Enlisting Employees in Improving Payroll-Tax Compliance: Evidence from Mexico

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  - Mexican social security agency (IMSS) supposed to cover all private-sector workers; in fact covers 53%.
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  - Lowest tax revenue/GDP share in the OECD: 15-20% over study period.
- Non-compliance of firms is a key element of general weakness of tax compliance.

Introduction (cont.)

- One well-appreciated dimension of non-compliance: failure to register.
  - Generates a variety of distortions: limited access to credit, limits on employment growth (Gordon and Li, 2009; Levy, 2008).
  - Recent papers have examined effect of policies/interventions to induce formalization (Fajnzylber, Maloney and Montes-Rojas, 2011; Bruhn, 2011; Kaplan, Piedra and Seira, forthcoming; McKenzie and Sakho, 2010; de Mel, McKenzie and Woodruff, 2012)

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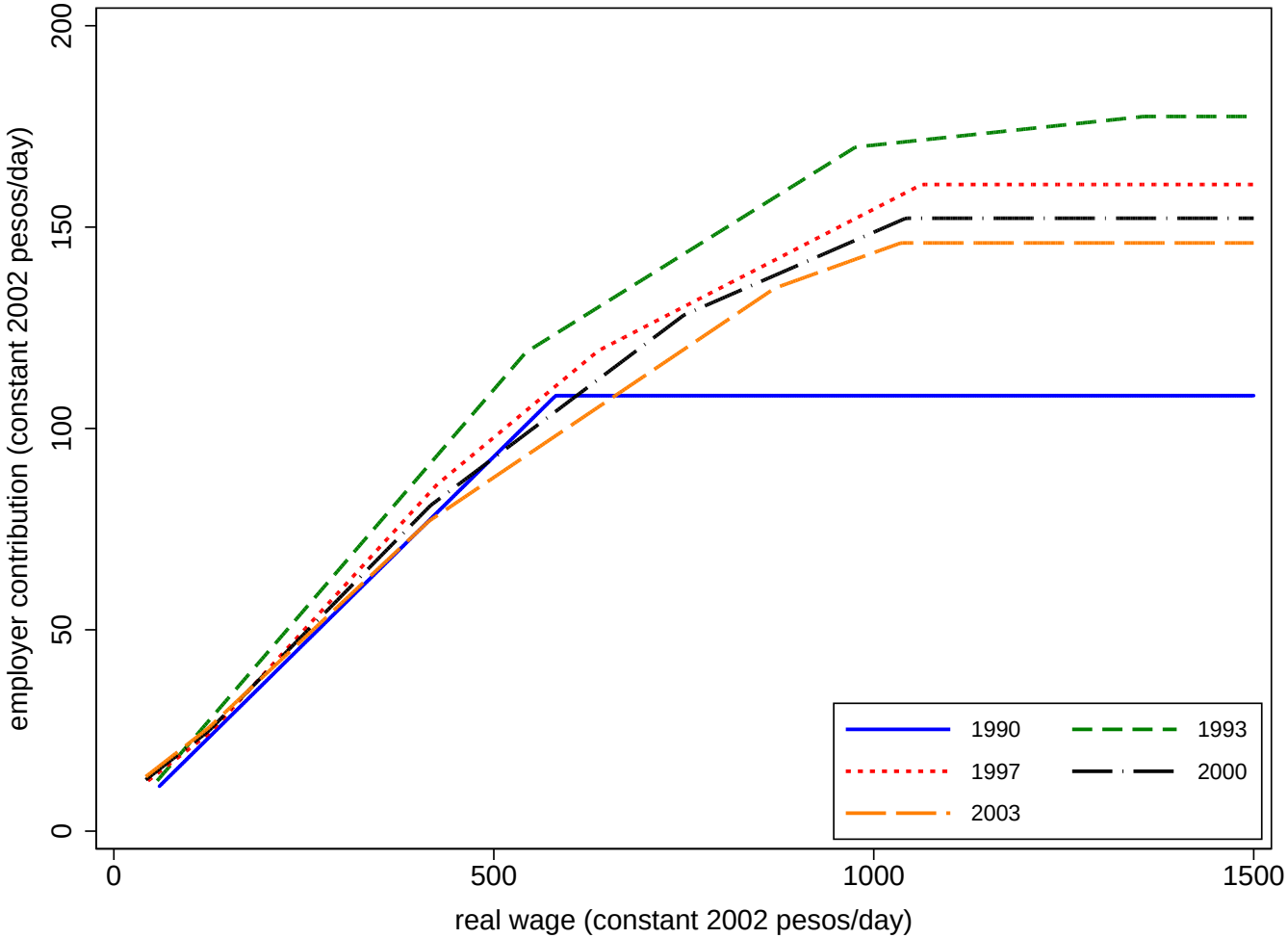
- This paper focuses on an under-appreciated form of non-compliance: under-reporting of wages by registered firms.
  - Arguably more relevant for larger firms, which are unlikely to be completely informal.

Institutional background

- *Instituto Mexicano del Seguro Social* (IMSS) is main source of social insurance for private-sector employees.
  - Public-sector workers, PEMEX workers have separate systems.
- Components:
  - Health care: free to covered employees and their families in IMSS clinics and hospitals.
  - Child care: free for children ages 7 weeks-4 years to mothers and single fathers covered in their jobs.
  - Retirement pension (more below)
  - Disability
  - Worker's compensation
  - Housing fund
- Health care, child care, disability, worker's compensation are available to all covered workers, spouses and dependents, *independent of wage reported*.
- Health care, child care, disability, worker's compensation changed little over study period.

▸ More on housing account ▸ Other dimensions of tax system

Fig. 1: Employer contribution schedule



- Employer contribution: 18-23% of wage, for most workers.

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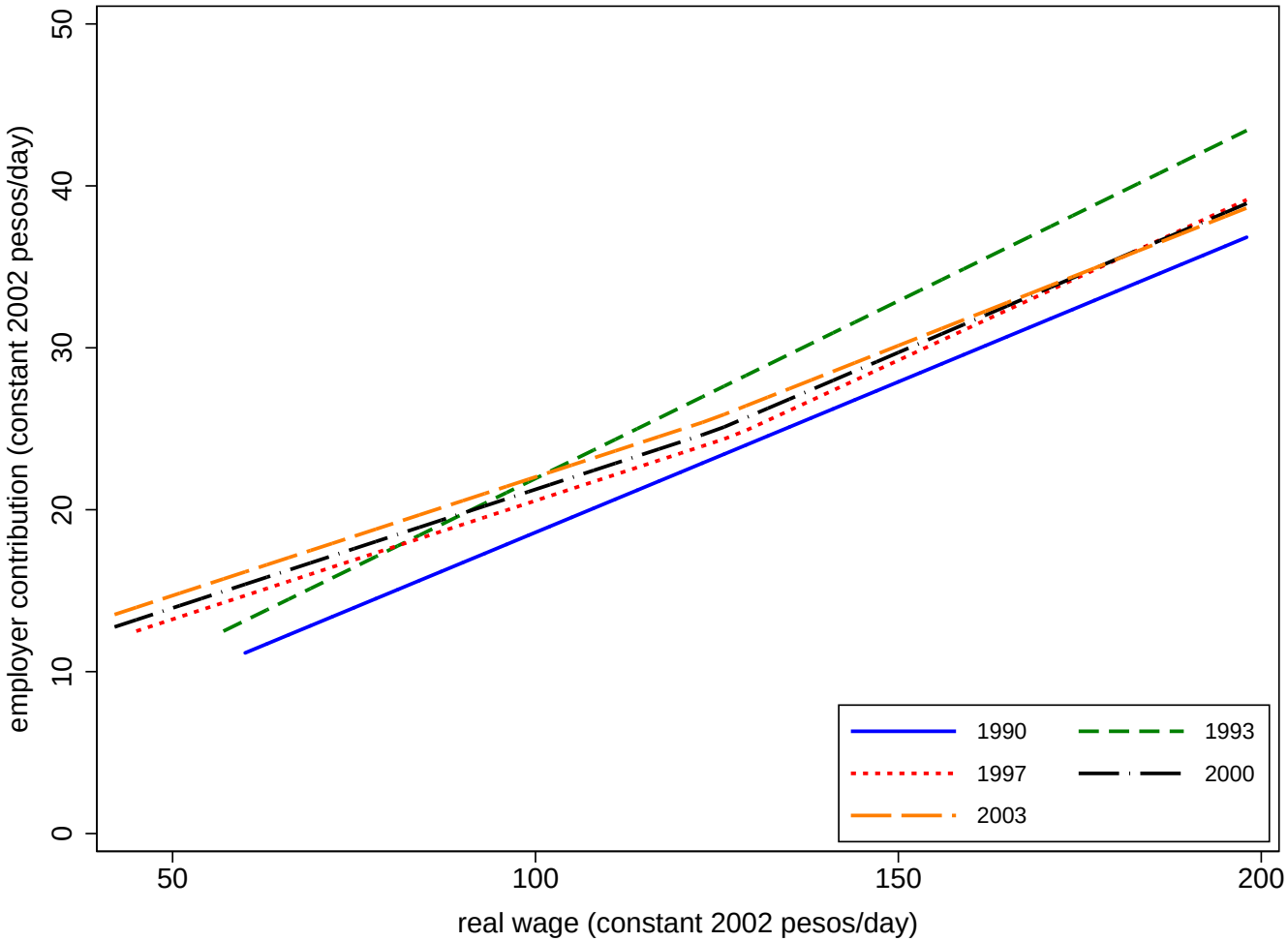

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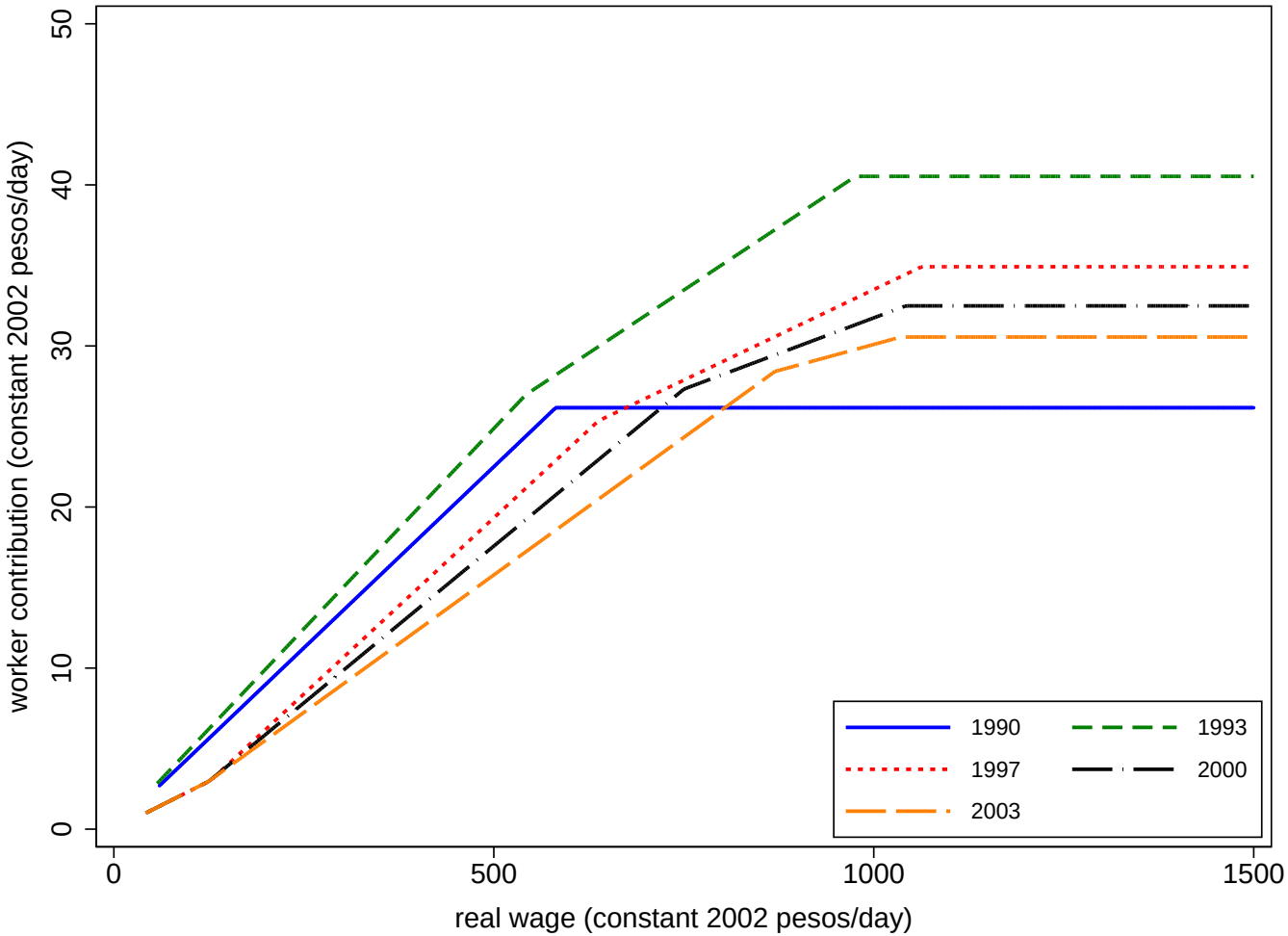
Fig. 2: Employee contribution schedule



- Employee contribution: 2-5% of wage, for most workers.

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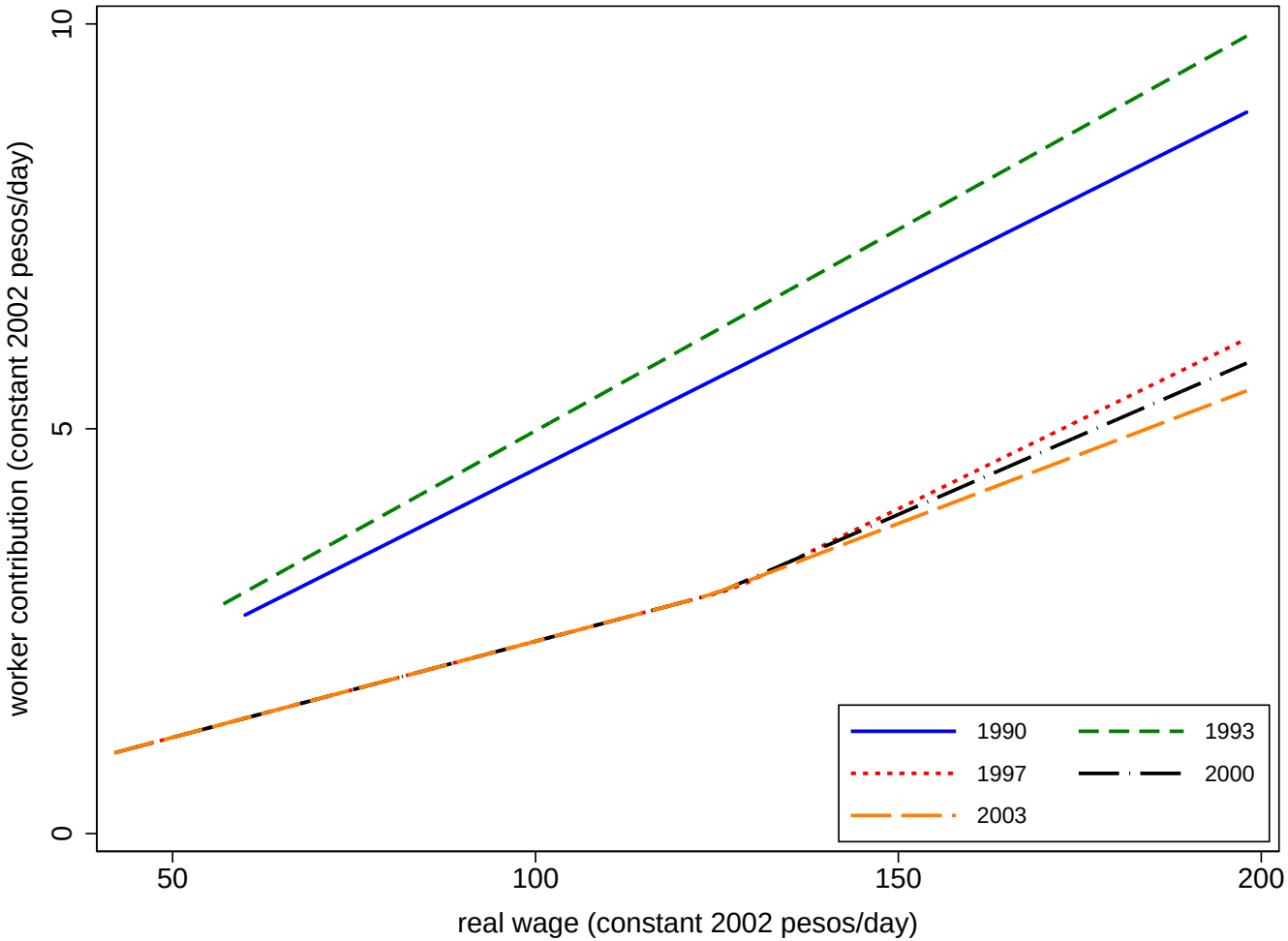

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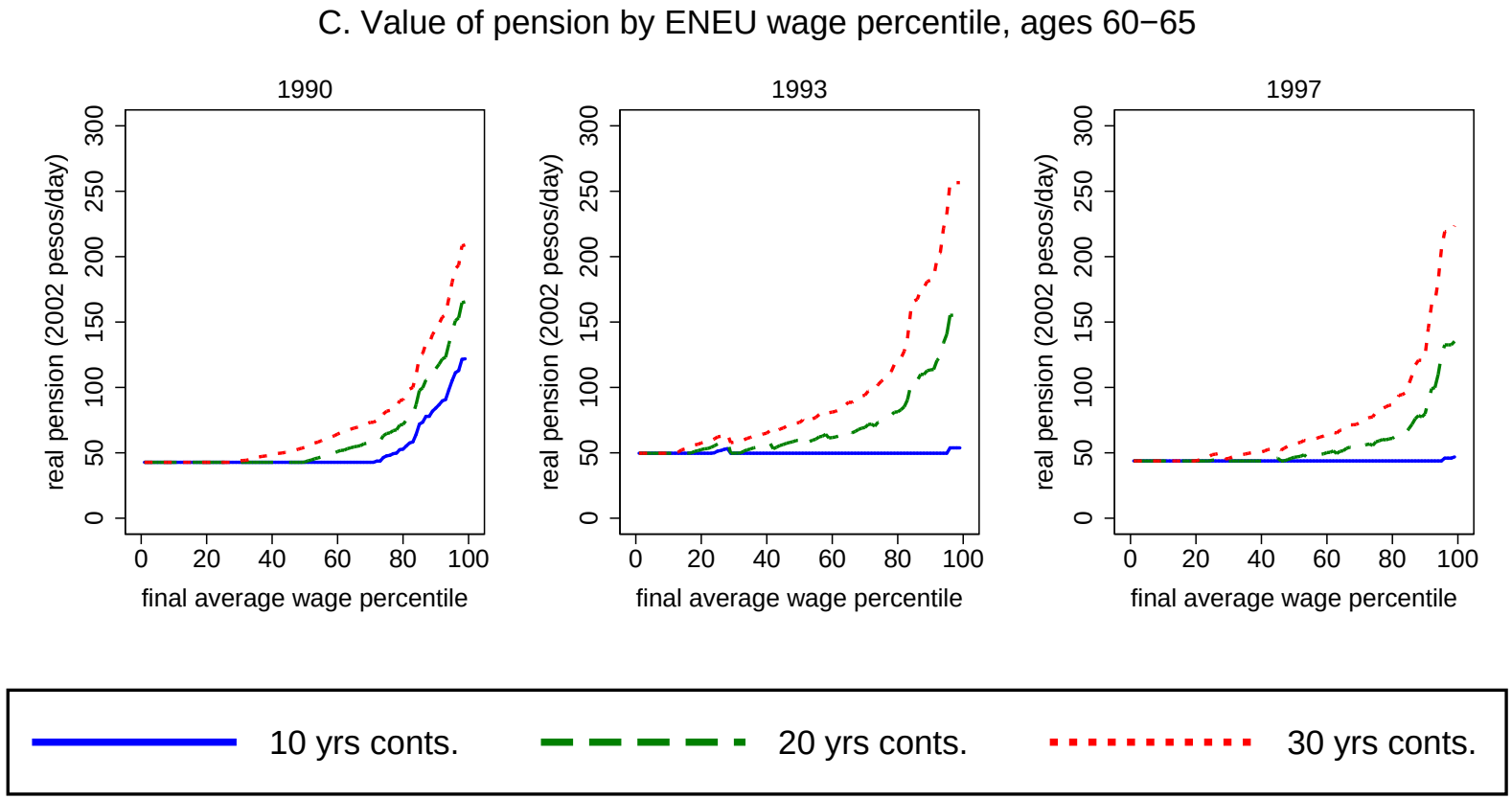
  - Many retirees near minimum 10 years of contributions.
  - Upshot: 80+% of retirees were getting minimum pension prior to 1997 reform.

Fig. 3C: Value of pension, men ages 60-65



- Pension vs. level of final avg. wage
- Pension vs. IMSS wage percentile
- Women

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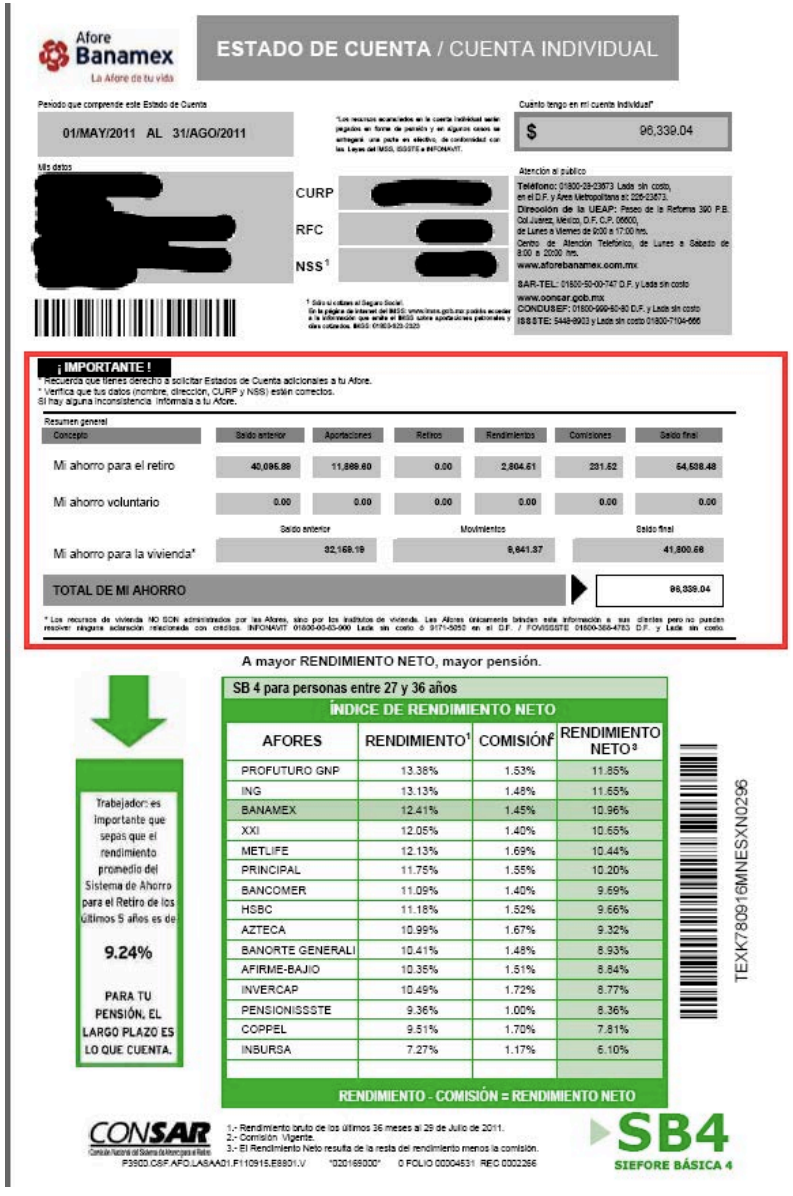
- "Transition generation" (in system June 30, 1997) retained right to choose between pre-reform and post-reform pensions.

Fig. 4: Estado de Cuenta



Afore Banamex
La Afore de tu vida

ESTADO DE CUENTA / CUENTA INDIVIDUAL

Periodo que comprende este Estado de Cuenta
01/MAY/2011 AL 31/AGO/2011

¿Cuánto tengo en mi cuenta individual*
$ 96,339.04

Mis datos
[redacted]
CURP [redacted]
RFC [redacted]
NSS[1] [redacted]

Atención al público
Teléfono: 01800-28-23673 Lada sin costo, en el D.F. y Área Metropolitana al 226-23673.
Dirección de la UEAP: Paseo de la Reforma 390 P.B. Col.Juárez, México, D.F. C.P. 06600, de Lunes a Viernes de 9:00 a 17:00 hrs.
Centro de Atención Telefónica, de Lunes a Sábado de 8:00 a 20:00 hrs.
www.aforebanamex.com.mx
SAR-TEL: 01800-50-00-747 D.F. y Lada sin costo
www.consar.gob.mx
CONDUSEF: 01800-999-80-80 D.F. y Lada sin costo
ISSSTE: 5448-9903 y Lada sin costo 01800-7104-666

¡ IMPORTANTE !
* Recuerda que tienes derecho a solicitar Estados de Cuenta adicionales a tu Afore.
* Verifica que tus datos (nombre, dirección, CURP y NSS) estén correctos.
Si hay alguna inconsistencia infórmala a tu Afore.

Resumen general

Concepto	Saldo anterior	Aportaciones	Retiros	Rendimientos	Comisiones	Saldo final
Mi ahorro para el retiro	40,095.88	11,889.60	0.00	2,804.61	231.62	54,538.48
Mi ahorro voluntario	0.00	0.00	0.00	0.00	0.00	0.00

	Saldo anterior	Movimientos	Saldo final
Mi ahorro para la vivienda*	32,168.19	9,641.37	41,809.56
TOTAL DE MI AHORRO			96,339.04

* Los recursos de vivienda NO SON administrados por las Afores, sino por los institutos de vivienda. Las Afores únicamente brindan esta información a sus clientes pero no pueden resolver ninguna aclaración relacionada con créditos. INFONAVIT: 01800-00-63-000 Lada sin costo ó 9171-5050 en el D.F. / FOVISSSTE 01800-366-4783 D.F. y Lada sin costo.

A mayor RENDIMIENTO NETO, mayor pensión.

Trabajador: es importante que sepas que el rendimiento promedio del Sistema de Ahorro para el Retiro de los últimos 5 años es de:
9.24%
PARA TU PENSIÓN, EL LARGO PLAZO ES LO QUE CUENTA.

SB 4 para personas entre 27 y 36 años
ÍNDICE DE RENDIMIENTO NETO

AFORES	RENDIMIENTO[1]	COMISIÓN[2]	RENDIMIENTO NETO[3]
PROFUTURO GNP	13.36%	1.53%	11.85%
ING	13.13%	1.48%	11.65%
BANAMEX	12.41%	1.45%	10.96%
XXI	12.05%	1.40%	10.65%
METLIFE	12.13%	1.69%	10.44%
PRINCIPAL	11.75%	1.55%	10.20%
BANCOMER	11.09%	1.40%	9.69%
HSBC	11.18%	1.52%	9.66%
AZTECA	10.99%	1.67%	9.32%
BANORTE GENERALI	10.41%	1.48%	8.93%
AFIRME-BAJIO	10.35%	1.51%	8.84%
INVERCAP	10.49%	1.72%	8.77%
PENSIONISSSTE	9.36%	1.00%	8.36%
COPPEL	9.51%	1.70%	7.81%
INBURSA	7.27%	1.17%	6.10%

RENDIMIENTO - COMISIÓN = RENDIMIENTO NETO

CONSAR
1.- Rendimiento bruto de los últimos 36 meses al 29 de Julio de 2011.
2.- Comisión Vigente.
3.- El Rendimiento Neto resulta de la resta del rendimiento menos la comisión.

SB4
SIEFORE BÁSICA 4

P3903.CSF.AFO.LASAA01.F110915.E8801.V "020169000" 0 FOLIO 00004531 REC 0002266

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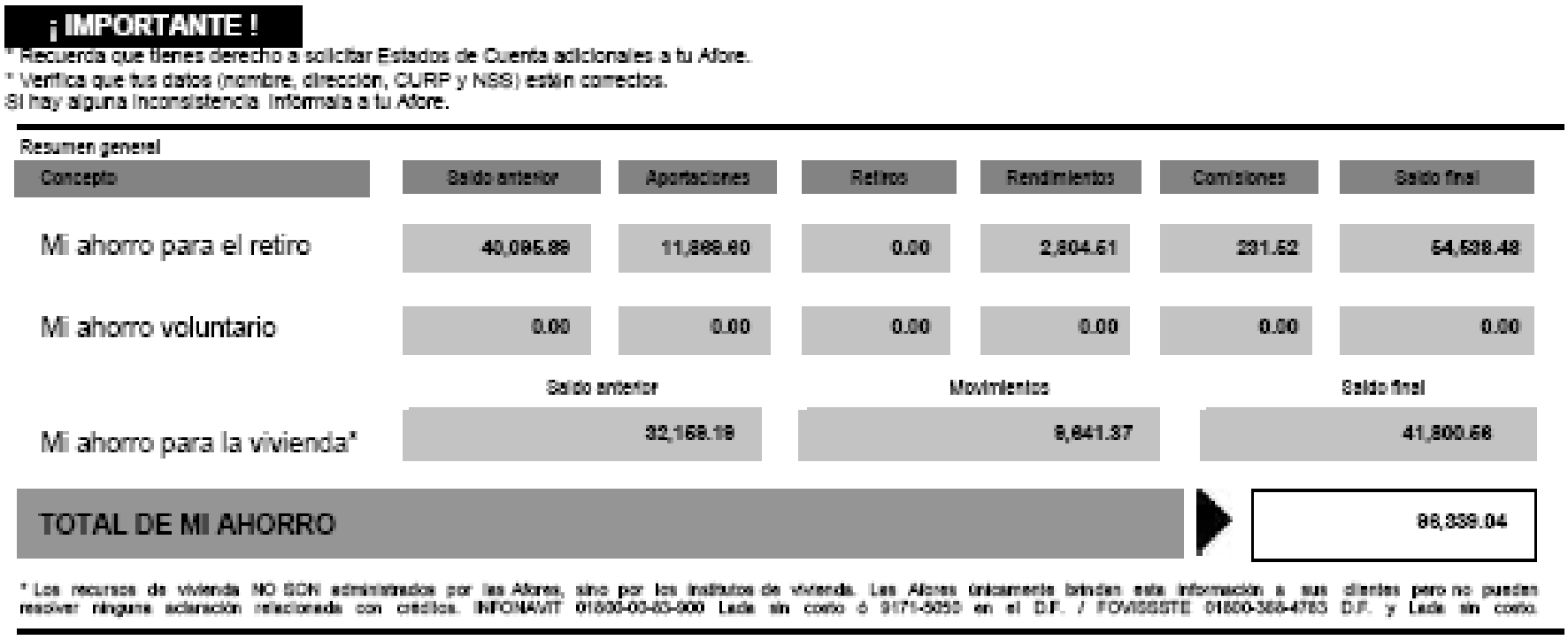

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Table 1: Pension wealth simulation, by age in 1997

Age in 1997	Years of Expected PRA Contributions	Plan	Real Daily Wage 43	100	200	300	500	1079
25	35	PRA	398.6	*815.0*	*1626.2*	*2437.3*	*4059.7*	*8751.9*
		PAYGO	398.6	*398.6*	*603.8*	*890.2*	*1483.6*	*3200.1*
30	30	PRA	398.6	*523.4*	*1044.3*	*1565.3*	*2607.1*	*5620.5*
		PAYGO	398.6	*398.6*	*603.8*	*890.2*	*1483.6*	*3200.1*
35	25	PRA	398.6	398.6	*659.1*	*987.8*	*1645.3*	*3546.9*
		PAYGO	398.6	398.6	*603.8*	*890.2*	*1483.6*	*3200.1*
40	20	PRA	398.6	398.6	403.9	605.4	1008.4	2173.9
		PAYGO	398.6	398.6	603.8	890.2	1483.6	3200.1
45	15	PRA	398.6	398.6	398.6	398.6	586.6	1264.7
		PAYGO	398.6	398.6	603.8	890.2	1483.6	3200.1
50	10	PRA	398.6	398.6	398.6	398.6	398.6	662.6
		PAYGO	398.6	398.6	603.8	890.2	1483.6	3200.1
55	5	PRA	398.6	398.6	398.6	398.6	398.6	398.6
		PAYGO	398.6	398.6	603.8	890.2	1483.6	3200.1

Notes: Values are real present discounted value of the future stream of pension benefits in thousands of 2002 pesos, for a male worker who began contributing at age 25 and expects to continue until age 60.

▸ New workers

Data

- IMSS administrative records:
  - Full set of employers' reports of employees' wages, 1985-2005.
  - Variables: age, sex, daily wage, state and year of first registration with IMSS, employer id (location, industry)
  - Wages reported as spells; we draw for June 30.
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- *Encuesta Nacional de Empleo Urbano* (ENEU)
  - CPS-like household survey, households surveyed quarterly for 5 quarters.
  - Began in 1987, some weirdness in first year.
  - Initial sample from 16 cities, expanded over time.
  - Questionnaire modified in 1994.
  - More extensive re-design in 2003.
  - Asks if workers receive IMSS coverage.
  - Contract type available 1994 on.

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  - Ages: 16-65
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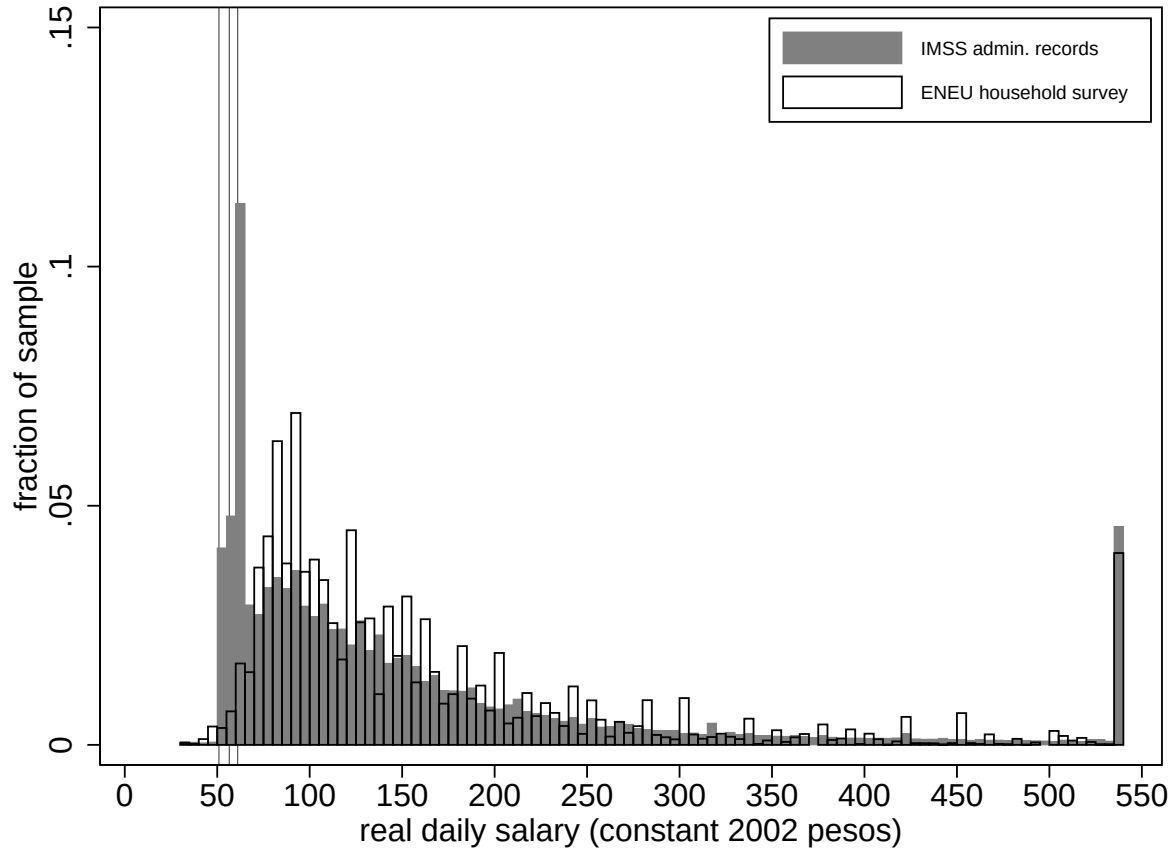
  - Summary: cross-sectional results for women similar to those for men. D-in-D noisier, no clear pattern.

Table 2: Comparison of IMSS and ENEU, men

	IMSS baseline sample (1)	full ENEU sample (2)	ENEU w/ IMSS (3)	ENEU w/o IMSS (4)	ENEU permanent w/ IMSS (5)	ENEU full-time w/ IMSS (6)
A. 1990						
real avg. daily post-tax wage	121.02	163.88	172.98	143.88		166.73
	(0.07)	(1.58)	(1.94)	(2.62)		(1.85)
age	31.75	31.46	32.13	29.98		32.22
	(0.01)	(0.15)	(0.17)	(0.29)		(0.17)
fraction employed in ests >100 employees	0.52	0.43	0.55	0.18		0.55
	(0.00)	(0.01)	(0.01)	(0.01)		(0.01)
N (raw observations)	1691417	16169	11592	4577		10978
N (population, using weights)	1691417	2578847	1772523	806324		1645229
B. 2000						
real avg. daily post-tax wage	123.60	148.20	161.15	120.78	166.42	155.80
	(0.07)	(1.31)	(1.60)	(2.16)	(1.80)	(1.59)
age	32.70	32.22	32.82	30.94	33.22	32.88
	(0.01)	(0.14)	(0.16)	(0.28)	(0.17)	(0.16)
fraction employed in ests >100 employees	0.58	0.44	0.59	0.10	0.63	0.59
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
N (raw observations)	2420307	19171	14063	5108	11918	13246
N (population, using weights)	2420307	3509828	2384267	1125561	2042988	2225318

▸ Women

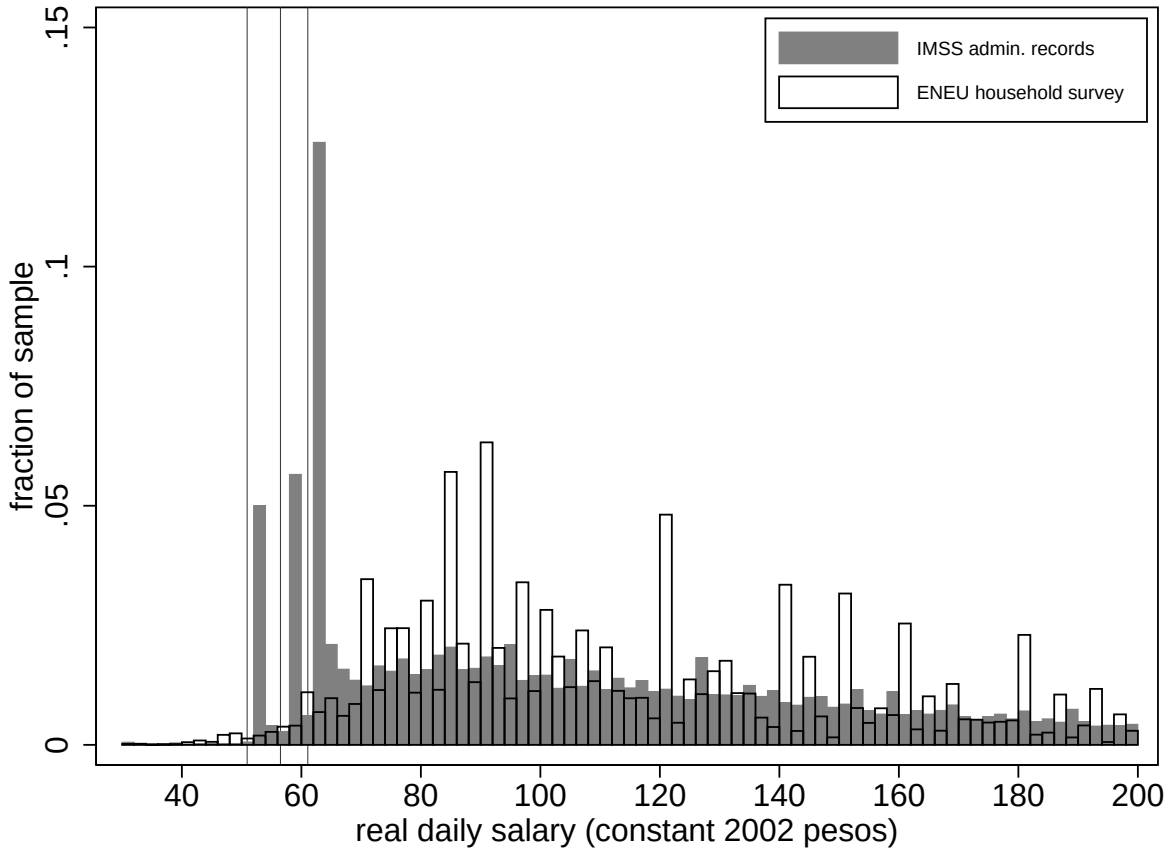
Fig. 6: Wage histograms, men, 1990



Notes: Bins are 5 pesos wide. Average 2002 exchange rate: 9.66 pesos/dollar. Vertical lines represent the three region-specific minimum wages. IMSS reported wage is pre-tax.

▸ Women

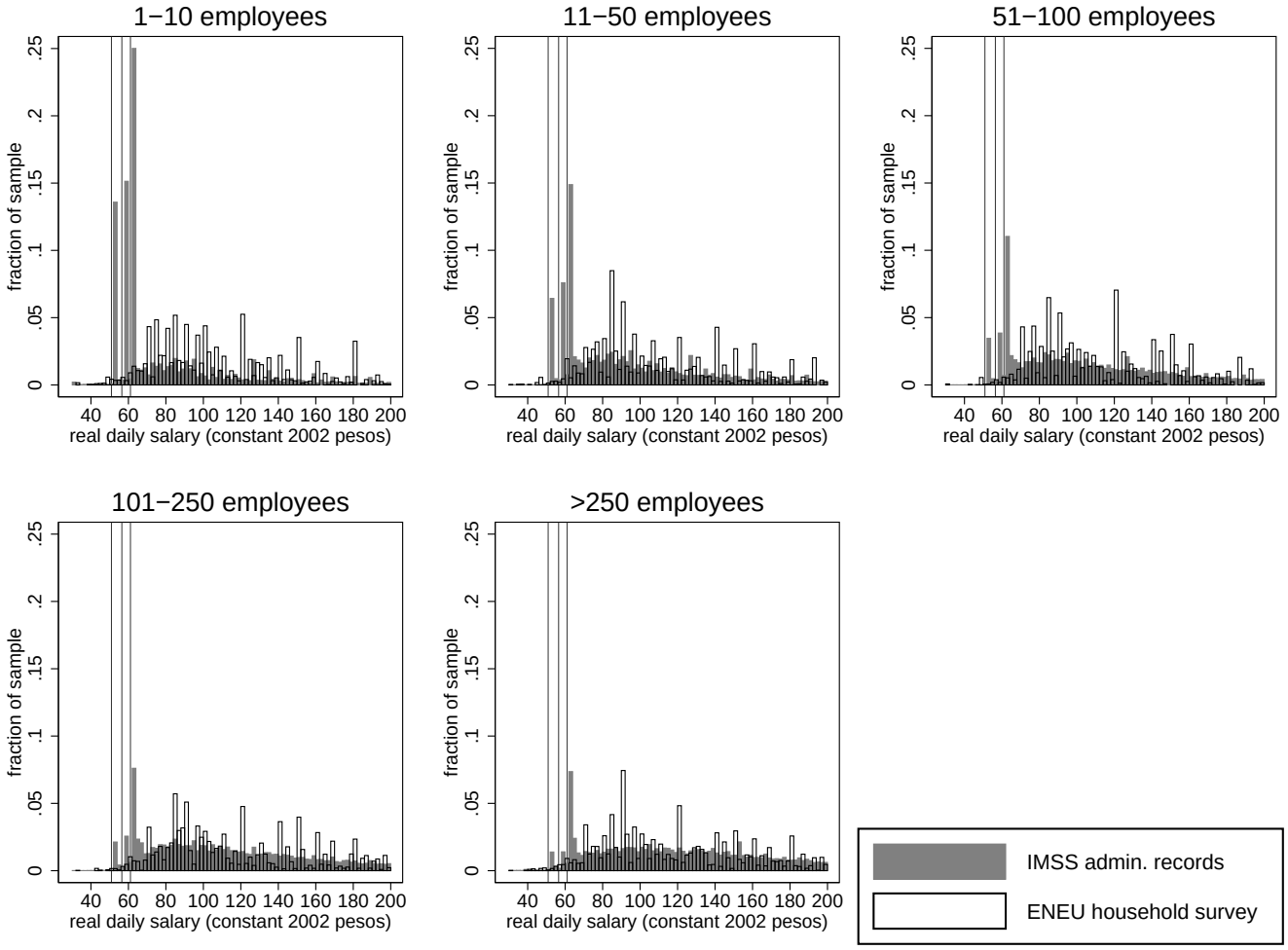
Fig. 7: Wage histograms, men, 1990, low wages



Notes: Bins are 2 pesos wide. Average 2002 exchange rate: 9.66 pesos/dollar. Vertical lines represent the three region-specific minimum wages. IMSS reported wage is pre-tax.

▸ Women

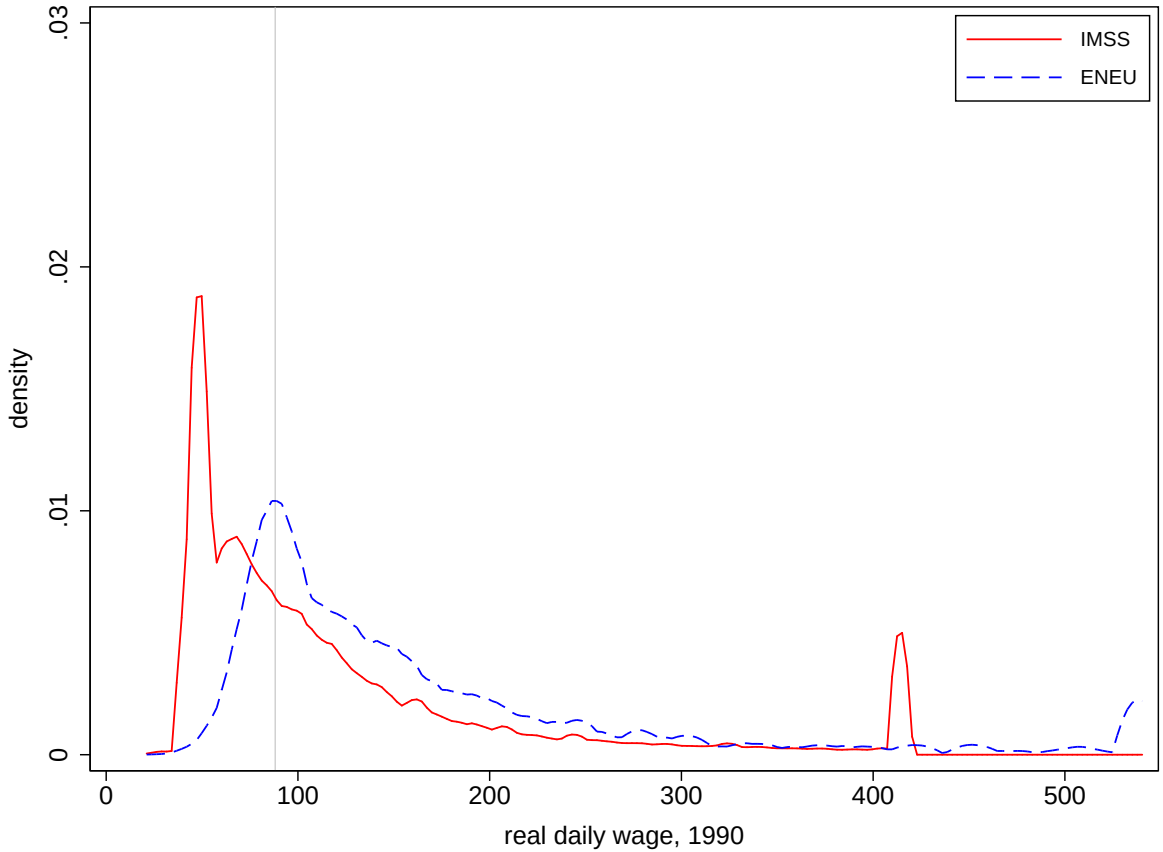
Fig. 8: Wage histograms, men, 1990, by firm size



Notes: Bins are 2 pesos wide. Average 2002 exchange rate: 9.66 pesos/dollar. IMSS reported wage is pre-tax.

▸ Women ▸ Non-EIA plants ▸ Other years ▸ Size histograms

Fig. 9: Excess mass calculation



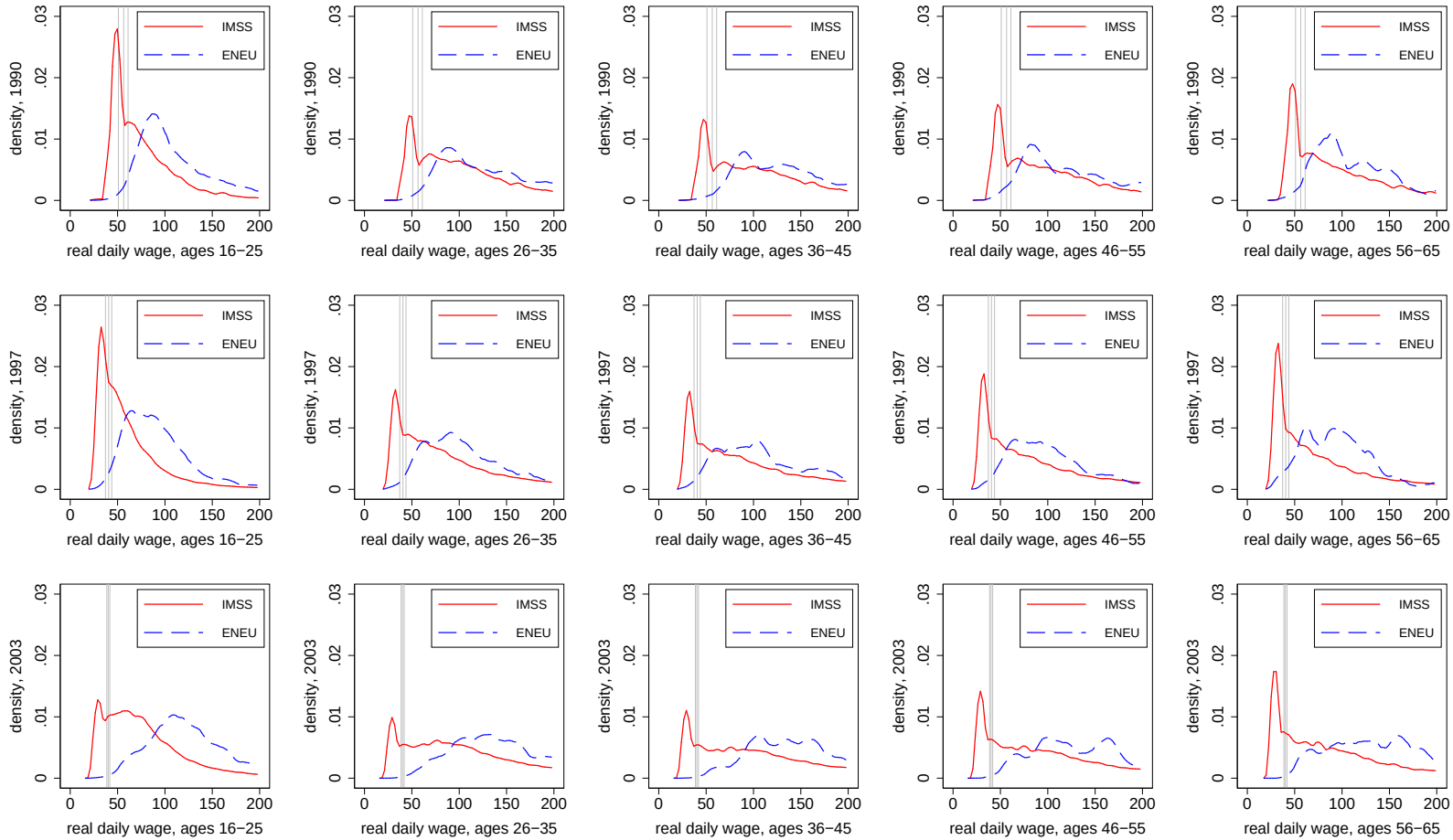
Notes: IMSS wage is post-tax. Densities estimated using 1990 Q2 data and an Epanechnikov kernel with bandwidth 3 pesos for IMSS data and 6 pesos for ENEU data. Vertical line is at 25th percentile of the ENEU wage distribution. Excess mass for 25th percentile defined as (area under red, left of vertical line) - (area under blue, left of vertical line).

Table 4: Cross-sectional patterns of evasion, 1990, men

	wage gap (medians)			wage gap (means)			exc. mass (25th percentile)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
age 26-35	-0.054*		-0.054**	-0.081***		-0.081***	-0.145***		-0.145***
	(0.029)		(0.021)	(0.024)		(0.019)	(0.015)		(0.013)
age 36-45	-0.072**		-0.073***	-0.149***		-0.150***	-0.167***		-0.168***
	(0.034)		(0.027)	(0.028)		(0.024)	(0.016)		(0.013)
age 46-55	-0.029		-0.026	-0.154***		-0.151***	-0.145***		-0.144***
	(0.035)		(0.031)	(0.031)		(0.027)	(0.017)		(0.014)
age 56-65	-0.026		-0.034	-0.165***		-0.172***	-0.108***		-0.112***
	(0.044)		(0.040)	(0.037)		(0.034)	(0.019)		(0.016)
11-50 employees		-0.332***	-0.333***		-0.173***	-0.173***		-0.129***	-0.128***
		(0.026)	(0.023)		(0.025)	(0.023)		(0.011)	(0.009)
51-100 employees		-0.480***	-0.478***		-0.281***	-0.281***		-0.218***	-0.214***
		(0.033)	(0.031)		(0.030)	(0.028)		(0.015)	(0.014)
101-250 employees		-0.393***	-0.374***		-0.242***	-0.233***		-0.214***	-0.203***
		(0.039)	(0.037)		(0.035)	(0.032)		(0.017)	(0.015)
$>$ 250 employees		-0.499***	-0.465***		-0.231***	-0.200***		-0.237***	-0.218***
		(0.035)	(0.034)		(0.030)	(0.029)		(0.017)	(0.016)
construction			0.128***			0.122***			0.064***
			(0.029)			(0.025)			(0.013)
retail/services			-0.073***			-0.108***			-0.045***
			(0.024)			(0.021)			(0.010)
constant	0.559***	0.854***	0.639***	0.501***	0.574***	0.505***	0.483***	0.524***	0.495***
	(0.017)	(0.018)	(0.047)	(0.016)	(0.018)	(0.039)	(0.009)	(0.006)	(0.019)
metro area effects	N	N	Y	N	N	Y	N	N	Y
R-squared	0.00	0.20	0.31	0.03	0.08	0.27	0.09	0.20	0.42
N	1068	1068	1068	1068	1068	1068	1068	1068	1068

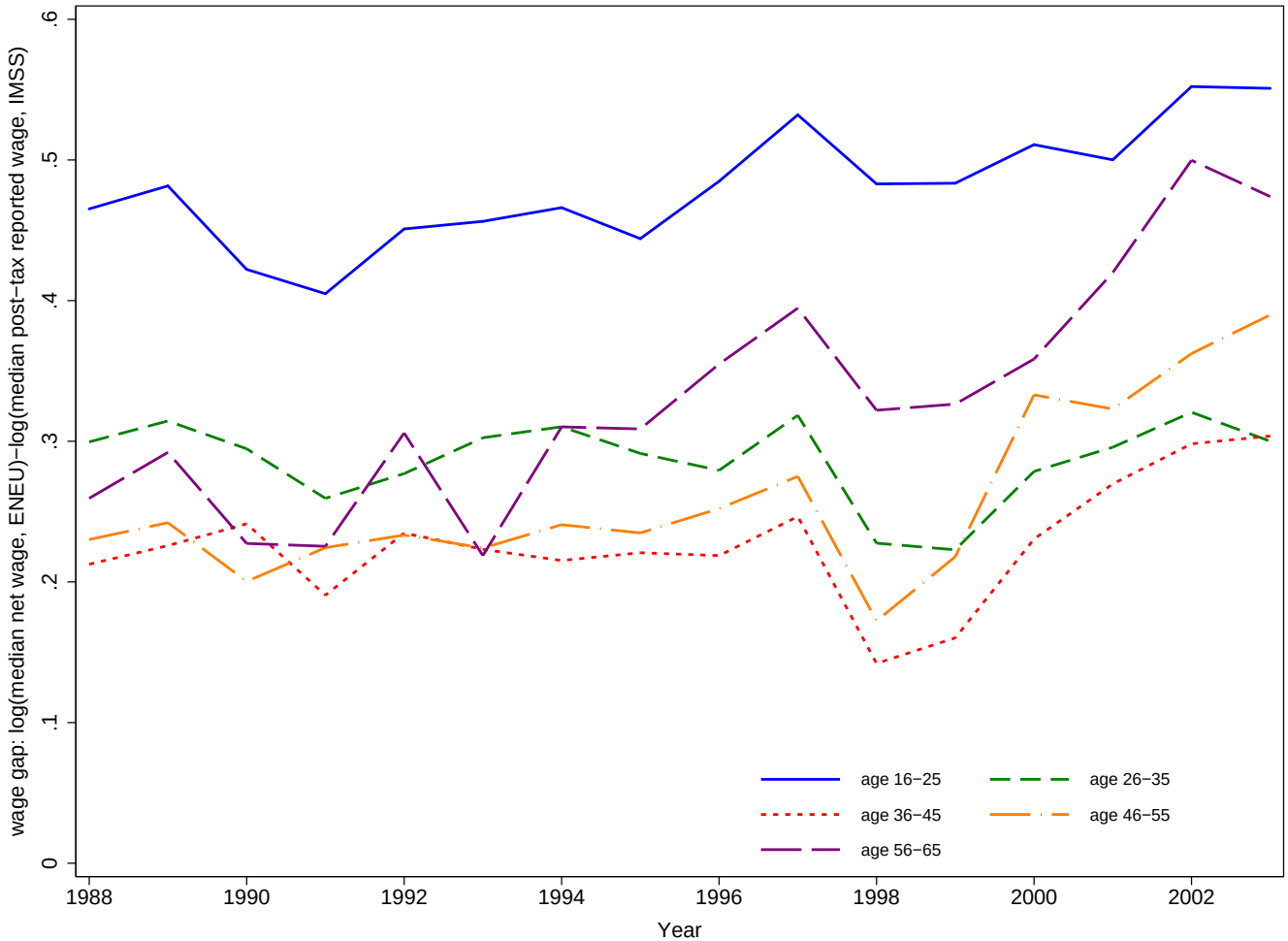
Notes: Data are from IMSS and ENEU baseline samples, collapsed to metro area/age group/firm-size category/sector level for 1990. The omitted category for age is 16-25, for firm size is 1-10 employees, and for sector is manufacturing. The wage gap (medians) is log median real daily take-home wage from the ENEU minus log median real daily post-tax reported wage from IMSS, calculated. Wage gap (means) is analogous, using mean in place of median.

Fig. 12: Wage densities by age group, men



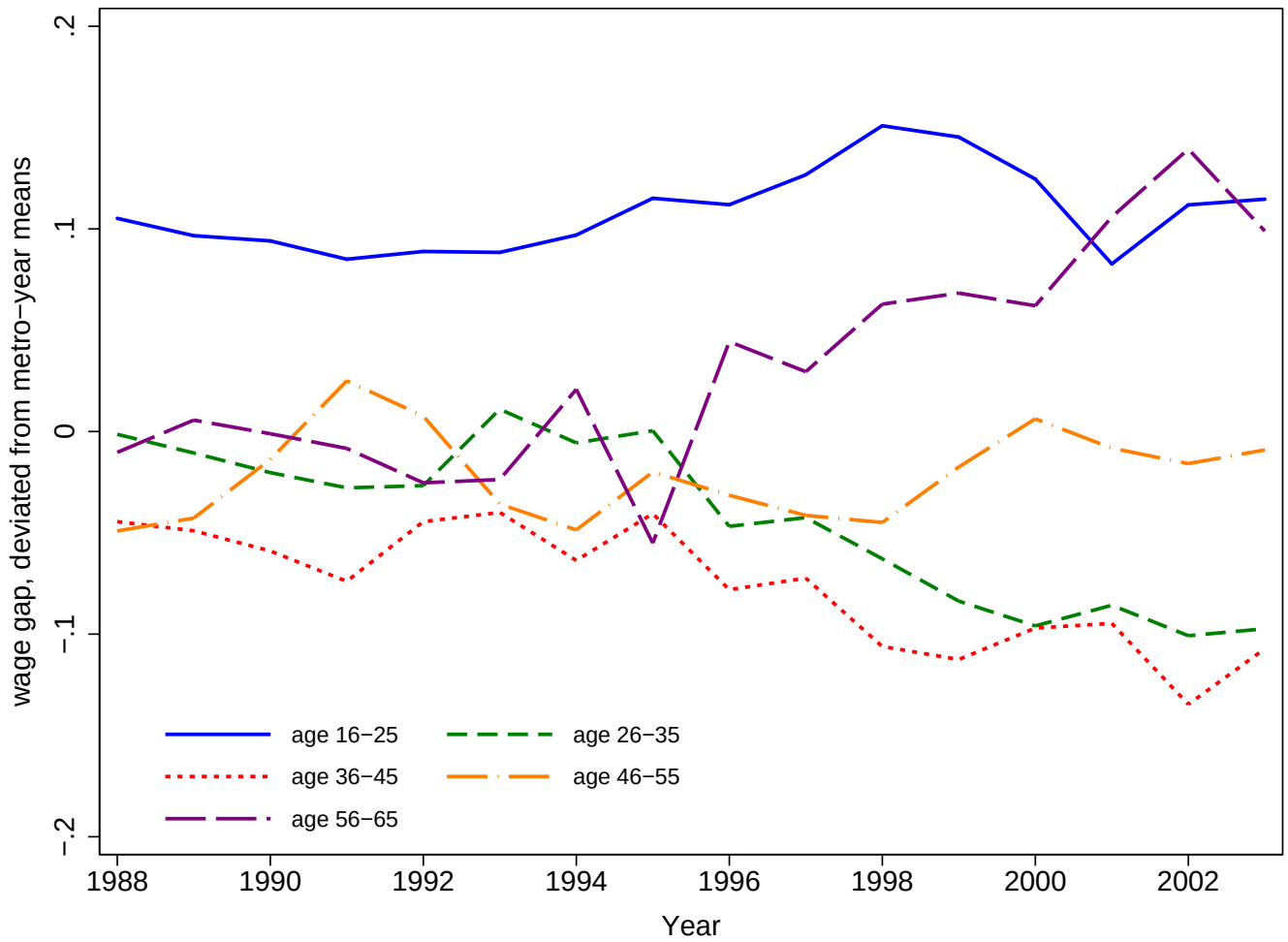
▸ Women

Fig. 13: Wage gaps (medians) by age group, men



Notes: Wage gap (medians) = log median net wage (ENEU) - log median post-tax reported wage (IMSS). ENEU data pooled across quarters within year.

Fig. 14: Wage gaps (medians) by age group, men, deviated from metro-year means



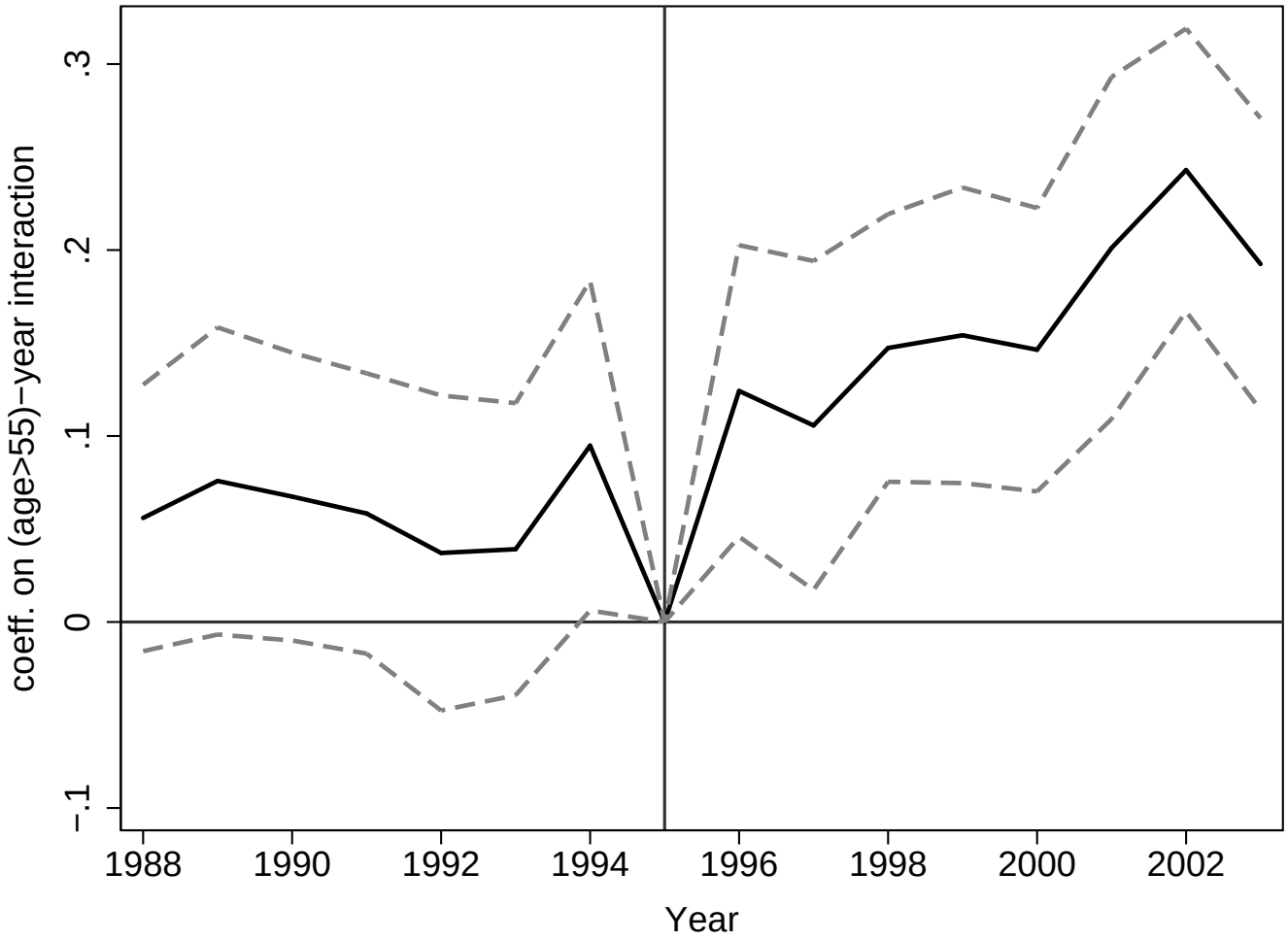
Notes: Wage gap (medians) = log median net wage (ENEU) - log median post-tax reported wage (IMSS), calculated at age-group/metro area/year level. Shown are average residuals from regressions of wage gaps on metro-year dummies. ENEU data pooled across quarters within year.

Table 5: Differential effects on evasion, men

	wage gap (medians)		wage gap (means)		excess mass (25^{th} perc.)	
	(1)	(2)	(3)	(4)	(5)	(6)
1(age > 55)*1988	0.056	0.056	0.040	0.040	0.022	0.022
	(0.040)	(0.037)	(0.035)	(0.027)	(0.024)	(0.019)
1(age > 55)*1989	0.076*	0.076*	0.048	0.048	0.026	0.026
	(0.045)	(0.042)	(0.039)	(0.032)	(0.021)	(0.016)
1(age > 55)*1990	0.067	0.067*	0.060	0.060*	0.027	0.027
	(0.044)	(0.039)	(0.041)	(0.034)	(0.022)	(0.017)
1(age > 55)*1991	0.058	0.058	0.040	0.040	0.042**	0.042***
	(0.039)	(0.038)	(0.036)	(0.037)	(0.019)	(0.014)
1(age > 55)*1992	0.037	0.037	-0.013	-0.013	0.029	0.029*
	(0.042)	(0.043)	(0.042)	(0.038)	(0.021)	(0.016)
1(age > 55)*1993	0.039	0.039	0.002	0.002	0.015	0.015
	(0.040)	(0.040)	(0.036)	(0.034)	(0.018)	(0.015)
1(age > 55)*1994	0.095**	0.095**	0.033	0.033	0.002	0.002
	(0.045)	(0.045)	(0.035)	(0.031)	(0.019)	(0.016)
1(age > 55)*1996	0.124***	0.124***	0.058	0.058	0.053**	0.053***
	(0.048)	(0.040)	(0.048)	(0.043)	(0.021)	(0.018)
1(age > 55)*1997	0.106**	0.106**	-0.029	-0.029	0.037*	0.037**
	(0.052)	(0.045)	(0.039)	(0.031)	(0.022)	(0.017)
1(age > 55)*1998	0.147***	0.147***	0.064	0.064**	0.054***	0.054***
	(0.043)	(0.037)	(0.040)	(0.031)	(0.018)	(0.013)
1(age > 55)*1999	0.154***	0.154***	0.100***	0.100***	0.062***	0.062***
	(0.045)	(0.041)	(0.032)	(0.033)	(0.017)	(0.013)
1(age > 55)*2000	0.146***	0.146***	0.104***	0.104***	0.053***	0.053***
	(0.044)	(0.039)	(0.030)	(0.024)	(0.017)	(0.014)
1(age > 55)*2001	0.201***	0.201***	0.151***	0.151***	0.074***	0.074***
	(0.049)	(0.047)	(0.041)	(0.035)	(0.018)	(0.015)
1(age > 55)*2002	0.243***	0.243***	0.188***	0.188***	0.071***	0.071***
	(0.046)	(0.039)	(0.033)	(0.030)	(0.018)	(0.013)
1(age > 55)*2003	0.192***	0.192***	0.175***	0.175***	0.051***	0.051***
	(0.044)	(0.040)	(0.035)	(0.031)	(0.018)	(0.014)
age group effects	Y		Y		Y	
age group-metro area effects	N	Y	N	Y	N	Y
metro-year effects	Y	Y	Y	Y	Y	Y
R-squared	0.85	0.92	0.83	0.89	0.91	0.96
N	1280	1280	1280	1280	1280	1280

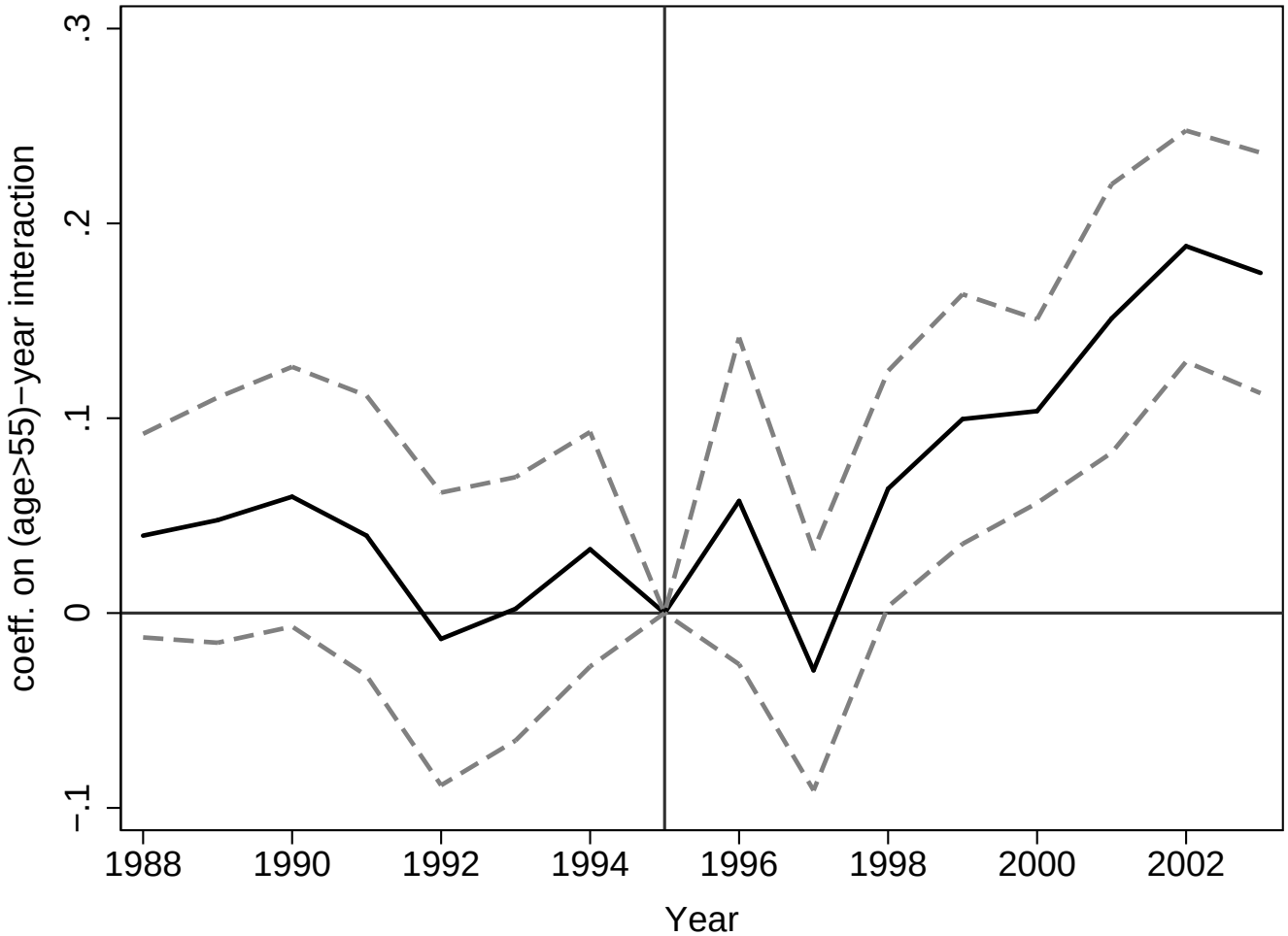
Notes: Data collapsed to metro area/age group/year level. ENEU data pooled across quarters within year.

Fig. 15: Differential effect of reform on wage gap (medians), ages 55-65, men



Notes: Figure plots coefficients for 1(age>55)*year interaction term from Column 2 of Table 5. The dotted lines indicate the 95 percent confidence interval.

Fig. 16: Differential effect of reform on wage gap (means), ages 55-65, men



Notes: Figure plots coefficients for 1(age>55)*year interaction term from Column 4 of Table 5. The dotted lines indicate the 95 percent confidence interval.

Conclusion

- Two basic points:
  - There is substantial under-reporting. Third-party reporting does not eliminate evasion.
  - The extent of under-reporting appears to respond to economic incentives, in particular to change in employees' incentives to ensure accurate reporting and information about employers' reports.

Conclusion

- Two basic points:
  - There is substantial under-reporting. Third-party reporting does not eliminate evasion.
  - The extent of under-reporting appears to respond to economic incentives, in particular to change in employees' incentives to ensure accurate reporting and information about employers' reports.
- Implication: giving employees incentives to monitor employers should be a consideration in the design of social-insurance systems.
  - Theoretical model suggests that reducing payroll taxes ($\tau \downarrow$) would have same effect on compliance as increase in benefit rate ($b \uparrow$).
  - But increasing sensitivity of benefits to contributions may be preferable on revenue grounds.

Conclusion

- Future work:
  - To what extent are workers aware of under-reporting by employers?
    - Empirically, need setting with independent variation in incentives and information.
  - Does greater compliance on intensive margin (less under-reporting by registered firms) induce lower compliance on extensive margin (fewer firms registering)?

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Housing account

- Employer contributes 5% of worker's wage to housing fund (INFONAVIT), to which workers can apply for loans.
- Workers can claim unused funds at retirement.
  - Prior to 1992: *nominal* contributions, real value low.
  - 1992-1997: nominal contributions + interest, but real rate of return negative.
  - Post-reform: Funds administered by AFORE, can be claimed by workers who choose PRA.
  - Grandfathered workers who choose PAYGO only receive unused housing funds from 1992-1997.
- Changes reinforce pension changes.

Return

Other dimensions of tax system

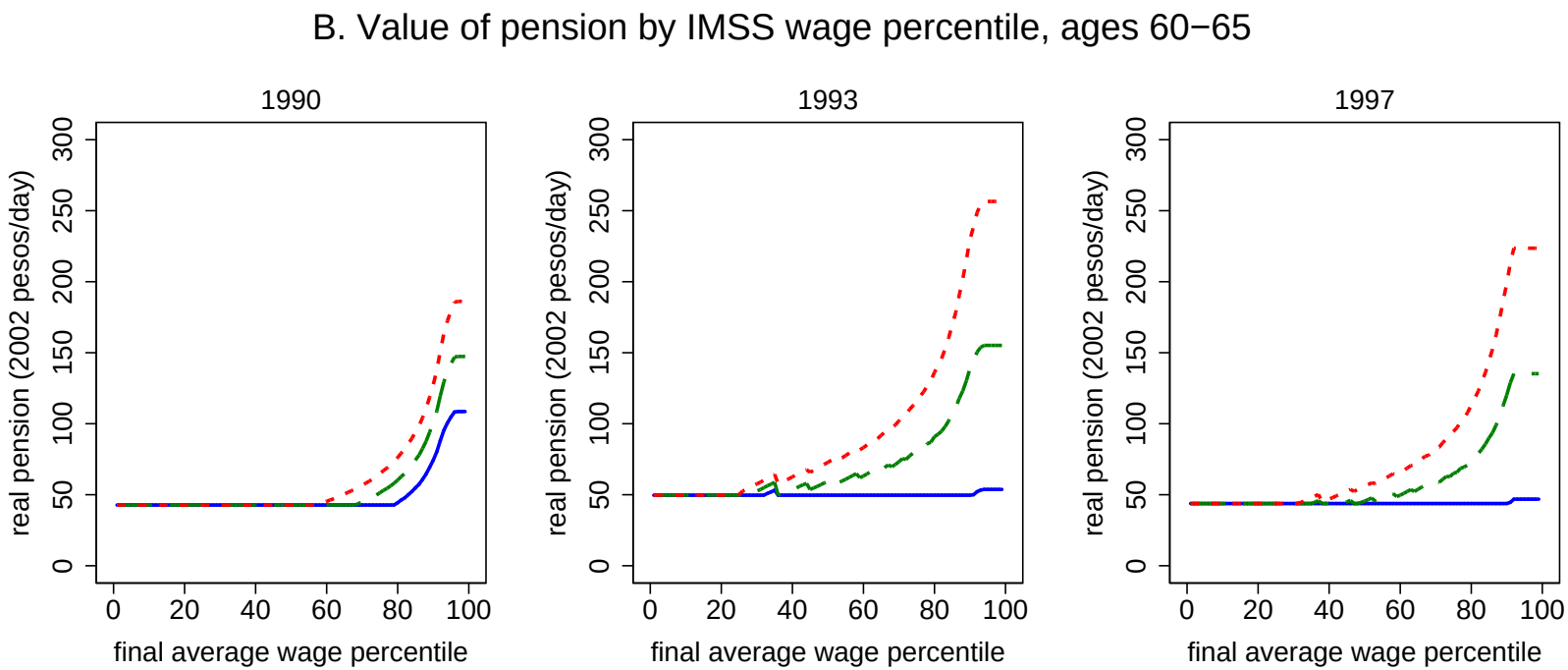
- VAT: 15% for 1988-2003 period.
- Corporate income taxes:
  - 39.2% in 1988, 34% in 2003
  - Widspread evasion: e.g. in early 1990s, 70% of corporations declared no income (OECD, 1992).
- Personal income taxes:
  - 3-50% in 1988, 3-34% in 2003.
  - Extensive tax credits for low-income workers, to offset regressive effects of VAT.
  - In 1997, individuals making $<$3.2 minimum wages (70% of all employees) paid $\leq$0 income tax (OECD, 1999, p. 80).
- VAT, social security taxes each $\sim$3% of GDP; corporate + personal income taxes and PEMEX contributions each $\sim$4% of GDP (OECD, 1999).
- IMSS and tax authority first signed agreement to share data in June 2002. No information sharing previously.

Return

Fig. 3A: Value of pension, men ages 60-65

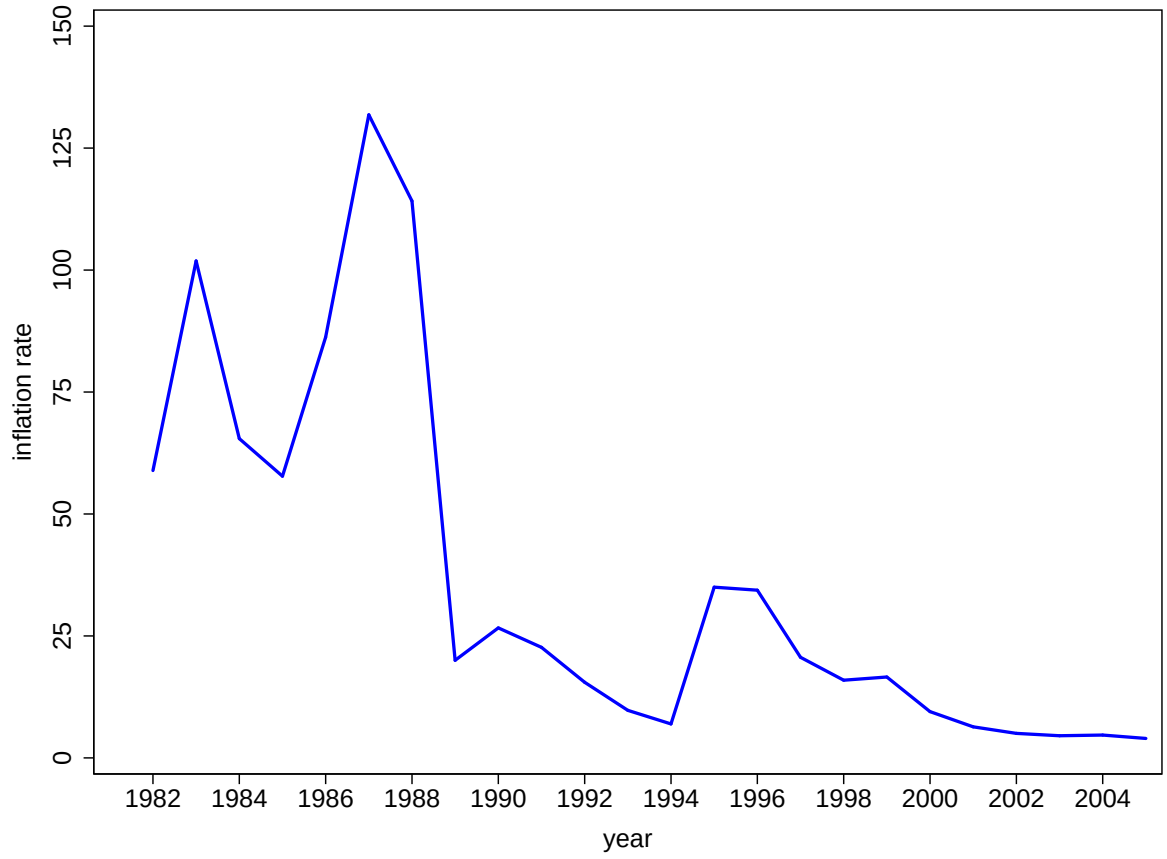
Return

Fig. 3B: Value of pension, men ages 60-65



Return

Inflation rate



▸ Return

Table A5: Pension wealth simulation, worker entering June 30, 1997

Years of Contributions	Plan	Real Daily Wage					
		43	100	200	300	500	1079
35	PRA	398.6	*815.0*	*1626.2*	*2437.3*	*4059.7*	*8751.9*
	PAYGO	398.6	*398.6*	*603.8*	*890.2*	*1483.6*	*3200.1*
30	PRA	398.6	*523.4*	*1044.3*	*1565.3*	*2607.1*	*5620.5*
	PAYGO	398.6	*398.6*	*510.7*	*743.3*	*1238.9*	*2672.1*
25	PRA	398.6	398.6	*659.1*	*987.8*	*1645.3*	*3546.9*
	PAYGO	398.6	398.6	*406.9*	*579.5*	*965.8*	*2083.2*
20	PRA	87.9	202.4	*403.9*	*605.4*	*1008.4*	*2173.9*
	PAYGO	398.6	398.6	*398.6*	*449.6*	*749.3*	*1616.2*
15	PRA	51.1	117.8	235.0	352.2	*586.6*	*1264.7*
	PAYGO	398.6	398.6	398.6	398.6	*504.5*	*1088.2*
10	PRA	26.8	61.7	123.1	184.5	307.4	*662.6*
	PAYGO	398.6	398.6	398.6	398.6	398.6	*560.3*
5	PRA	*10.7*	*24.6*	*49.0*	*73.5*	*122.4*	*264.0*
	PAYGO	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Notes: Values are real present discounted value of the future stream of pension benefits in thousands of 2002 pesos, for a male worker who enters the system on June 30, 1997.

Return

Theoretical framework

- Simple model of payroll-tax compliance by heterogeneous firms.

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- Shares features with models in Yaniv (1992), Kopczuk and Slemrod (2006), Kleven et al. (2009), and Besley and Persson (2013), but these papers do not focus on heterogeneity across firms.

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- Shares features with models in Yaniv (1992), Kopczuk and Slemrod (2006), Kleven et al. (2009), and Besley and Persson (2013), but these papers do not focus on heterogeneity across firms.
- Model is special in a number of ways. Goal is to spell out in a precise way why empirical exercise makes sense.

Theoretical framework (cont.)

- Payroll taxes:
  - τ_f on firms, τ_w on workers (statutorily).
  - Let $\tau = \tau_f + \tau_w$, assuming $0 < \tau < 1$.

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  - w_r = pre-tax wage reported by firm to government
  - w_u = unreported wage.
  - Total wage paid by firm: $w_f = w_r + w_u$.
  - Net take-home wage to worker: $w_{net} = w_u + (1 - \tau)w_r$.
  - "Effective" wage: $w_e = w_{net} + bw_r = w_u + (1 - (\tau - b))w_r$, where b is "benefit rate."

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- w_r, w_{net} observable to econometrician in IMSS, ENEU data, respectively (at cell level).
  - Can infer unreported wage from them: $w_u = w_{net} - (1 - \tau)w_r$

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- w_r, w_{net} observable to econometrician in IMSS, ENEU data, respectively (at cell level).
  - Can infer unreported wage from them: $w_u = w_{net} - (1 - \tau)w_r$
- Assume w_r, w_u, w_{net}, w_e observable to workers.
  - Issue: pre-reform, do workers know w_u (they collude) or not (they are uninformed)? We will return to this.

Theoretical framework (cont.)

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Theoretical framework (cont.)

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  - Cost of evasion: $xc(w_u)$, where $c(0) = 0$, $c'(w_u) > 0$, $c''(w_u) > 0$

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  - CES demand: $x(\varphi) = Ap(\varphi)^{-\sigma}$
  - Cost of evasion: $xc(w_u)$, where $c(0) = 0$, $c'(w_u) > 0$, $c''(w_u) > 0$
- Labor market competitive; firms are price-takers of w_e.
- Firm's problem: choose w_u, p to maximize

$$\pi(w_u, p; \varphi, w_e) = \{p - \frac{1}{\varphi} \underbrace{\frac{w_e - (\tau - b)w_u}{1 - (\tau - b)}}_{w_f} - c(w_u)\}x - f$$

Theoretical framework (cont.)

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  - Optimal evasion $w_u^*(\varphi)$ depends on neither p nor w_e:

$$c'(w_u) = \frac{\tau - b}{\varphi(1 - (\tau - b))}$$

Theoretical framework (cont.)

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  - Optimal evasion $w_u^*(\varphi)$ depends on neither p nor w_e:

$$c'(w_u) = \frac{\tau - b}{\varphi(1 - (\tau - b))}$$

  - Price is fixed mark-up over costs:

$$p^*(w_e, \varphi) = \left(\frac{\sigma}{\sigma - 1}\right)\left\{\frac{w_e - (\tau - b)w_u^*(\varphi)}{\varphi(1 - (\tau - b))} + c(w_u^*(\varphi))\right\}$$

Theoretical framework (cont.)

- First order conditions yield:
  - Optimal evasion $w_u^*(\varphi)$ depends on neither p nor w_e:

$$c'(w_u) = \frac{\tau - b}{\varphi(1 - (\tau - b))}$$

  - Price is fixed mark-up over costs:

$$p^*(w_e, \varphi) = \left(\frac{\sigma}{\sigma - 1}\right)\left\{\frac{w_e - (\tau - b)w_u^*(\varphi)}{\varphi(1 - (\tau - b))} + c(w_u^*(\varphi))\right\}$$

- Aggregate labor demand:

$$L_{agg}^D(w_e) = \int_{\varphi^{min}}^{\varphi^{max}} \frac{Ap^*(w_e, \varphi)^{-\sigma}}{\varphi} g(\varphi) d\varphi$$

Theoretical framework (cont.)

- First order conditions yield:
  - Optimal evasion $w_u^*(\varphi)$ depends on neither p nor w_e:

$$c'(w_u) = \frac{\tau - b}{\varphi(1 - (\tau - b))}$$

  - Price is fixed mark-up over costs:

$$p^*(w_e, \varphi) = \left(\frac{\sigma}{\sigma - 1}\right)\left\{\frac{w_e - (\tau - b)w_u^*(\varphi)}{\varphi(1 - (\tau - b))} + c(w_u^*(\varphi))\right\}$$

- Aggregate labor demand:

$$L_{agg}^D(w_e) = \int_{\varphi^{min}}^{\varphi^{max}} \frac{Ap^*(w_e, \varphi)^{-\sigma}}{\varphi} g(\varphi) d\varphi$$

- Assume constant elasticity of labor supply (with $\rho > 0$ and $B > 0$):

$$L_{agg}^S = Bw_e^\rho$$

Theoretical framework (cont.)

- First order conditions yield:
  - Optimal evasion $w_u^*(\varphi)$ depends on neither p nor w_e:

$$c'(w_u) = \frac{\tau - b}{\varphi(1 - (\tau - b))}$$

  - Price is fixed mark-up over costs:

$$p^*(w_e, \varphi) = \left(\frac{\sigma}{\sigma - 1}\right)\left\{\frac{w_e - (\tau - b)w_u^*(\varphi)}{\varphi(1 - (\tau - b))} + c(w_u^*(\varphi))\right\}$$

- Aggregate labor demand:

$$L_{agg}^D(w_e) = \int_{\varphi^{min}}^{\varphi^{max}} \frac{Ap^*(w_e, \varphi)^{-\sigma}}{\varphi} g(\varphi) d\varphi$$

- Assume constant elasticity of labor supply (with $\rho > 0$ and $B > 0$):

$$L_{agg}^S = Bw_e^\rho$$

- Labor market clearing pins down w_e:

$$L_{agg}^S(w_e) = L_{agg}^D(w_e)$$

Theoretical framework (cont.)

- Theoretical punchlines:
  1. Evasion declining in productivity in cross-section:

$$\frac{dw_u^*}{d\varphi} = -\frac{\tau - b}{\varphi^2 c''(w_u)(1-(\tau-b))} < 0$$

     - If employment is increasing in productivity (true if cost of evasion not too large), then evasion is also declining in employment.

Theoretical framework (cont.)

- Theoretical punchlines:
  1. Evasion declining in productivity in cross-section:

$$\frac{dw_u^*}{d\varphi} = -\frac{\tau - b}{\varphi^2 c''(w_u)(1-(\tau-b))} < 0$$

     - If employment is increasing in productivity (true if cost of evasion not too large), then evasion is also declining in employment.
  2. Evasion declines in response to increase in benefit rate, b (as for younger workers following pension reform):

$$\frac{dw_u^*}{db} = -\frac{1}{(1-(\tau-b))^2 \varphi c''(w_u^*(\varphi))} < 0$$

Theoretical framework (cont.)

- Theoretical punchlines:
  1. Evasion declining in productivity in cross-section:

$$\frac{dw_u^*}{d\varphi} = -\frac{\tau - b}{\varphi^2 c''(w_u)(1-(\tau-b))} < 0$$

     - If employment is increasing in productivity (true if cost of evasion not too large), then evasion is also declining in employment.
  2. Evasion declines in response to increase in benefit rate, b (as for younger workers following pension reform):

$$\frac{dw_u^*}{db} = -\frac{1}{(1-(\tau-b))^2 \varphi c''(w_u^*(\varphi))} < 0$$

  3. Incidence of increase in b on w_e, w_{net}, w_f ambiguous, depends on elasticity of labor supply, ρ, and extent of firm heterogeneity.
     - Note: implications for evasion do not depend on incidence.

Return Incidence

Incidence (Appendix B)

- Differentiating labor-market-clearing condition with respect to b and re-arranging:

$$\frac{dw_e}{db} = \frac{\int_{\varphi^{min}}^{\varphi^{max}} \left[w_r^*(w_e,\varphi)\right] \frac{(p^*)^{-\sigma-1}}{\varphi^2} g(\varphi) d\varphi}{\frac{1-\tau+b}{\sigma A}\left(\frac{\sigma-1}{\sigma}\right)\rho B w_e^{\rho-1} + \int_{\varphi^{min}}^{\varphi^{max}} \frac{(p^*)^{-\sigma-1}}{\varphi^2} g(\varphi) d\varphi}$$

- Effect can be bounded:

$$\lim_{\rho\to\infty} \frac{dw_e}{db} = 0$$

$$\lim_{\rho\to 0} \frac{dw_e}{db} = \int_{\varphi^{min}}^{\varphi^{max}} \mu(\varphi)\left[w_r^*(w_e,\varphi)\right] g(\varphi) d\varphi \equiv \overline{w}_r^*(w_e)$$

where $\mu(\varphi) = \dfrac{\left(\frac{(p^*)^{-\sigma-1}}{\varphi^2}\right)}{\int_{\varphi^{min}}^{\varphi^{max}} \left(\frac{(p^*)^{-\sigma-1}}{\varphi^2}\right) g(\varphi) d\varphi}$

Incidence (cont.)

- It follows immediately that:

$$\frac{dw_r^*}{db} = \frac{1}{\varphi c''(w_u^*(\varphi))(1-\tau+b)^2} + \frac{1}{1-\tau+b}\left\{\frac{dw_e}{db} - w_r^*(w_e,\varphi)\right\}$$

$$\frac{dw_{net}^*}{db} = -\frac{b}{\varphi c''(w_u^*(\varphi))(1-\tau+b)} + \frac{1-\tau}{1-\tau+b}\left\{\frac{dw_e}{db} - w_r^*(w_e,\varphi)\right\}$$

- In special case when firms are homogenous, we have:

$$\frac{dw_{net}^*}{db} < -\frac{b}{\varphi c''(w_u^*(\varphi))(1-\tau+b)} < 0$$

- But effect on w_{net} (or w_r) cannot be signed in general case.
- Intuition: with reform ($b \uparrow$)
  - Gov't pays more of effective wage: tends to reduce w_{net}.
  - $\frac{dw_e}{db}$ can be shown to be bounded above by average response; an individual firm's response depends on its own w_r, so $\left\{\frac{dw_e}{db} - w_r^*(w_e,\varphi)\right\}$ term is of ambiguous sign.

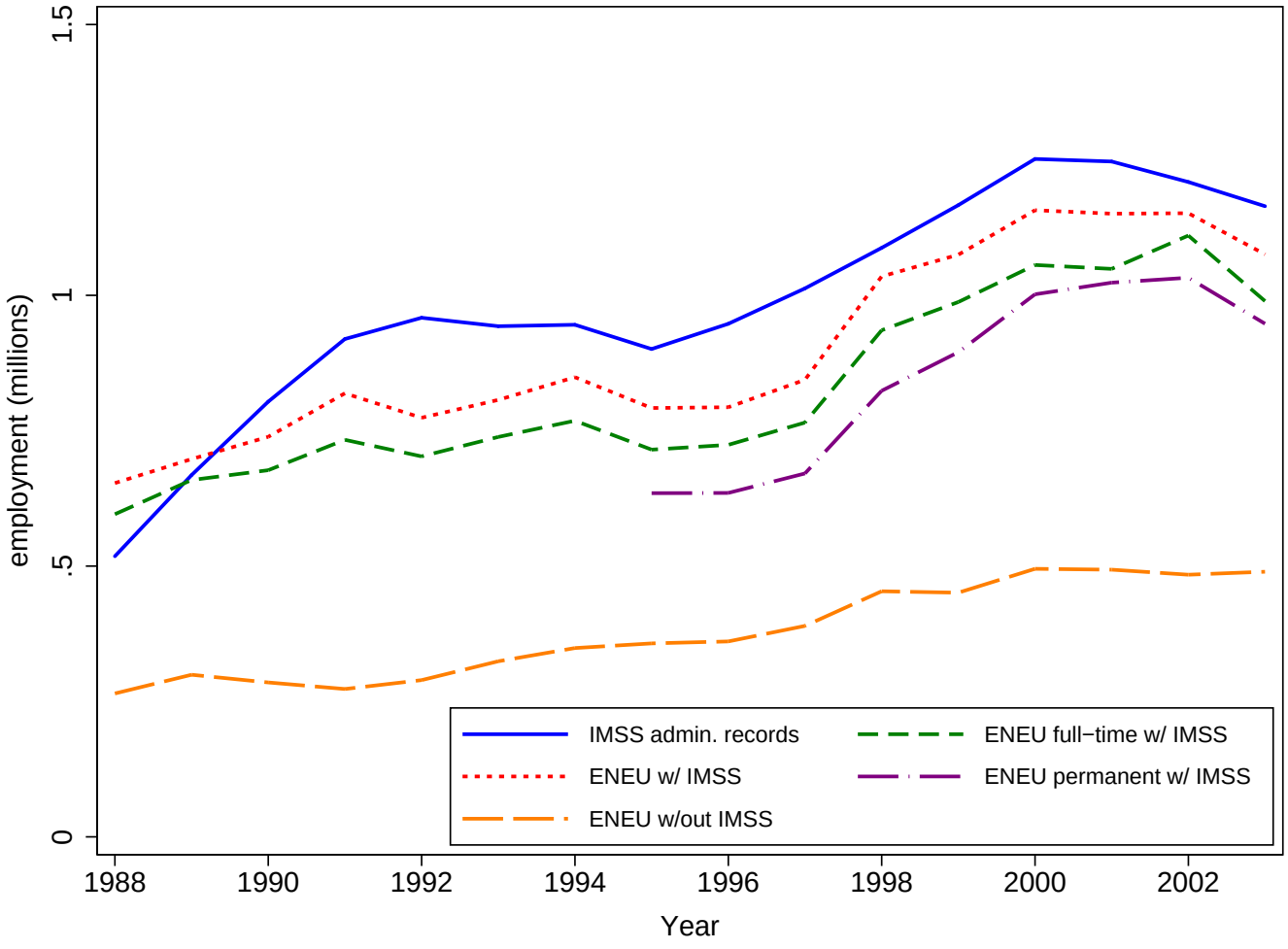
Return

Table A6: Comparison of IMSS and ENEU, 1990, women

	IMSS baseline sample (1)	full ENEU sample (2)	ENEU w/ IMSS (3)	ENEU w/o IMSS (4)	ENEU permanent w/ IMSS (5)	ENEU full-time w/ IMSS (6)
A. 1990						
real avg. daily post-tax wage	88.29	133.55	136.91	124.84		128.57
	(0.08)	(2.16)	(2.65)	(3.59)		(2.50)
age	28.12	28.35	28.03	29.17		27.82
	(0.01)	(0.21)	(0.23)	(0.47)		(0.24)
fraction employed in ests >100 employees	0.55	0.45	0.54	0.21		0.54
	(0.00)	(0.01)	(0.01)	(0.02)		(0.01)
N (raw observations)	803579	6685	5126	1559		4745
N (population, using weights)	803579	1023858	738698	285160		677053
B. 2000						
real avg. daily post-tax wage	90.86	128.04	135.88	109.72	140.56	129.65
	(0.07)	(1.82)	(2.21)	(3.06)	(2.49)	(2.18)
age	30.44	30.34	29.85	31.50	30.17	29.71
	(0.01)	(0.18)	(0.19)	(0.40)	(0.21)	(0.20)
fraction employed in ests >100 employees	0.64	0.49	0.62	0.19	0.64	0.62
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
N (raw observations)	1251832	9670	7227	2443	6305	6607
N (population, using weights)	1251832	1652164	1157184	494980	1001866	1056013

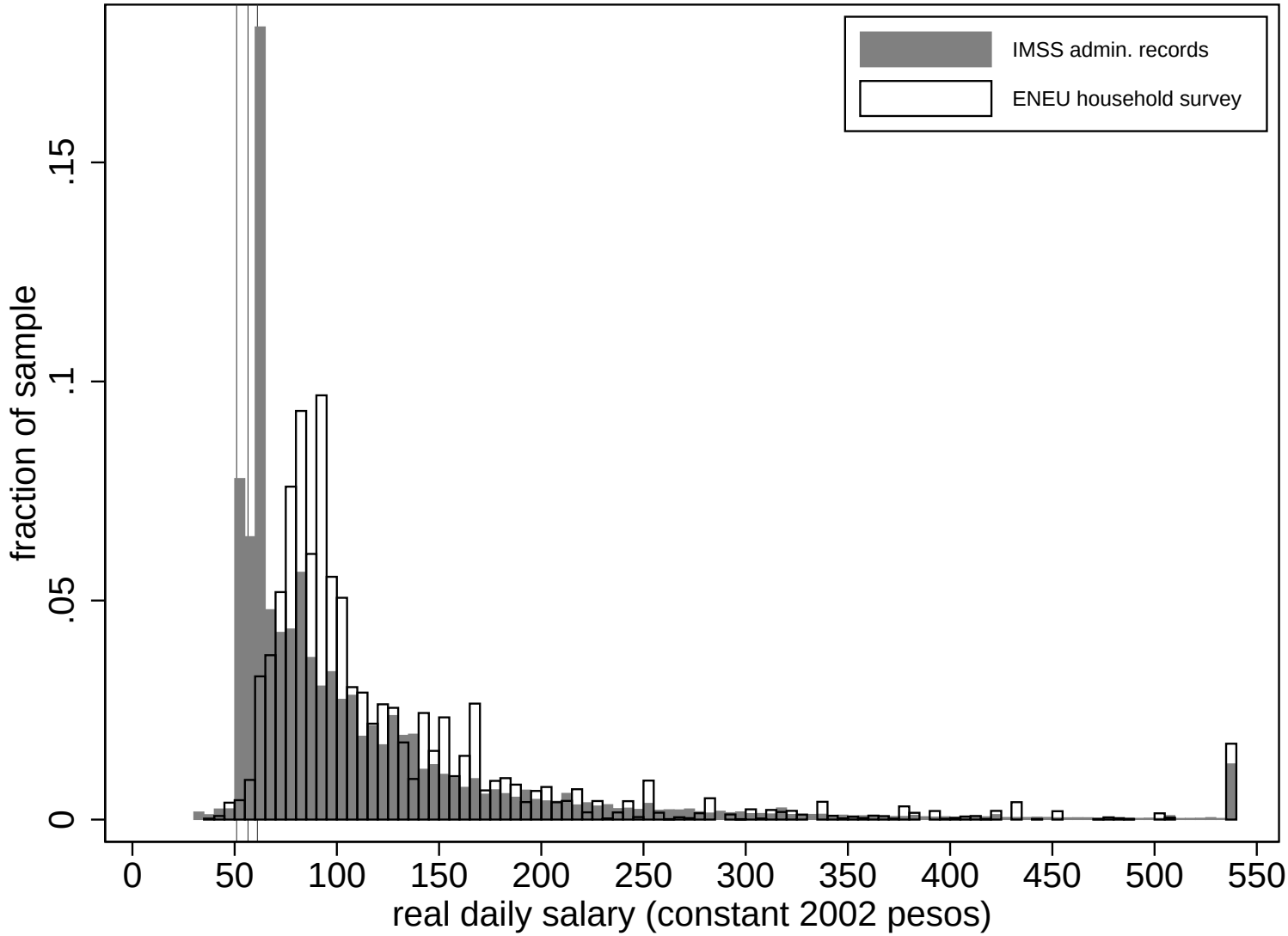
Return

Fig. A1: Employment, IMSS vs. ENEU samples, women



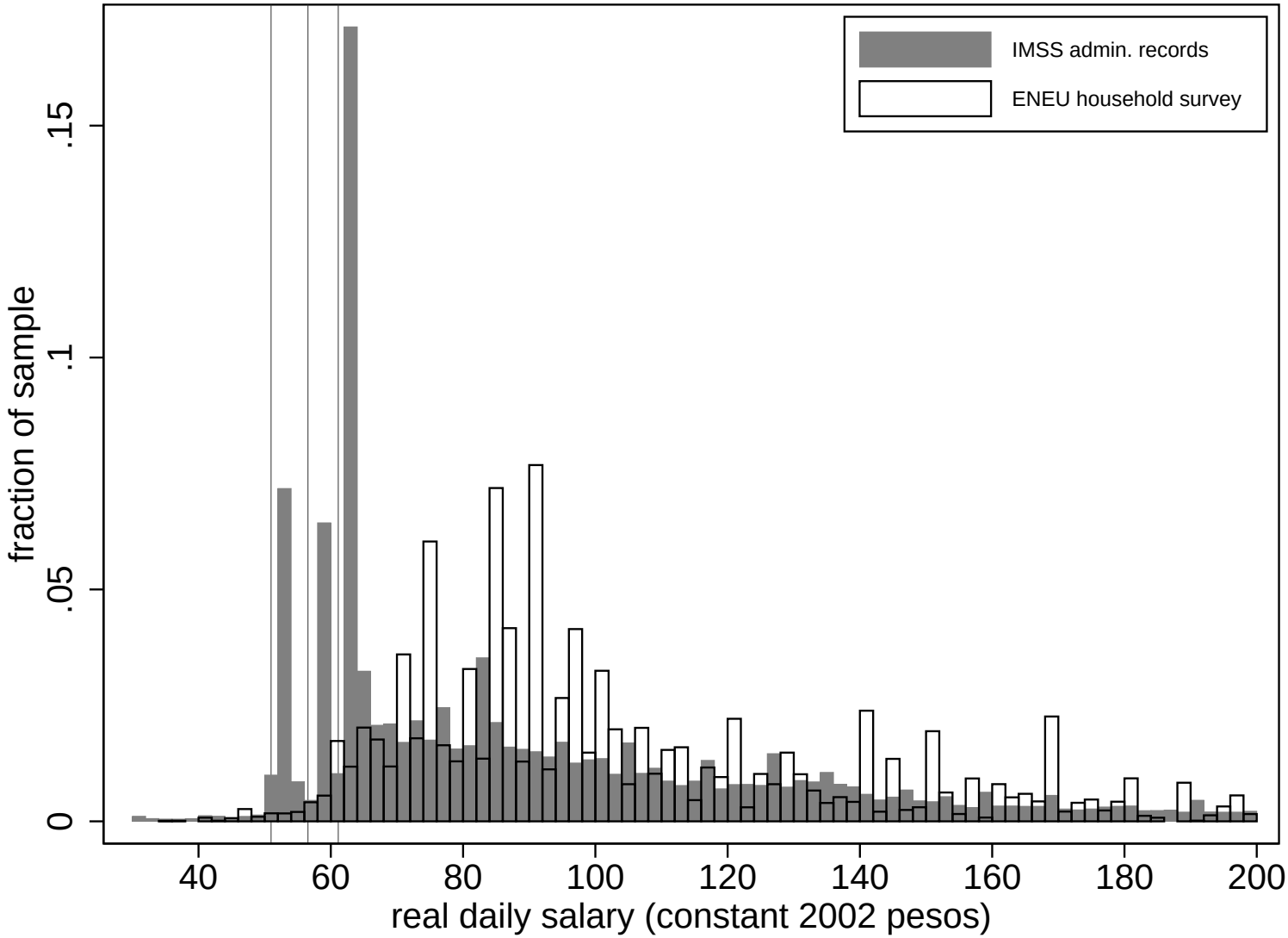
▸ Return

Fig. A2: Wage histograms, women, 1990



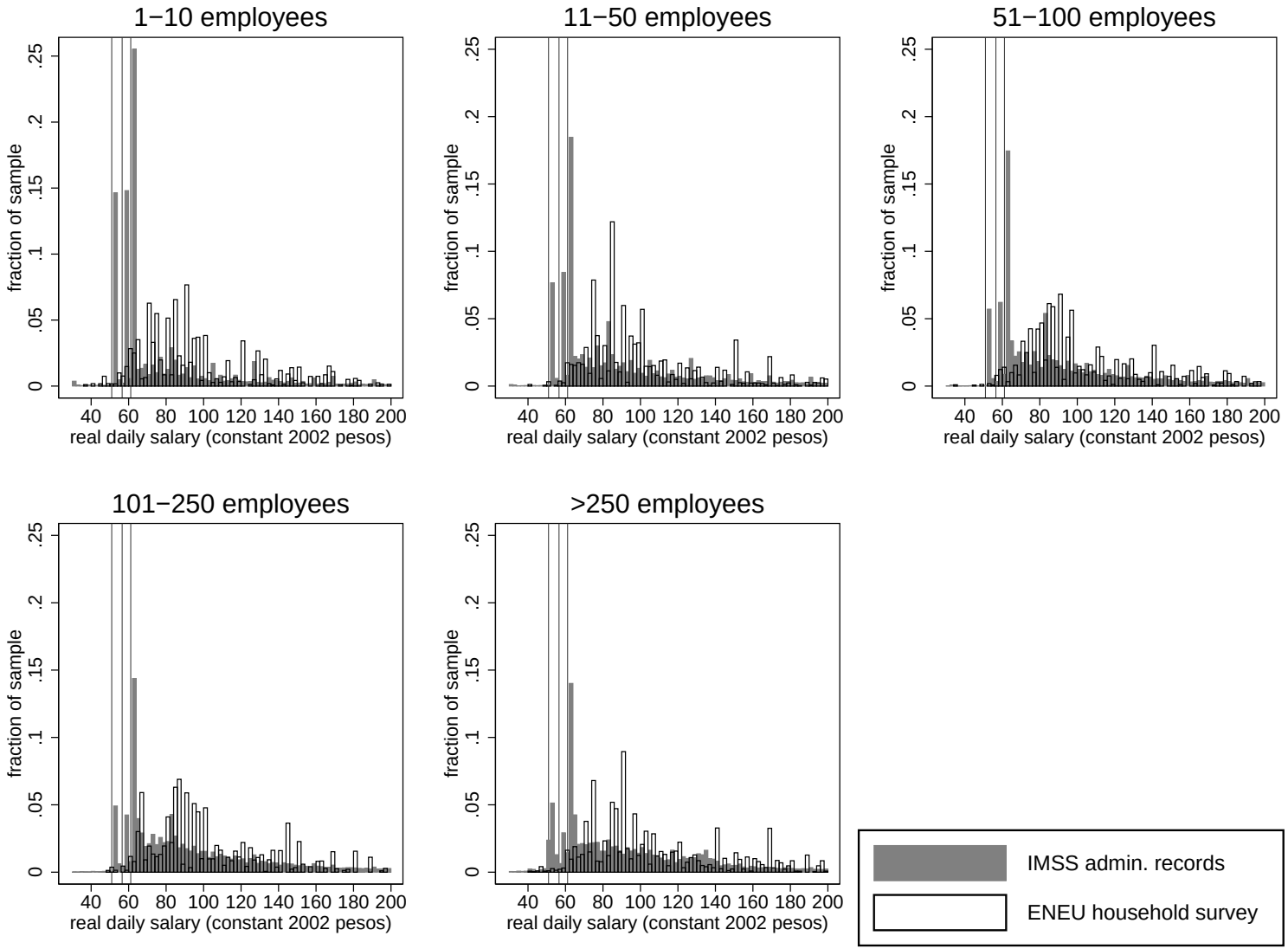
▸ Return

Fig. A3: Wage histograms, women, 1990, low wages



▸ Return

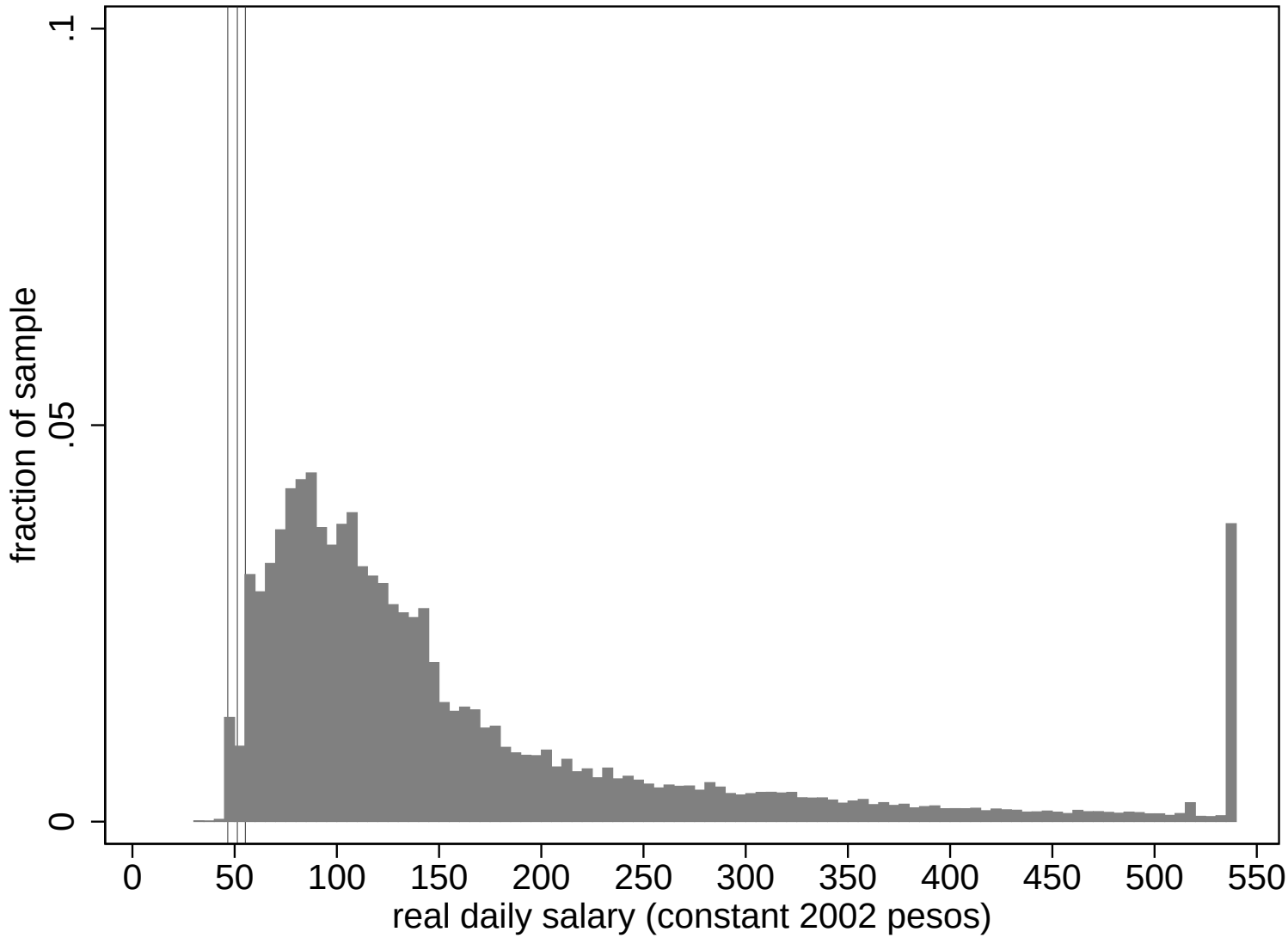
Fig. A4: Wage histograms, women, 1990, by firm size



Notes: Bins are 2 pesos wide. Average 2002 exchange rate: 9.66 pesos/dollar.

▸ Return

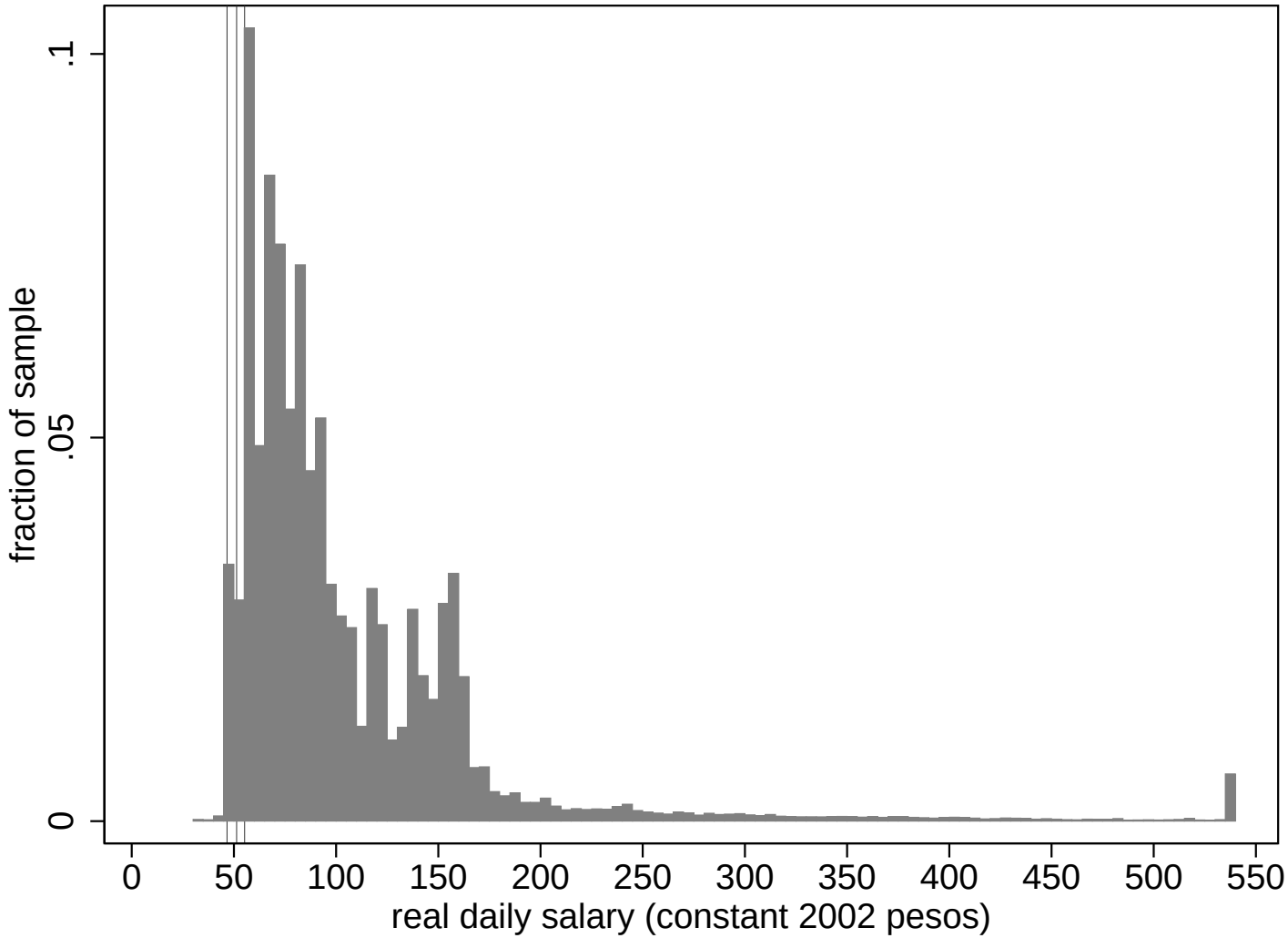
Fig. A5: Wage histogram, women, 1993, EIA plants



Notes: Bins are 2 pesos wide. Average 2002 exchange rate: 9.66 pesos/dollar.

Return

Fig. A6: Wage histogram, women, 1993, EMIME plants



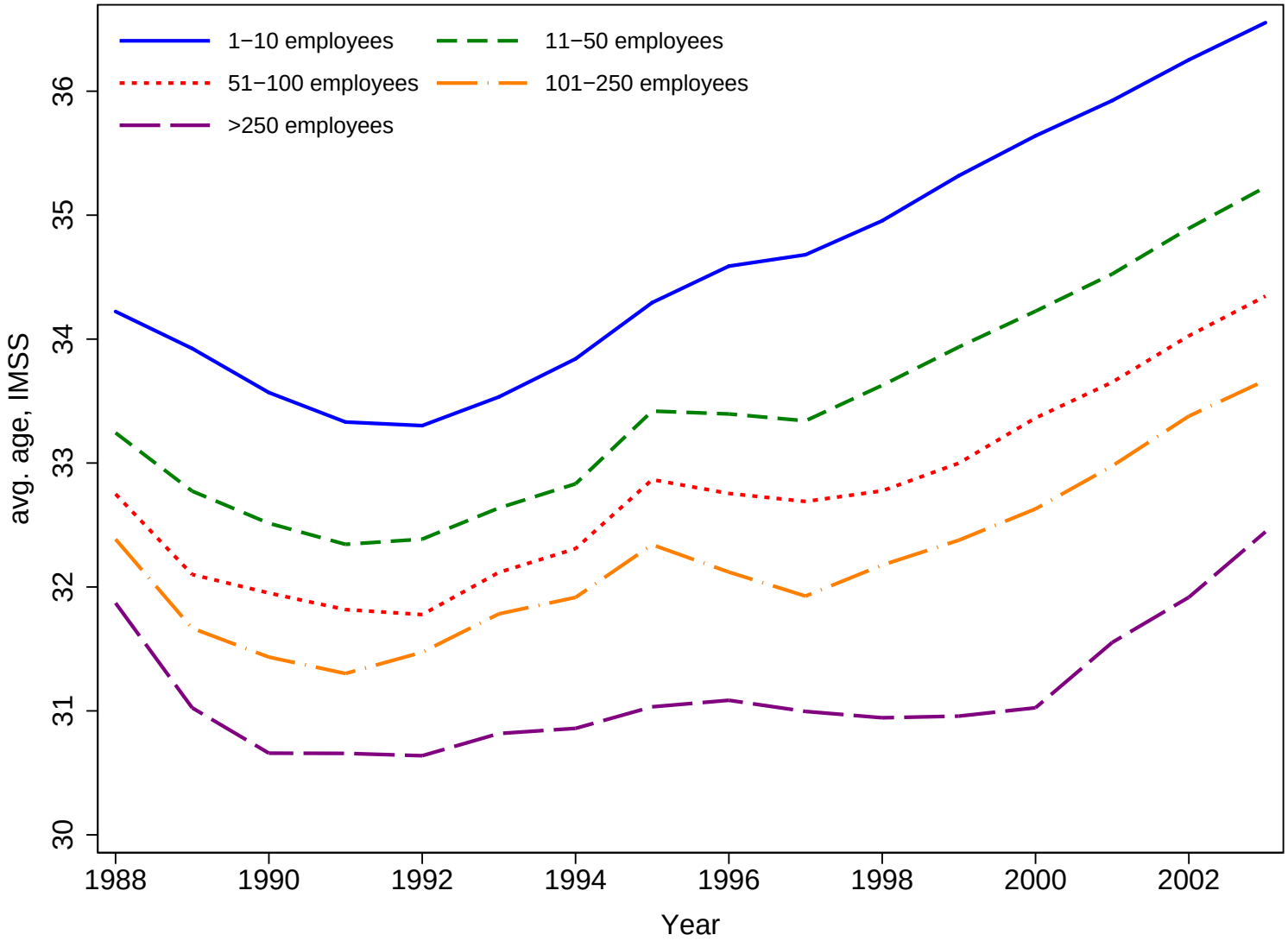
Notes: Bins are 2 pesos wide. Average 2002 exchange rate: 9.66 pesos/dollar.

▸ Return

Fig. ??: Wage densities by age group, women

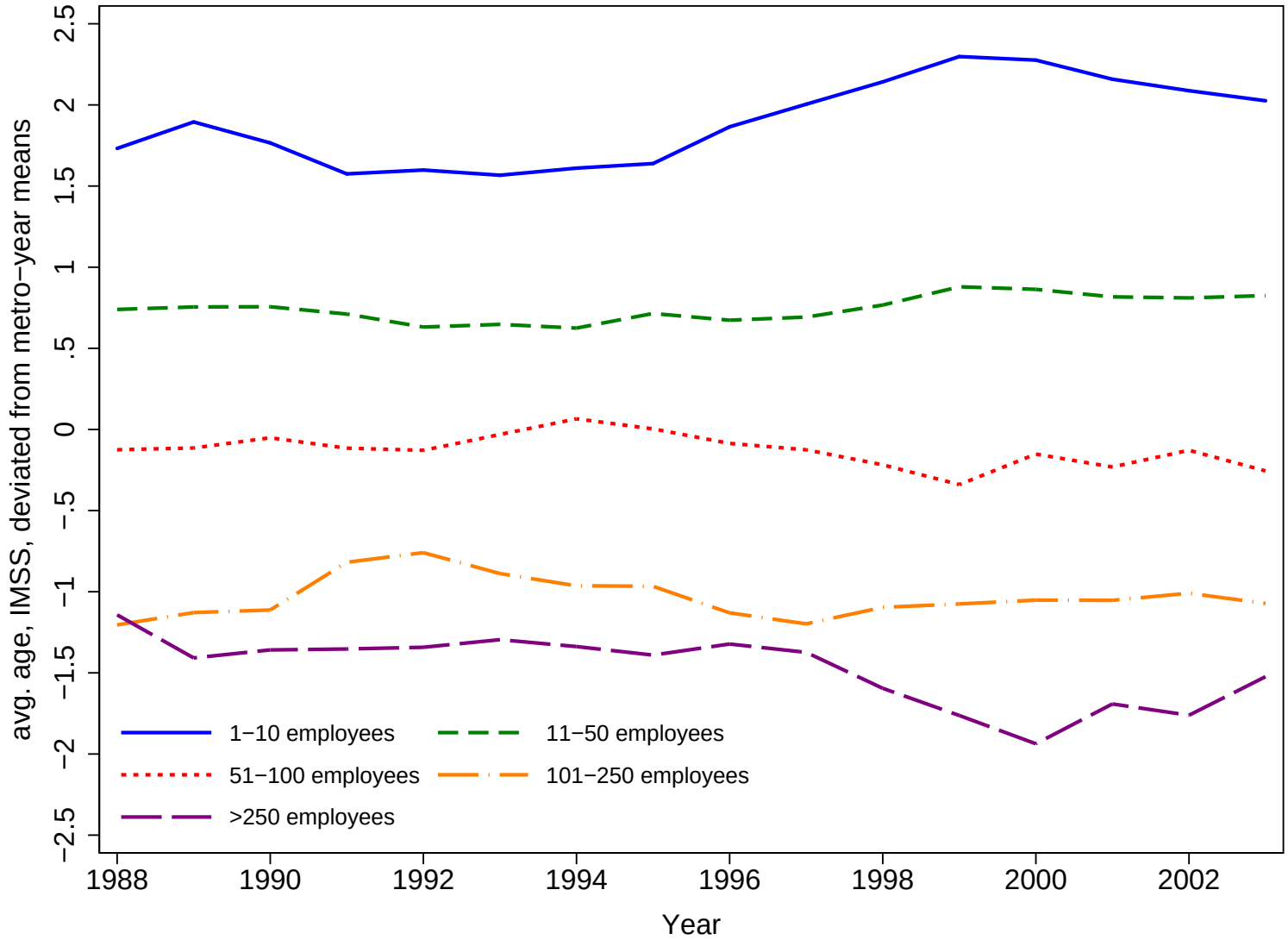
Return

Fig. B17: Average age by firm size, men



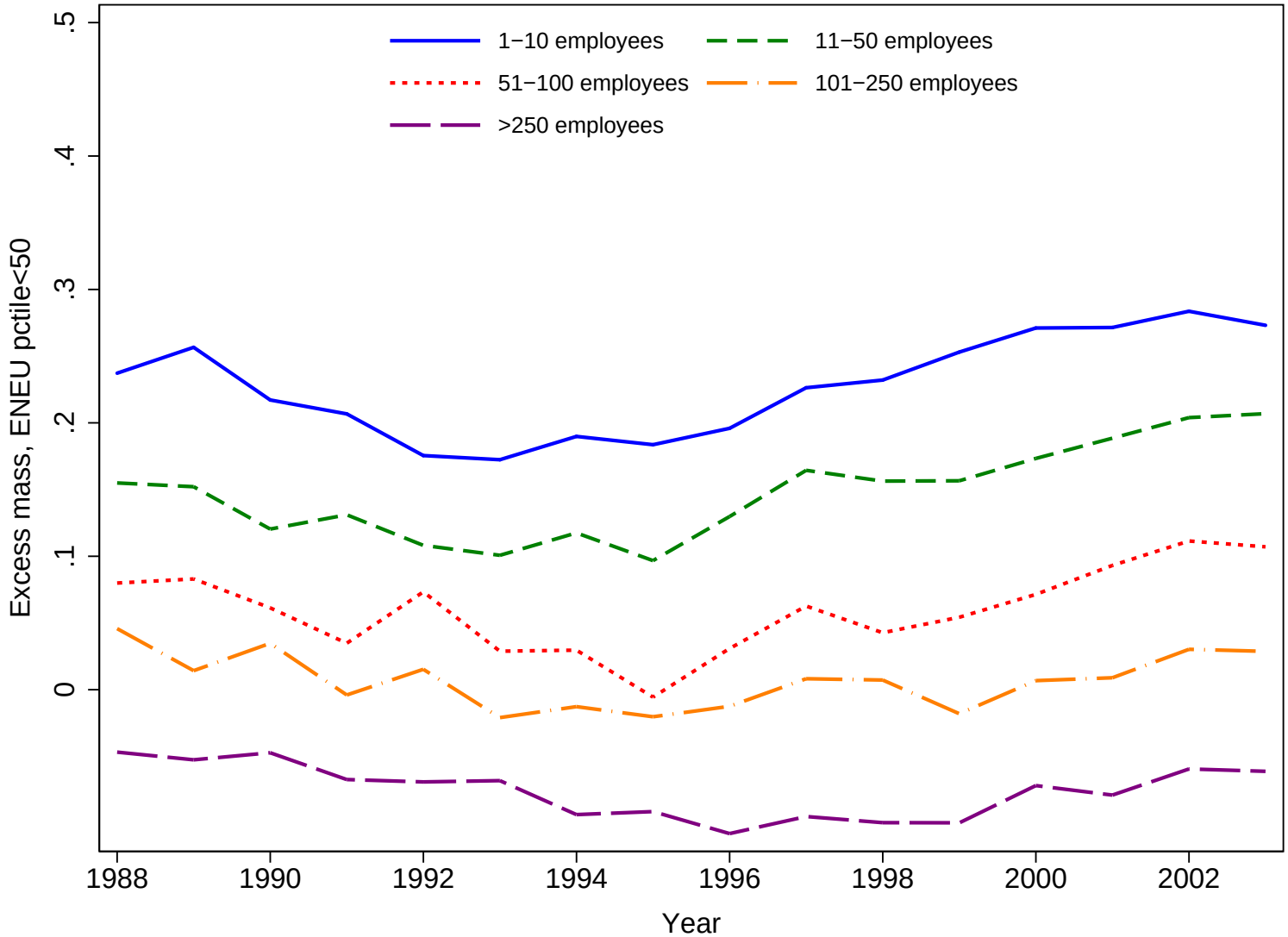
▸ Return

Fig. B18: Average age by firm size, men, deviated from metro-year means



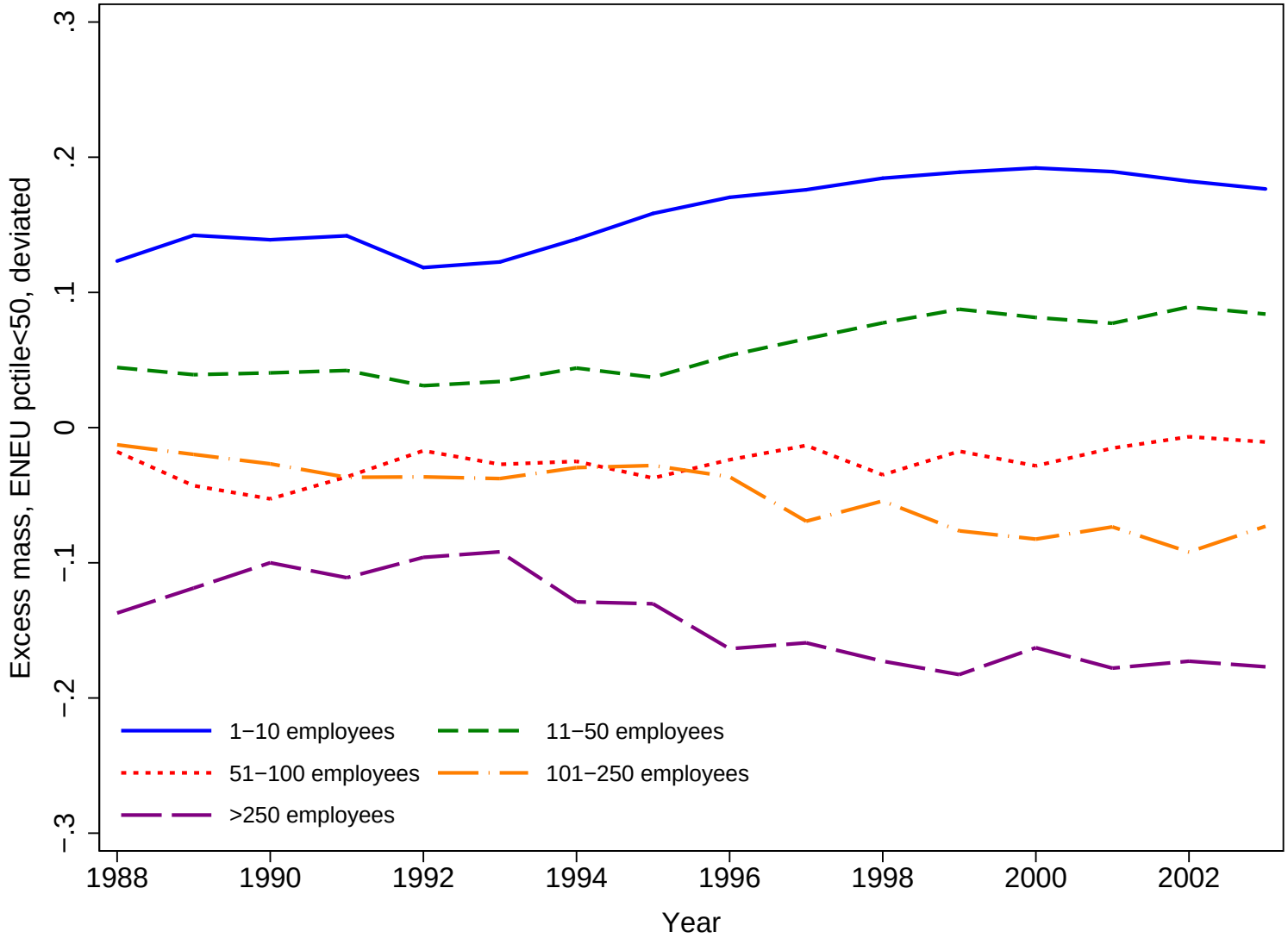
Return

Fig. B11: Excess mass (below 50th perc.) by firm size



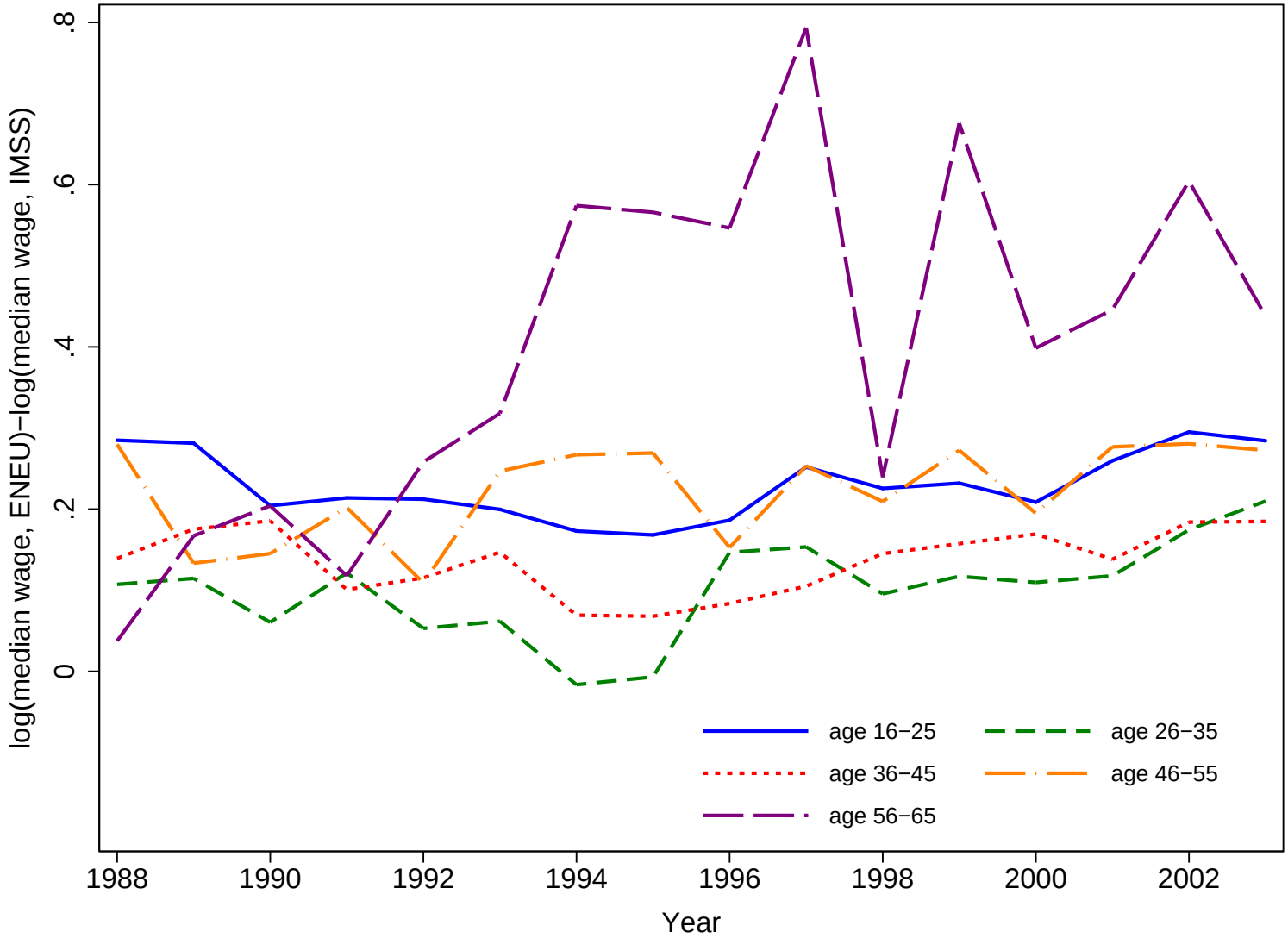
▸ Return

Fig. B12: Excess mass (below 50th perc.) by firm size, deviated



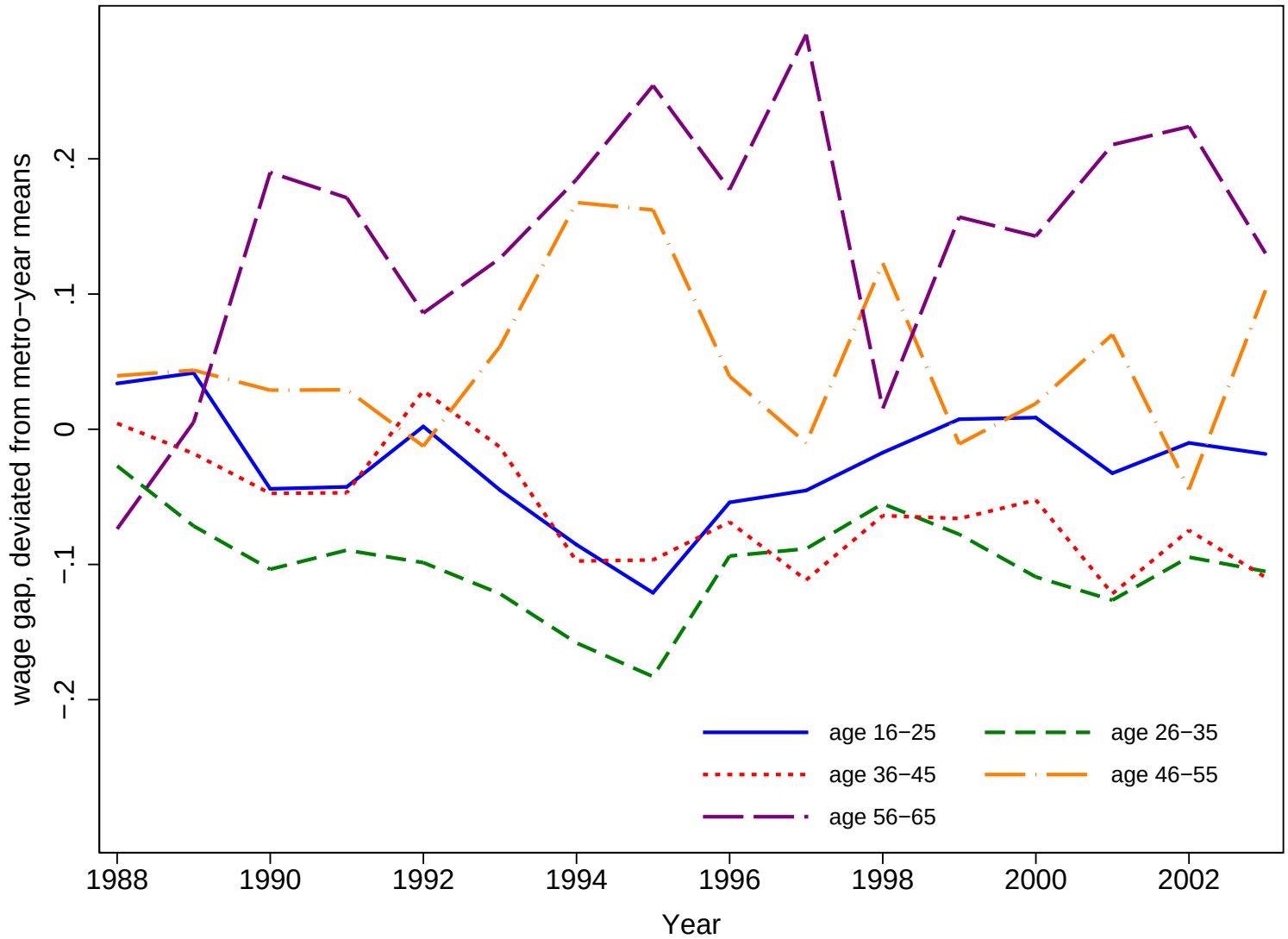
Return

Fig. ??: Wage gaps by age group, women



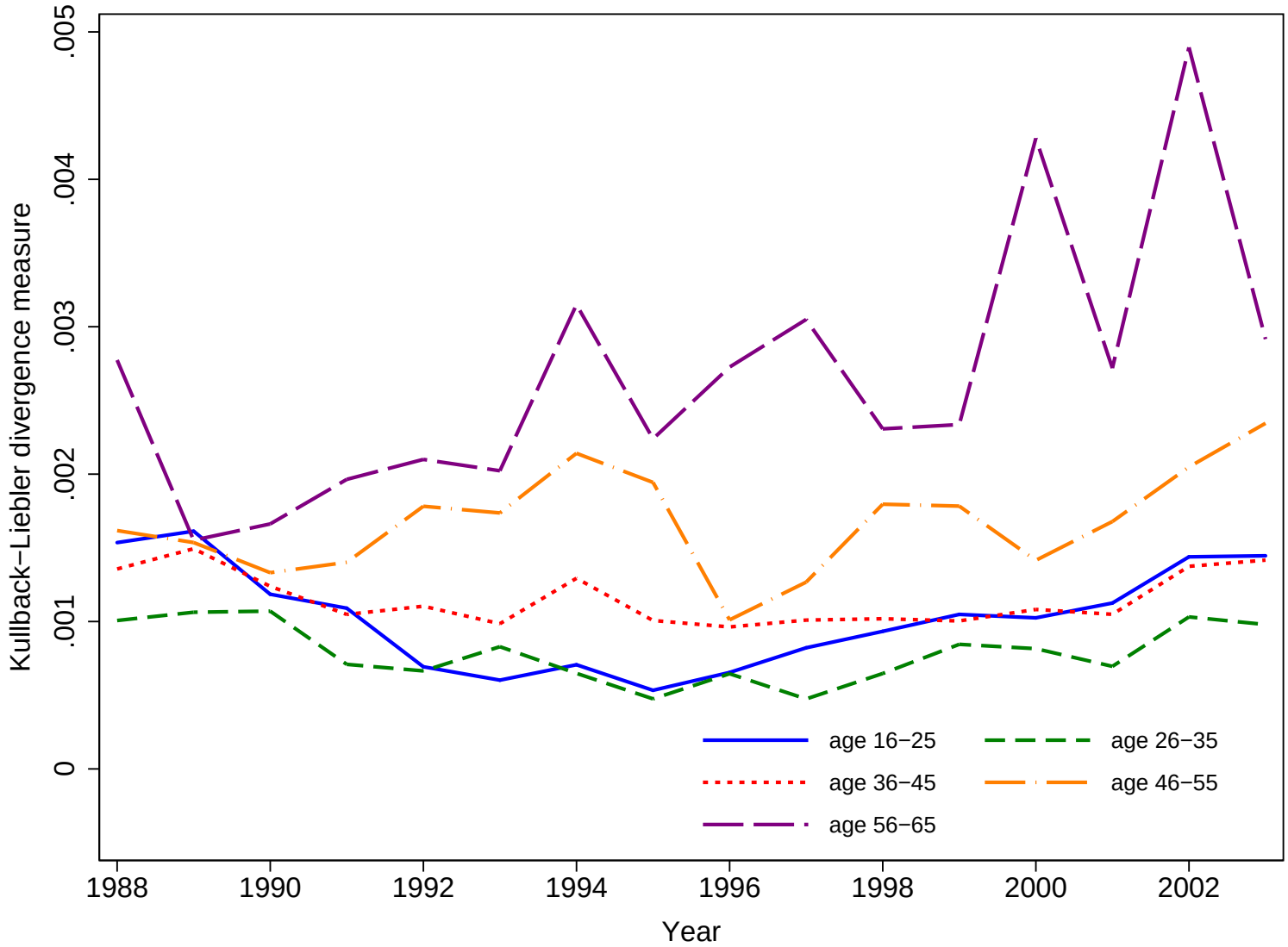
▸ Return

Fig. ??: Wage gaps by age group, women, deviated from metro-year means



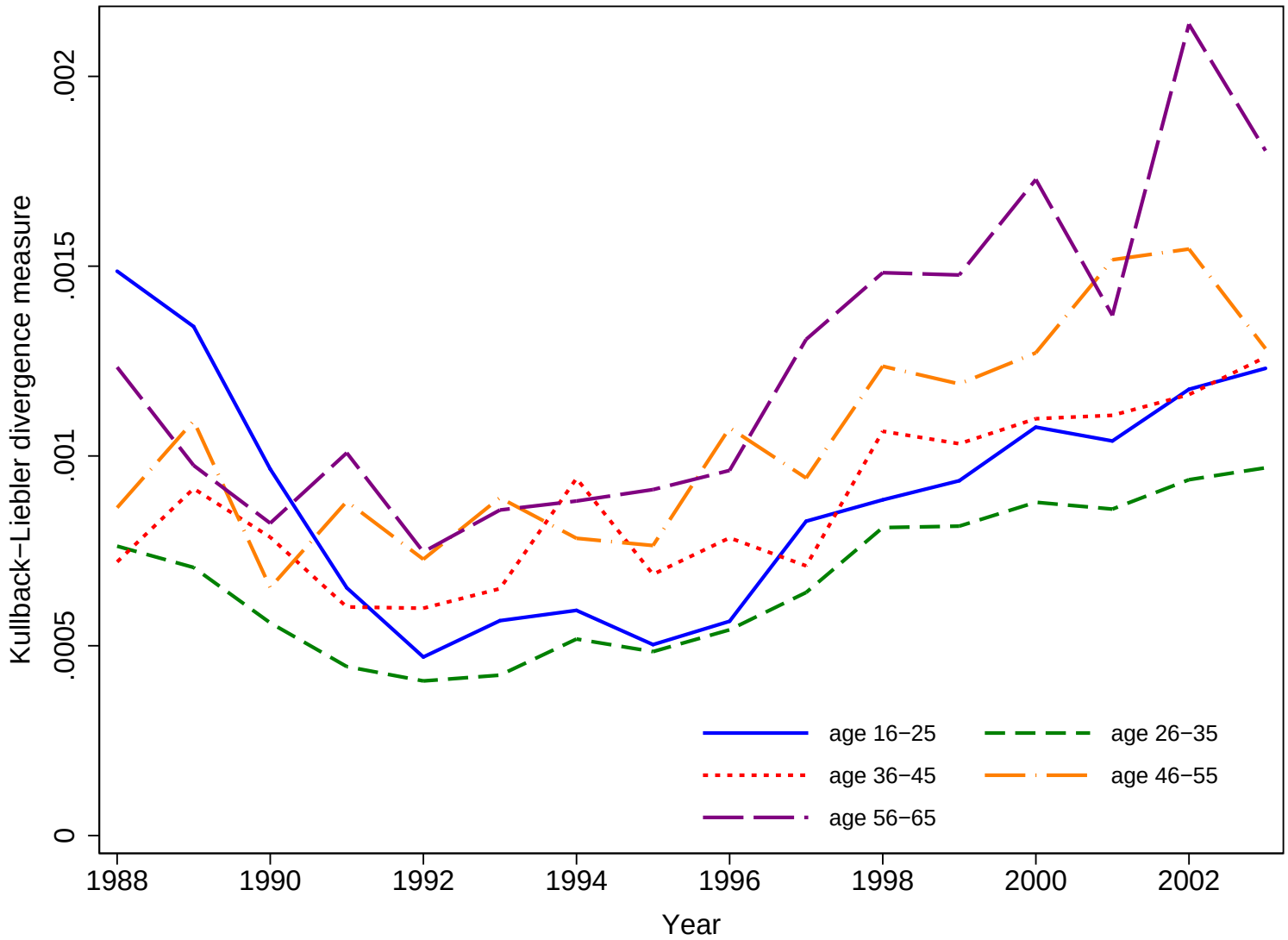
Return

Fig. ??: Kullback-Liebler divergence by age group, women



▸ Return

Fig. ??: Kullback-Liebler divergence by age group, men



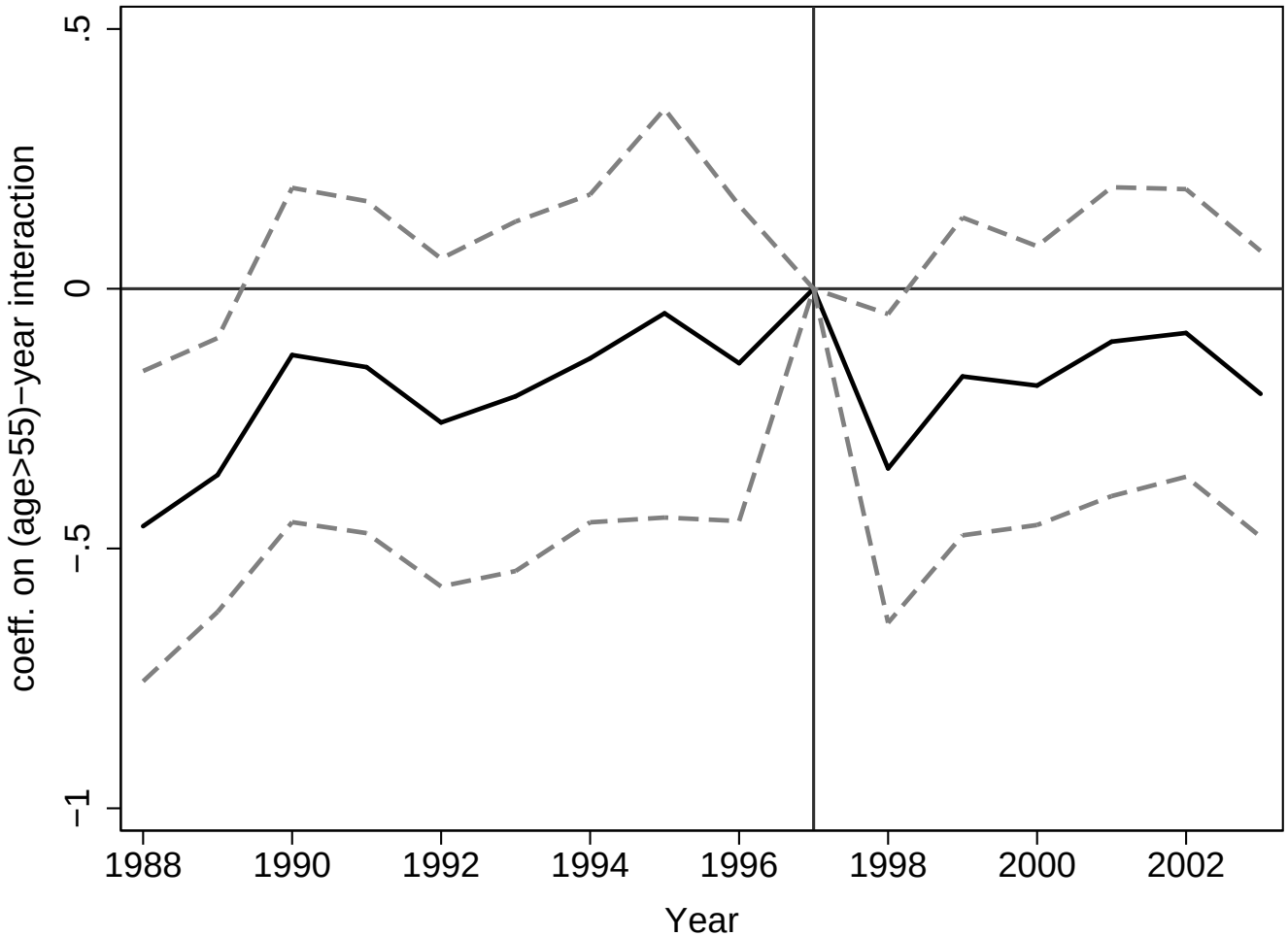
▸ Return

Table ??: Differential effects on wage gap, women

	dep. var.: log(median wage, ENEU) - log(median wage, IMSS)		
	(1)	(2)	(3)
1(age > 55)*1988	-0.477***	-0.457***	-0.457***
	(0.178)	(0.164)	(0.152)
1(age > 55)*1989	-0.362**	-0.370**	-0.358***
	(0.158)	(0.155)	(0.134)
1(age > 55)*1990	-0.147	-0.123	-0.127
	(0.191)	(0.177)	(0.164)
1(age > 55)*1991	-0.167	-0.159	-0.151
	(0.207)	(0.188)	(0.163)
1(age > 55)*1992	-0.283	-0.267	-0.257
	(0.185)	(0.180)	(0.161)
1(age > 55)*1993	-0.219	-0.211	-0.207
	(0.198)	(0.189)	(0.172)
1(age > 55)*1994	-0.180	-0.167	-0.134
	(0.182)	(0.178)	(0.161)
1(age > 55)*1995	-0.066	-0.060	-0.047
	(0.216)	(0.218)	(0.201)
1(age > 55)*1996	-0.155	-0.149	-0.143
	(0.186)	(0.175)	(0.155)
1(age > 55)*1998	-0.363**	-0.350**	-0.346**
	(0.179)	(0.165)	(0.152)
1(age > 55)*1999	-0.185	-0.177	-0.169
	(0.185)	(0.174)	(0.156)
1(age > 55)*2000	-0.197	-0.185	-0.186
	(0.176)	(0.159)	(0.137)
1(age > 55)*2001	-0.114	-0.108	-0.102
	(0.186)	(0.174)	(0.152)
1(age > 55)*2002	-0.097	-0.091	-0.085
	(0.173)	(0.161)	(0.141)
1(age > 55)*2003	-0.214	-0.208	-0.202
	(0.163)	(0.156)	(0.140)
metro area effects	N	Y	
year effects	Y	Y	
metro-year effects	N	N	Y
age category effects	Y	Y	Y
R-squared	0.14	0.34	0.50
N	1258	1258	1258

Return

Fig. ??: Coeffs. on age*year interaction (Table 4 Col 3)



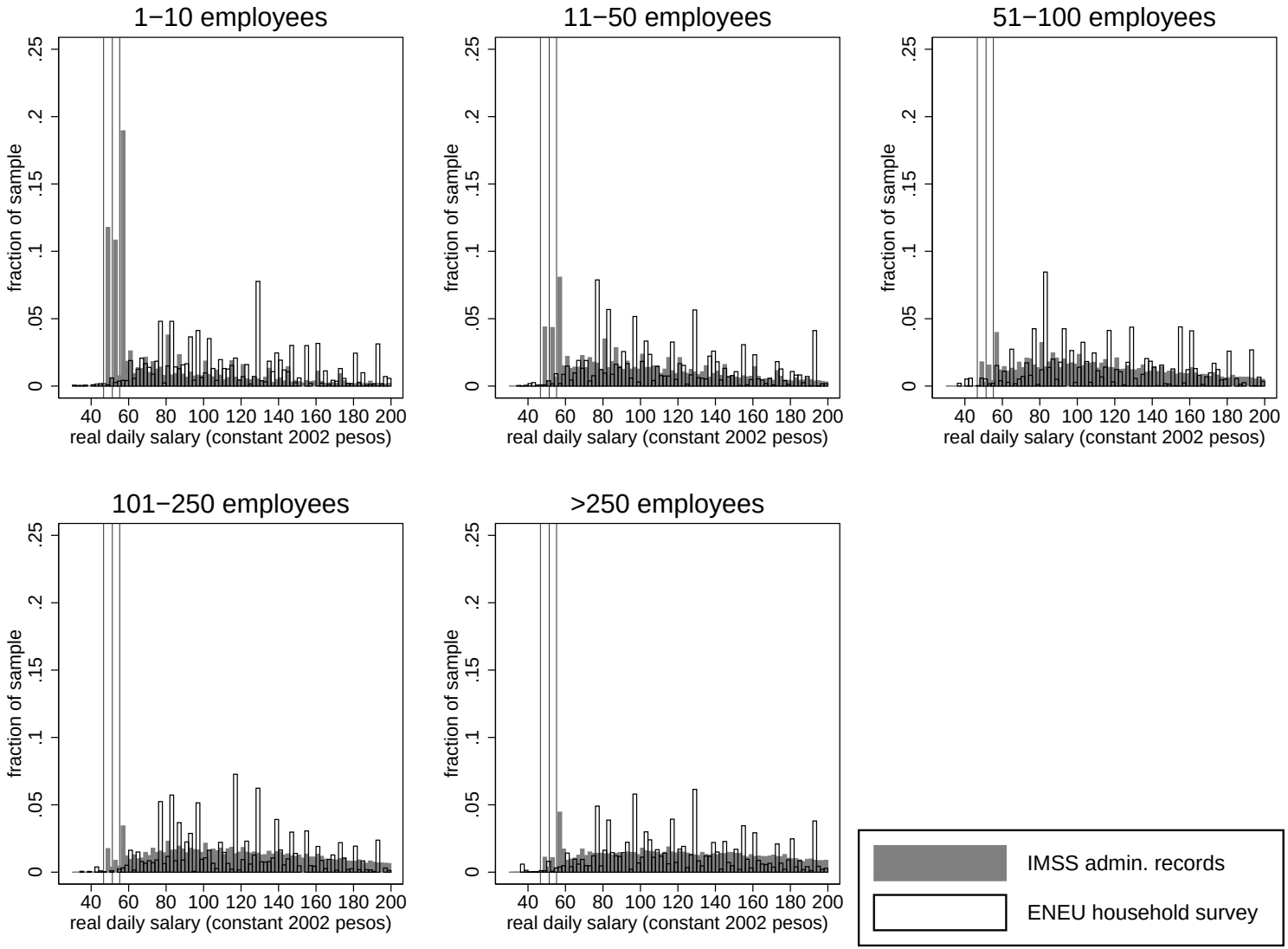
▸ Return

Table ??: Differential effects on employment gap, women

	dep. var.: log(employment, IMSS) - log(employment, ENEU)		
	(1)	(2)	(3)
1(age > 55)*1988	-0.141	-0.176	-0.185
	(0.252)	(0.237)	(0.229)
1(age > 55)*1989	0.161	0.153	0.186
	(0.234)	(0.222)	(0.194)
1(age > 55)*1990	0.139	0.129	0.153
	(0.238)	(0.219)	(0.199)
1(age > 55)*1991	0.246	0.243	0.244
	(0.220)	(0.215)	(0.201)
1(age > 55)*1992	-0.172	-0.174	-0.174
	(0.265)	(0.259)	(0.236)
1(age > 55)*1993	0.156	0.169	0.165
	(0.234)	(0.230)	(0.222)
1(age > 55)*1994	0.029	0.019	-0.014
	(0.260)	(0.244)	(0.232)
1(age > 55)*1995	-0.331	-0.321	-0.314
	(0.285)	(0.271)	(0.255)
1(age > 55)*1996	-0.095	-0.093	-0.091
	(0.240)	(0.222)	(0.207)
1(age > 55)*1998	-0.133	-0.115	-0.116
	(0.203)	(0.191)	(0.183)
1(age > 55)*1999	-0.286	-0.295	-0.289
	(0.255)	(0.239)	(0.220)
1(age > 55)*2000	-0.153	-0.163	-0.153
	(0.257)	(0.238)	(0.221)
1(age > 55)*2001	0.144	0.146	0.148
	(0.225)	(0.211)	(0.201)
1(age > 55)*2002	-0.013	-0.011	-0.009
	(0.300)	(0.286)	(0.260)
1(age > 55)*2003	-0.275	-0.272	-0.271
	(0.245)	(0.245)	(0.223)
metro area effects	N	Y	
year effects	Y	Y	
metro-year effects	N	N	Y
age category effects	Y	Y	Y
R-squared	0.23	0.32	0.46
N	1258	1258	1258

Return

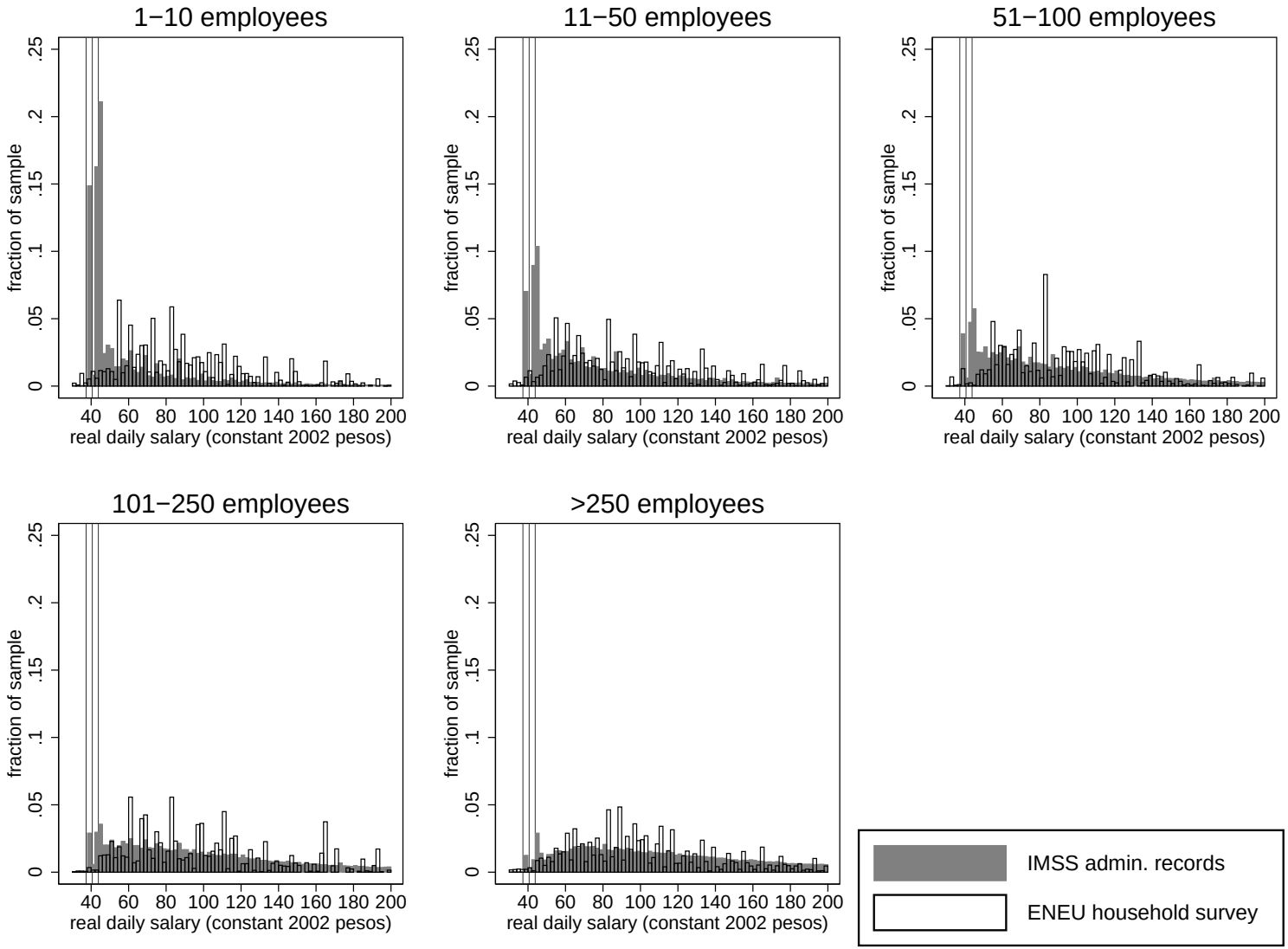
Wage histograms, men, 1993, by firm size



Notes: Bins are 2 pesos wide. Average 2002 exchange rate: 9.66 pesos/dollar.

▸ Return

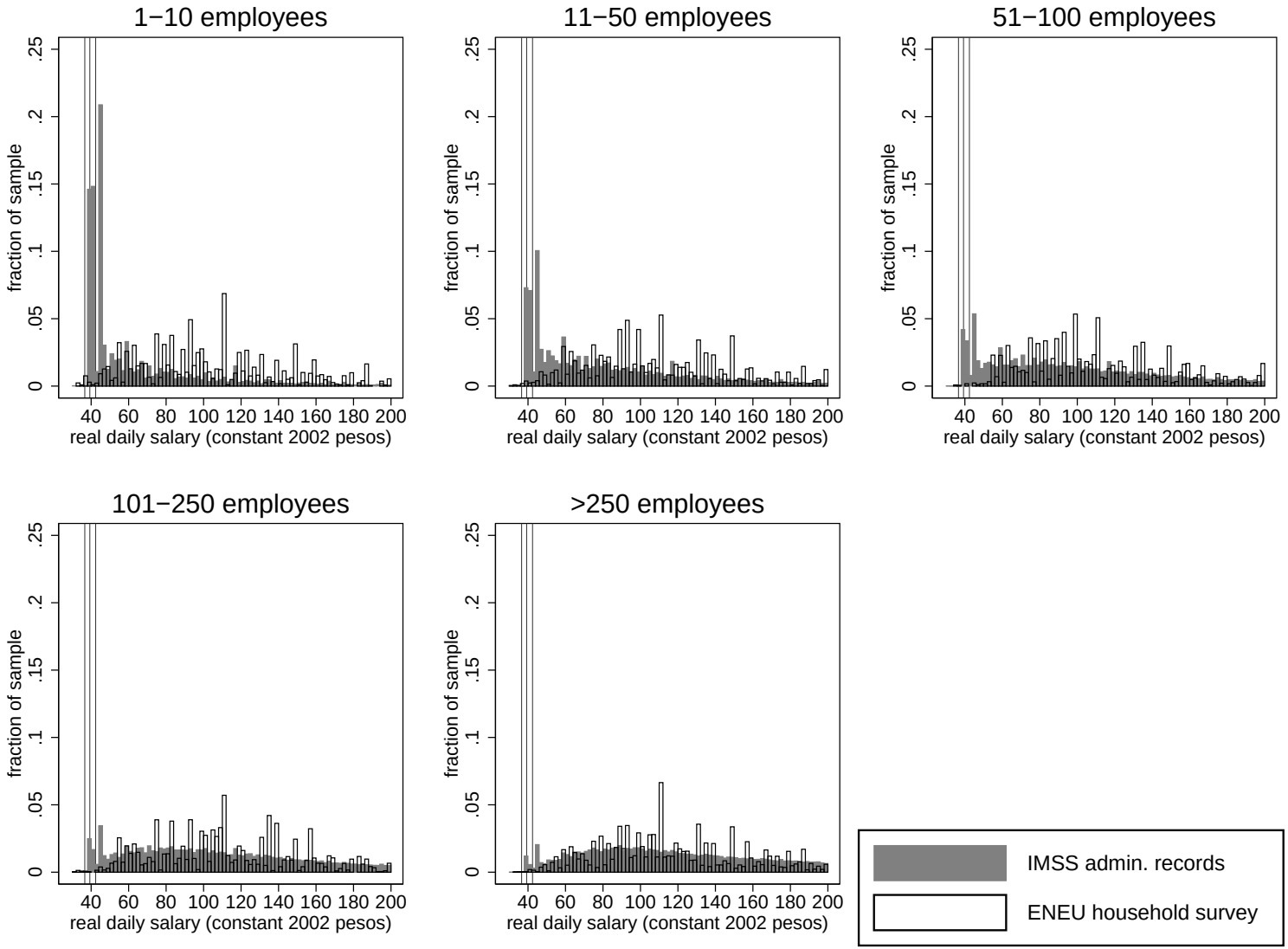
Wage histograms, men, 1997, by firm size



Notes: Bins are 2 pesos wide. Average 2002 exchange rate: 9.66 pesos/dollar.

▸ Return

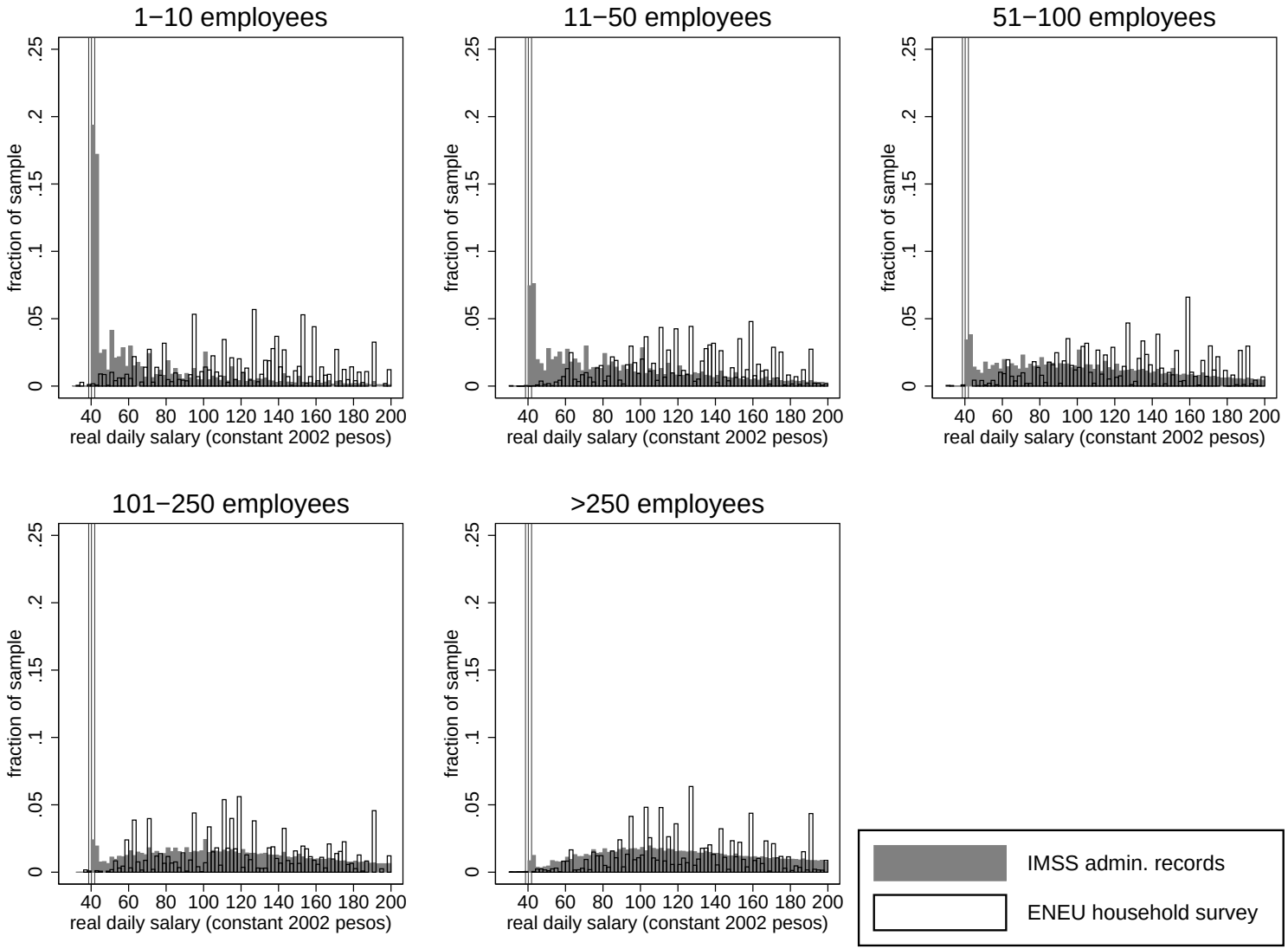
Wage histograms, men, 2000, by firm size



Notes: Bins are 2 pesos wide. Average 2002 exchange rate: 9.66 pesos/dollar.

▸ Return

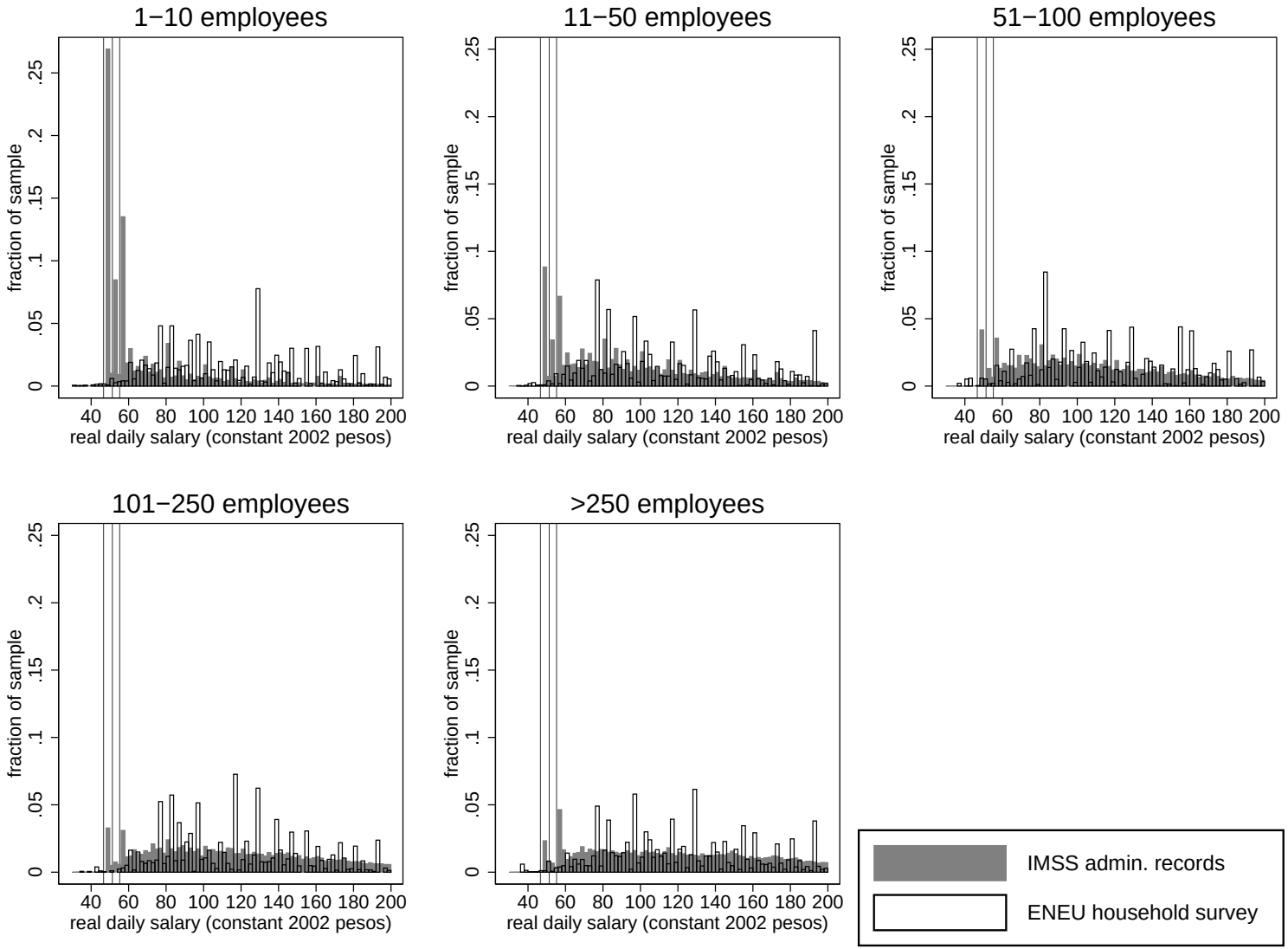
Wage histograms, men, 2003, by firm size



Notes: Bins are 2 pesos wide. Average 2002 exchange rate: 9.66 pesos/dollar.

▸ Return

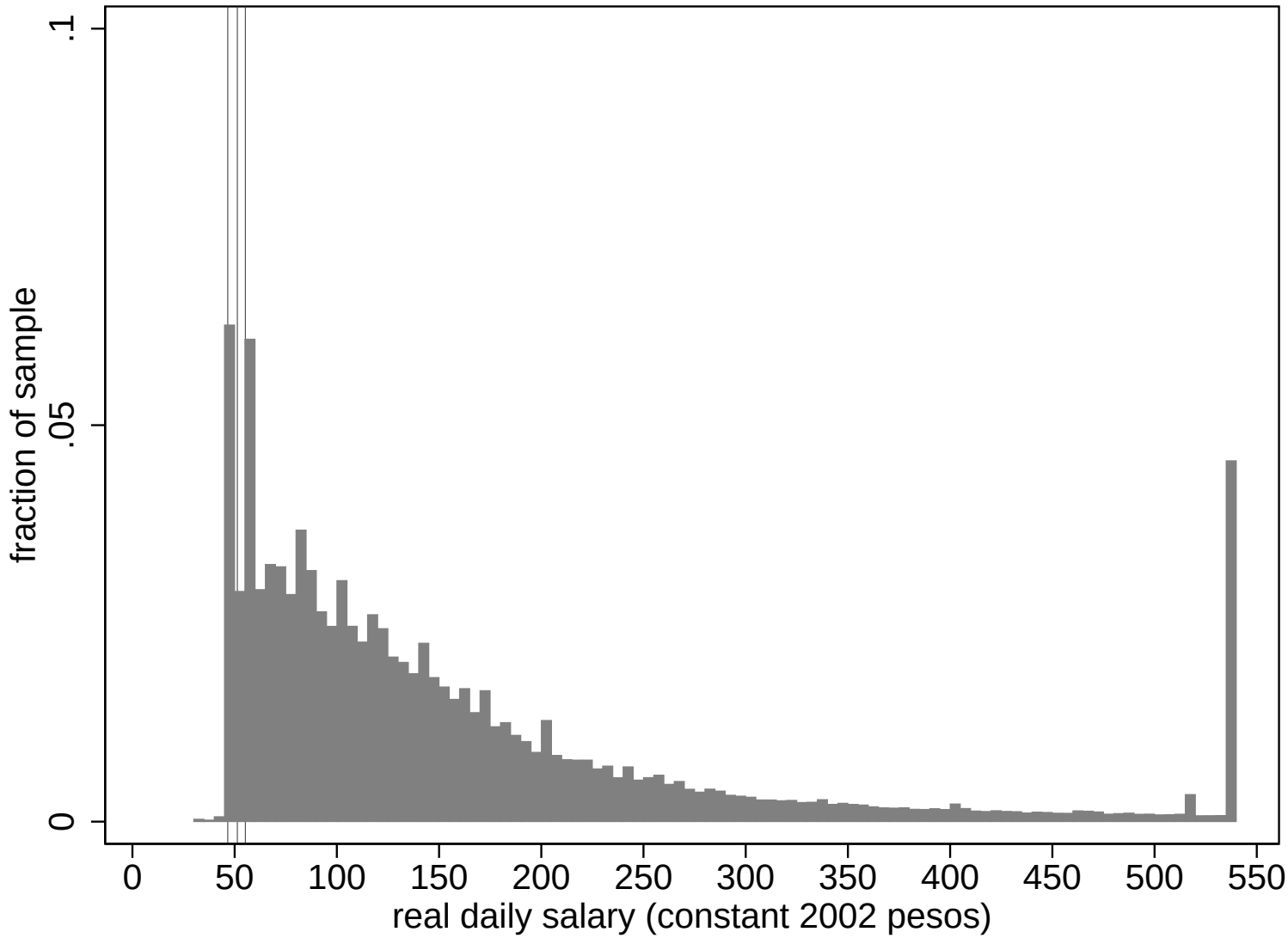
Wage histograms, men, 1993, by firm size, non-EIA plants



Notes: Bins are 2 pesos wide. Average 2002 exchange rate: 9.66 pesos/dollar.

▸ Return

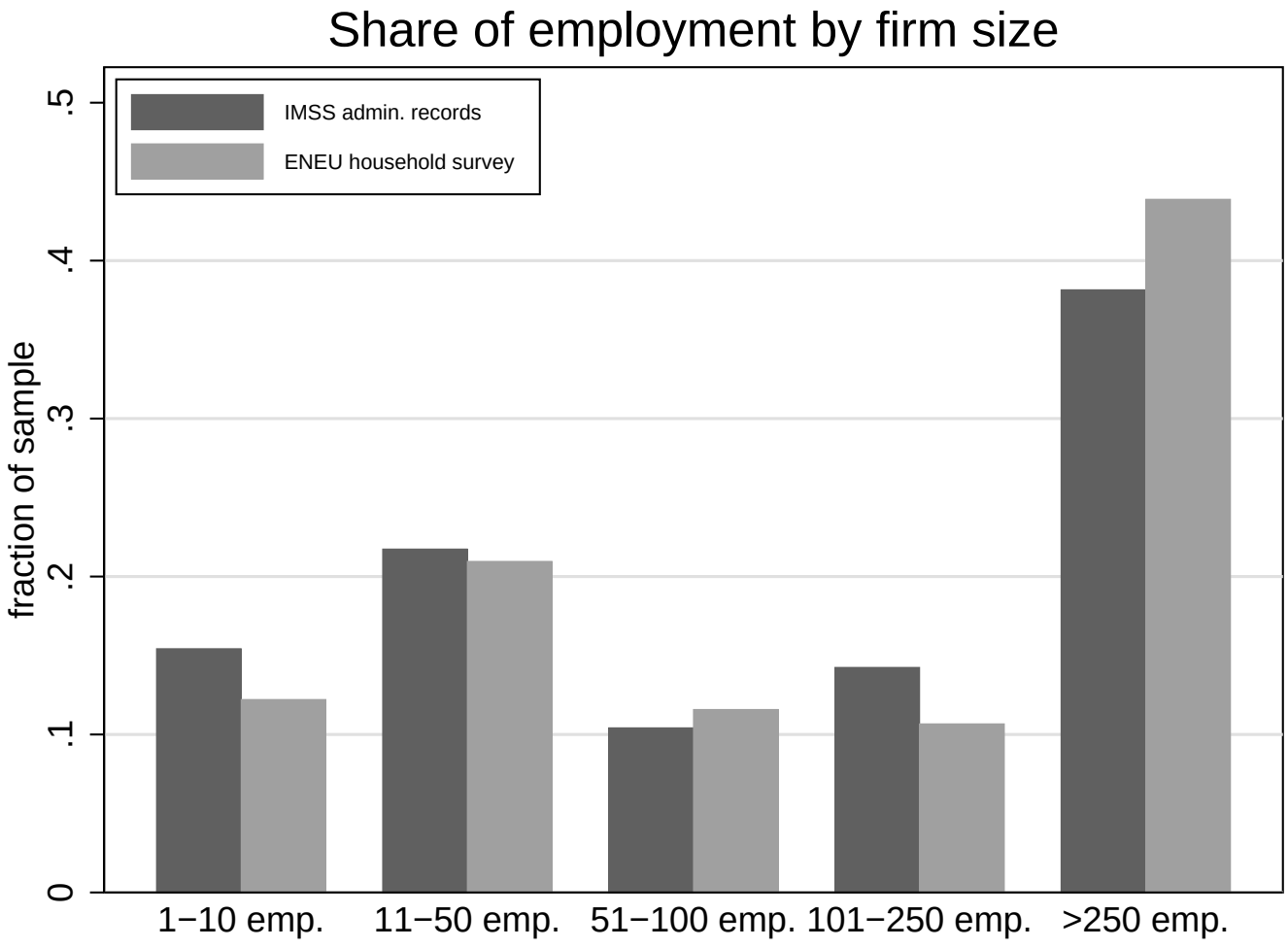
Wage histogram, men, 1993, non-EIA plants



Notes: Bins are 2 pesos wide. Average 2002 exchange rate: 9.66 pesos/dollar.

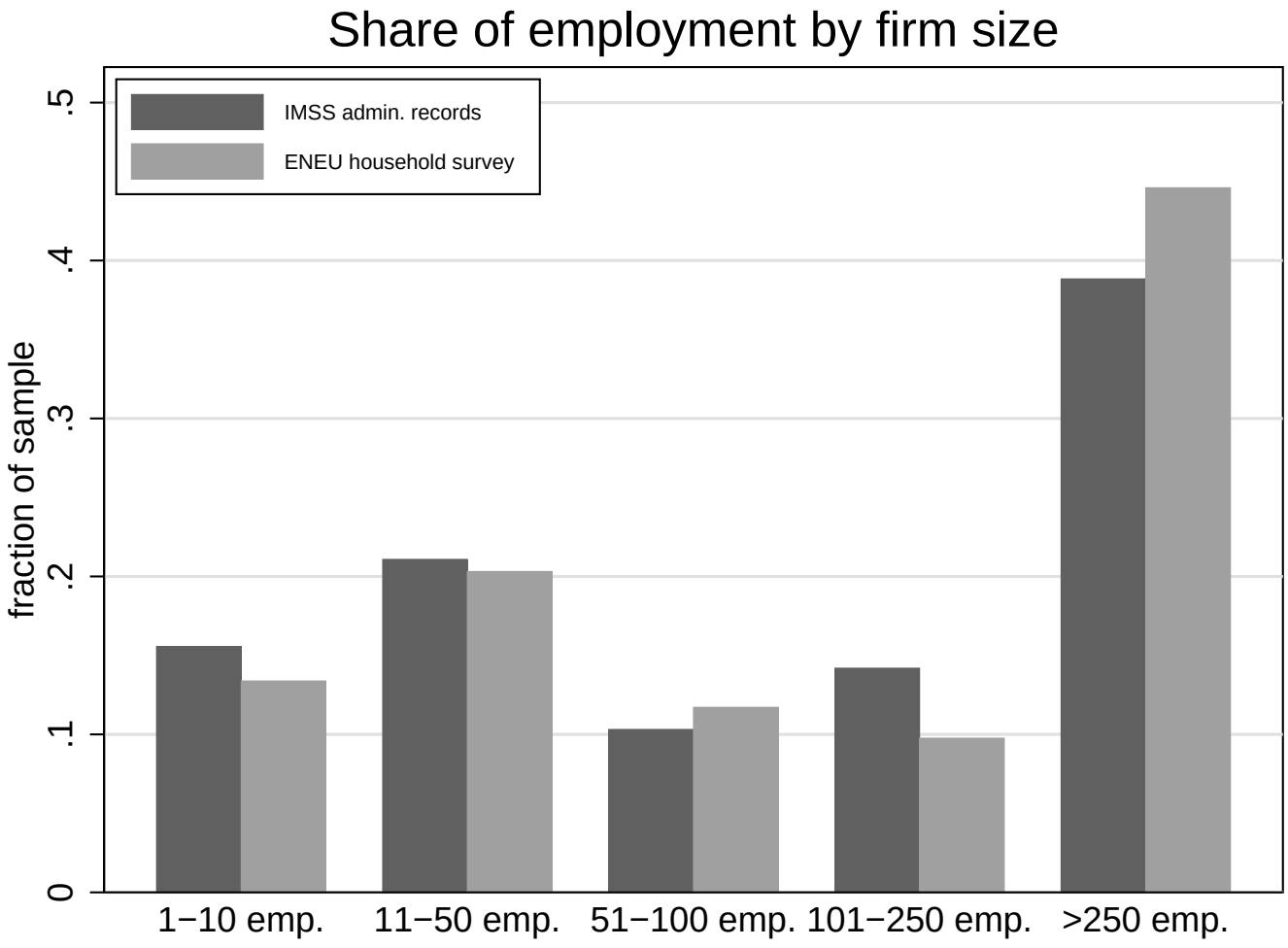
▸ Return

Firm size distributions, IMSS vs. ENEU, 1990

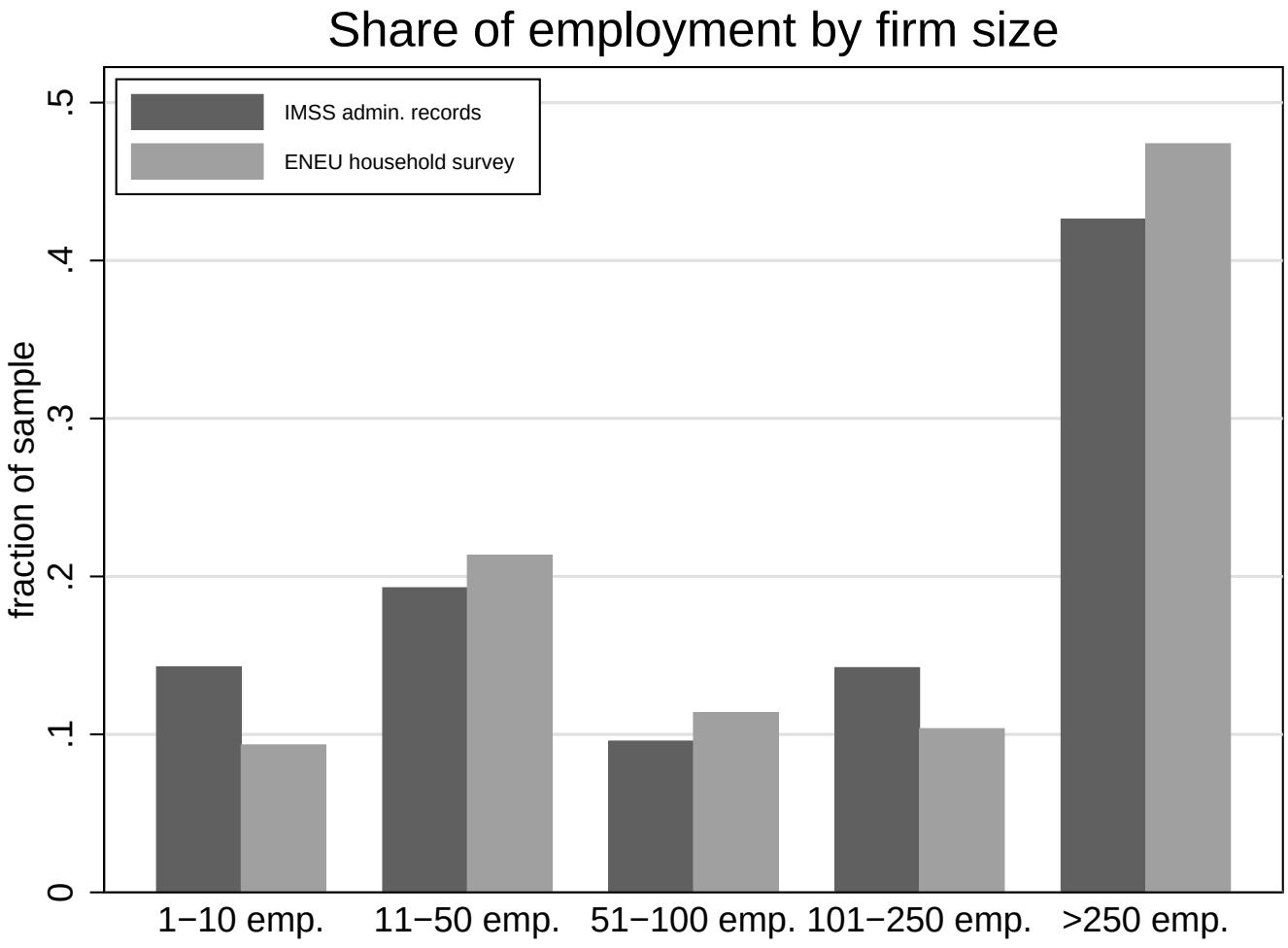


▸ Return

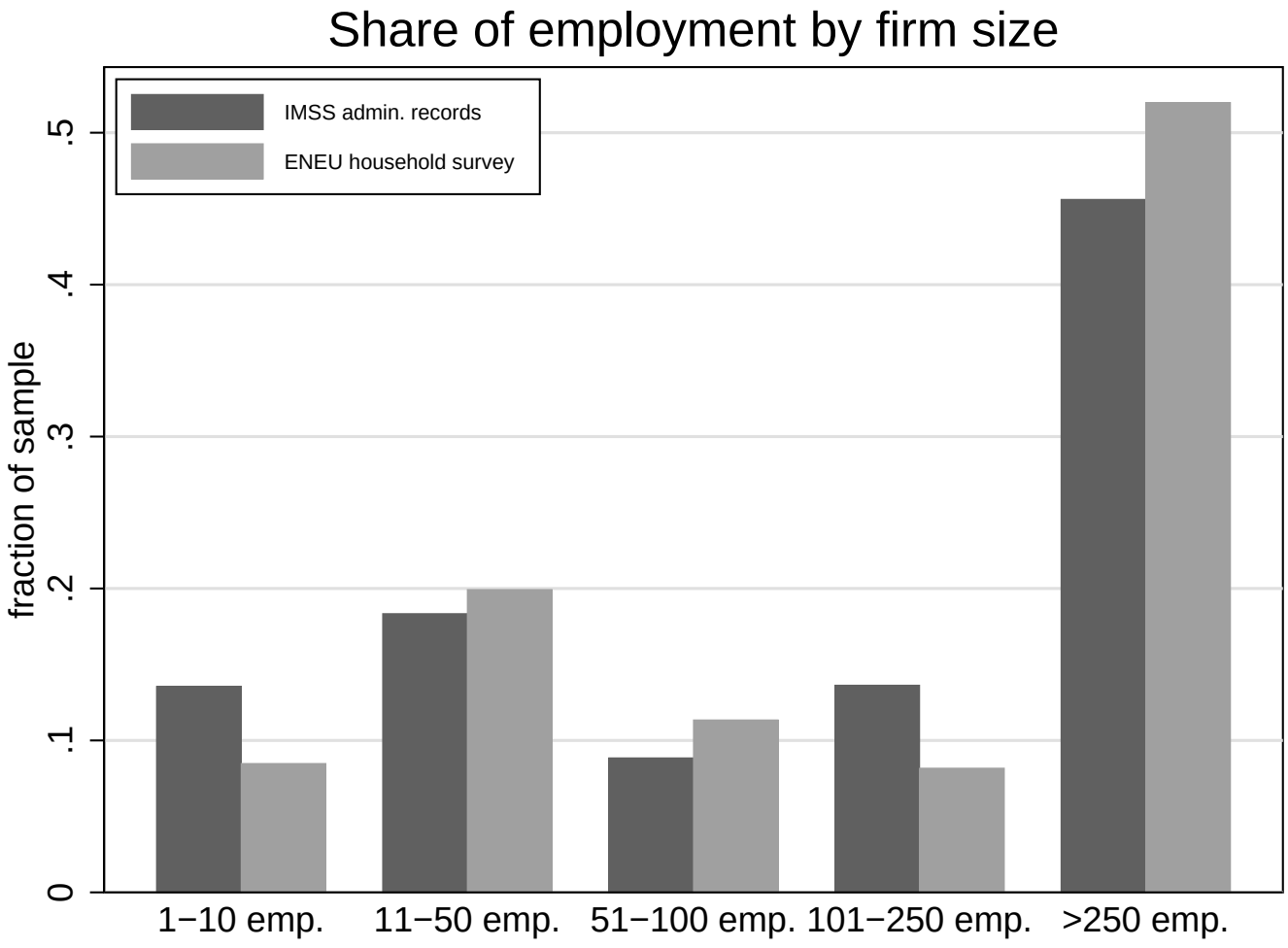
Firm size distributions, IMSS vs. ENEU, 1993



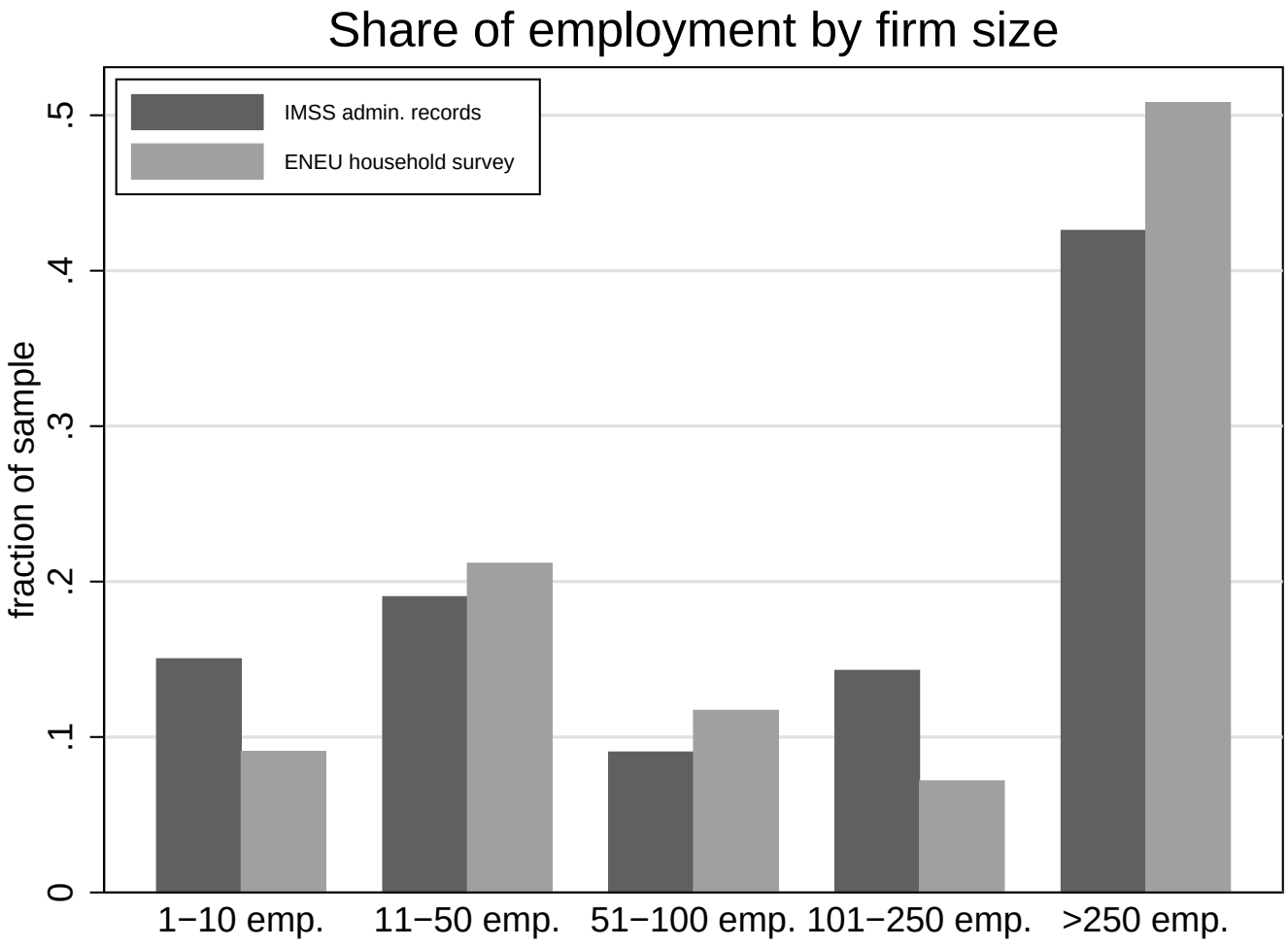
Firm size distributions, IMSS vs. ENEU, 1997



Firm size distributions, IMSS vs. ENEU, 2000

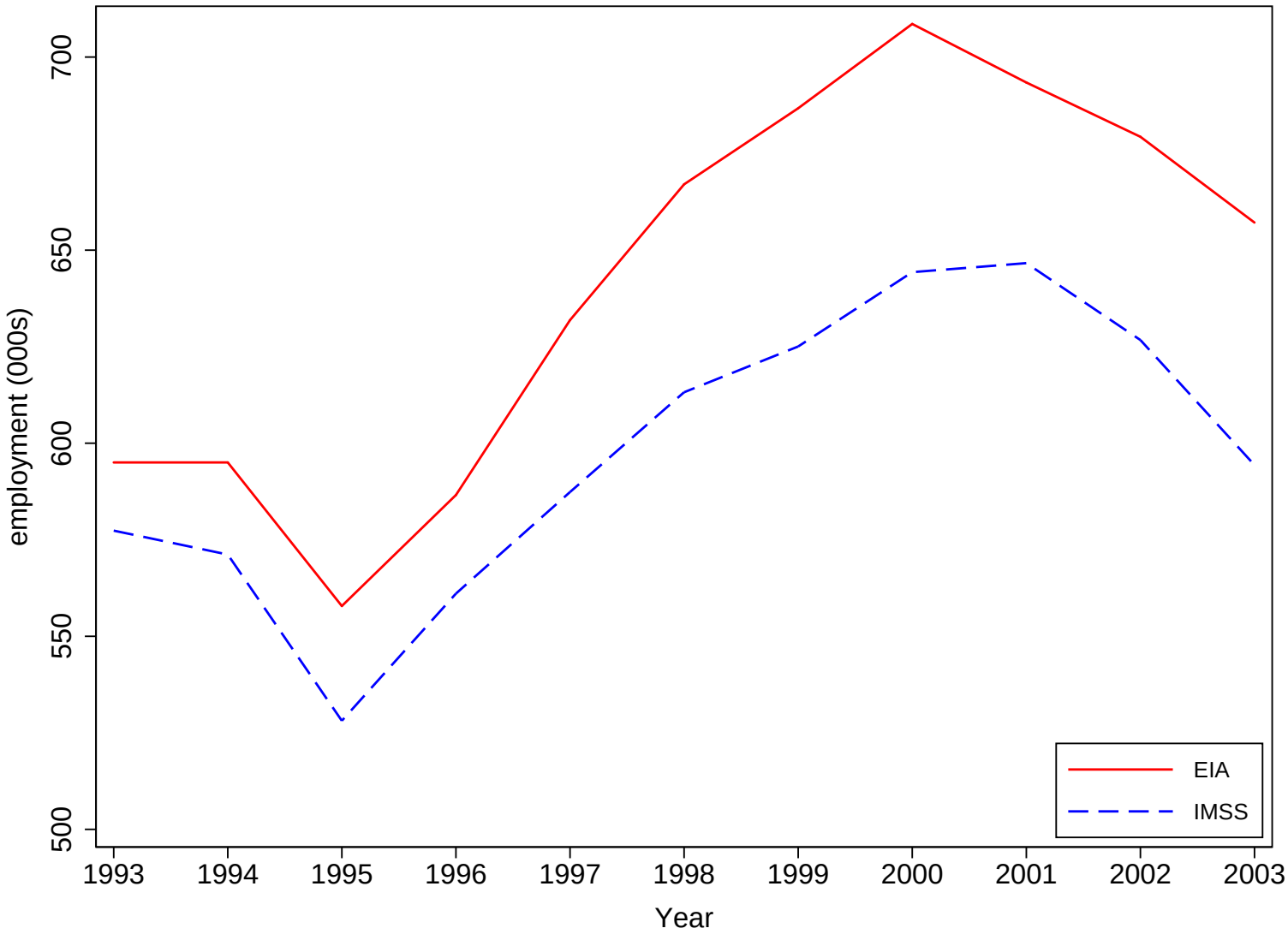


Firm size distributions, IMSS vs. ENEU, 2003

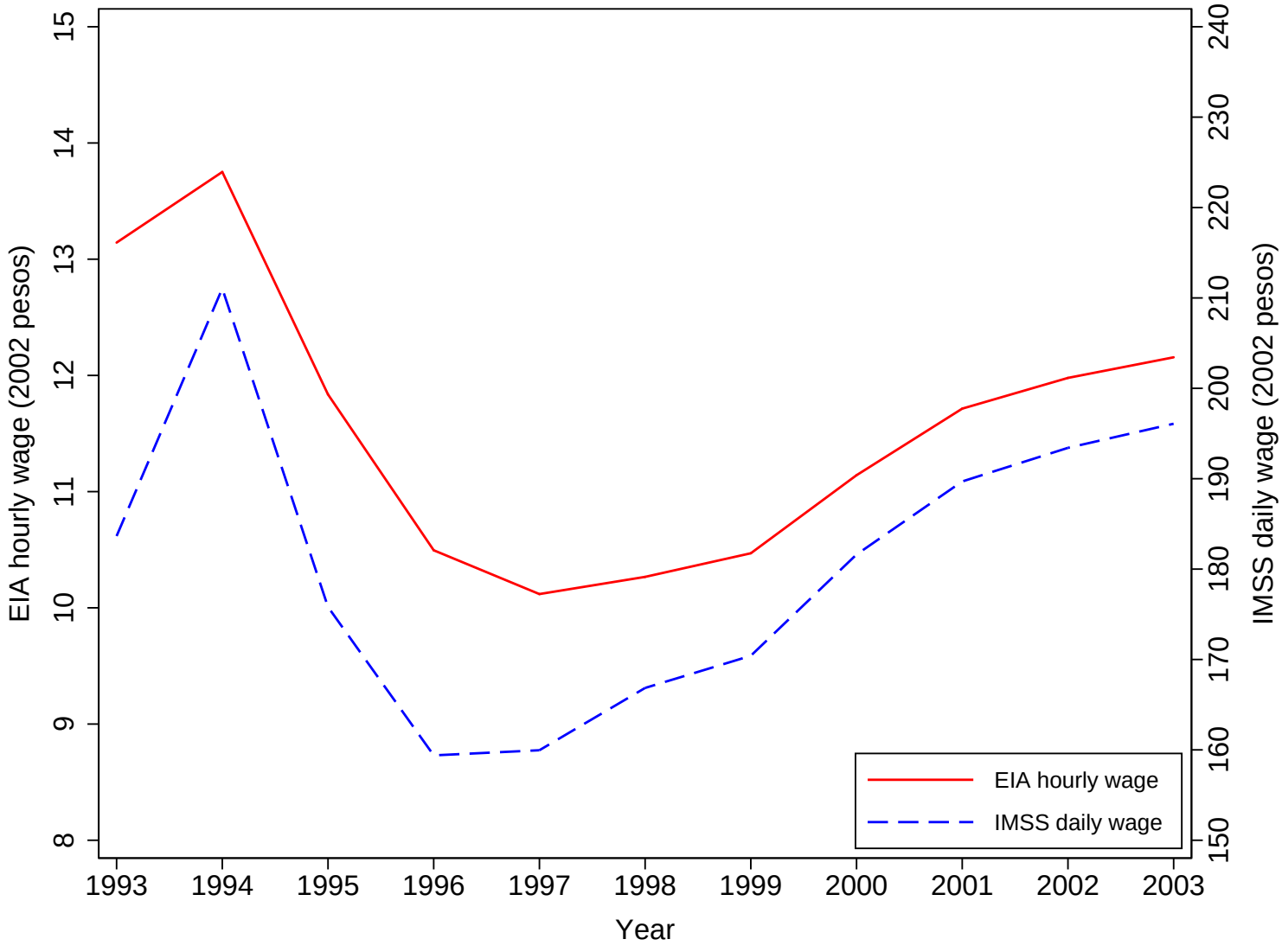


▸ Return

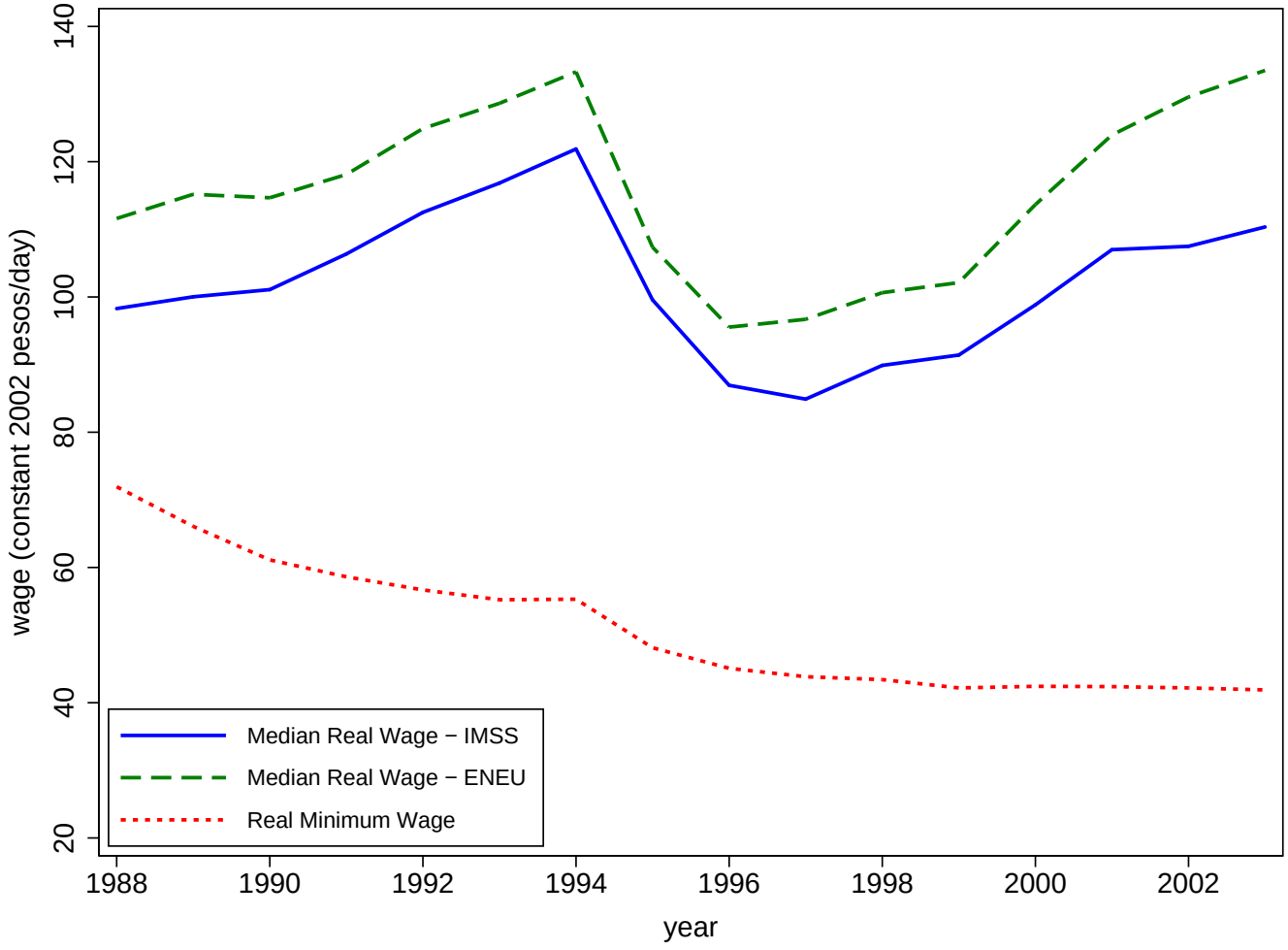
Employment, IMSS vs. EIA



Wages, IMSS vs. EIA

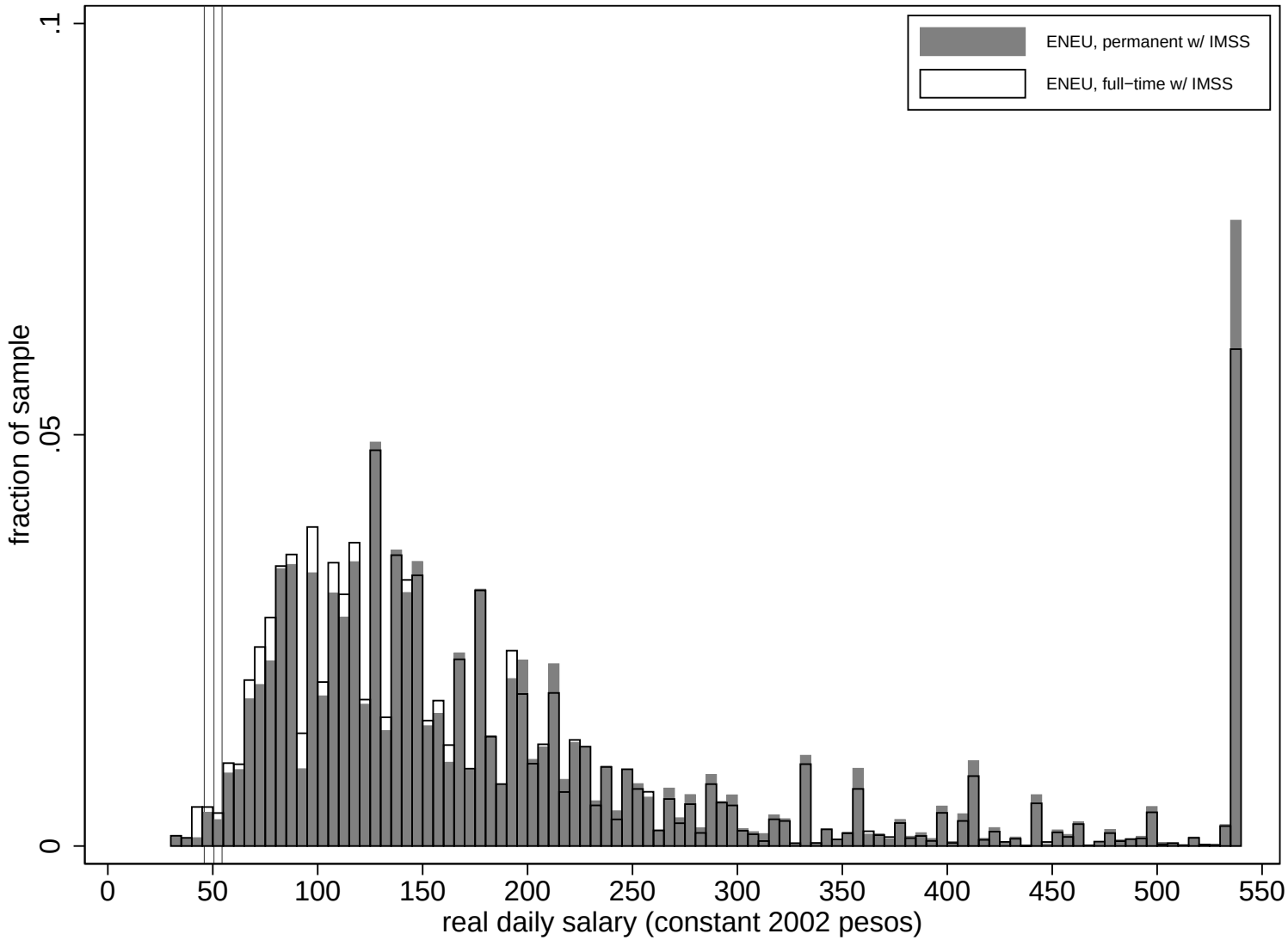


Mean, median, minimum wages

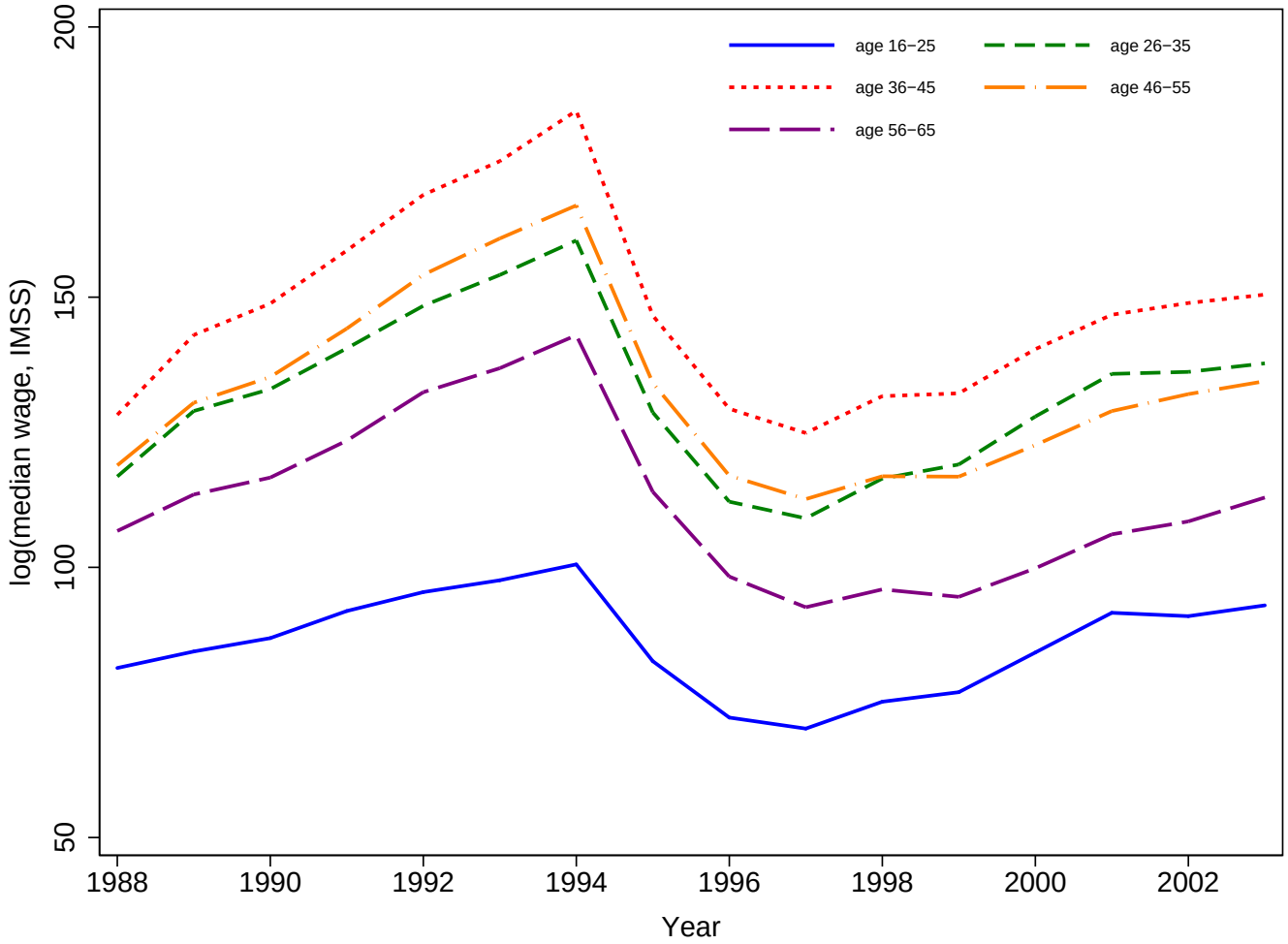


▸ Return

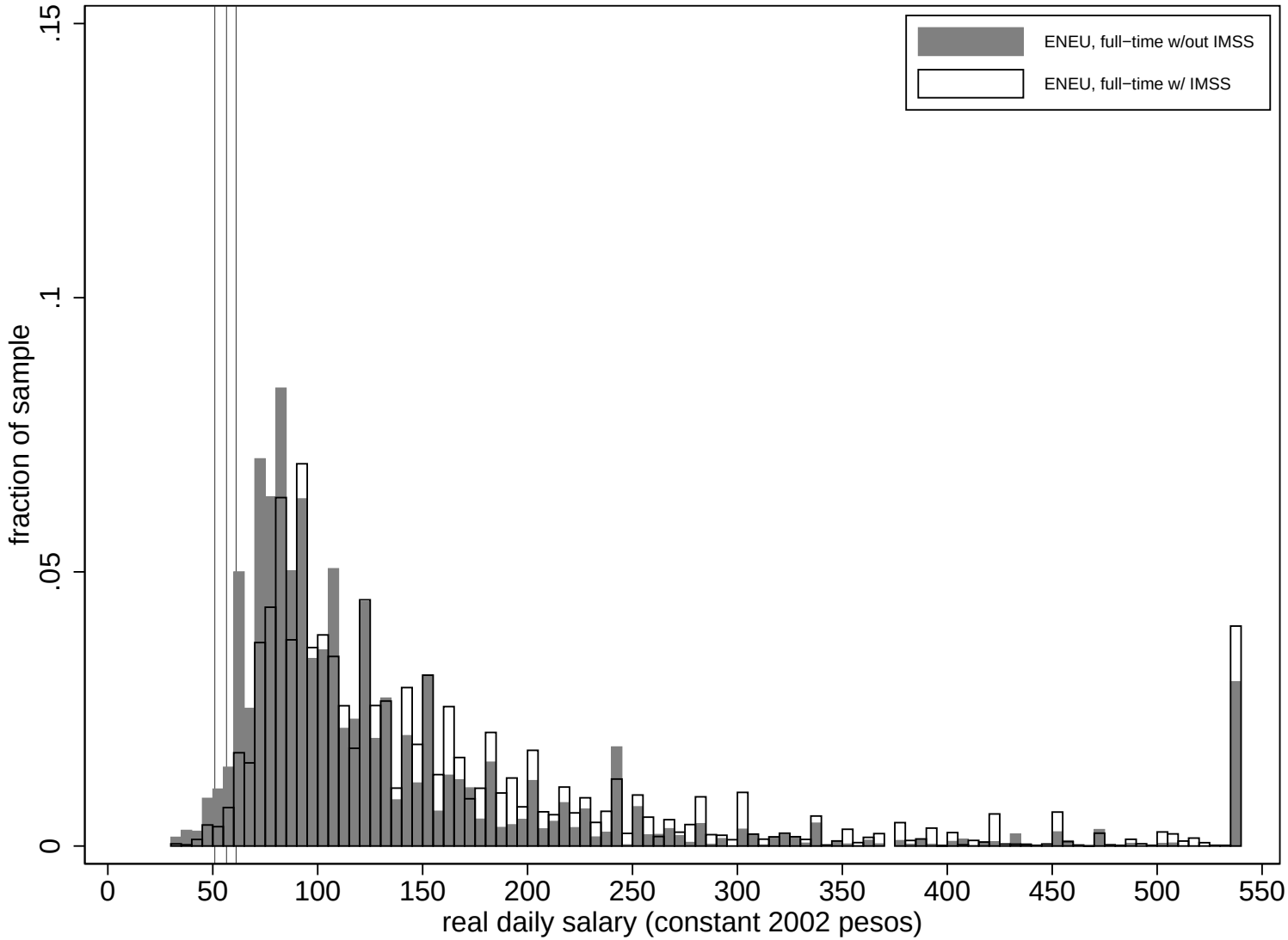
ENEU wage distributions, full-time vs. permanent w/ IMSS, men, 1994



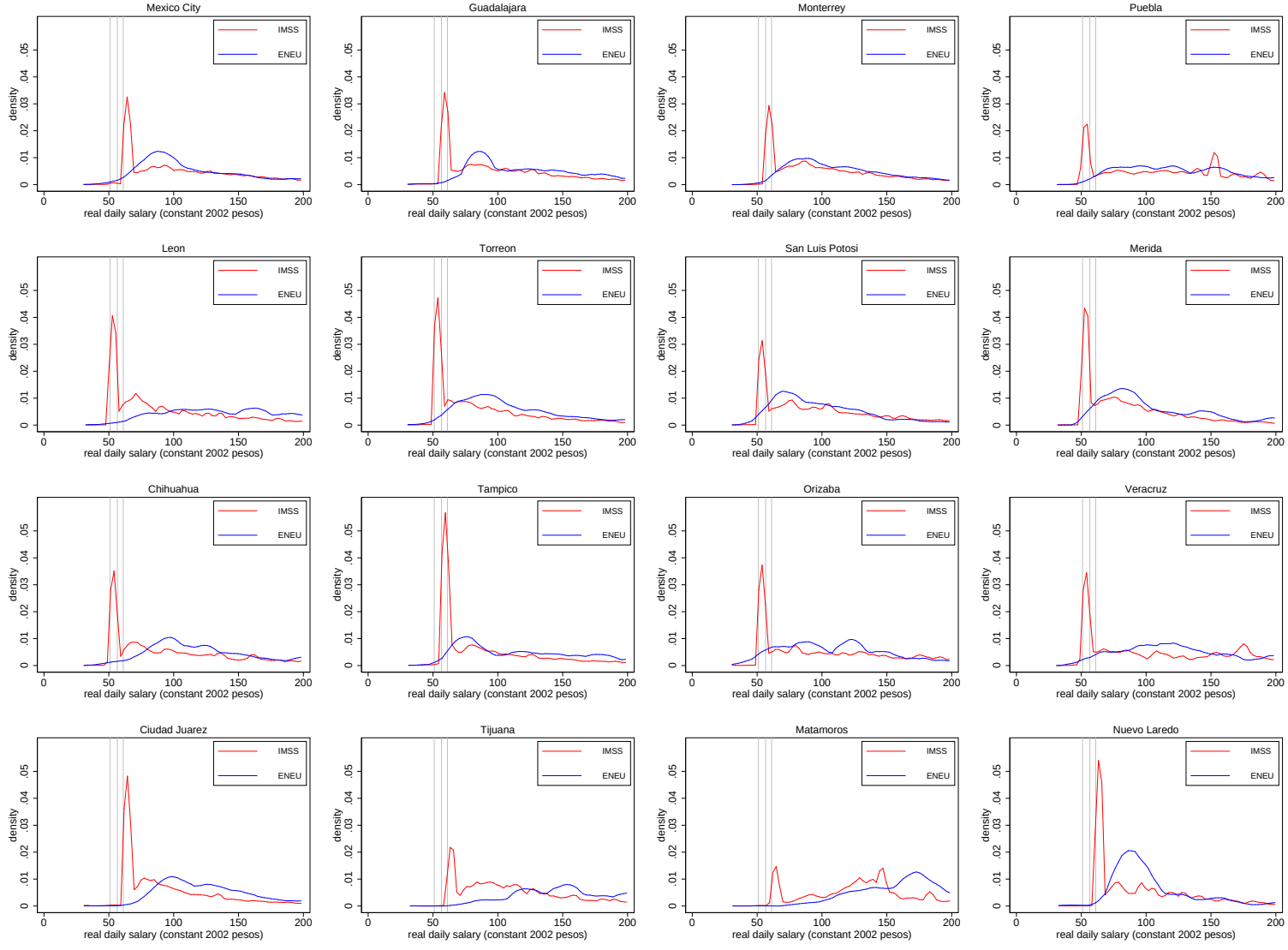
Log median daily wages, men, IMSS data, by age group



Wage histograms, covered vs. not covered by IMSS, men, 1990



Wage distributions, by metro area, men, 1990



Wage gaps (in means) by age group, men

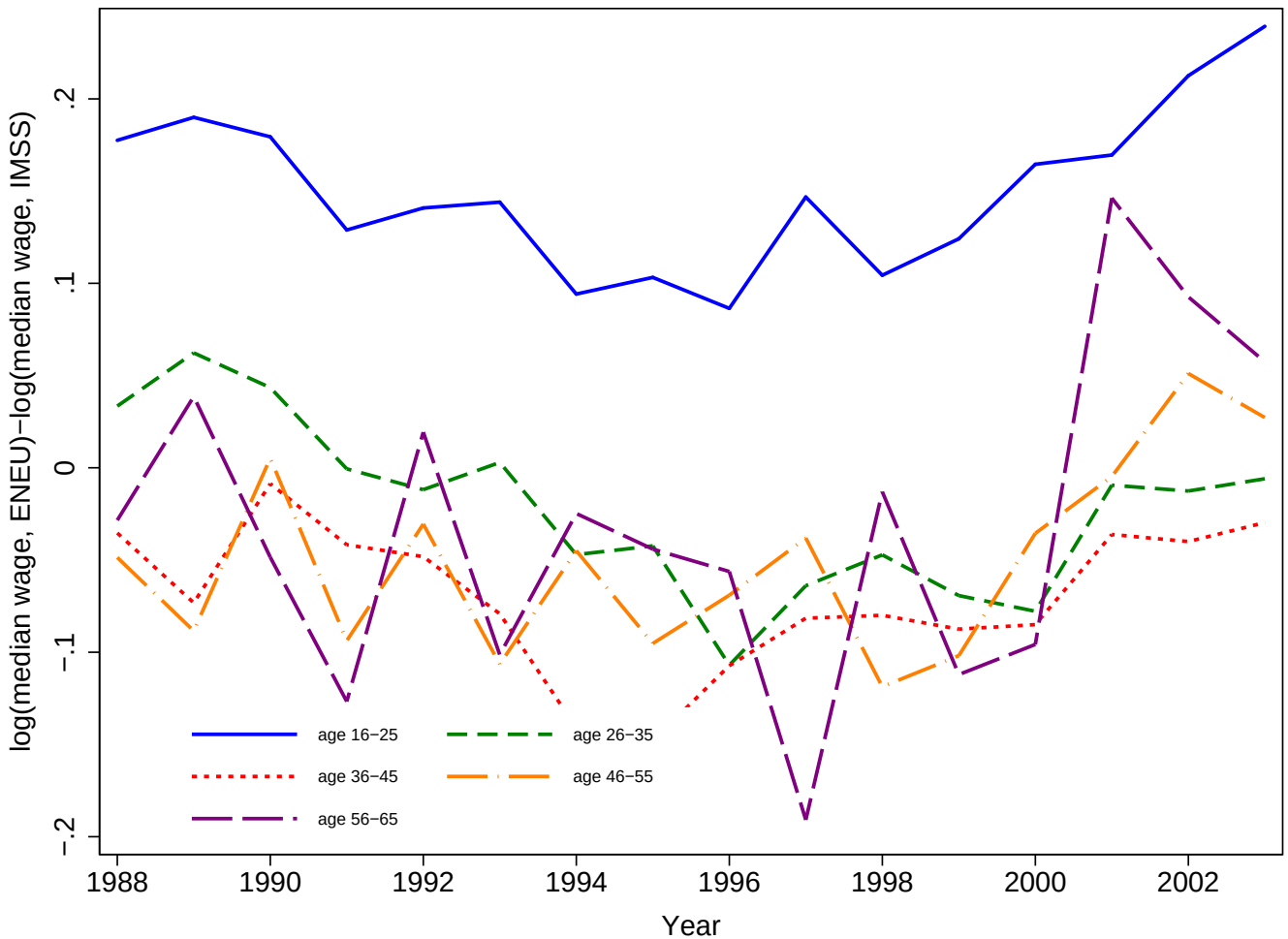


Table 1: Tenure in IMSS system, 1997 Q2, baseline sample

	Men					Women				
Years in IMSS	16-25 (%)	26-35 (%)	36-45 (%)	46-55 (%)	56-65 (%)	16-25 (%)	26-35 (%)	36-45 (%)	46-55 (%)	56-65 (%)
0	27.9	6.7	4.4	4.4	6.1	29.6	10.0	8.0	5.9	6.3
1	23.0	8.0	4.6	4.4	5.8	24.0	11.2	8.4	5.8	6.1
2	14.1	7.4	4.1	3.7	4.4	14.4	9.4	6.8	4.7	4.4
3	11.7	8.0	4.4	3.7	4.1	11.5	9.5	7.1	5.3	5.5
4	8.9	8.3	4.6	3.9	4.3	8.3	9.2	6.9	5.3	5.3
5	6.7	9.1	5.2	4.3	4.5	5.9	9.4	7.1	5.6	5.1
6	4.5	10.5	7.3	6.3	6.1	3.7	9.8	8.3	7.8	7.6
7	2.3	9.4	6.4	5.5	5.2	1.8	8.6	7.0	6.8	6.1
8	0.8	8.6	6.5	5.4	4.9	0.7	7.1	6.4	6.4	5.9
9	0.1	7.3	9.0	9.7	10.1	0.1	5.4	6.9	8.1	8.8
10	0.0	5.6	7.4	6.3	4.8	0.0	3.7	5.4	5.5	4.3
11	0.0	5.2	9.8	8.7	6.8	0.0	3.2	6.2	7.0	5.7
12	0.0	5.9	26.5	33.5	32.9	0.0	3.5	15.7	25.8	29.2
N (000s)	646.3	767.3	412.3	198.2	71.8	425.1	355.6	165.0	63.1	17.9

Table B3: Differential effects on excess mass, women

dep. var.: excess mass (below indicated ENEU percentile)						
10^{th}	20^{th}	25^{th}	30^{th}	40^{th}	50^{th}	60^{th}
(1)	(2)	(3)	(4)	(5)	(6)	(7)