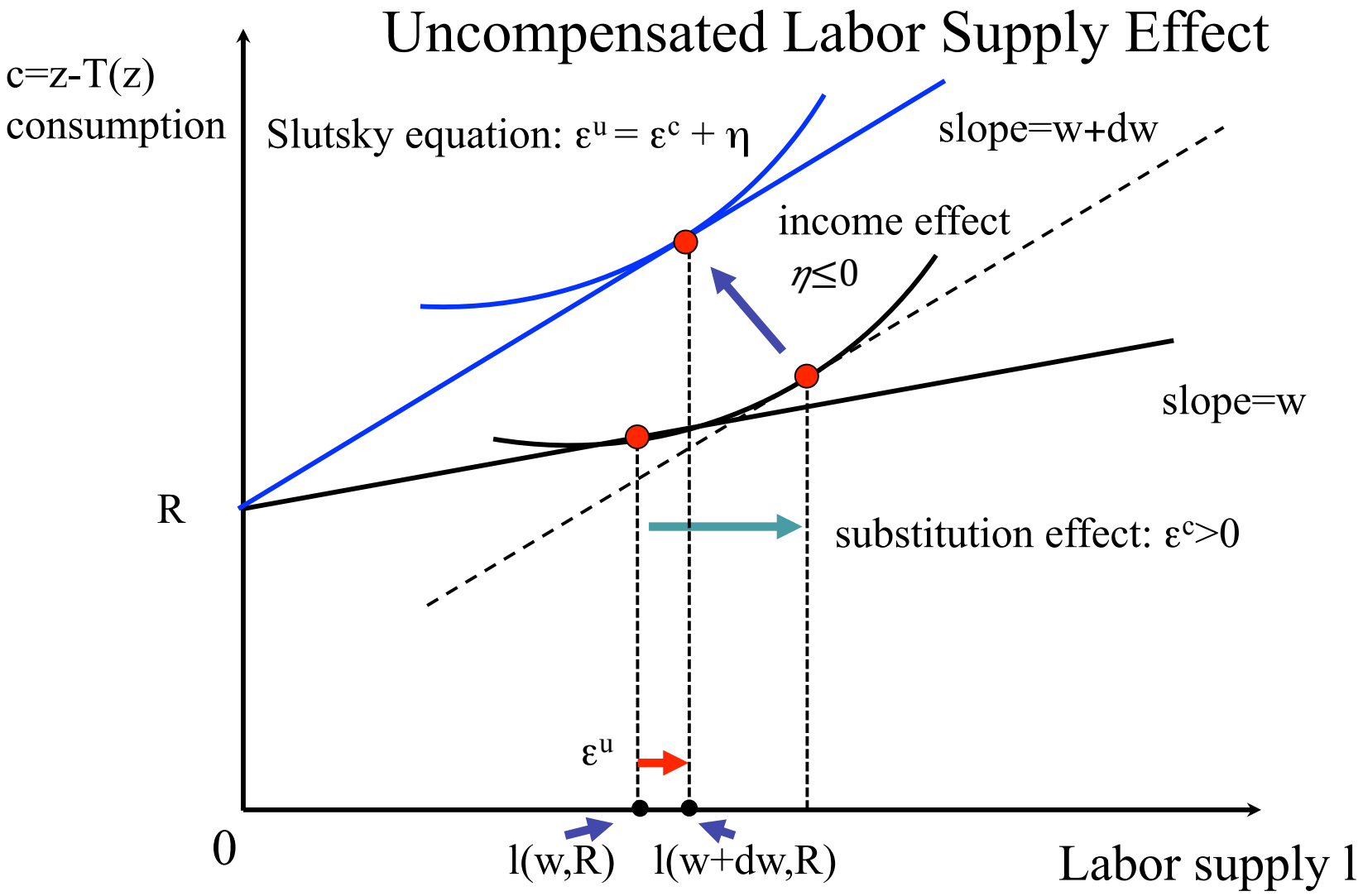
- Tax rate τ discourages work through **substitution effects** (work pays less at the margin)
- Tax rate τ encourages work through **income effects** (taxes make you poorer and hence in more need of income)
- Net effect **ambiguous** (captured by sign of ε^u)

Uncompensated Labor Supply Effect




Uncompensated Labor Supply Effect
c=z-T(z)
consumption
slope=w+dw
slope=w
R
ε^u
0
l(w,R)
l(w+dw,R)
Labor supply l


Uncompensated Labor Supply Effect
c=z-T(z)
consumption
slope=w+dw
slope=w
R
substitution effect: ε^c>0
ε^u
0
l(w,R)
l(w+dw,R)
Labor supply l


Uncompensated Labor Supply Effect
c=z-T(z)
consumption
Slutsky equation: $\varepsilon^u = \varepsilon^c + \eta$
slope=w+dw
income effect
$\eta \leq 0$
slope=w
R
substitution effect: $\varepsilon^c > 0$
ε^u
0
l(w,R)
l(w+dw,R)
Labor supply l

Income Effects and Labor Supply

1. **What would happen if we raise the income tax by 1 %?**
2. Should we give cash assistance to working poor?
3. Should we decrease the tax on pension income?
4. Should we increase the property tax?

The answer depends on the **income effect** or how a wealth shock influences willingness to work.

1. and 3. also have a **substitution effects**.

Income Effects and Labor Supply

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Poll time

- www.menti.com
- Code:

How can we empirically estimate income shocks?

- Ideally: **drop money randomly on individuals**.
- Cesarini et al (2017): Use data from lottery-based savings accounts in Sweden.
- Advantage of lotteries: random experiment.
- Disadvantages of lotteries:
  - External validity: specific group of the population play.
  - Mental accounting: use of a 1 million lottery gain is not the same as an unexpected gift of 1 million.

  $\Rightarrow$ Can we really use these estimates to judge the income-effect-component in tax reforms?
- Sample here is very similar to average population.
  - Not overly represented by risk-loving characteristics, such as young men.
- Alternative: use inheritances as income shocks.

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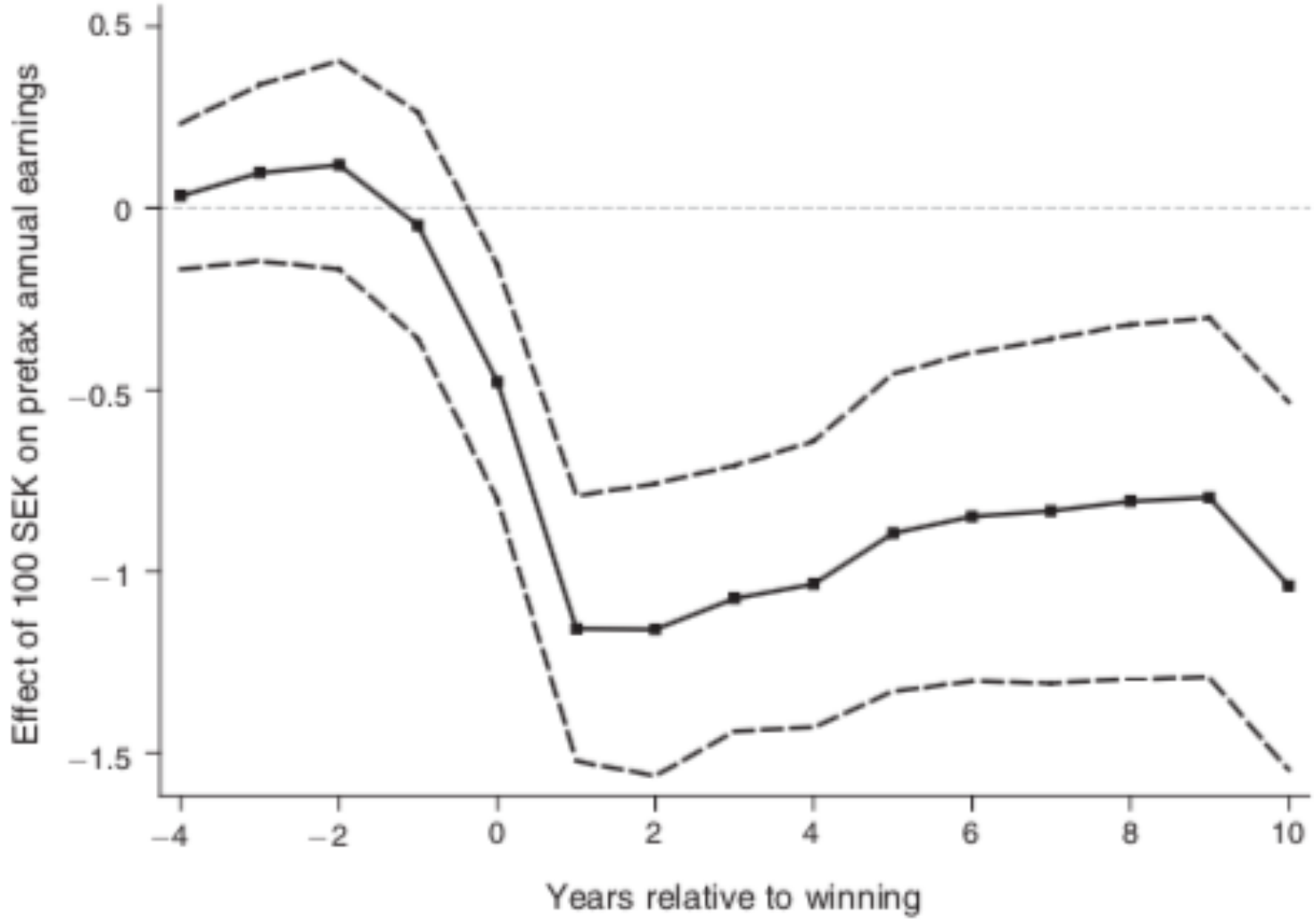

Effect of 100 SEK on pretax annual earnings
0.5
0
−0.5
−1
−1.5
−4
−2
0
2
4
6
8
10
Years relative to winning

Uncompensated Elasticity?

- Winning 1 mSEK $\Rightarrow$ Reduction in earnings of around 11 kSEK per year (around 5.5% of annual earnings).

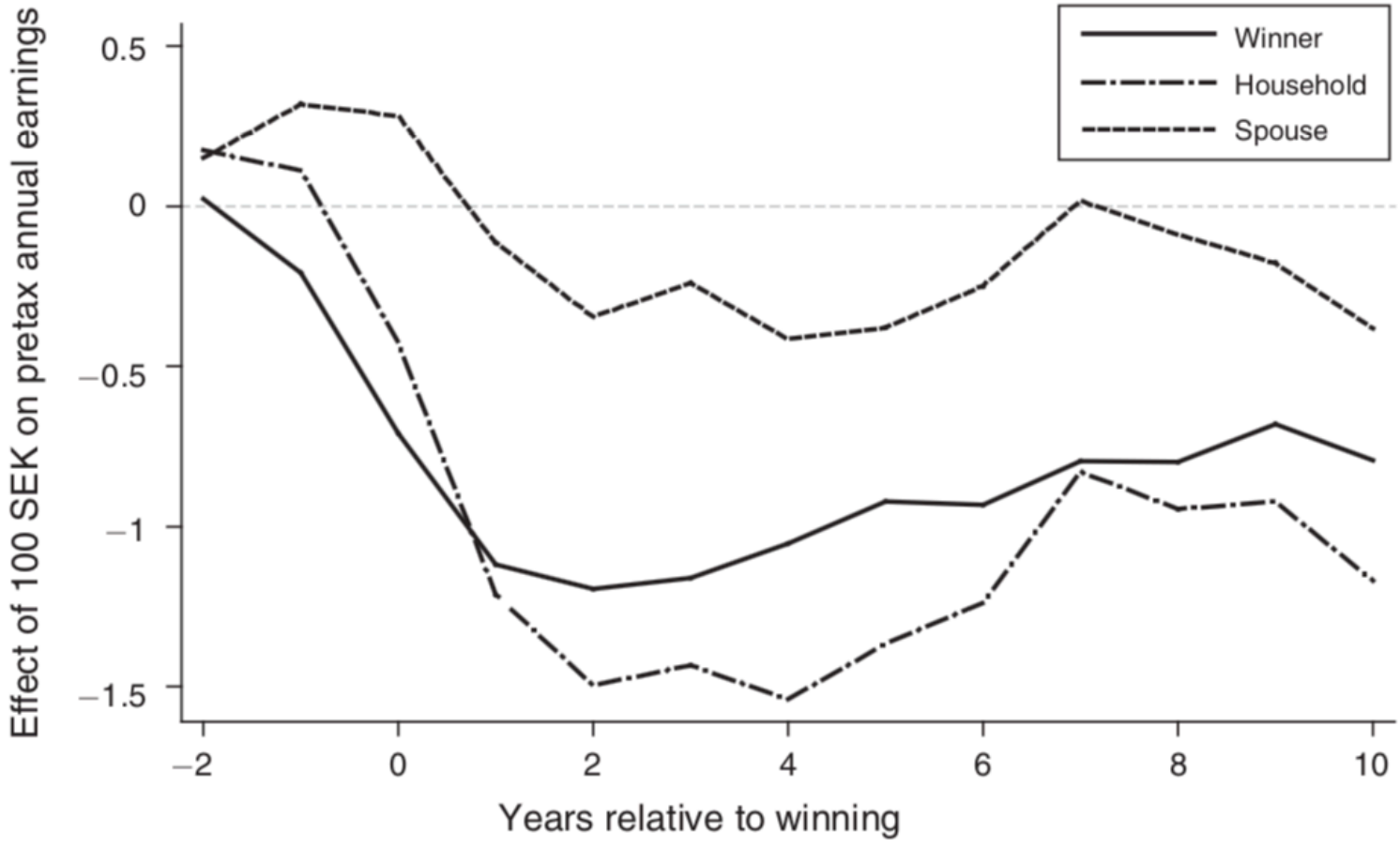
- This is about the same magnitude as the **compensated** tax elasticity.

  $\Rightarrow$ RAISING TAXES BY 1% $\rightarrow$ **NO EFFECT** ON LABOR SUPPLY.

- Why? It reduces labor supply through the compensated elasticity by around 5% (leisure has become relatively cheaper compared to consumption goods) but increases labor supply through the income effect by 5.5% (agent is poorer).

- **The effects cancel out!**

- NB! Should interpret this cautiously.


Winner
Household
Spouse
Effect of 100 SEK on pretax annual earnings
0.5
0
−0.5
−1
−1.5
−2
0
2
4
6
8
10
Years relative to winning

Optimal linear tax rate: Laffer curve

- Q: **What is the tax rate that maximizes revenue?**

  Normative question.

- Budget constraint:

$$c = (1 - \tau) \cdot z + R$$

  where $\tau =$ **linear** tax rate; $R =$ fixed transfer funded by taxes ($R = \tau \cdot Z$ with $Z =$ average earnings).

- Individual $i = 1, .., N$ chooses l_i to max $u^i((1 - \tau) \cdot w_i l_i + R, l_i)$

- Labor supply choices l_i determine individual earnings $z_i = w_i l_i$

  $\Rightarrow$ Average earnings $Z = \sum_i z_i / N$ depends (positively) on net-of-tax rate $1 - \tau$.

- **Laffer curve:** Tax Revenue per person $R(\tau) = \tau \cdot Z(1 - \tau)$ is inversely U-shaped with τ:
  1. $R(\tau = 0) = 0$ (no taxes) and
  2. $R(\tau = 1) = 0$ (nobody works).

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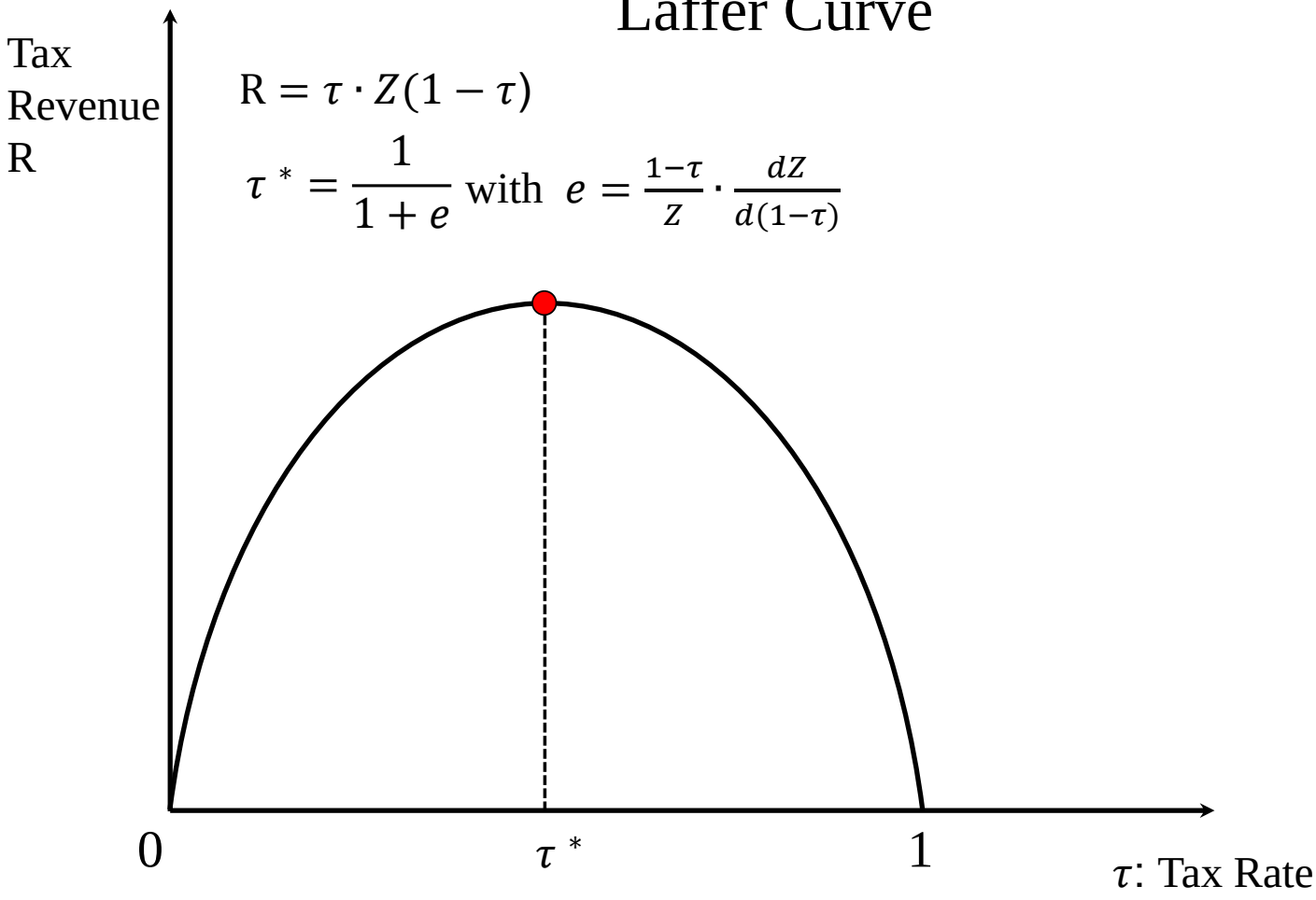
Laffer Curve



Optimal linear tax rate: Laffer curve

- Top of the Laffer Curve, τ^*, **maximizes** tax revenue:

$$0 = R'(\tau^*) = Z - \tau^* \frac{dZ}{d(1-\tau)} \Rightarrow \frac{\tau^*}{1-\tau^*} \cdot \frac{1-\tau^*}{Z} \frac{dZ}{d(1-\tau)} = 1$$

  Rearrange to get the revenue-maximizing tax rate:

$$\tau^* = \frac{1}{1+e} \text{ with } e = \frac{1-\tau}{Z} \frac{dZ}{d(1-\tau)}.$$

- e is the elasticity of average income Z with respect to the net-of-tax rate $1-\tau$ [empirically estimable]

- Inefficient to have $\tau > \tau^*$: decreasing τ makes taxpayers better off (they pay less taxes) and increases gov't's tax revenue [and hence univ. transfer R]

- If government is **Rawlsian** (maximizes welfare of the worst-off person), then $\tau^* = 1/(1+e)$ is optimal to make transfer $R(\tau)$ as large as possible.

Taking the theory to data

- **Goal:** Estimate the elasticity, e.

Q: **Why?**

A: If we know e, we would know

(i) how gov't revenue changes with the tax rate.

(ii) revenue-maximizing tax rate.

Q: **How?**

- Data and variation in **labor supply**, **tax rates**.
- Data on hours worked, wages, non-labor income available in surveys (e.g. LNU).

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Taking the theory to data

- Simple ordinary-least-squares (OLS) regression:

$$l_i = \alpha + \beta w_i + \gamma R_i + X_i \delta + \varepsilon_i$$

l_i: measure of labor supply (e.g. hours worked)

w_i: net-of-tax wage (take-home wage)

Key parameter: β: uncompensated wage effect, similar to ε^u.

R_i: non-labor income (transfers, or spouse's earnings)

γ: income effect

X_i: control variables (age, tenure etc)

Omitted variable bias

- Simple ordinary-least-squares (OLS) regression:

$$l_i = \alpha + \beta w_i + \gamma R_i + X_i \delta + \varepsilon_i$$

Key parameter: β: uncompensated wage effect, similar to ε^u.

- **Key problem:**
- Underlying, confounding differences between individuals that influence both l_i and w_i.
- Example: individuals have different skills. Higher skills $\Rightarrow l_i \uparrow$ and $w_i \uparrow$.
- $\Rightarrow \varepsilon_i$ correlated with w_i.
- And our estimate of β_i is biased upward.
- Adding controls X_i help but is not a panacea.

How to make progress?

- **Goal:** Estimate the elasticity, e.
- ~~Simple ordinary-least-squares (OLS) regression.~~
- Need variation in w_i (τ_i) that is **unrelated to baseline characteristics**!
- One solution: Bunching
  - Exploit that marginal tax rate varies with income.

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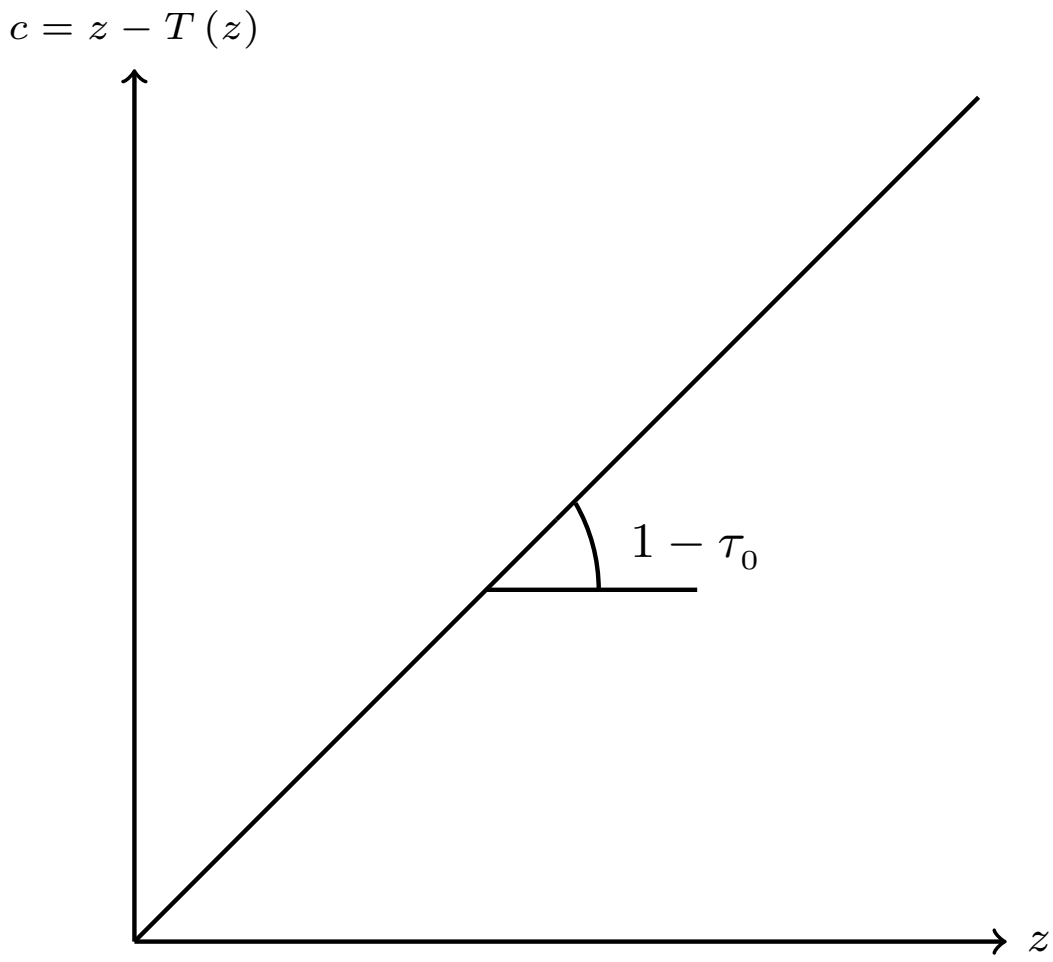
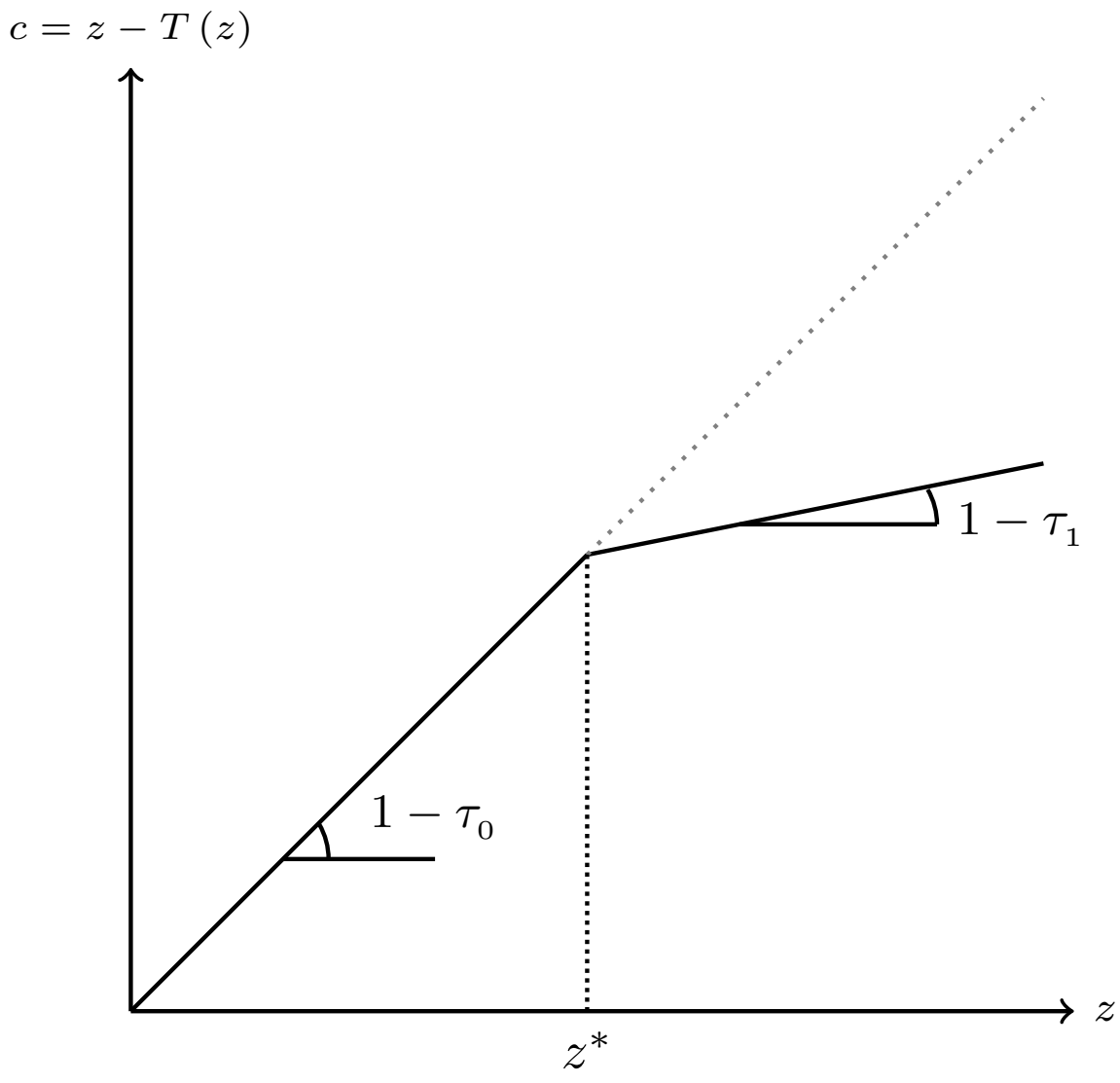
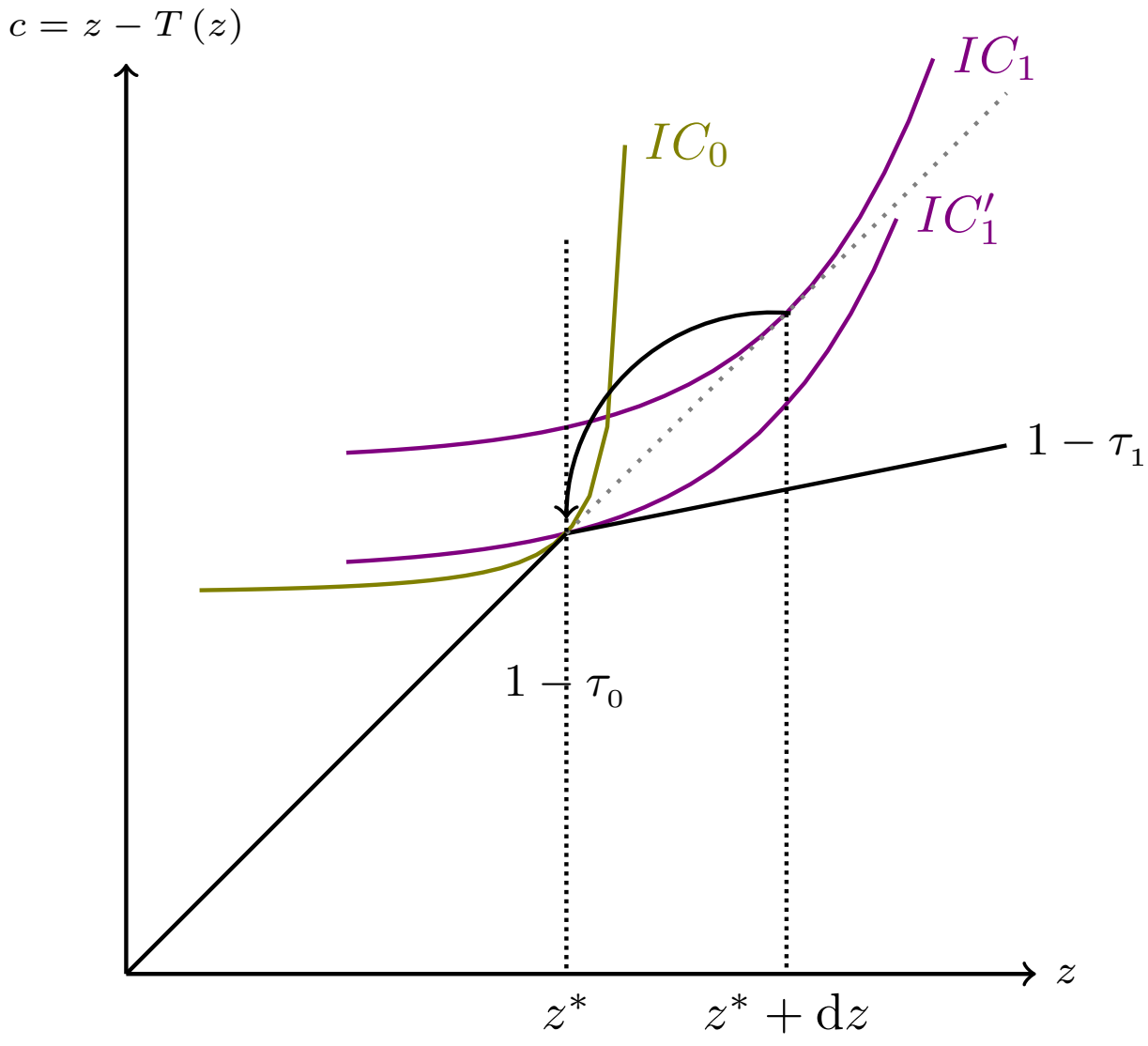
Heterogenous Model, Linear Tax



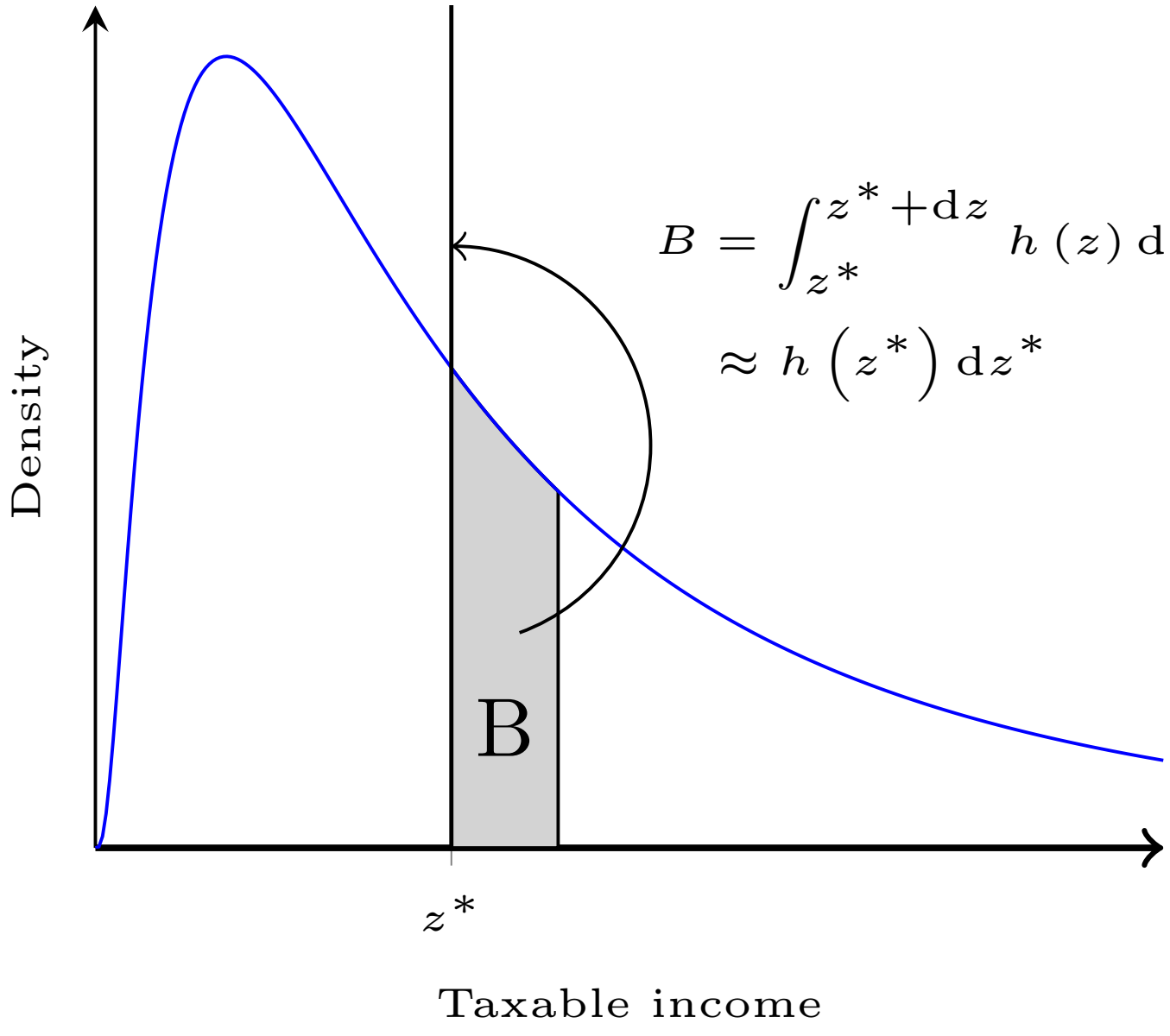
Progressive Tax Scheme: $\tau = \tau_1 > \tau_0$ for $z > z^*$



Taxable income around the kink



Distributions with and w/o Progressivity



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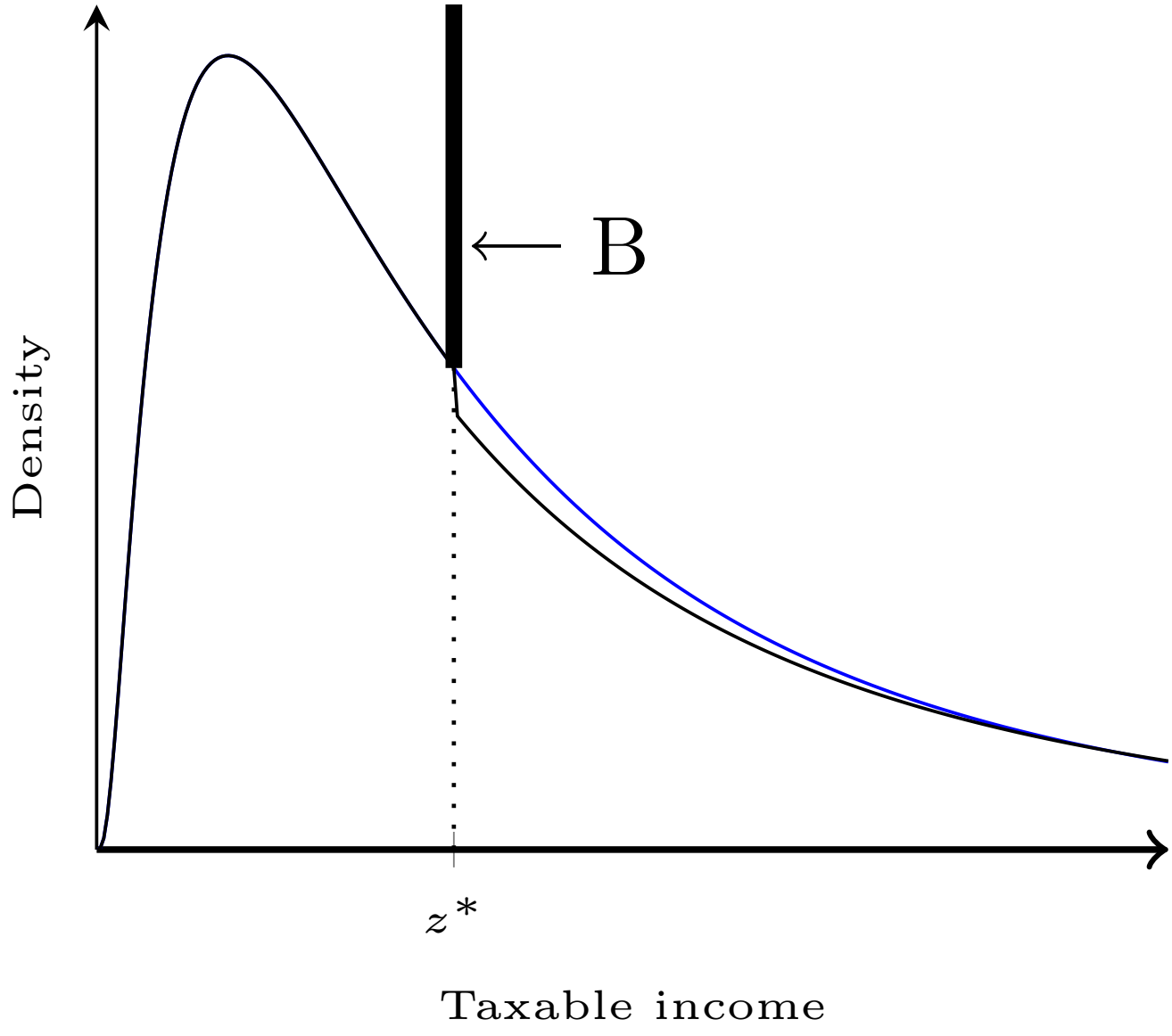

EXTRA: Simple Model

- What is the bunching framework useful for?
- Suppose individuals face labor-leisure choice:

$$U = c - \frac{n}{1+\frac{1}{\varepsilon}}\left(\frac{z}{n}\right)^{1+\frac{1}{\varepsilon}}$$

  s.t. $c = (1-\tau)\,z$.

- Individuals have different values of n denoting skills.
- Here z is pre-tax earnings (wl).
- This functional form (so called *quasi-linear*) is linear in consumption and convex in earnings.

  $\Rightarrow$ **No income effects.**
- (All extra income is always spent on the linear good.)
- **Iso-elastic**

- FOC:

$$(1-\tau) = \left(\frac{z}{n}\right)^{\frac{1}{\varepsilon}}$$

- Solution

$$z = n\,(1-\tau)^{\varepsilon}$$

- Elasticity check:

$$\frac{\partial z}{\partial\,(1-\tau)}\,\frac{(1-\tau)}{z}$$

EXTRA: Tax experiment

- Suppose first that there is only one tax, τ_0 and skills, n, are distributed according to a continuous distribution.
- Distribution of taxable earnings continuous as above.
- How to analyze the case with progressive taxation, where τ_0 for $z < z^*$ and $\tau_1 > \tau_0$ for $z > z^*$?

1. Individuals who located below kink z^* in first regime, behave as before.

$$z = (1 - \tau_0)^{\varepsilon} n$$

2. What is the solution for tax payers who locate in interior position above kink?

$$z = (1 - \tau_1)^{\varepsilon} n$$

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$$z = (1 - \tau_1)^{\varepsilon} n$$

EXTRA: Tax experiment, cont.

- We now know that individuals with:

  $n < z^* (1 - \tau_0)^{-\varepsilon}$ will locate below the kink.

  $n > z^* (1 - \tau_1)^{-\varepsilon}$ will locate above the kink.

- What about those with

$$n \in \left[z^* (1 - \tau_0)^{-\varepsilon}, z^* (1 - \tau_1)^{-\varepsilon} \right]$$

- They bunch.

EXTRA: Tax experiment, cont.

- Highest ability person who bunches had taxable earnings under linear regime:

$$\begin{aligned} z_{last} &= (1-\tau_0)^{\varepsilon} n_{last} \\ &= z^* \left(\frac{1-\tau_0}{1-\tau_1} \right)^{\varepsilon} \end{aligned}$$

Everyone with earnings b/w z^* and z_{last} bunch.

So

$$\begin{aligned} \Delta z^* &= z_{last} - z_* \\ &= z^* \left(\left(\frac{1-\tau_0}{1-\tau_1} \right)^{\varepsilon} - 1 \right) \end{aligned}$$

Who are bunching?

- Who are the individuals who bunch?

$$B = \int_{z^*}^{z^*+\Delta z^*} h_0(z)\,\mathrm{d}z$$
$$\approx \Delta z^* h_0(z^*)$$

but

$$\Delta z^* = \varepsilon \frac{z^* \Delta t}{1-\tau}$$

from the definition of the elasticity. Therefore:

$$\frac{B}{h_0(z^*)} = \varepsilon \frac{z^* \mathrm{d}t}{1-\tau}$$

- This expression consists of observable inputs, such as τ, estimable unit ($\frac{B}{h_0(z^*)}$) and the unknown parameter ε.
- How do you approach this problem econometrically?

  Construct histogram around the kink/notch.

  Complicated by noise: bunching is not a spike at the threshold.

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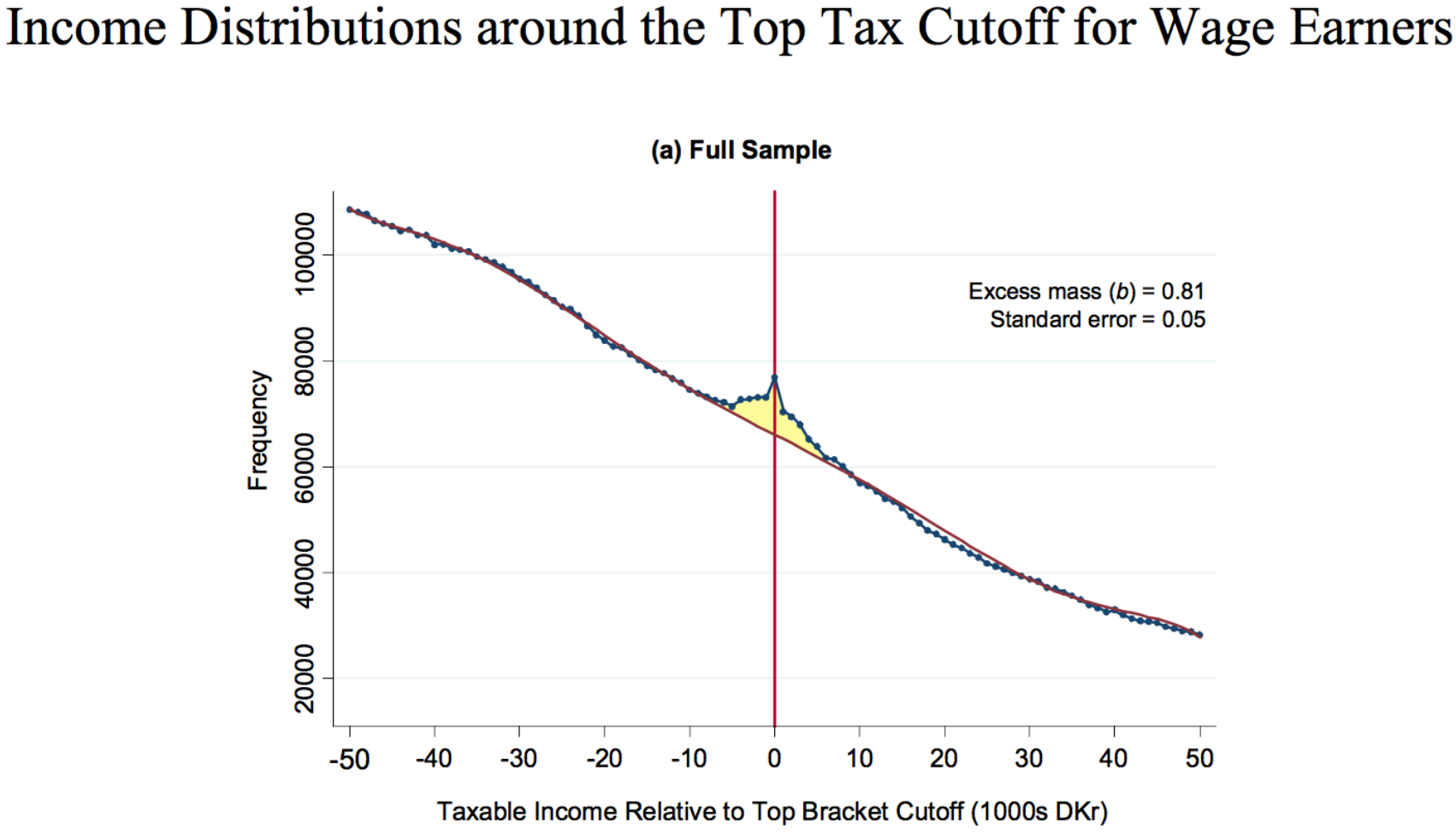
- How do you approach this problem econometrically?

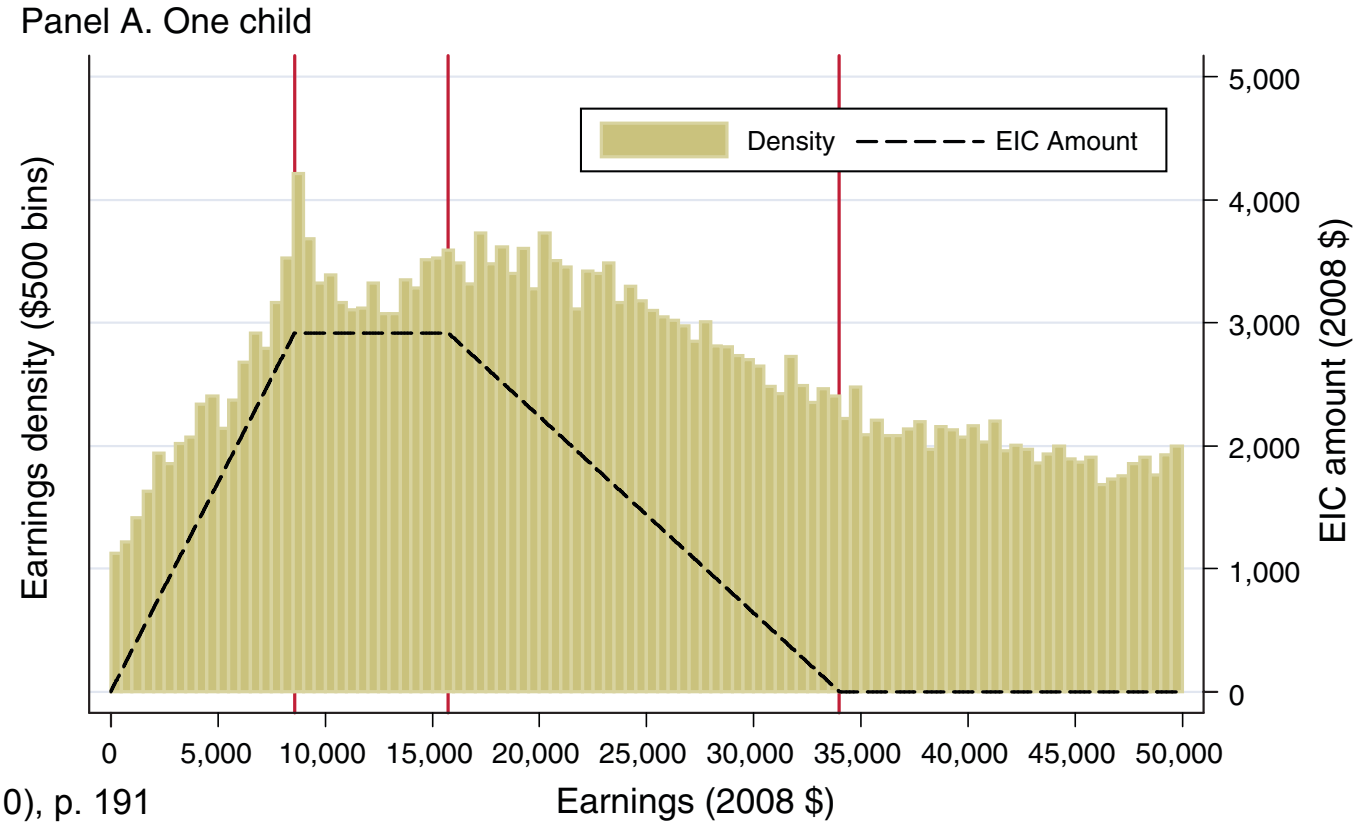
  Construct histogram around the kink/notch.

  Complicated by noise: bunching is not a spike at the threshold.

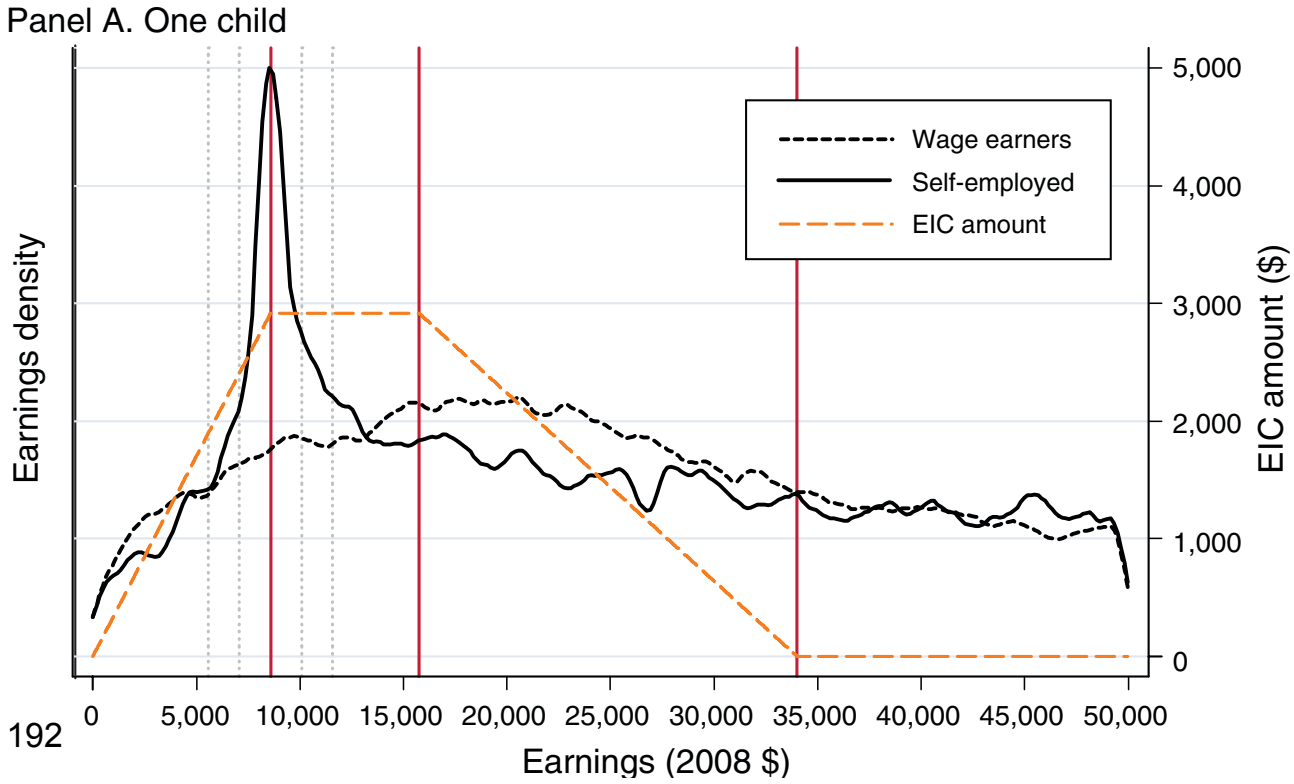
How do we estimate the excess mass at the kink?



Source: Chetty, Friedman, Olsen and Pistaferri, 2010



Source: Saez (2010), p. 191



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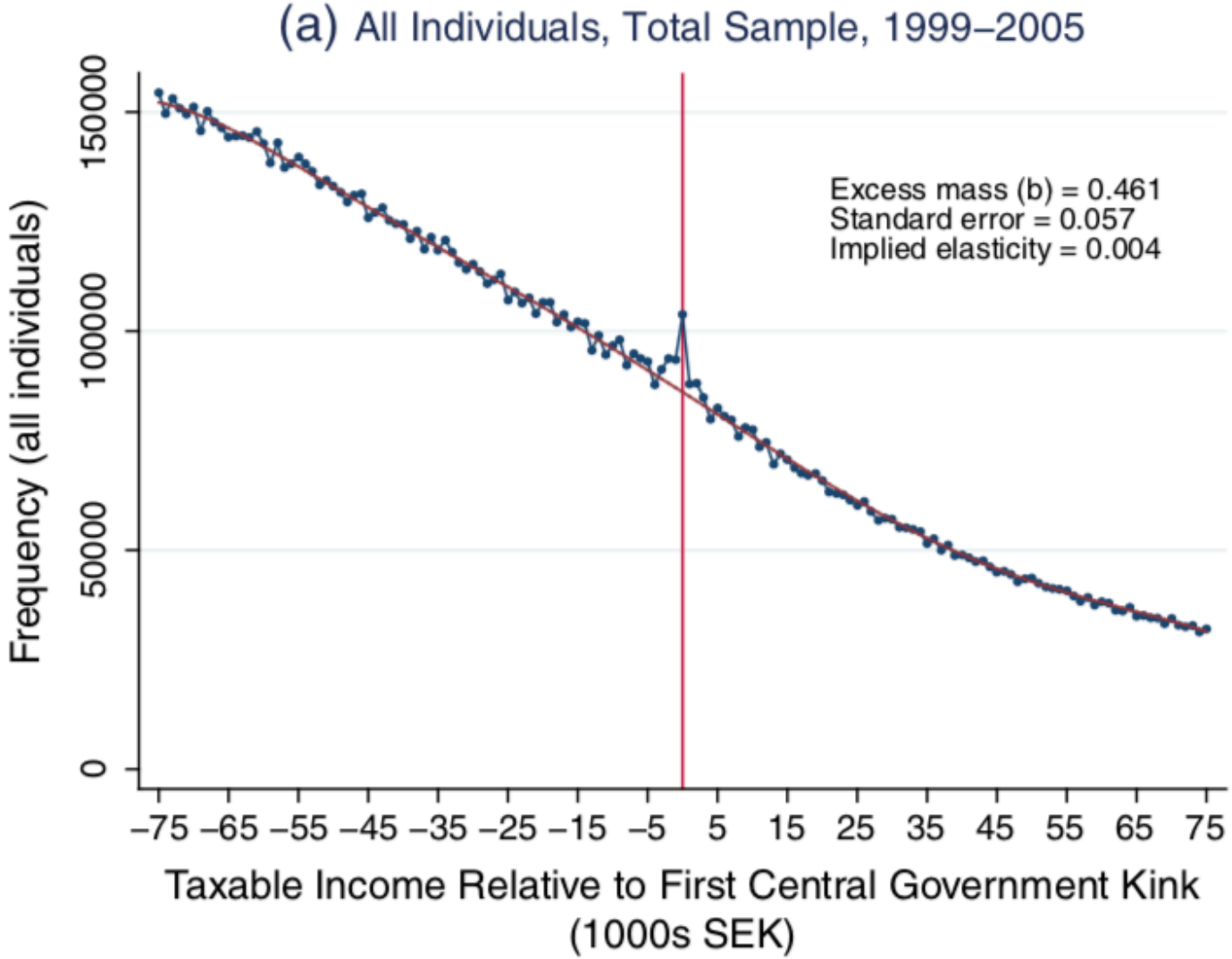
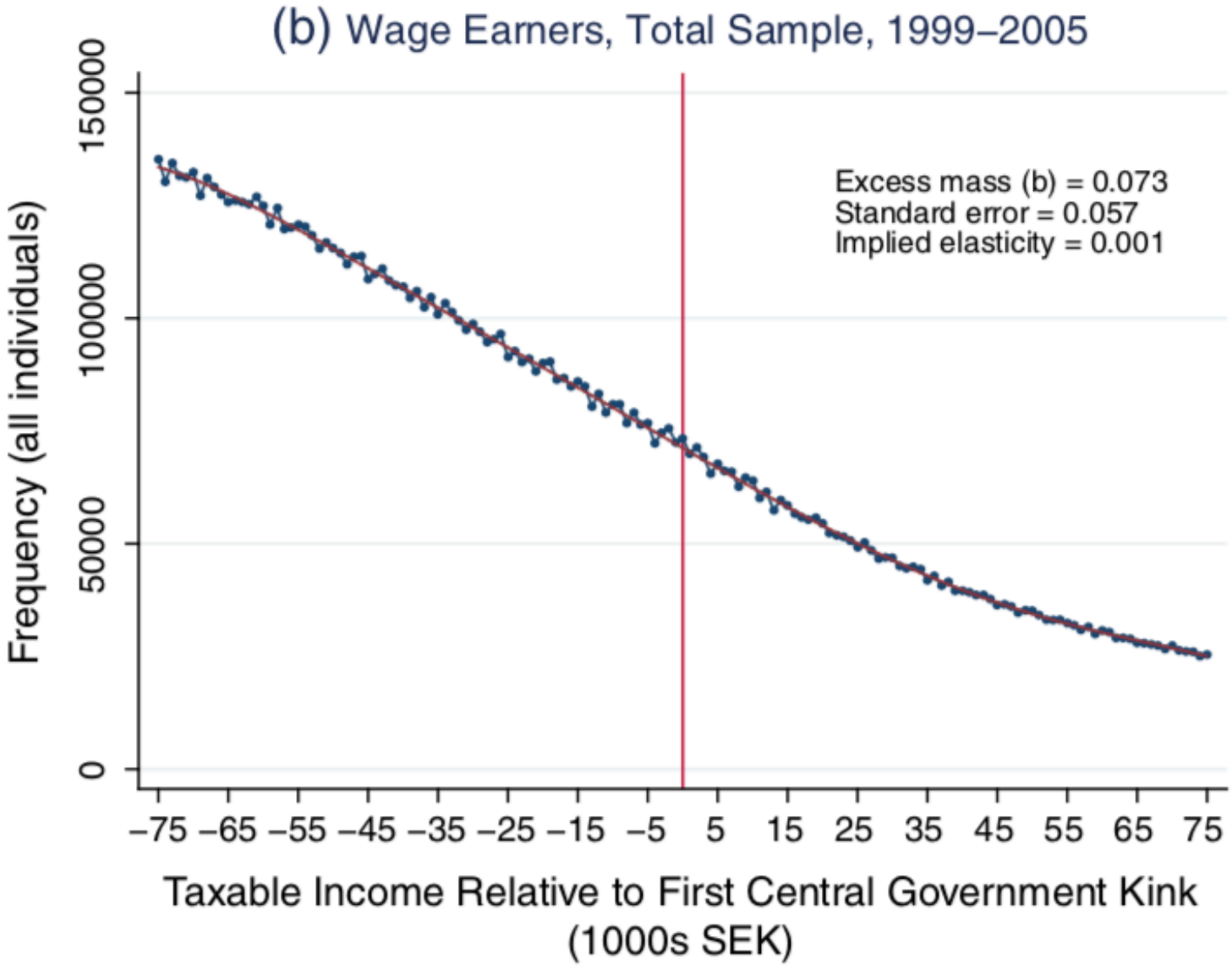
Swedish case



- Very large kink when central gov't tax starts.
- Source: Bastani and Selin (2014).

Swedish case



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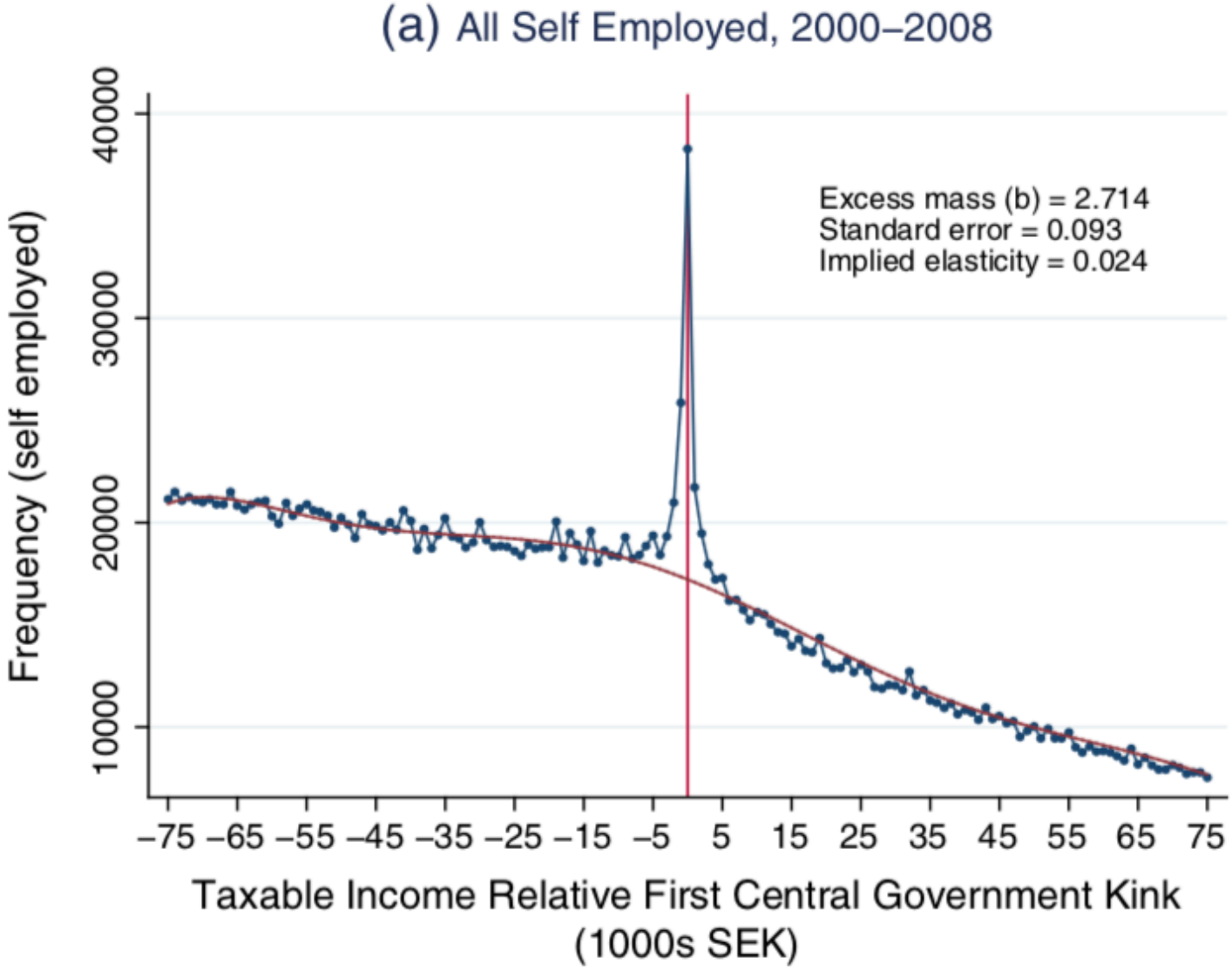

- Source: Bastani and Selin (2014).

Implications

- Recall: Revenue-maximizing tax rate $\tau^* = 1/(1+\varepsilon)$:

- Bastani and Selin (2014): $\varepsilon \approx 0 \rightarrow \tau^* \approx 100\%$.
- Saez (2010): $\varepsilon \approx 0.25 \rightarrow \tau^* \approx 80\%$.
- Critique: Bunching captures **sophisticated, specific** responses.
- Not generalizable to population.

Empirical application

- Starting point: **indirect taxes / payroll taxes** as important as direct income taxes.
- You are the Swedish finance minister.

  Problem: Youth unemployment **excessive**.

  → What should you do?
- Idea: cut income taxes for young.
- Good or bad?
  - If labor supply inelastic → Incidence borne by **workers' wages**
  - ⇔ Wages ↑ ⇒ No reduction in labor cost.
  - Therefore, **no** or **small** employment effects.
- Swedish experiment: cut payroll taxes for young in 2007.

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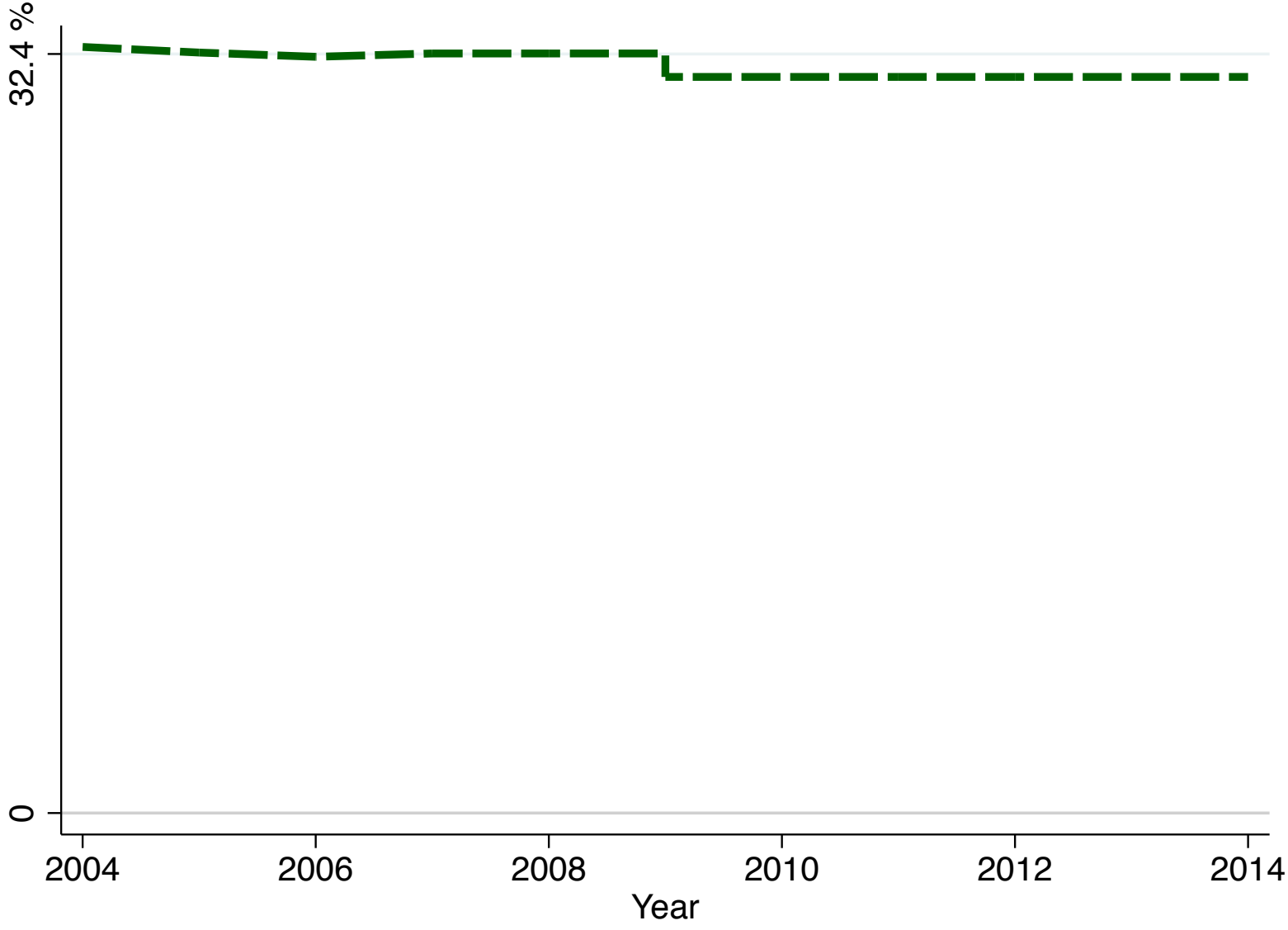
The Payroll Tax Cut



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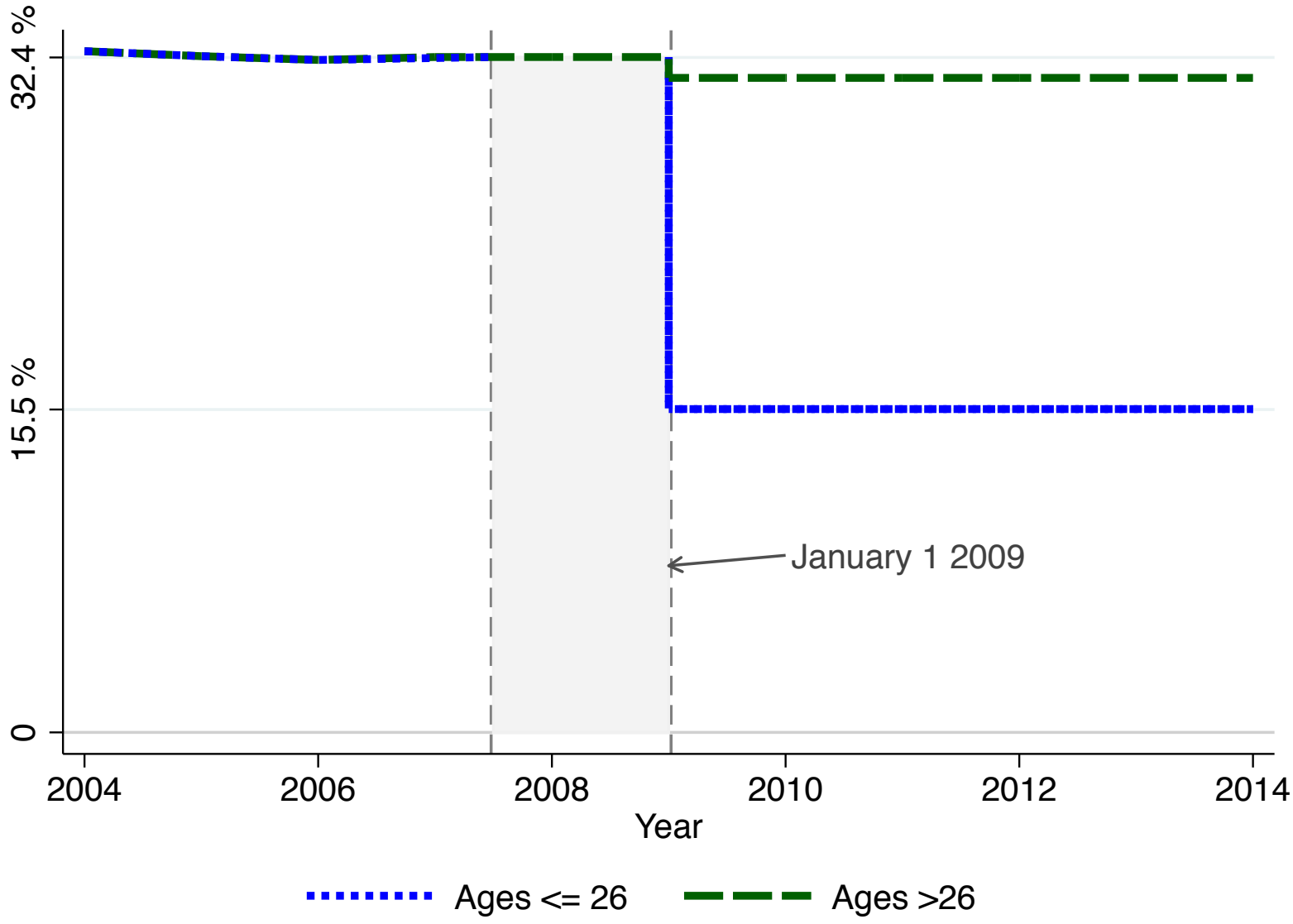

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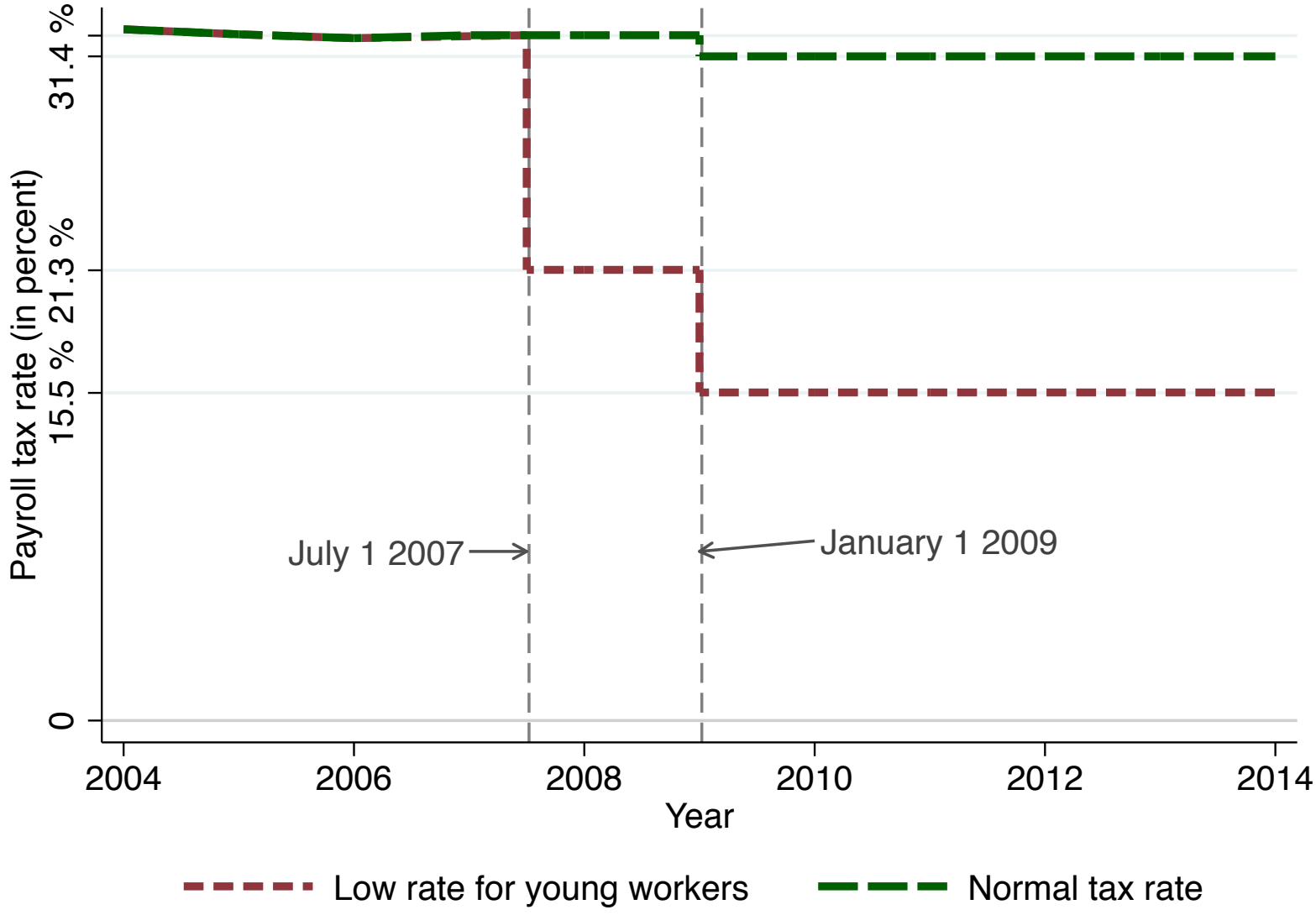
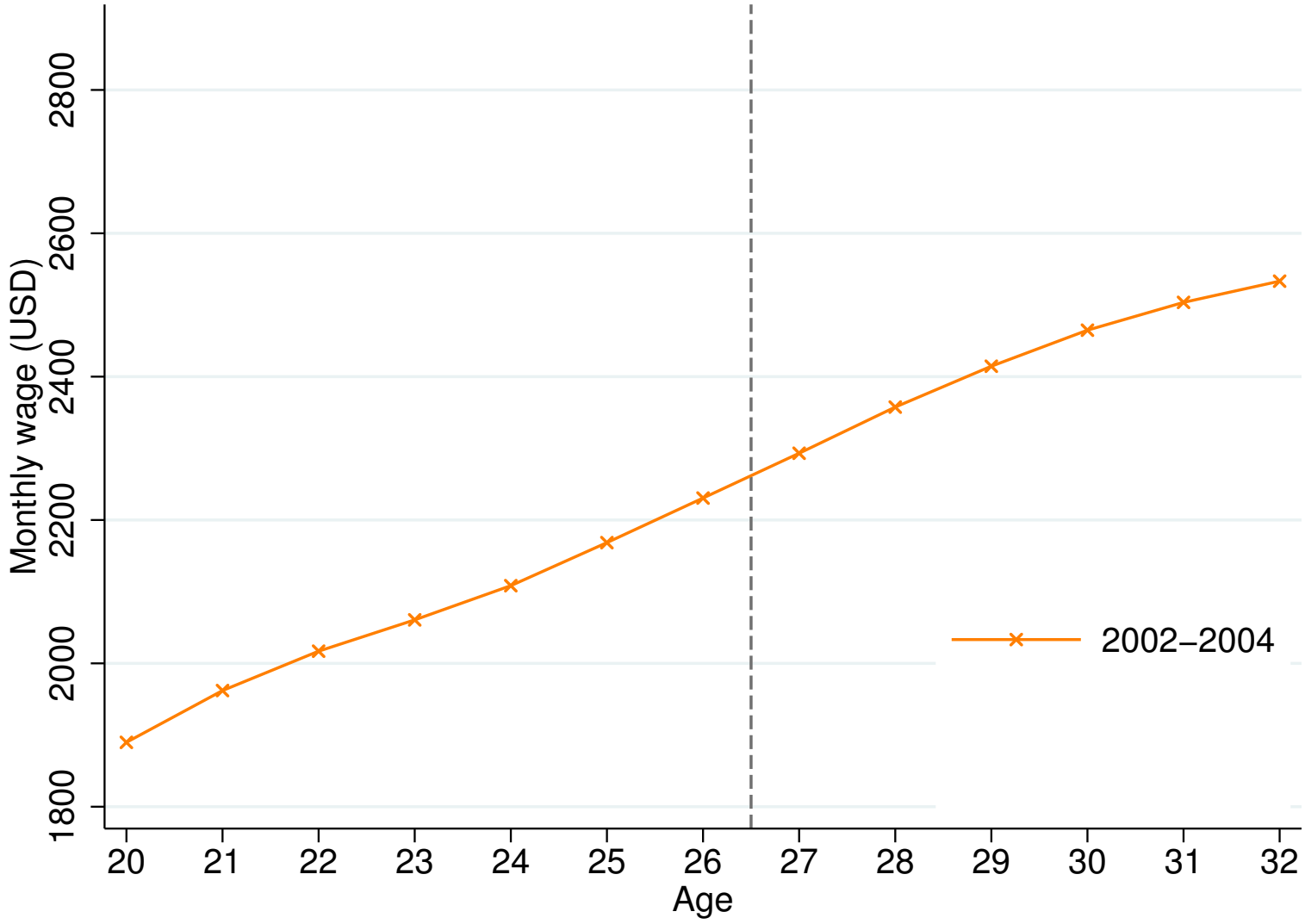


Wage Incidence



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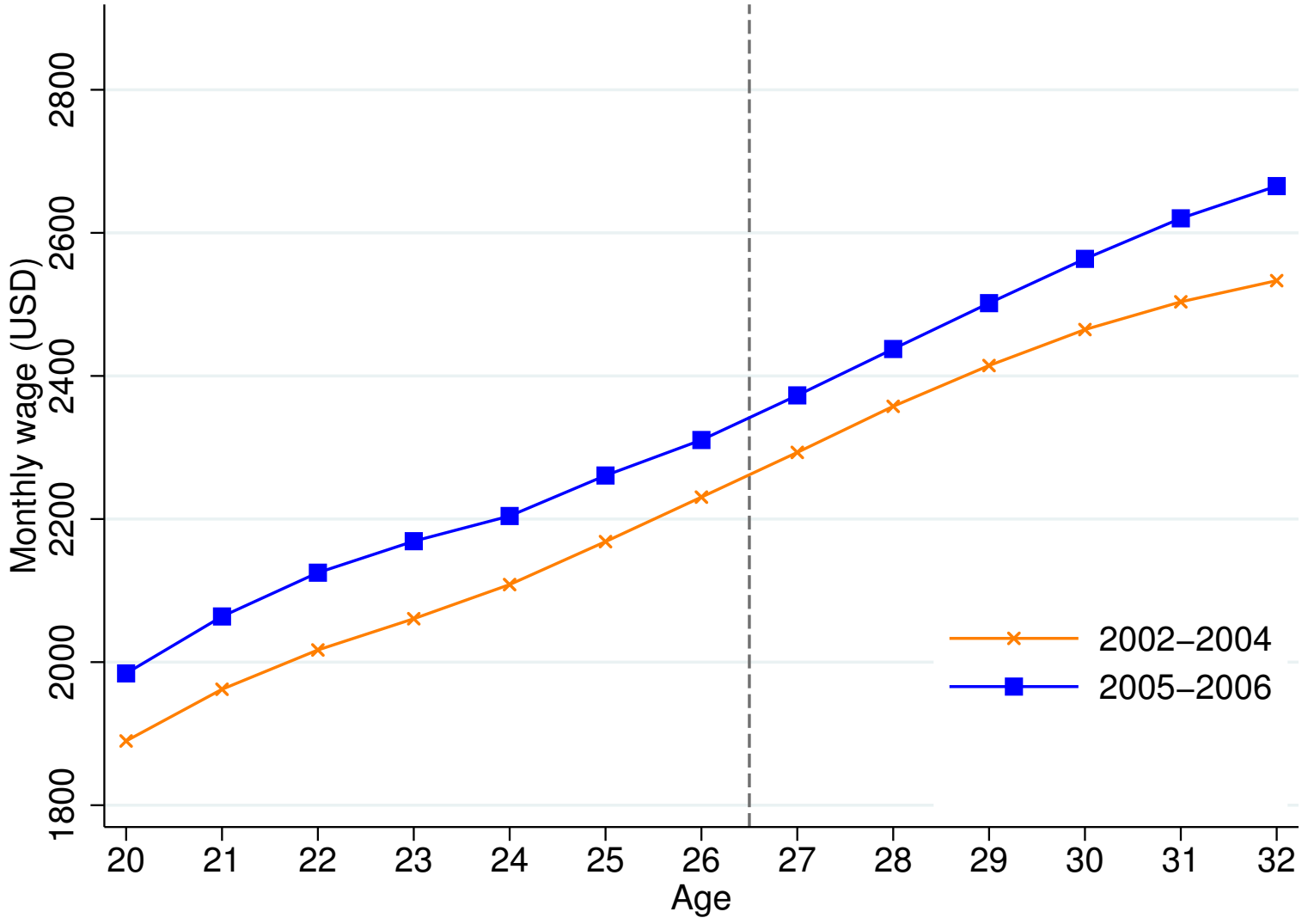
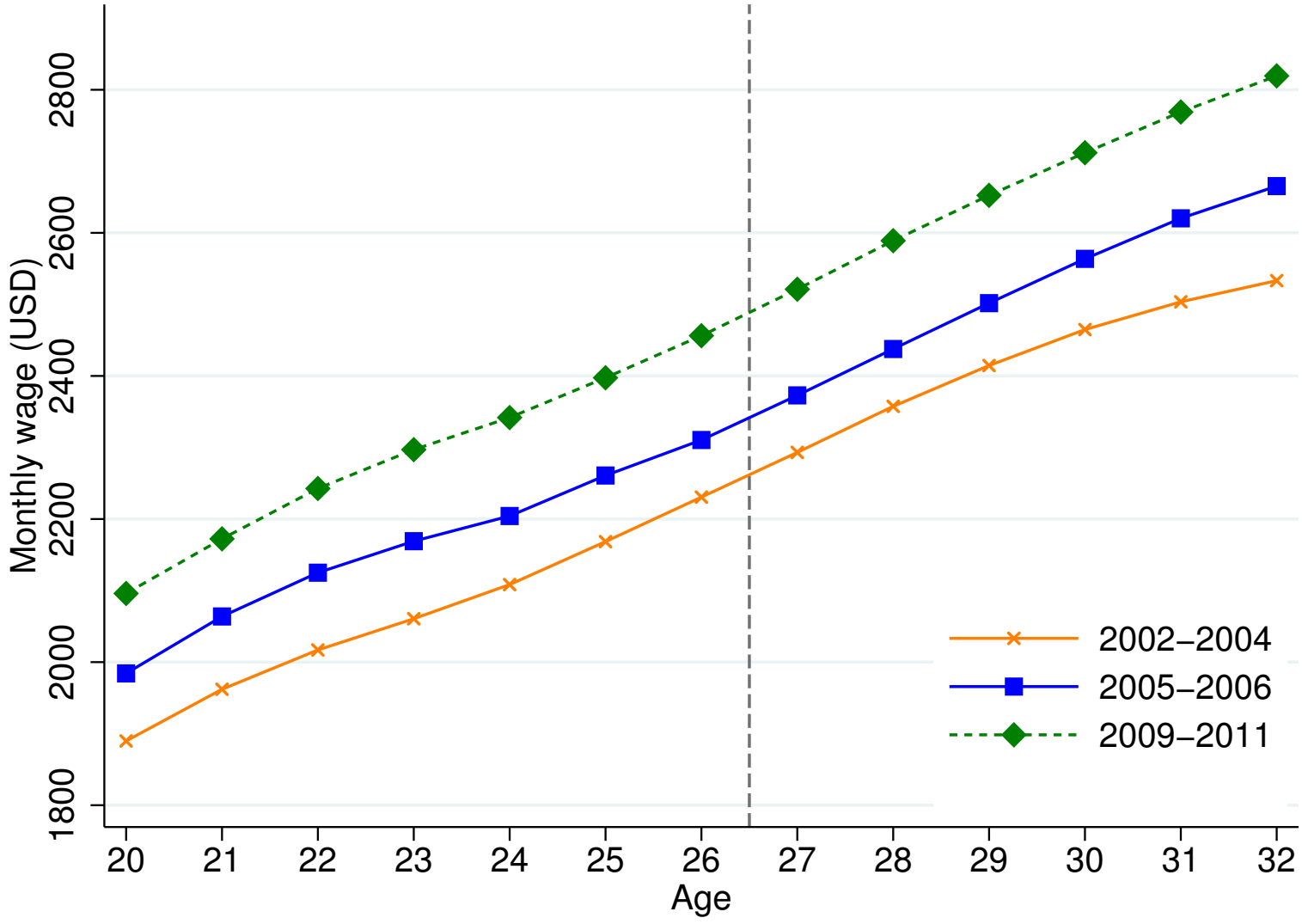


Wage Incidence

Cf. Egebark & Kaunitz (2014) Cf. Skedinger (2014)



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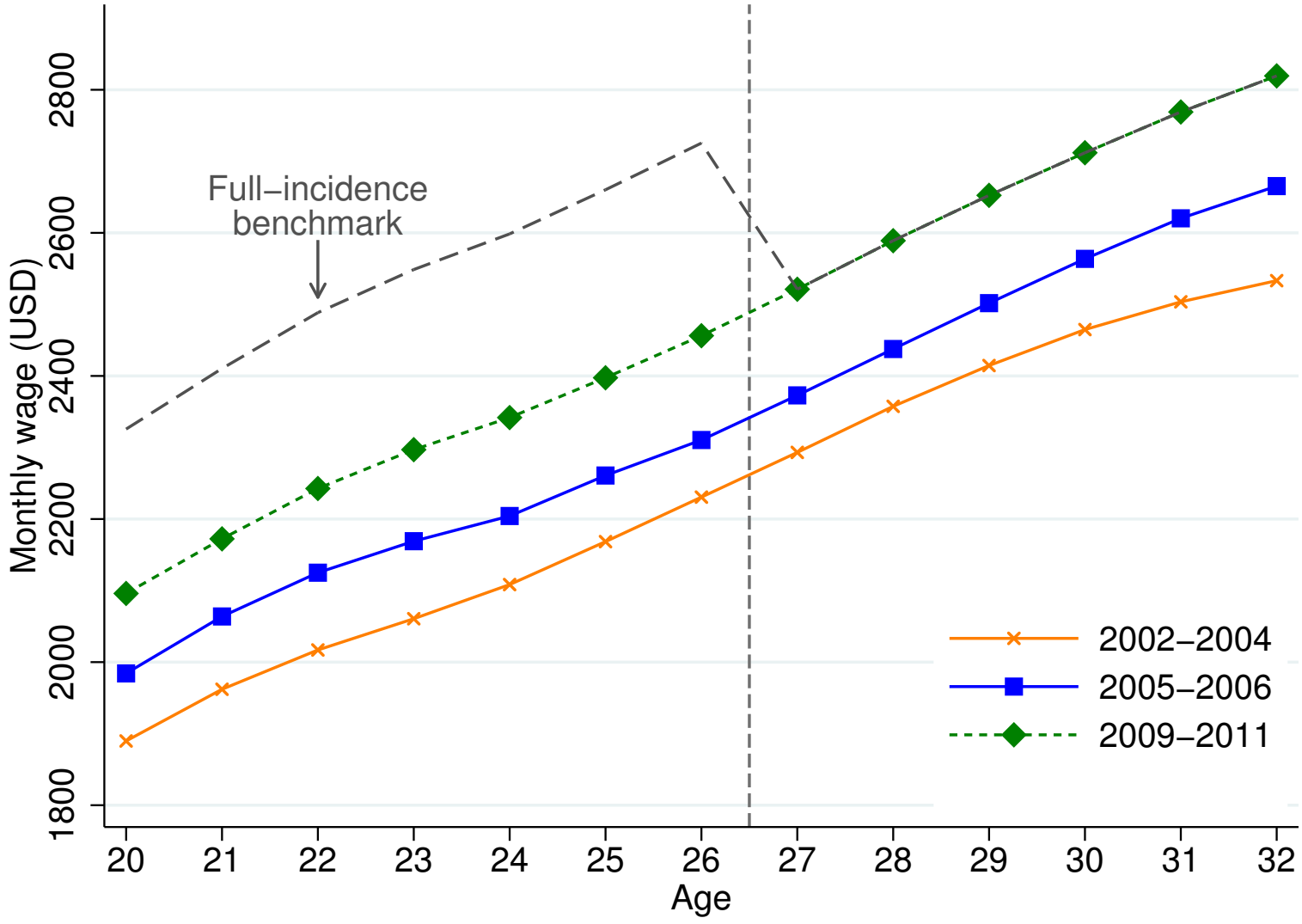

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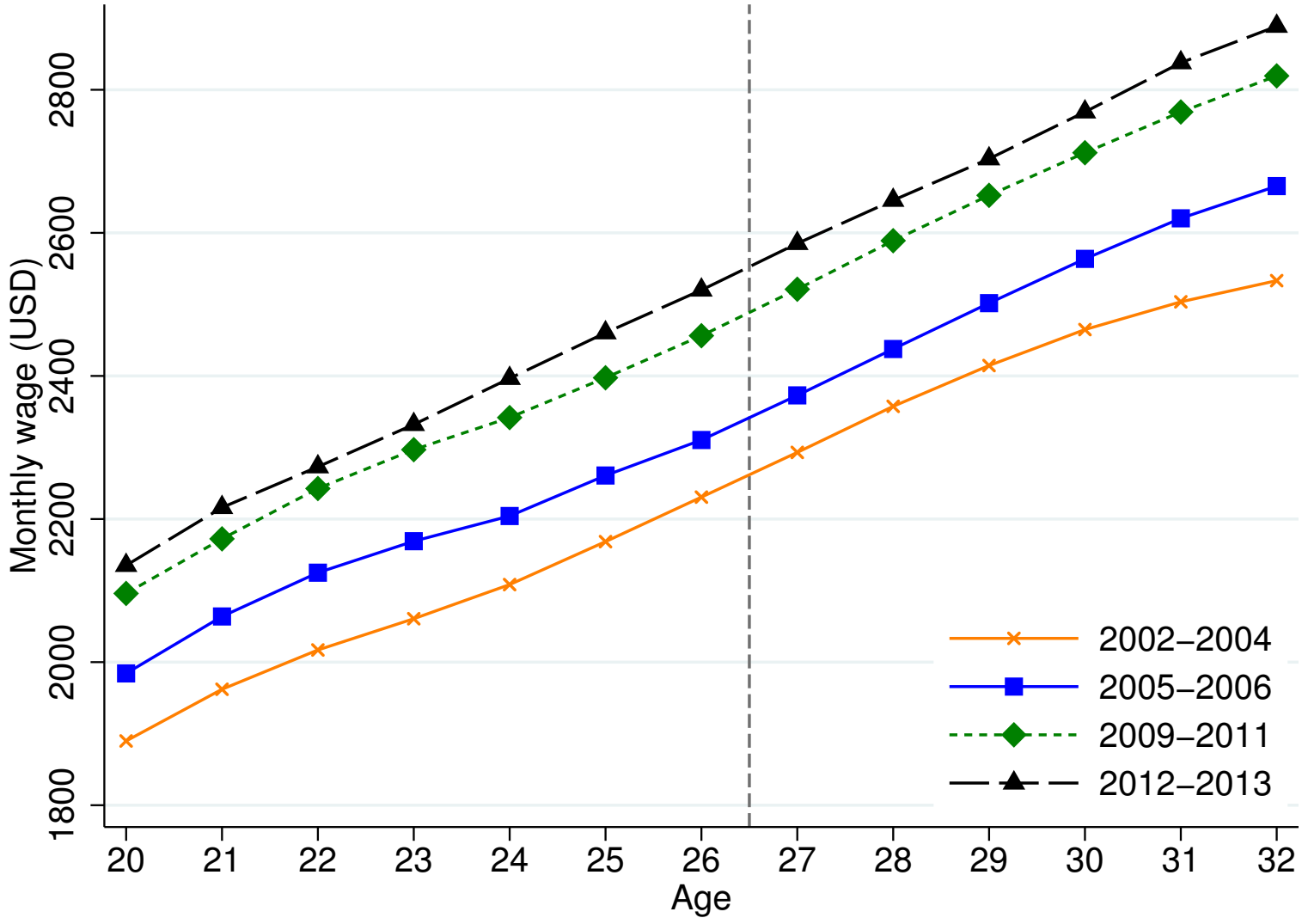
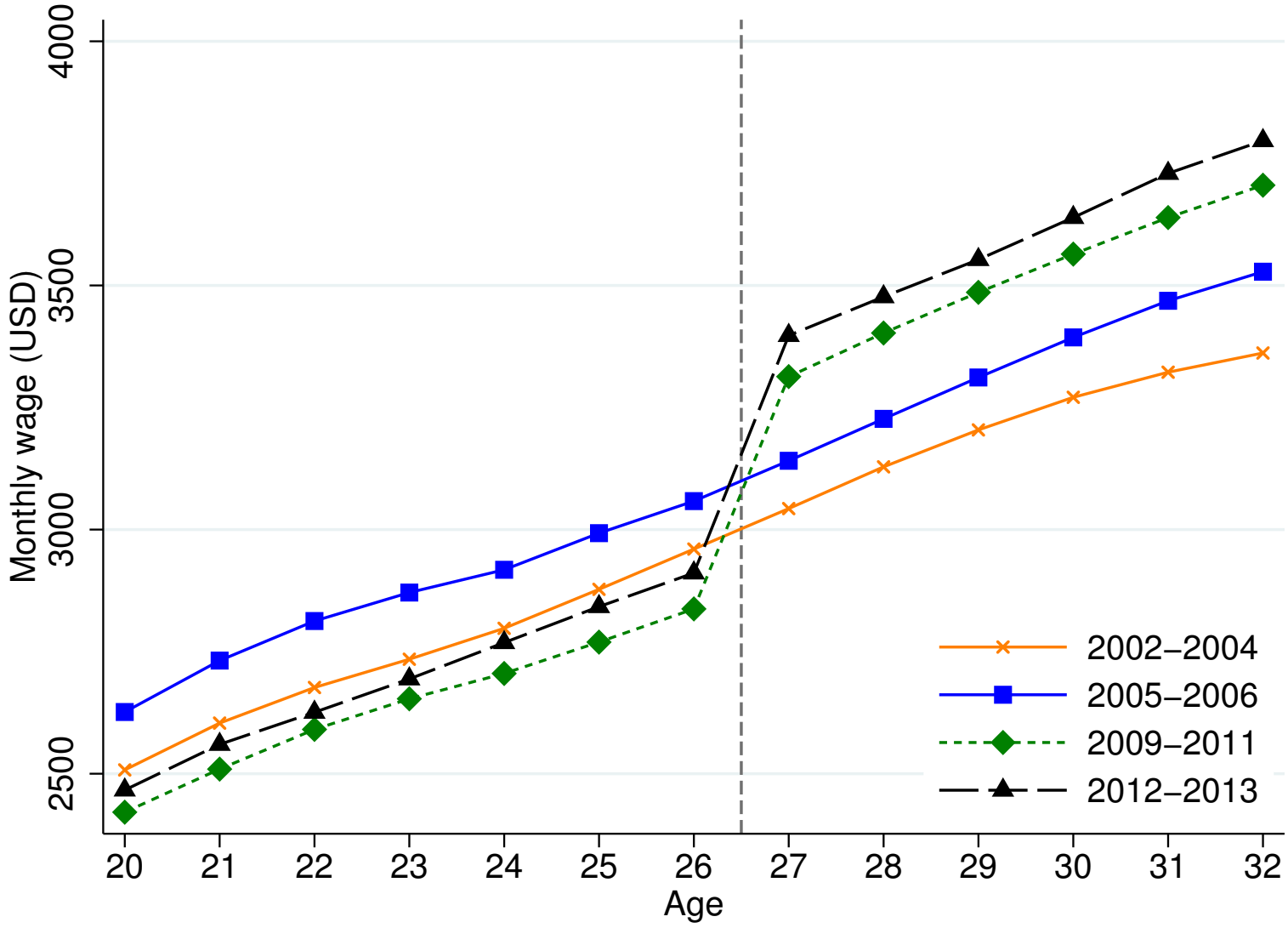


Labor Costs $(1 + \tau_{y,\text{age}}) \cdot w_{y,\text{age}}$



Implications

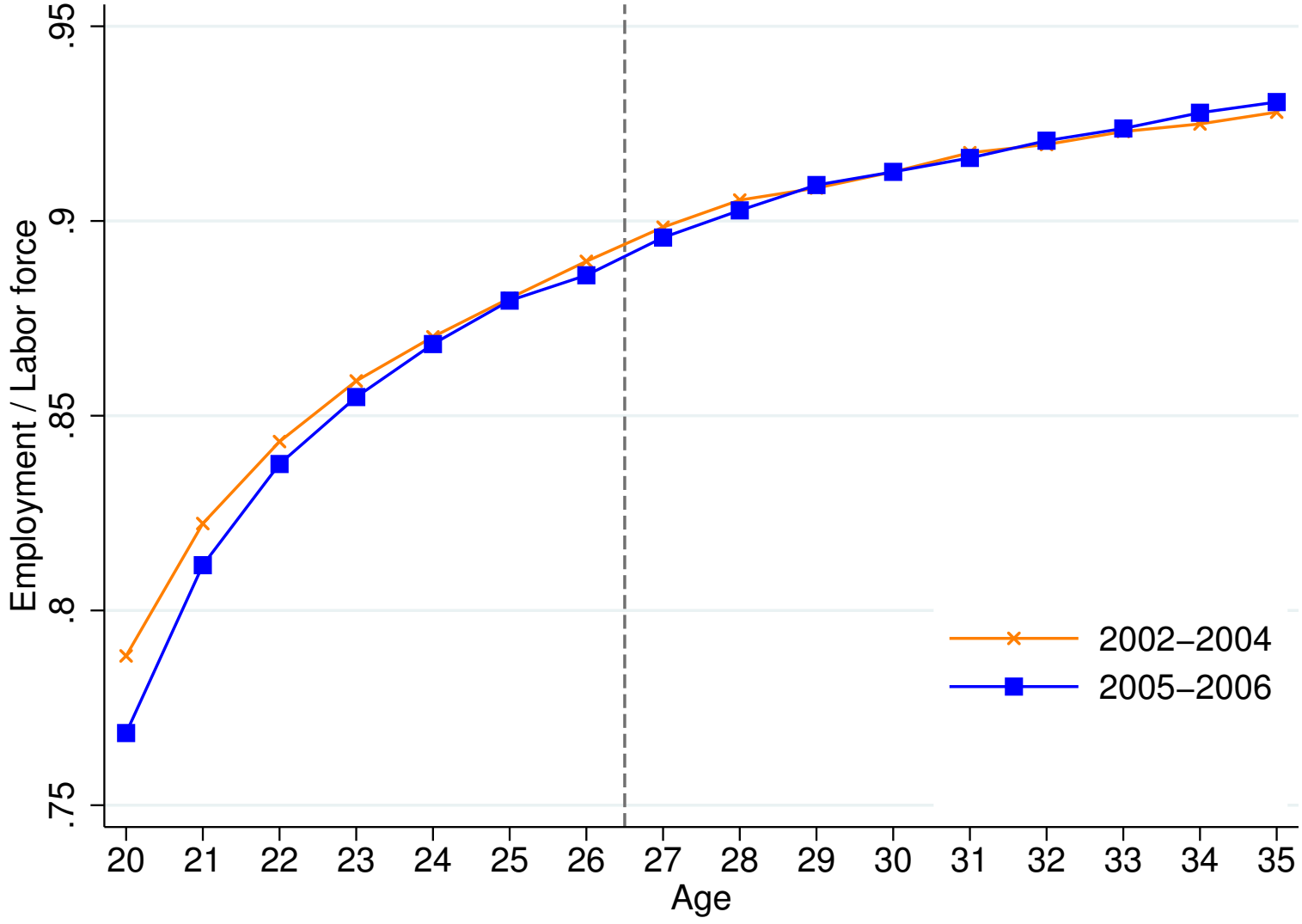
1. Canonical received wisdom of inelastic supply seems **wrong**.

   Payroll tax cut $\Rightarrow$ labor costs $\downarrow$!.

- Next question: Did employers respond to cheaper labor by hiring more?
- Look at employment:

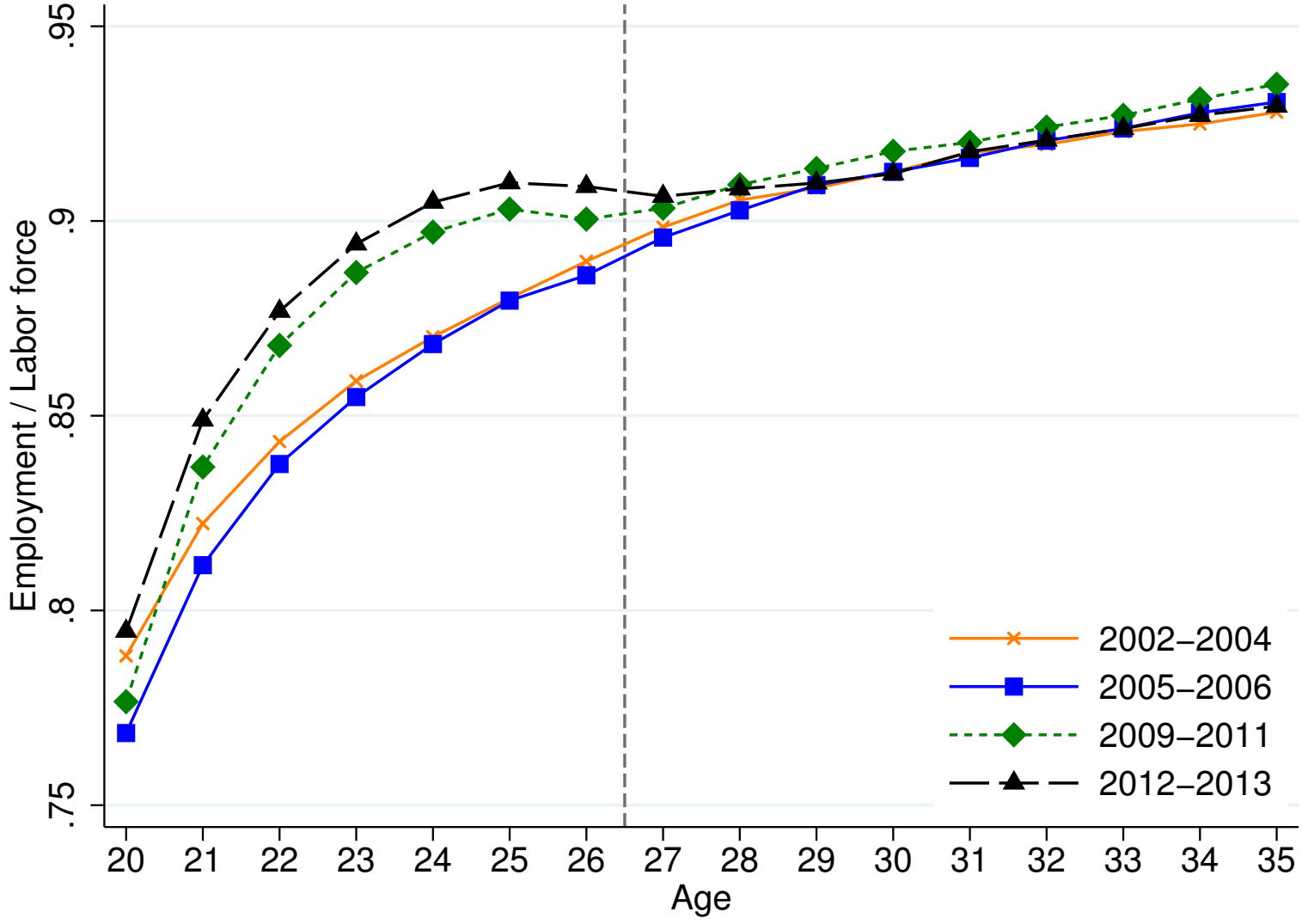
$$\begin{aligned}\text{Employment rate}_{t,age} &= \frac{\#\text{Employed}_{t,age}}{\#\text{Labor force}_{t,age}} \\ &= \frac{\#\text{Employed}_{t,age}}{\#\text{Employed}_{t,age} + \#\text{Unemployed}_{t,age}}\end{aligned}$$

Employment Effects

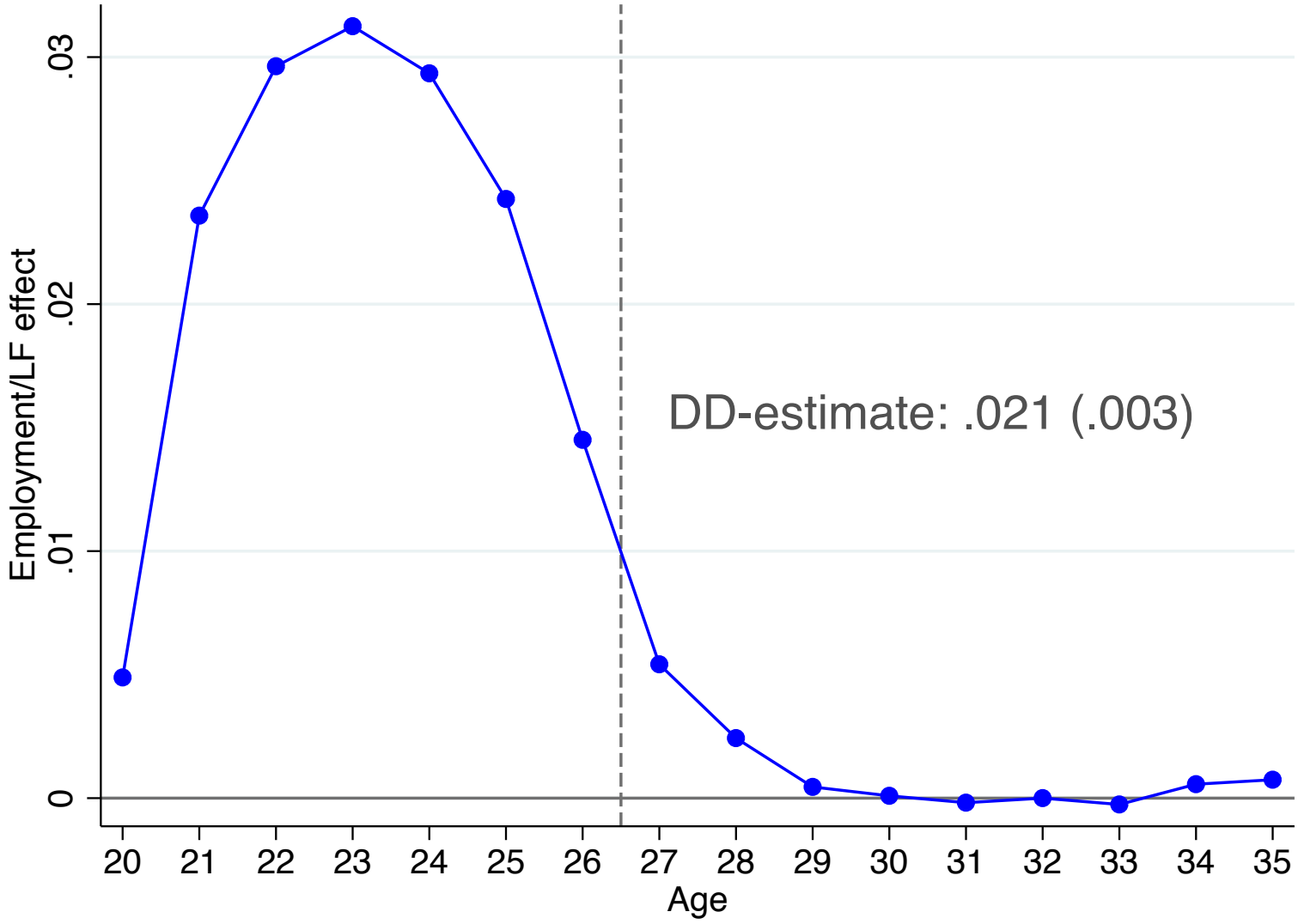


Employment Effects

Appendix: LFP | Cf.: E&K (2014)



Employment Effects by Age



Firm Data

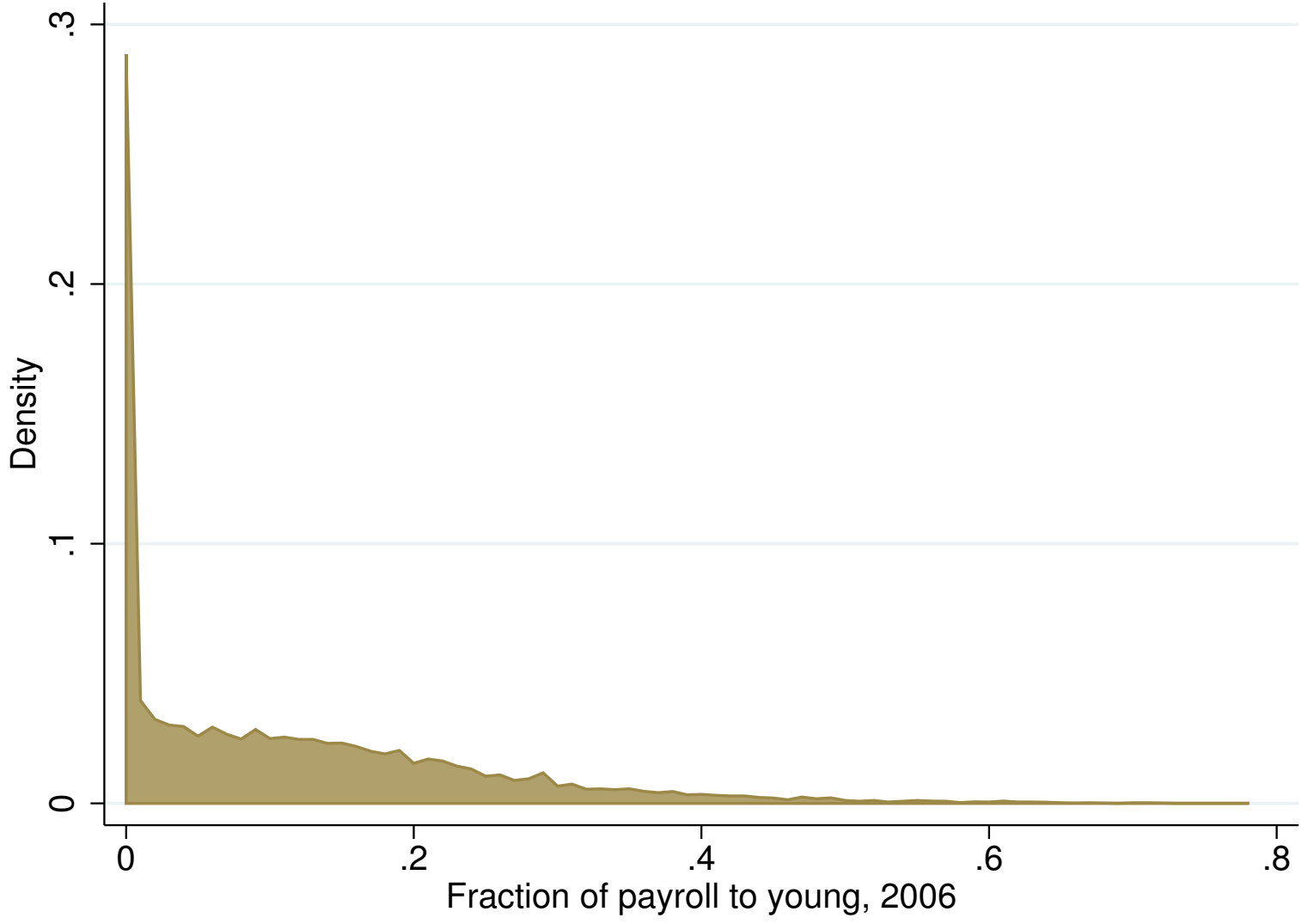
Merged data:

- Our micro worker data from part A
- Firm-level income statements and balance sheets (FK data, Statistics Sweden)

Sample:

- Private-sector, domestic firms
- > 3 employees.
- Balanced panel 2003–2013

Firm Heterogeneity in Exposure: $\frac{\text{Treated Wage Bill}_{f,2006}}{\text{Total Wage Bill}_{f,2006}}$



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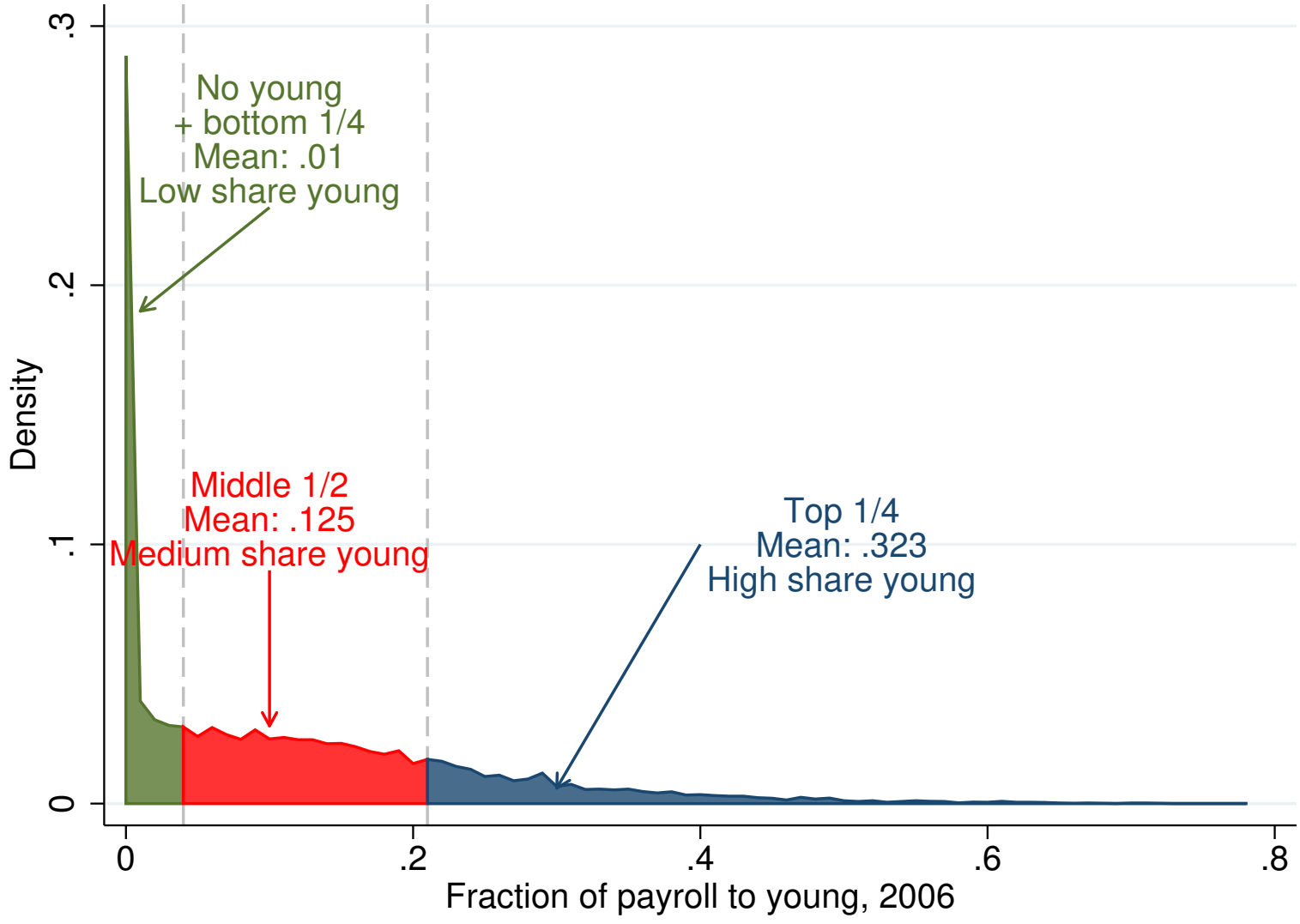

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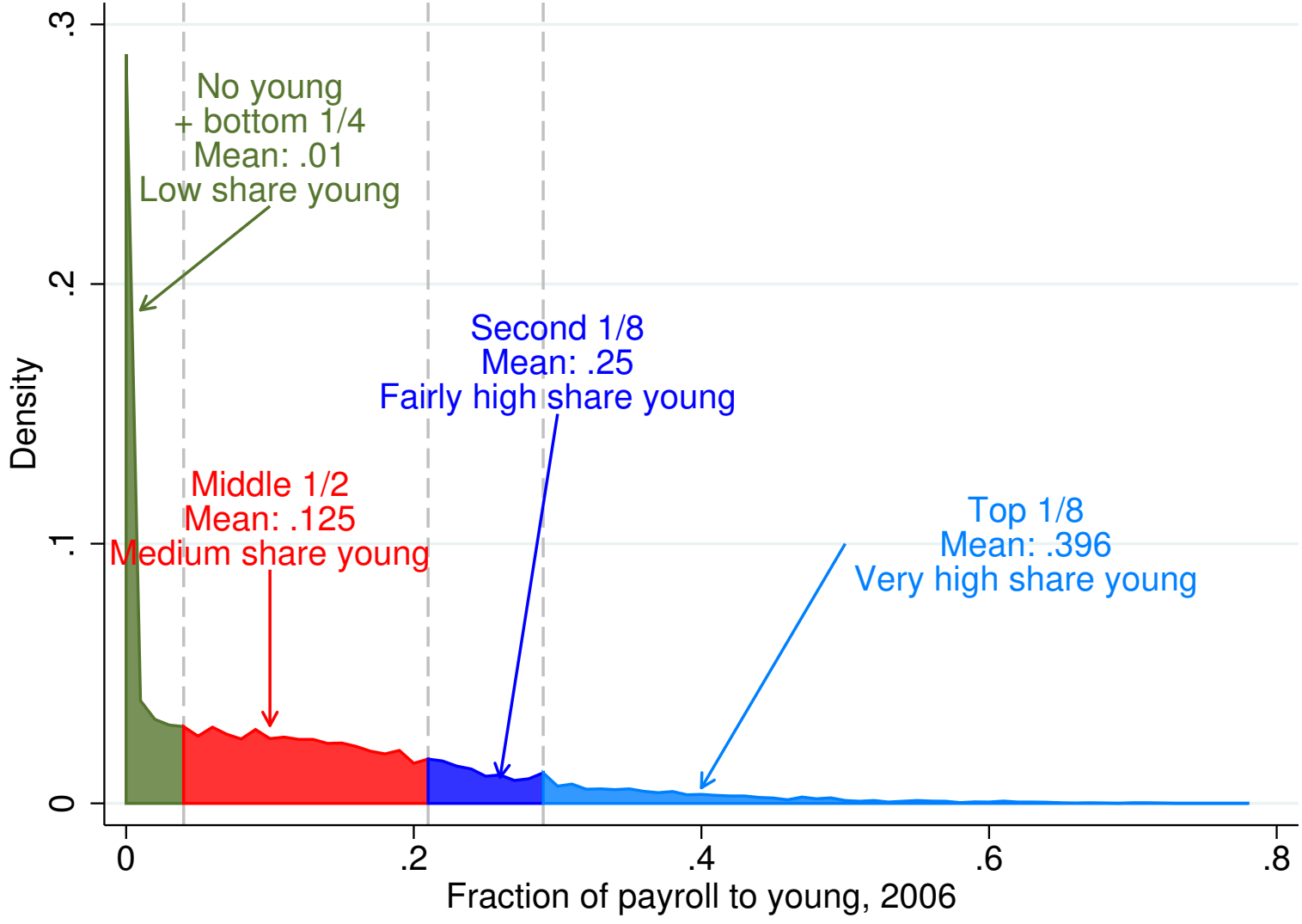


Firm-Level Employment

Firm-level employment: firm f, year y

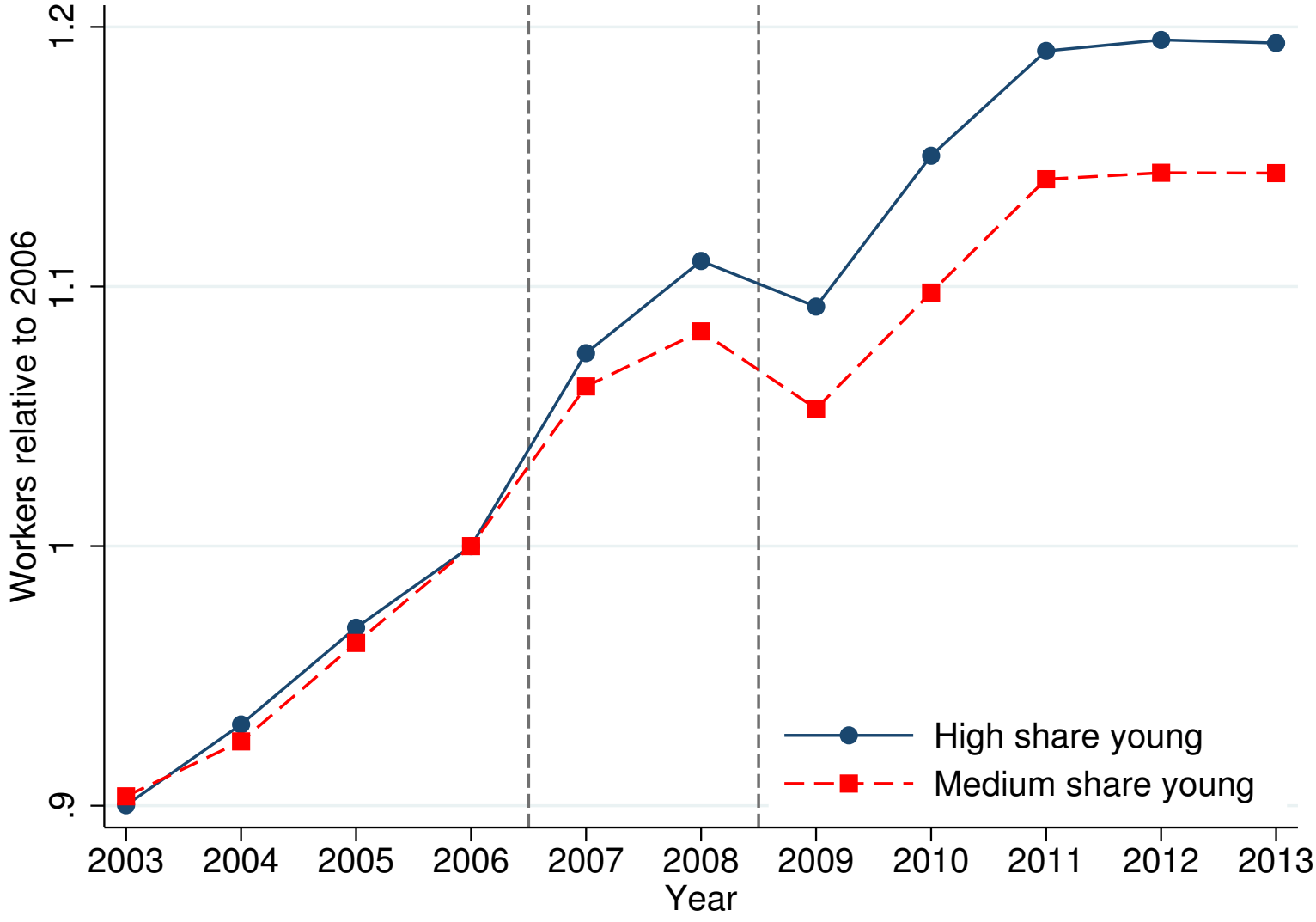
$$\frac{\text{Employees}_{f,y}}{\text{Employees}_{f,2006}}$$

Plot time series of unweighted average for each group

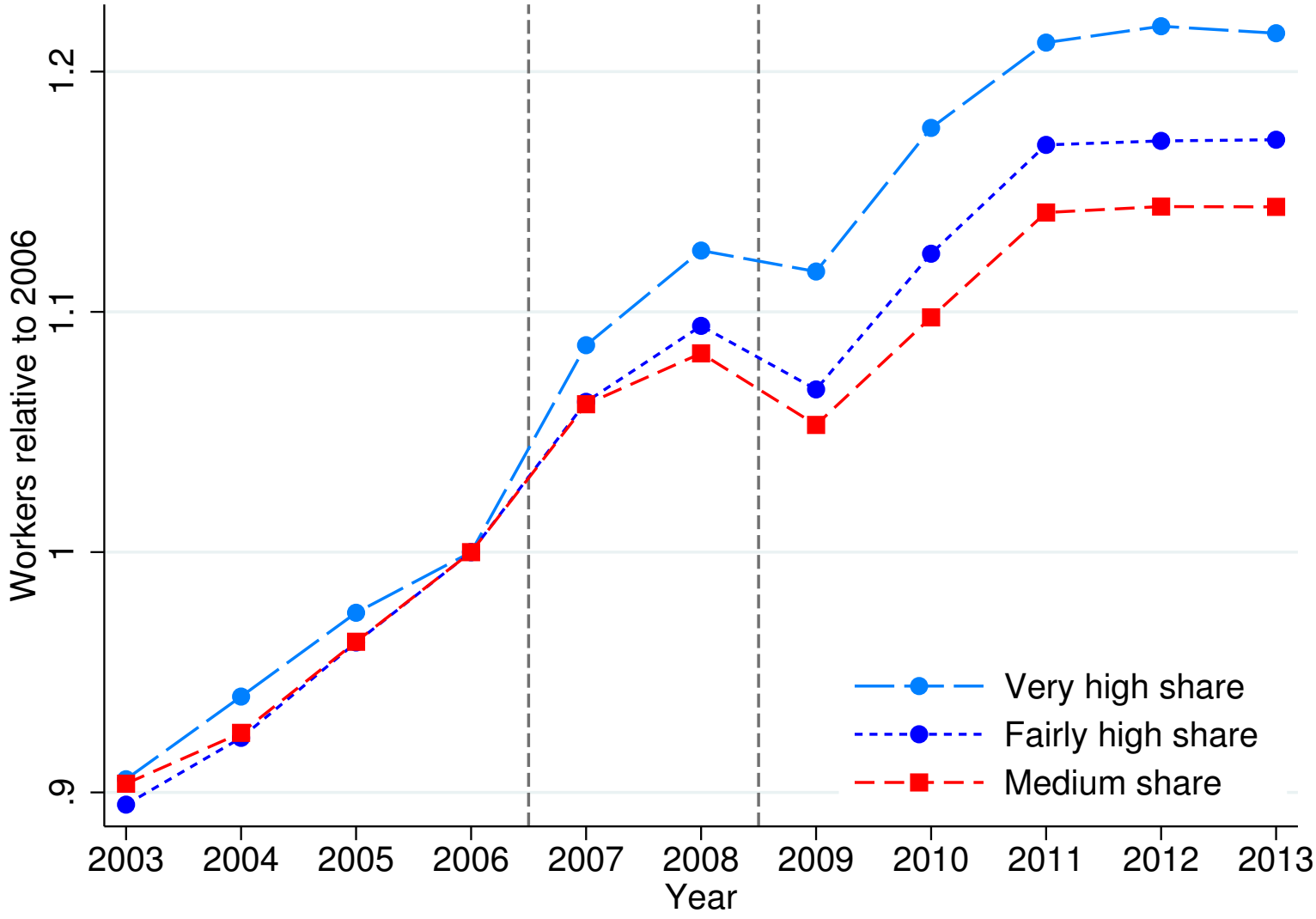
Definition: Full-time-equivalent workers, i.e. annual earnings above (small) earnings index provided by social insurance benchmark ($>$ \$4.5K in 2013)

Results are robust to changing threshold and considering cumulative wage bill instead of bodies

Firm-Level Employment: $\frac{\text{Emp}_{f,t}}{\text{Emp}_{f,2006}}$



Dose Treatment: Splitting the Top-Group in Two



Individual-Level Wages

Average wage dynamics may be confounded by composition shifts.

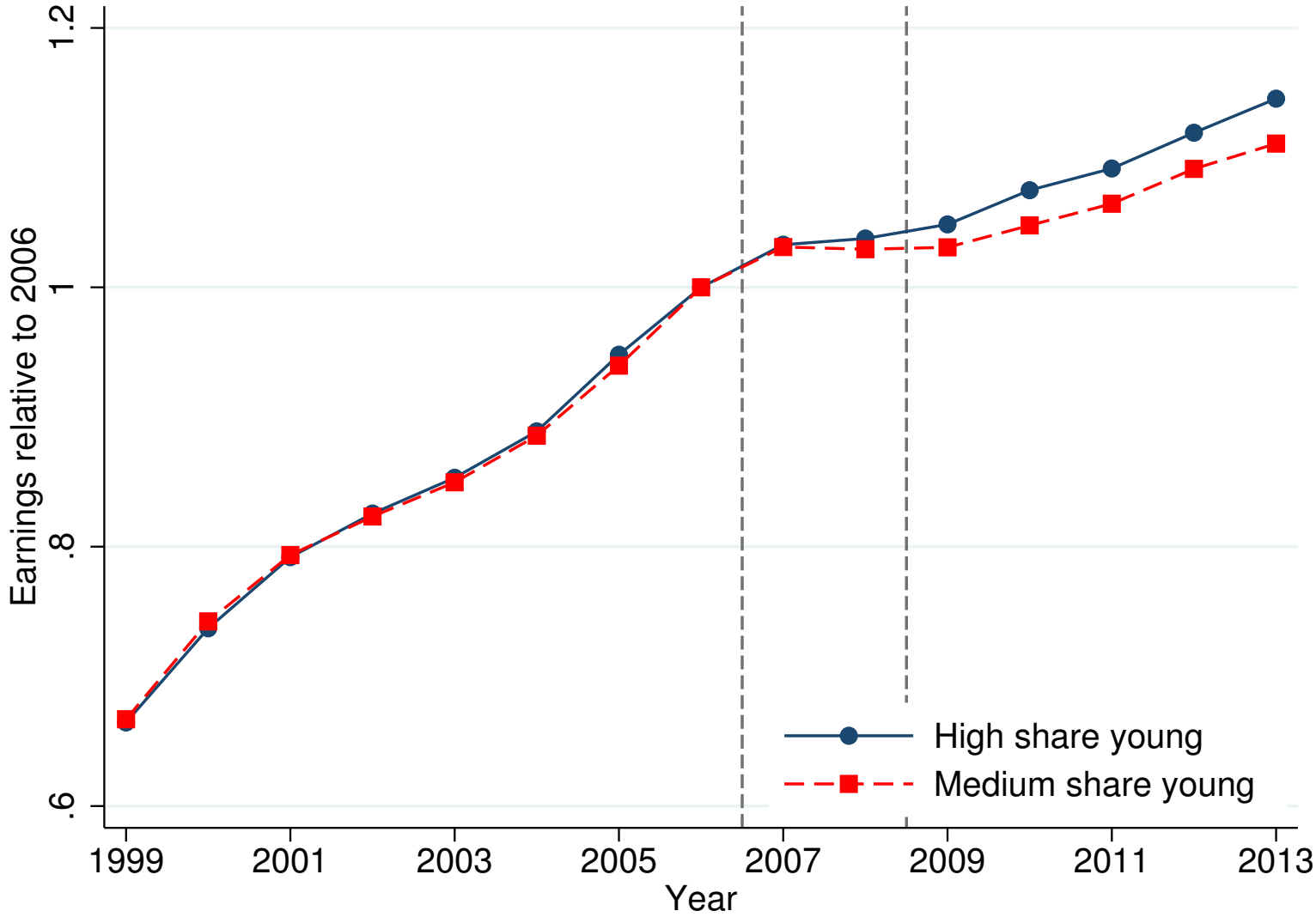
⇒ Follow cohort of **individuals** based on their 2006 firm.

Sample: **untreated** workers aged 25-60 in 2006 (to have pre-trends and uncover spillovers)

Details:

- DFL-reweight wage series to keep 2006 cohort's age composition constant within firm groups (5-year age groups 25-29,30-35,...).
- Allow for firm mobility.

Worker Earnings: Aged 25-60 in 2006



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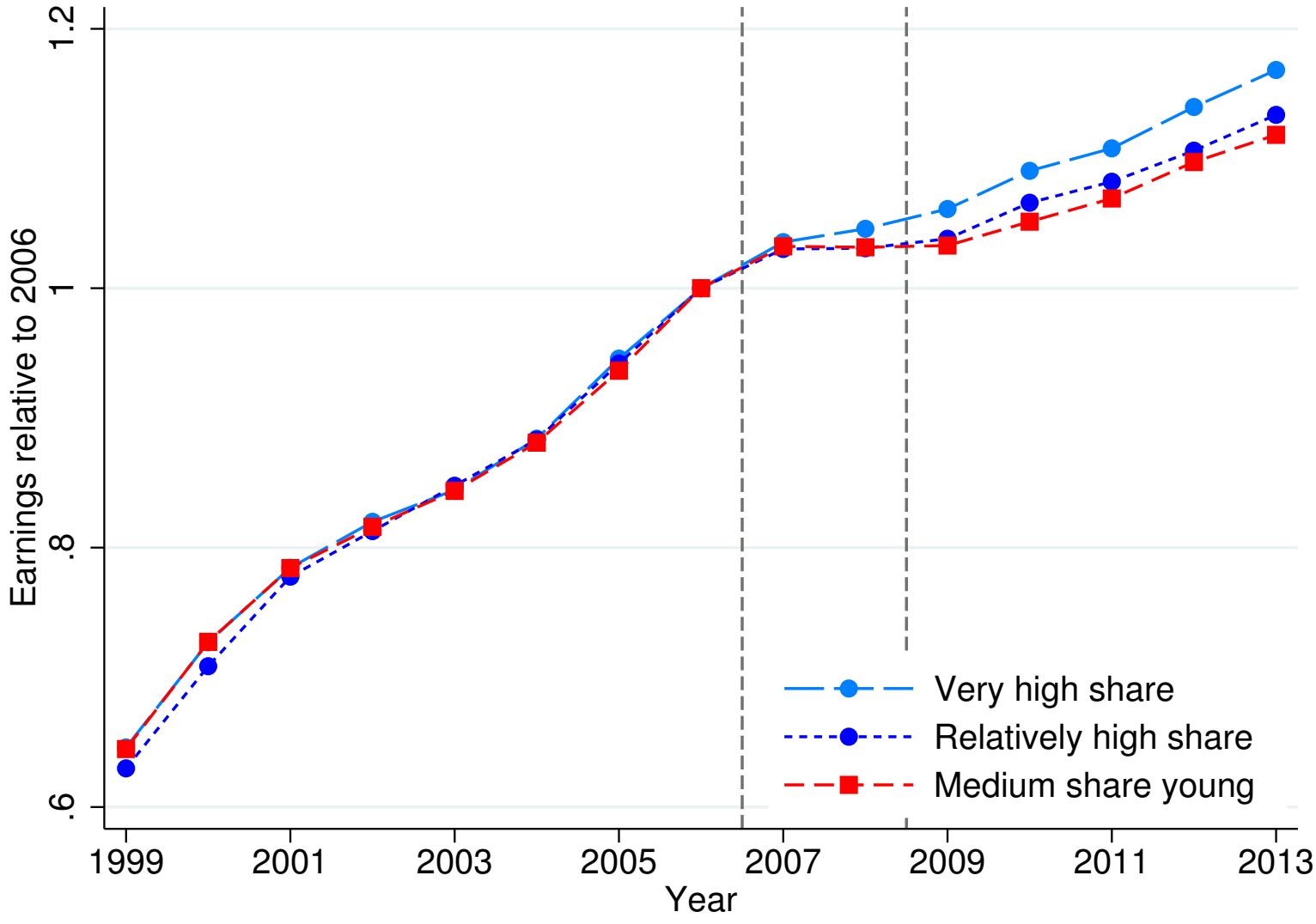


Individual vs. Collective Tax Incidence on Labor

Standard frictionless benchmark predicts 100% incidence on directly affected worker beneficiary group.

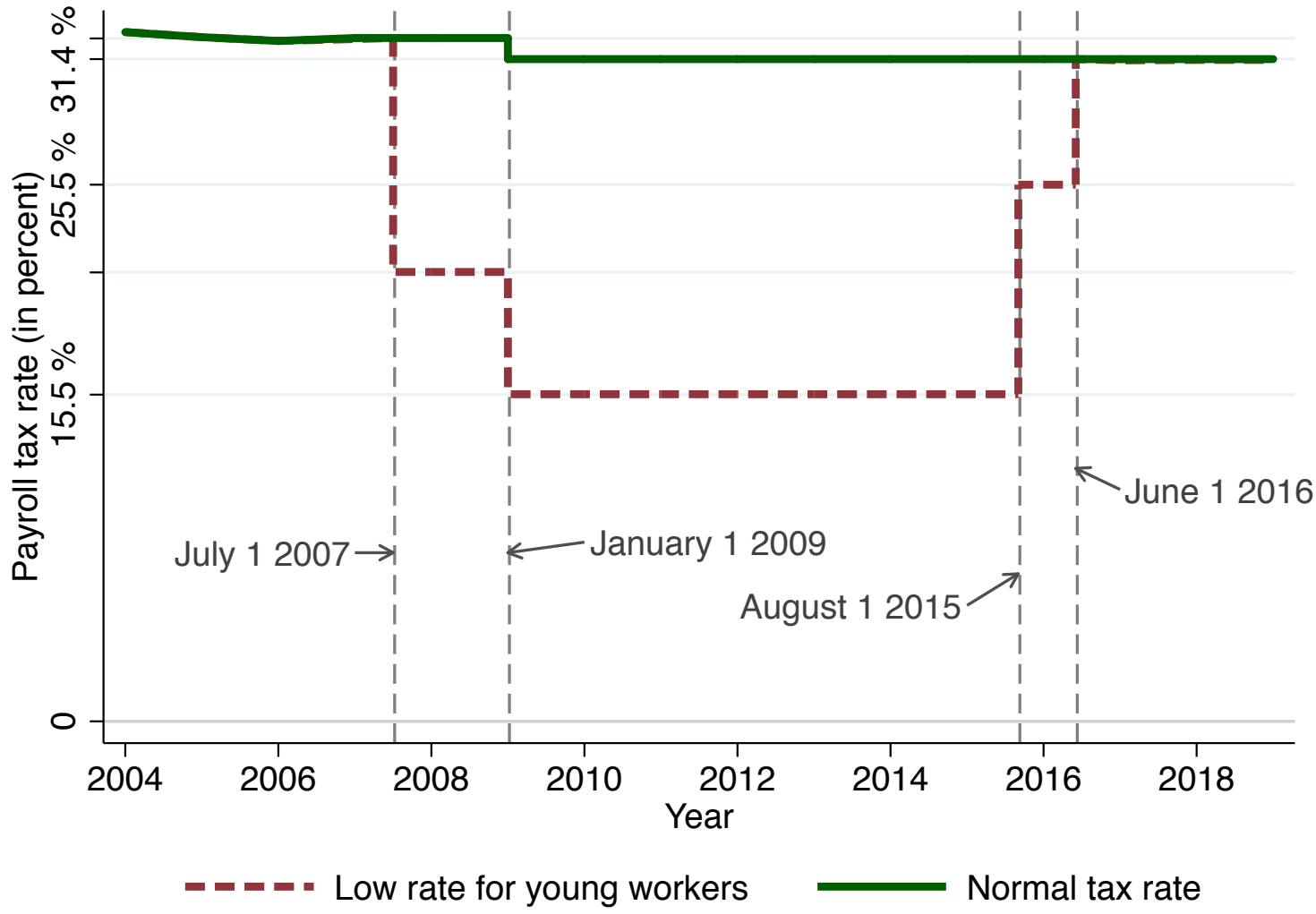
Our evidence shows that workers benefit from the payroll tax cut – but collectively in specific firms, not only the treated workers.

Hence, at the macro level, our evidence is consistent with part of the incidence falling on workers – young and old workers in the "treated firms".

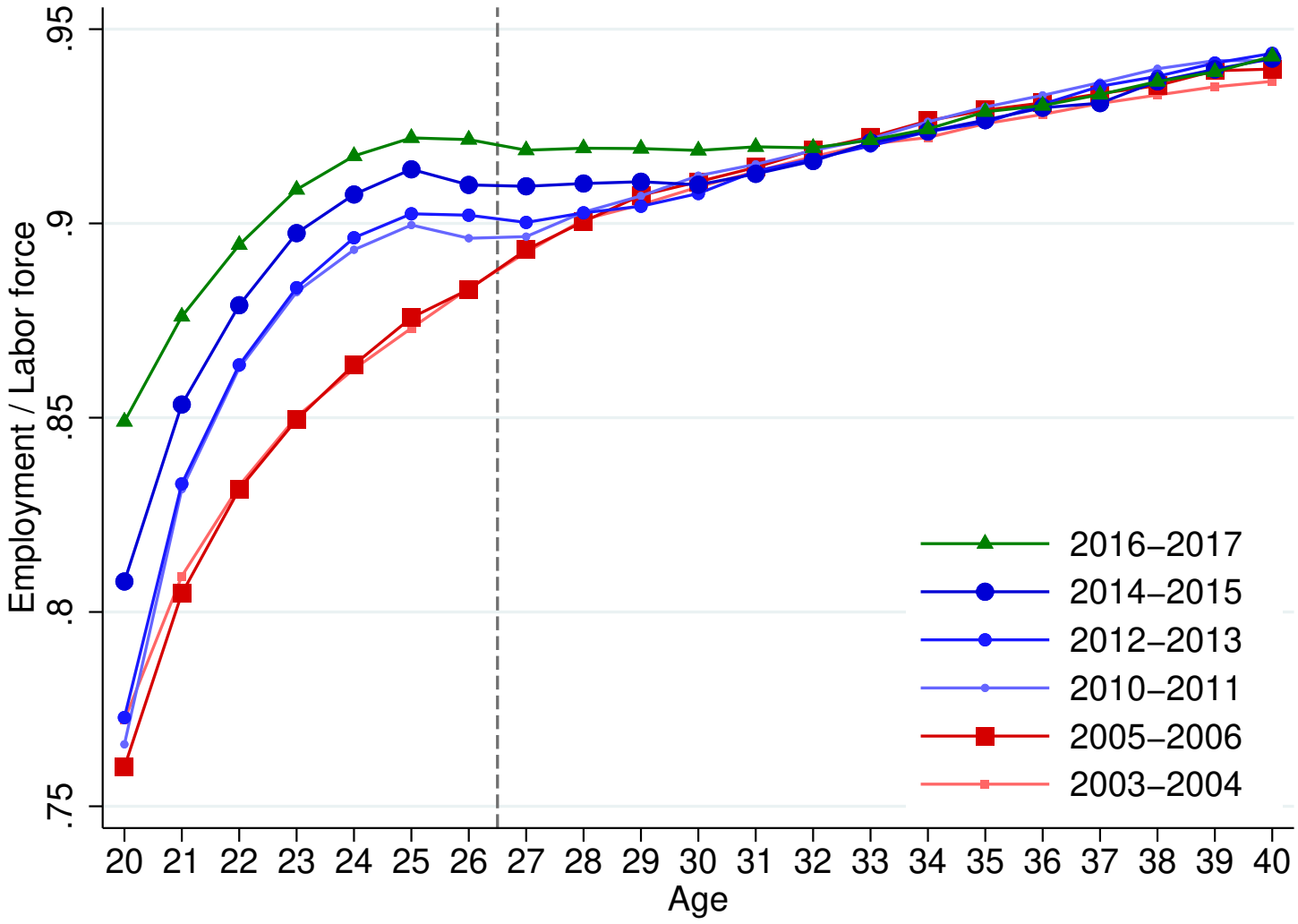
$\Rightarrow$ Possible that insensitivity of labor income share to payroll taxation is due more to rent sharing than Cobb-Douglas production function.

Follow-up study

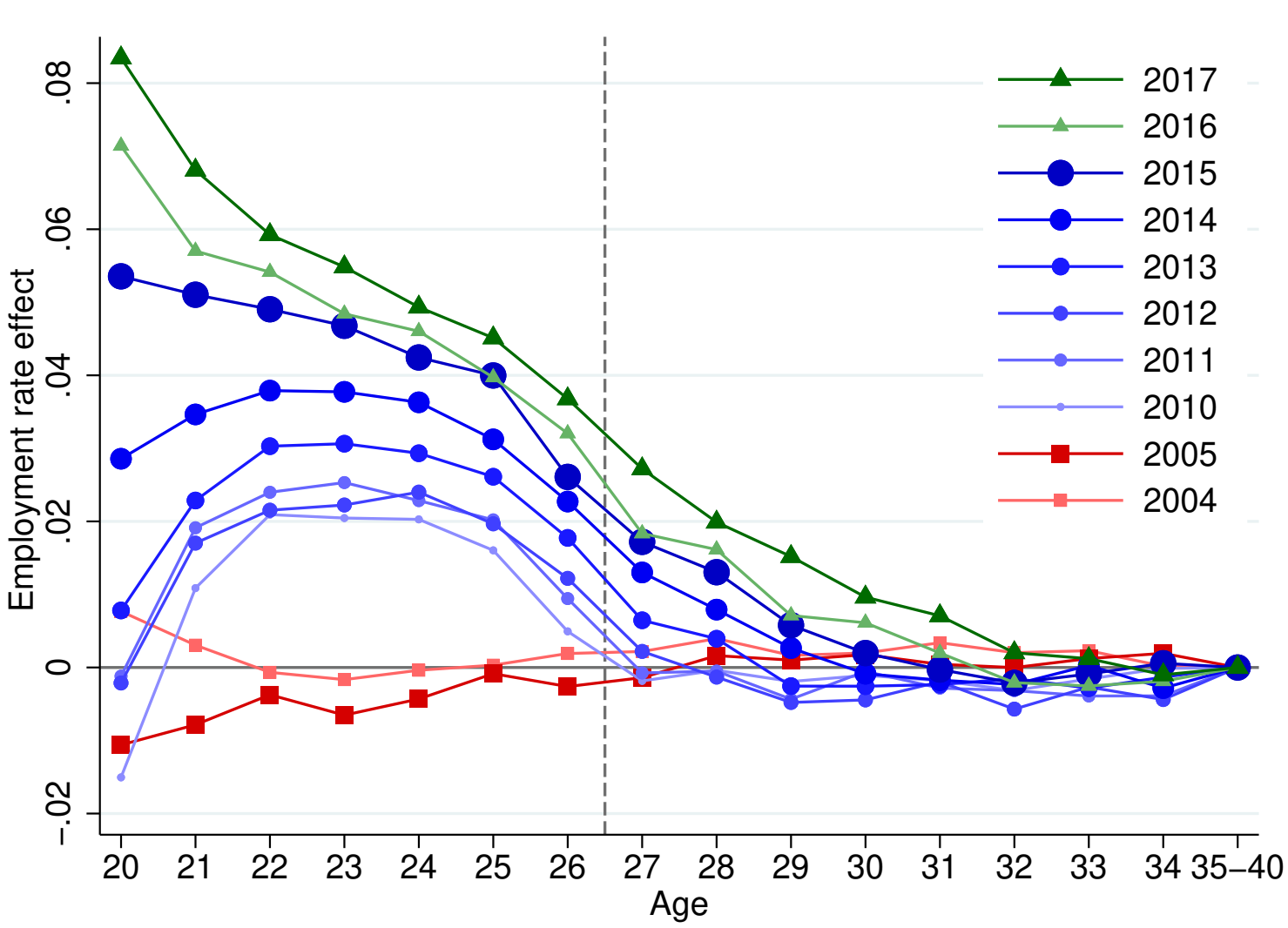
- Swedish government thought the reform was too expensive.
  - Subsidizing too many existing jobs.
- $\Rightarrow$ Repealed by center-left coalition in 2014.



Employment rates by age and time period



Employment rates by age and year rel. to 2006



Persistent effects

- Reform had persistent effects along two dimensions:
  1. After workers age out of the reform → positive effect.
  2. After **2014** → positive and even larger effects among young.
- Why?

Candidate explanations:

1. Reform induced firms to change production towards young inputs.
2. Employers were **discriminating against young** and stopped thanks to the reform.

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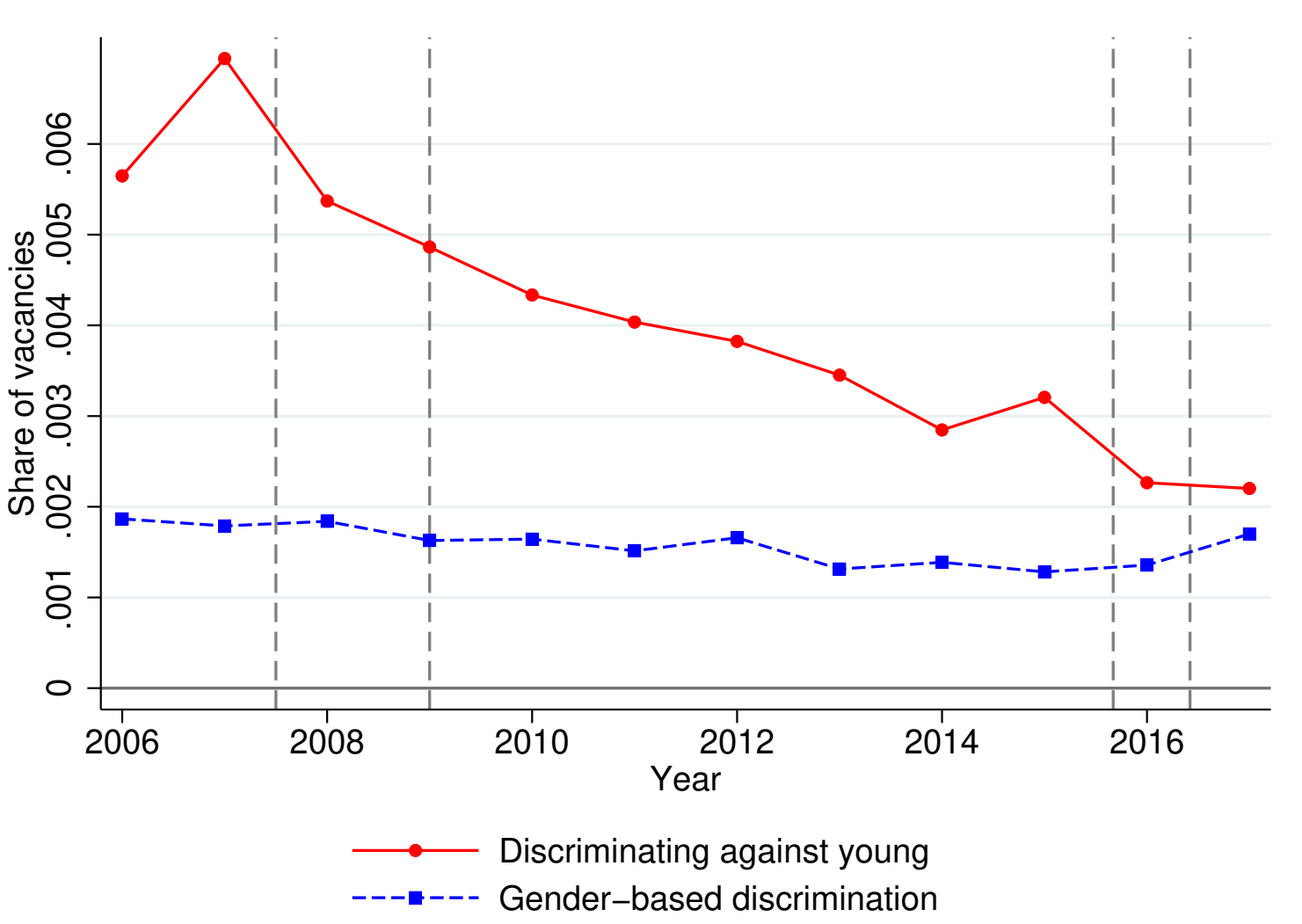
Youth discrimination over time



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