When supply meets demand: Wage inequality in Portugal

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Labor Economics

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1 Why is Portugal an interesting case to study wage inequality?

- **Large supply shifts**;
  - Start with low education levels;
  - Shifted occurred since mid 90s; Constrast with US (80s) and Germany (both 80s and 90s);
- **Institutional setting** (Continental Europe vs. Anglo-Saxon):
  - Minimum wage;
  - Wage setting institutions;
- **Open/integrated economy** (technological changes; globalization);
- **High employment and low unemployment**;
  - High-pressure labor market;

Outline

2 Facts: 1984-2009

90/50 percentiles ratio

- Inequality levels:
  - Portugal higher than in Germany (twice as much);
  - Portugal starts at lower levels than the U.S., but ends up higher;
- Inequality increased over the 1984-09 period;
  - Portugal: $\approx +18$ log points (1984-95); $\approx +15$ l.p, (1996-09);
  - United States: $\approx +4$ l.p. $(80s \ \& \ 90s)$;
  - Germany: $\approx +5$ l.p. $(80s \ \& \ 90s)$;

[Sources: Autor, Katz & Kearny, 2008 (US); Schönberg, Dustmann & Ludsteck, 2009 (D)]

50/10 percentiles ratio

- Inequality levels:
  - United States $>$ **Portugal** $>$ Germany;
- Inequality has a **dichotomous evolution** over 1984-09:
  - **Portugal**:
    - 1984-95: ≈ 9 l.p.
    - 1996-09: Males ≈ -6 l.p. and Females ≈ 2 l.p.
  - **United States**:
    - 1980s: $\approx 5/8$ l.p. (M/F);
    - 1990s: ≈ -1 l.p.;
  - **Germany**:
    - 1980s: ≈ 3 l.p.;
    - 1990s: ≈ 6 l.p.;

Previous studies: Portugal

- Cover the earlier period of our data (up to mid 90s);
- Tended to focus on **college wage premium**;
  - Machado & Mata (2001), Martins & Pereira (2004), Cardoso (2007)
- **Inequality analysis**:
  - Cardoso (1998), Machado & Mata (2005);
  - The facts are in line with our findings – **increasing degrees of inequality** – for the overlapping period;

3 Market and institutions

1984-1995: Increasing inequality

- **Low supply of skills**
  - 6 or less years of schooling: 65% in 1984, 44% in 1995;
  - college degree: 3% in 1984, 5% in 1995;
- **No** significant change in the **institutional setting**
- **Skill-biased technological change** is the main explanation

- It's a **demand story**.

1995-2009: Increasing upper-tail inequality; decreasing in the lower-tail

- **Large shift in the supply of skills**
  - 5% of workers with college degree in 1995;
  - 13% in 2009;
- Real **minimum wage increased** in the late 1990s
- **Polarization**

- It's a **demand and supply** story;

4 Data

Administrative data: Private & Public Sectors

- Private sector data
  - **Quadros de Pessoal**:
    - 1984-2009; annual (October's spnashot)
    - All (almost) salaried workers; socio-demographics
  - **Social Security Records**
    - 2000-2009; continuously updated (monthly frequency);
    - All salaried workers; few socio-demographics
- Public sector data
  - **Public Administration dataset**:
    - 1996, 1999, 2005; annual (December's snapshot);

5 Analysis

5.1 Supply and demand

Supply & Demand framework

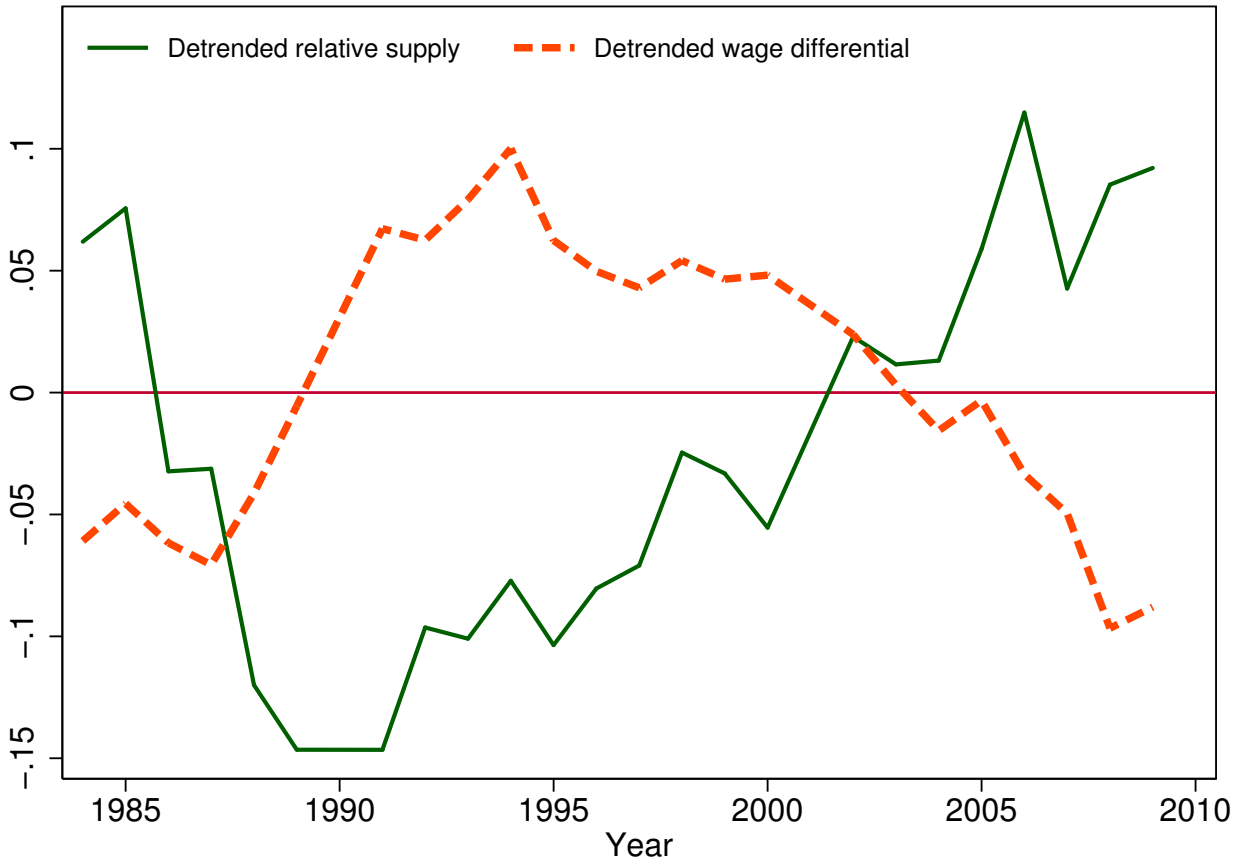
- Methodological setting: **Katz & Murphy (1992)**;

$$\text{CES: } Q_t = \left[\alpha_t \left(a_t N_{ct}\right)^{\rho} + \left(1-\alpha_t\right)\left(b_t N_{nt}\right)^{\rho}\right]^{\frac{1}{\rho}} \tag{1}$$

$$ln\left(\frac{w_{ct}}{w_{nt}}\right) = \left(\frac{1}{\sigma}\right)\left[D_t - ln\left(\frac{N_{ct}}{N_{nt}}\right)\right], \tag{2}$$

- **Supply factors**, $\frac{N_{ct}}{N_{nt}}$ (college/non-college relative supply);
  - Elasticity of substitution, $\sigma = \frac{1}{1-\rho}$;
- **Demand factors** (time trend), D_t;
- Good **'Wage gap' model** (fitted vs. actual);

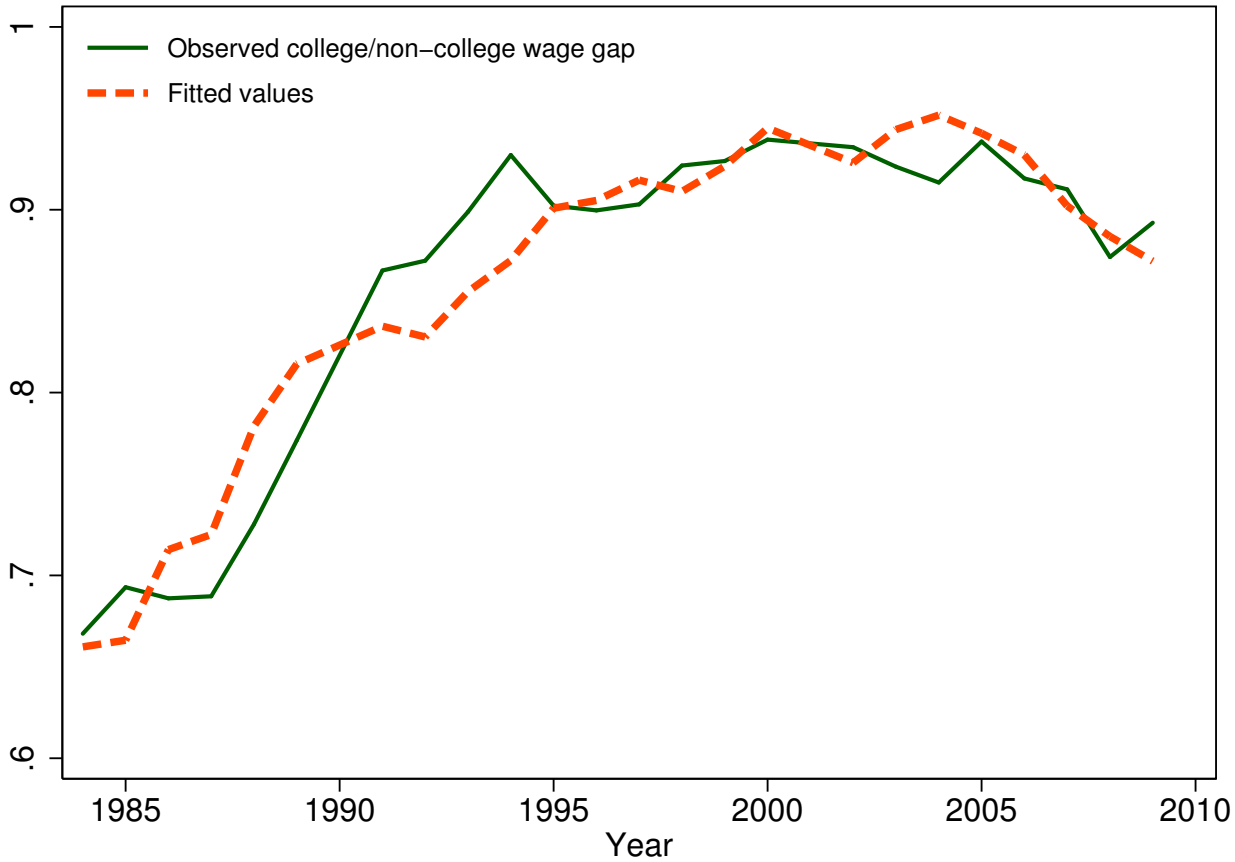
College/Non-college: Elasticity of substitution



College/Non-college log wage gap

	(1)	(2)	(3)	(4)	(5)
College/Noncollege relative supply	-0.678	-0.683	-0.713	-0.481	-0.378
	0.129	*0.144*	*0.127*	*0.091*	*0.098*
Log real minimum wage			-0.610		-0.211
			0.400		*0.246*
Natural unemployment rate				-0.038	-0.043
				0.006	*0.007*
Time	0.052	0.052	0.059	0.043	0.045
	0.008	*0.009*	*0.010*	*0.006*	*0.006*
Time*1995		0.001			-0.004
		0.003			*0.001*
Constant	-1.109	-1.116	1.044	-0.409	0.632
	0.349	*0.381*	*1.450*	*0.258*	*0.869*
No. of observations	24	24	24	24	24
R^2	0.777	0.777	0.800	0.911	0.937

Katz & Murphy (1992): Fitted vs. Actual Wage Gap



5.2 Experience levels

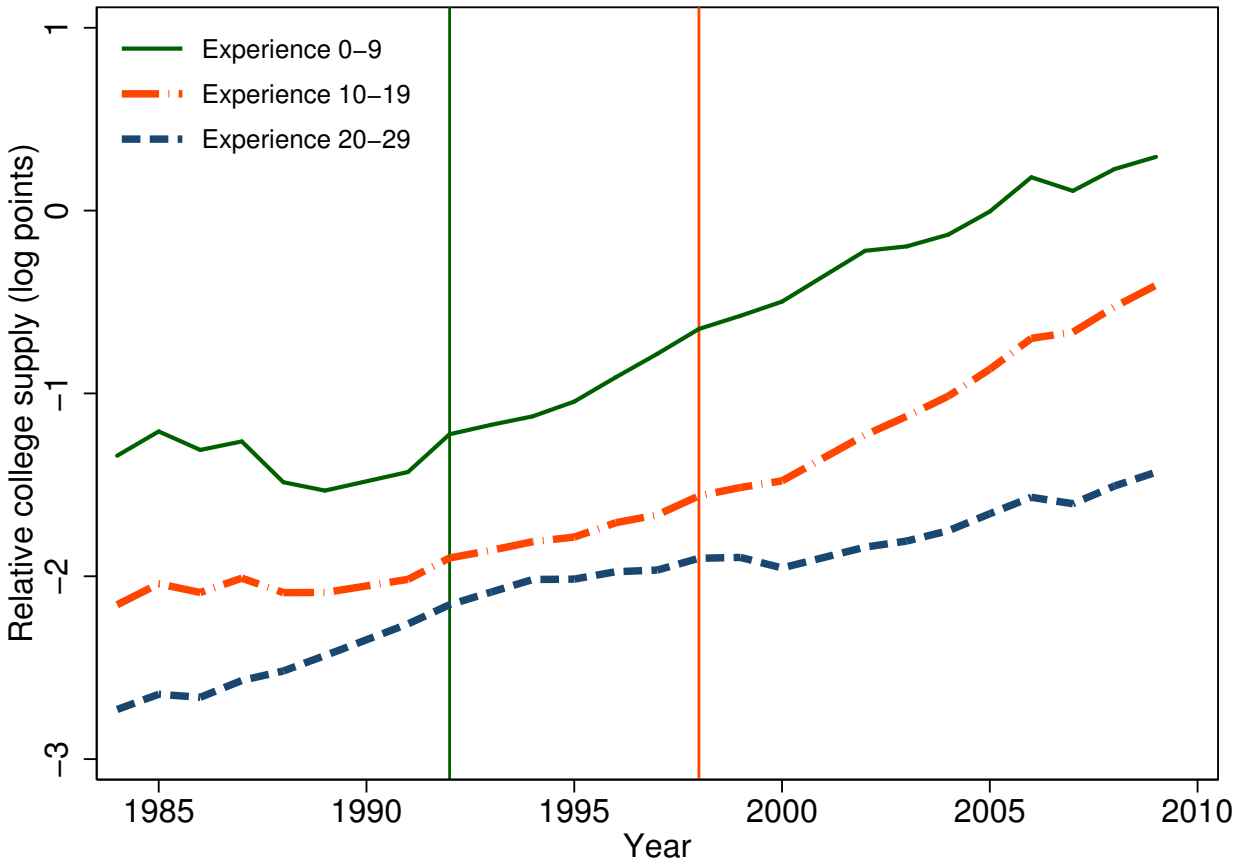
Experience levels: College/Non-college log wage gap

- **Card & Lemieux (2001)**: Impact of experience
  - (same education, different experience): not perfect substitutes;
- **Large supply shift** concentrated in the 1990s;
  - Most noticeable in the **younger cohort**;
  - Visible impact on unconditional inequality;
- Split workers into **4 experience groups** and compute the **own-group relative college/non-college** supply and wage gaps;

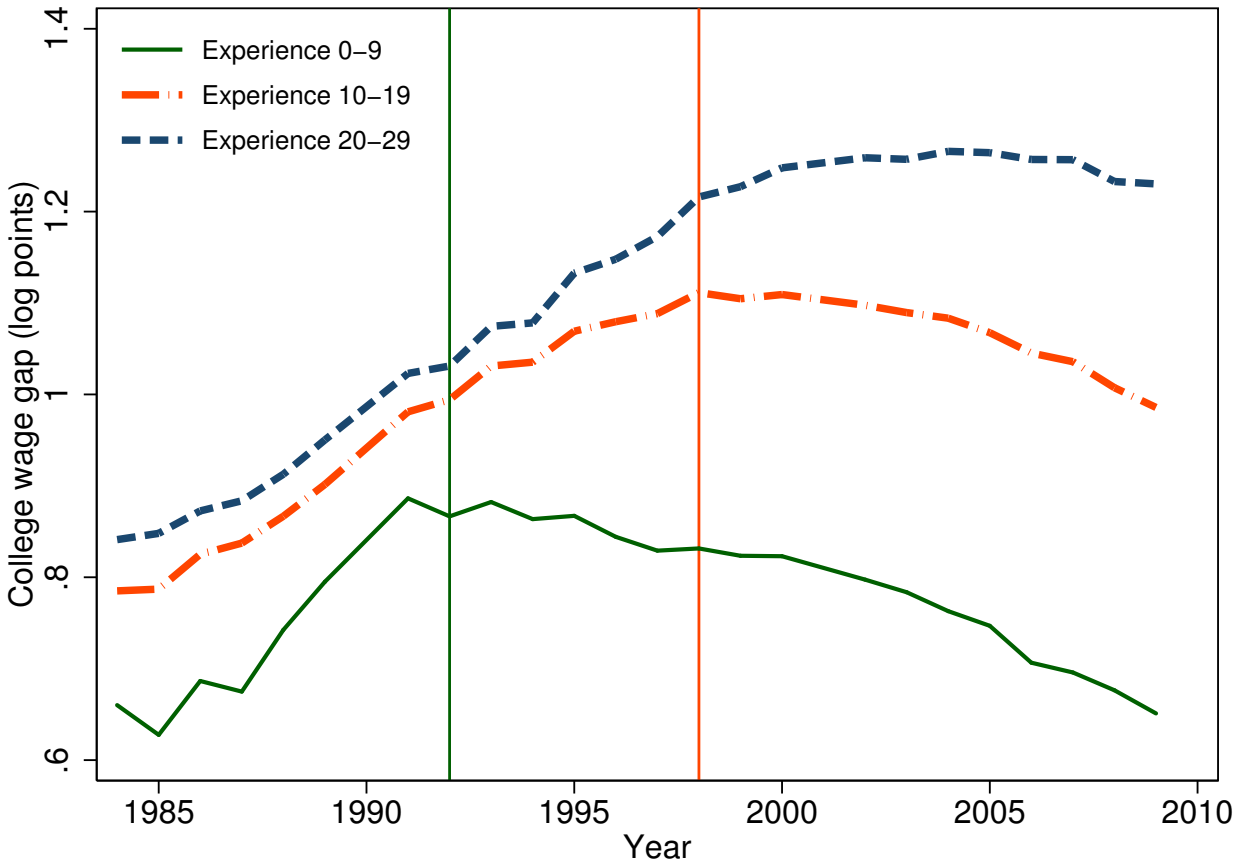
Experience levels: College/Non-college wage gap (cont.)

		Within-group wage dispersion			Worker share		
		1984	1995	2009	1984	1995	2009
				Low skill			
All	50/10	0.310	0.358	0.200	0.649	0.442	0.372
	90/50	0.455	0.639	0.667			
				Medium skill			
All	50/10	0.561	0.528	0.377	0.321	0.506	0.486
	90/50	0.741	1.100	1.149			
				High skill			
Age $<$ 36	50/10	0.731	0.983	0.786	0.014	0.028	0.085
	90/50	0.571	0.920	0.867			
Age 36-45	50/10	0.815	1.220	1.115	0.009	0.014	0.038
	90/50	0.562	0.877	1.117			
Age $>$ 45	50/10	1.287	1.308	1.865	0.007	0.010	0.019
	90/50	0.608	1.000	1.228			
All	50/10	0.865	1.194	0.984	0.030	0.051	0.142
	90/50	0.725	1.082	1.344			

Experience level: Supply shits (cont.)



Experience level: Wage gap (cont.)



Pool all 4 experience groups: College/Non-college wage gap

	Potential experience groups									
	All groups		0-9 years		10-19 years		20-29 years		30-39 years	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Own minus aggregate supply	-0.324	-0.323	-0.209	-0.254	-0.584	-0.548	0.132	0.059	0.427	0.200
	0.010	*0.009*	*0.129*	*0.110*	*0.043*	*0.112*	*0.161*	*0.064*	*0.197*	*0.116*
Aggregate supply	-0.578	-0.400	-0.614	-0.435	-0.459	-0.464	-0.242	-0.106	-0.163	-0.034
	0.105	*0.107*	*0.187*	*0.176*	*0.064*	*0.068*	*0.308*	*0.125*	*0.085*	*0.054*
Log real minimum wage		-0.174		-0.188		-0.016		-0.141		-0.130
		0.314		*0.325*		*0.189*		*0.198*		*0.160*
Natural unemployment rate		-0.036		-0.027		-0.004		-0.052		-0.027
		0.008		*0.008*		*0.012*		*0.005*		*0.004*
Time	0.048	0.042	0.044	0.038	0.040	0.041	0.035	0.033	0.040	0.030
	0.007	*0.008*	*0.011*	*0.011*	*0.004*	*0.005*	*0.017*	*0.008*	*0.007*	*0.005*
Constant	-0.734	0.543	-0.782	0.544	-0.325	-0.267	0.194	1.291	0.630	1.451
	0.284	*1.107*	*0.585*	*1.109*	*0.168*	*0.665*	*0.847*	*0.731*	*0.260*	*0.562*
No. of observations	96	96	24	24	24	24	24	24	24	24
R^2	0.882	0.906	0.738	0.848	0.972	0.972	0.903	0.987	0.969	0.991

Experience levels: College/Non-college wage gap (cont.)

- How much of the 21 log points increase in the difference between the C/NC wage gap of the less- and most-experienced groups is attributable to the different evolution in the relative supply of each experience group (53 log points difference)?
  - Using the estimated own-group elasticity: 17 log points; 82% of total difference;
- Own and aggregate supply coefficients by experience group are only significant for the two less experienced groups.

5.3 Minimum wage

Minimum wage

- Re-run **Katz-Murphy** model with **90/50 and 50/10 wage percentiles ratios as dependent variables**;
  - Results highlight: **Females 50/10 ratio is "explainable"** with minimum wage developments.

Minimum wage: Results

	Male		Female	
	90/50	50/10	90/50	50/10
College/Noncollege relative supply	-0.065	-0.185	-0.267	0.006
	0.037	*0.048*	*0.072*	*0.033*
Log real minimum wage	-0.030	-0.265	-0.331	-0.457
	0.110	*0.141*	*0.210*	*0.098*
Natural unemployment rate	-0.011	-0.016	-0.010	-0.008
	0.003	*0.004*	*0.005*	*0.003*
Time	0.020	0.018	0.035	0.007
	0.003	*0.003*	*0.005*	*0.002*
Constant	0.528	0.901	1.085	1.924
	0.387	*0.499*	*0.743*	*0.346*
No. of observations	24	24	24	24
R^2	0.992	0.828	0.969	0.934

5.4 Counterfactuals analysis

DiNardo, Fortin & Lemieux (1996)

Let $f(w|T=t)$ be the **observed wage density** at time t. It can be decomposed into the density of observed wage **conditional on attributes** x at time t, $g(w|x,T=t)$ and the density of the same **attributes**, $h(x|T=t)$.

$$f(w|T=t) = \int g(w|x,T=t)h(x|T=t)dx$$

Counterfactual: wage distribution of t that would have prevailed if attributes were those of year t'.

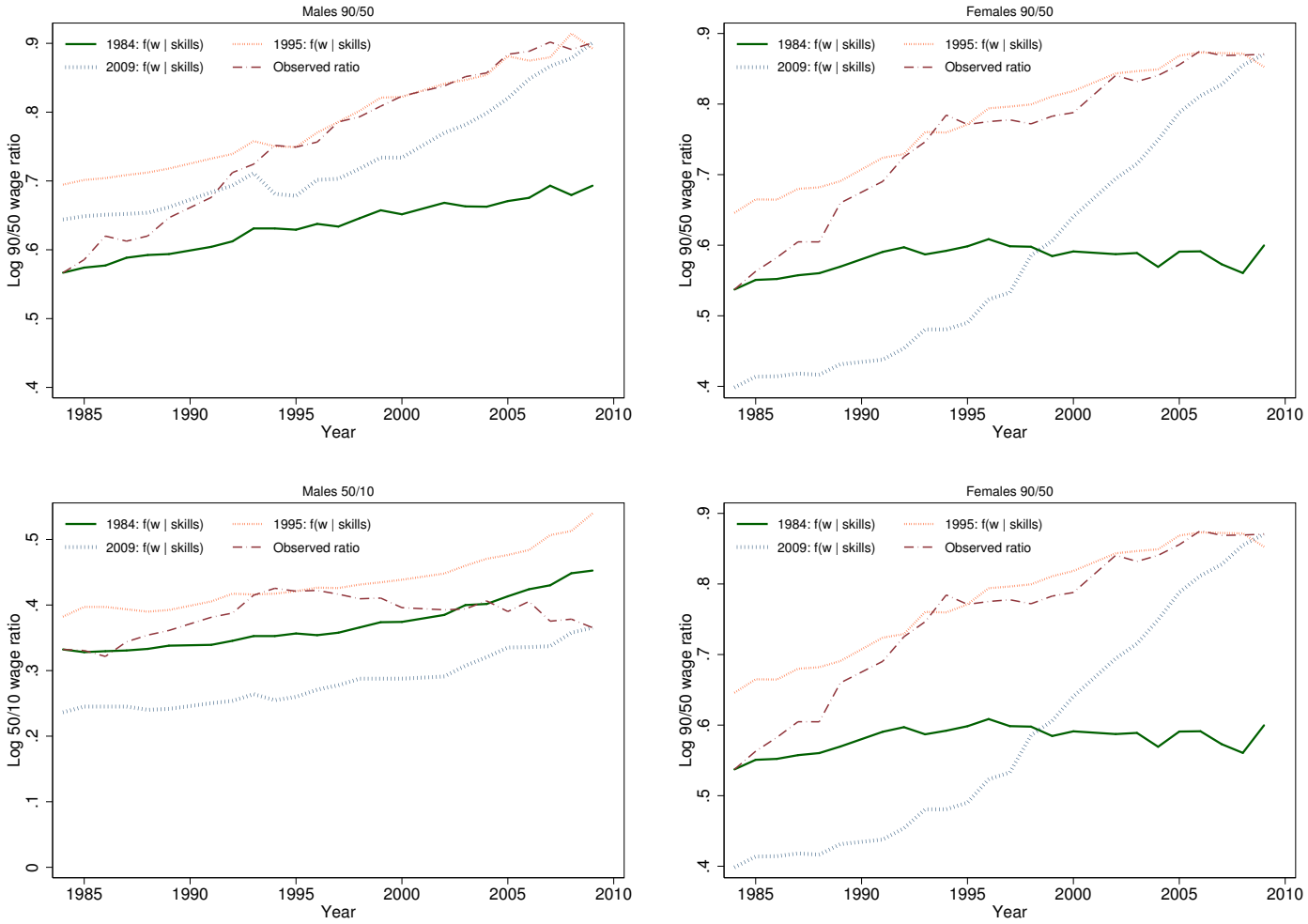
Just re-weight the **"price" function** $g(w|x,T=t)$ by the ratio of the **"composition" functions**, $h(x|T=t')/h(x|T=t)$.

Note that

$$\frac{h(x|T=t')}{h(x|T=t)} = \frac{\Pr(T=t'|x)}{\Pr(T=t|x)} \times \frac{(1-\Pr(T=t'))}{\Pr(T=t')}$$

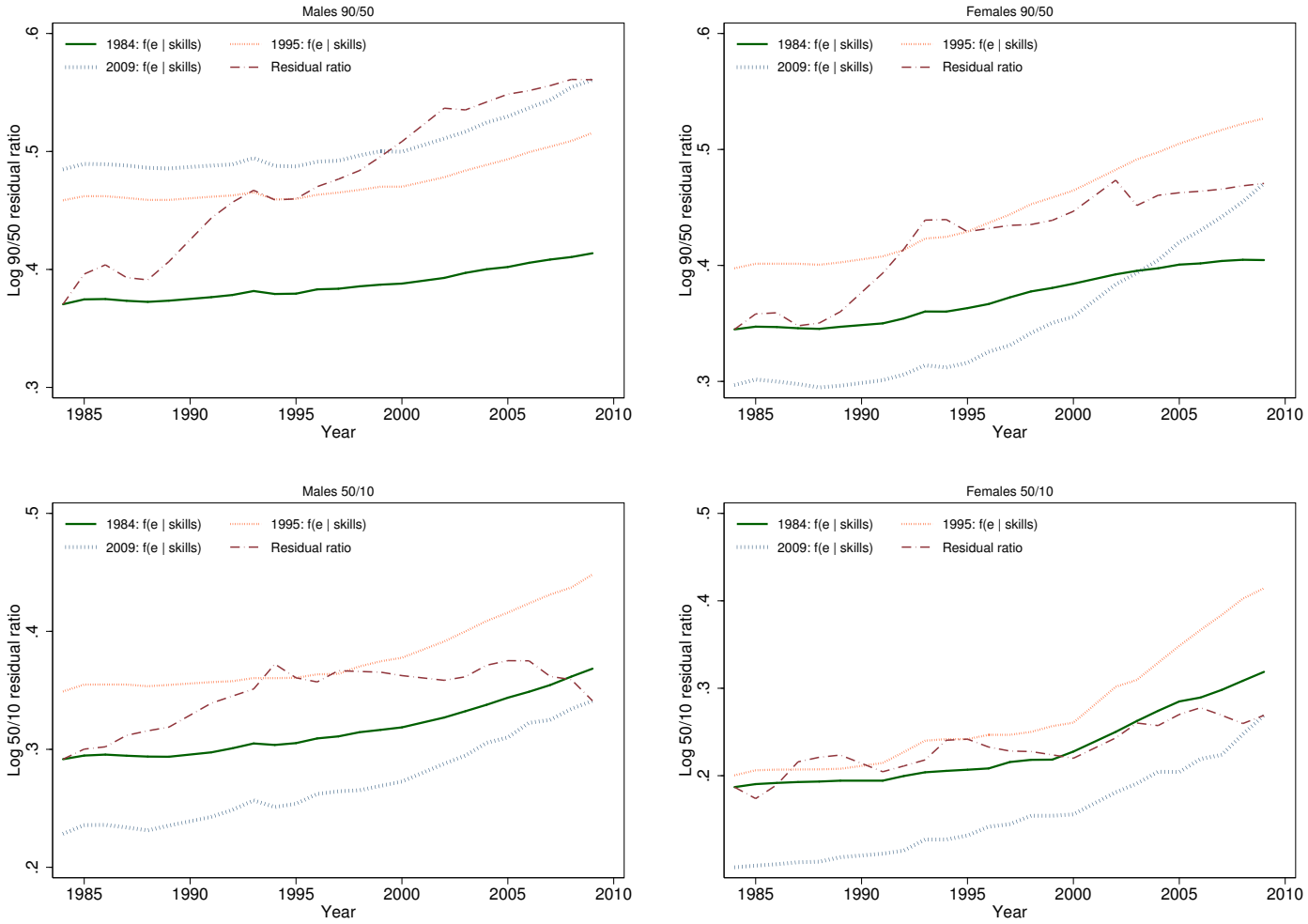
which can be computed using a probit or logit model. In our case, the x vector is composed of dummy variables for **(i)** five levels of schooling; **(ii)** eight age groups and **(iii)** all possible interaction terms between education and age dummies.

Overall inequality



Price effect: Vertical distance bewteen curves; *Composition effect*: Movement along curves

Residual inequality



Price effect: Vertical distance bewteen curves; *Composition effect*: Movement along curves

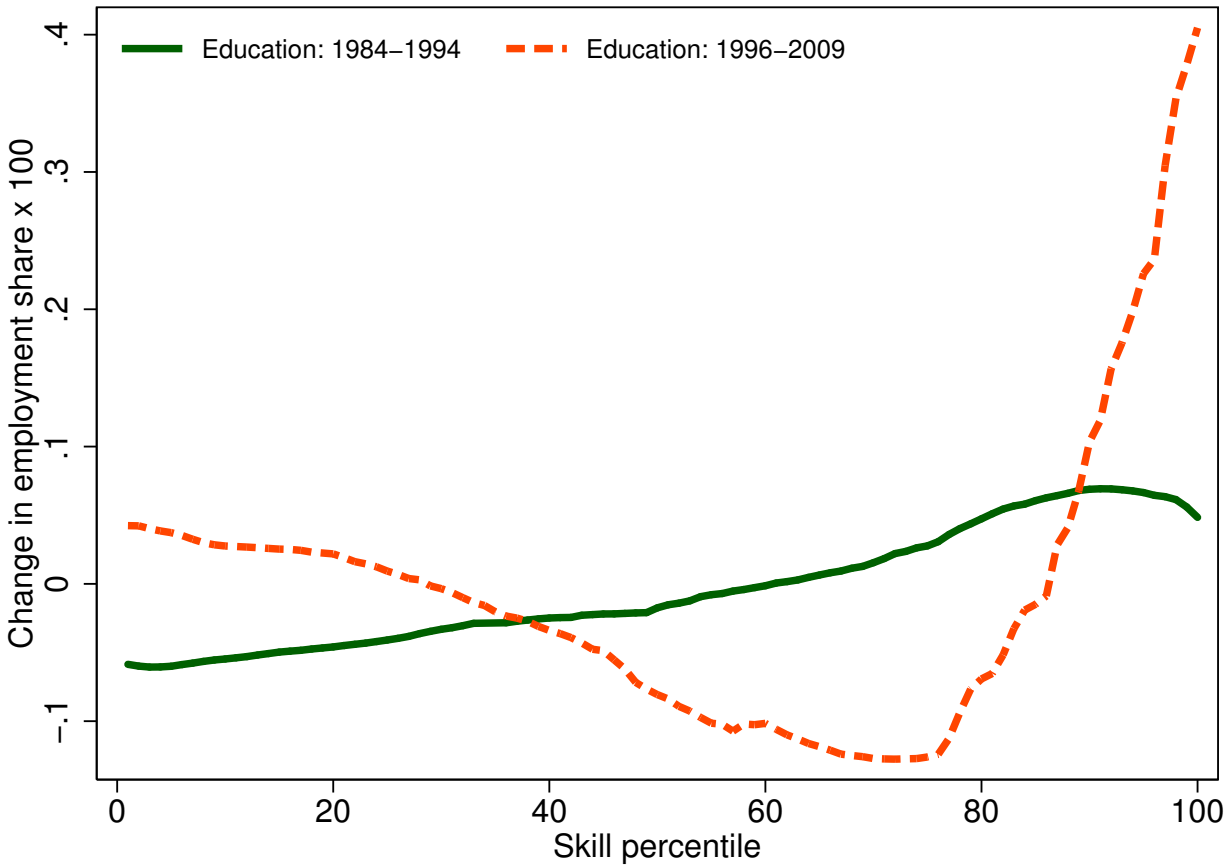
- Male overall **90/50** wage inequality
  - **Price effect** in the first period (84-95):
    - Observed: $18.3 \Rightarrow$ Price effect 12.0 $(1995's\ X)$;
  - **Composition effect** in the second period (95-09):
    - Observed: $15.2 \Rightarrow$ Price effect -7.1 $(1995's\ X)$;
- Male overall **50/10** wage inequality
  - **Price effect** in the first period:
    - $8.9 \Rightarrow$ Price effect6.4 $(1995's\ X)$;
  - **Price-composition effect mix** in the second period:
    - $-5.6 \Rightarrow -16.1$ $(1995's\ X)$;

5.5 Polarization

Polarization

- Decrease in 50/10 wage inequality. Explanations?
  - **SBTC** cannot account for the decrease;
  - **Minimum wage** helps marginally;
  - But other **demand factors** may be at play (Goos & Manning, 2007); we can gauge them by:
    * Employment shares by occupational skill;
    * Real wage variation by wage percentile;

Polarization: Skill shares (cont.)



Polarization: Real wage log variation (cont.)

5.6 Public sector

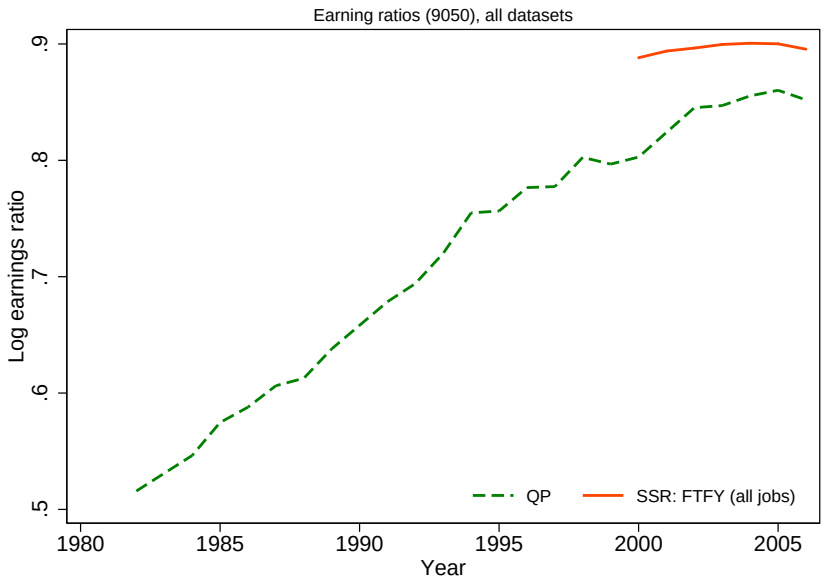
- Public sector characteristics:
  - Significant share of total employment;
    - Although it decreased from 1996 to 2005;
  - Highly educated;
  - Unionized;
- Public sector inequality:
  - **Overall**:
    - **Higher than private** sector;
  - **Residual**:
    - **Lower-tail higher** in the public sector,
    - But **upper-tail lower** than in the private sector;

- **Counterfactual analysis** (Public + Private): From 1996 to 2005, **holding the size of the public sector constant at its 1996 level**:
  - **Higher upper-tail** inequality: $7.0 \Rightarrow 8.3$ $(1996's\ X)$;
  - **Higher lower-tail** inequality: $-2.0 \Rightarrow -0.2$ $(1996's\ X)$;

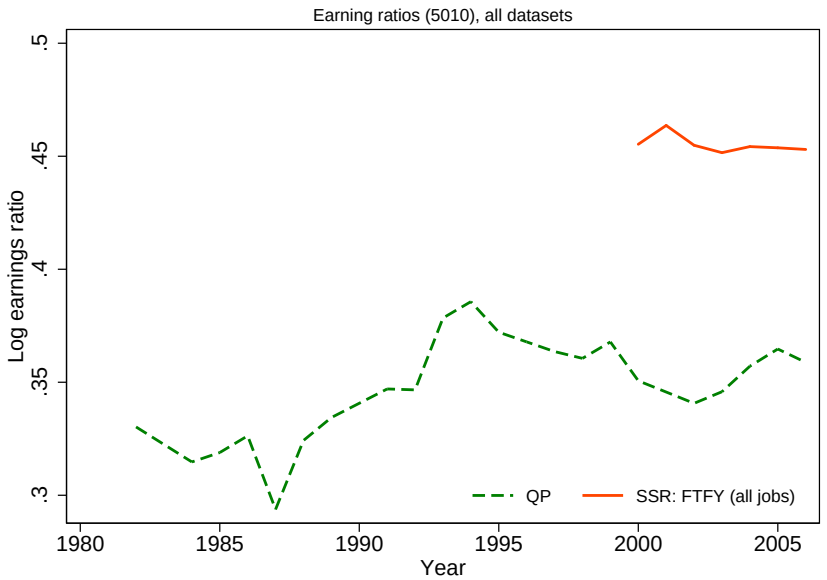
5.7 Future inroads

- **Fixed-term contracts**:
  - Low-wage/low-skill individuals;
  - Higher turnover (Centeno & Novo, 2012)
- **Full-year wages**:
  - *Quadros de Pessoal*: October wages;
    - Stock-sampling bias;
    - Overstates longer job tenures;
  - Social Security Records:
    - All employment spells; Full-year wages;

Future inroads: Full-year 90/50 wage ratios



Future inroads: Full-year 50/10 wage ratios



Conclusions

- **Inequality increased from 1984 to 2009**:
  - Although it slowed down in the upper-tail;
  - Even some compression in the lower-tail;
- Continental drift. . . only geologically;
  - As in Germany, inequality is **increasing in Europe**;
- **Supply & demand** have been the **"designated drivers"**
  - **Institutional settings** took the **"passenger seat"**;
- Gran Prix to be completed:
  - Relate turnover with inequality and wage mobility;

Thank you