Adjustment Costs, Firm Responses, and Labor Supply Elasticities: Evidence from Danish Tax Records

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Introduction

- How do taxes affect labor supply and earnings behavior?
  - Most find intensive margin elasticities near zero (Heckman 1993, Blundell and MaCurdy 1999, Saez et al 2009)
  - Literature assumes that workers may freely choose labor supply
- Two factors prevent workers from choosing labor supply freely:
  - Search costs in finding optimal job
  - Constraints imposed by firms (e.g. hours constraints)
- Because of these frictions, workers may not reoptimize in response to tax changes of small size and scope in short run

  → Micro elasticity estimates may be attenuated relative to elasticities relevant for macro comparisons

Overview

- Derive three testable predictions about how adjustment costs and hours constraints affect micro labor supply elasticity estimates
- Test predictions using an administrative tax panel for the population of Denmark
- Find that standard micro methods of estimating elasticities on this dataset yields elasticities close to zero
- But accounting for frictions produces sharp evidence of larger elasticities and explains why standard approach is biased
- Calibration suggests that micro elasticity estimates understate the macro elasticities by an order of magnitude

Model with Search Costs and Endogenous Institutional Constraints

- Two types of labor supply models in existing literature
  - Neo-classical: workers freely choose hours
  - Hours constraints: wage-hours packages determined by firms' production technologies (Rosen 1976, Blundell et al. 2008)
- This paper: model of *endogenous* hours constraints
  - Wage-hours packages offered by firms reflect workers' *aggregate* preferences
  - But workers face search frictions, so each worker is not at his individual optimum

Model Setup

- Workers: Constant elasticity quasi-linear utility function

$$u_i(c,h) = c - \alpha_i^{-1/\varepsilon} \frac{h^{1+1/\varepsilon}}{1+1/\varepsilon}$$

  - c is consumption and α_i is an individual taste parameter
  - Smooth distribution $F(\alpha_i)$ in the economy

- Firms: CRS Leontief production function

$$\pi_j = pN_j \min\{h_j^1, \ldots, h_j^{N_j}\} - w_j \sum_{i=1}^{N_j} h_j^i$$

  - Offers (possibly heterogeneous) wage-hours packages $\{h_j, w_j\}$
  - Workers all produce goods sold a price p
  - Firm size N_j determined endogenously in equilibrium

Model Setup

- Search Frictions:
  - Workers initially draw job with wage-hours package $\{h_0, w_0\}$ from distribution $G(.)$ offered by firms
  - Two ways to switch jobs:
    1. Switch to job with same hours but higher wage at no cost (e.g., no re-training required)
    2. Switch to different hours by paying a cost:
       - Draw new wage-hours package $\{h', w'\}$ from $G_e(.|h_i^*)$
         - Draw centered at optimal job, $E(h' \mid h_i^*) = h_i^*$
         - Variance decreasing in effort, $Var(h') = k(1 - e)$
       - Search cost $\Phi(e)$ weakly increasing in effort e

Model Setup

- Equilibrium:
  - Firm maximize profits
    - All workers paid same wage $w_j = w = p$
  - Workers choose optimal search effort (or not to search at all)
    - Workers only search if utility gain $u_i(h^*) - u_i(h_0) > \Phi(e_i^*)$

$$h_0 \notin \left[\underline{h}_i, \overline{h}_i \right]$$

  - Market clears: Supply equals demand at each hours level
    - Search process $\mathcal{F}(.)$ does not change the hours distribution

$$G(h) = \mathcal{F}(G(h))$$

Estimating Elasticities: Benchmark Frictionless Model

- Special case: $\Phi(e) = 0$, all workers choose $h_i = h_i^*$
- Structural parameter ε determines wage elasticity of labor supply

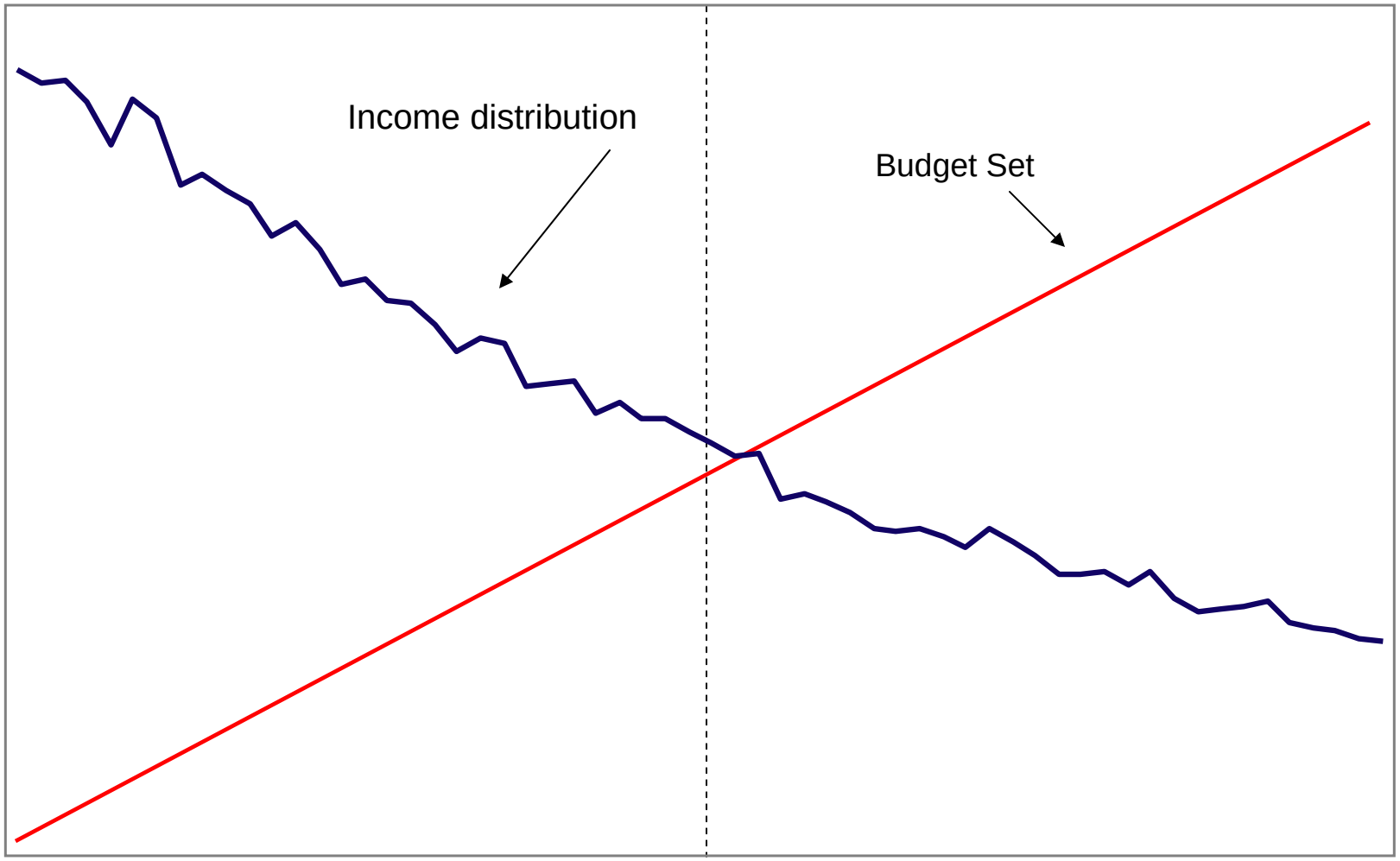
$$\varepsilon = \frac{d \log h}{d \log(1-\tau)}$$

- Two micro methods of identifying structural elasticity ε

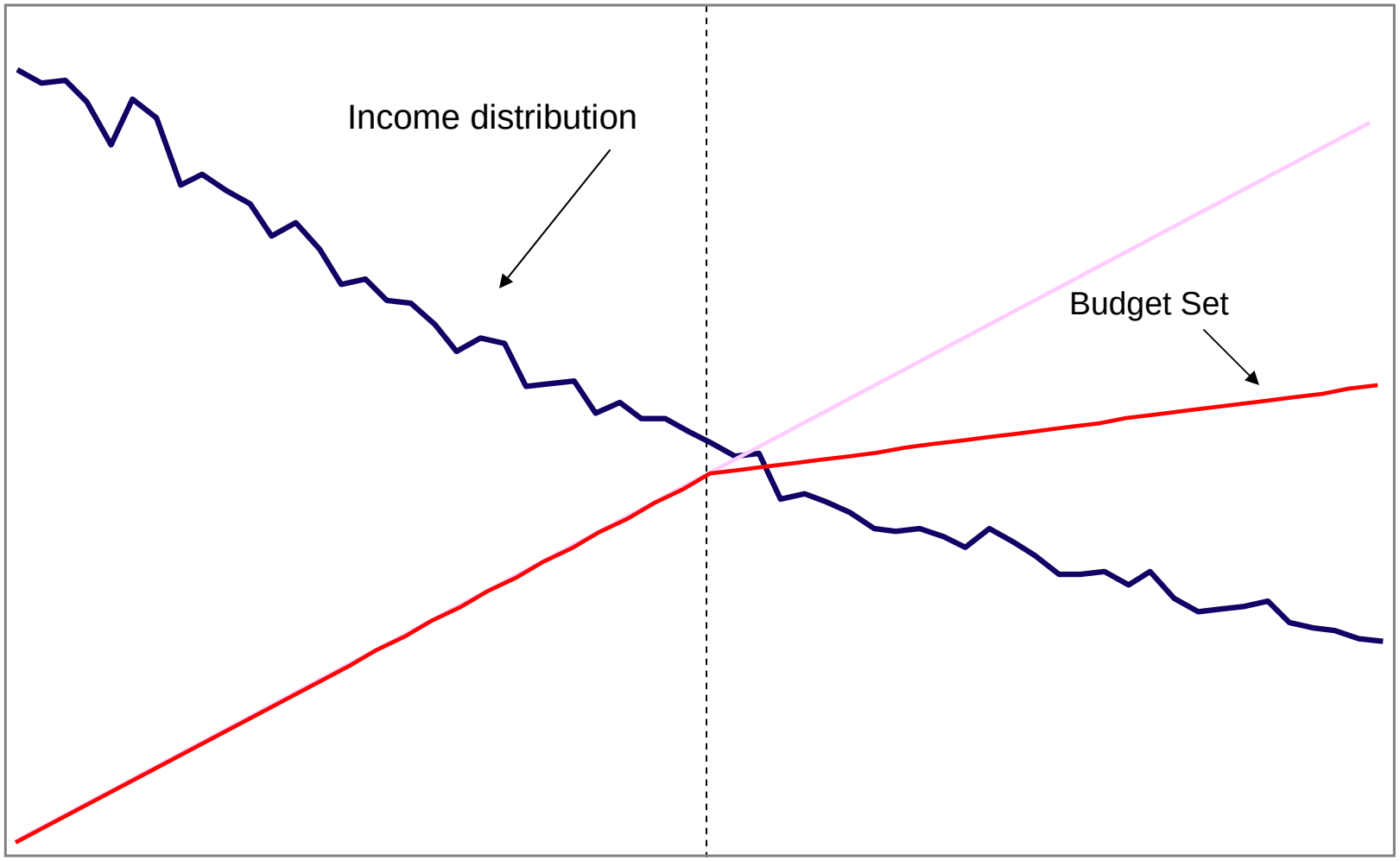
1. Variation in tax rates over time. For individuals affected by tax change, observed hours elasticity w.r.t. net-of-tax wage equals ε

2. Variation in rates across tax brackets. Amount of bunching at kinks can be used to estimate ε

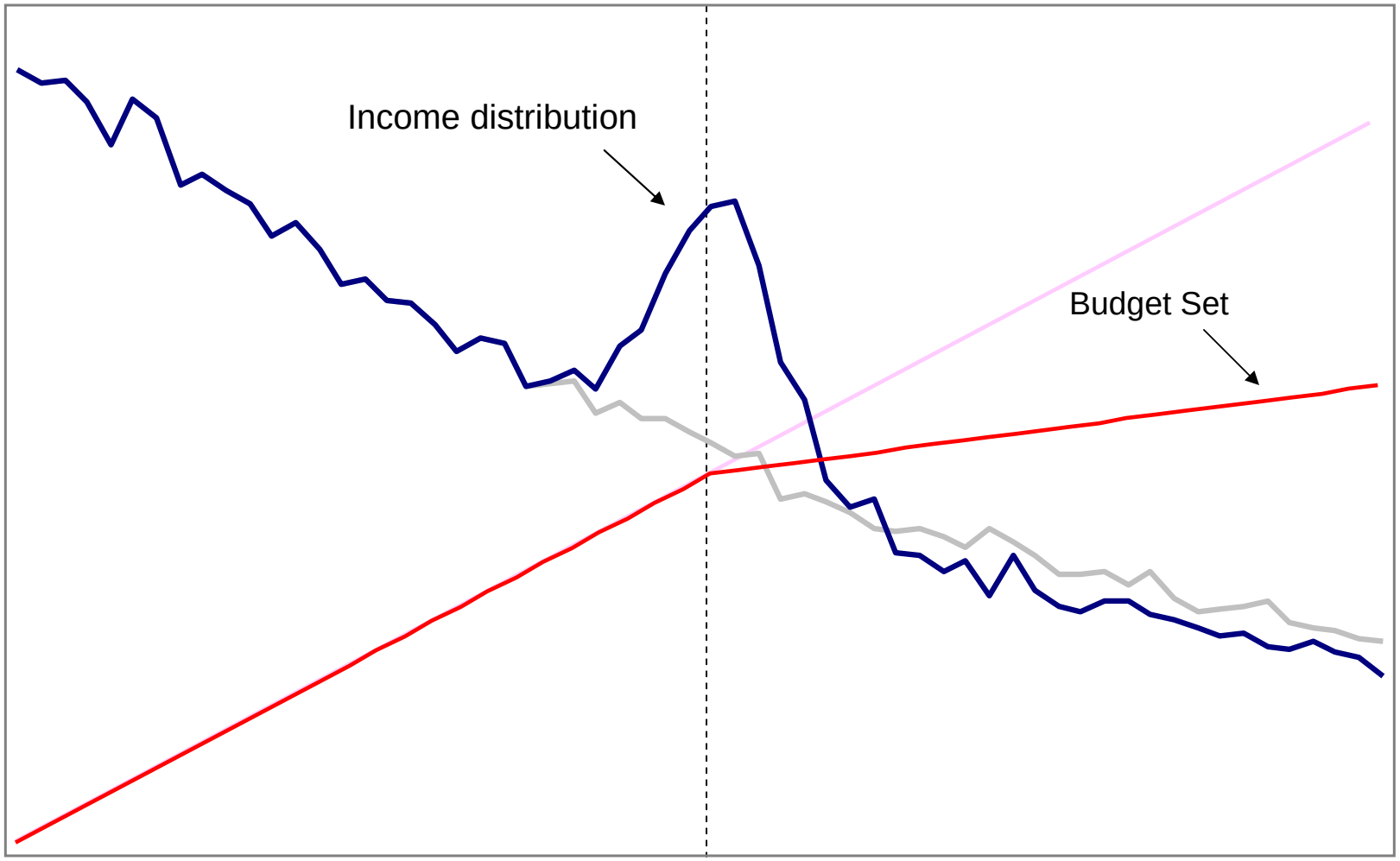
Bunching at Kink Points



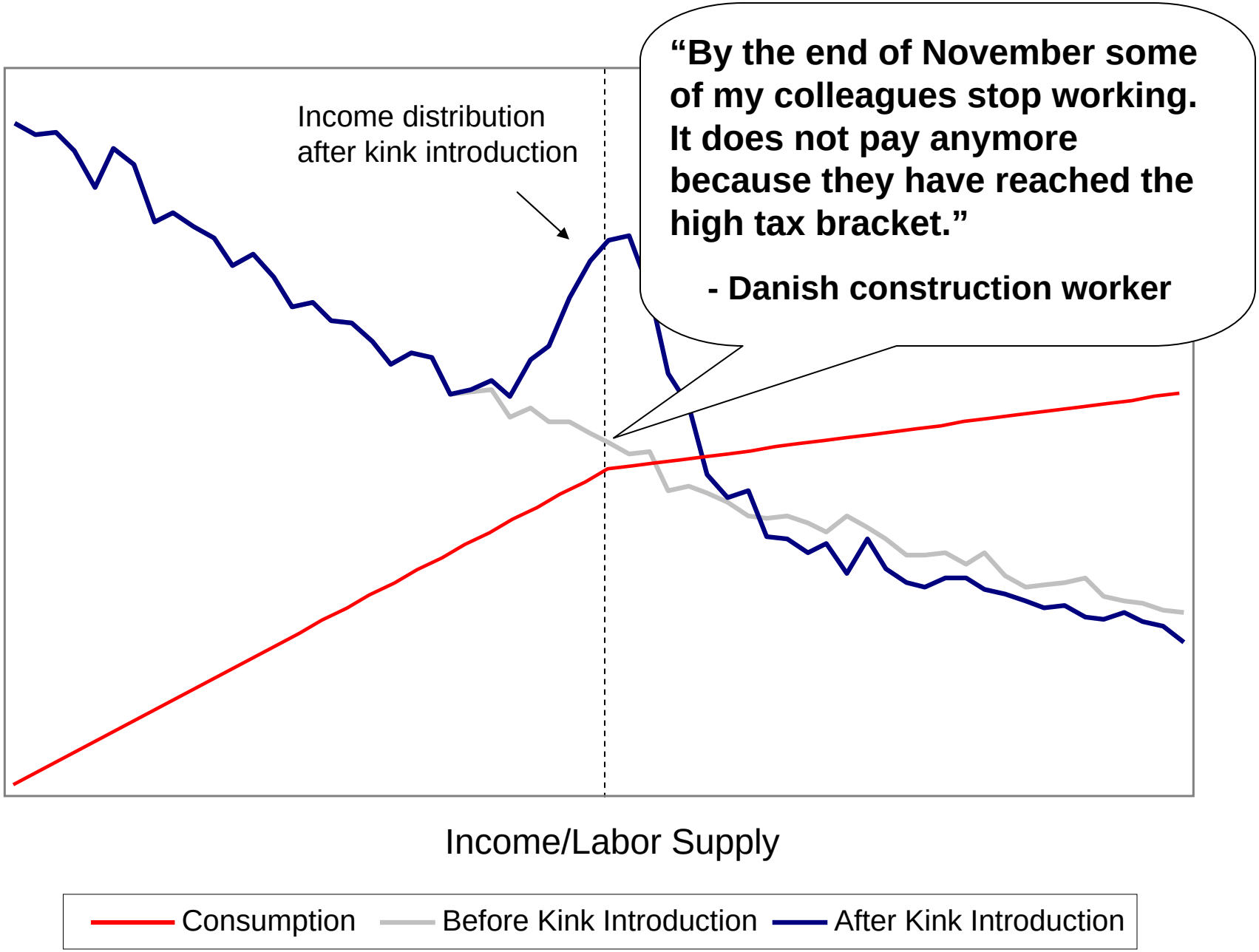
Bunching at Kink Points



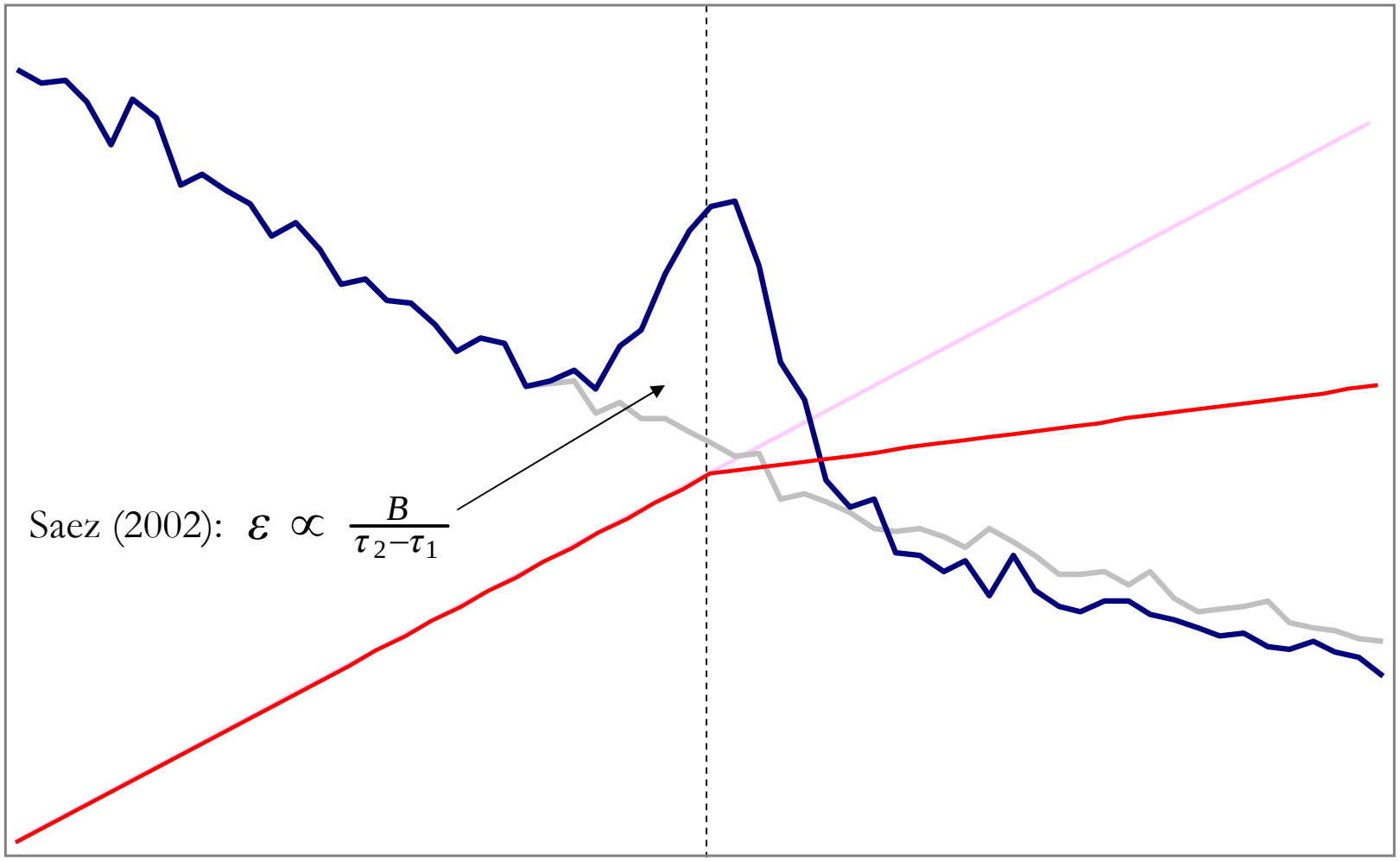
Bunching at Kink Points



Bunching at Kink Points



Bunching at Kink Points



Baseline Case: Estimating Elasticities

- Special case: $\Phi(e) = 0$, all workers choose $h_i = h_i^*$
- Structural parameter ε determines wage elasticity of labor supply

$$\varepsilon = \frac{d \log h}{d \log(1-\tau)}$$

- Two micro methods of identifying structural elasticity ε

1. Variation in tax rates over time. For individuals affected by tax change, observed hours elasticity w.r.t. net-of-tax wage equals ε

2. In non-linear tax system, use variation in rates across tax brackets. Examine amount of bunching at the kink.

→ **How do frictions affect estimated elasticities?**

Bunching with Search Frictions

- With hour constraints, there are two ways to locate at the kink

    1. *Individual Bunching*: Workers search for a job at the kink

    2. *Firm Bunching*: Draw job at kink to begin with

        - Signature of firm bunching: Even workers who **do not face** a kink bunch there

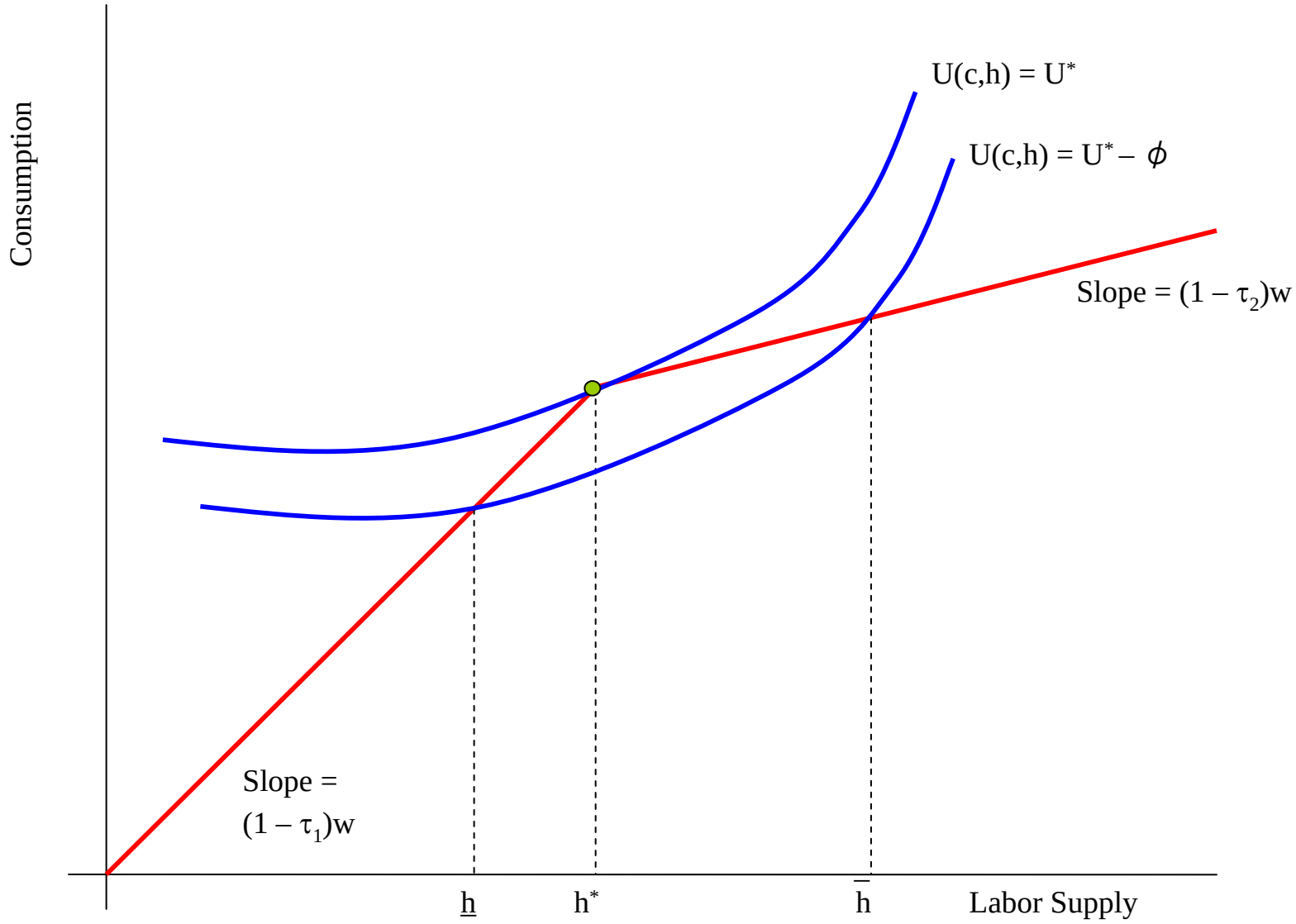
- Three predictions about observed elasticity measured from bunching at kink

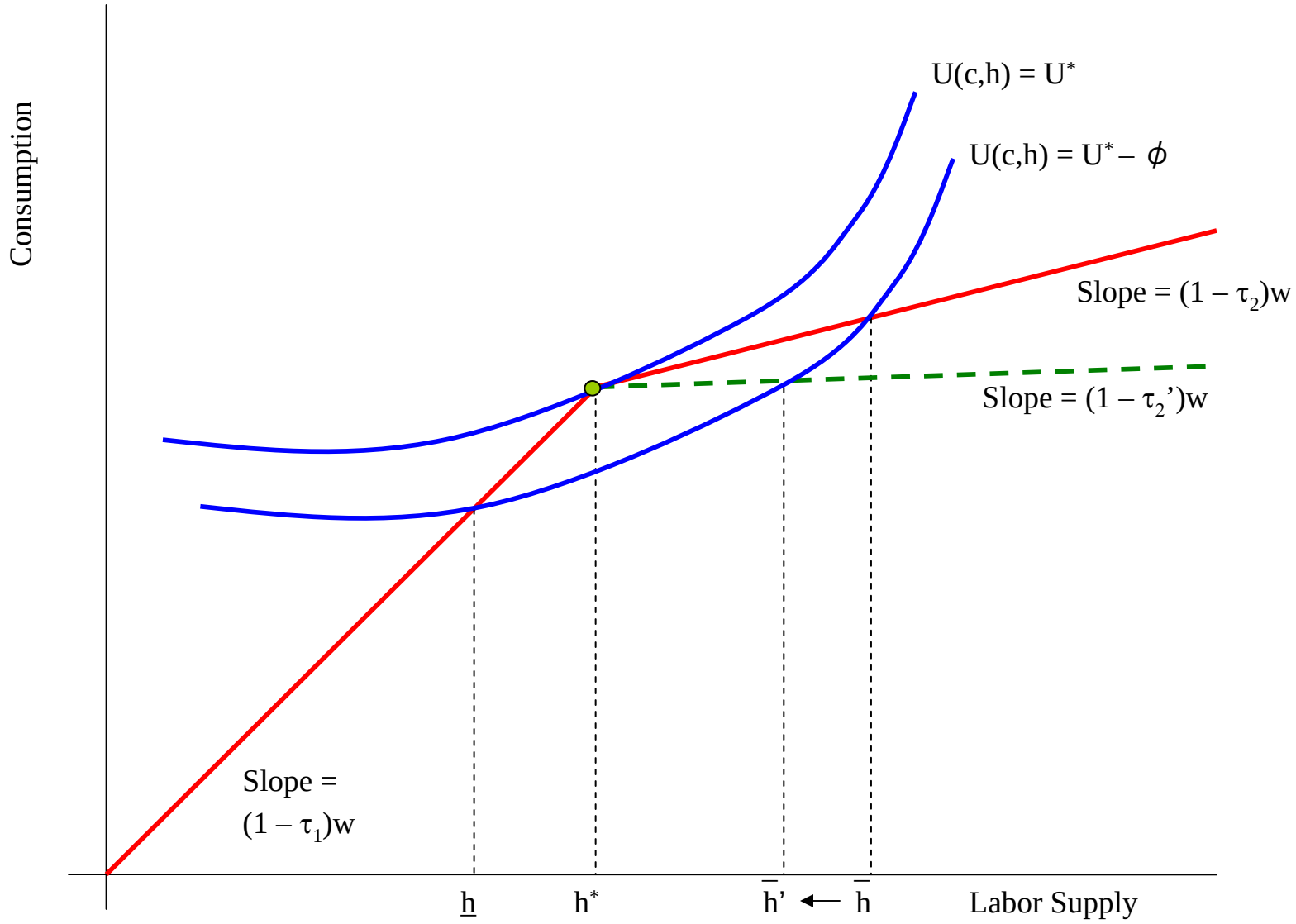
Effects of Frictions on Observed Elasticities

- Three empirical predictions:

1. [**Size**] Larger kinks generate larger observed elasticities

    - Large kinks are more likely to induce workers to pay search costs and relocate to the kink


Consumption
U(c,h) = U*
U(c,h) = U* – ϕ
Slope = (1 – τ2)w
Slope =
(1 – τ1)w
h
h*
h̄
Labor Supply


Consumption
U(c,h) = U*
U(c,h) = U* – ϕ
Slope = (1 – τ2)w
Slope = (1 – τ2')w
Slope =
(1 – τ1)w
h
h*
h'
h
Labor Supply

Effects of Frictions on Observed Elasticities

- Three empirical predictions:

1. [**Size**] Larger kinks generate larger observed elasticities

    - Large kinks are more likely to induce workers to pay search costs and relocate to the kink

2. [**Scope**] Kinks that affect a larger group of workers generate larger observed elasticities

    - Firms tailor jobs to *aggregate* preferences → more firm bunching at common kinks

Effects of Frictions on Observed Elasticities

- Three empirical predictions:

1. [**Size**] Larger kinks generate larger observed elasticities

    - Large kinks are more likely to induce workers to pay search costs and relocate to the kink

2. [**Scope**] Kinks that affect a larger group of workers generate larger observed elasticities

    - Firms tailor jobs to *aggregate* preferences → more firm bunching at common kinks

3. [**Correlation**] More firm bunching in sectors with greater individual bunching

    - In sectors of the economy where workers are more elastic, firms offer more jobs at the kink.

Micro vs Macro Elasticities

- Define macro elasticity as effect of difference in tax rates across economies on average hours of work:

$$\hat{\varepsilon}_{\text{MAC}} = \frac{\mathbb{E}\log h_i(\tau_1') - \mathbb{E}\log h_i(\tau_1)}{\log(1-\tau_1') - \log(1-\tau_1)}$$

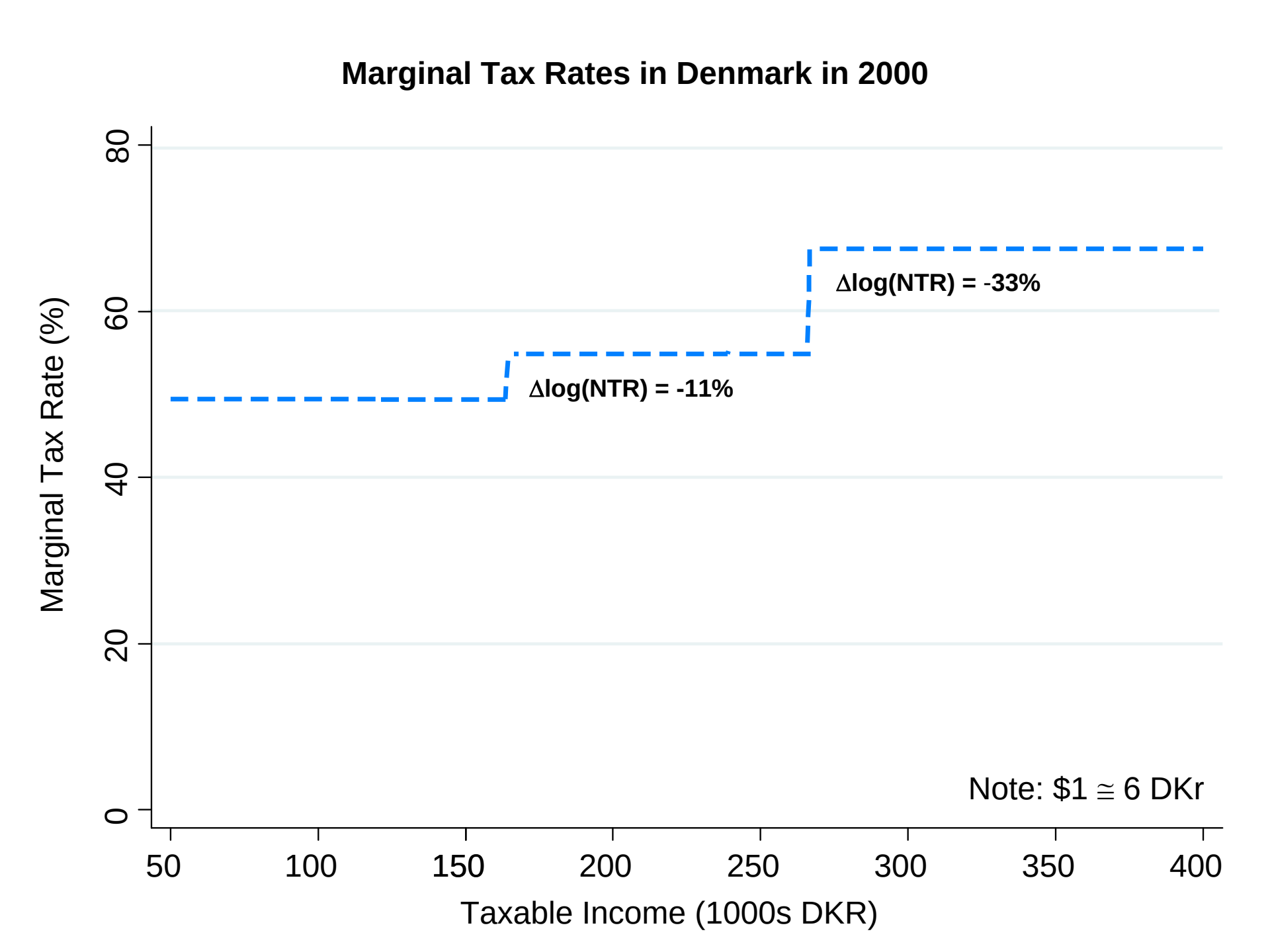
- In frictionless model, observed elasticities coincide with structural elasticity irrespective of size and scope

  → No difference between micro and macro elasticities

- In our model, macro elasticity coincides with ε even with frictions
  - But micro estimates are attenuated
  - Intuition: micro estimates identified from “fine tuning” of hours in response to tax changes or locating at kinks

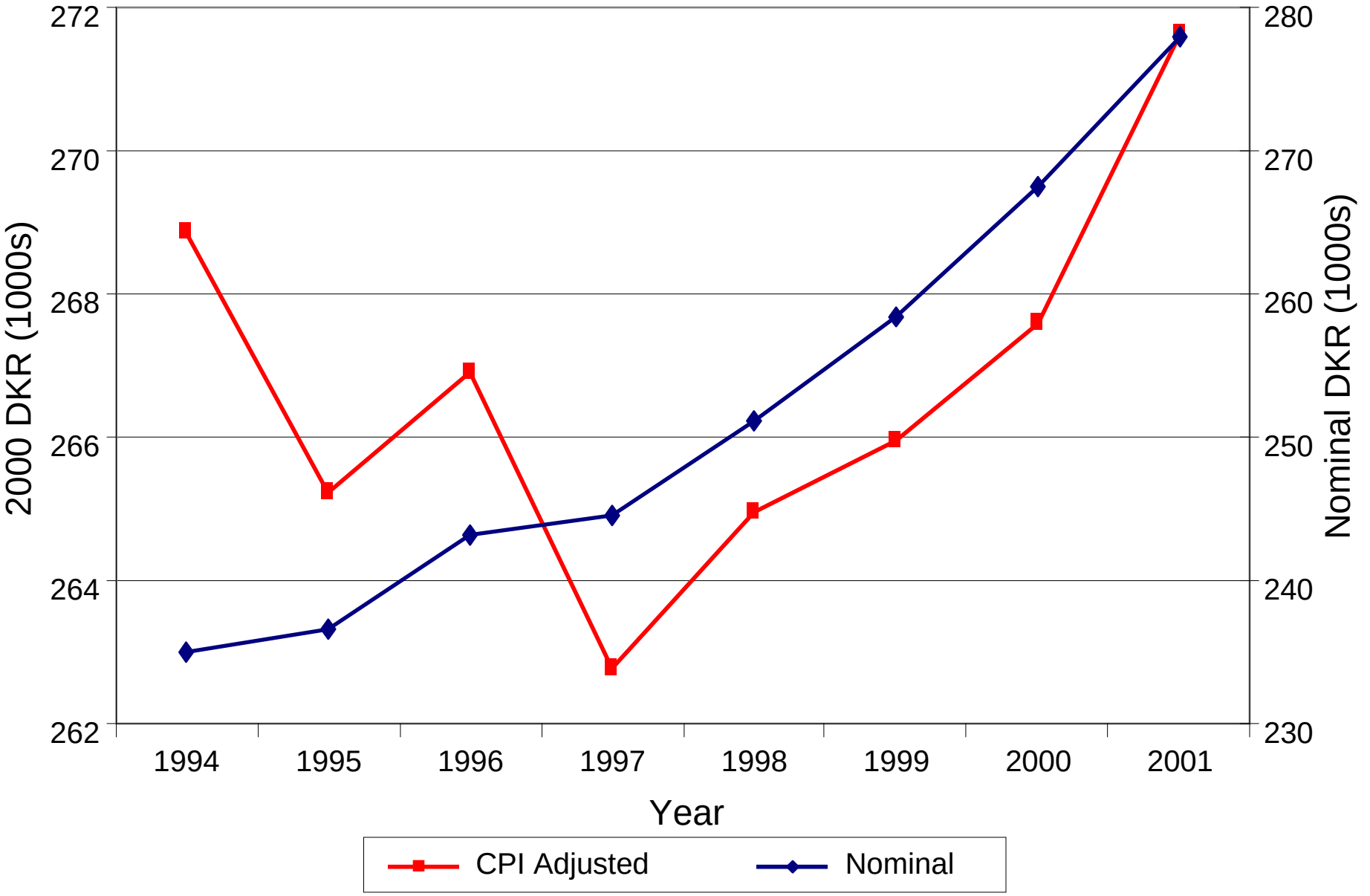
DATA AND INSTITUTIONAL BACKGROUND

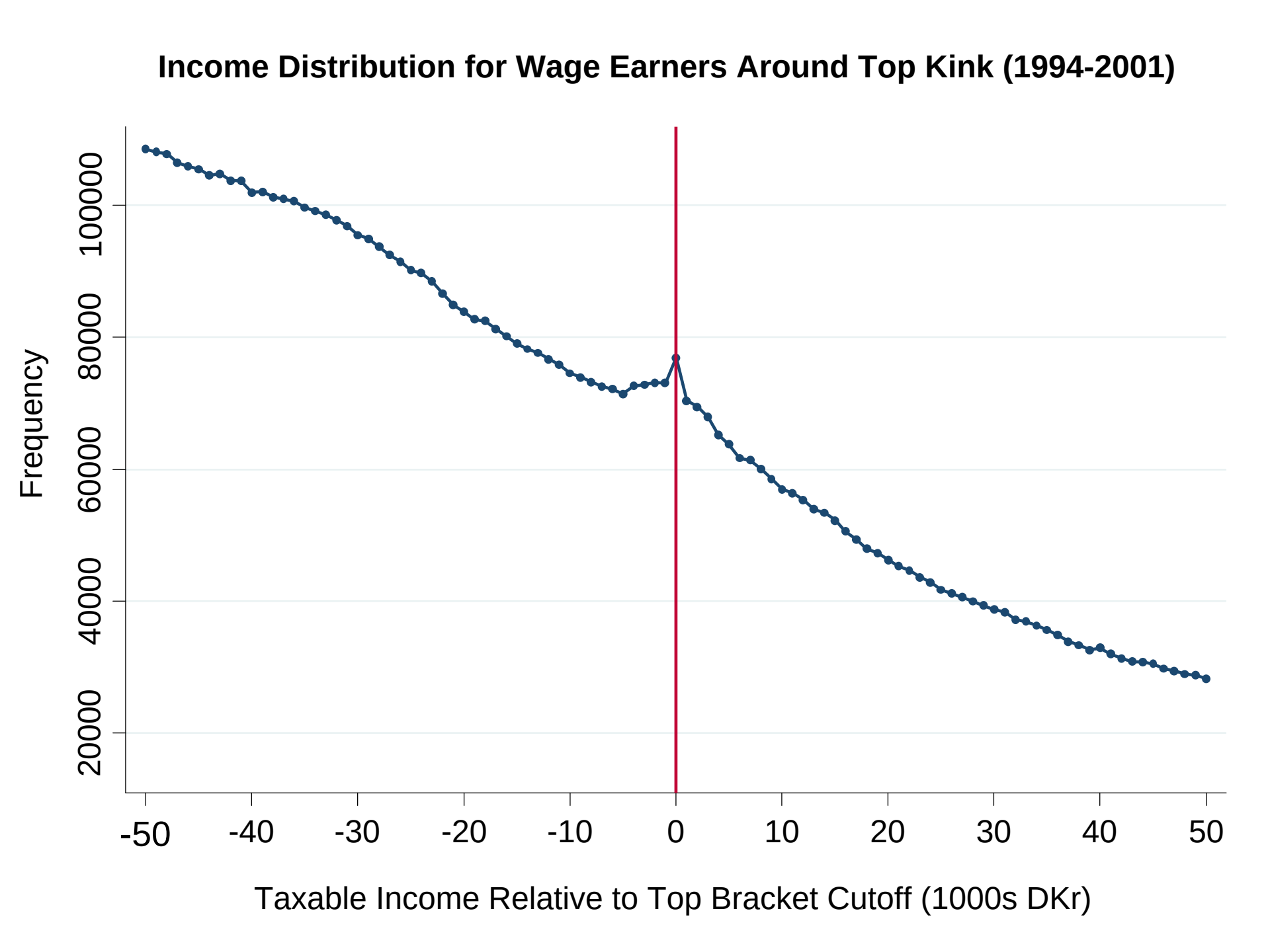
- Matched employer-employee panel data with admin tax records for full population
    - Income vars: wage earnings, capital and stock income, pension contributions
    - Employer vars: tenure, occupation, employer ID
    - Demographics: education, spouse ID, kids, municipality
- Sample restriction: Wage-earners aged 15-70, 1994-2001
    - Approximately 2.42 million people per year

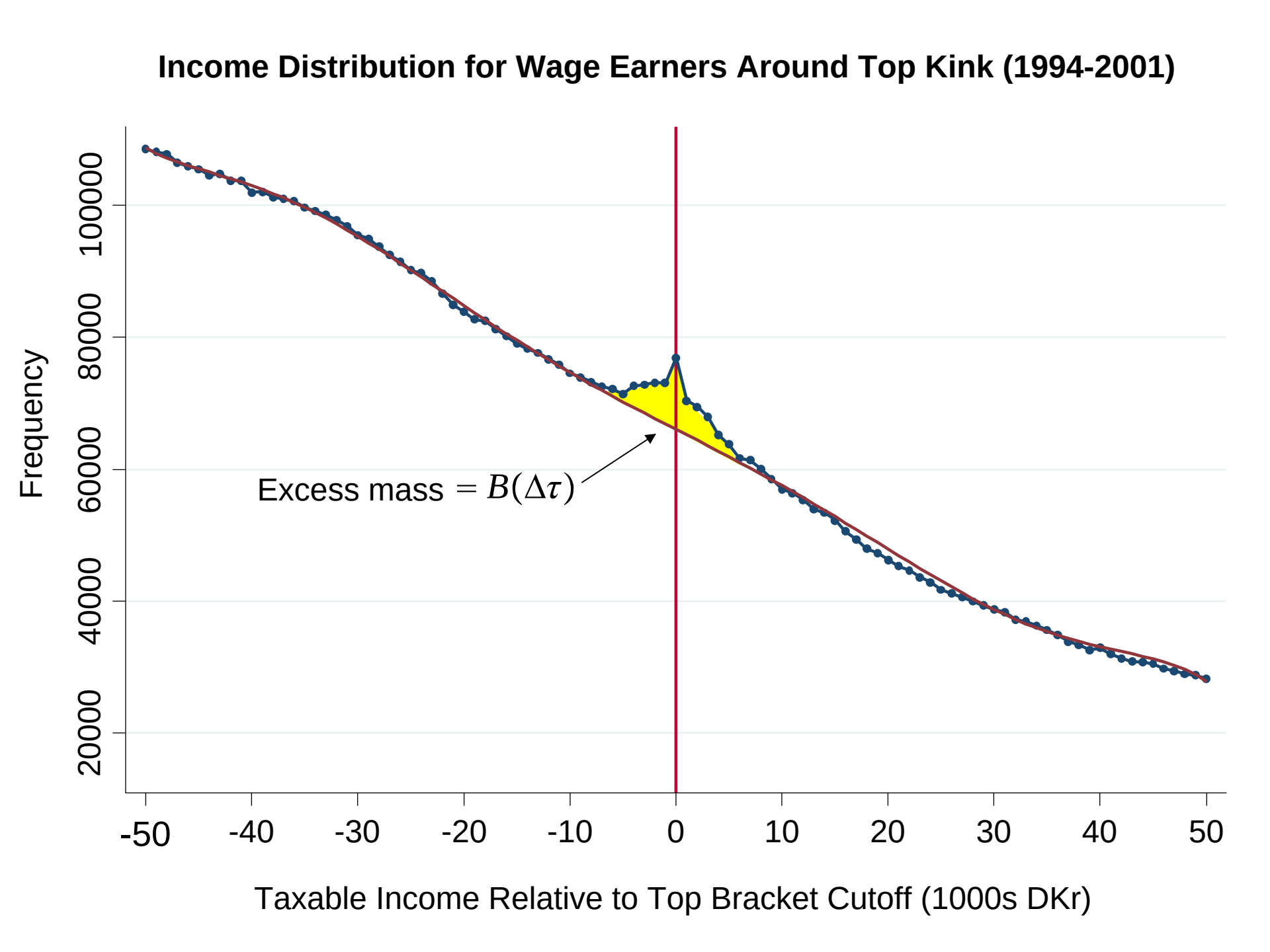

Marginal Tax Rates in Denmark in 2000
Marginal Tax Rate (%)
0
20
40
60
80
Δlog(NTR) = -33%
Δlog(NTR) = -11%
Note: $1 ≅ 6 DKr
50
100
150
200
250
300
350
400
Taxable Income (1000s DKR)

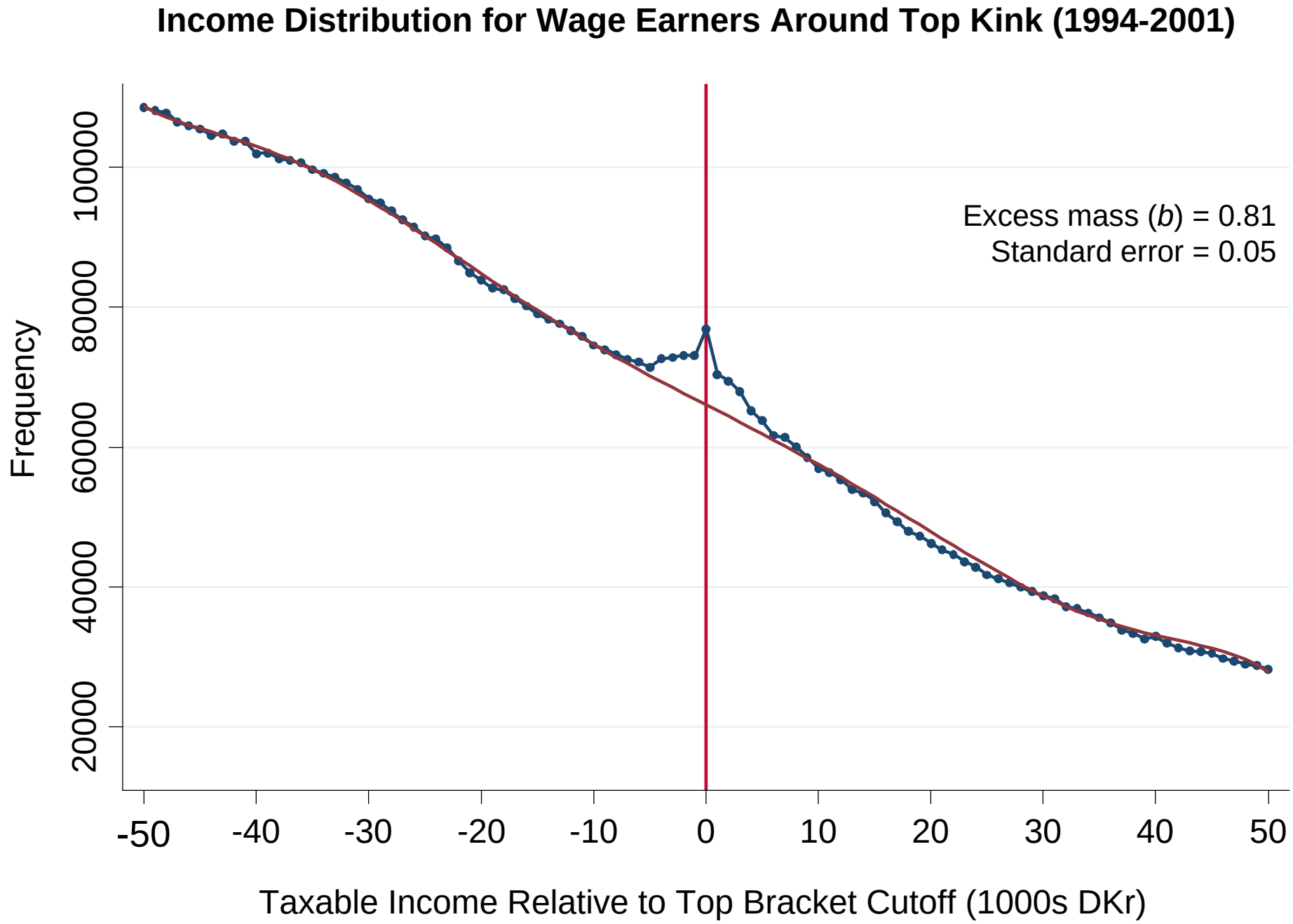
KEY FEATURES OF TAX SYSTEM 1994-2001

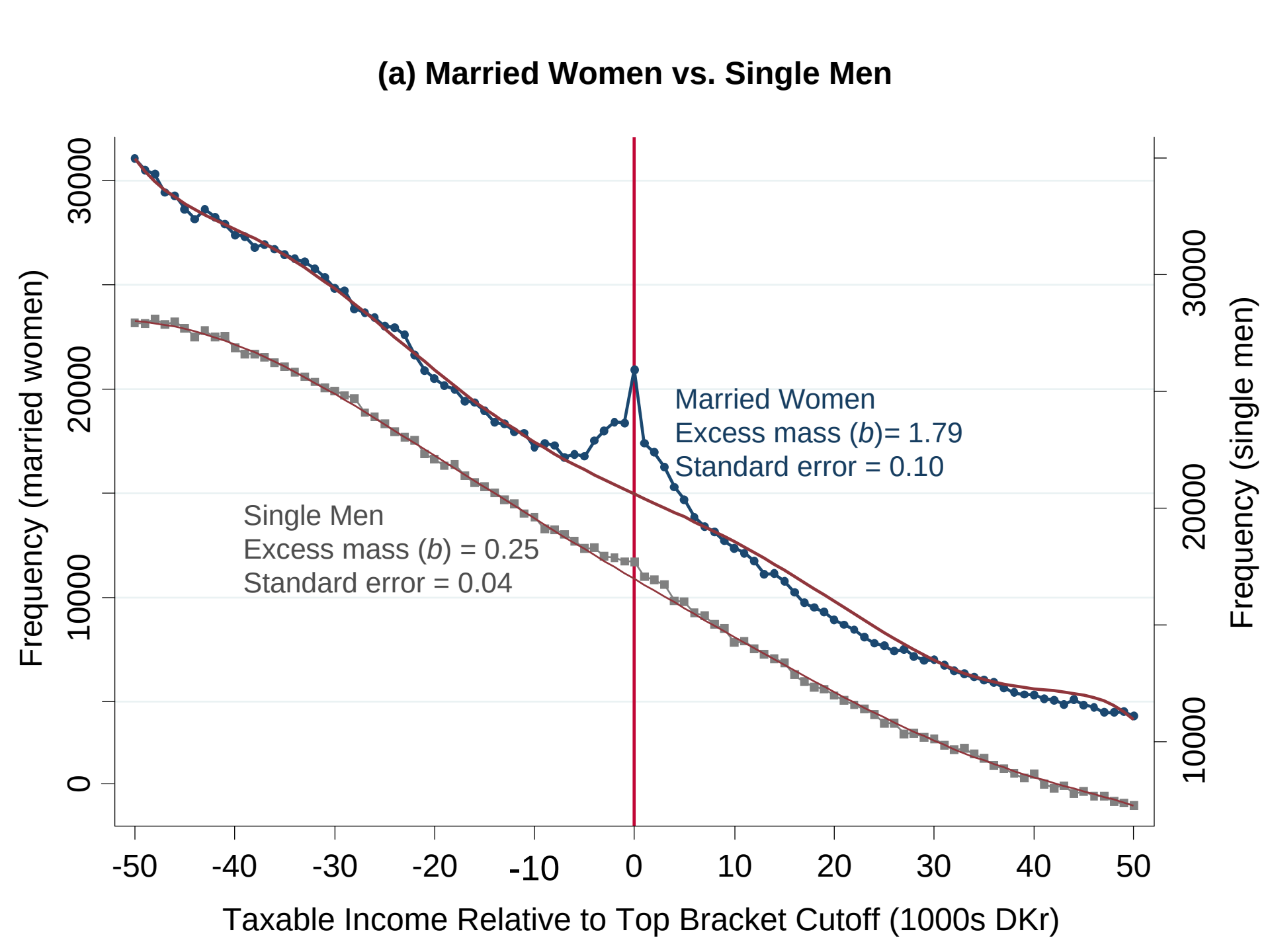
- Taxable income = wage earnings + net deductions
  - Wage earnings: double reported by firms and workers
  - Net deductions:
    - Non-wage income: gifts, awards, company cars
    - Deductions: pension contributions, some work expenses
- Question of shifting vs. "real" labor supply responses
- Top bracket cutoffs move over time
  - Indexed to two-year lagged earnings growth: tax policy set *before* earnings choices are made

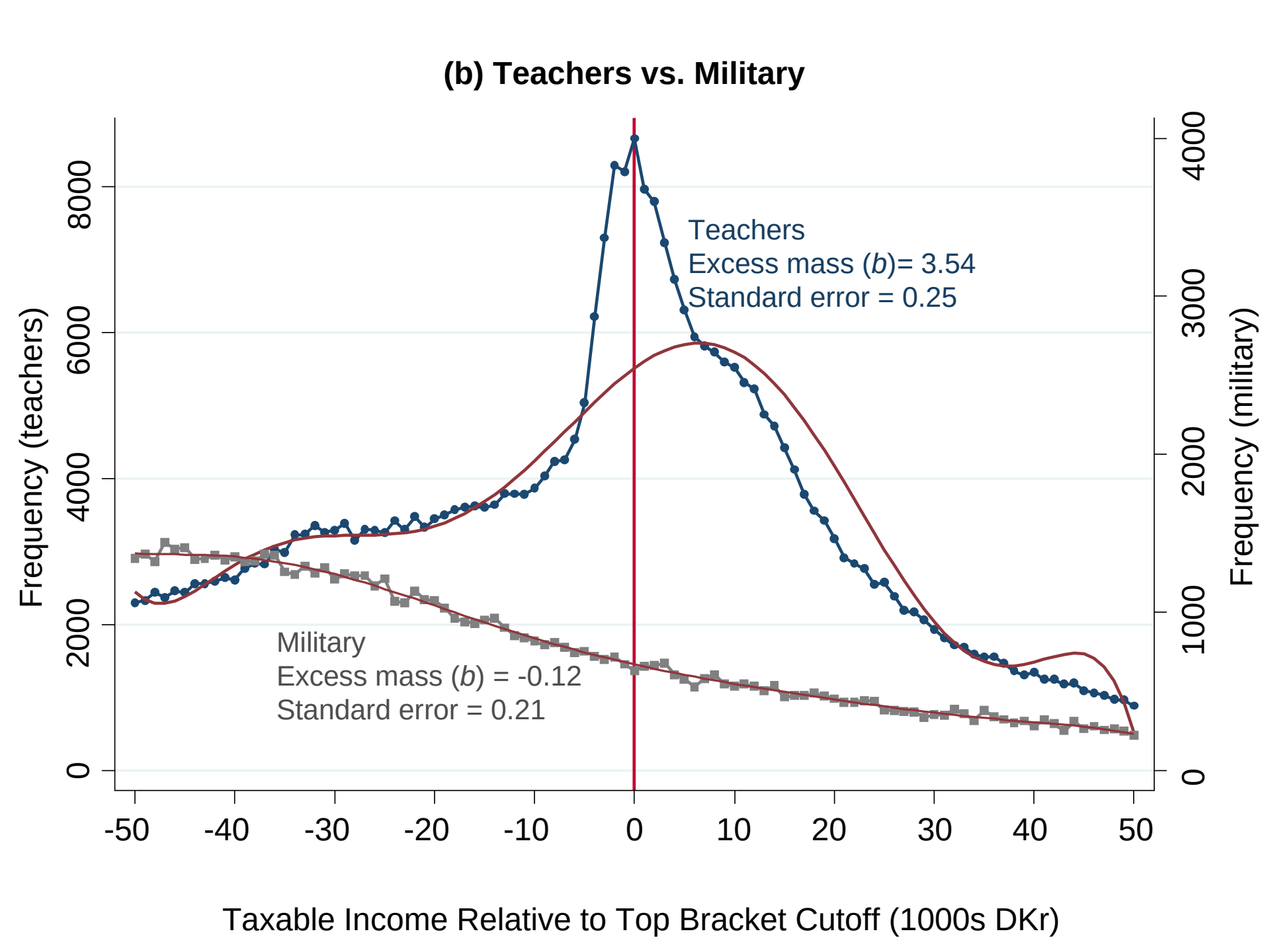

Movement in Top Tax Cutoff Across Years
272
270
268
266
264
262
2000 DKR (1000s)
280
270
260
250
240
230
Nominal DKR (1000s)
1994
1995
1996
1997
1998
1999
2000
2001
Year
CPI Adjusted
Nominal

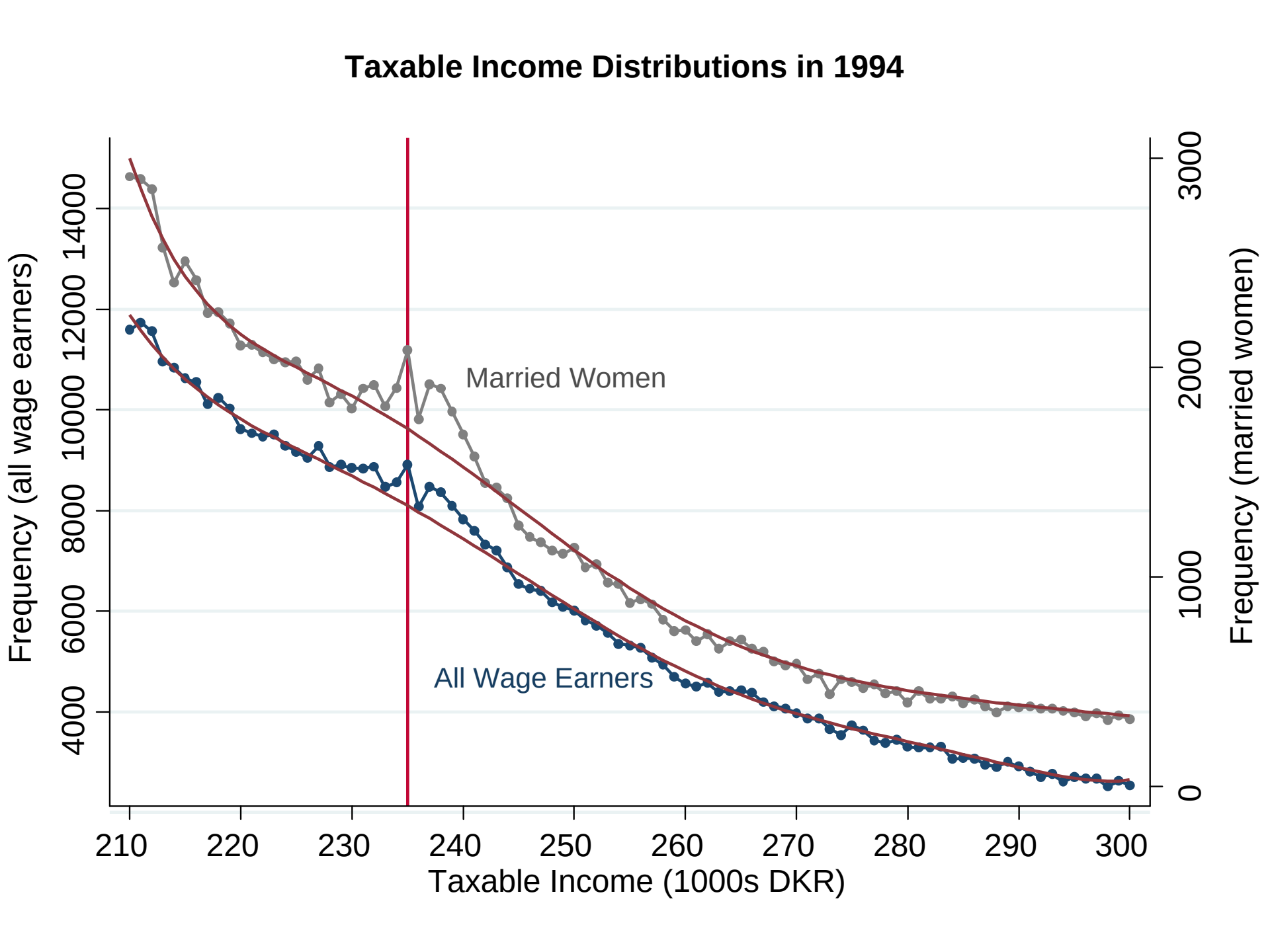

Income Distribution for Wage Earners Around Top Kink (1994-2001)
Frequency
20000
40000
60000
80000
100000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Taxable Income Relative to Top Bracket Cutoff (1000s DKr)

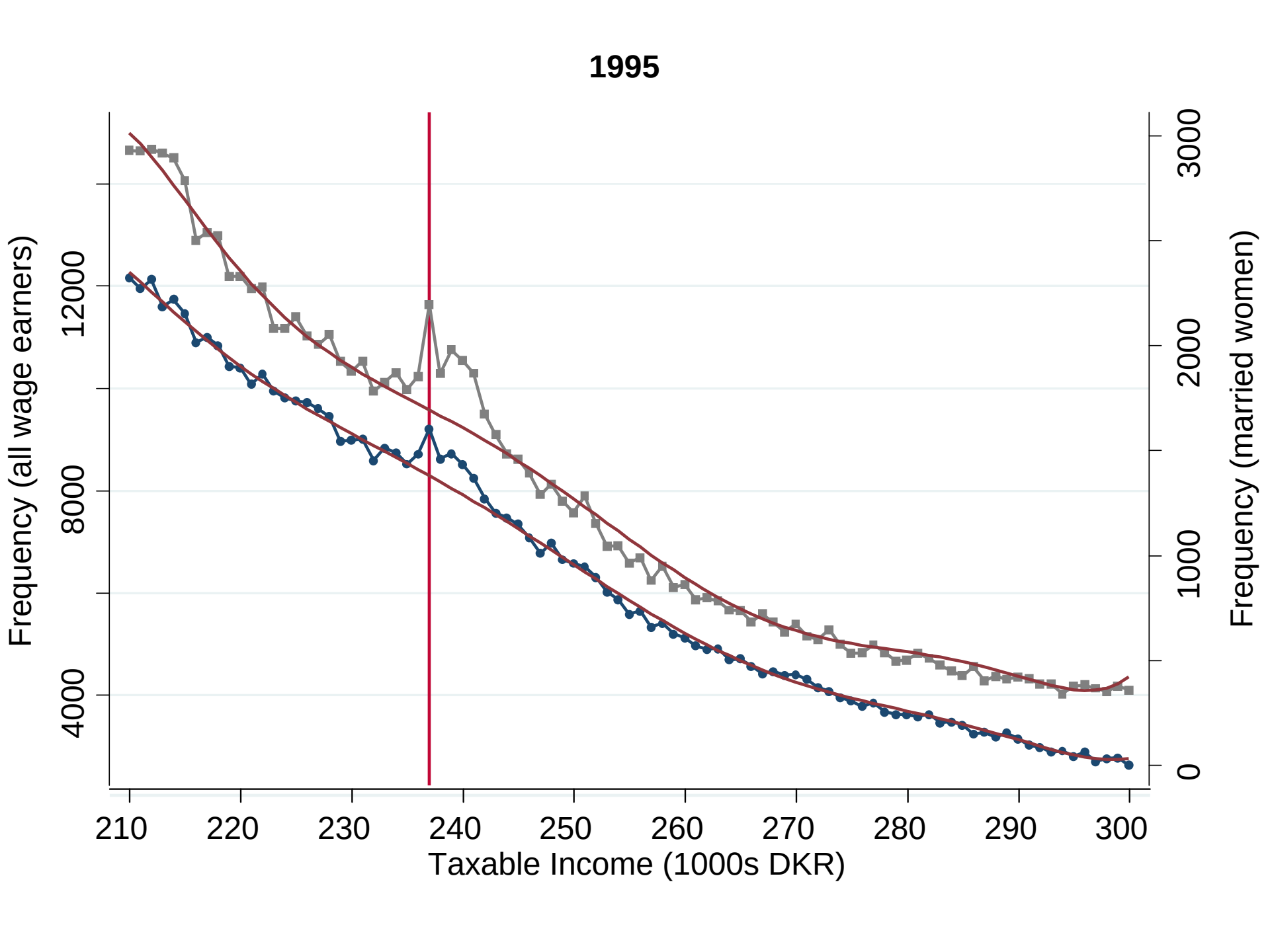

Income Distribution for Wage Earners Around Top Kink (1994-2001)
Frequency
20000
40000
60000
80000
100000
Excess mass $= B(\Delta\tau)$
-50
-40
-30
-20
-10
0
10
20
30
40
50
Taxable Income Relative to Top Bracket Cutoff (1000s DKr)

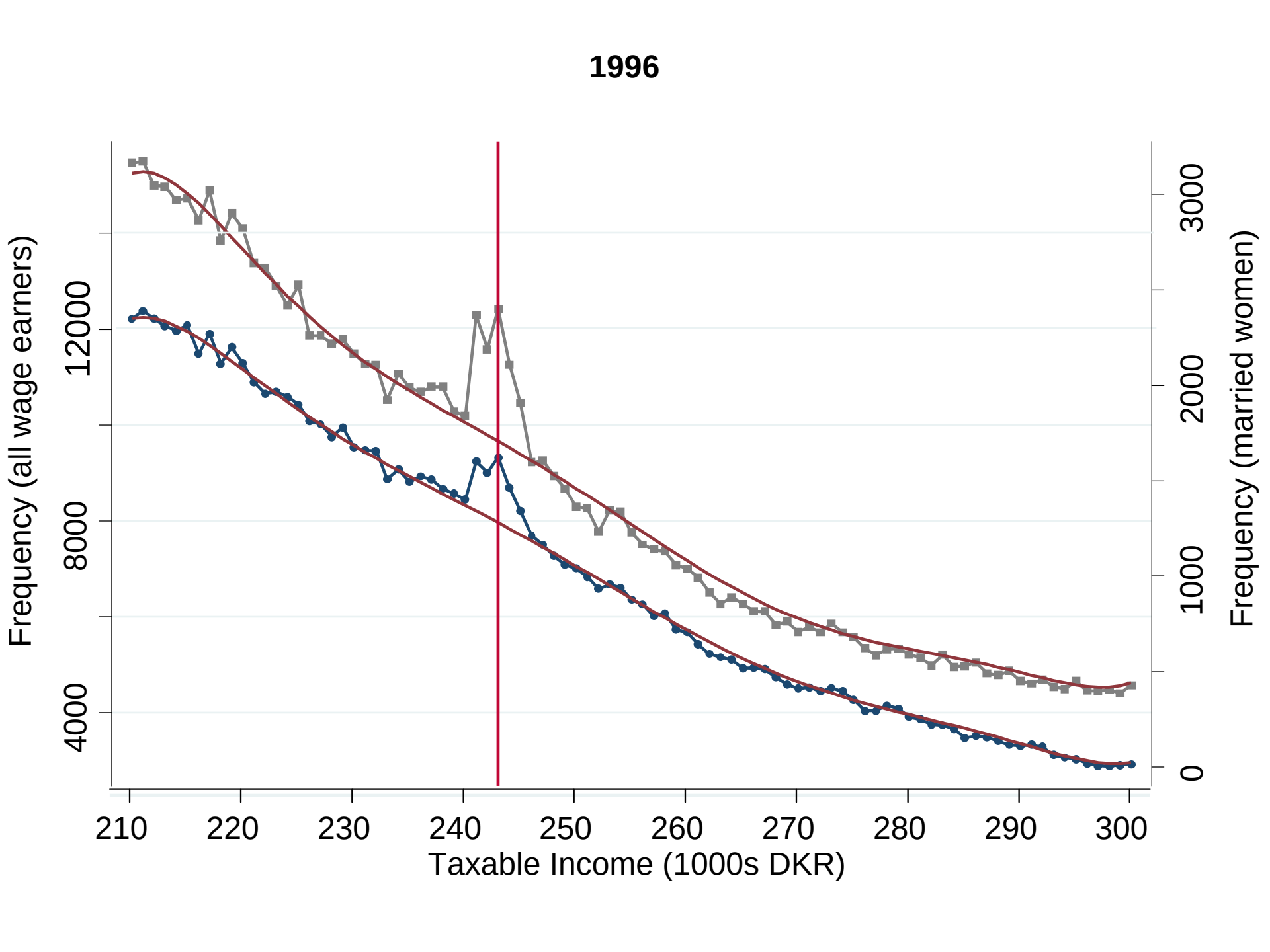

Income Distribution for Wage Earners Around Top Kink (1994-2001)
Excess mass (b) = 0.81
Standard error = 0.05
Frequency
20000
40000
60000
80000
100000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Taxable Income Relative to Top Bracket Cutoff (1000s DKr)

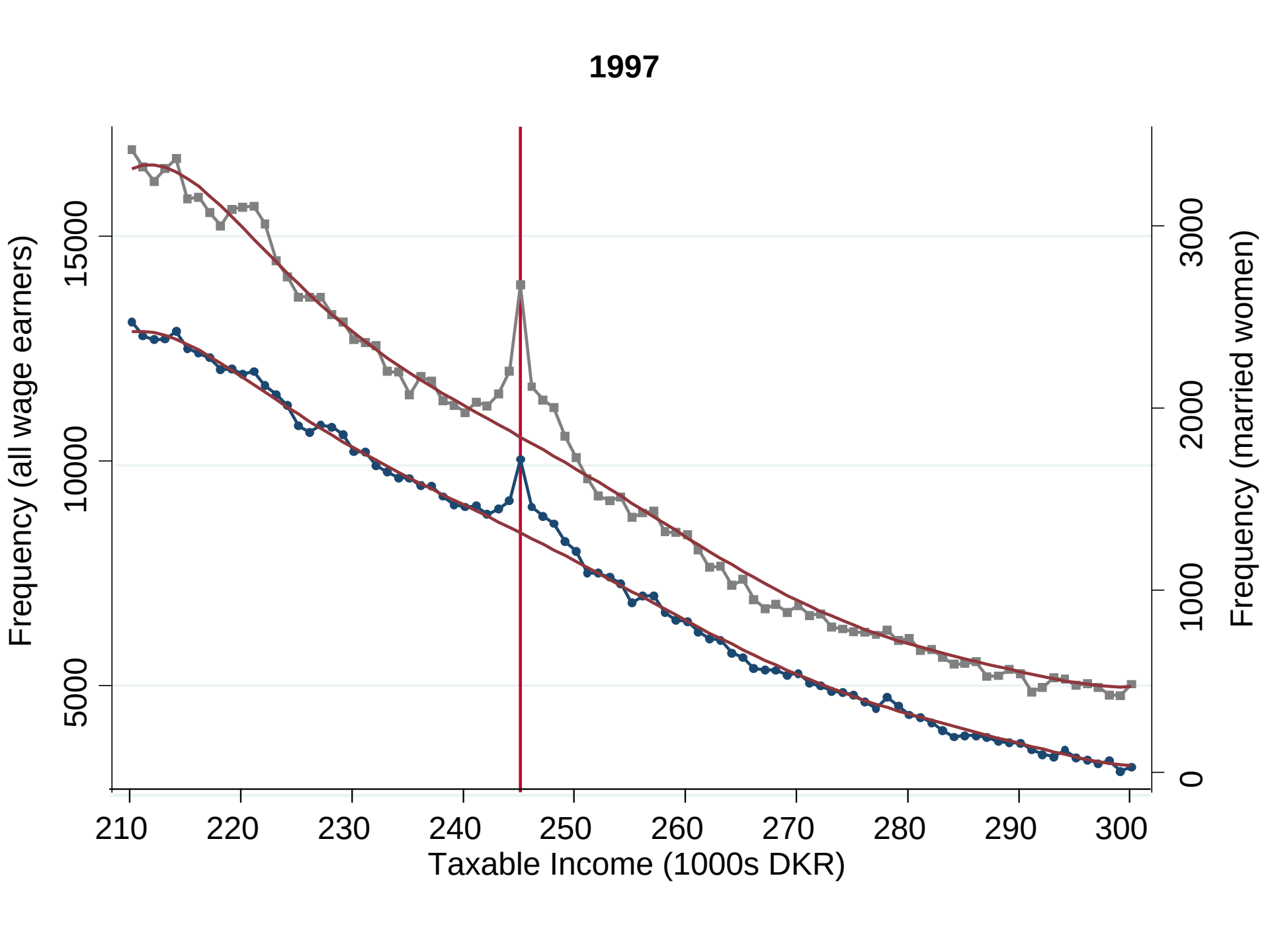

(a) Married Women vs. Single Men
Frequency (married women)
0
10000
20000
30000
Frequency (single men)
10000
20000
30000
Married Women
Excess mass (b)= 1.79
Standard error = 0.10
Single Men
Excess mass (b) = 0.25
Standard error = 0.04
-50
-40
-30
-20
-10
0
10
20
30
40
50
Taxable Income Relative to Top Bracket Cutoff (1000s DKr)

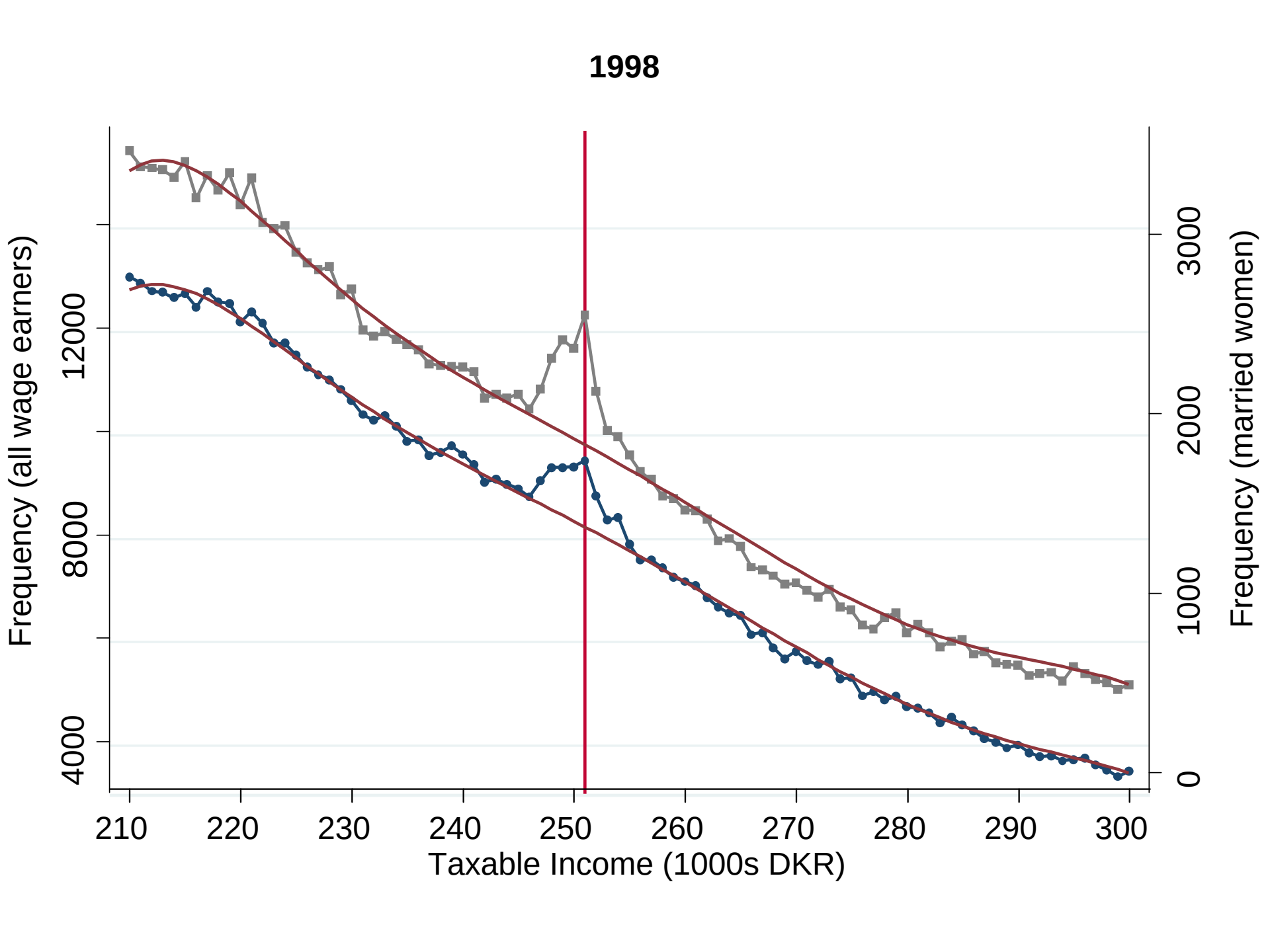

(b) Teachers vs. Military
Teachers
Excess mass (b)= 3.54
Standard error = 0.25
Military
Excess mass (b) = -0.12
Standard error = 0.21
Frequency (teachers)
0
2000
4000
6000
8000
Frequency (military)
0
1000
2000
3000
4000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Taxable Income Relative to Top Bracket Cutoff (1000s DKr)

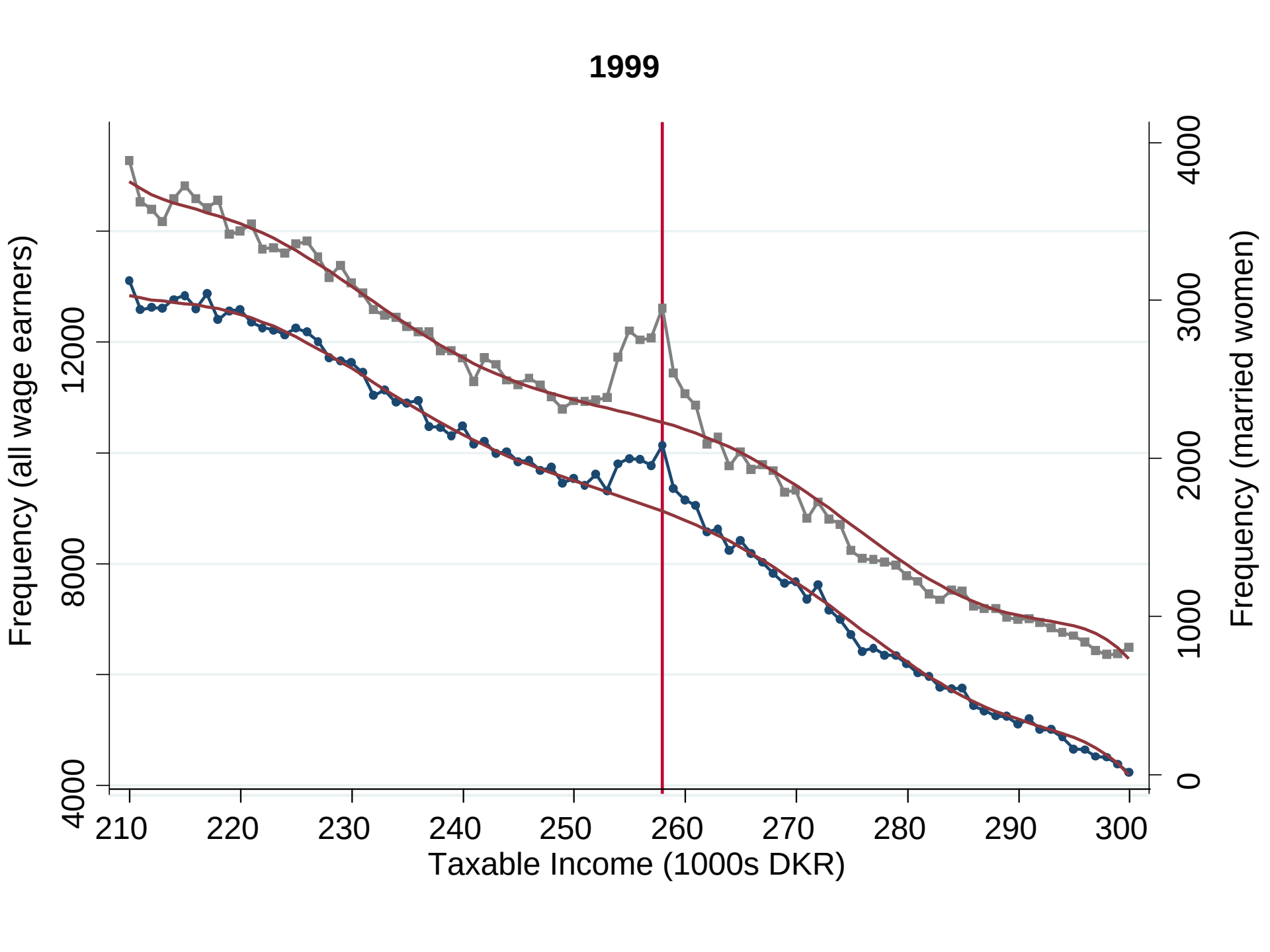

Taxable Income Distributions in 1994
Frequency (all wage earners)
4000
6000
8000
10000
12000
14000
Frequency (married women)
0
1000
2000
3000
Married Women
All Wage Earners
210
220
230
240
250
260
270
280
290
300
Taxable Income (1000s DKR)

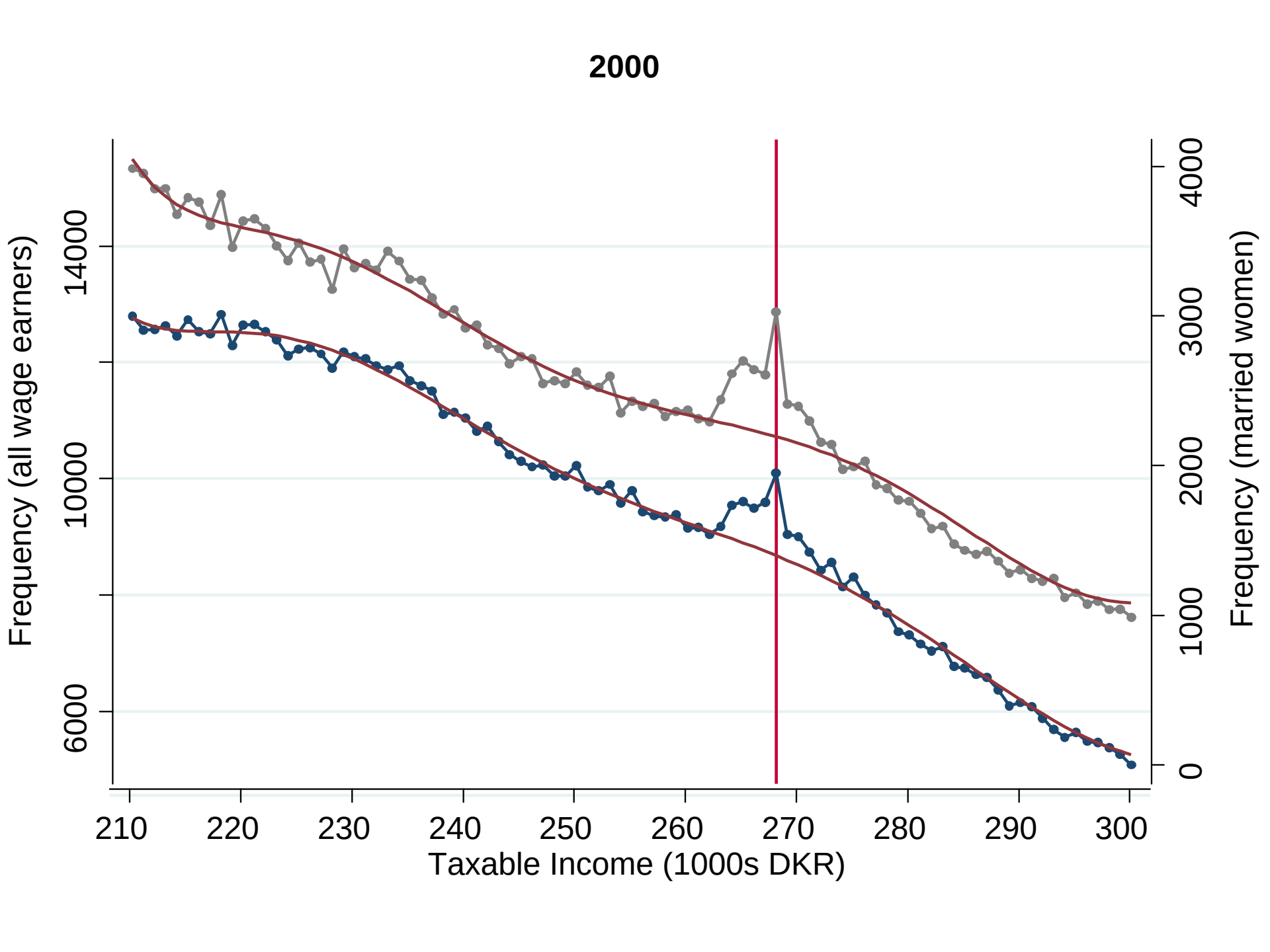

1995
Frequency (all wage earners)
4000
8000
12000
Frequency (married women)
0
1000
2000
3000
210
220
230
240
250
260
270
280
290
300
Taxable Income (1000s DKR)

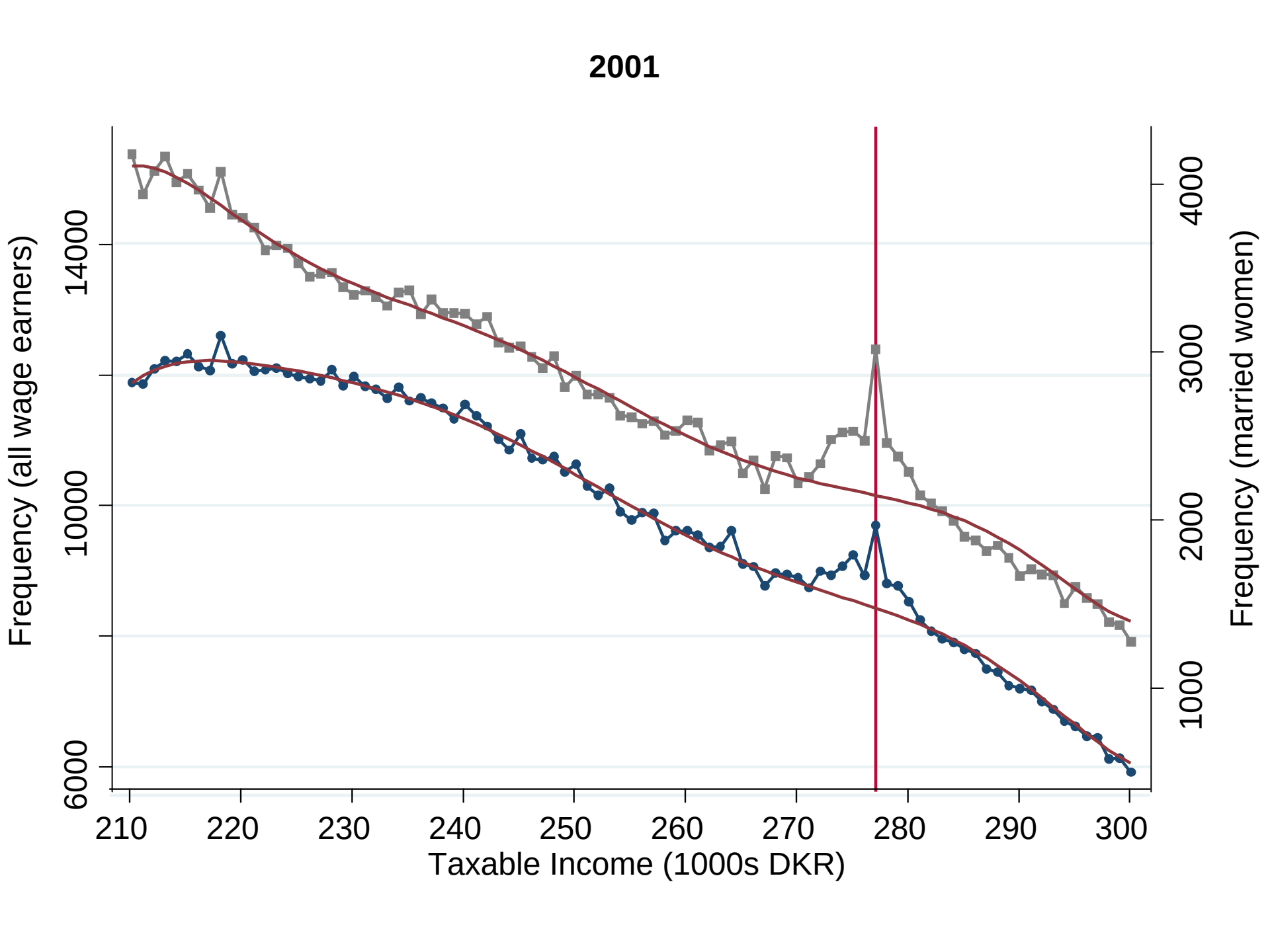

1996
Frequency (all wage earners)
4000
8000
12000
Frequency (married women)
0
1000
2000
3000
210
220
230
240
250
260
270
280
290
300
Taxable Income (1000s DKR)

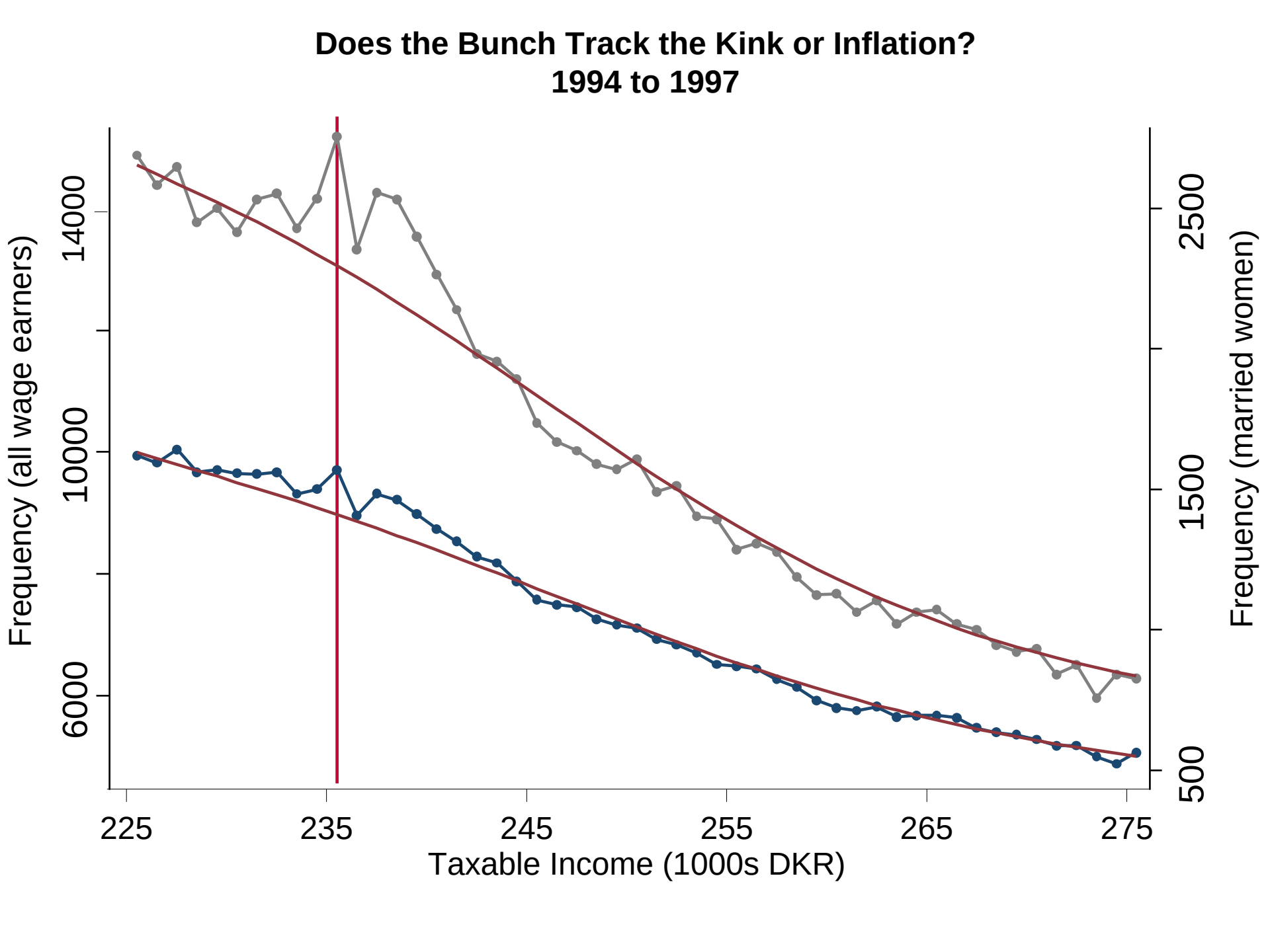

1997
Frequency (all wage earners)
5000
10000
15000
Frequency (married women)
0
1000
2000
3000
210
220
230
240
250
260
270
280
290
300
Taxable Income (1000s DKR)

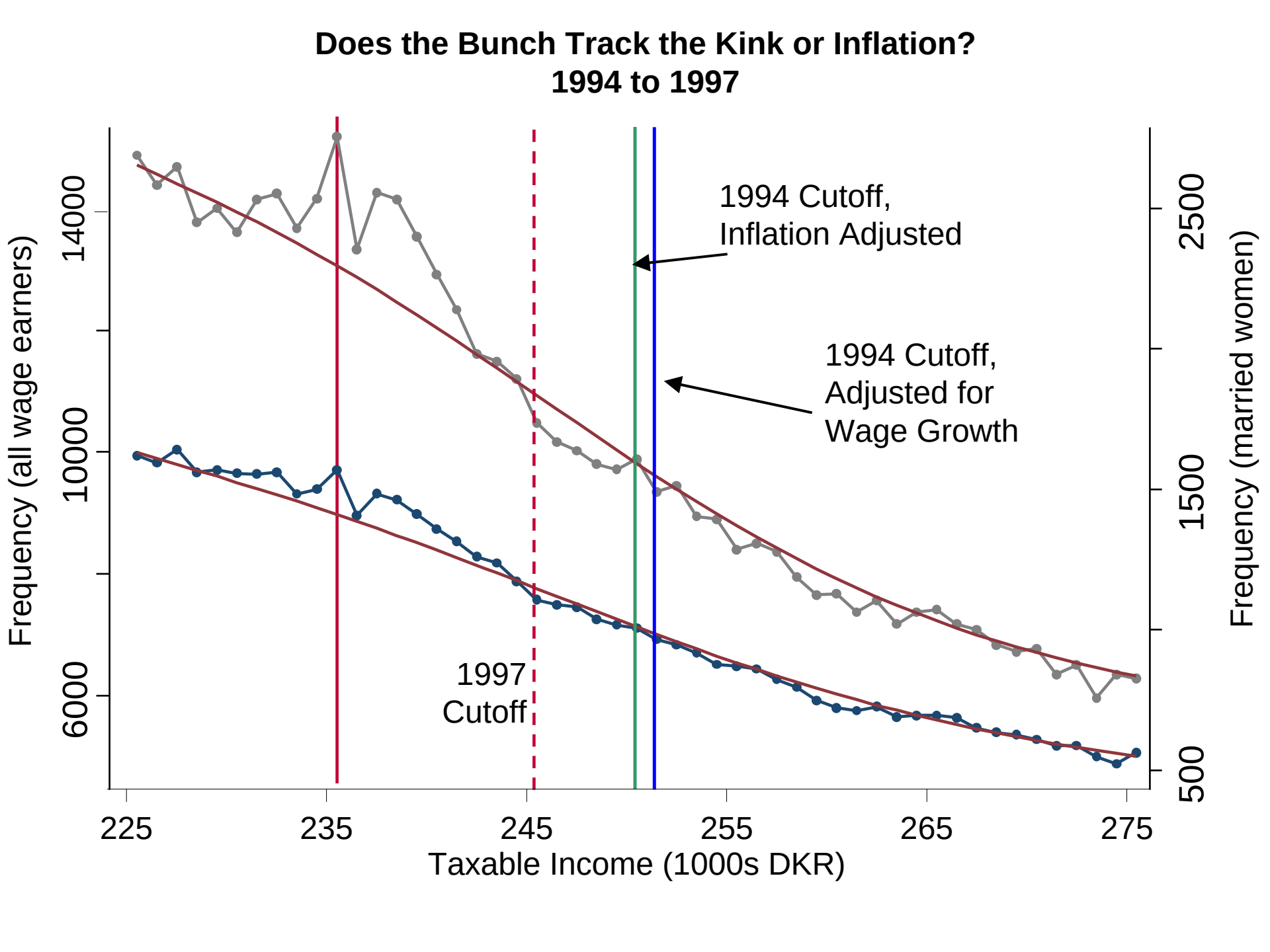

1998
Frequency (all wage earners)
4000
8000
12000
Frequency (married women)
0
1000
2000
3000
210
220
230
240
250
260
270
280
290
300
Taxable Income (1000s DKR)

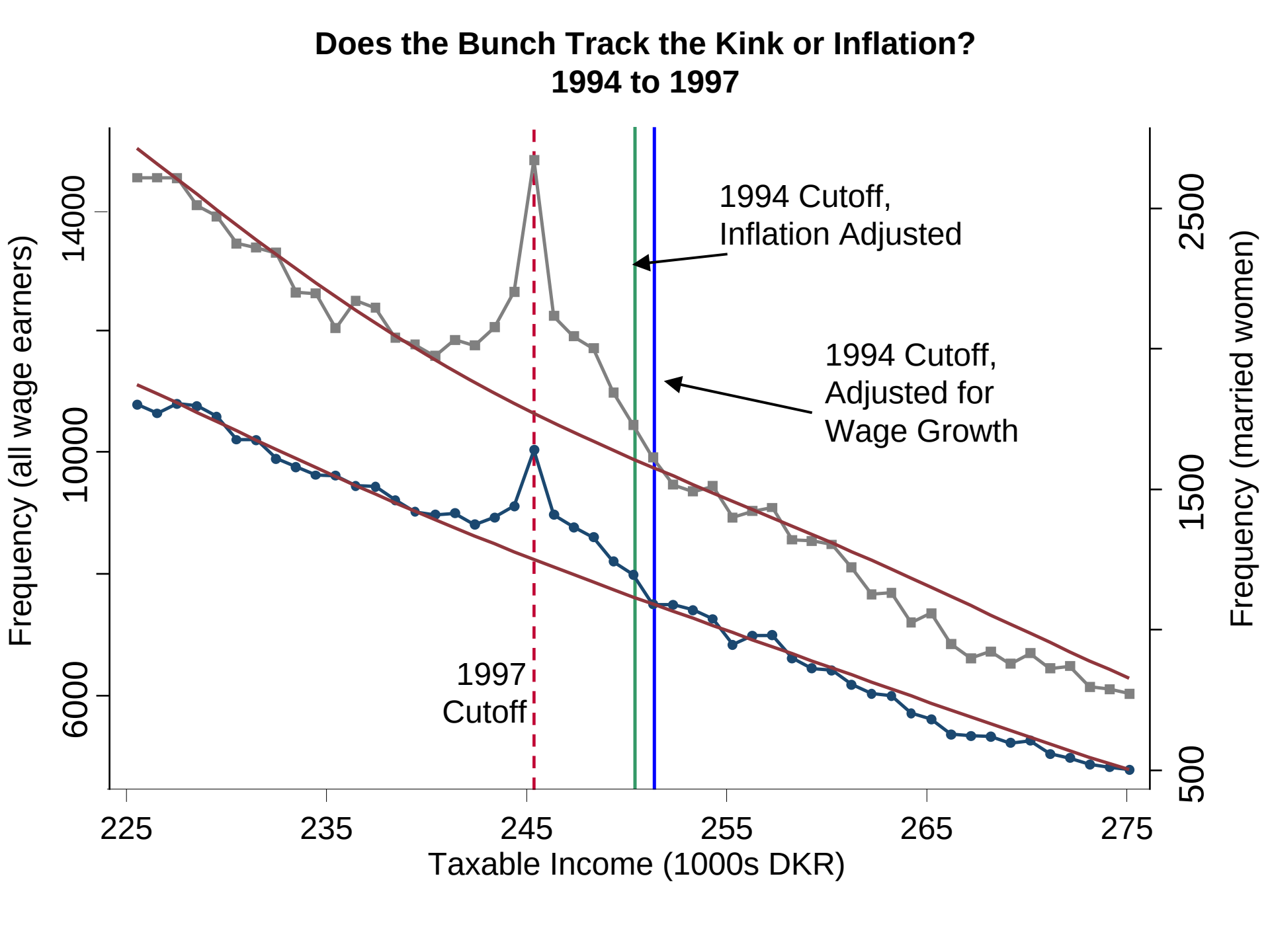

1999
Frequency (all wage earners)
4000
8000
12000
Frequency (married women)
0
1000
2000
3000
4000
210
220
230
240
250
260
270
280
290
300
Taxable Income (1000s DKR)

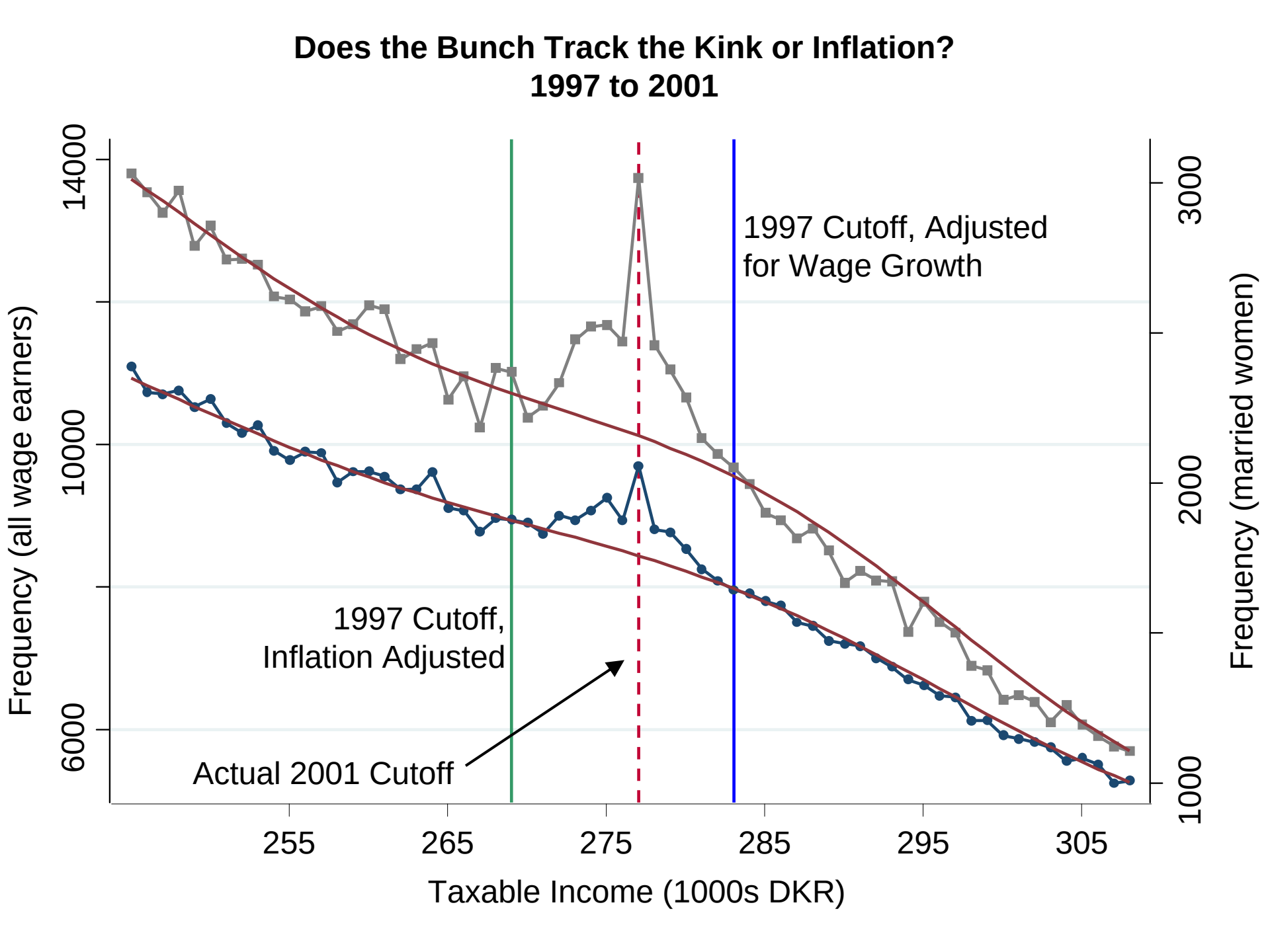

2000
Frequency (all wage earners)
6000
10000
14000
Frequency (married women)
0
1000
2000
3000
4000
210
220
230
240
250
260
270
280
290
300
Taxable Income (1000s DKR)


2001
Frequency (all wage earners)
6000
10000
14000
Frequency (married women)
1000
2000
3000
4000
210
220
230
240
250
260
270
280
290
300
Taxable Income (1000s DKR)


Does the Bunch Track the Kink or Inflation?
1994 to 1997
Frequency (all wage earners)
14000
10000
6000
Frequency (married women)
2500
1500
500
225
235
245
255
265
275
Taxable Income (1000s DKR)


Does the Bunch Track the Kink or Inflation?
1994 to 1997
1994 Cutoff,
Inflation Adjusted
1994 Cutoff,
Adjusted for
Wage Growth
1997
Cutoff
Frequency (all wage earners)
14000
10000
6000
2500
1500
500
Frequency (married women)
225
235
245
255
265
275
Taxable Income (1000s DKR)


Does the Bunch Track the Kink or Inflation?
1994 to 1997
1994 Cutoff,
Inflation Adjusted
1994 Cutoff,
Adjusted for
Wage Growth
1997
Cutoff
Frequency (all wage earners)
14000
10000
6000
Frequency (married women)
2500
1500
500
225
235
245
255
265
275
Taxable Income (1000s DKR)


Does the Bunch Track the Kink or Inflation?
1997 to 2001
Frequency (all wage earners)
14000
10000
6000
Frequency (married women)
3000
2000
1000
1997 Cutoff, Adjusted
for Wage Growth
1997 Cutoff,
Inflation Adjusted
Actual 2001 Cutoff
255
265
275
285
295
305
Taxable Income (1000s DKR)

LABOR SUPPLY RESPONSES VS. SHIFTING

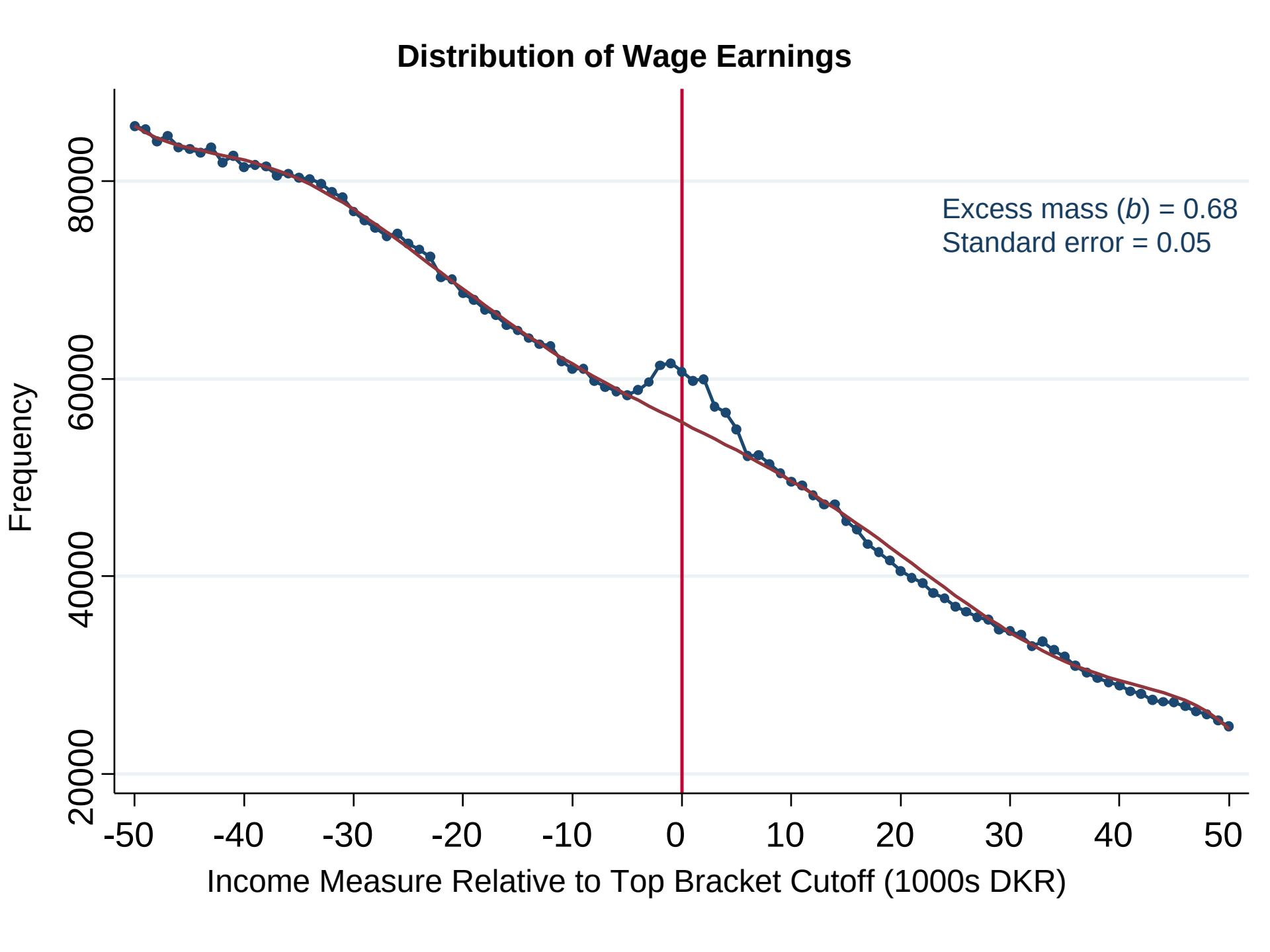
- Does bunching reflect earnings responses or income shifting?
- Two mechanisms for income shifting

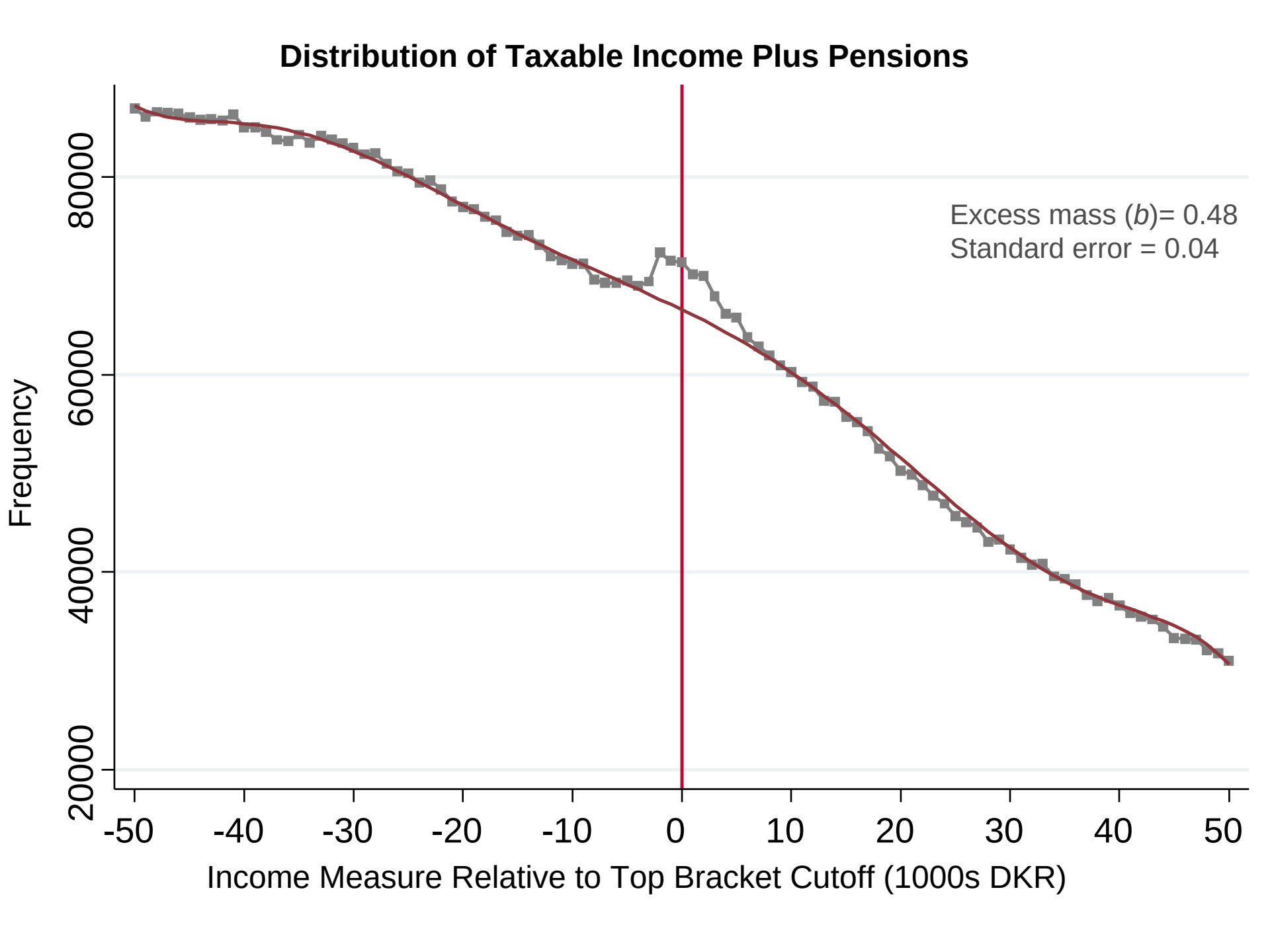
1. Evasion: under-reporting of income to avoid higher tax
    - Kleven et al. (2009) audit study: no evasion in wage earnings
    - Could still have mis-reporting of non-wage income

    → Test: Bunching in wage earnings?

2. Shift to nontaxable compensation (pension contributions)

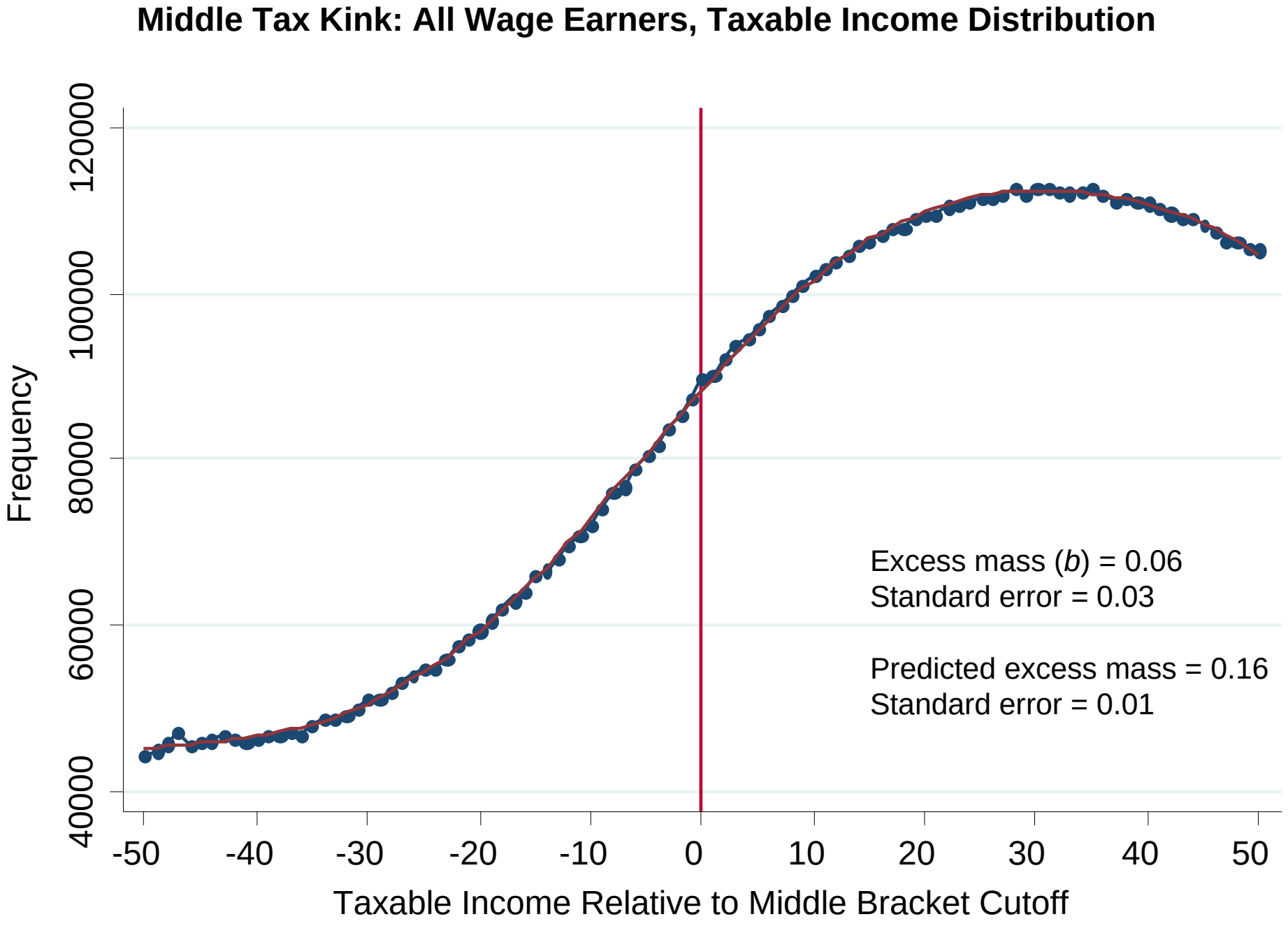
    → Test: Bunching in pensions plus taxable income?

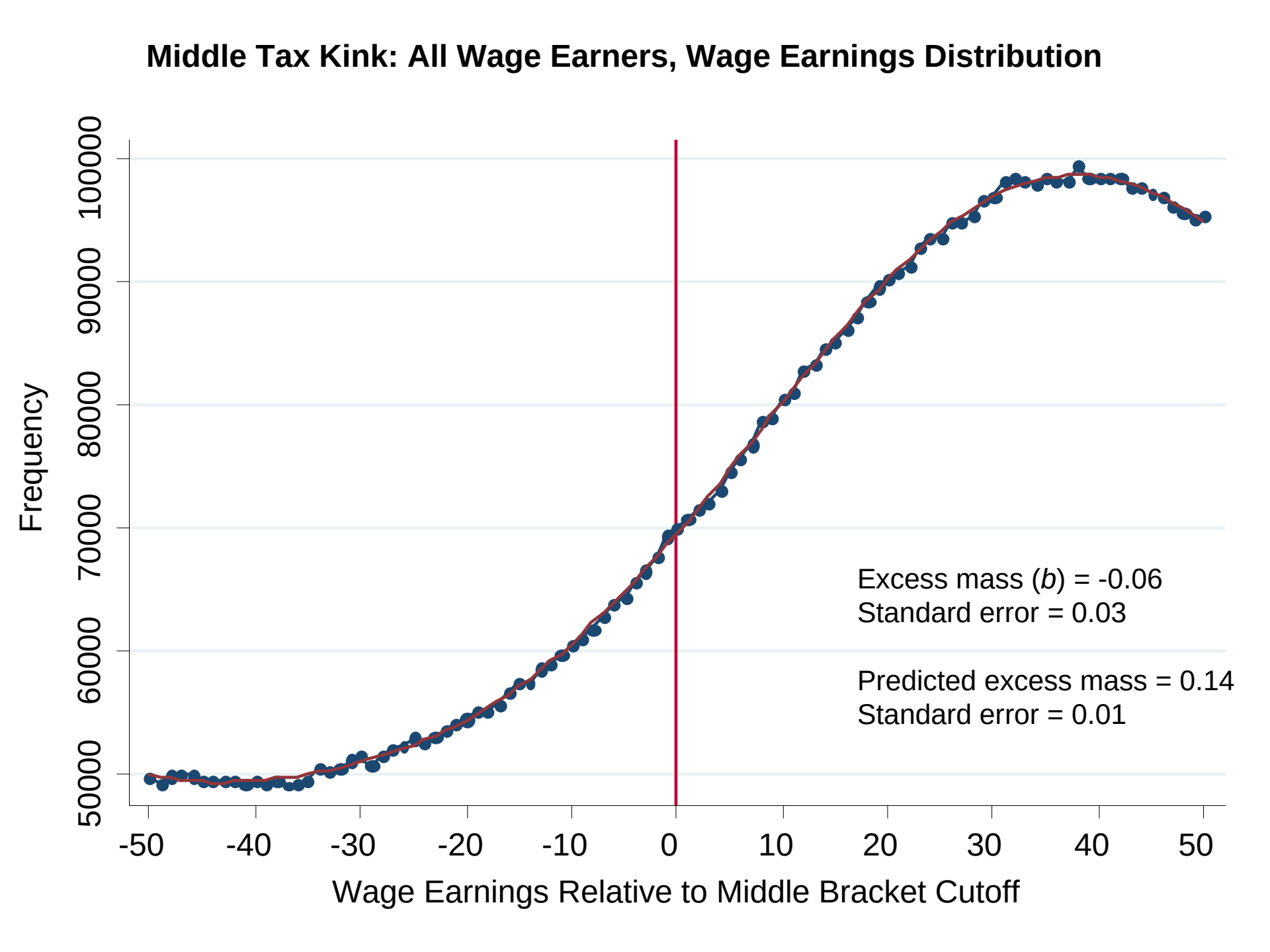

Distribution of Wage Earnings
Excess mass (b) = 0.68
Standard error = 0.05
Frequency
80000
60000
40000
20000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Income Measure Relative to Top Bracket Cutoff (1000s DKR)

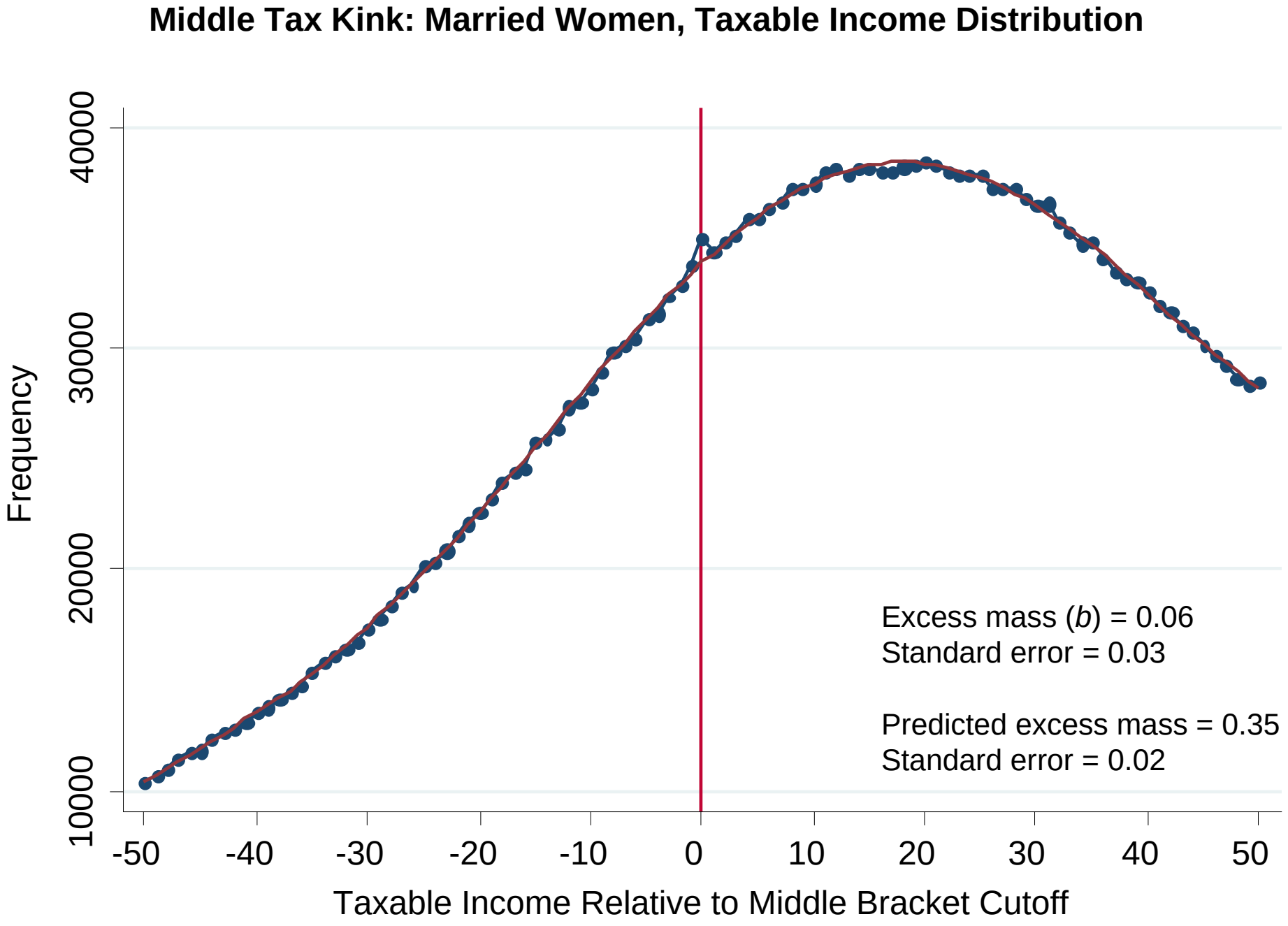

Distribution of Taxable Income Plus Pensions
Excess mass (b)= 0.48
Standard error = 0.04
Frequency
20000
40000
60000
80000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Income Measure Relative to Top Bracket Cutoff (1000s DKR)

PREDICTION 1: Small vs. Large Tax Changes

- We have already examined the larger, top tax kink
  - Top Bracket Cutoff: $\Delta \log(\text{NTR}) \approx 30\%$
- Two sources of smaller tax variation:
  - Middle Bracket Cutoffs: $\Delta \log(\text{NTR}) \approx 10\%$
  - Small Tax Reforms
- Now estimate observed elasticities from bunching at smaller kinks and small tax reforms


Middle Tax Kink: All Wage Earners, Taxable Income Distribution
Frequency
40000
60000
80000
100000
120000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Taxable Income Relative to Middle Bracket Cutoff
Excess mass (b) = 0.06
Standard error = 0.03
Predicted excess mass = 0.16
Standard error = 0.01


Middle Tax Kink: All Wage Earners, Wage Earnings Distribution
Frequency
50000
60000
70000
80000
90000
100000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Wage Earnings Relative to Middle Bracket Cutoff
Excess mass (b) = -0.06
Standard error = 0.03
Predicted excess mass = 0.14
Standard error = 0.01


Middle Tax Kink: Married Women, Taxable Income Distribution
Frequency
10000
20000
30000
40000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Taxable Income Relative to Middle Bracket Cutoff
Excess mass (b) = 0.06
Standard error = 0.03
Predicted excess mass = 0.35
Standard error = 0.02

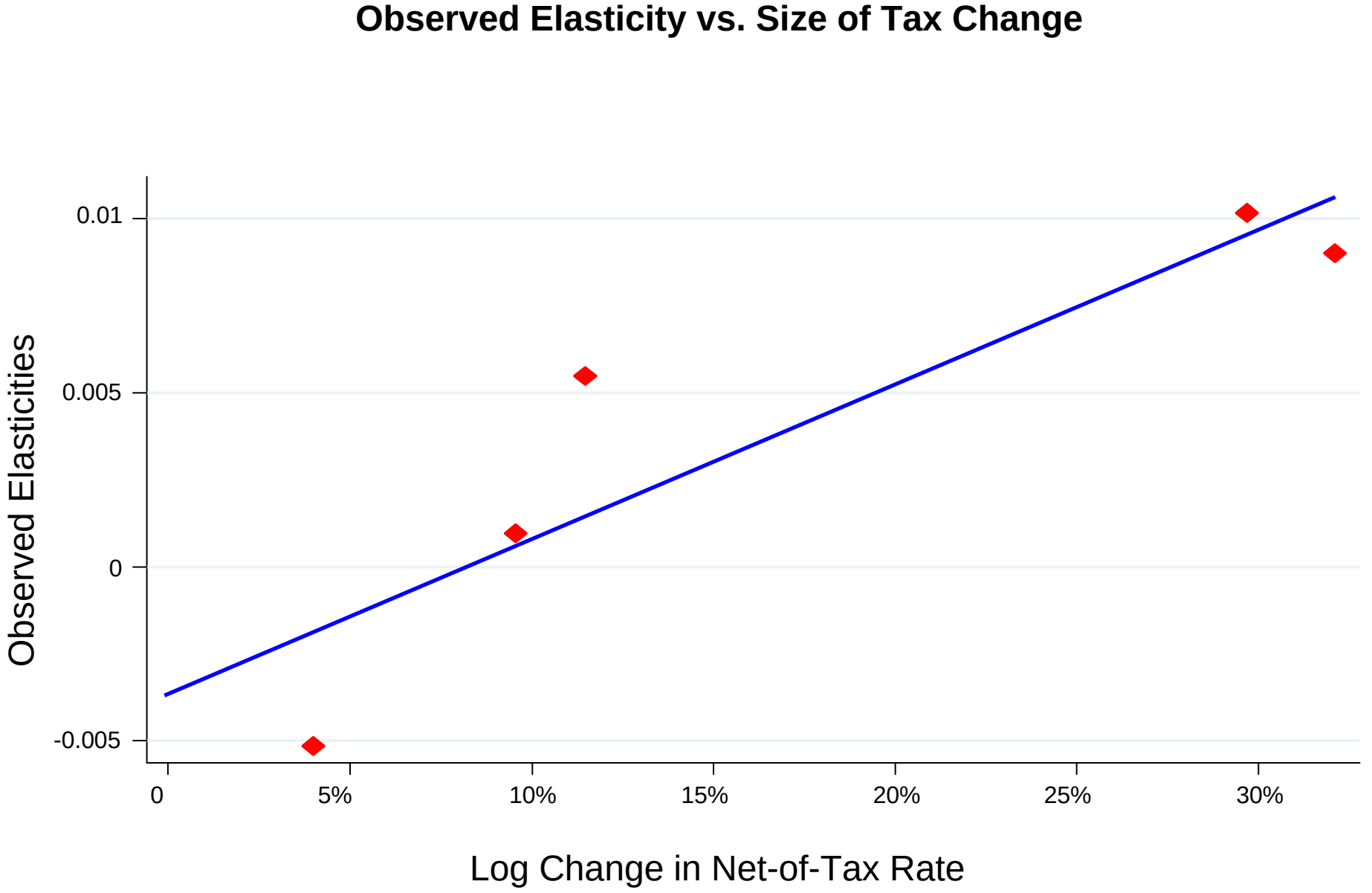
PREDICTION 1: Small vs. Large Tax Changes

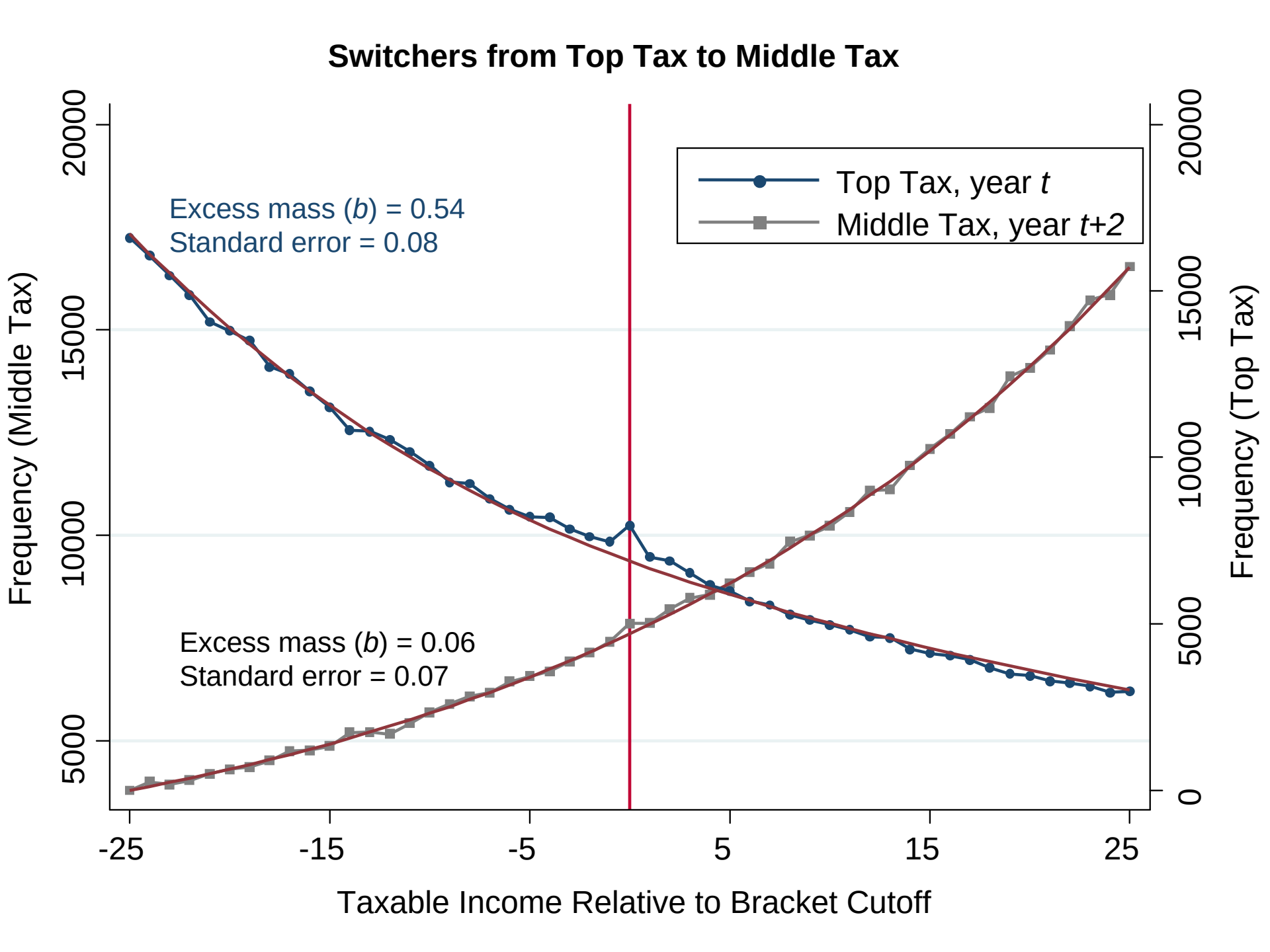
- Tax Reforms
  - Many small reforms during period we study: 4% change in net-of-tax wage on average

- Methodology: Gruber and Saez (2002)
  - Regress 2-year income change on 2-year change in net-of-tax wage (1-MTR)
  - Instrument for actual change in (1-MTR) with simulated change holding fixed base year characteristics
  - Include 10-piece spline in income and various fixed effects

Observed Elasticity Estimates Using Small Tax Reforms

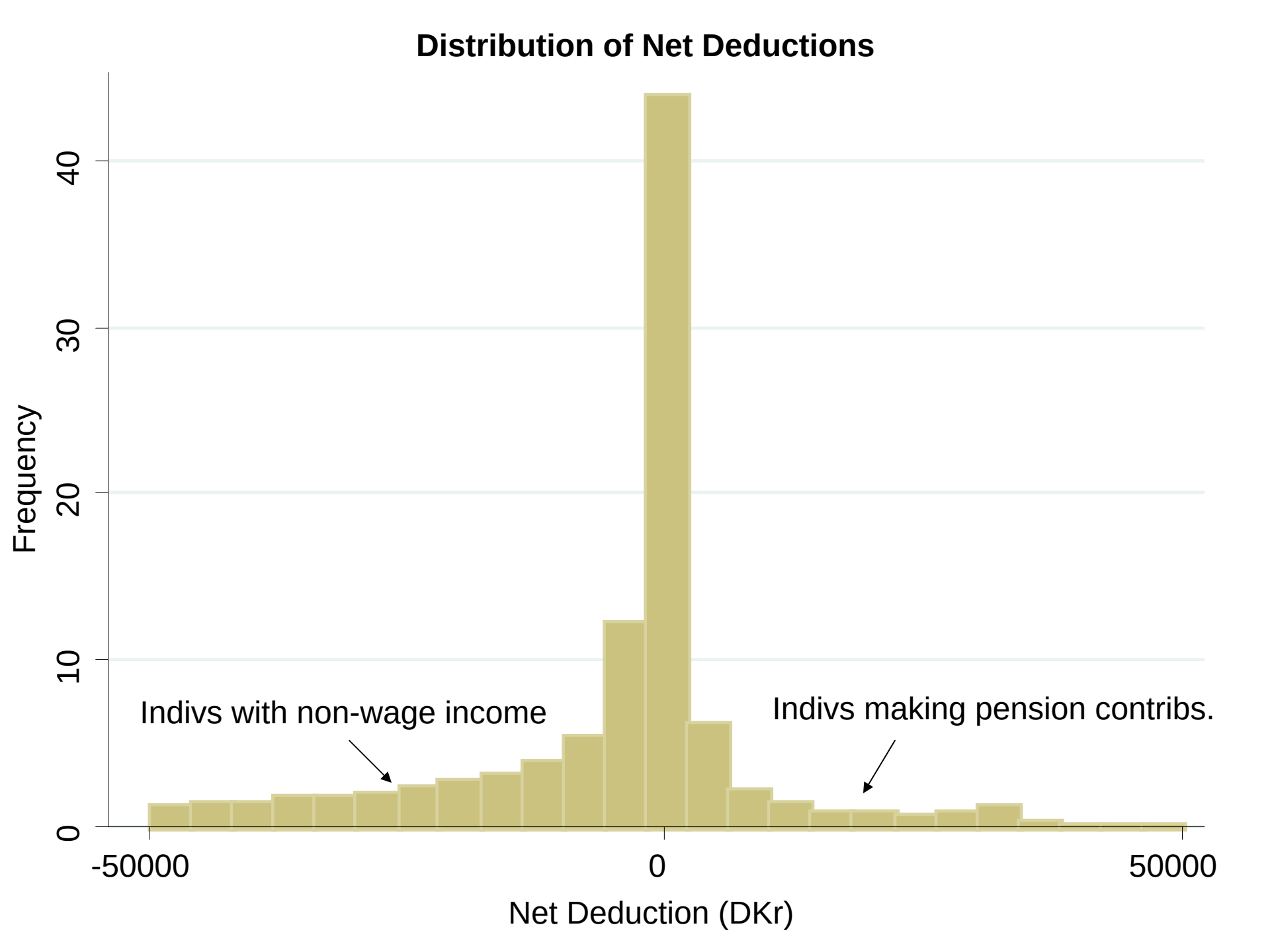
	Dependent Variable: % Change in Labor Income:				
Subgroup:	All Wage Earners		Married Females	Married Fem. Professionals w/ High Exp.	Wage Earners > 200K
Variable:	(1)	(2)	(3)	(4)	(5)
% Change in NTR	-0.005 (0.003)	-0.007 (0.004)	0.002 (0.005)	0.001 (0.011)	-0.001 (0.003)
Labor Income Spline	x	x	x	x	x
Total Income Spline	x	x	x	x	x
Year Fixed Effects	x	x	x	x	x
Age Fixed Effects	x	x	x	x	x
Region Fixed Effects		x			
Occupation Fixed Effs.		x			
Gender/Married FE		x			
Sample Size	11,512,625	8,189,920	3,136,894	156,527	7,480,900

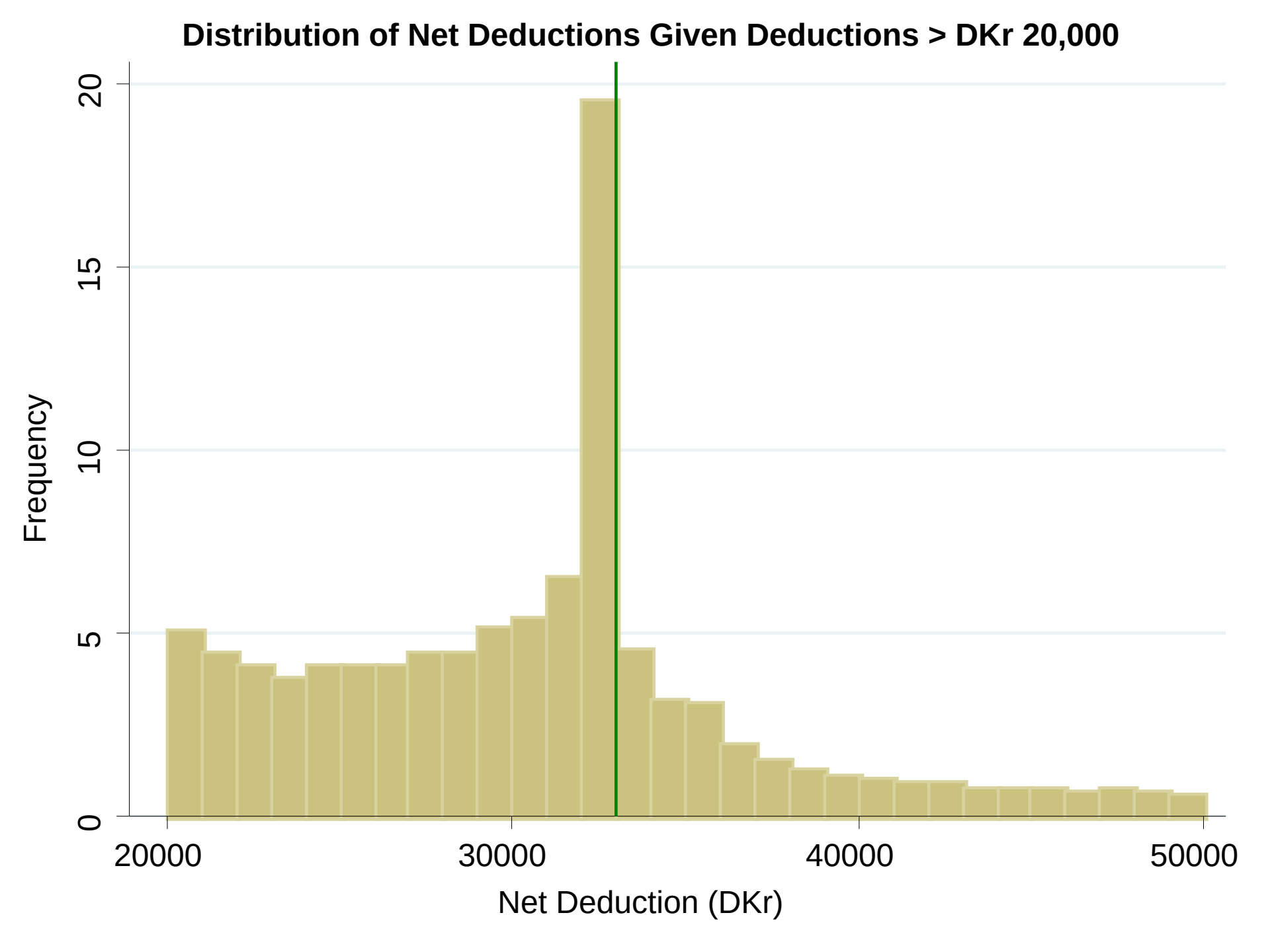

Observed Elasticity vs. Size of Tax Change
Observed Elasticities
0.01
0.005
0
-0.005
0
5%
10%
15%
20%
25%
30%
Log Change in Net-of-Tax Rate


Switchers from Top Tax to Middle Tax
Top Tax, year t
Middle Tax, year t+2
Excess mass (b) = 0.54
Standard error = 0.08
Excess mass (b) = 0.06
Standard error = 0.07
Frequency (Middle Tax)
Frequency (Top Tax)
20000
15000
10000
5000
0
-25
-15
-5
5
15
25
Taxable Income Relative to Bracket Cutoff

PREDICTION 2: Firm Responses and Scope of Kinks

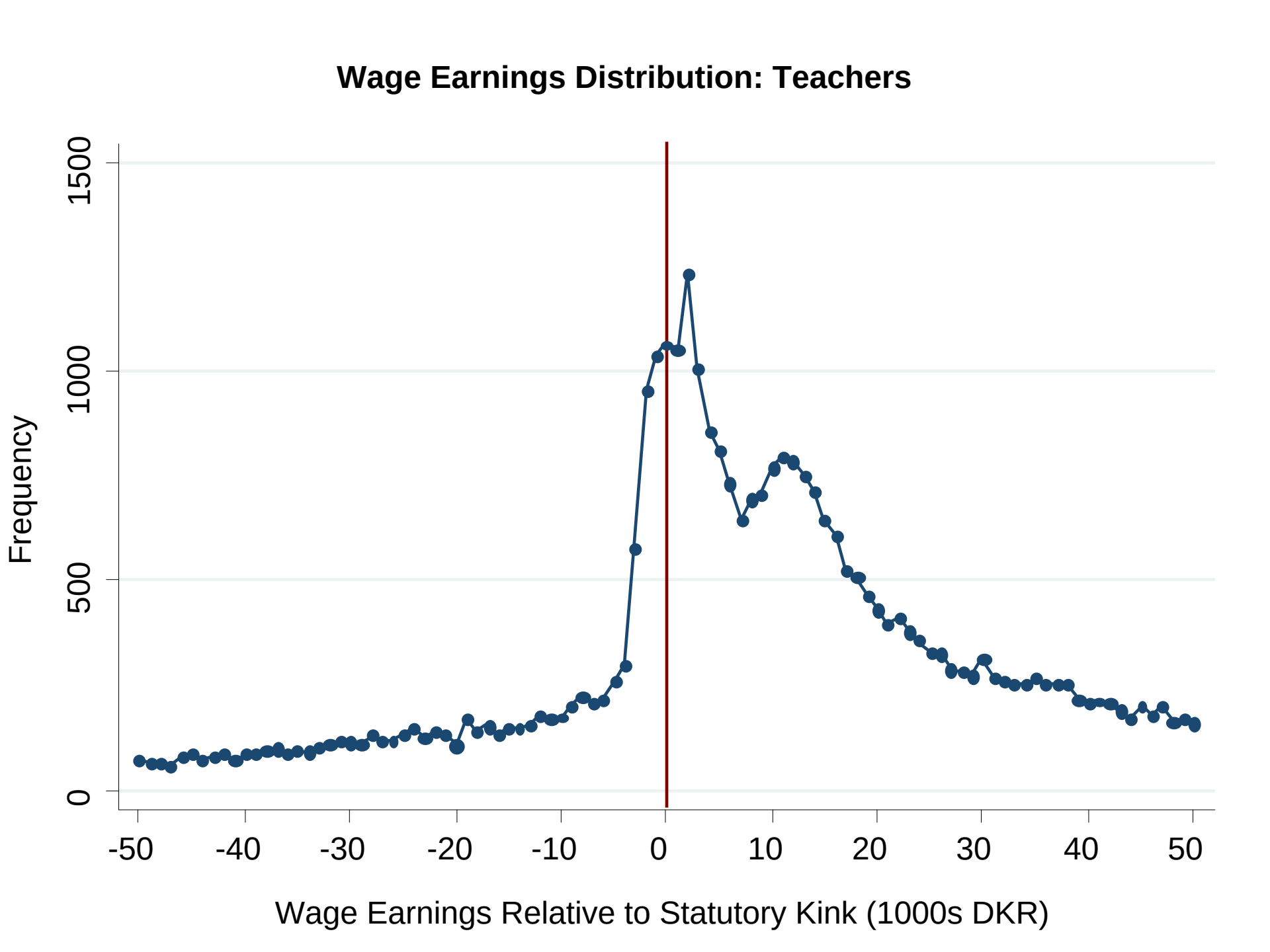
- Do tax incentives that affect a larger group of workers generate larger elasticities?
- Need variation in size of group affected by a tax change
  - Exploit variation in deductions and non-wage income across workers
  - Creates variation in effective location of top bracket cutoff (the labor income required to be just at the top bracket)
- We focus on two kinks:
  - Statutory top tax kink, faced by 60% of population
  - “Pension” kink, faced by 2.5% of population

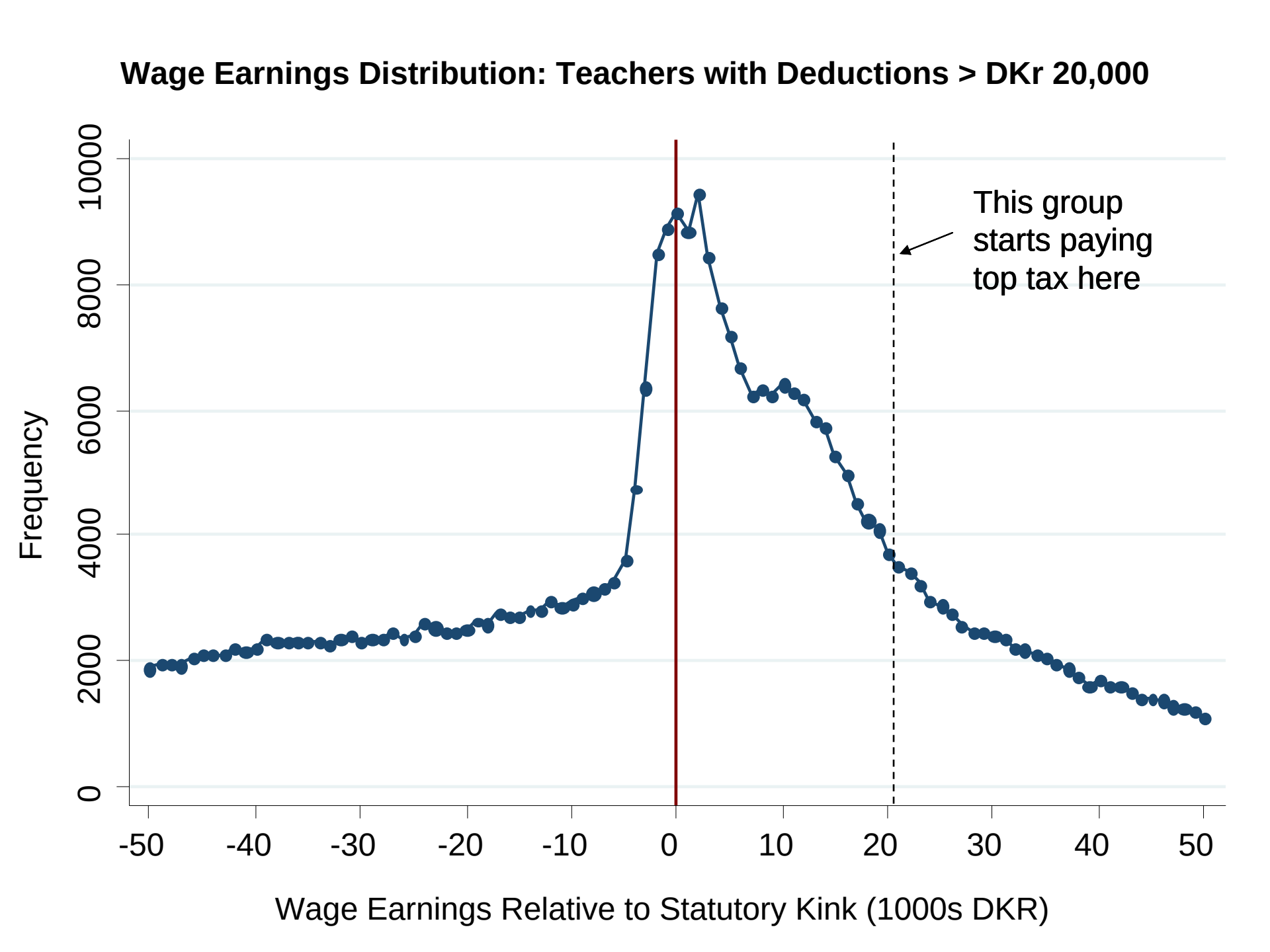

Distribution of Net Deductions
Frequency
0
10
20
30
40
Indivs with non-wage income
Indivs making pension contribs.
-50000
0
50000
Net Deduction (DKr)

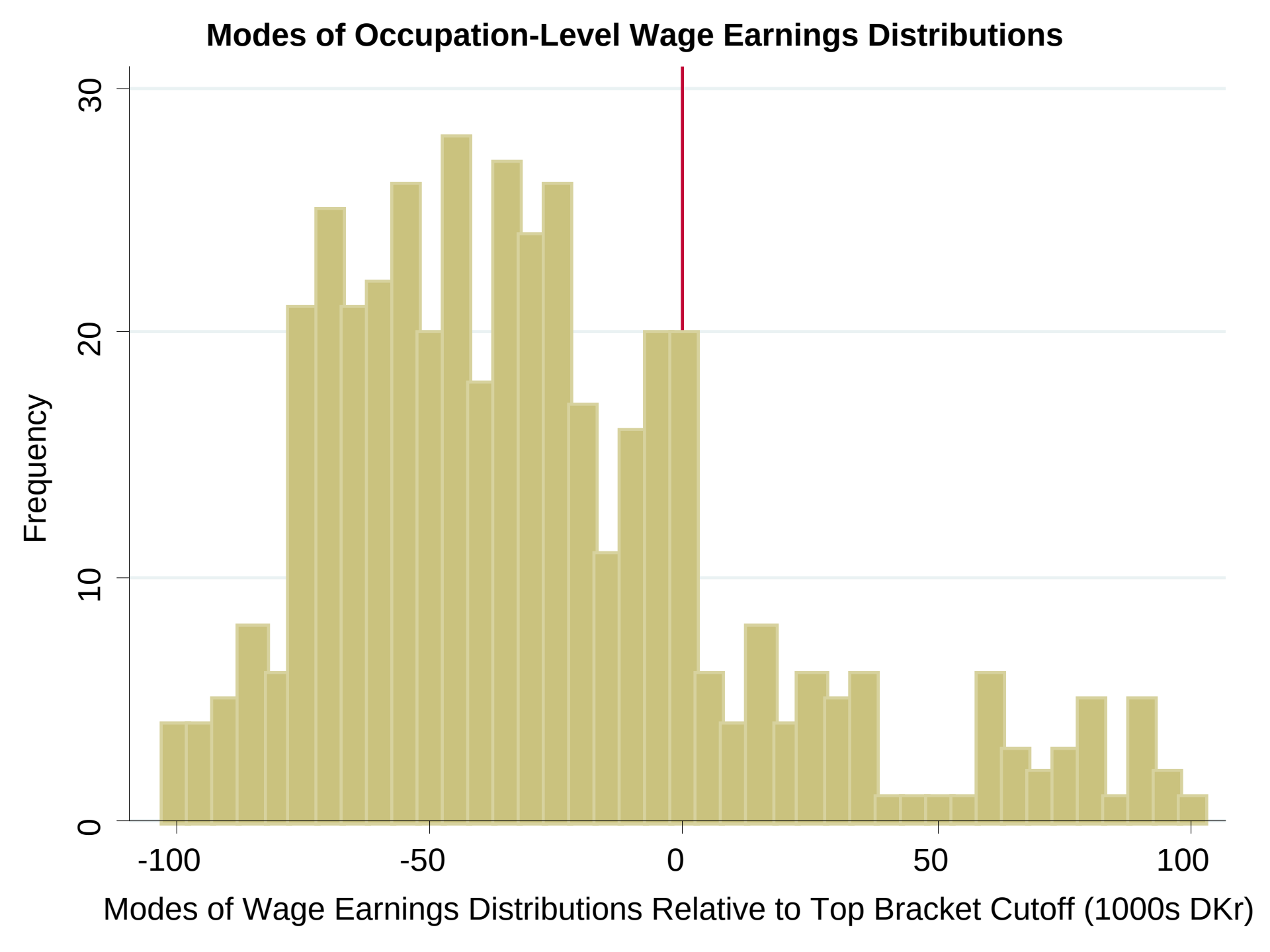

Distribution of Net Deductions Given Deductions > DKr 20,000
Frequency
0
5
10
15
20
20000
30000
40000
50000
Net Deduction (DKr)

PREDICTION 2: Firm Responses and Small vs. Large Groups

- Prediction 2.1: There is firm bunching at the statutory top tax cutoff
  - Firms should have excess propensity to structure jobs so that salaries are close to *statutory* top bracket cutoff because 60% of workers face that cutoff
  - Signature of firm bunching: bunching among people who do not face a given change in tax incentives
- Examine wage earnings distribution at occupation level because of prevalence of collective wage bargaining in Denmark
- Start with case study of one of the largest occupations: teachers

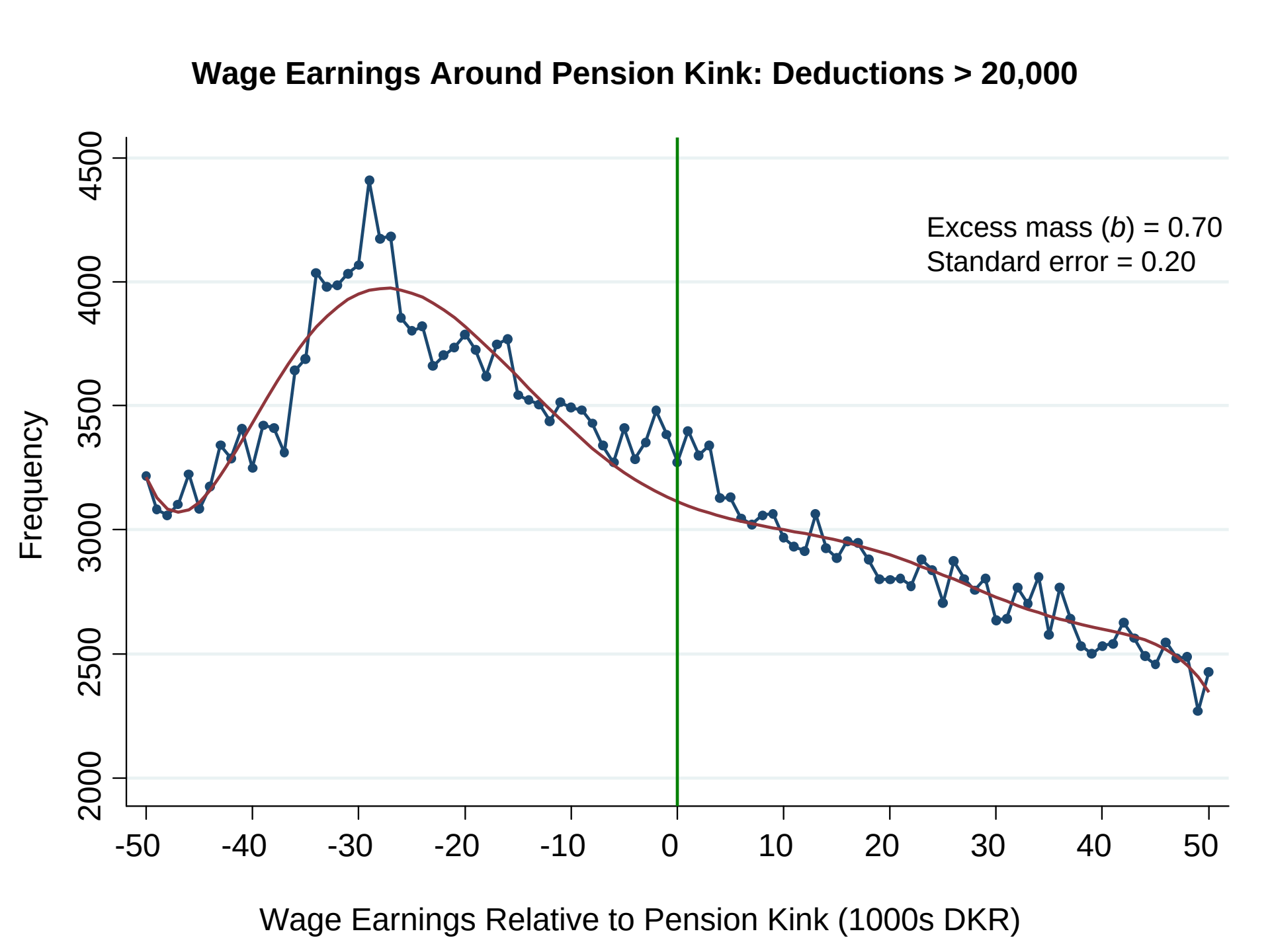

Wage Earnings Distribution: Teachers
Frequency
0
500
1000
1500
-50
-40
-30
-20
-10
0
10
20
30
40
50
Wage Earnings Relative to Statutory Kink (1000s DKR)

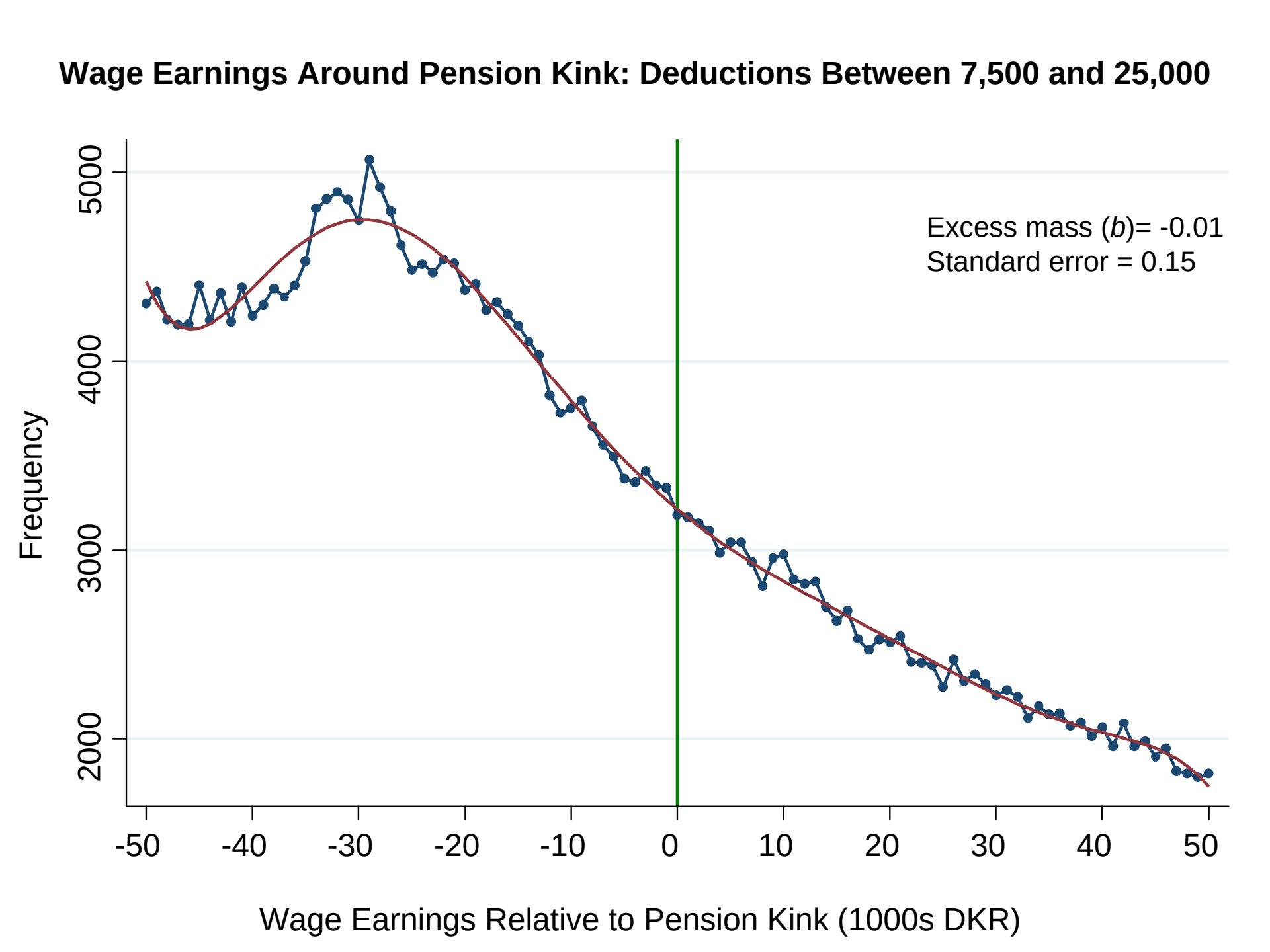

Wage Earnings Distribution: Teachers with Deductions > DKr 20,000
Frequency
0
2000
4000
6000
8000
10000
This group
starts paying
top tax here
-50
-40
-30
-20
-10
0
10
20
30
40
50
Wage Earnings Relative to Statutory Kink (1000s DKR)

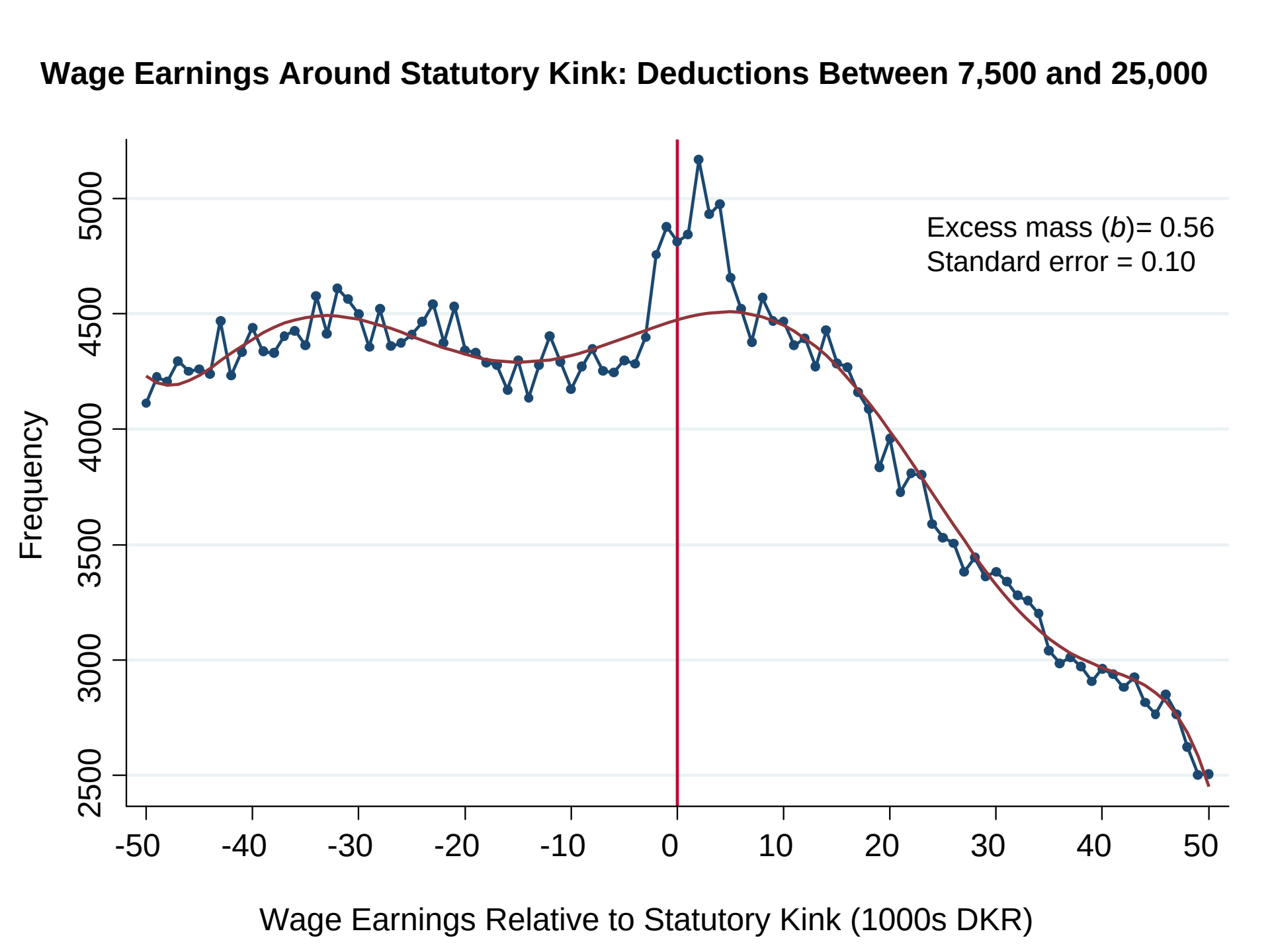

Modes of Occupation-Level Wage Earnings Distributions
Frequency
0
10
20
30
-100
-50
0
50
100
Modes of Wage Earnings Distributions Relative to Top Bracket Cutoff (1000s DKr)

PREDICTION 2: Firm Responses and Small vs. Large Groups

- Prediction 2.1: There is firm bunching at the common kink
- Prediction 2.2: More firm bunching at more common kinks
  - Compare between statutory and pension kinks
  - Focus on group that faces *neither* kink:
    - Deductions between 7,500 and 25,000

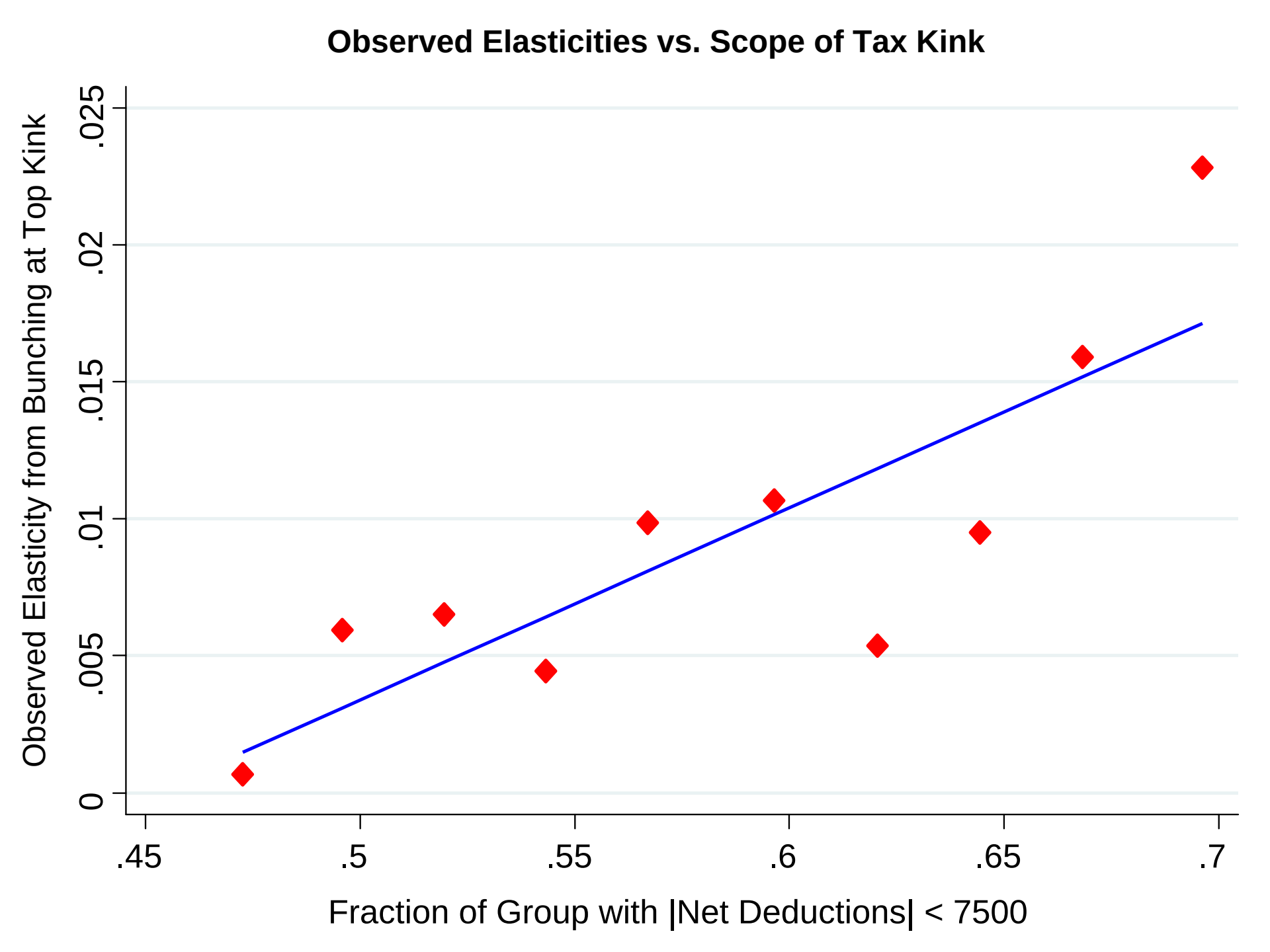

Wage Earnings Around Pension Kink: Deductions > 20,000
Excess mass (b) = 0.70
Standard error = 0.20
Frequency
2000
2500
3000
3500
4000
4500
-50
-40
-30
-20
-10
0
10
20
30
40
50
Wage Earnings Relative to Pension Kink (1000s DKR)


Wage Earnings Around Pension Kink: Deductions Between 7,500 and 25,000
Excess mass (b)= -0.01
Standard error = 0.15
Frequency
2000
3000
4000
5000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Wage Earnings Relative to Pension Kink (1000s DKR)


Wage Earnings Around Statutory Kink: Deductions Between 7,500 and 25,000
Excess mass (b)= 0.56
Standard error = 0.10
Frequency
2500
3000
3500
4000
4500
5000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Wage Earnings Relative to Statutory Kink (1000s DKR)

PREDICTION 2: Firm Responses and Small vs. Large Groups

- Prediction 2.1: There is firm bunching at the common kink
- Prediction 2.2: More firm bunching at common kink
- Prediction 2.3: Larger observed elasticity at more common kinks
  - Bunchers set wage earnings + deductions = top kink
    - Need exogenous variation in deductions to isolate bunching through earnings margin
  - Identification: Split pop. into gender-age-married-year groups
    - Calculate fraction of each group with |net ded.| < 7500
    - Use this group average as a proxy for how “common” is an individual’s level of deductions
  - Calculate elasticity estimate from bunching for these groups

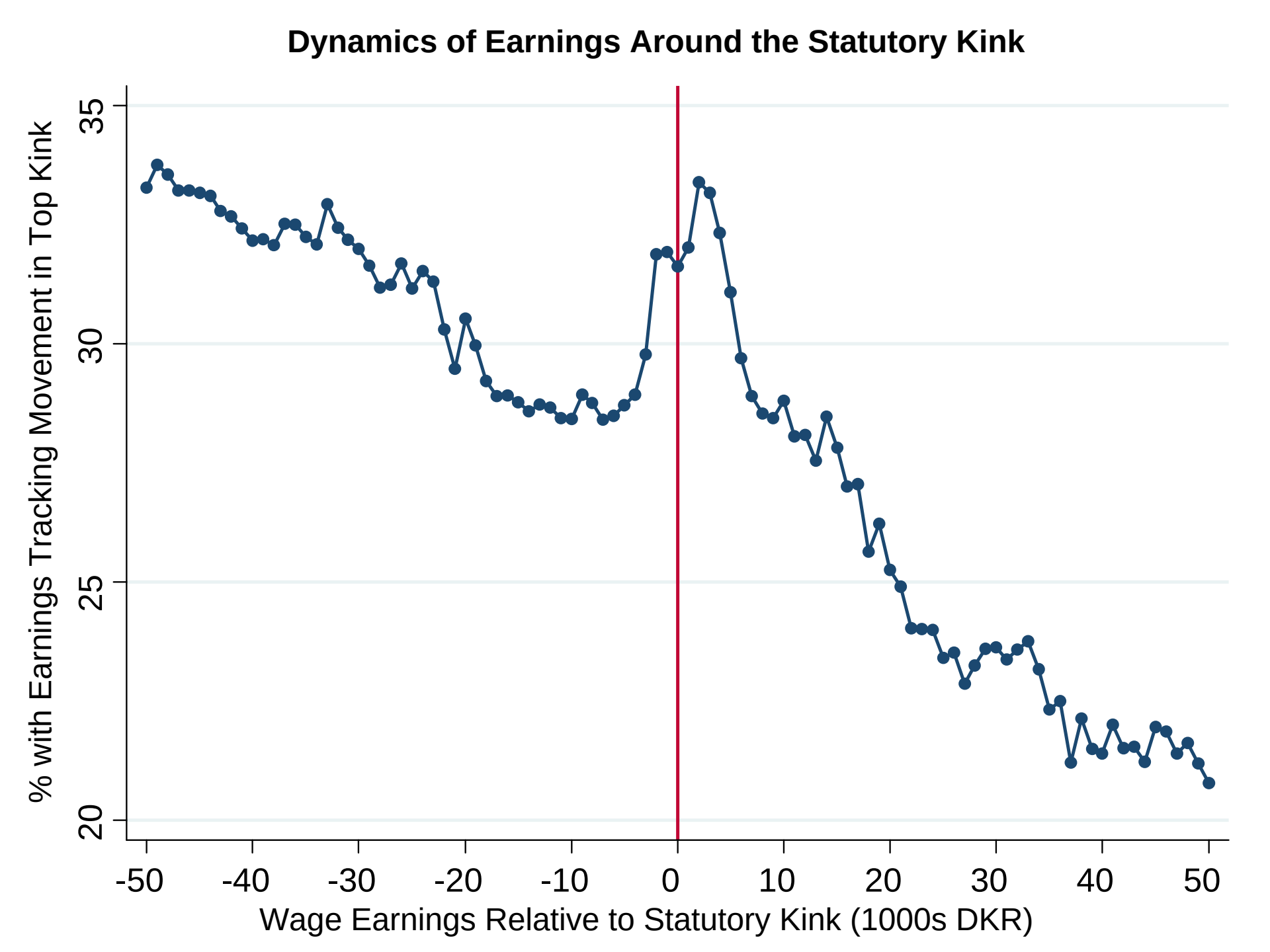

Observed Elasticities vs. Scope of Tax Kink
Observed Elasticity from Bunching at Top Kink
0
.005
.01
.015
.02
.025
.45
.5
.55
.6
.65
.7
Fraction of Group with |Net Deductions| < 7500

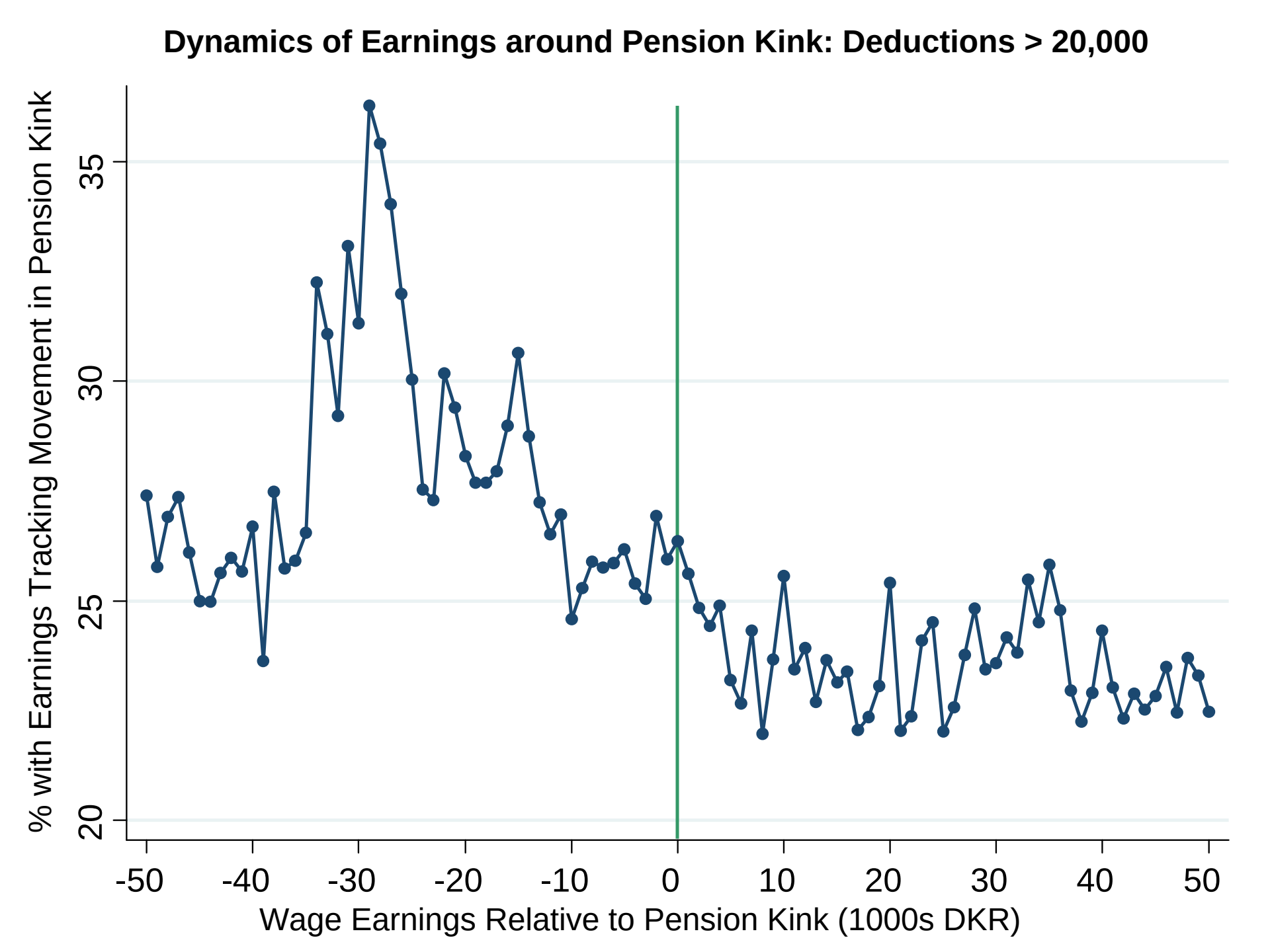
Dynamics: Movement with the Kink

- Why do individuals move with the kink despite search frictions?
  - Firm bunchers move with the kink because firm changes salaries for all workers
  - Individual bunchers do *not* move with the kink because of search costs

→ Should see different individual bunchers at kink in each year

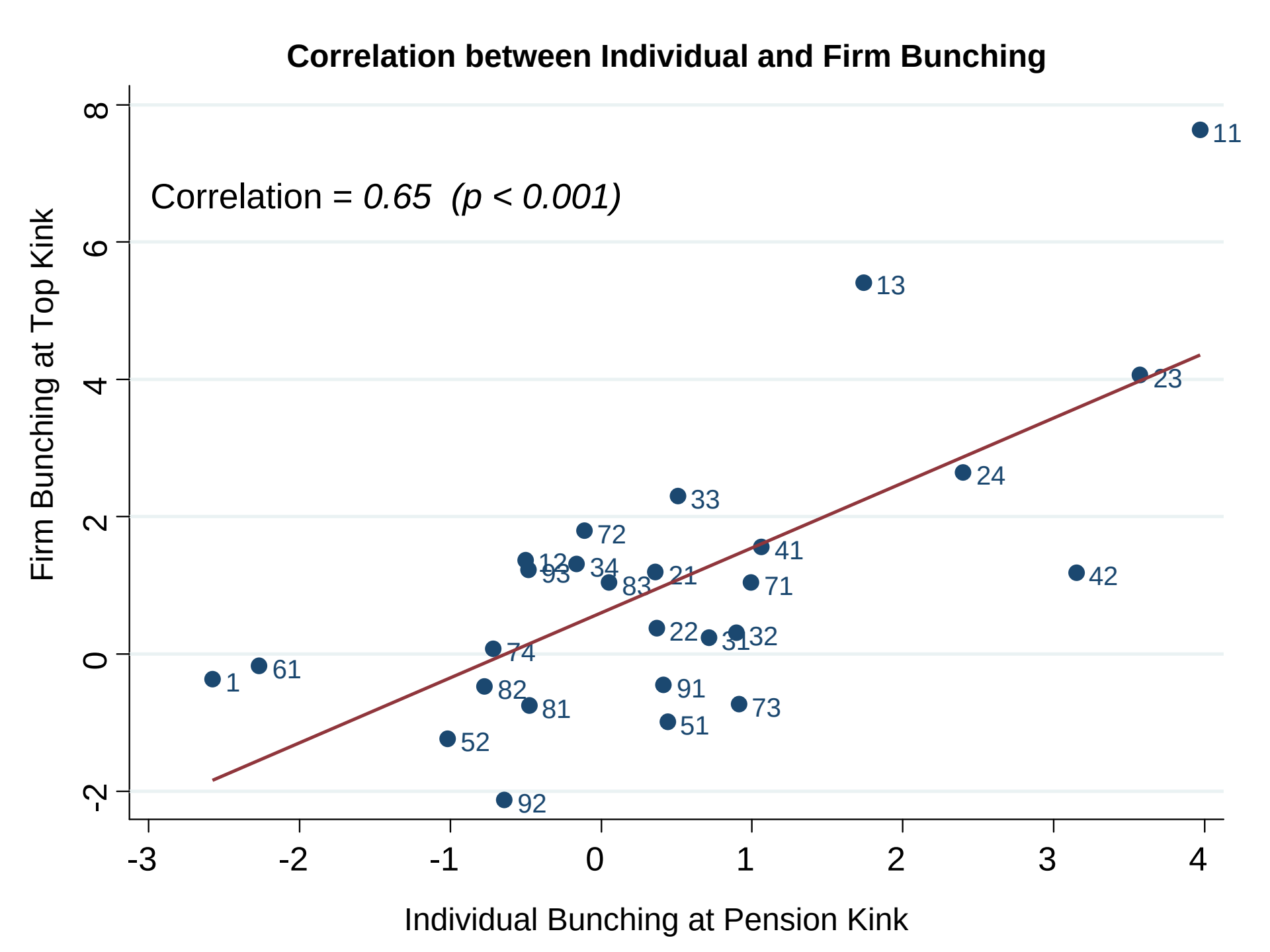
- Test by examining probability of tracking movement in kink
  - Define indicator for change in earnings from year *t* to *t+2* within DKr 7,500 of change in top tax bracket from *t* to *t+2*

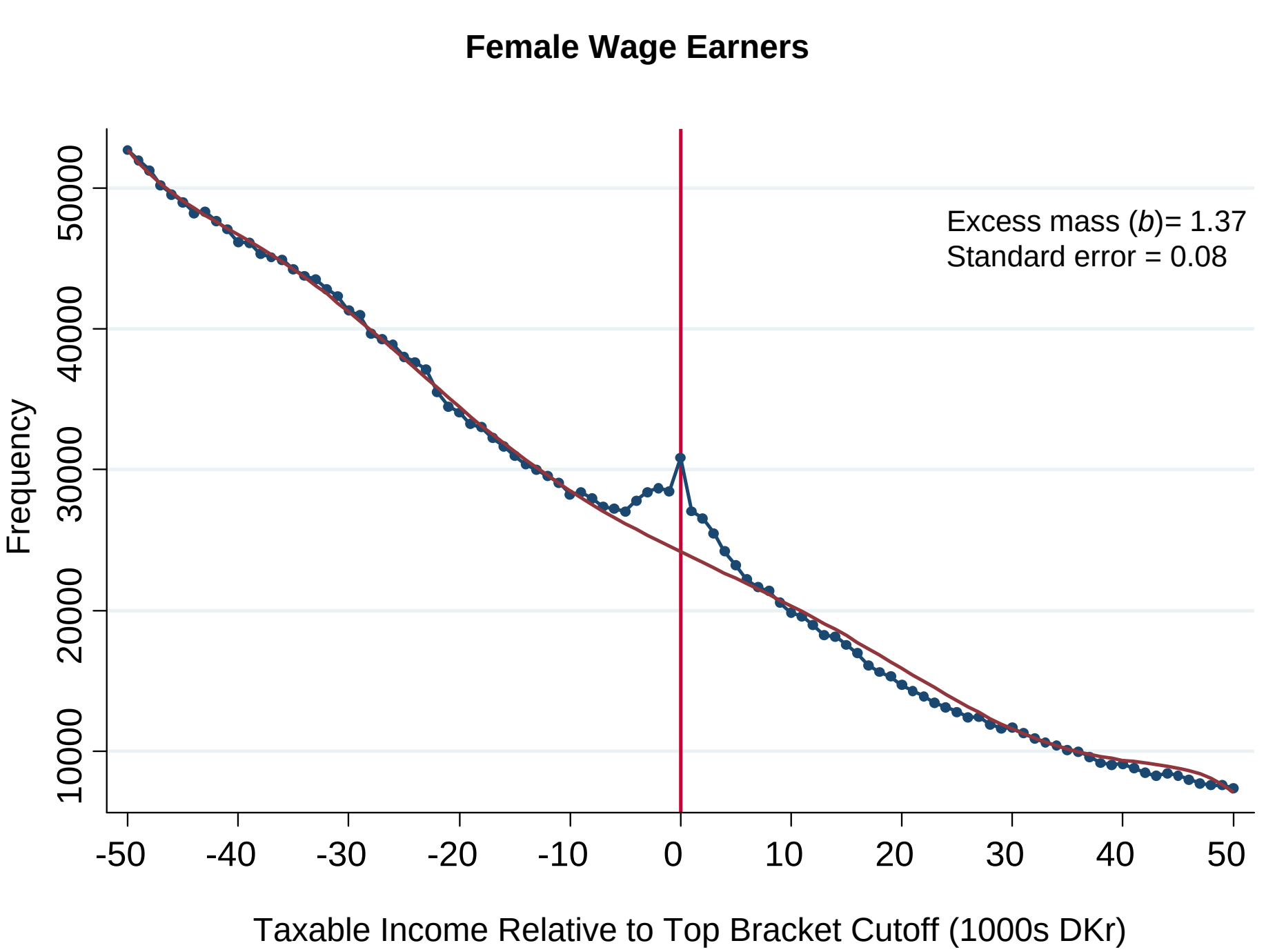

Dynamics of Earnings Around the Statutory Kink
% with Earnings Tracking Movement in Top Kink
20
25
30
35
-50
-40
-30
-20
-10
0
10
20
30
40
50
Wage Earnings Relative to Statutory Kink (1000s DKR)

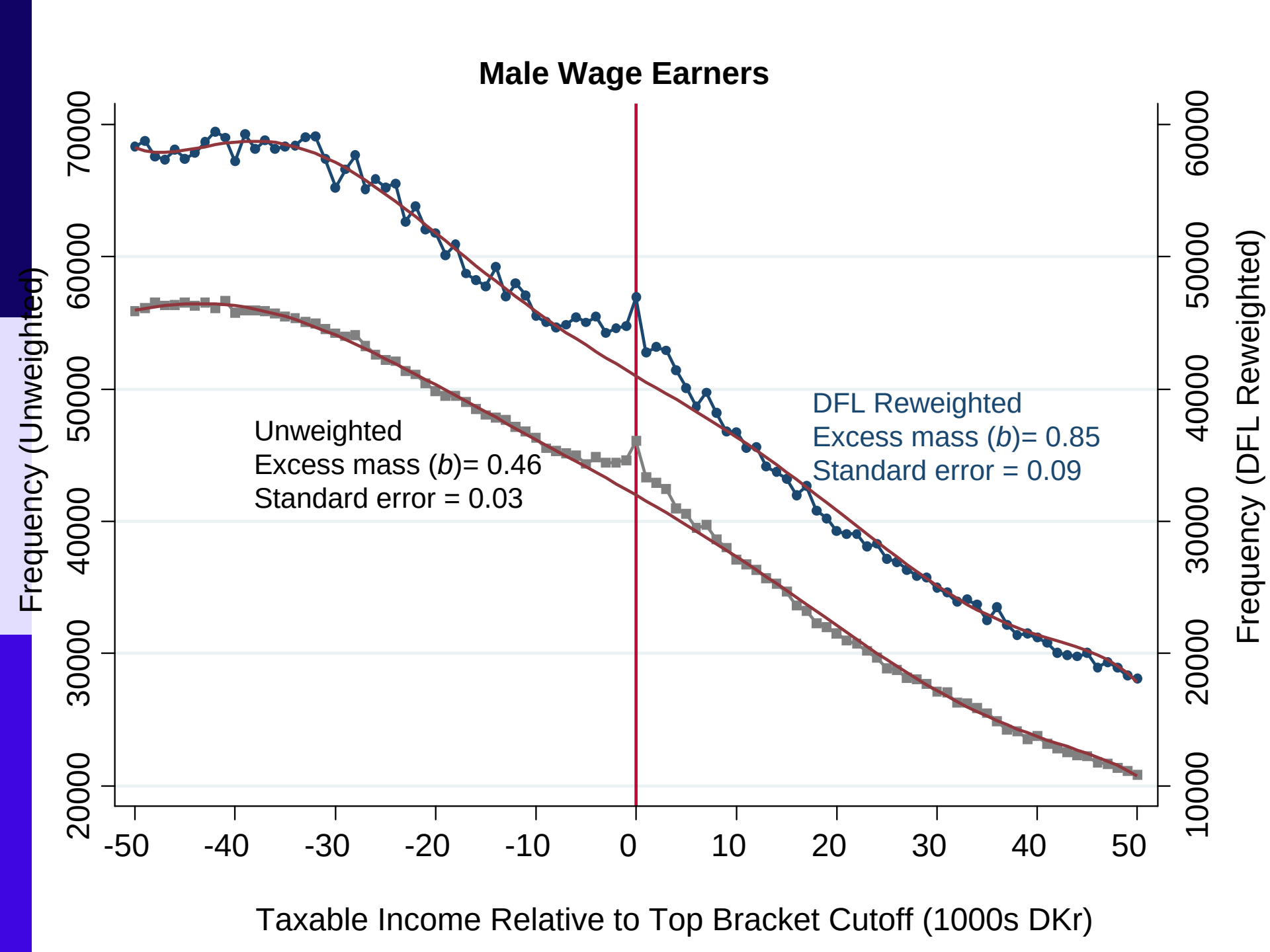

Dynamics of Earnings around Pension Kink: Deductions > 20,000
% with Earnings Tracking Movement in Pension Kink
20
25
30
35
-50
-40
-30
-20
-10
0
10
20
30
40
50
Wage Earnings Relative to Pension Kink (1000s DKR)

PREDICTION 3: Correlation between Individual And Firm Bunching

- Intuitively, individual preferences drive the firm job distribution
- Test prediction by looking across occupations
  - Two-digit Danish ISCO codes

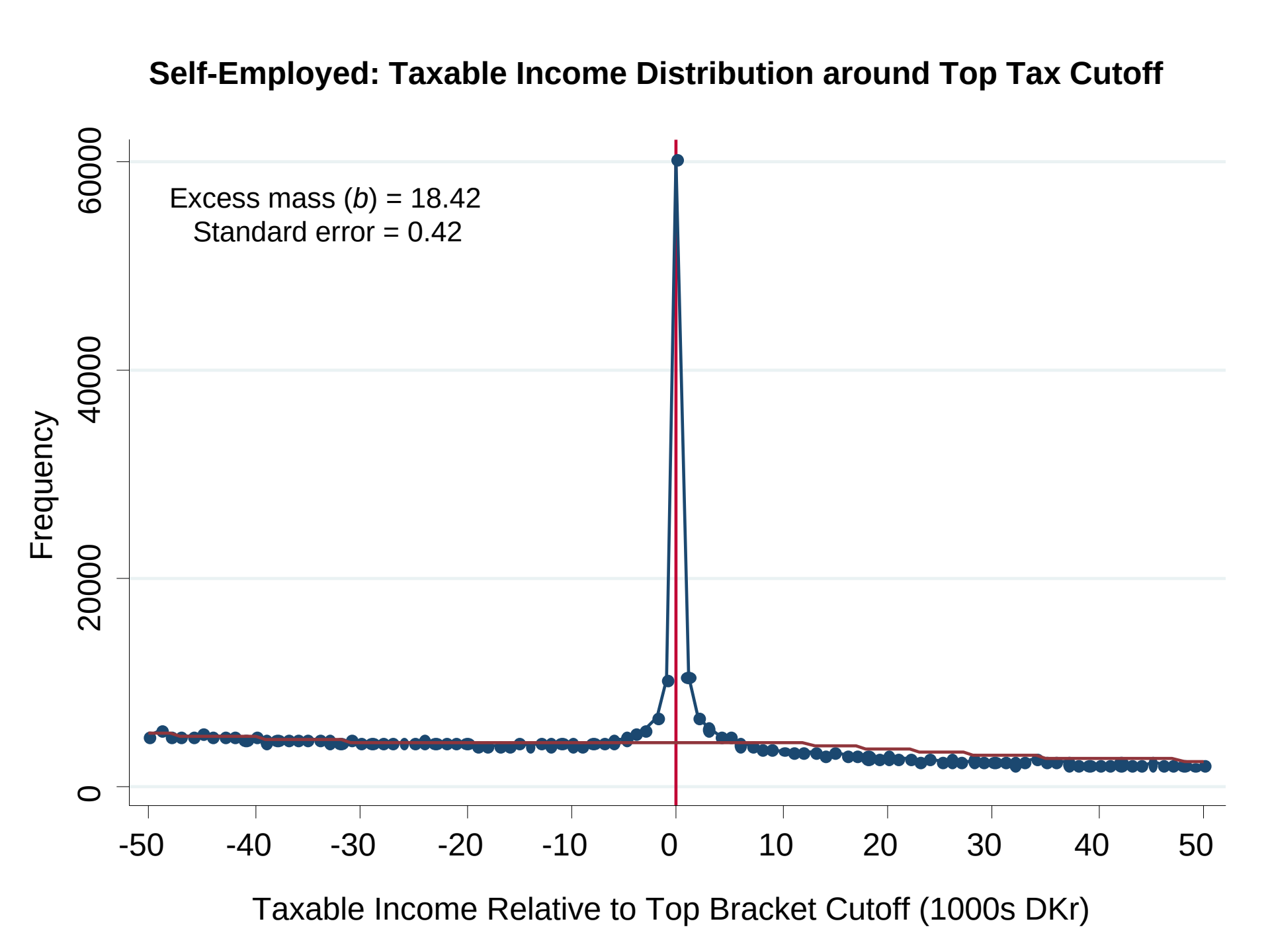

Correlation between Individual and Firm Bunching
Correlation = 0.65 (p < 0.001)
Firm Bunching at Top Kink
Individual Bunching at Pension Kink
8
6
4
2
0
-2
-3
-2
-1
0
1
2
3
4
11
13
23
24
33
72
41
12
93
34
21
42
83
71
22
31
32
74
1
61
82
91
73
81
51
52
92

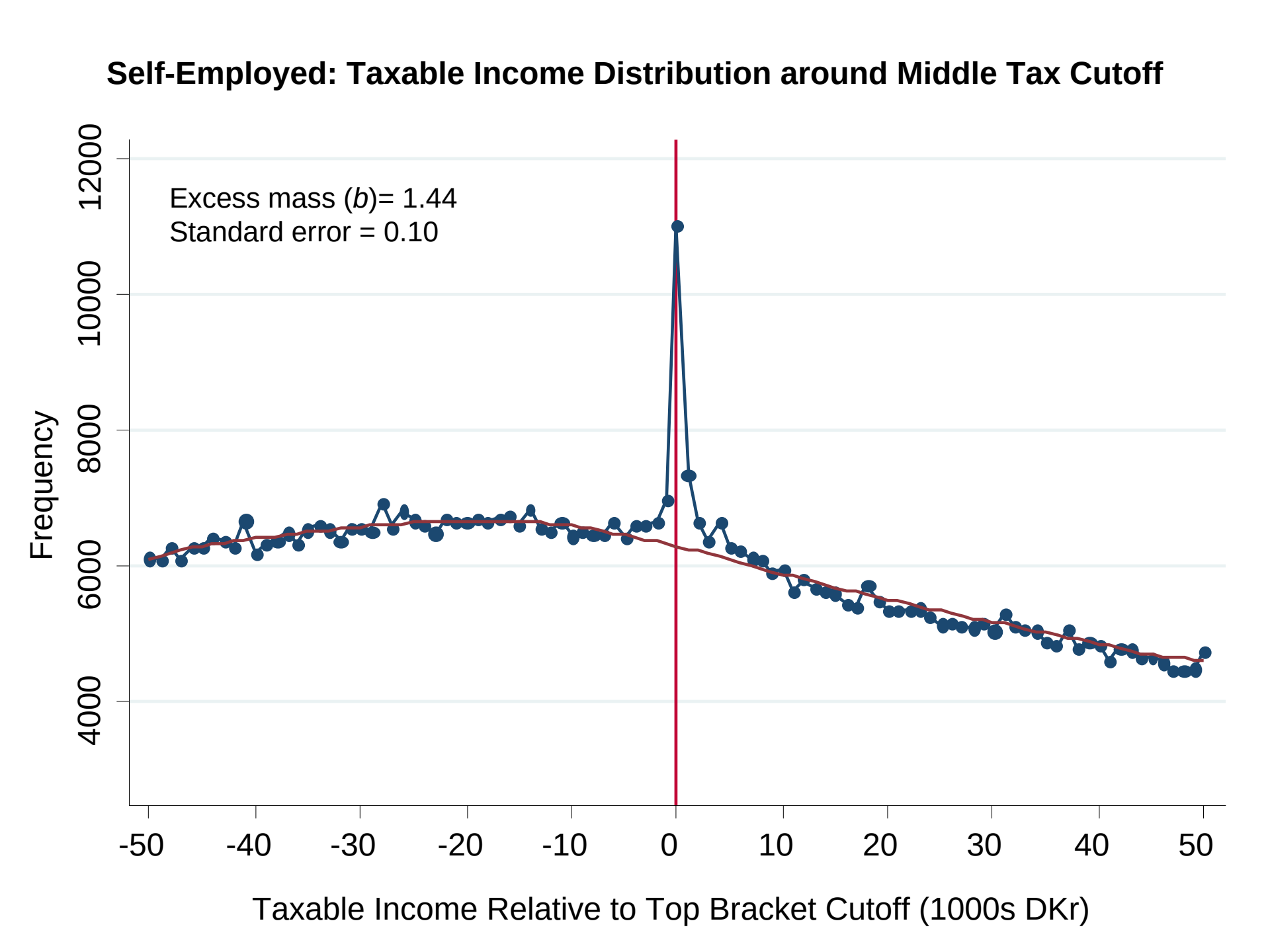

Female Wage Earners
Excess mass (b)= 1.37
Standard error = 0.08
Frequency
10000
20000
30000
40000
50000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Taxable Income Relative to Top Bracket Cutoff (1000s DKr)

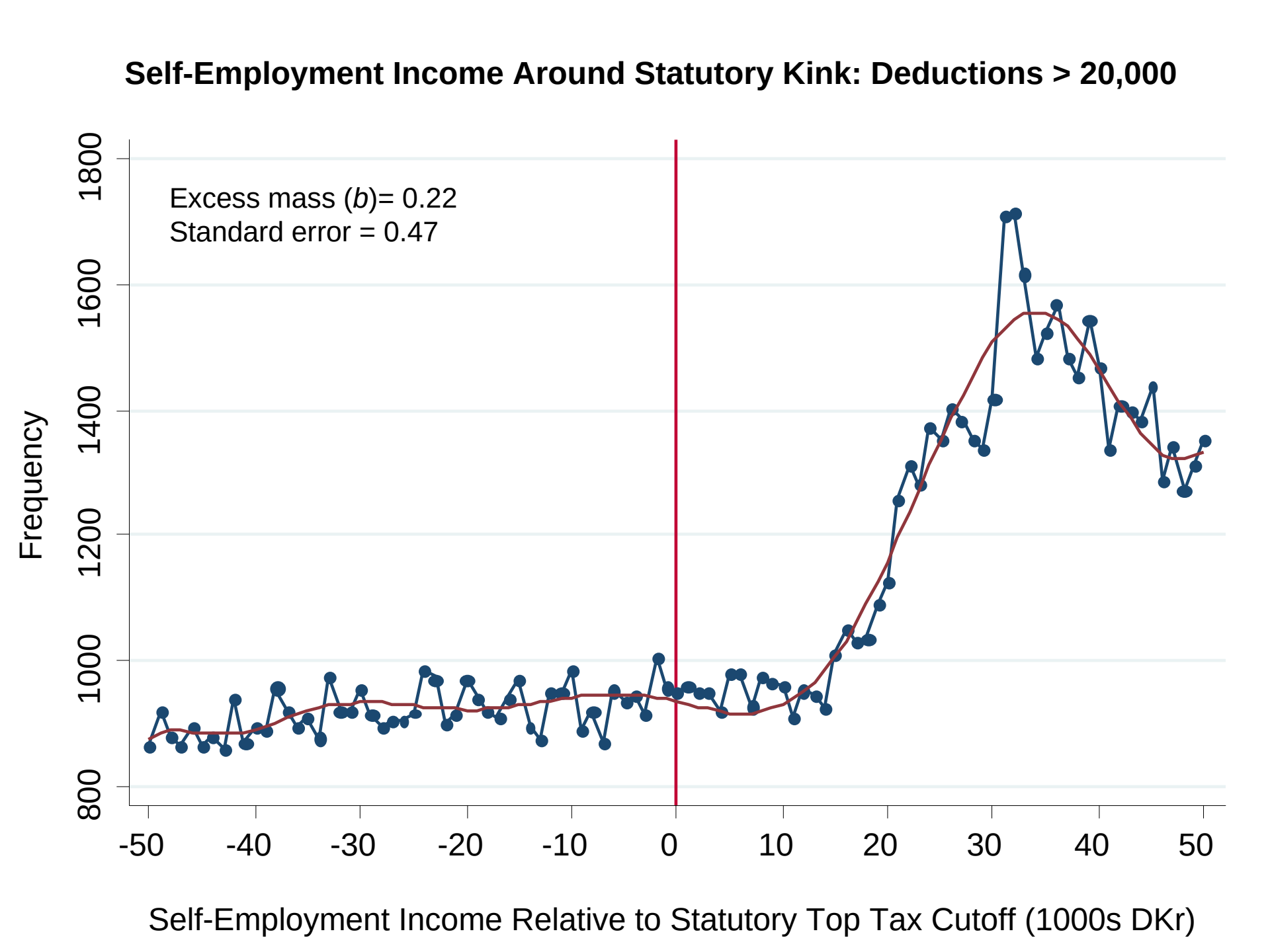

Male Wage Earners
Frequency (Unweighted)
70000
60000
50000
40000
30000
20000
Frequency (DFL Reweighted)
60000
50000
40000
30000
20000
10000
Unweighted
Excess mass (b)= 0.46
Standard error = 0.03
DFL Reweighted
Excess mass (b)= 0.85
Standard error = 0.09
-50
-40
-30
-20
-10
0
10
20
30
40
50
Taxable Income Relative to Top Bracket Cutoff (1000s DKr)

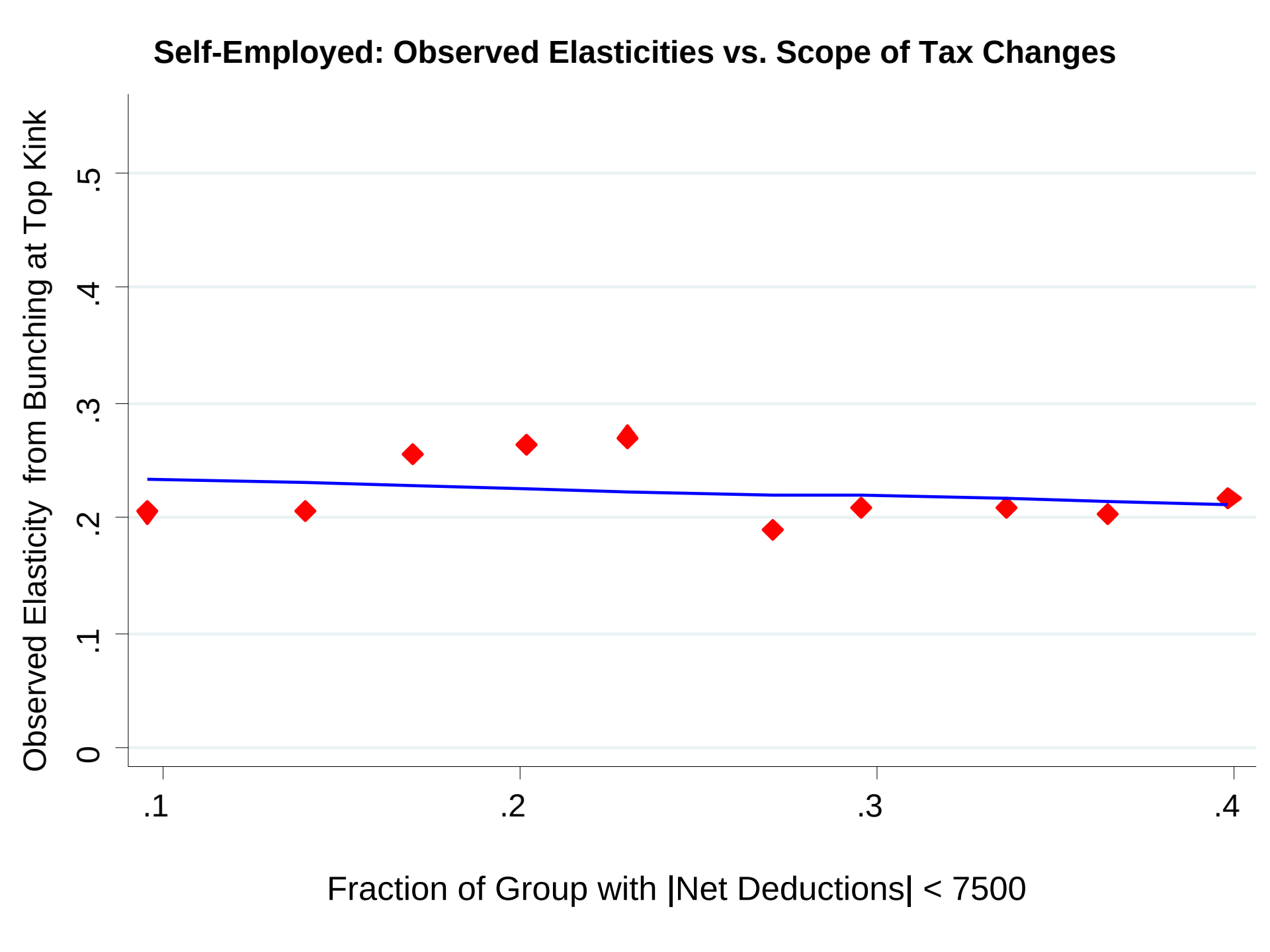
Self-Employed

- Thus far, we have looked only at wage earners
- Self-employed do not face search frictions or hours constraints
  - Can more easily adjust earnings, both by changing labor supply and by reporting/intertemporal shifting
- Serve as a “placebo test” for our findings
  - Three predictions should not hold for the self-employed
  - Size and scope of tax change should not matter


Self-Employed: Taxable Income Distribution around Top Tax Cutoff
Excess mass (b) = 18.42
Standard error = 0.42
Frequency
0
20000
40000
60000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Taxable Income Relative to Top Bracket Cutoff (1000s DKr)


Self-Employed: Taxable Income Distribution around Middle Tax Cutoff
Excess mass (b)= 1.44
Standard error = 0.10
Frequency
4000
6000
8000
10000
12000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Taxable Income Relative to Top Bracket Cutoff (1000s DKr)


Self-Employment Income Around Statutory Kink: Deductions > 20,000
Excess mass (b)= 0.22
Standard error = 0.47
Frequency
800
1000
1200
1400
1600
1800
-50
-40
-30
-20
-10
0
10
20
30
40
50
Self-Employment Income Relative to Statutory Top Tax Cutoff (1000s DKr)


Self-Employed: Observed Elasticities vs. Scope of Tax Changes
Observed Elasticity from Bunching at Top Kink
0
.1
.2
.3
.4
.5
.1
.2
.3
.4
Fraction of Group with |Net Deductions| < 7500

Calibration

- What do our micro estimates tell us about the macro elasticity?
  - Ideal experiment: Infinite tax change for a very small group

- Instead, we partially identify our model to bound the magnitude of the attenuation of the elasticity
- Key intuition: ε controls the utility loss of deviating from optimum

$$u_i(h_i^*) - u_i(h) \simeq -\frac{1}{2}\frac{1}{\varepsilon} w h_i^* (\Delta \log h)^2$$

  - Low ε implies very convex loss function, inflexible labor supply

➔ Upper bound on utility losses from search cost yield a lower bound on the structural elasticity

Calibration: Mechanics

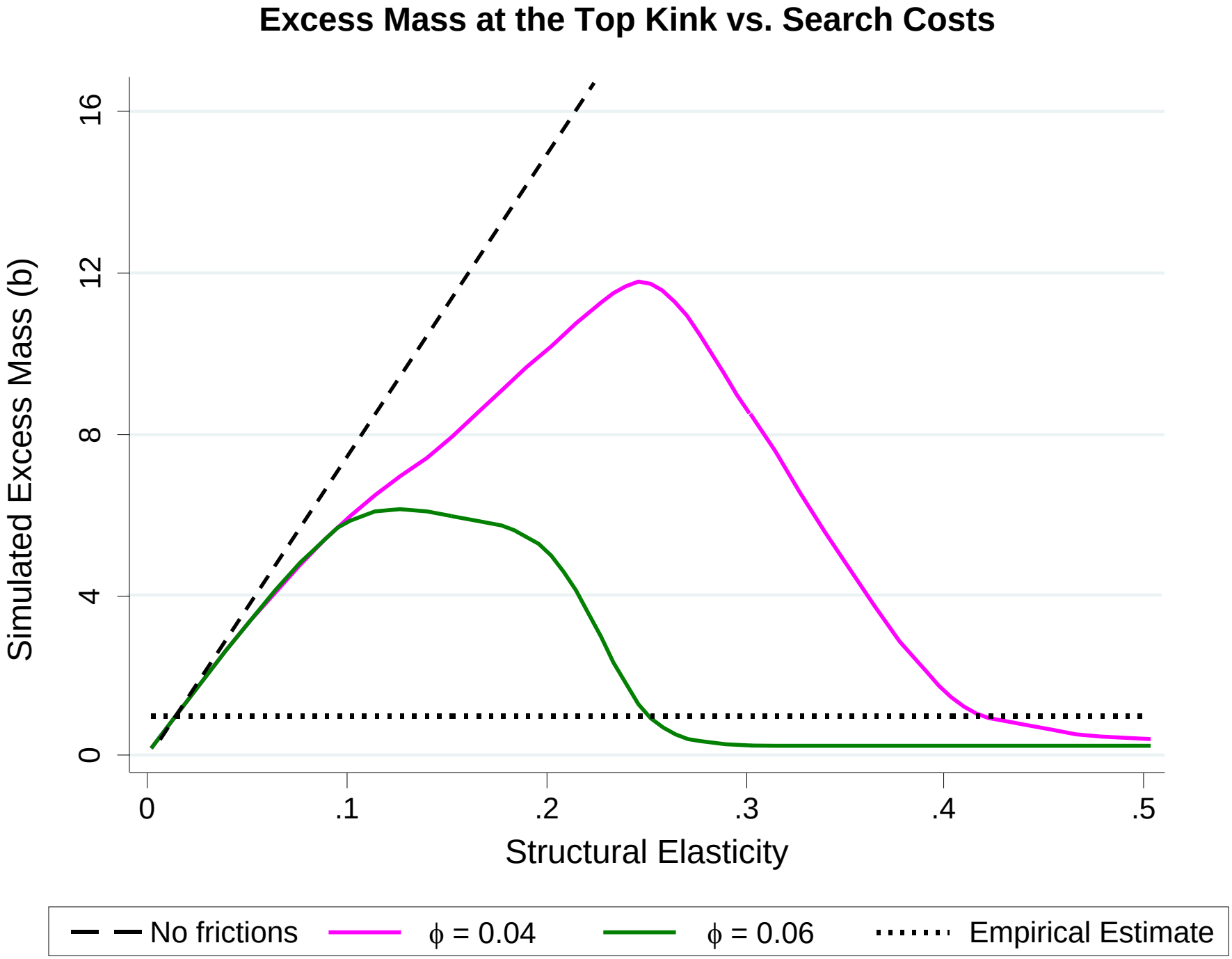
- Calibrate tax system to match Danish economy
- Utility function: $u_i(c,h) = c - \alpha_i^{-1/\varepsilon} \frac{h^{1+1/\varepsilon}}{1+1/\varepsilon}$

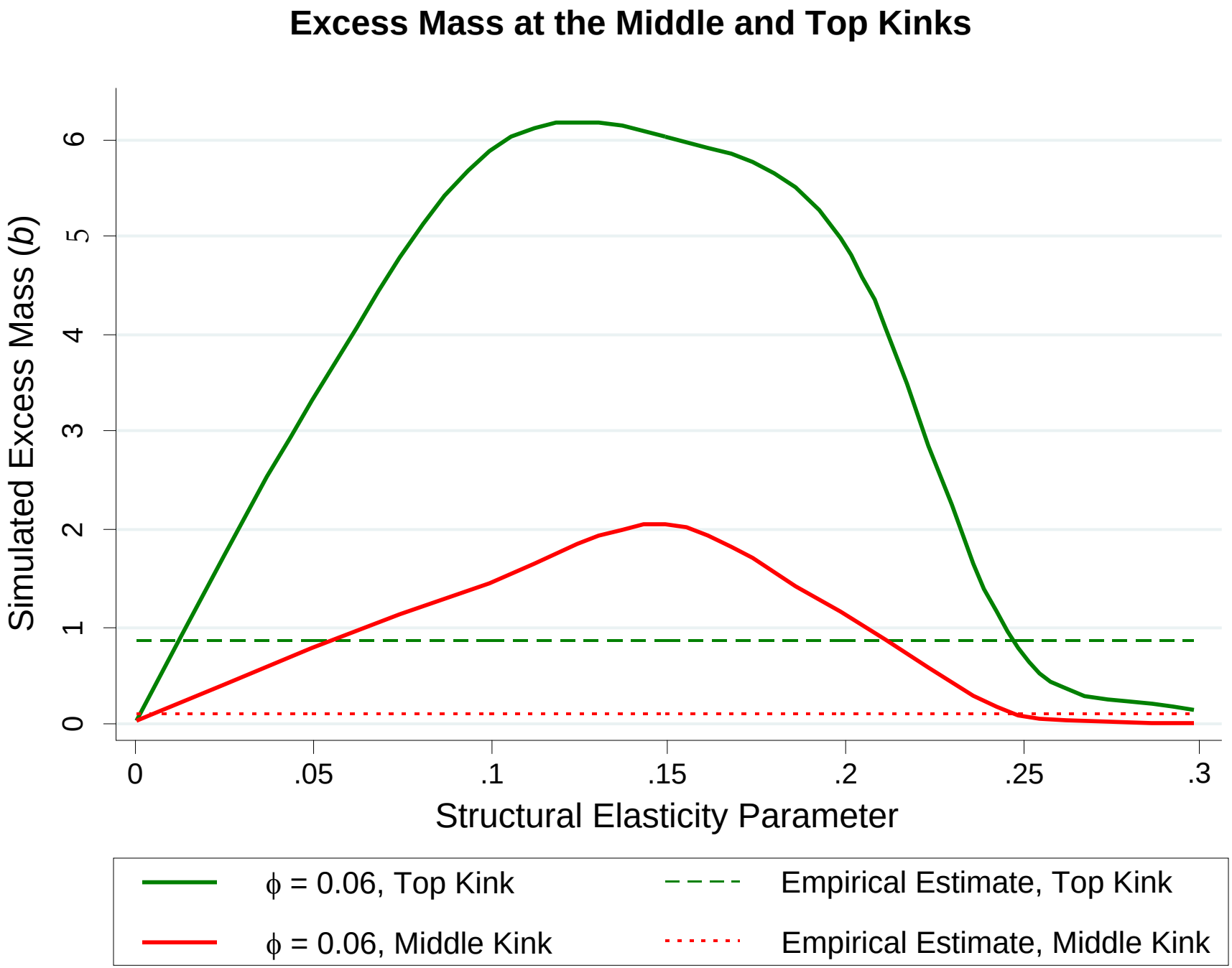
- Fit heterogeneous tastes to match income distribution *away* from the kink
- Parametric assumptions:

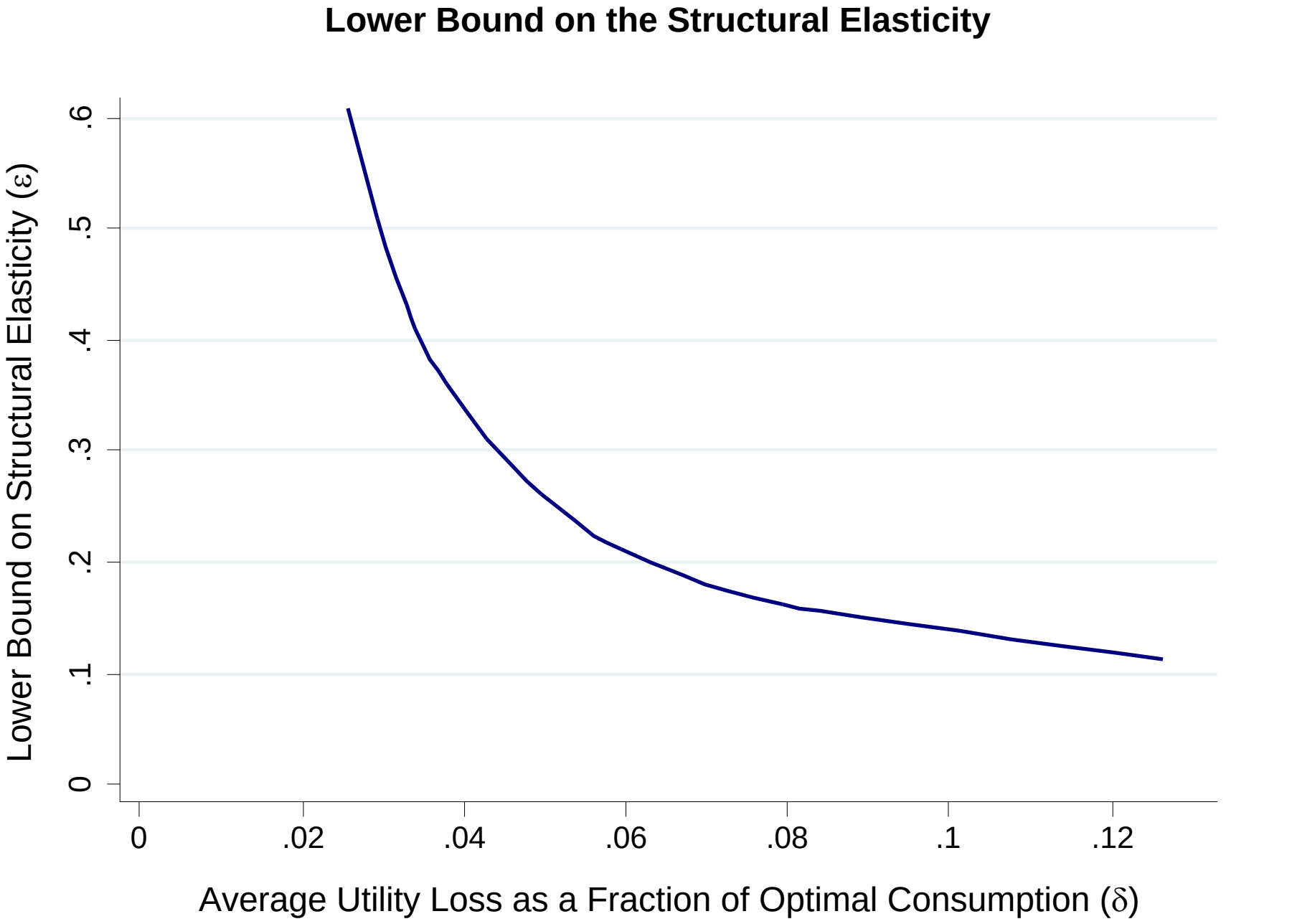
Distribution of new draw: $G_e(h'|h_i^*) = e \lim_{\lambda \to 0} N(h_i^*, \lambda) + (1-e)N(h_i^*, \sigma)$

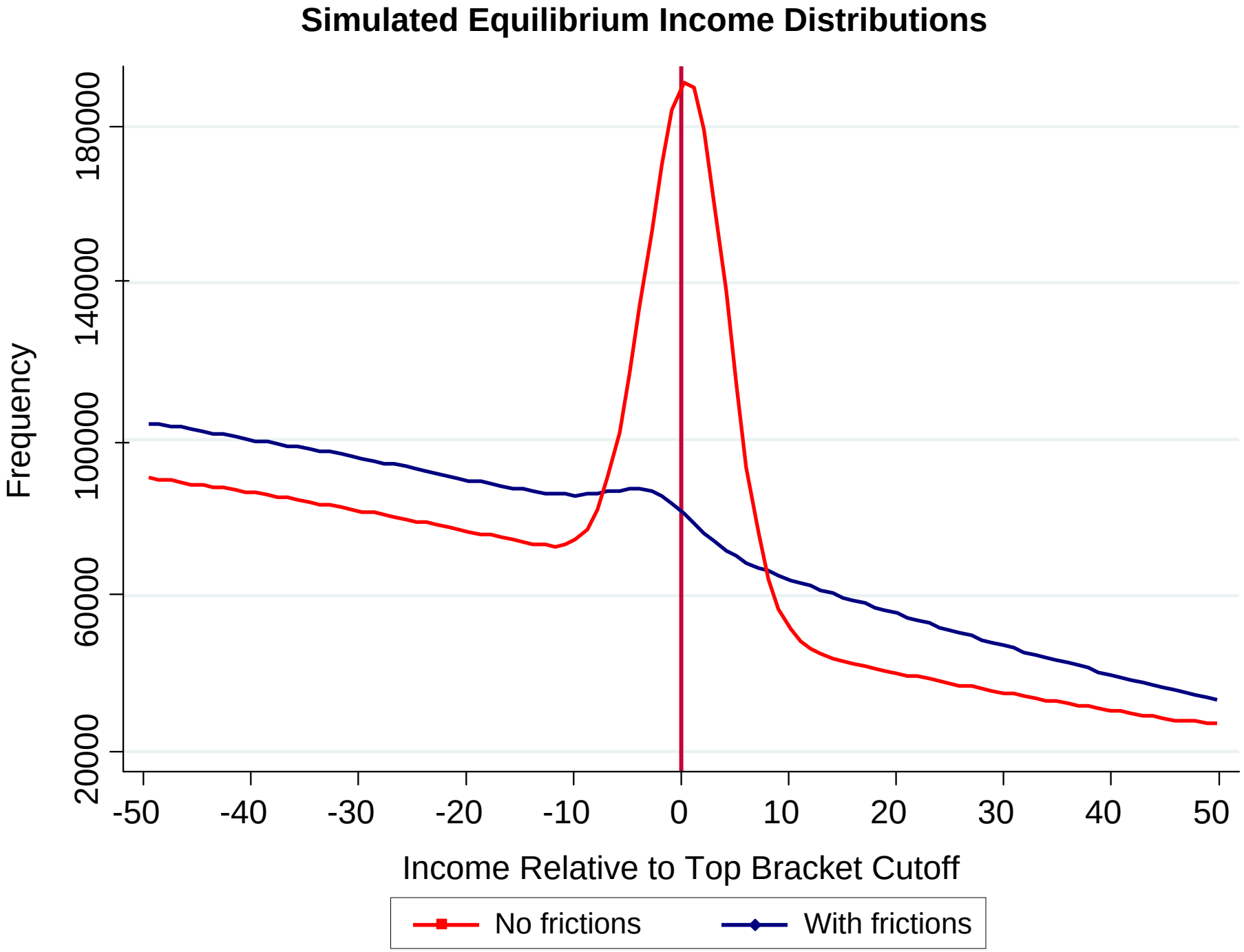
Search cost: $\Phi_i(e) = \phi \cdot c_i^* \cdot (1 + e^{\gamma})$

- Fit the remaining parameters $\{\phi, \sigma, \gamma, \varepsilon\}$ from the data


Excess Mass at the Top Kink vs. Search Costs
Simulated Excess Mass (b)
0
4
8
12
16
0
.1
.2
.3
.4
.5
Structural Elasticity
No frictions
ϕ = 0.04
ϕ = 0.06
Empirical Estimate


Excess Mass at the Middle and Top Kinks
Simulated Excess Mass (b)
0
1
2
3
4
5
6
0
.05
.1
.15
.2
.25
.3
Structural Elasticity Parameter
ϕ = 0.06, Top Kink
Empirical Estimate, Top Kink
ϕ = 0.06, Middle Kink
Empirical Estimate, Middle Kink


Lower Bound on the Structural Elasticity
Lower Bound on Structural Elasticity (ε)
0
.1
.2
.3
.4
.5
.6
0
.02
.04
.06
.08
.1
.12
Average Utility Loss as a Fraction of Optimal Consumption (δ)


Simulated Equilibrium Income Distributions
Frequency
20000
60000
100000
140000
180000
-50
-40
-30
-20
-10
0
10
20
30
40
50
Income Relative to Top Bracket Cutoff
No frictions
With frictions

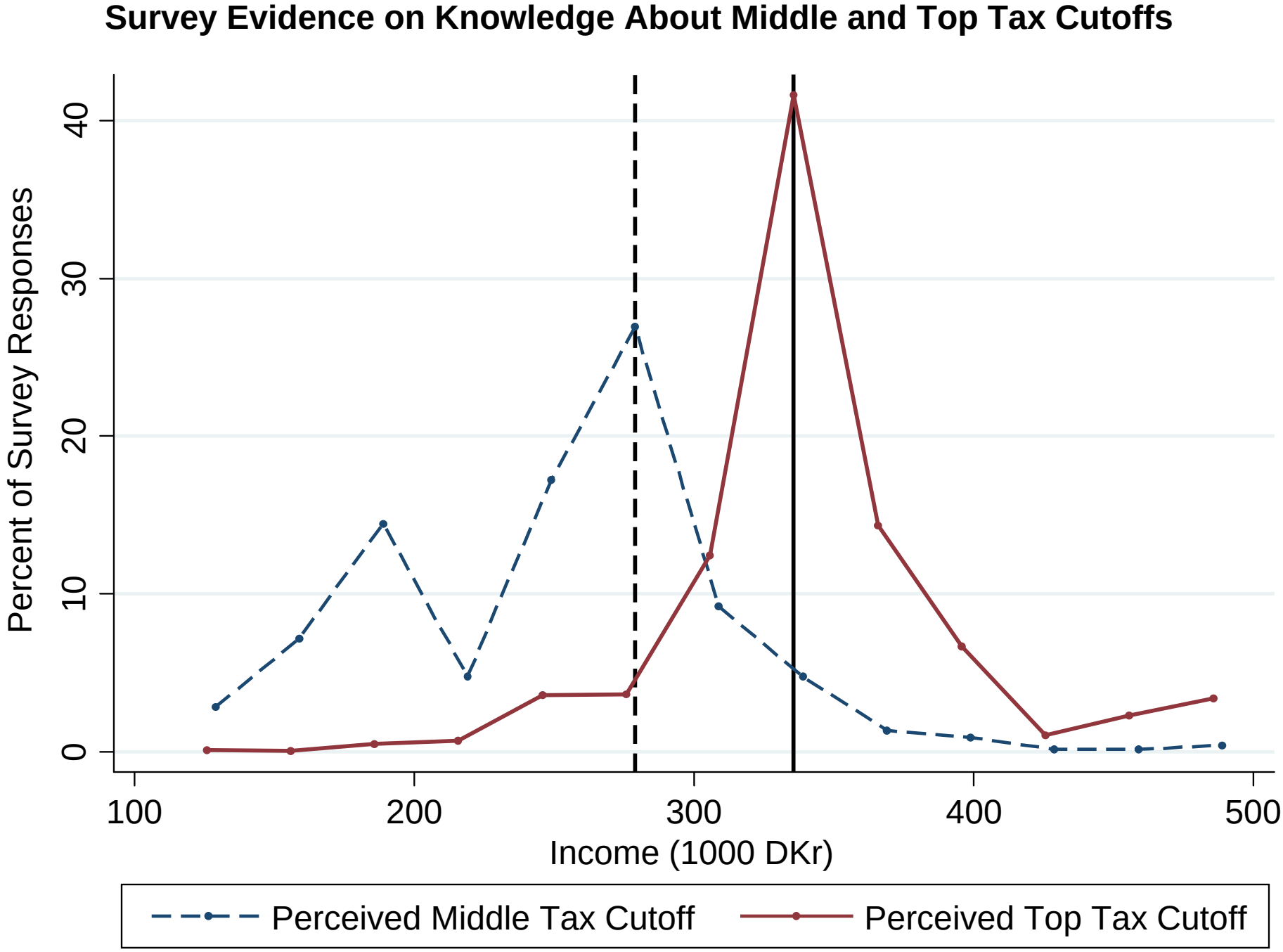
Conclusion

- Search costs and institutional constraints attenuate short run behavioral responses substantially
  - Demonstrated the effects of size and scope on elasticity
  - Standard method of estimating elasticities using small tax reforms on *same data* yields close-to-zero elasticity estimate
- If we assume utility loss from frictions is less than 5% of optimal consumption, 0.25 is a lower bound on consumption
  - May help explain why macro cross-country comparisons find larger elasticities (Prescott 2004, Davis and Henrekson 2005)

Conclusion: Potential Policy Implications and Future Work

- Welfare consequences of tax policies can be very different in the presence of frictions
  - Suppose individuals have heterogeneous elasticities and must coordinate on hours choices

    → long run efficiency cost of taxing one group of workers differs from that implied by their own elasticities
- Optimal taxation in the presence of frictions
- Effect of frictions on other behavioral responses and the interpretation of other quasi-experimental estimates


Survey Evidence on Knowledge About Middle and Top Tax Cutoffs
Percent of Survey Responses
0
10
20
30
40
100
200
300
400
500
Income (1000 DKr)
Perceived Middle Tax Cutoff
Perceived Top Tax Cutoff