

# How is the Minimum Wage Shaping the Wage Distribution: Bite, Spillovers, and Wage Inequality

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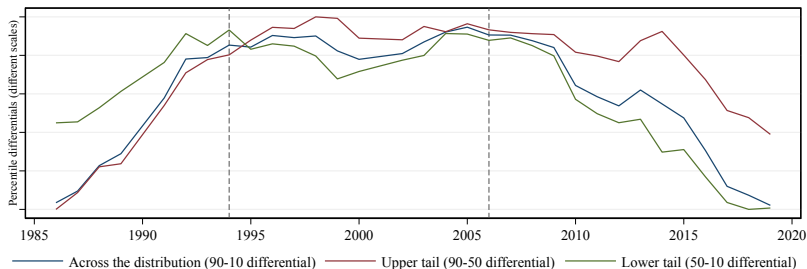
Seminário GEE/GPEARl

# Motivation

- ▶ Wage inequality rising in most advanced economies, especially at the top of the distribution
- ▶ Behavior at the bottom has been much more heterogeneous
- ▶ Negative correlation between the importance of the minimum wage and lower-tail inequality in many countries
  - ▶ US: real MW fell and lower-tail wage inequality increased (DiNardo, Fortin, and Lemieux 1996; Lee 1999)
  - ▶ UK, Germany: instituted a MW and lower-tail wage inequality decreased (Stewart 2012; Bossler and Schank 2020)
- ▶ We see that negative correlation in Portugal

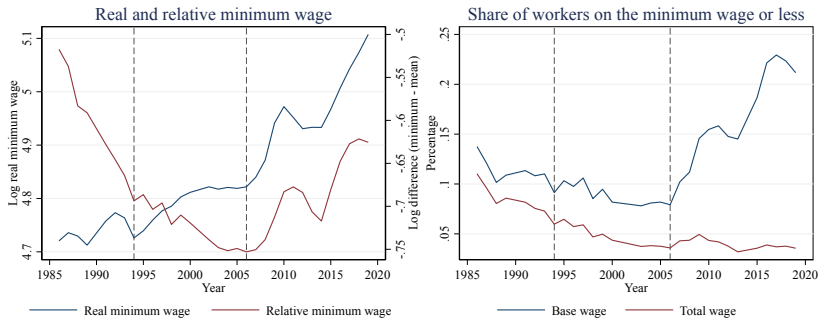
## Wage inequality in Portugal

- ▶ **Rose rapidly until 1994**, mainly at the top
  - ▶ Unequal returns to education (Machado and Mata 2005)
  - ▶ Increasing levels of education (Pereira 2020)
- ▶ **Stabilized until mid-2000s**, across the distribution
  - ▶ Fading assortative matching (Portugal, Raposo, and Reis 2018)
  - ▶ Demand for unskilled workers (Centeno and Novo 2014)
- ▶ **Fell sharply since then**, mainly at the bottom
  - ▶ We don't know why (gap in the literature)



# Importance of the minimum wage

The importance of the minimum wage **decreased** until the mid-1990s, **was stagnant** until the mid-2000s, and **increased sharply** since then



# How does the minimum wage shape the wage distribution?

## ▶ Disemployment effects

- ▶ Workers that cannot find a job with the higher minimum
- ▶ Increase income inequality, but *ironically* reduce wage inequality
- ▶ Often negligible and sometimes even go in the opposite direction (Card and Krueger 1994; Portugal and Cardoso 2006)

## ▶ The minimum wage bite

- ▶ Workers that get their wages pushed up to the new minimum wage
- ▶ This is the main purpose, and the main effect, of the minimum wage (Freeman 1996; Machin, Manning, and Rahman 2003)

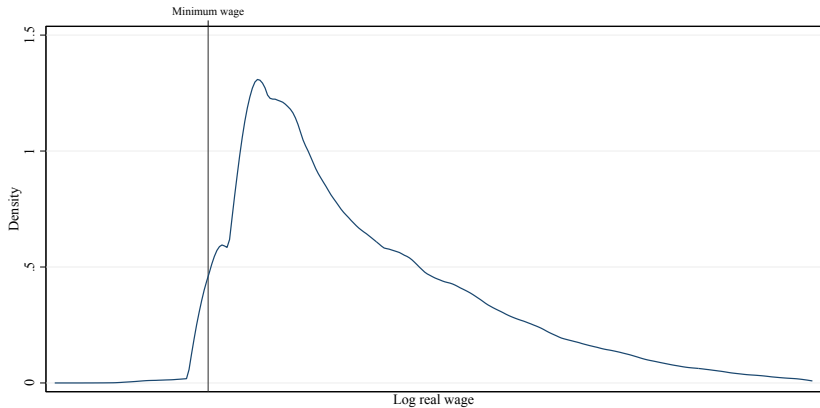
## ▶ Spillover effects

- ▶ Workers that get higher wages than the new minimum
- ▶ Relative wages: firms reward more productive/skilled workers (Katz and Krueger 1992; Lee 1999; Fortin, Lemieux, and Lloyd 2021)
- ▶ Collective bargaining may play major role (Card and Cardoso 2021)

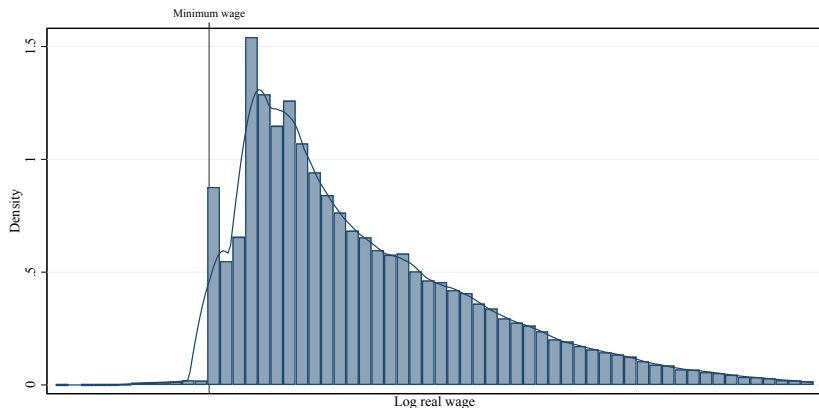
# The empirical strategy

1. Construct the conditional wage distribution
  - ▶ Capture the minimum wage effects
2. Construct counterfactual distributions
  - ▶ With past minimum wage
  - ▶ Without spillovers
3. Quantify and decompose changes in the wage distribution

# 1. Constructing the conditional distribution

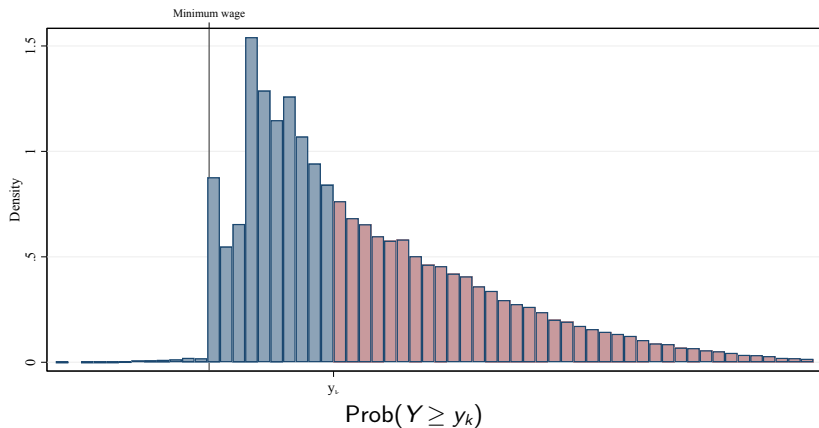


# 1. Constructing the conditional distribution

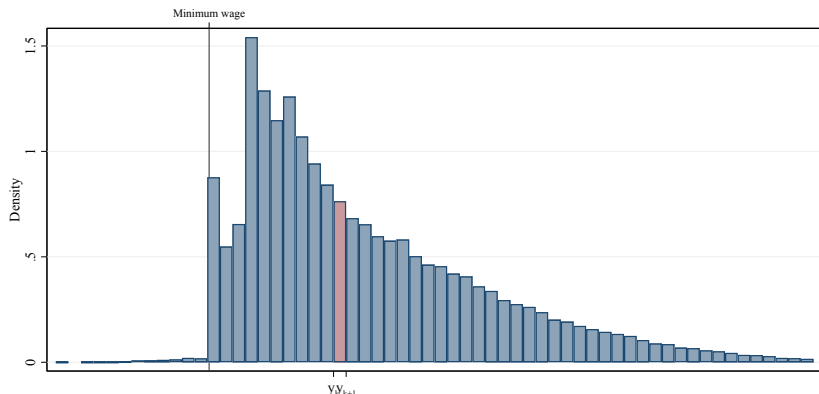




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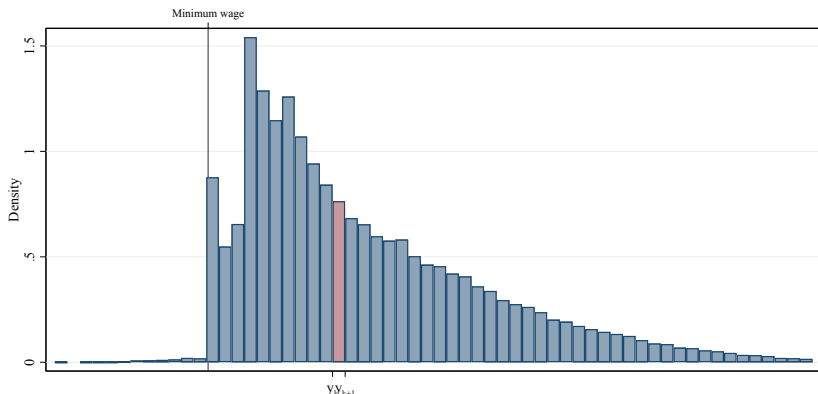


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$$\text{Prob}(y_k \leq Y < y_{k+1}) = \text{Prob}(Y \geq y_k) - \text{Prob}(Y \geq y_{k+1})$$

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Distribution regression (Chernozhukov et al. 2013)

$$\text{Prob}(Y \geq y_k) = \Phi(X\beta_k)$$

Rank regression (Fortin and Lemieux 1998)

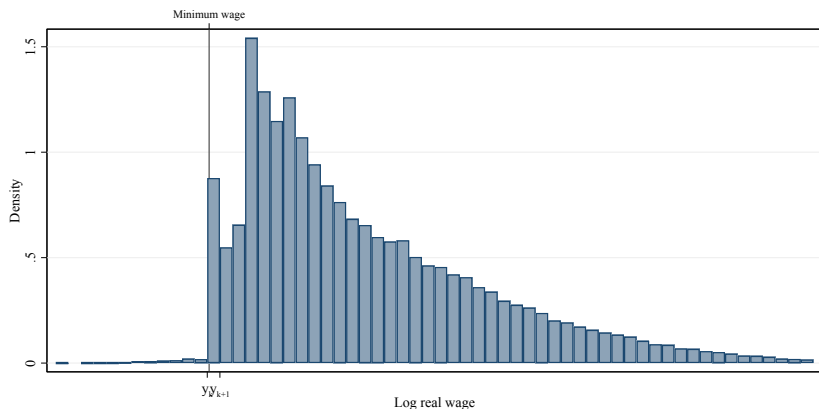
$$\text{Prob}(Y \geq y_k) = \Phi(X\beta - c_k)$$

(Fortin et al. 2021)

$$\text{Prob}(Y \geq y_k) = \Phi(X\beta + y_k X\gamma - c_k)$$

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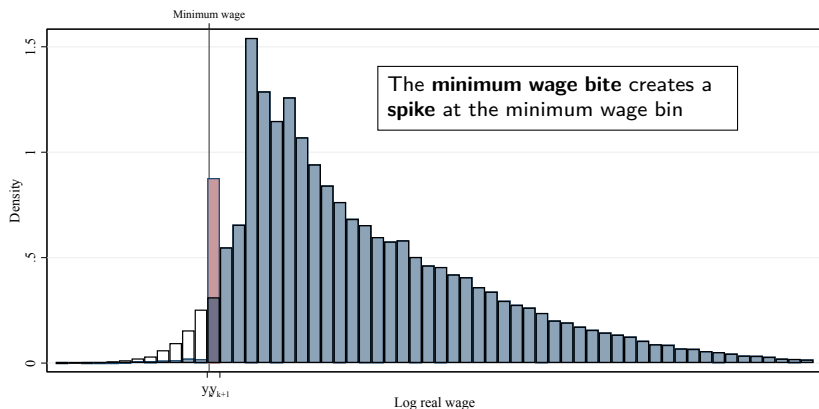
## Capturing the minimum wage effects



$$\text{Prob}(y_k \leq Y < y_{k+1}) = \Phi(X\beta + y_k X\gamma - c_k) - \Phi(X\beta + y_{k+1} X\gamma - c_{k+1})$$

# 1. Constructing the conditional distribution

## Capturing the minimum wage effects

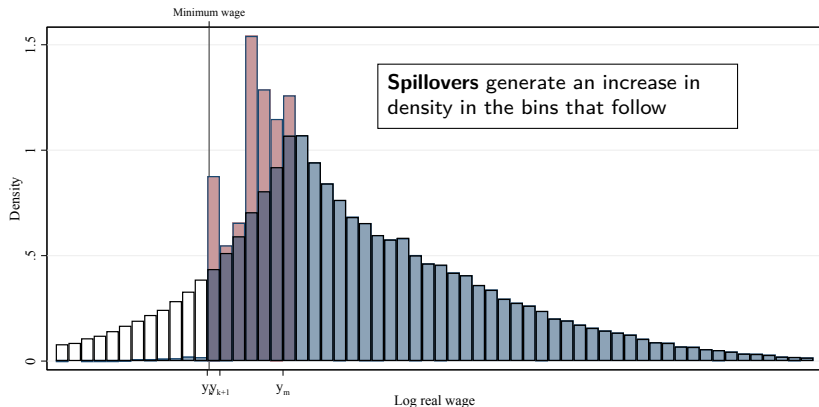


$$\text{Prob}(y_k \leq Y < y_{k+1}) = \Phi(X\beta + y_k X\gamma - c_k) - \Phi(X\beta + y_{k+1} X\gamma - c_{k+1})$$

$$\text{Prob}(Y \geq y_k) = \Phi(X\beta + y_k X\gamma - c_k + \delta_0) \quad \text{for } y_k \geq MW_t$$

# 1. Constructing the conditional distribution

## Capturing the minimum wage effects



$$\text{Prob}(y_k \leq Y < y_{k+1}) = \Phi(X\beta + y_k X\gamma - c_k) - \Phi(X\beta + y_{k+1} X\gamma - c_{k+1})$$

$$\text{Prob}(Y \geq y_k) = \Phi(X\beta + y_k X\gamma - c_k + \delta_0 + \delta_1 + \dots + \delta_m) \quad \text{for } y_m \geq MW_t$$

# 1. Constructing the conditional distribution

## Estimating the model

$$\text{Prob}(Y_{it} \geq y_k) = \Phi(X_{it}\beta + y_k X_{it}\gamma + \sum_{m=b}^a D_{kt}^m \delta_m - c_k) \quad \text{for } k = 1, 2, \dots, 61$$

- ▶  $X_{it}$  are covariates including age, gender, education, tenure, region, year FE...
- ▶  $y_k X_{it}\gamma >$  interaction term of select covariates
- ▶  $\sum_{m=b}^a D_{kt}^m \delta_m$  capture the minimum wage effects
- ▶  $c_k$  are wage bin dummies

Great matched employer-employee data from *Quadros de Pessoal*

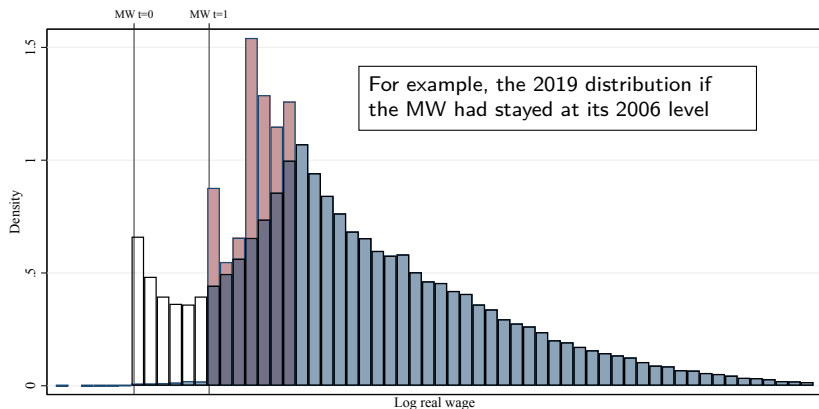
- ▶ Random sample of 10% of all full-time employees in Portugal age 18-64

1986 to 2019, divided into the three periods - a specification for each period

- ▶ 1986-1994 (Importance of MW ↓ ; Inequality ↑)
- ▶ 1994-2006 (Importance of MW ~ ; Inequality ~)
- ▶ 2006-2019 (Importance of MW ↑ ; Inequality ↓)

## 2. Constructing counterfactual distributions

Wage distribution in  $t = 1$  if the **MW had not changed since  $t = 0$**



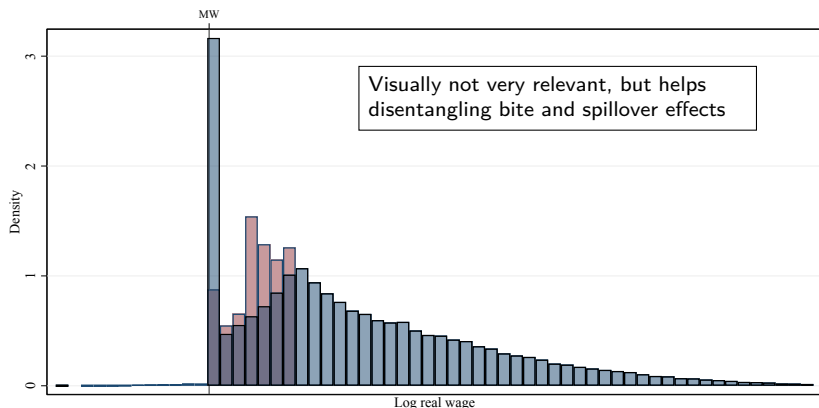
$$\text{Prob}(Y_{it} \geq y_k) = \Phi(X_{it}\beta + y_k X_{it}\gamma + \sum_{m=b}^a D_{kt}^m \delta_m - c_k)$$

Switch the  $D_{kt=1}^m$  dummies to their  $t = 0$  distribution,  $D_{kt=0}^m$



## 2. Constructing counterfactual distributions

Wage distribution in  $t = 1$  in the **absence of spillovers**



$$\text{Prob}(Y_{it} \geq y_k) = \Phi \left( X_{it}\beta + y_k X_{it}\gamma + \sum_{m=b}^a D_{kt}^m \delta_m - c_k \right)$$

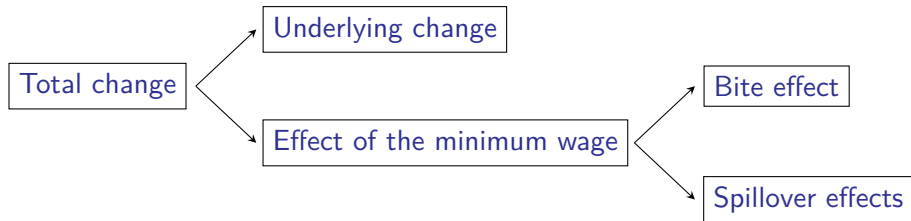
Set the distribution of  $D_{kt}^m$  to 0 after the MW,  $D_{kt}^m = 0$  for  $m > 0$

### 3. Quantifying and decomposing

We can **quantify** changes in the wage distribution into statistics:

- ▶ Standard deviation
- ▶ Percentile differentials
- ▶ Share of workers on the minimum wage
- ▶ Average wage

And then **decompose** the change in those statistics:



# Portugal experienced three very distinct periods

The last period, 2006-2019, is when the rising MW was most important

Mid-1980s to mid-1990s:

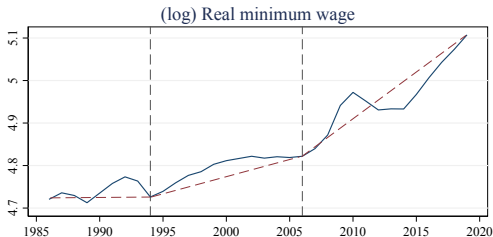
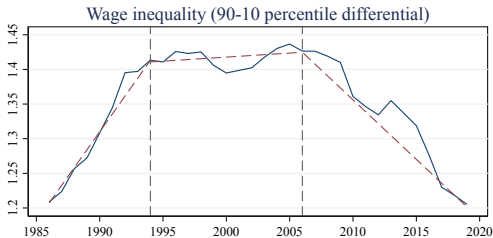
- ▶  $\Delta MW = 1\%$
- ▶  $\Delta 90:10 = 20\%$

Mid-1990s to mid-2000s:

- ▶  $\Delta MW = 10\%$
- ▶  $\Delta 90:10 = 2\%$

Mid-2000s to today:

- ▶  $\Delta MW = 30\%$
- ▶  $\Delta 90:10 = -22\%$



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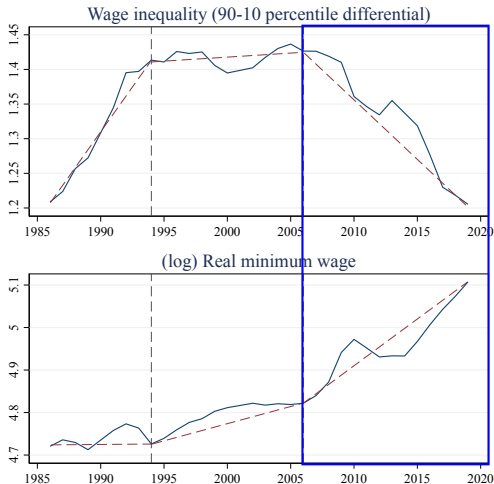
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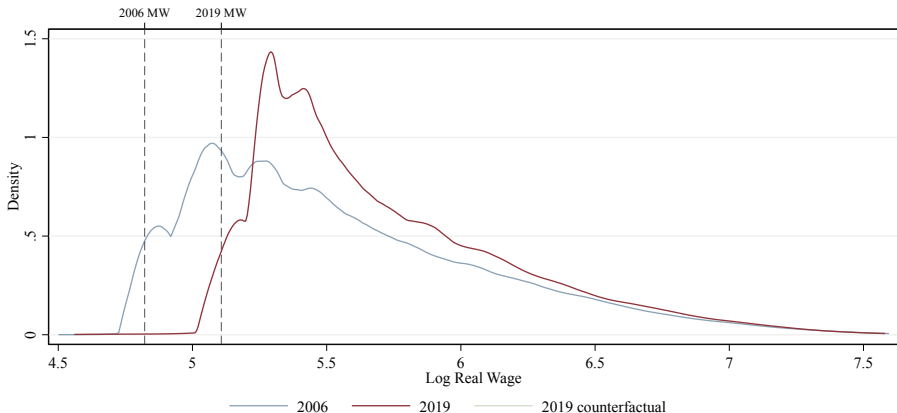
- ▶  $\Delta MW = 30\%$
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# The MW structurally reshaped the distribution

Had the MW not risen, the distribution would look completely different

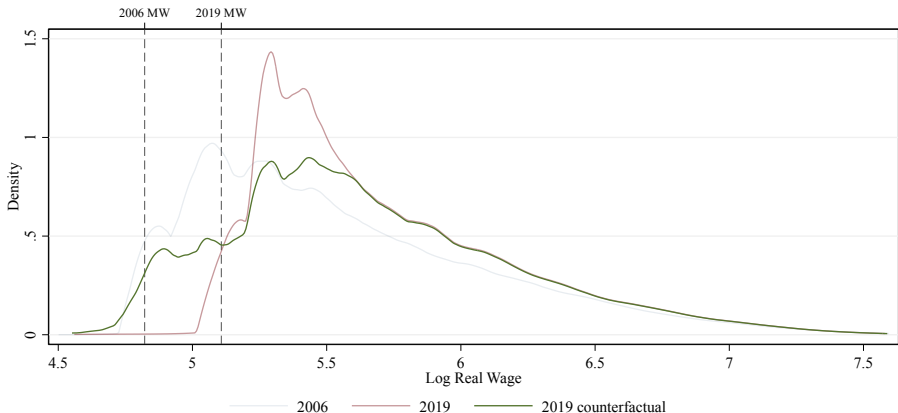
Wage distribution of 2019, had the minimum wage stayed at its 2006 level



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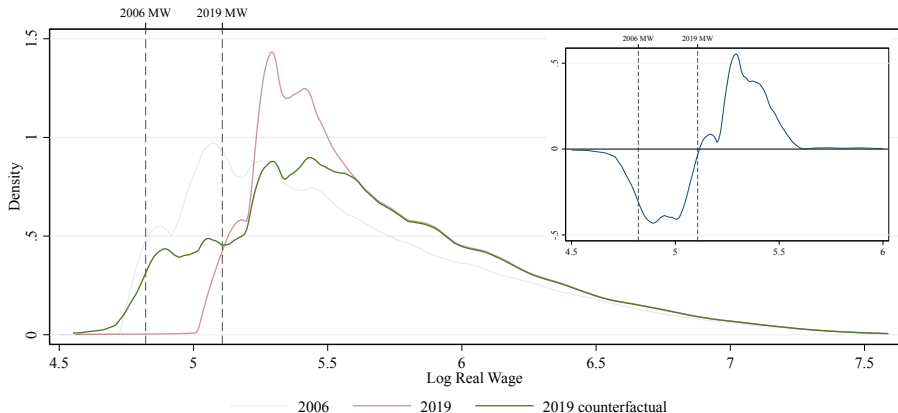
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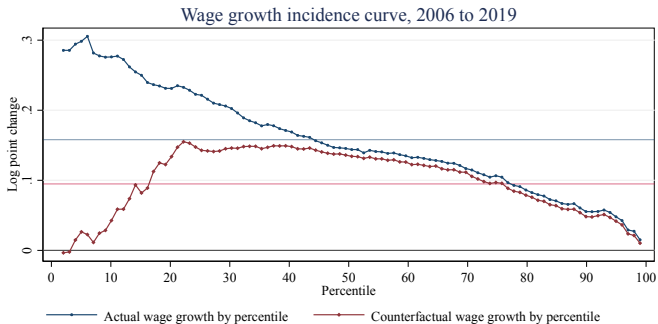
Wage distribution of 2019, had the minimum wage stayed at its 2006 level



# The MW fully explained the fall in wage inequality

Inequality would have remained as high as it was, had the MW not risen

	Sd	90:10	90:50	50:10	Incidence of MW <sub>2019</sub>
2006	0.58	1.43	0.95	0.48	23%
2019	0.51	1.21	0.86	0.35	4%
2019 w/ MW <sub>2006</sub>	0.57	1.43	0.86	0.57	16%
Total change	-7%	-22%	-9%	-13%	-19%
<b>Change due to MW</b>	<b>-6%</b>	<b>-22%</b>	<b>0%</b>	<b>-22%</b>	<b>-12%</b>

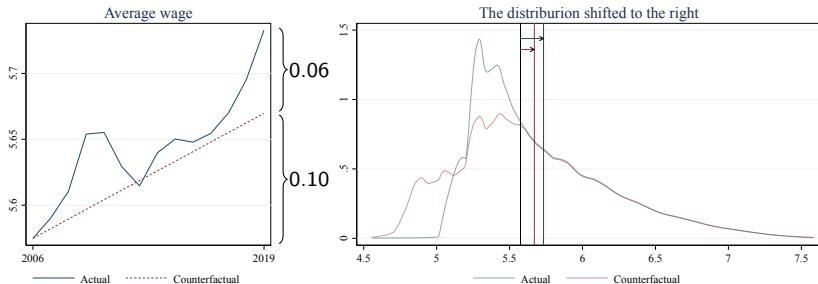




# The MW drove the average wage up

The impact of the MW was such that it shifted the distribution

The average wage grew by 16pp between 2006 and 2019. 38% of that growth (6pp) was due to the rise in the minimum wage.



## Spillover effects played a crucial role

Reaching very high up in the distribution, being sometimes greater than bite effects

- ▶ Spillover effects were substantial
- ▶ Reaching 40% above the minimum wage
- ▶ And in some cases being more important than the bite itself
  - ▶ E.g., most of the decrease in 50:10 was due to spillovers

	Sd	90:10	50:10	Mean
Change due to MW	-0.06	-0.22	-0.22	0.06
Change due to bite	-0.04	-0.09	-0.08	0.04
Change due to spillovers	-0.02	-0.13	-0.14	0.02

## Effects were highly heterogeneous

### Gender

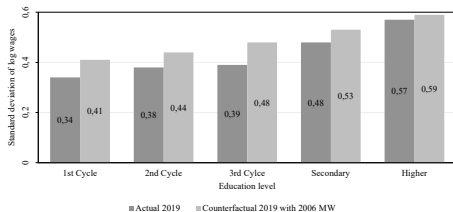
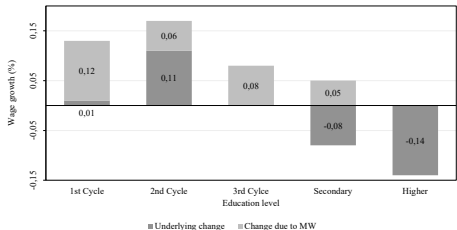
- ▶ "Within-women" inequality would have increased, had the MW not risen ("within-males" would not)
- ▶ 60% of female average wage growth was due to rising MW (only 7% for males)
- ▶ Cut the gender wage gap by a quarter (from 22% to 17%)

	90:10		50:10		Mean wage	
	Females	Males	Females	Males	Females	Males
Total change	-0.18	-0.19	-0.09	-0.12	0.2	0.14
Underlying change	0.07	-0.09	0.14	-0.01	0.08	0.13
Change due to MW	-0.25	-0.1	-0.23	-0.09	0.12	0.01

# Effects were highly heterogeneous

## Education

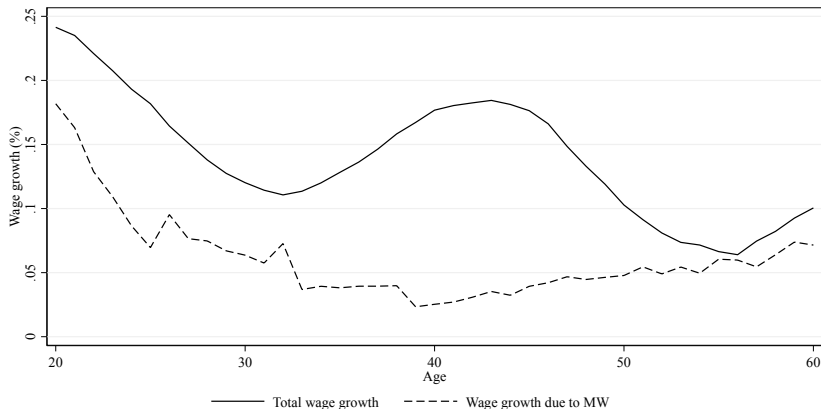
- ▶ Rising MW explains all wage growth for lowest educated (and none for highest)
- ▶ Inequality within education levels also decreased (especially for least educated)



# Effects were highly heterogeneous

## Age

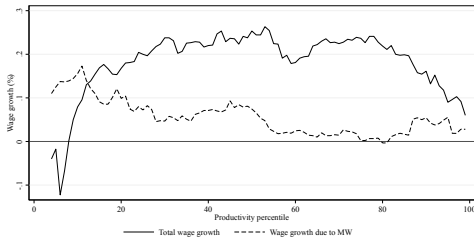
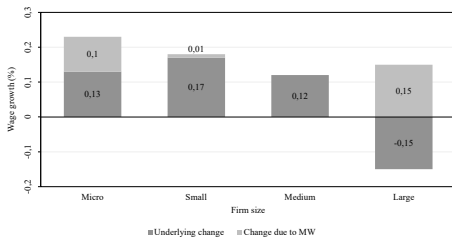
- ▶ Benefited youngest workers the most, and older workers approaching retirement



# Effects were highly heterogeneous

## Firms

- ▶ Most influential for workers at micro firms and large firms
- ▶ And for workers at less productive firms



## Conclusion

The minimum wage is definitely shaping the wage distribution

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## Main results:

- ▶ Strong effects when MW rose steadily
- ▶ Structurally reshaped the distribution
- ▶ Fully explained the fall in inequality
- ▶ Drove the average wage up
- ▶ Spillovers played a crucial role
- ▶ Effects were highly heterogeneous



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## Further issues:

- ▶ *"Pay particular attention to **the role of collective bargaining**. Important to discuss how this institution mediates the effects you estimate."*
- ▶ *"Emphasize the **similarities of your setting with other European countries**."*
- ▶ How to incorporate disemployment effects? Maybe selection into employment (Heckman 1974, Arellano and Bonhomme 2017)