The Effects of Taxes on Earnings: Evidence from a Cohort Based Payroll Tax Reform in Greece

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1. INTRODUCTION

Payroll taxes (financing Social Security programs) raise about the same revenue (25% of total revenue) as individual income taxes in OECD countries

Payroll taxes have **two** characteristics:

1. Flat rates with cap

2. Taxes nominally shared by employers and employees

Payroll taxes create large tax wedges but are much less studied than individual income taxes

1. AIM OF THE PAPER

We use a unique 1992 reform of the Greek payroll taxes:

Individuals entering the labor market after 1992 face a permanently much higher earnings cap

Using longitudinal administrative data on 2004-2007 earnings, we can cast light on:

1. Incidence of the payroll tax on employers vs. employees

2. Effects of payroll tax on earnings and labor market outcomes

2.1 PAYROLL TAX SYSTEM IN GREECE

1. Payroll taxes are large in Greece: fund pension, health, unemployment, and family benefits

2. Several systems: (a) self-employed, (b) govt workers, (c) IKA: private sector employees, 2m workers, 45% of all workers. **This study on IKA workers only**

3. IKA tax rates: **28%** for employers, **16%** for employees $\Rightarrow$ combined rate of **35%**

4. Flat rates up to a **monthly** earnings cap of €2,315 in '07 and indexed [around 90th percentile]

5. Pension benefits based on last 5 years of earnings $\Rightarrow$ **Pure tax** for younger workers

2.1 THE 1992 PAYROLL TAX REFORM

1. 1992 reform increases taxes and reduces benefits but reform is **cohort** based: individuals with no covered earnings before 1993 (new entrants) face **a higher cap** and lower retirement benefits

    (a) New entrants cap set at **2.3** times the old cap [€5,280 per month in '07, around 99th percentile]

    (b) Tax remains a pure tax when far from retirement

2. Impact of New vs. Old tax differential develops over time [as new entrants reach old cap]

2.2 IKA ADMINISTRATIVE DATA

Longitudinal Data include **all** Greek workers who entered IKA (Social Security System) from 1988 to 1997 [1988-1992 entrants are in old regime, 1993-1997 entrants are in new regime]

1) Core variables: date of birth, gender, nationality, date of IKA entry (by day), regime

2) Job level variables: (March '04, March '05,..,March '07) Occupation, Days of work, Monthly Earnings by type: regular, overtime, bonus, etc., Payroll Taxes and Rates, Employer (ID, industry, location, size)

2.3 STANDARD CONCEPTUAL FRAMEWORK

w is (monthly) earnings (posted wage/salary), $z = w(1 + \tau_R)$ is gross earnings [τ_R is employer rate], $c = w \cdot (1 - \tau_E)$ is net earnings [τ_E is employee rate]

Caps: $\bar{w}$, $\bar{z} = \bar{w} \cdot (1 + \tau_R)$, $\bar{c} = \bar{w} \cdot (1 - \tau_E)$

$c = z \cdot (1 - \tau_E)/(1 + \tau_R) = (1 - \tau)z$ [$\tau = (\tau_E + \tau_R)/(1 + \tau_R)$]

Old entrants face rate τ up to $\bar{z}_O$ (90th percentile) while New entrants face rate τ up to $\bar{z}_N = 2.3 \cdot \bar{z}_O$ (99th percentile)

In standard competitive model: (a) gross earnings $z =$ marginal product, (b) w concept (posted wage/salary) is irrelevant, (c) only τ and $\bar{z}$ matter for labor supply

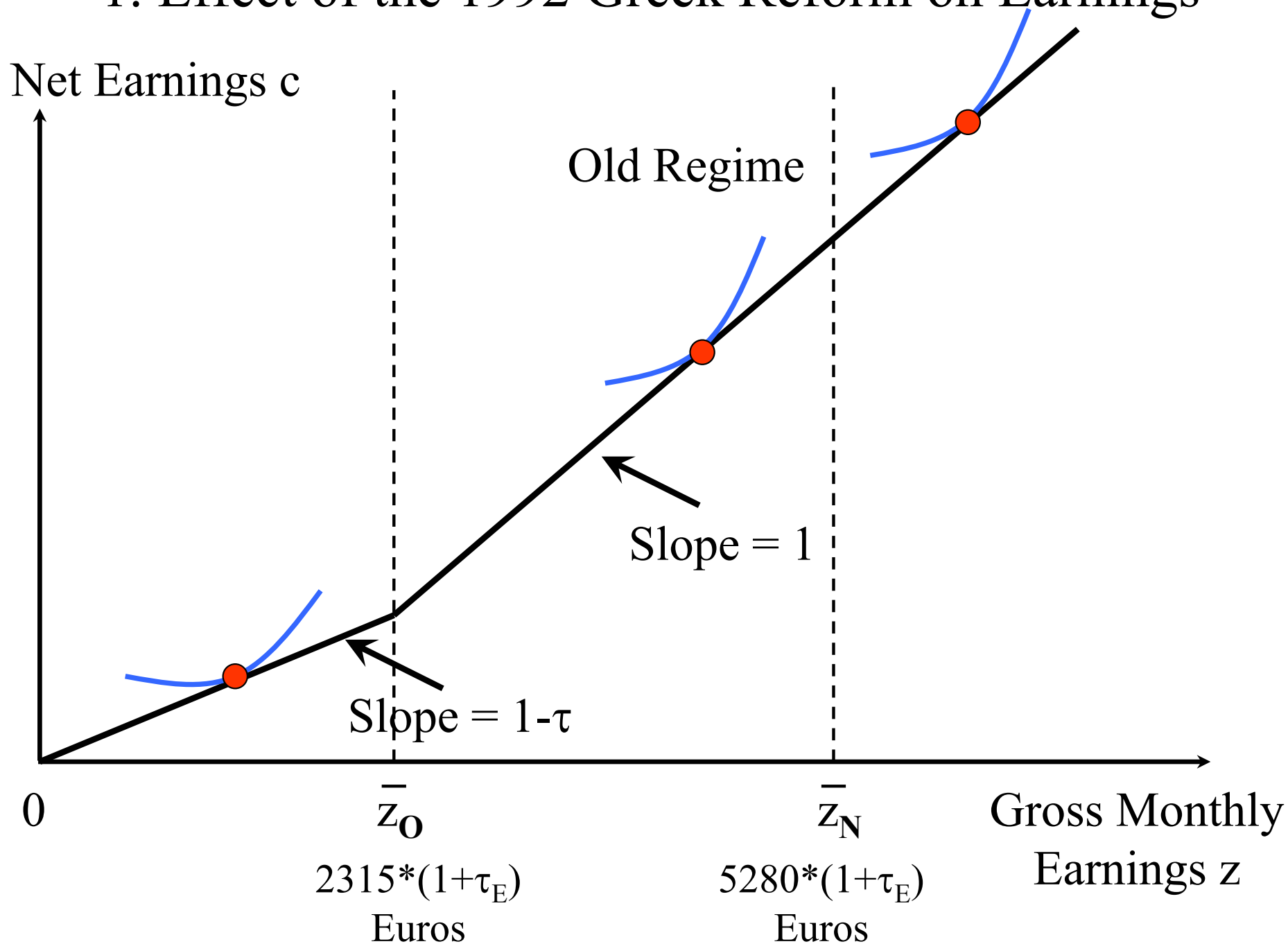# 2.3 STANDARD COMPETITIVE MODEL PREDICTIONS

Old entrants shortly before 1993 and new entrants shortly after 1993 are almost identical [reform was voted late in 1992, no time to game system]

Absent labor supply effects, they have same marginal product and hence get same gross earnings $z \Rightarrow$ New entrants above $\bar{z}_O$ bear full burden of tax increase
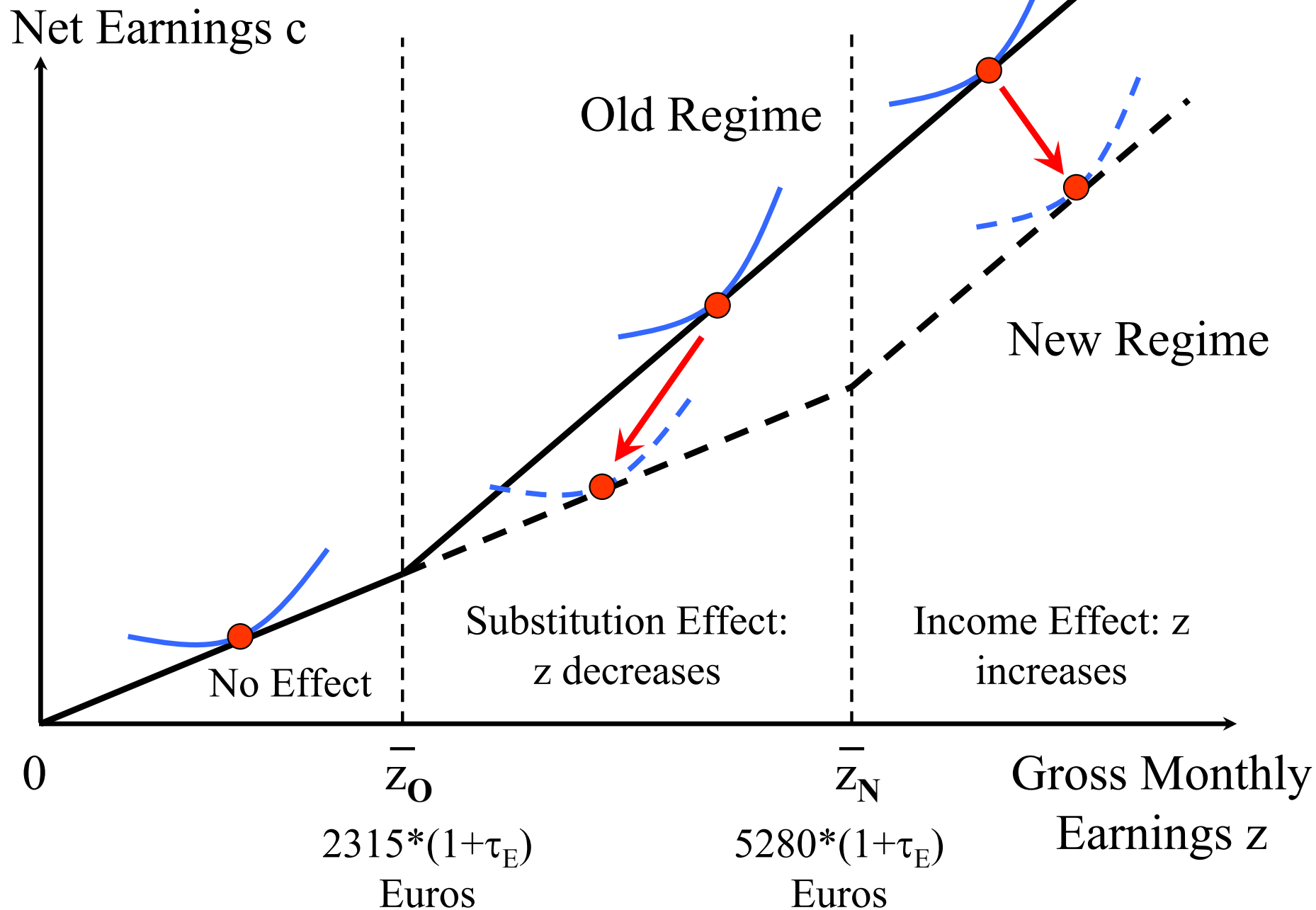
Labor Supply Effects for new entrants:

(a) Below $\bar{z}_O$ (P90): unaffected

(b) Between $\bar{z}_O$ and $\bar{z}_N$: work less (subst.), $z \downarrow$

(c) Above $\bar{z}_N$ (P99): work more (income effect), $z \uparrow$

1. Effect of the 1992 Greek Reform on Earnings

Net Earnings c

Old Regime

Slope = 1

Slope = 1-τ

0

$\overline{z}_O$

2315*(1+τ_E)
Euros

$\overline{z}_N$

5280*(1+τ_E)
Euros

Gross Monthly
Earnings z

1. Effect of the 1992 Greek Reform on Earnings

Net Earnings c

Old Regime

New Regime

No Effect

Substitution Effect: z decreases

Income Effect: z increases

0

$\bar{z}_O$

2315*(1+τ_E) Euros

$\bar{z}_N$

5280*(1+τ_E) Euros

Gross Monthly Earnings z

3.1 EMPIRICAL STRATEGY: RDD PLOTS

Compare outcomes for pre and post entrants. RDD plots by month of entry with quadratic fits on each side.

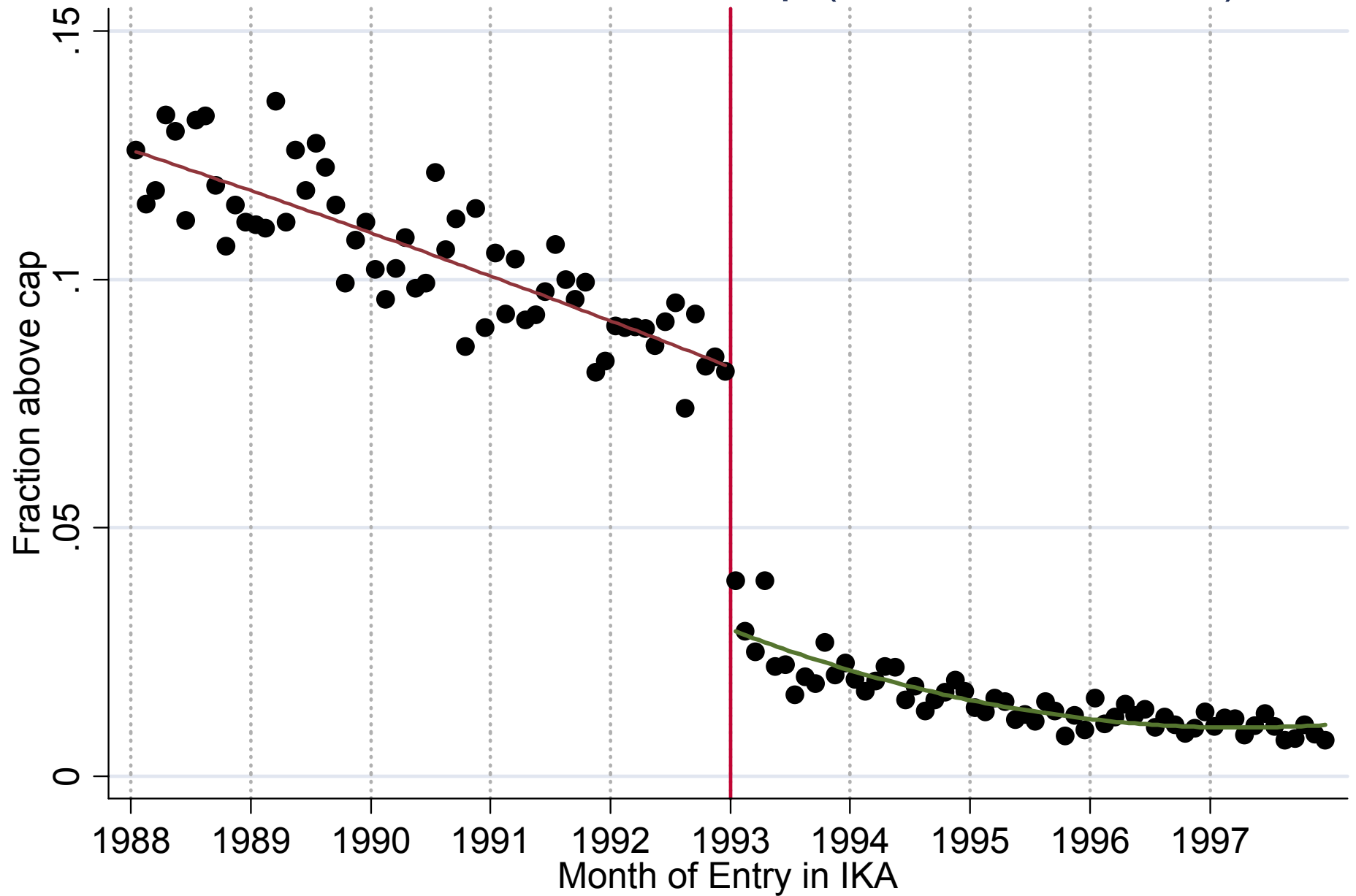**1) First Stage:** (a) fraction new regime, (b) fraction above cap

2) Checks: (a) Number of workers (no gaming), (b) age, (c) gender

3) Second Stage: distribution of current earnings z, w, c (expect no effect below $\bar{z}_O$, and effects above $\bar{z}_O$)
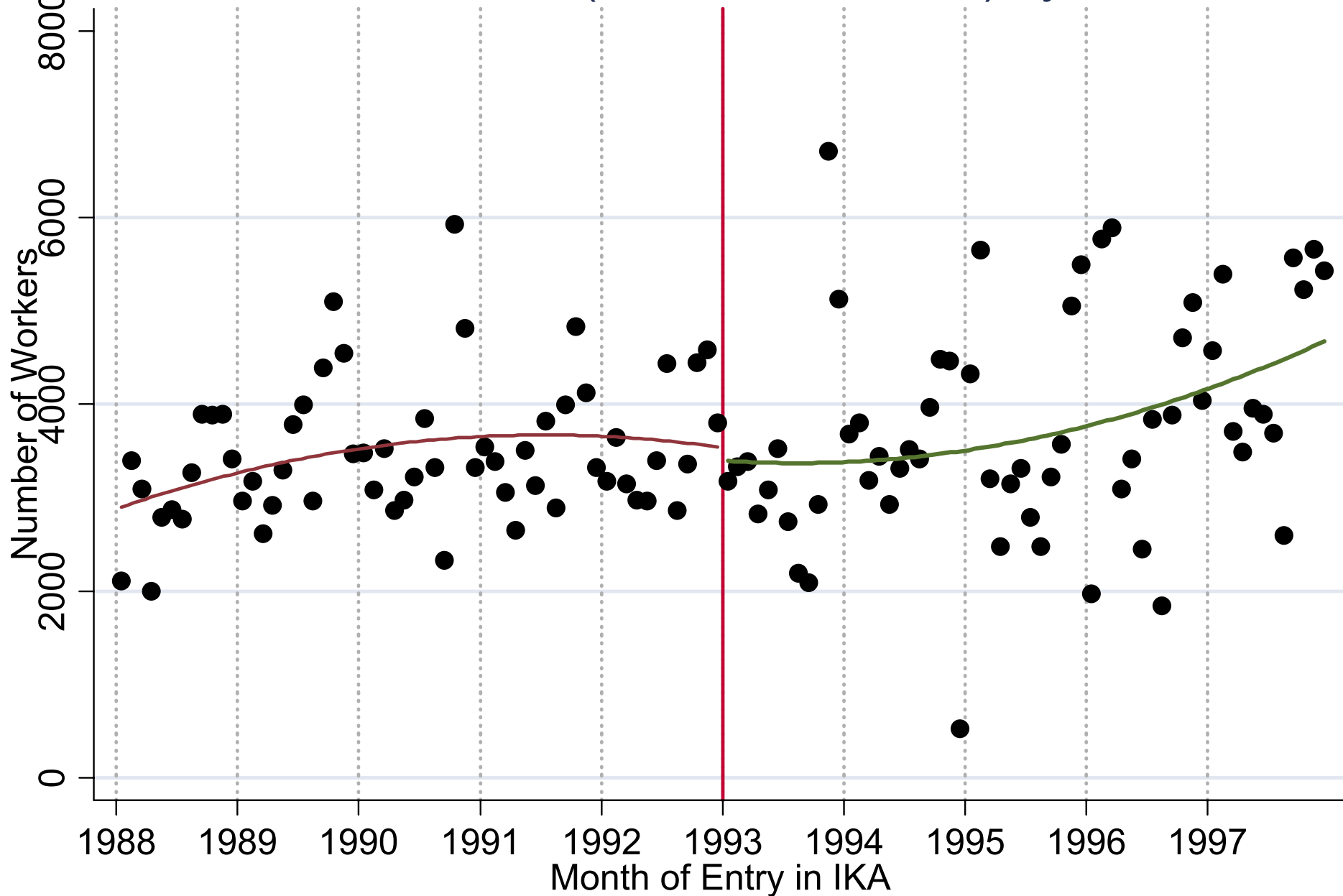
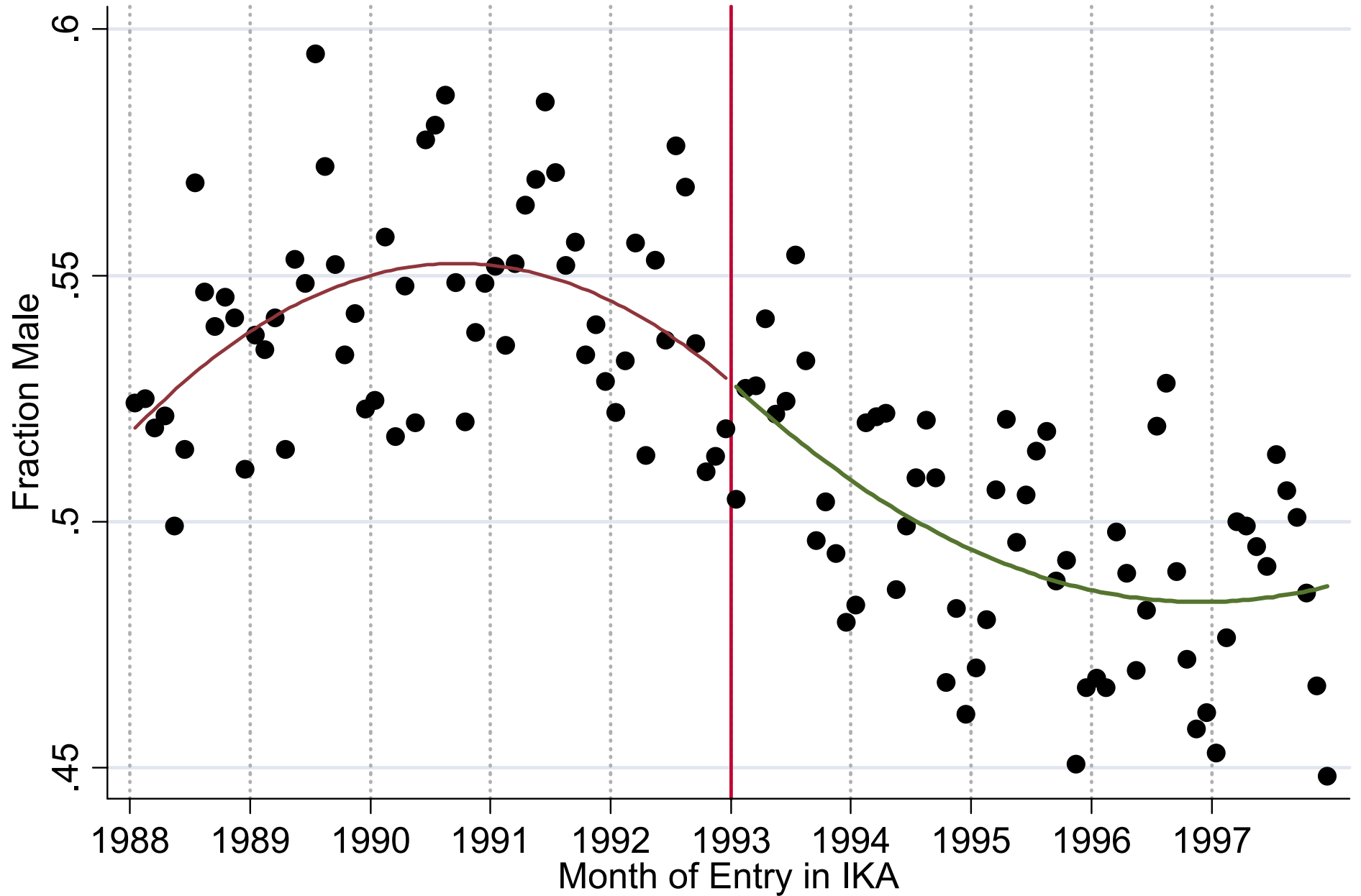2A. Fraction in New Regime (as of March 2007)
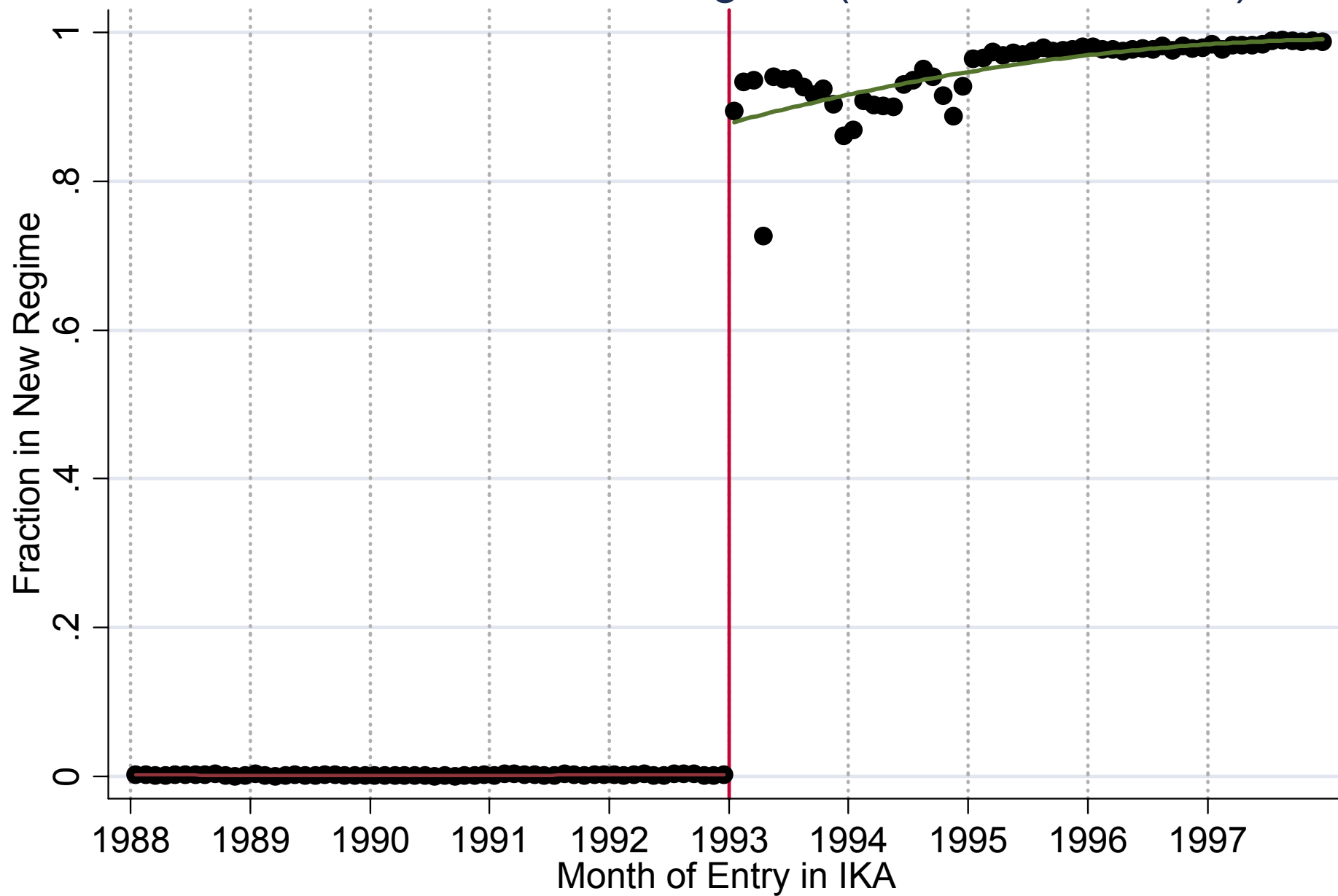
2B. Fraction above tax cap (as of March 2007)

Fraction above cap

Month of Entry in IKA

2C. Number of Workers (as of March 2007) by Month of entry

2D. Fraction Male (as of March 2007)

3.2 RDD: REGRESSION SPECIFICATIONS

Reform takes place at $t = 0$ (1/1/1993):

$$Y_i = \alpha_0 + \beta_0 \cdot 1(t_i \geq 0) + \alpha_1 \cdot t_i + \beta_1 \cdot t_i \cdot 1(t_i \geq 0) + \varepsilon_i$$

where t_i is date of entry (by day), Y_i is the outcome, β_0 is the coefficient of interest.

Robustness: (a) Restrict the sample of 1991-1994 entrants, (b) add control variables (month of entry dummies), (c) add higher polynomials in t_i

3. RDD: 1st Stage Results and Identification Checks (March 2007)

A. First Stage

Percent in new Regime	89.25	89.39	89.12	87.38	88.96
	(0.09)	(0.20)	(0.10)	(0.14)	(0.20)
Percent with earnings above cap	-5.87	-5.35	-5.89	-5.37	-5.24
	(0.14)	(0.23)	(0.14)	(0.21)	(0.29)

B. Identification Checks

Number of monthly entrants	-690	-535	-529	22	-579
	(347)	(530)	(291)	(430)	(595)
Age (in years)	0.075	0.233	-0.024	-0.022	0.080
	(0.035)	(0.060)	(0.035)	(0.053)	(0.072)
Gender (% male)	-3.14	0.09	-3.24	-0.03	0.33
	(0.31)	(0.49)	(0.31)	(0.46)	(0.63)

RDD Specification

|					
Linear entry date trends	Yes	Yes	Yes	Yes	Yes
Only 1991-1994 entrants		Yes			
Monthly dummies			Yes	Yes	Yes
Quadratic date trends				Yes	Yes
Cubic entry date trends					Yes
Number of Observations:	434,132	166,895	434,132	434,132	434,132

3.1 SECOND STAGE OUTCOMES

1. $Prob(z > z^*)$ with $z^* \in (\bar{z}_O, \bar{z}_N)$ [placebo test: use $z^* < \bar{z}_O$]

2. $E(z|z \geq \bar{z}_O)$ or $E(\min(z, \bar{z}_N)|z \geq \bar{z}_O)$ [placebo test: use $E(\min(z, \bar{z}_O)|z \geq z^*)$ with $z^* < \bar{z}_O$]

Repeat substituting z with w and c

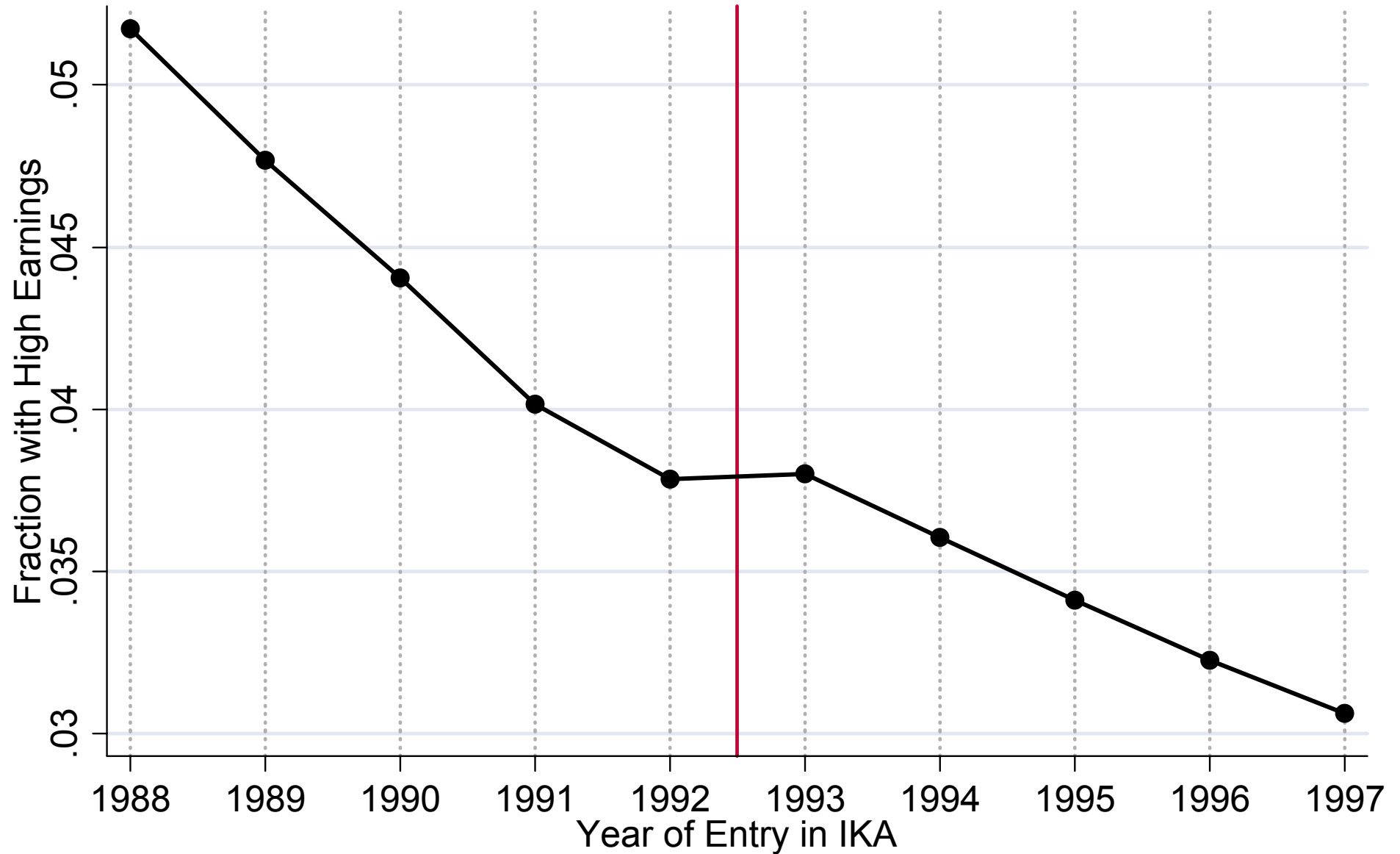Because of strong seasonality effects $\Rightarrow$ Series by year of entry are much smoother and easier to read

2E. Fraction with z above 3000*(1+0.25) Euros

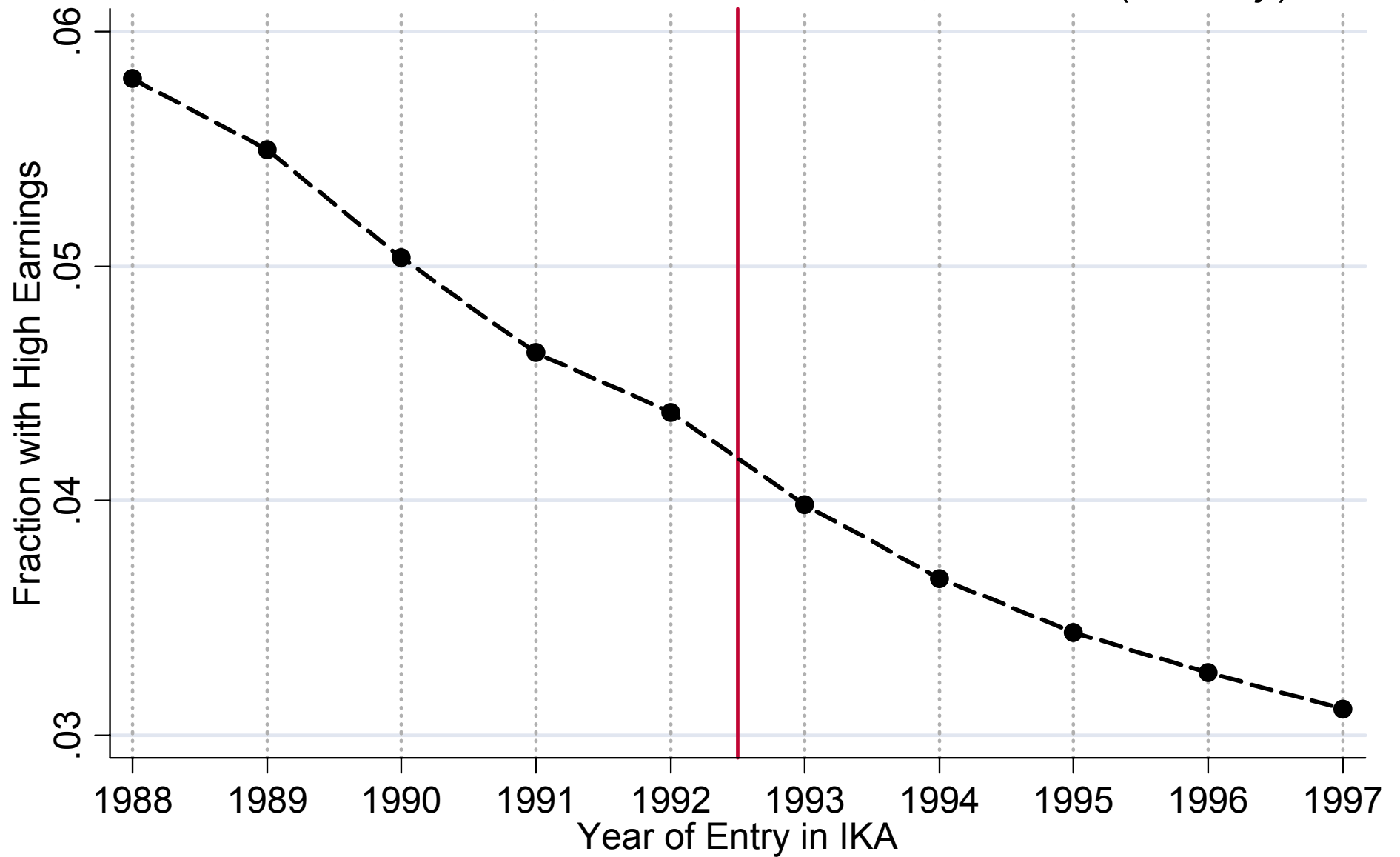Combines March '04, March '05, March '06, March '07 (with adj.)
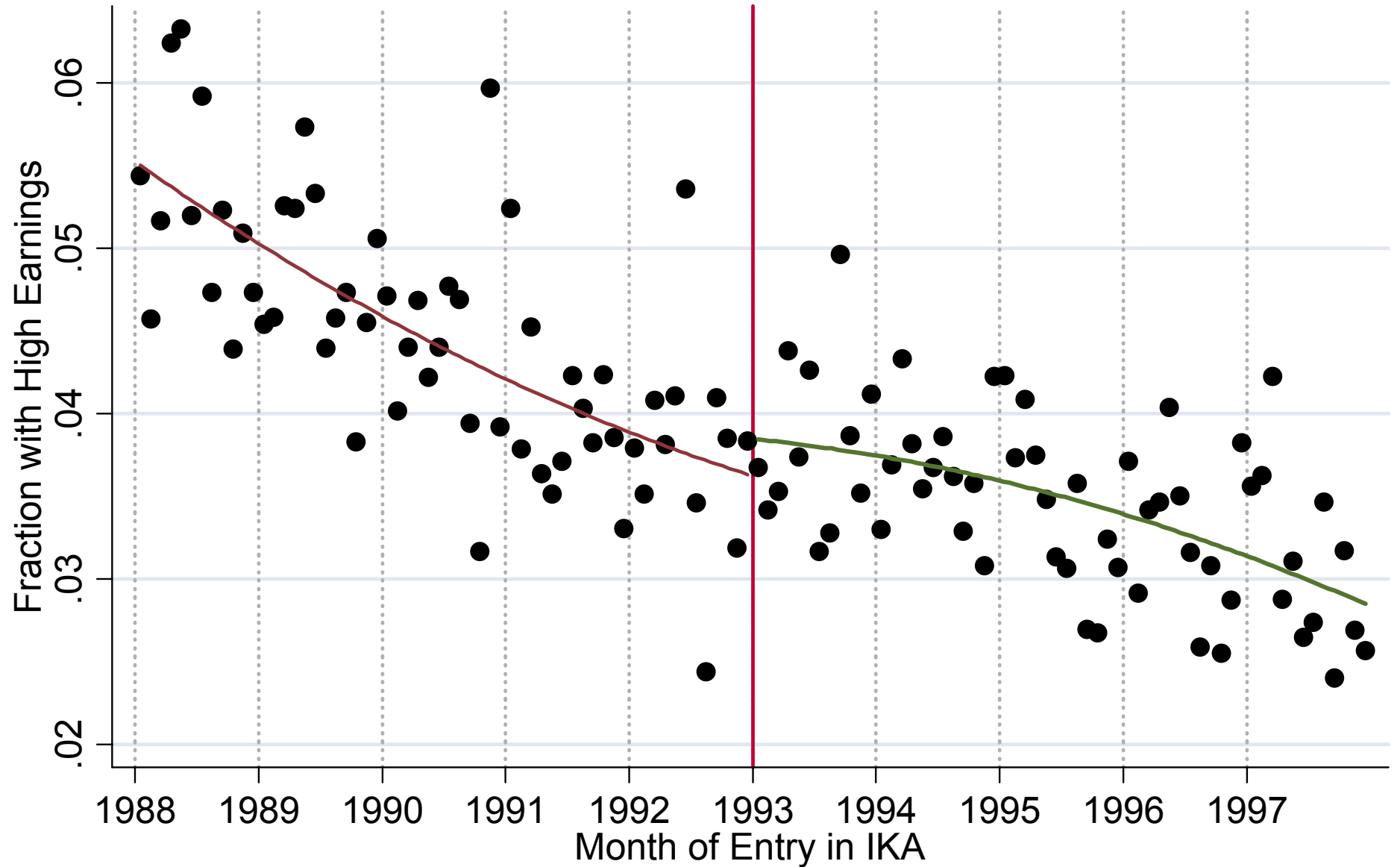
3A. Fraction with Gross Earnings > 3000*(1+.25) Euros

Combines March '04,March '05,March '06,March '07 (with adj.)
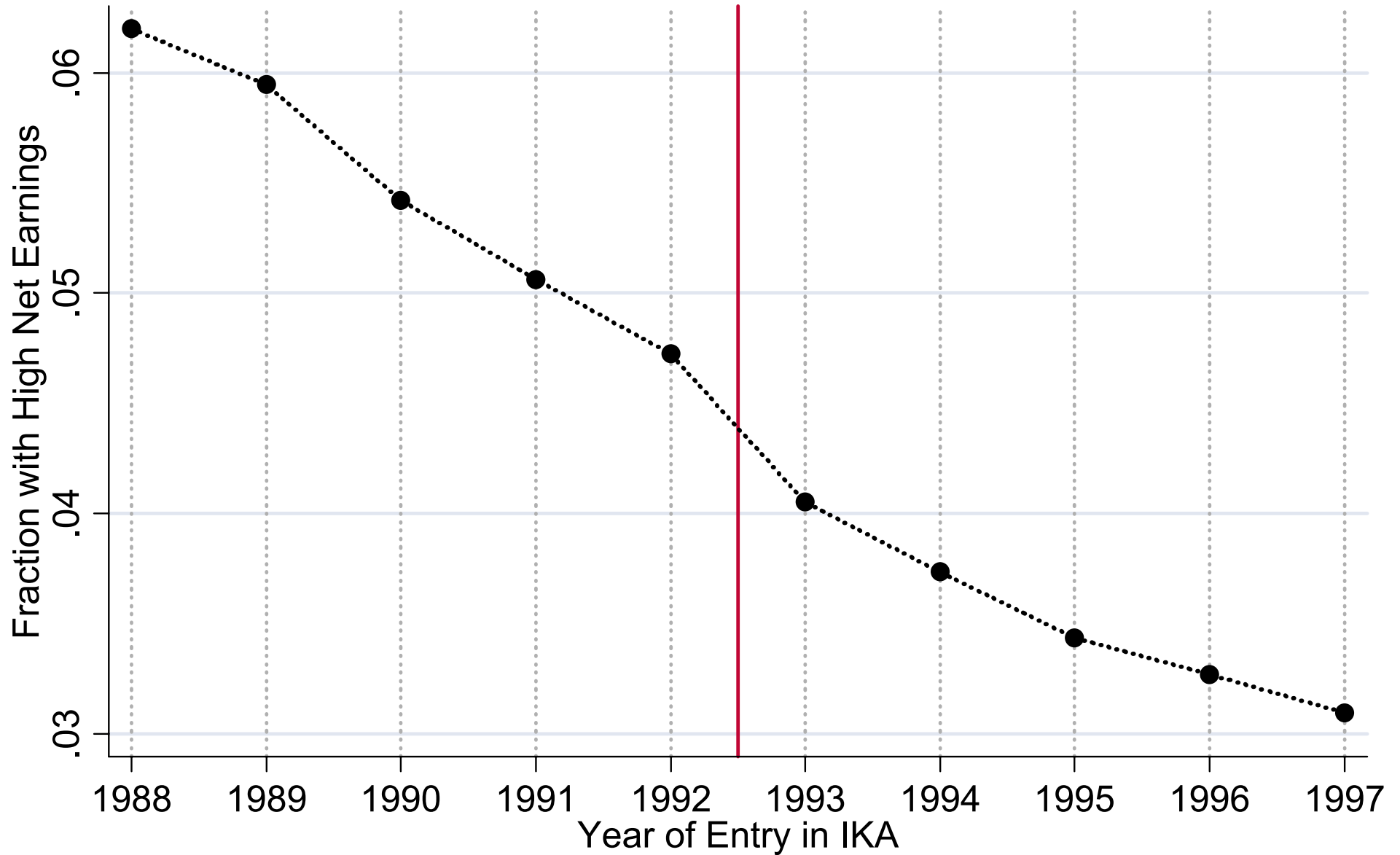
3A. Fraction with Earnings > 3000 Euros

Combines March '04,March '05,March '06,March '07 (with adj.)

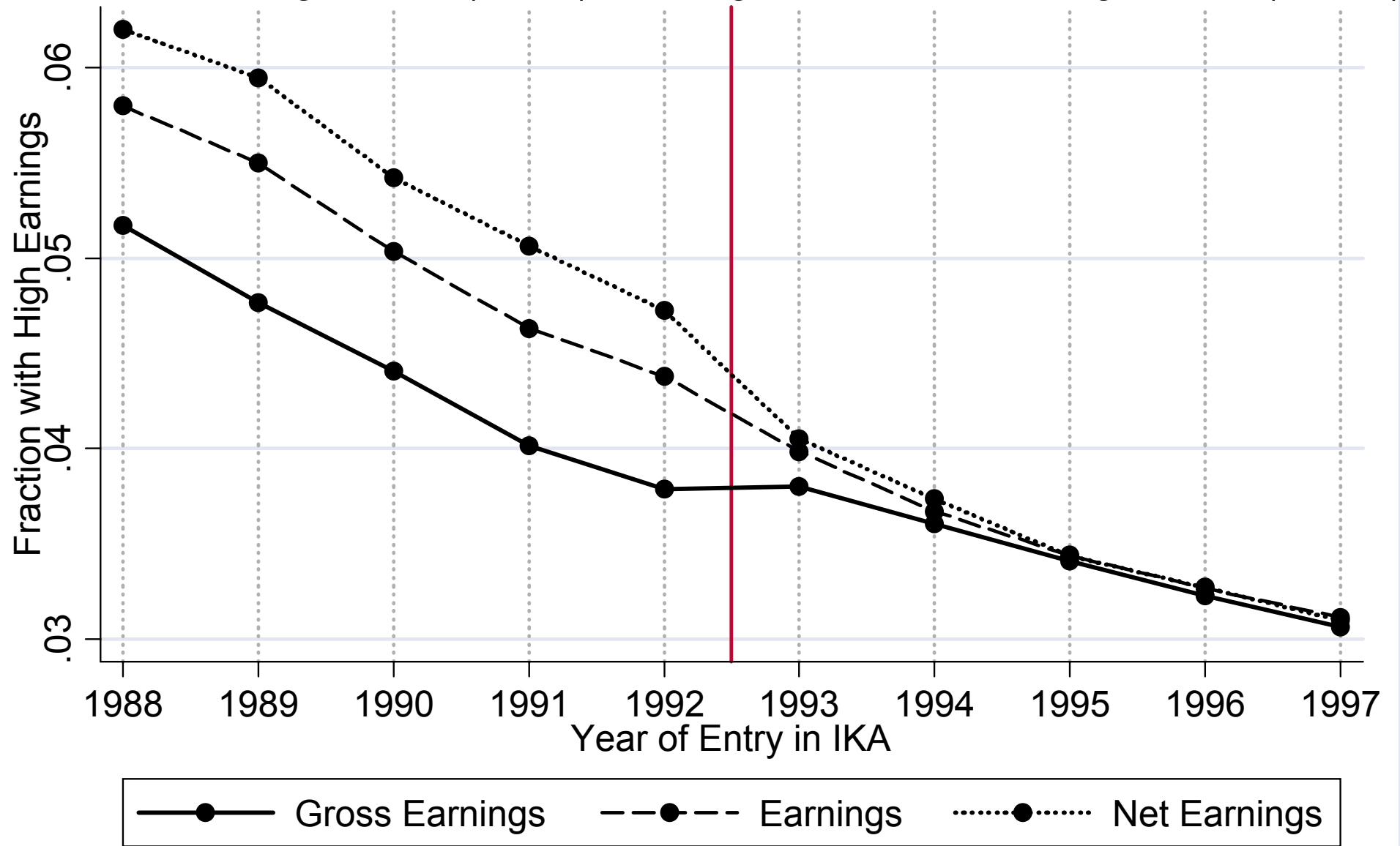3A. Fraction with Net Earnings > 3000*(1-0.14) Euros

Combines March '04, March '05, March '06, March '07 (with adj.)

3A. Fraction with Earnings > 3000 Euros (March '04-'07)

Gross Earnings>3000*(1+.25), Earnings>3000, Net Earnings>3000*(1-0.14)

3A. Placebo: Fraction with Earnings > 2000 Euros

Gross Earnings>2000*(1+.26), Earnings>2000, Net Earnings>2000*(1-0.145

- Gross Earnings
- Earnings
- Net Earnings

Year of Entry in IKA

Fraction with Earnings > 2000 Euros
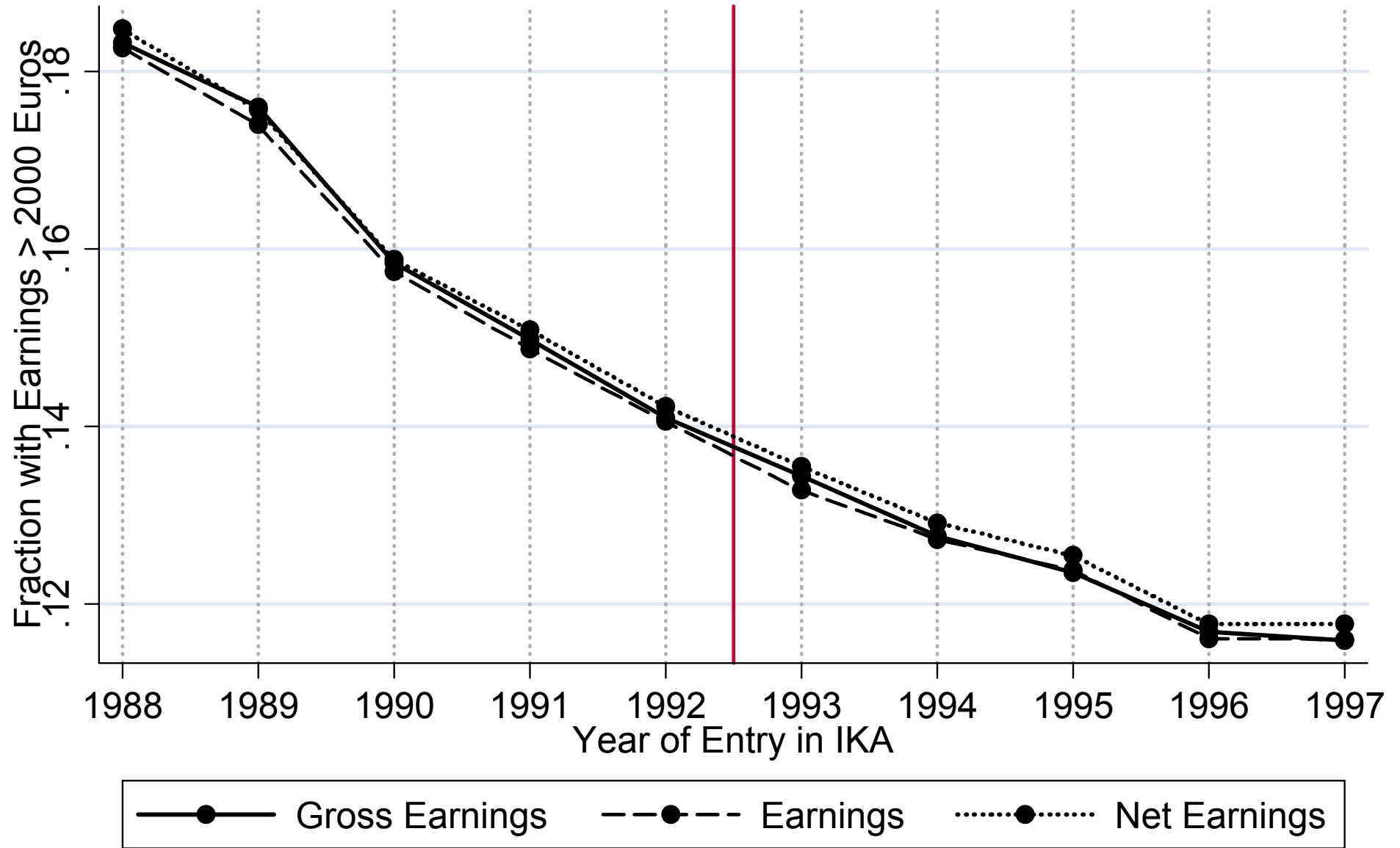
3A. Average Gross Earnings Above Old Cap

Total Earnings, Capped at New Cap
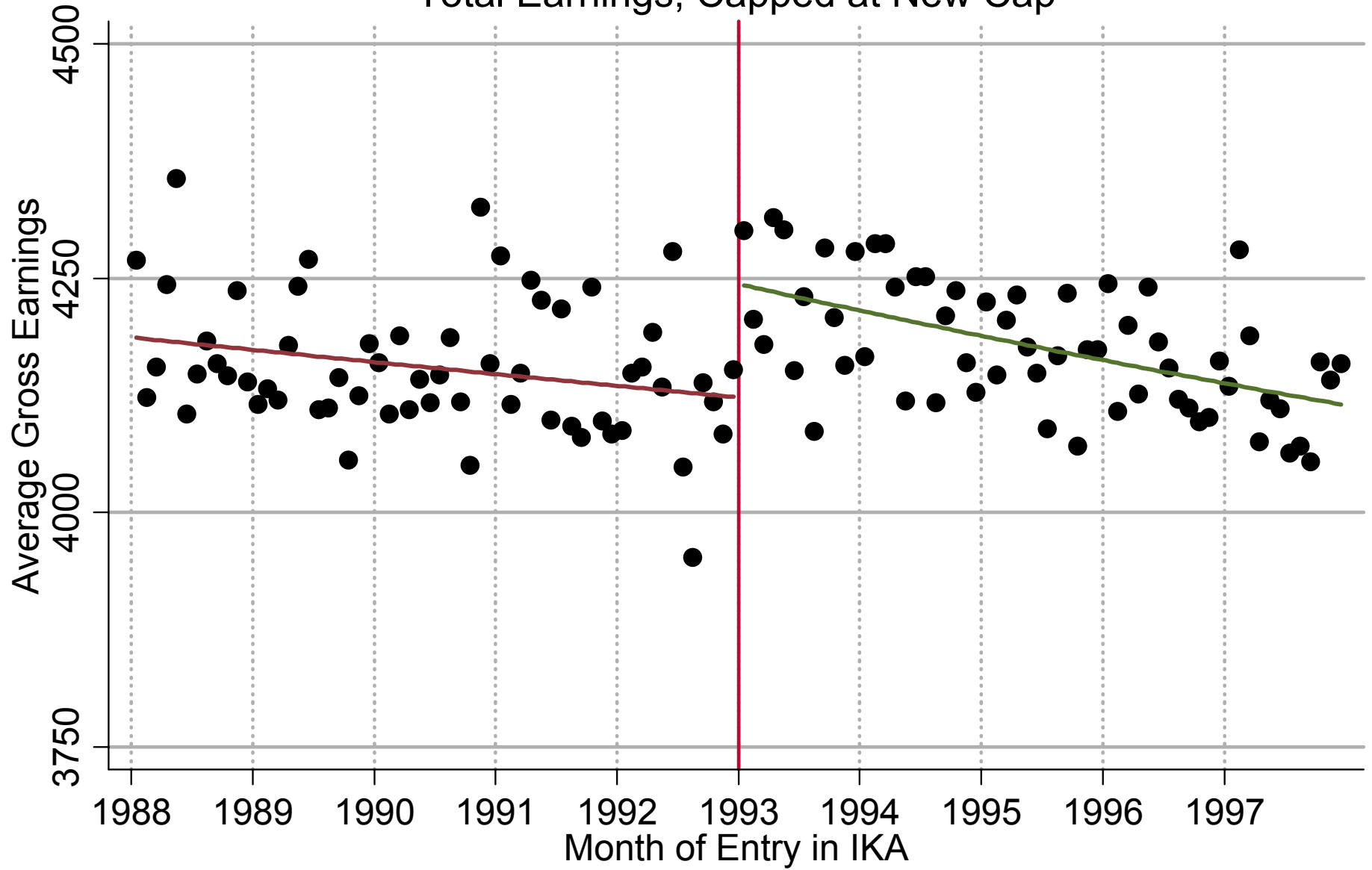
3B. Average Gross Earnings Above Old Cap

Total Earnings, Capped at New Cap, $E(\min(z, z_N)|z > z_O)$

3B. Average Earnings Above Old Cap

Total Earnings, Capped at New Cap, E(min(w,w_N)|w>w_O)
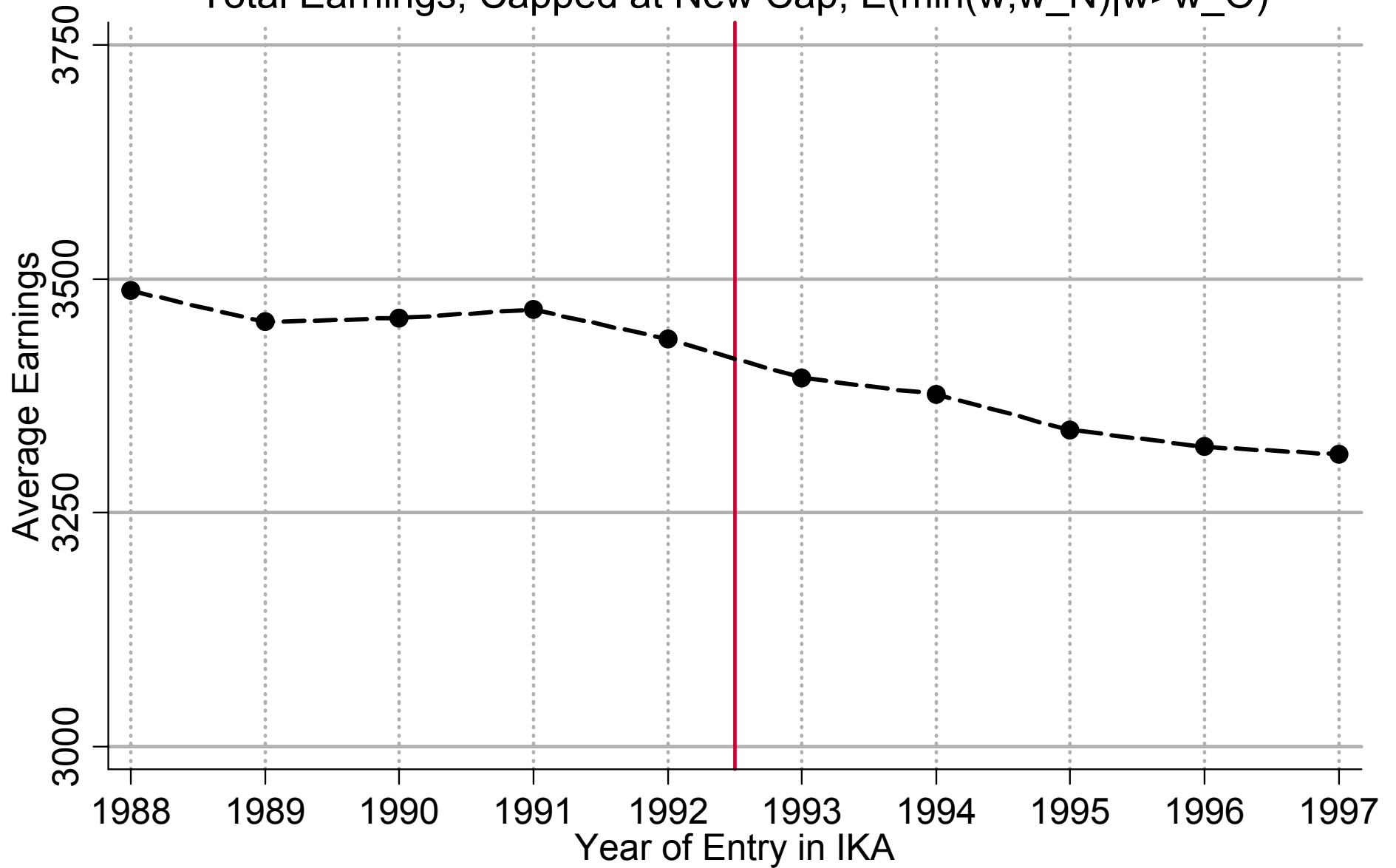
3B. Average Net Earnings Above Old Cap

Total Earnings, Capped at New Cap, $E(\min(c, c_N) \mid c > c_O)$

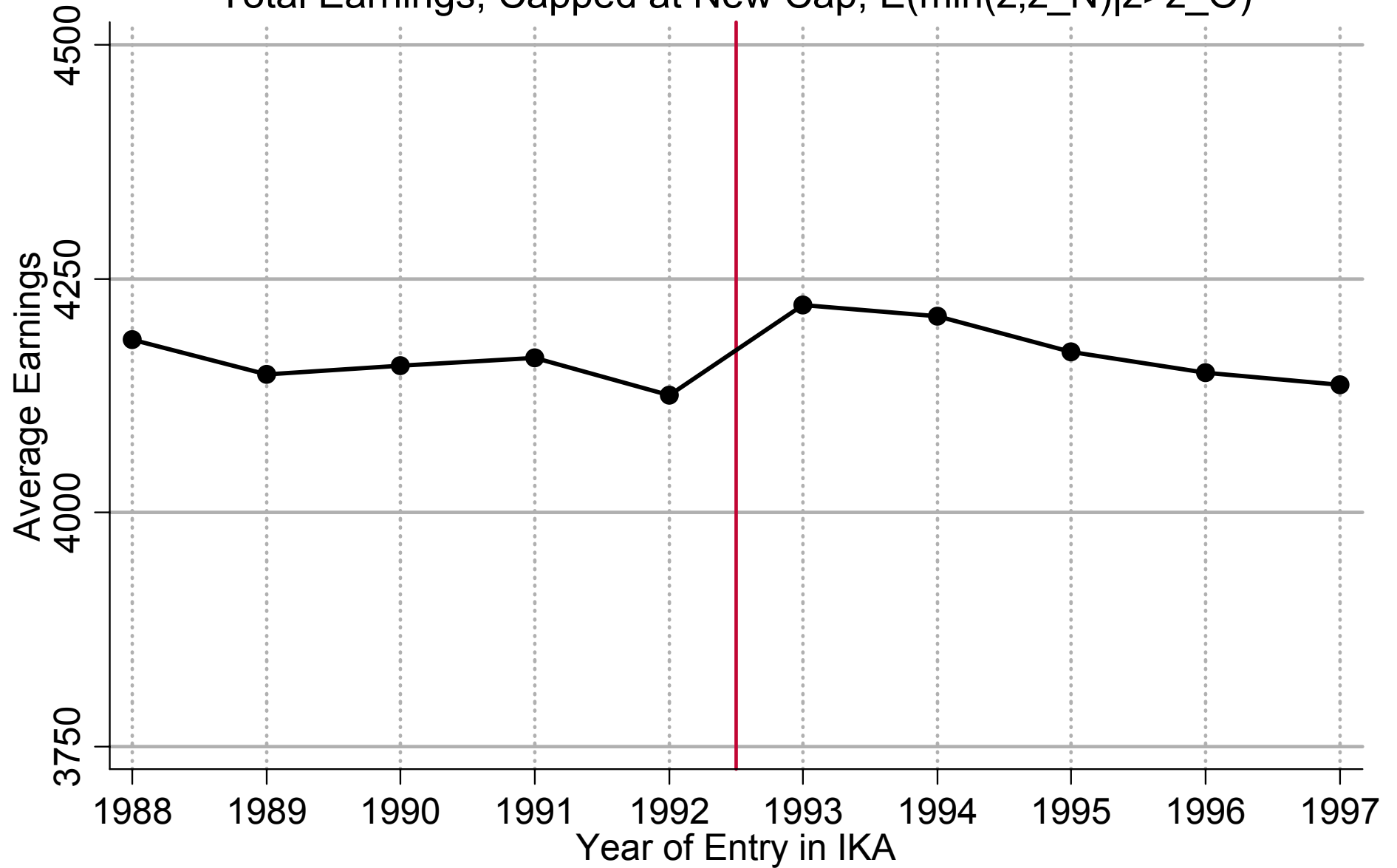## 3B. Average Earnings Above Old Cap
Total Earnings, Capped at New Cap

Y-axis: Average Earnings (2750, 3000, 3250, 3500, 3750, 4000, 4250)

X-axis: Year of Entry in IKA (1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997)

Legend: ●——— Gross Earnings   ●– – – Earnings   ●······· Net Earnings
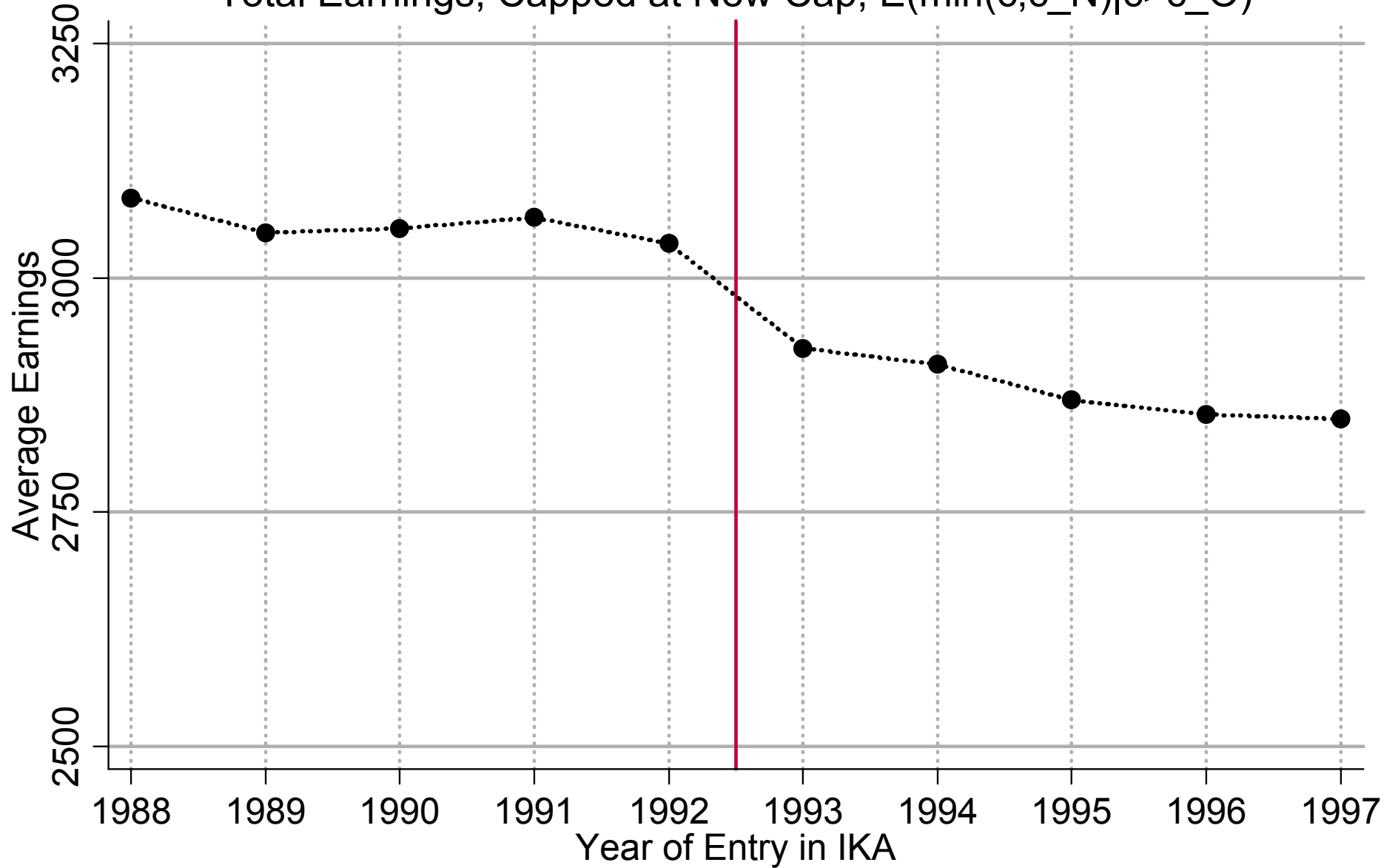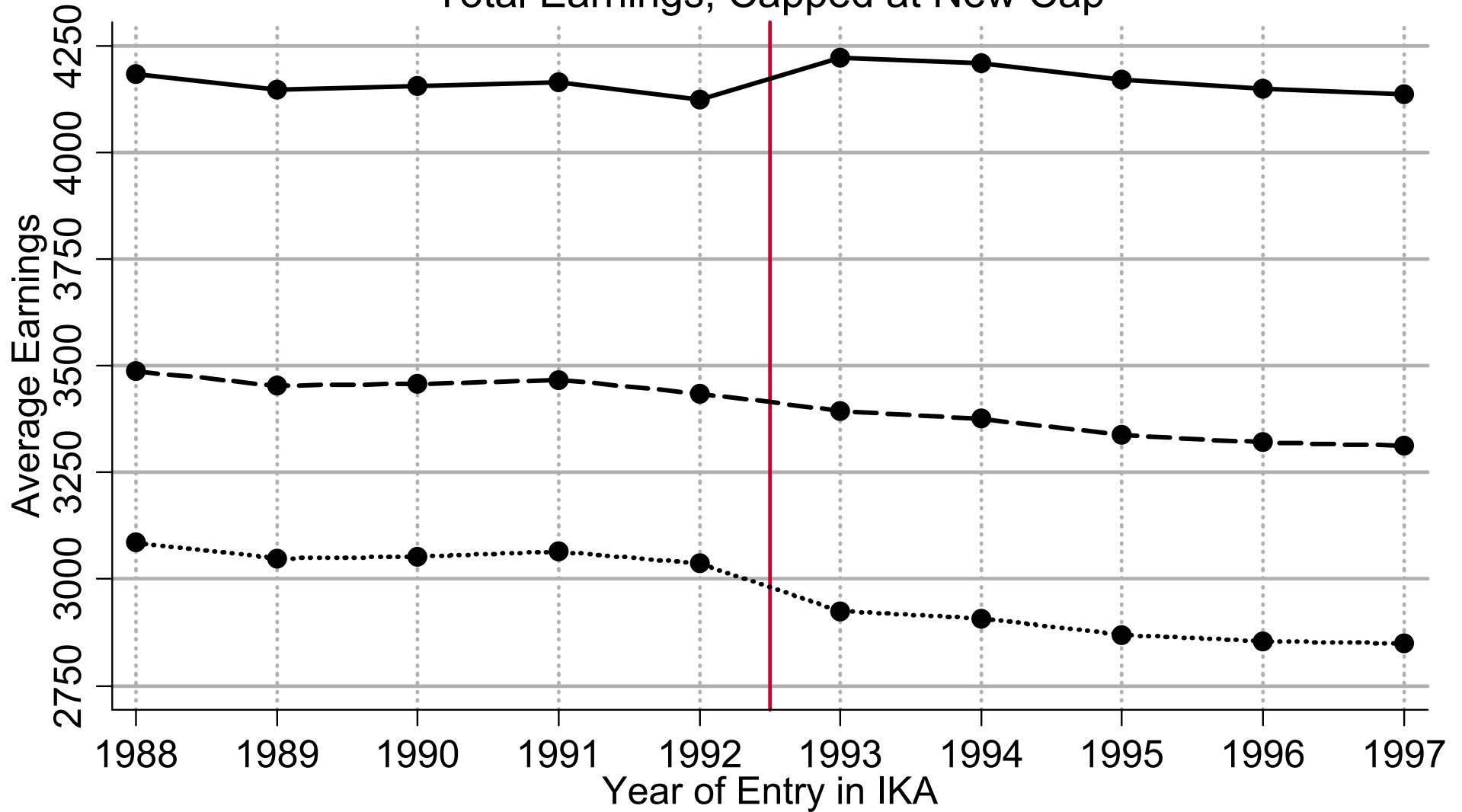
3B. Placebo: Average Earnings Above 1500 Euros

Total Earnings, Capped at Old Cap
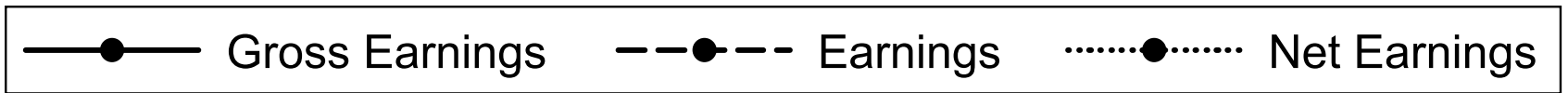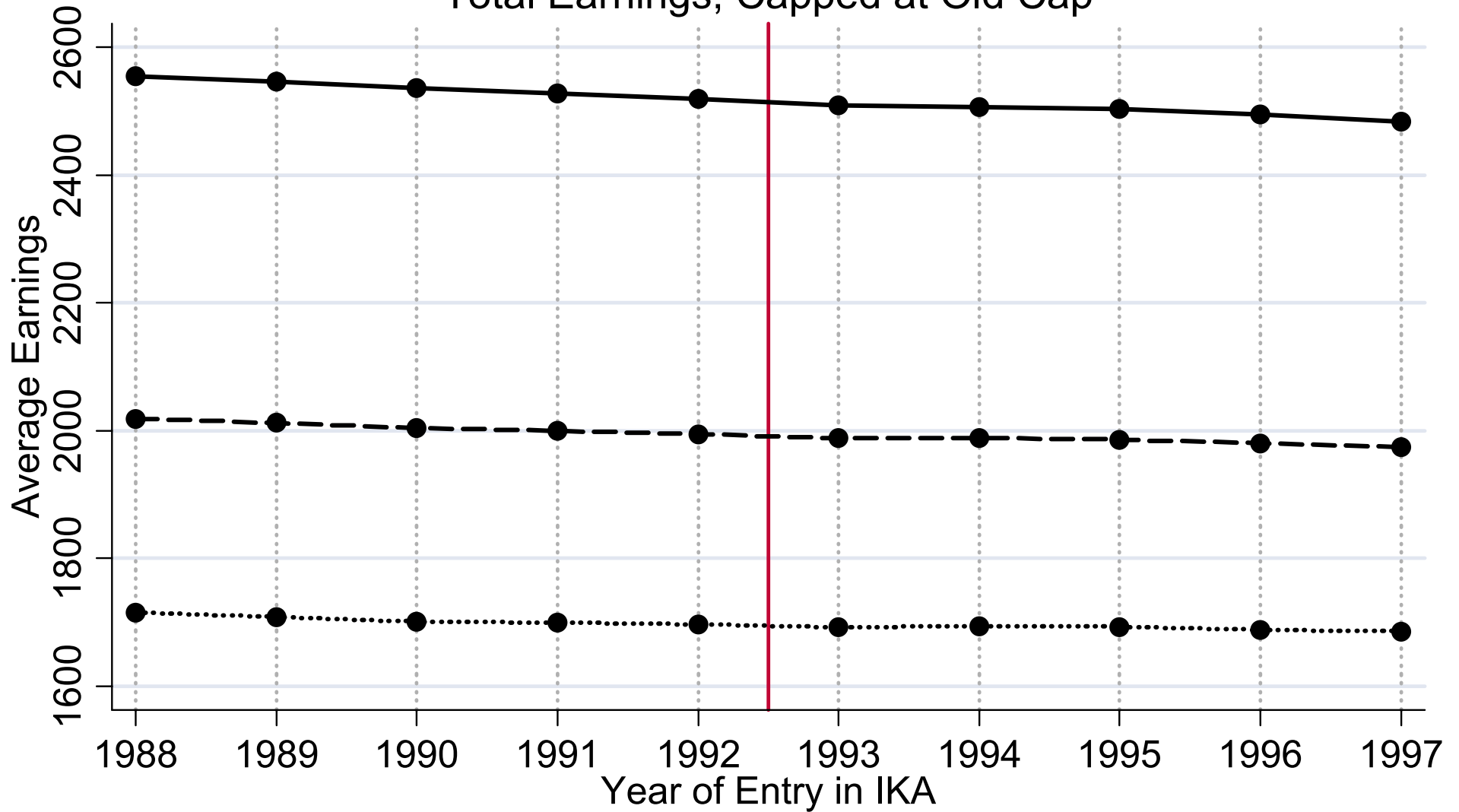
4A. RDD: 2nd Stage Results, Earnings $E(\min(z,z_N) \mid z > z_O)$

Average Monthly Earnings above old cap (capped at new cap)

Gross Earnings z (in Euros)	111	144	104	108	139
	(14)	(23)	(14)	(21)	(29)
Earnings w (in Euros)	-29	2	-35	-25	0
	(11)	(19)	(12)	(17)	(24)
Net Earnings c (in Euros)	-99	-74	-105	-97	-73
	(10)	(17)	(11)	(15)	(21)

RDD Specification

Linear entry date trends	Yes	Yes	Yes	Yes	Yes
Only 1991-1994 entrants		Yes			
Monthly dummies			Yes	Yes	Yes
Quadratic date trends				Yes	Yes
Cubic entry date trends					Yes
# of Observations:	127,396	48,329	127,396	127,396	127,396

Regressions combine March '04, March '05, March '06, March '07

4B. RDD PLACEBO Earnings $E(\min(z, z_O) \mid z > 1500 \cdot (1 + \tau_R))$

Average Monthly Earnings above 1500 (capped at old cap)

Gross Earnings z (in Euros)	1.5	-5.2	0.8	-9.8	-4.1
	(2.6)	(4.2)	(2.6)	(3.9)	(5.4)
Earnings w (in Euros)	2.1	-6.2	1.9	-8.3	-6.6
	(2.0)	(3.3)	(2.1)	(3.1)	(4.3)
Net Earnings c (in Euros)	2.6	-7.8	2.7	-8.4	-9.0
	(1.9)	(3.0)	(1.9)	(2.8)	(3.9)

RDD Specification

|					
Linear entry date trends	Yes	Yes	Yes	Yes	Yes
Only 1991-1994 entrants		Yes			
Monthly dummies			Yes	Yes	Yes
Quadratic date trends				Yes	Yes
Cubic entry date trends					Yes
# of Observations:	357,348	136,985	357,348	357,348	357,348

Regressions combine March '04, March '05, March '06, March '07

5. RDD: Effects on Earnings: Prob(z>z*)

	1988-1997 entrants			1991-1994 entrants only		
	Gross Earn. z	Earnings w	Net Earn. c	Gross Earn. z	Earnings w	Net Earn. c
Earnings	0.494	0.135	-0.134	0.301	-0.079	-0.353
above 3000 Euros (%):	(0.056)	(0.058)	(0.059)	(0.089)	(0.092)	(0.094)
Earnings	0.148	-0.043	-0.208	0.178	0.019	-0.139
above 5000 Euros (%):	(0.028)	(0.031)	(0.033)	(0.045)	(0.051)	(0.053)
[Placebo] Earnings	0.546	0.482	0.500	0.175	0.031	0.068
above 2000 Euros (%):	(0.093)	(0.092)	(0.090)	(0.149)	(0.147)	(0.145)
Regular Earnings	0.220	-0.004	-0.173	0.186	0.002	-0.153
above 3000 Euros (%):	(0.041)	(0.042)	(0.043)	(0.065)	(0.067)	(0.069)
Regular Earnings	0.035	-0.081	-0.173	0.079	-0.031	-0.111
above 5000 Euros (%):	(0.018)	(0.021)	(0.022)	(0.029)	(0.033)	(0.035)
[Placebo] Reg. Earnings	0.167	0.148	0.141	0.072	-0.009	0.006
above 2000 Euros (%):	(0.076)	(0.075)	(0.074)	(0.121)	(0.120)	(0.117)
Number of Observations:	1,781,559	1,781,559	1,781,559	685,415	685,415	685,415

Regressions combine March '04, March '05, March '06, March '07

3D. Gender Effects: Average Reg. Gross Earnings Above Old C
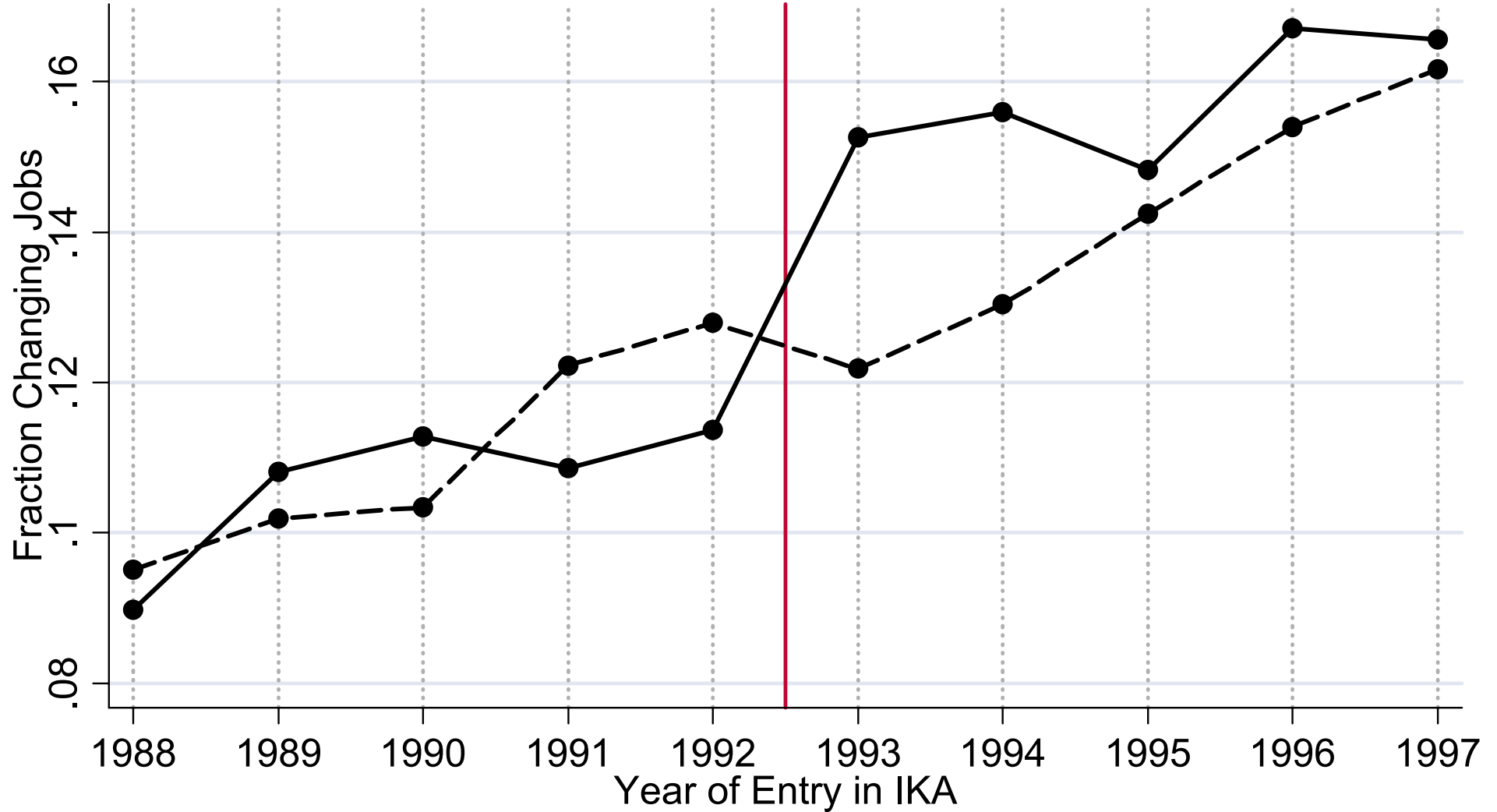
Total Regular Earnings, Capped at New Cap

Male Workers — Female Workers

X-axis: Year of Entry in IKA

Y-axis: Average Gross Earnings
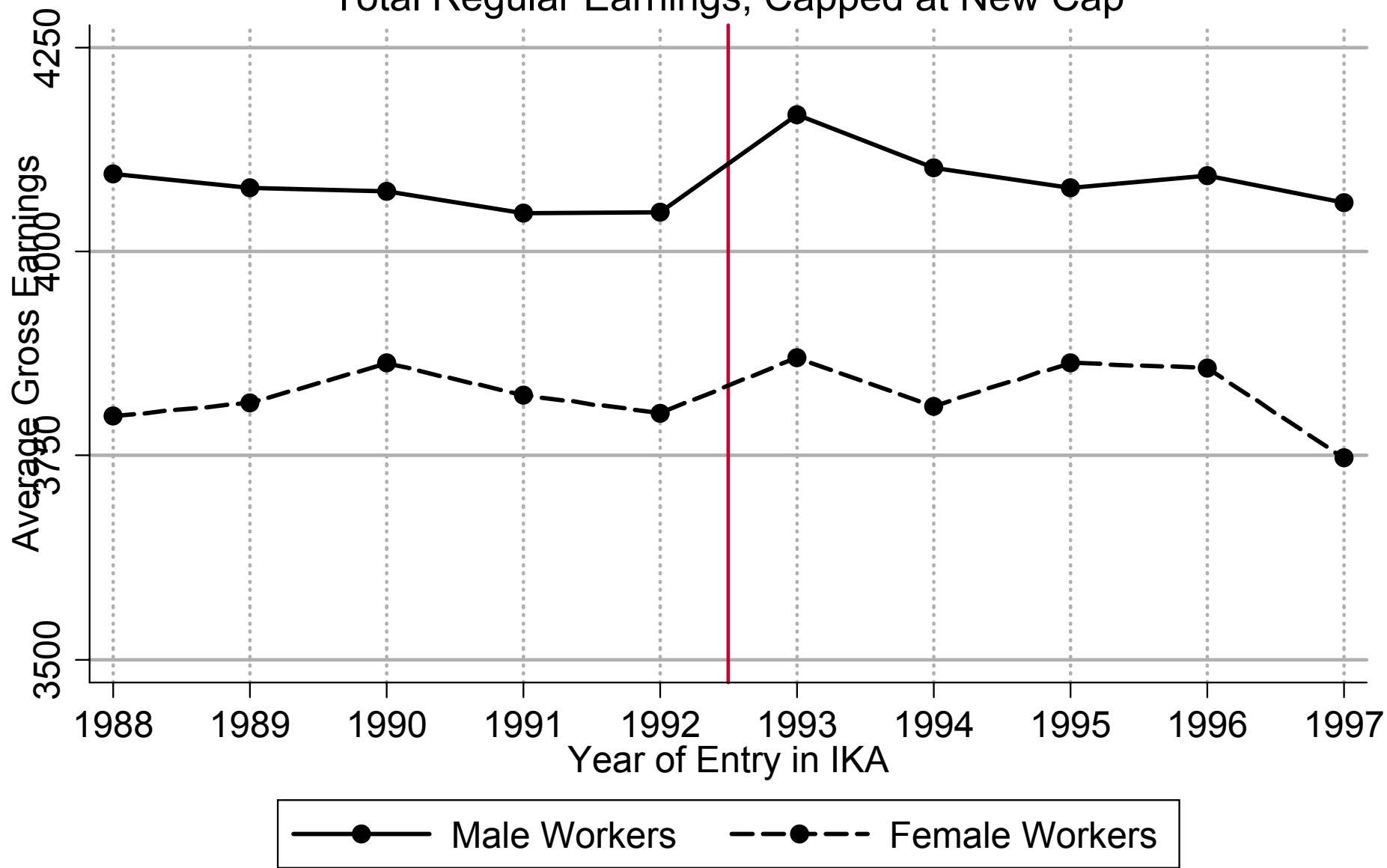
5. RDD $E(\min(z,z_N)|z>z_O)$, Heterogeneity by Groups

	1988-1997 entrants			1991-1994 entrants only		
	Gross Earn. z	Earnings w	Net Earn. c	Gross Earn. z	Earnings w	Net Earn. c
Male Workers	130	-11	-81	177	37	-33
	(21)	(17)	(15)	(34)	(28)	(25)
Female Workers	48	-77	-140	88	-36	-103
	(27)	(23)	(21)	(44)	(38)	(34)
Difference: Male-Female	81	66	59	89	73	70
	(36)	(31)	(27)	(59)	(50)	(44)
Small Firms (<400 workers)	117	-20	-90	122	-2	-66
	(20)	(16)	(14)	(32)	(27)	(23)
Large Firms (>400 workers)	114	-34	-108	169	6	-83
	(19)	(23)	(14)	(31)	(26)	(23)
Difference: Small-Large	-4	-14	-18	48	7	-17
	(28)	(23)	(20)	(45)	(37)	(33)

Regressions combine March '04, March '05, March '06, March '07

3F. Firm Size: Fraction Changing Jobs
Probability of Changing Job the Following Year

Legend:
- Large Firms, High Earners
- Large Firms, Medium Earners

Y-axis: Fraction Changing Jobs (.08, .1, .12, .14, .16)

X-axis: Year of Entry in IKA (1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997)

3.4. INFORMAL SURVEY OF 5 EMPLOYERS

Knowledge and Responses to Tax Regime Diff:

(a) 5/5 know about differential tax regime
(b) 2/5 know/ask prospective recruits about their regime
(c) 0/5 say new regime affects negatively offered salaries or pay raises [consistent with empirical results]

Reasons for offering same salaries w:

(a) Union pressure 0/5
(b) Risk of legal anti-discrimination action 0/5
(c) Fairness/morale concerns 1/5
(d) 3/5 Younger workers are more productive (hence, remain a good deal for employers)

4. IMPLICATIONS AND INTERPRETATION

Gross earnings z not equal to marginal product individual by individual

In Greece, young subsidize the old possibly because of social norms regarding pay seniority

Firms cannot arbitrage because it would require firing the old (legal and workplace morale constraints)

If norms are based on posted salaries w, then differential incidence of employer vs. employee payroll taxes