Racial inequality, minimum wage spillovers, and the informal sector

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Introduction

Many post-slavery, post-colonial societies characterized by persistent and large racial and ethnic economic disparities.

How effective is the minimum wage at reducing these types of disparities?

Ambiguous effects on inequality:

- Wage inequality
  - In the formal sector
  - In the informal sector not constrained by the min. wage
- Displacement effects
  - From employment to non-employment
  - From formal sector to informal sector

We study this question in the context of Brazil.

The Brazilian context

Brazil is an ideal setting to study these questions:

1. Persistence of large racial disparities.
2. Large informal sector where nonwhite workers are overrepresented.
   - 40% of private workforce with no formal contract in 2009.
   - 38% of formal workers are nonwhite vs. 60% of informal in 2009.
3. Large nationwide minimum wage increases in the 2000s.
4. Rich micro-data with info on race:
   - Labor force surveys and census data
     $\rightarrow$ study informality
   - Linked employer-employee data

Main results

Using graphical evidence and difference-in-differences, we show **minimum wage hikes led to large $\searrow$ in racial *income* gaps**:

1. Reduction in wage inequality among formal workers:
   - Racial gaps erased at p10 nationally, p30 in Northeast.
   - No reduction in racial gaps above p15 nationally.
2. Minimum wage increases wages in informal sector:
   - Minimum wage largely binding.
   - 80% pass-through of min. wage $\nearrow$ into informal sector.
3. Displacement of workers:
   - No evidence of disemployment or reallocation to informal.
   - No disproportionate reallocations of nonwhite workers.

Contributions

1. Document role of min. wage on racial wage inequality in formal sector:
   - Transparent evidence, percentile by percentile.
     Juhn et al. (1991), Bayer and Charles (2018), Engbom and Moser (2021), Derenoncourt and Montialoux (2021)

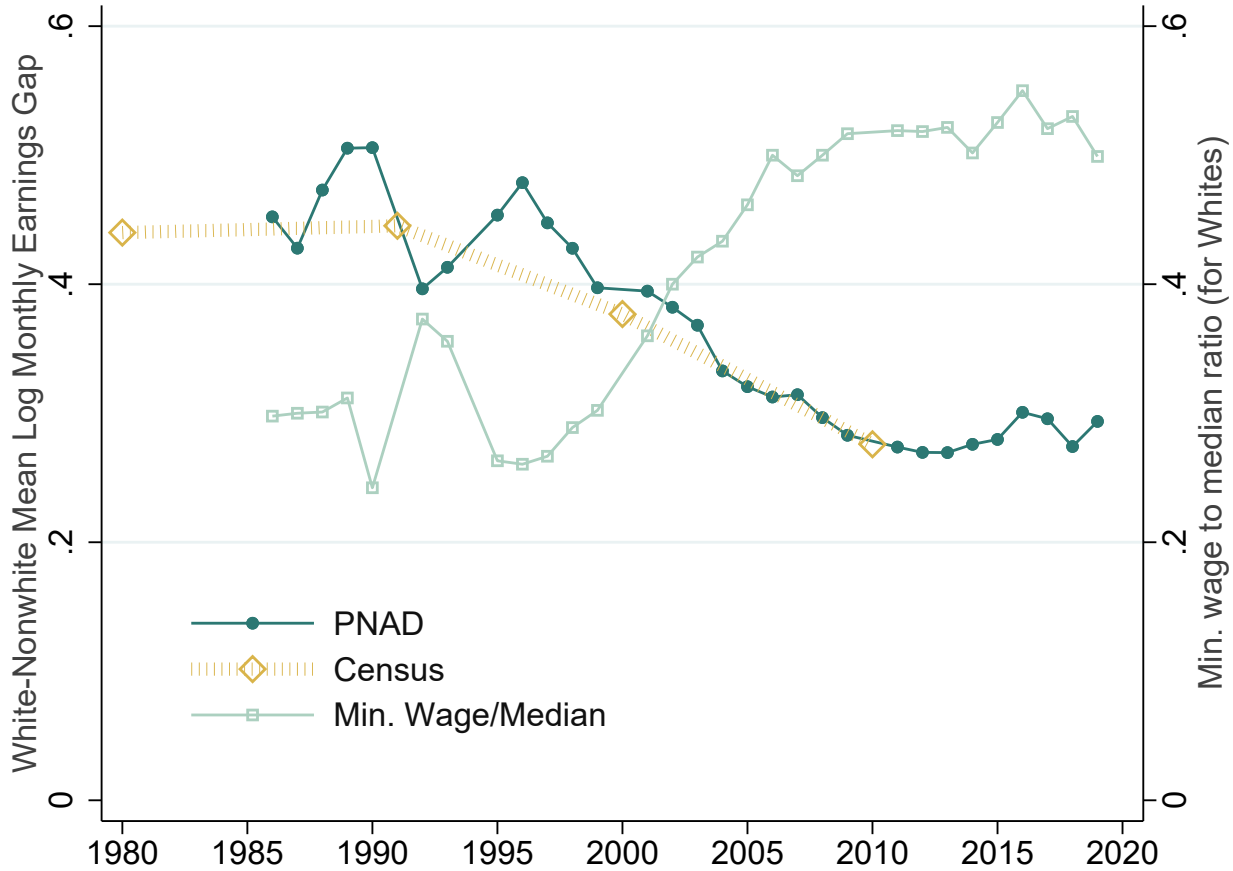
2. Uncover wage increases in informal jobs due to min. wage ↗:
   - Quantify spillover effects to informal ("lighthouse effects").
     Fajnzylber (2001), Neri et al. (2001, 2006), Lemos (2009)
   - Consistent with evidence across age groups & within multi-establishment firms. Hazell et al. (2022), Giupponi and Machin (2018), Hjort et al. (2021)
   - Implications for middle-income countries & gig sector in others. Ulyssea (2018, 2020), Haanwinckel and Soares (2020), Parente (2021)

3. Quantify role of min. wage in racial income inequality & poverty gaps in middle-income countries:
   - Role of domestic policies vs. trade & other economic forces.
     Galle et al. (2020), Adao et al. (2020), Dix-Carneiro et al. (2021)

Roadmap

1. **Context and data**
2. Reduction in racial wage inequality among formal workers
3. Effect of minimum wages on informal sector
4. Displacement effects
   - From the formal sector to the informal
   - From employment to non-unemployment
5. Conclusion

Decline in racial gaps coincides with minimum wage hikes



→ Decline in racial inequality by 15 log points over 1995-2010.

→ Racial poverty gap (share $< 0.5 \times$ min. wage) $\searrow$ by 1/3. ▸ plot

→ Min. wage/median $\nearrow$ from 30% in 1999 to >50% in 2009.

→ MW is federal; set in monthly terms; approved by President

▸ mw

Monthly earnings distributions by racial group

$\rightarrow$ Min. wage binds at $\sim$ p10 nationally over 1995-2015 (e.g. p7 in 1995, p13 in 2006). ▸ numbers ▸ by region ▸ pnad vs. rais ▸ hourly wage distributions

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CDFs of monthly earnings by racial group

log earnings$_{it} = \alpha_t(q) + \beta_t(q)$nonwhite$_i + \epsilon_{it}(q)$
$\beta_t(q)$: Estimate of racial earnings level gap at qth percentile

$\rightarrow$ Racial gaps at p10 $\searrow$ 0 in 2006 (bc min. wage binds at $\sim$ p10 for white and $>$ p10 for nonwhite workers) ▸ measure

Wrap-up on ↘ in racial inequality in formal sector

At the national level

- Racial gaps erased at p10.
- Above p15, no ↘ in racial gaps from min. wage ▸ time series

  → Pattern of racial inequality reverse to the US (Bayer and Charles (2018)).
- Other factors at play to reduce racial inequality higher up.

At the regional level

- Racial gaps erased at p15 in states with high initial min. wage/median ratios. ▸ graph
- Racial gaps erased at p30 in Northeast. ▸ graph

→ Combined w/ result of no displacement to informal or non-emp., mw ↘ racial gap in overall (formal + informal) workforce.

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Minimum wage de facto binding in informal sector

Monthly earnings distributions, formal vs. informal sector

→ Informal workers' wages are also responding.

→ Inconsistent with perfectly competitive, segmented labor markets. ▸ nb ▸ all private ▸ Back ▸ sh, 2015

Quantifying spillover effects to informal sector

Step 1: Quantifying effects on earnings in formal sector

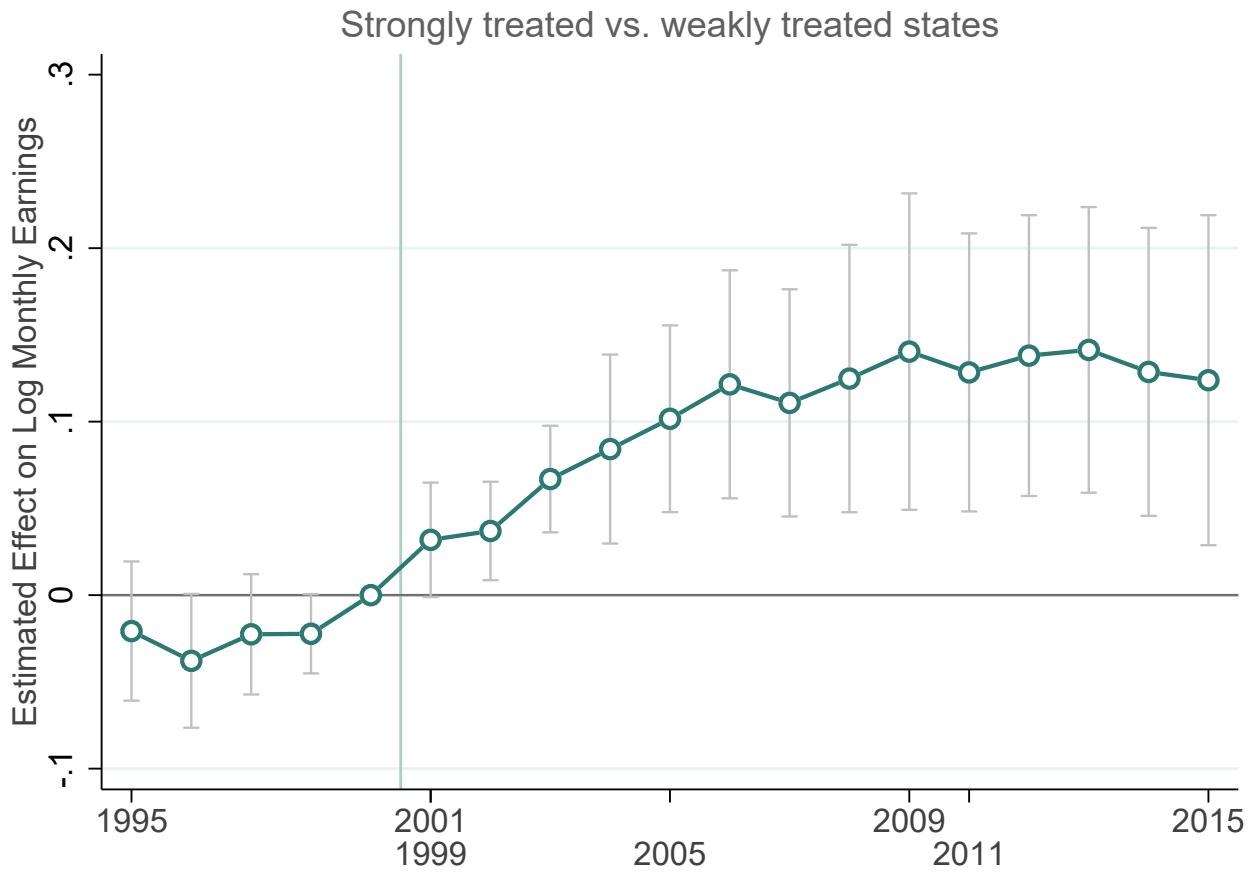
$$\text{Monthly Earnings}_{ist} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

- w_{ijst}: log monthly earnings for individual i, state s and year t.
- Strongly_s: min. wage/median for white workers above 35% in 1999 ▸ map
- β_k measures effect of reform k years after base year 1999.
- $\mathbb{X}_{ijst}$: individual-level controls (gender, race, exp., educ., $(+^2)$) and state-level (log gdp per capita by state $(+^2)$).
- δ_j and δ_t: state and year fixed effects.

$\rightarrow$ Identification assumption: absent 2000-2009 reforms, earnings in strongly and weakly treated states would have evolved similarly.

Step 1: Quantifying effects on earnings in formal sector

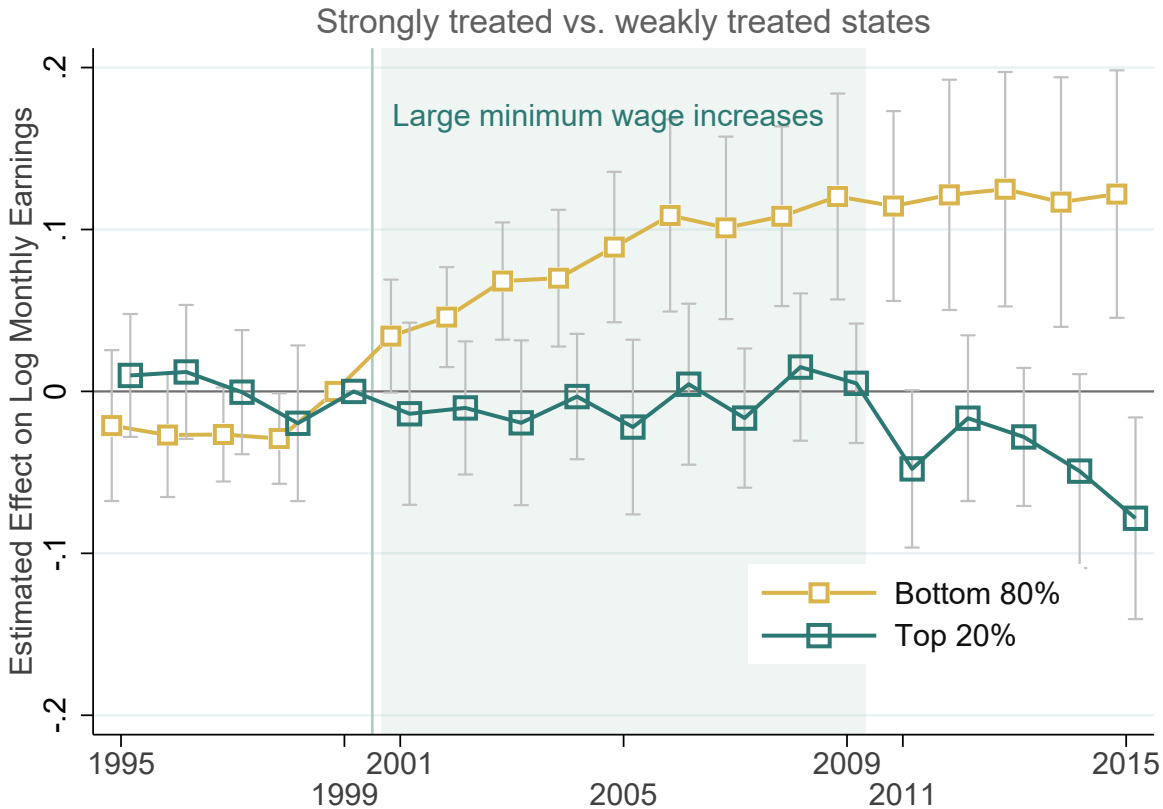
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$\rightarrow$ Overall effect: $\sim$+11 log pts in strongly treated states.

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→ Effects concentrated in part of distribution not affected by min. wage increases, below p80 (Engbom, Moser, 2021).

→ Effects concentrated among low-education workers. ▸ table

→ Robust to other def. of treat. var, levels (industry × state/micro-region), and data sets (RAIS, Census) ▸ here

Step 2: Quantifying spillover effects to informal sector

$\forall$ period $k \in$ [1995-1999], [2001-2009] & [2011-2015],

Monthly Earnings$_{ist} = \alpha + \delta_k + \sum_k \beta_k$Strongly$_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$

	All	Nonwhite	White
Strongly treated state × 2001-2009			
Monthly earnings	0.114***	0.096**	0.116***
Among formal workers	(0.031)	(0.036)	(0.029)
	706,028	342,185	363,843
Monthly earnings	0.092***	0.090**	0.090***
Among informal workers	(0.033)	(0.038)	(0.031)
	275,292	165,051	110,241
Cross-sector wage elasticity	0.80	0.94	0.78
se	(0.12)	(0.17)	(0.12)
lower bound	0.57	0.61	0.54
upper bound	1.03	1.26	1.01

→ Cannot rule out that spillover effects of minimum wage from formal to informal sector are 1 to 1.

→ No statistically significant differences across racial groups.

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Understanding existence & magnitude of these spillovers

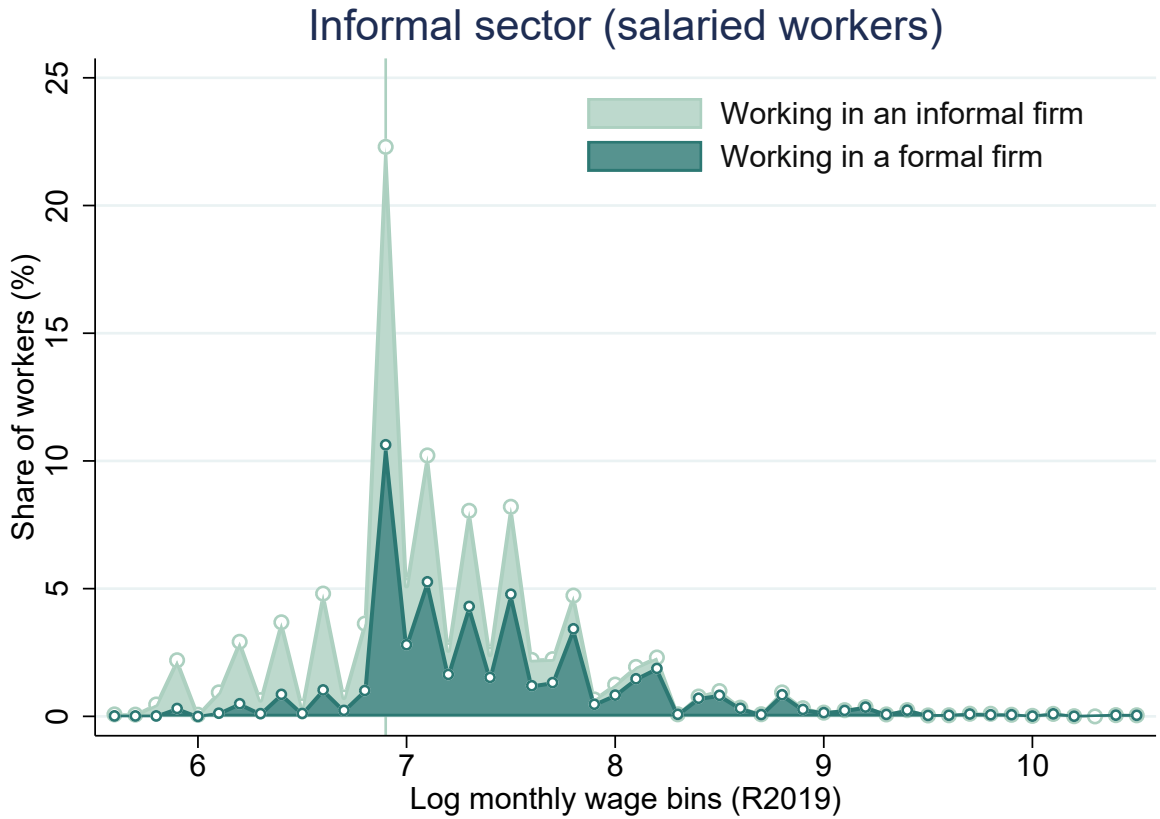
Informal and formal sectors are integrated (Meghir, Narita and Robin (2015)).

Three mechanisms might be at play:

1. **Constraints in firm wage setting or norms**.
2. **Competitive mechanisms**.
   $\rightarrow$ There may be oligopsonistic competition (Berger, Herkenhoff, Mongey (2019)) between informal and formal sector for min. wage workers.
3. **Differences in enforcement** (or threat of) of labor law regulations.

1. Constraints in firm wage setting or norms

Monthly earnings distributions, informal employees



→ Non-compliance with min. wage concentrated on extensive margin of informality.

→ Evidence of wage setting constraints within firms, across ≠ types of contracts, complementing Hjort, Li, Sarsons (2020) and Hazell, Patterson, Sarsons & Taska (2021).

2. Competitive mechanisms (1/2)

Shares of formal and informal employees, by **occupation** (2015)

	Formal workers	**Informal workers**	
		at formal firms	at informal firms
Occupation			
Managerial	0.05	0.04	0.01
Scientific and artistic	0.07	0.09	0.01
Mid-level technicians	0.08	0.08	0.01
Administrative service workers	0.15	0.09	0.02
Service workers	0.21	0.19	0.09
Retail service workers	0.10	0.13	0.05
Agricultural workers	0.04	0.08	0.34
Manufacturing, constr. & repair	0.29	0.30	0.47
Armed forces	0.00	0.00	0.00
Other	0.00	0.00	0.00

$\rightarrow$ Formal workers and informal workers working at formal firms work in similar occupations.

$\rightarrow$ Informal workers working at informal firms have $\neq$ profile.

2. Competitive mechanisms (2/2)

Shares of formal and informal employees, by **industry** (2015)

	Formal workers	**Informal workers**	
		at formal firms	at informal firms
Industry			
Agriculture	0.05	0.09	0.35
Manufacturing	0.22	0.15	0.06
Construction	0.08	0.09	0.35
Extractive industries	0.02	0.01	0.01
Trade	0.24	0.30	0.11
Hotels, rest., repair and dom. services	0.05	0.10	0.04
Transportation and communication	0.09	0.08	0.05
Education and health	0.09	0.07	0.01
Public administration	0.02	0.00	0.00
Finance, insurance, real estate	0.14	0.12	0.02

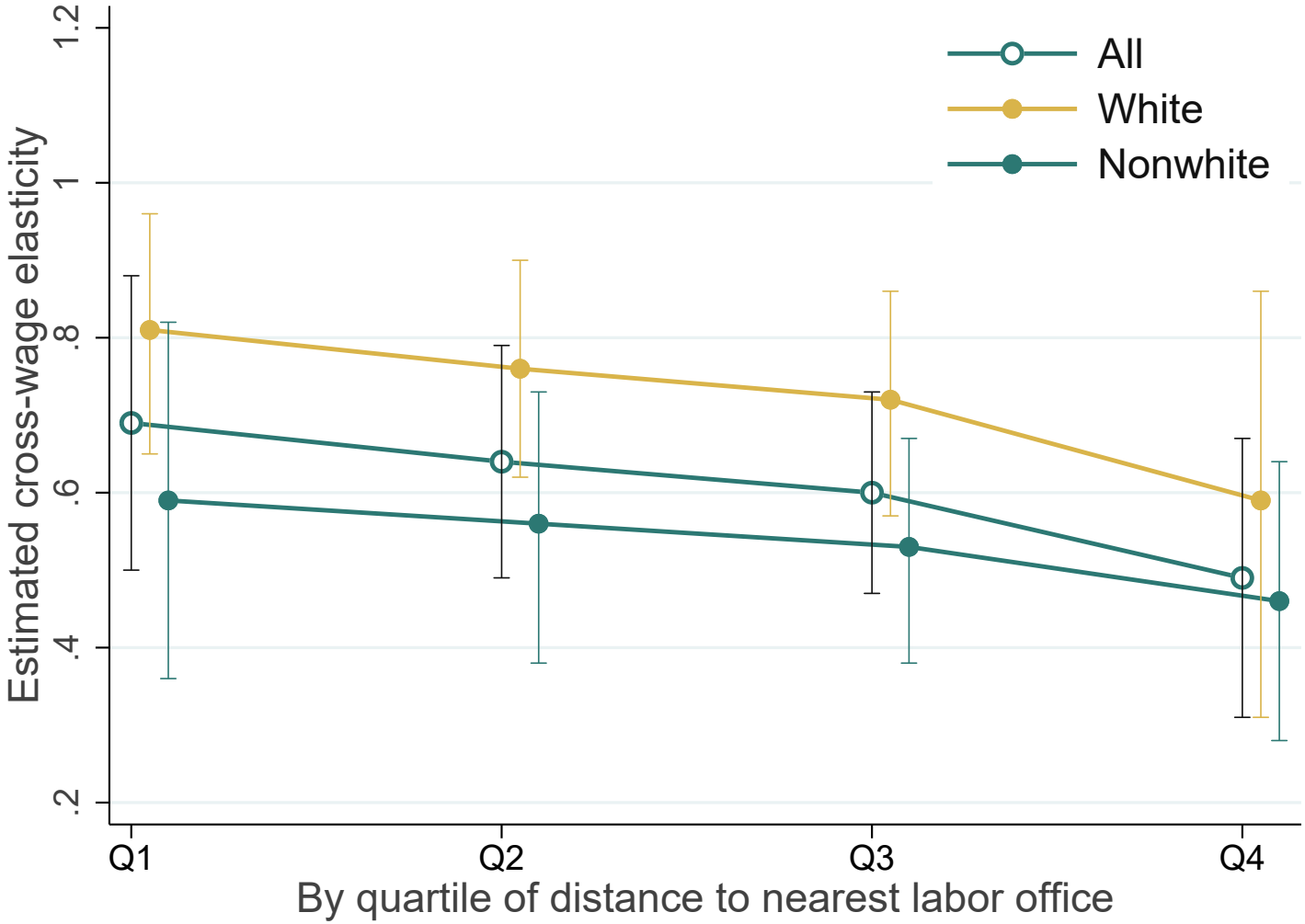
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$\rightarrow$ Informal workers working at informal firms have $\neq$ profile.

3. Differences in enforcement

$\forall$ period k in Census $\in$ 2000 and 2010, and micro-regions m map

$$\text{Monthly Earnings}_{imt} = \alpha + \delta_k + \sum_k \beta_k \text{Kaitz}_m \times \delta_{t+k} + \gamma \text{Dist}_m \times \delta_{t+k} + \sum_k \eta_k \text{Kaitz}_m \times \text{Dist}_m \times \delta_{t+k} + \mathbb{X}'_{imt}\Gamma + \delta_m + \varepsilon_{imt}$$



→ Magnitude of spillovers ↗ w/ higher enforcement.

→ Pattern true across white and nonwhite workers.

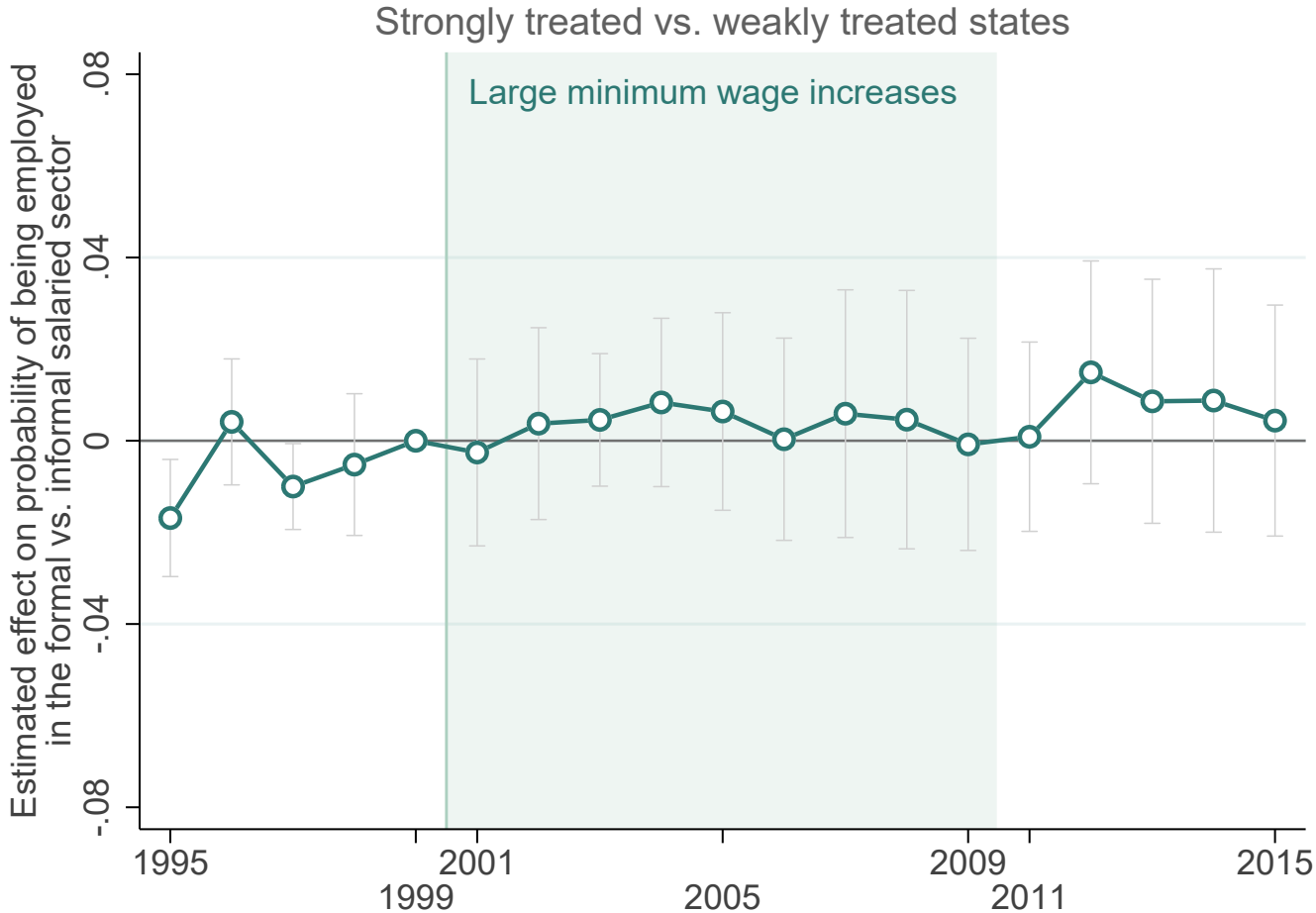
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Reallocation from formal to informal employment

$$\mathbb{1}\{\text{Formal}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

With $\mathbb{1}\{\text{Formal}_{ist}\} = 1$ if private formal; $= 0$ if informal employee
Controls = gender, race, educ., work exp. $(+^2)$, log gdp per capita by state $(+^2)$



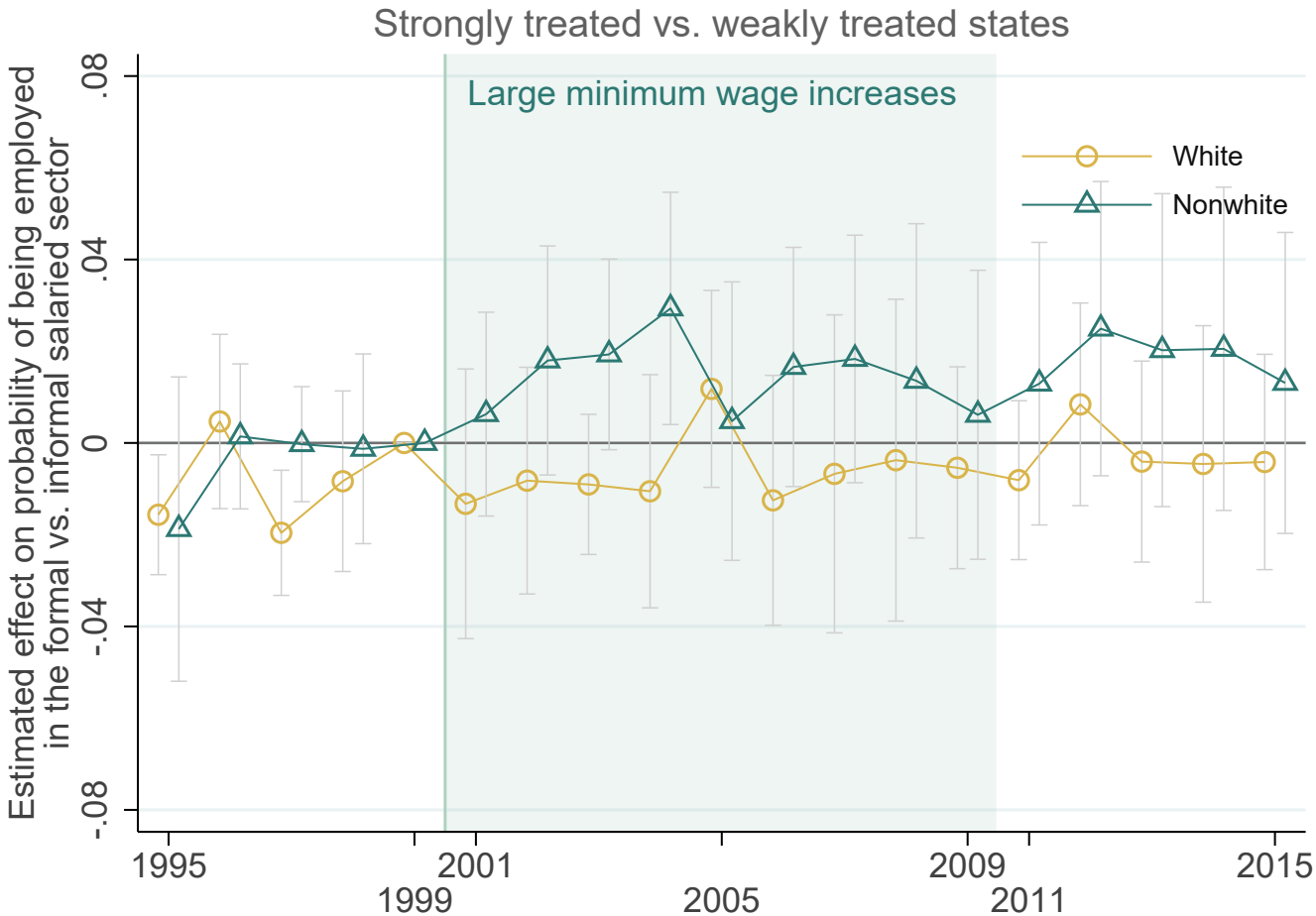
→ No relative increase in informal sector in strongly vs. weakly treated states.

→ Similar point estimates with and w/o controls. ▸ No controls

Reallocation from formal to informal by racial group

$$\mathbb{1}\{\text{Formal}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

With $\mathbb{1}\{\text{Formal}_{ist}\} = 1$ if private formal; $= 0$ if informal employee
Controls = gender, educ., work exp. $(+^2)$, log gdp per capita by state $(+^2)$



→ Similar point estimates across racial groups.

▸ No controls

Results on cross-sector reallocations

$$\mathbb{1}\{\text{Formal}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

With $\mathbb{1}\{\text{Formal}_{ist}\} = 1$ if private formal; $= 0$ if informal employee
Controls = gender, educ., work exp. $(+^2)$, log gdp per capita by state $(+^2)$

	All	Nonwhite	White
Strongly treated state × 2001-2009			
Reallocation effect	0.010	0.019	0.003
	(0.010)	(0.013)	(0.011)
	1,173,807	609,259	564,548
Monthly earnings	0.114***	0.096**	0.116***
Among formal workers	(0.031)	(0.036)	(0.029)
	706,028	342,185	363,843
Cross-sector emp. elasticity	0.13	0.32	0.03
se	(0.15)	(0.26)	(0.13)
lower bound	-0.16	-0.19	-0.23
upper bound	0.42	0.83	0.29

→ Can rule out cross-sector elasticity wrt earnings < -0.19 among nonwhite workers, < -0.23 among white workers.

→ Similar cross-sector elast. w/ all informal sector ▸ all informal

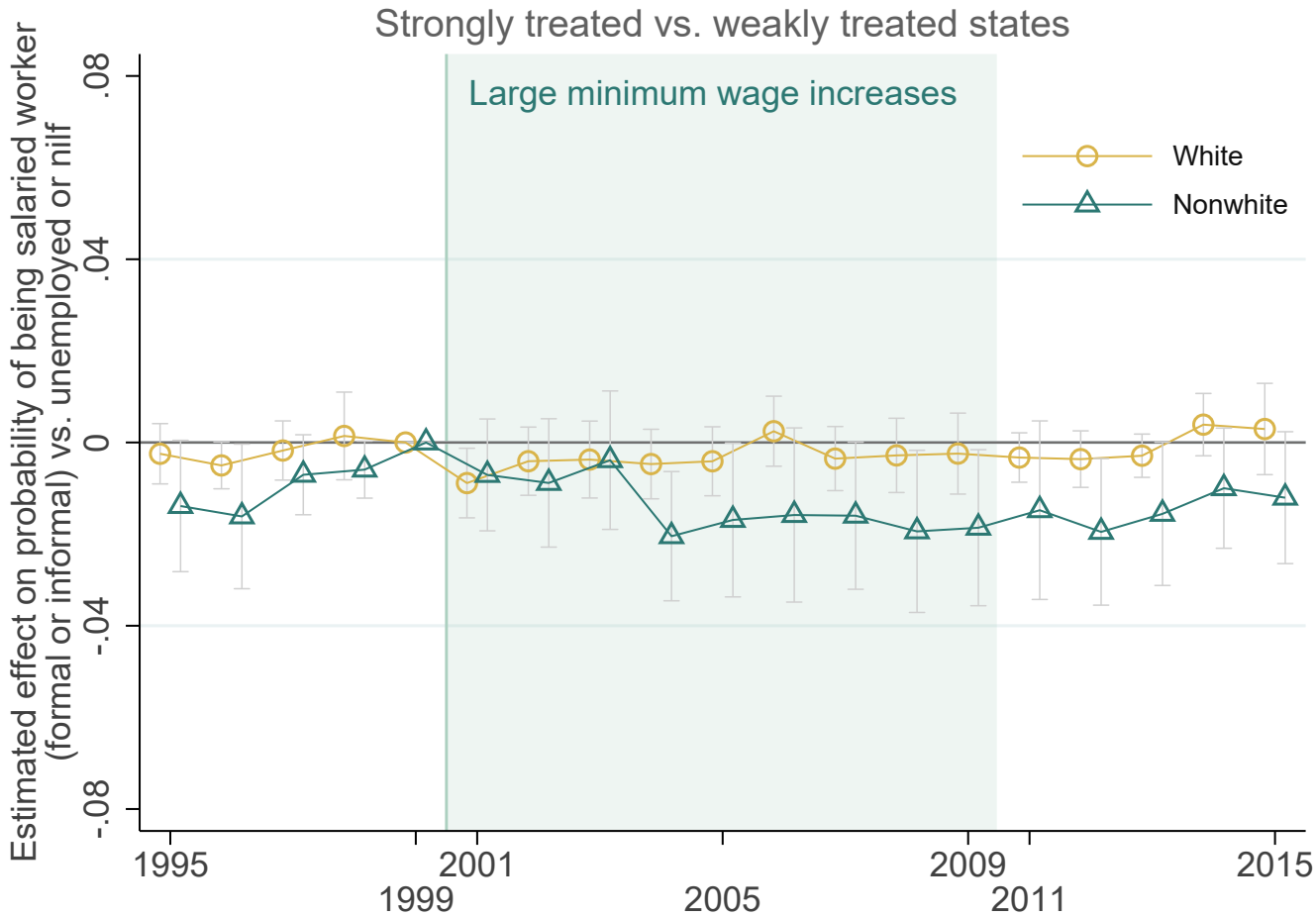
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Displacement from employment to unemployment

$$\mathbb{1}\{\text{Employed}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

With $\mathbb{1}\{\text{Employed}_{ist}\} = 1$ if employed (formal or informal); $= 0$ if unemployed
Controls $=$ gender, educ., log gdp per capita by state $(+^2)$



→ No differential effects on unemployment across racial groups.

▸ unemp., all ▸ unemp./nilf, by race ▸ unemp./nilf, all

Results on displacement from employment to unemp.

$\forall$ period $k \in$ [1995-1999], [2001-2009] & [2011-2015],

$\mathbb{1}\{\text{Employed}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$

With $\mathbb{1}\{\text{Employed}_{ist}\} = 1$ if employed (formal or informal); $= 0$ if unemployed

Controls = gender, educ., log gdp per capita by state ($+^2$)

	All	Nonwhite	White
Strongly treated state × 2001-2009			
Employment vs. unemp.	-0.005	-0.006	-0.002
	(0.004)	(0.006)	(0.003)
	2,092,994	1,095,336	997,658
Monthly earnings	0.114***	0.096**	0.116***
Among formal workers	(0.031)	(0.036)	(0.029)
	706,028	342,185	363,843
Elasticity	-0.04	-0.07	-0.02
se	(0.03)	(0.05)	(0.03)
lower bound	-0.10	-0.16	-0.07
upper bound	0.01	0.02	0.03

→ Can rule out elast. < -0.16 among nonwhite workers.

→ If anything, small <0 effect on labor force participation. ▸ table

→ Overall emp. results consistent w/ tight competitive labor markets or monopsonistic labor markets.

Results on displacement from employment to unemp./nilf

$\forall$ period $k \in$ [1995-1999], [2001-2009] & [2011-2015],

$$\mathbb{1}\{\text{Formal}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

With $\mathbb{1}\{\text{Formal}_{ist}\} = 1$ if employed formal; $= 0$ if unemp. or nilf
Controls [Model (1)] = gender, educ., log gdp per capita by state $(+^2)$
Controls [Model (2)] = (1) + log bolsa familia exp. per capita by state ▸ Graph

	Model (1)	Model (2)	Family w/o kids	Family w/ kids
Strongly treated state × 2001-2009				
Reallocation effect	-0.010	-0.010	-0.007*	-0.010
	(0.008)	(0.008)	(0.004)	(0.010)
	1,516,951	1,516,951	640,707	876,244
Monthly earnings	0.114***	0.116***	0.118***	0.115***
	(0.031)	(0.031)	(0.037)	(0.028)
	706,028	706,028	296,893	409,135
Elast.	-0.16	-0.17	-0.11	-0.16
se	(0.12)	(0.12)	(0.05)	(0.15)
lower bound	-0.39	-0.39	-0.20	-0.46
upper bound	0.07	0.06	-0.01	0.14

→ Similar elasticities when controlling or not for bolsa familia expenditures.

Results on displacement from employment to unemp./nilf

$\forall$ period $k \in$ [1995-1999], [2001-2009] & [2011-2015],
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$\rightarrow$ Similar elasticities across families with and w/o kids.

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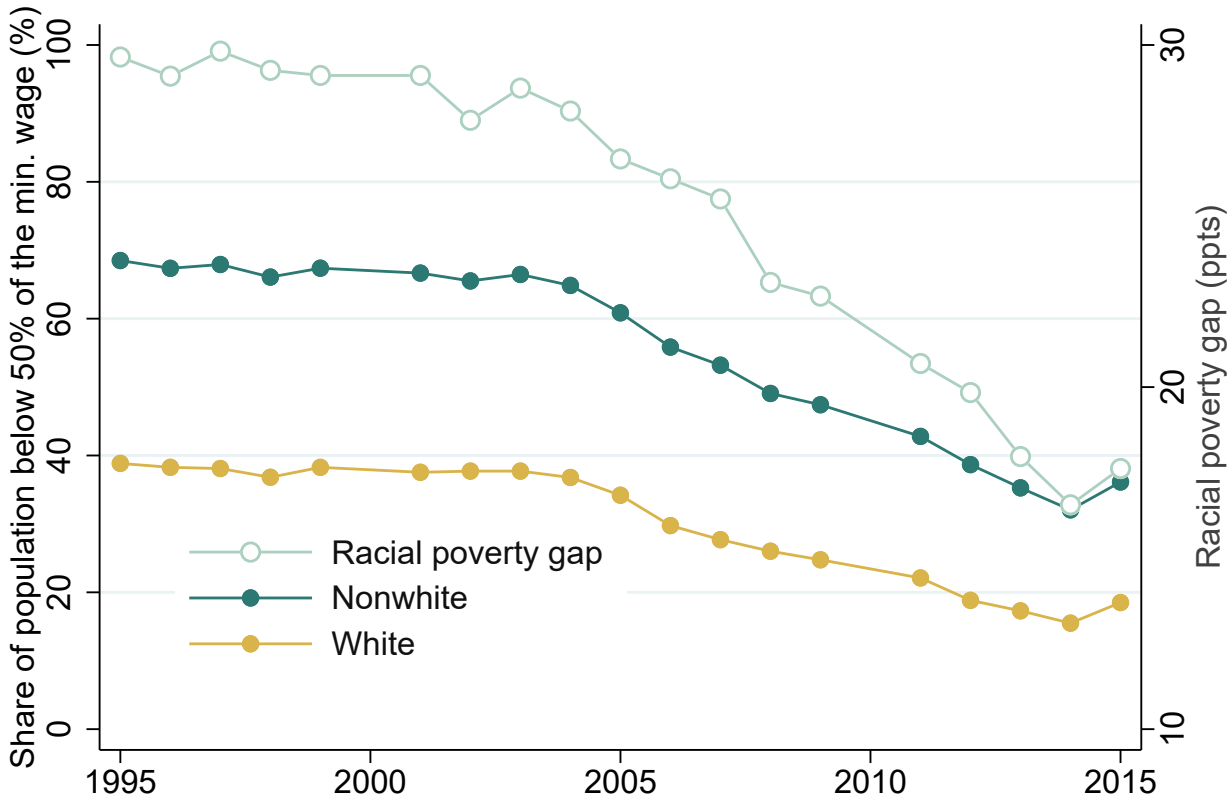
Conclusion

1. **Min. wage closed racial income gap at bottom in Brazil**:
   - Gap $\searrow$ to zero up to 10th percentile nationally, 30th in Northeast.
   - No reallocation to informal/non-employment for any racial group.
2. **Minimum wage improves conditions in informal sector**:
   - Strongly binds in informal sector.
   - Consistent with strategic competition among informal and formal employers, & and with min. wage acting as a norm.
   - Its role in $\searrow$ inequality and poverty may have been underestimated if it spills over so strongly to informal sector.

$\rightarrow$ **Min. wage may be one of the few policy tools able to influence the informal sector in the short-run**.

Appendix

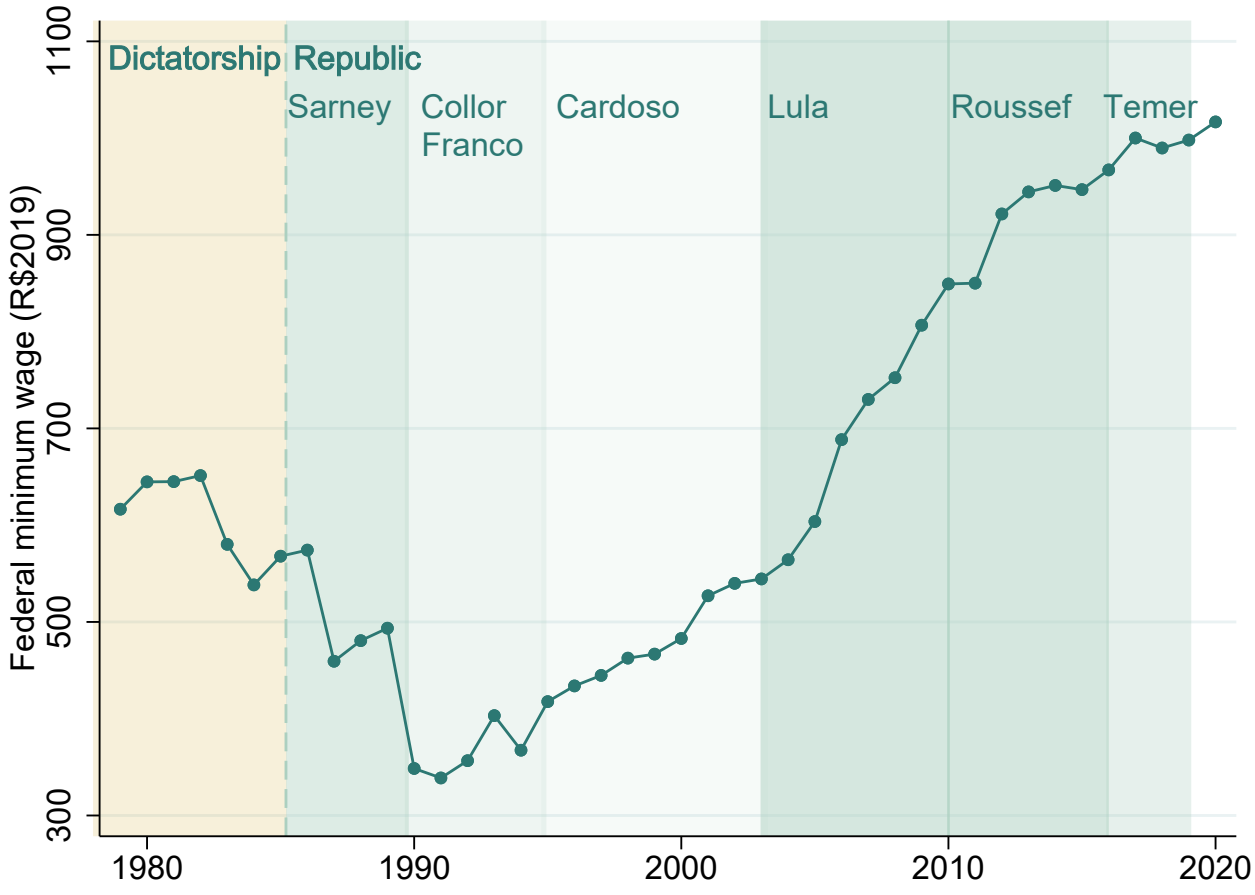
Decline in racial poverty gap in 2000s



→ Measured as share of pop. with household monthly earnings per capita $< 0.5 \times$ min. wage.

→ Decline in racial poverty gap by 1/3 over 1995-2010 (from 30 to 20ppts), 1/2 over 1995-2015. Back

Big minimum wage increases in 2000s



→ Minimum wage is federal, applies to all industries & states.

→ Also de facto binding in informal sector.

Back

Monthly earnings distribution

Back

Monthly earnings distribution by region

Back

Monthly earnings distribution by region

Back

Monthly earnings distribution by region

Back

Monthly earnings distribution by region

Back

Monthly earnings distribution by region

Back

Monthly earnings distributions, formal sector

Back

Hourly wage distributions by PT/FT status

$\rightarrow$ Part-time (PT) workers slightly less paid on hourly basis

$\rightarrow$ Only 10% of PT workers in formal sector

$\rightarrow$ Similar hourly wage distributions in formal sector back

Hourly wage distributions by PT/FT status

$\rightarrow$ Part-time (PT) workers slightly less paid on hourly basis

$\rightarrow$ Only 10% of PT workers in formal sector

$\rightarrow$ Similar hourly wage distributions in formal sector back

Hourly wage distributions by PT/FT status

back

Hourly wage distributions by PT/FT status

back

Hourly wage distributions by PT/FT status

Back

Measuring racial disparities in the labor market

Earnings level gap:

- Measures the log-point diff. in NW and W's monthly earnings at a given percentile of their respective distribution
- Expressed as:

$$f_t^{nw}(q) - f_t^{w}(q) = f_t^{w}(q_t^{w}(q)) - -f_t^{w}(q). \tag{1}$$

  - $\beta_t(q) = f_t^{nw}(q) - f_t^{w}(q)$: estimate of earnings level gap
  - $\alpha_t(q) = f_t^{w}(q)$: estimate of log earnings of the worker at q^{th} percentile of earnings distrib. of nonwhite workers.

- Estimated by:

$$\text{log earnings}_{it} = \alpha_t(q) + \beta_t(q)\text{nonwhite}_i + \epsilon_{it}(q) \tag{2}$$

  - $\beta_t(q) = f_t^{nw}(q) - f_t^{w}(q)$: estimate of earnings level gap
  - $\alpha_t(q) = f_t^{w}(q)$: estimate of log earnings of the worker at q^{th} percentile of earnings distrib. of nonwhite workers.

Back

White-nonwhite earnings gap



→ As we move above 15th percentile, racial earnings level gaps move closer to the mean. Back

Racial earnings gaps in weakly vs. strongly treated states

log earnings$_{it} = \alpha_t(q) + \beta_t(q)\text{white}_i + \epsilon_{it}(q)$

Strongly treated states: minimum wage/median for white workers above 35% in 1999

$\rightarrow$ Effect of minimum wage on racial wage compression sharper in strongly vs. weakly treated states up to 21st percentile

▸ Back

Racial earnings gaps in weakly vs. strongly treated states

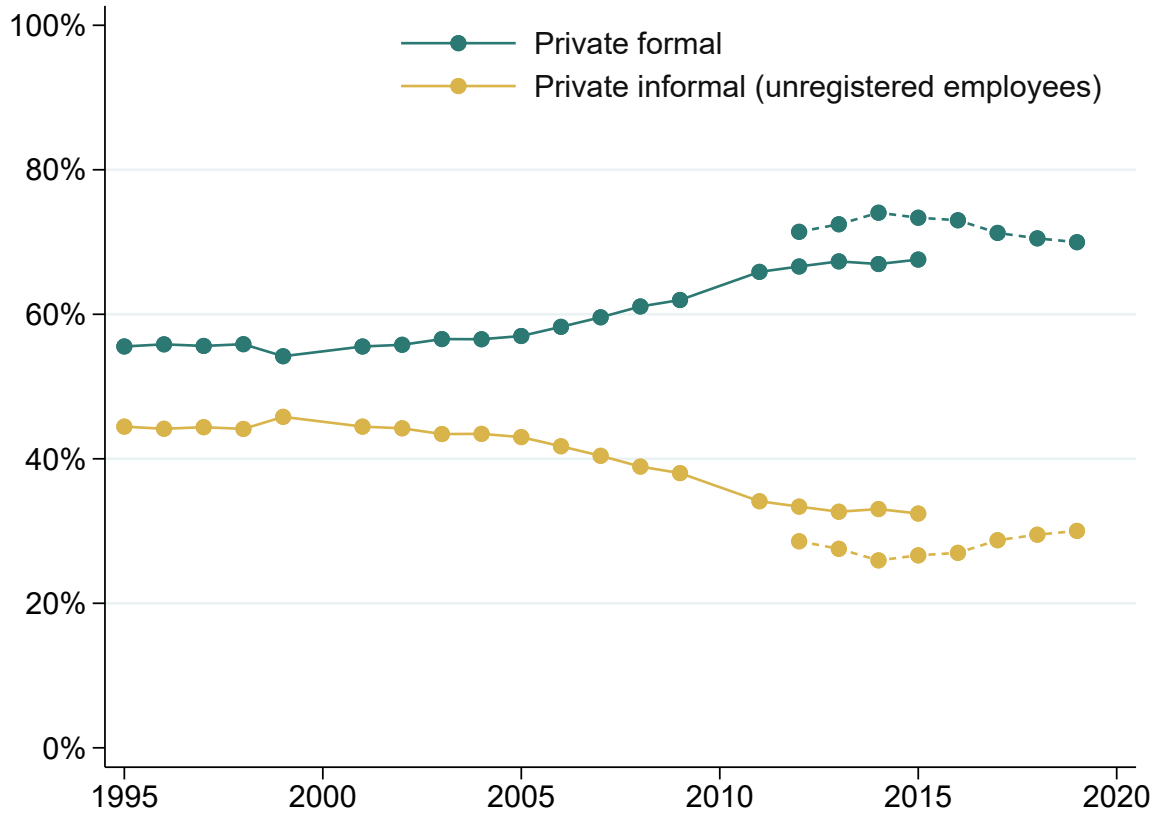
$\text{log earnings}_{it} = \alpha_t(q) + \beta_t(q)\text{white}_i + \epsilon_{it}(q)$

Most strongly treated states: Northeast

$\rightarrow$ Effect of minimum wage on racial wage compression sharper in most strongly vs. weakly treated states up to 30th percentile

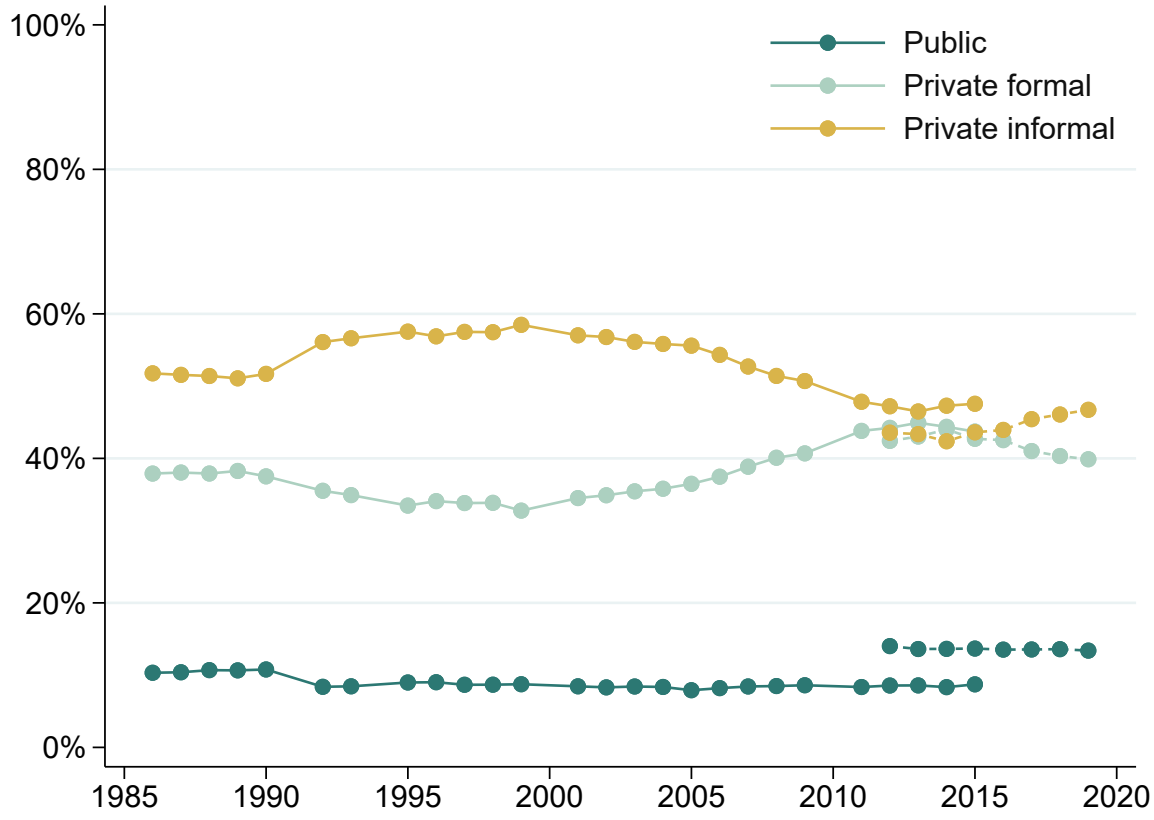
Back

Definition of informal employees



→ Decline in informality still true among informal employees (i.e. for whom we expect the min. wage to spill over from the formal sector). Back

Definition of informal workers



→ In 1999: 56% of workers in private sector are informal.
→ In 2009: 45% of workers in private sector are informal.
→ Decline in informality across racial groups; nonwhite workers overrepresented in informal sector.

▸ Back

Monthly earnings distributions, formal vs. informal

$\rightarrow$ Minimum wage de facto binding in informal sector

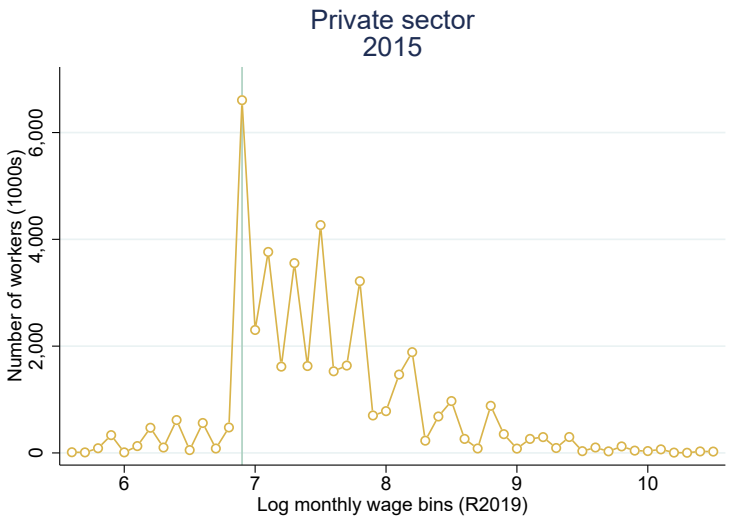
$\rightarrow$ Still true when the minimum wage peaks in 2009

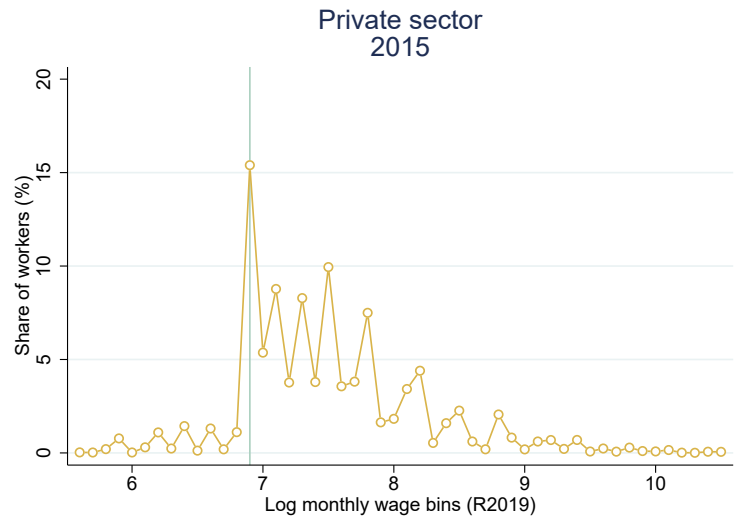
▸ nb ▸ all private ▸ Back

Monthly earnings distribution, private salaried workers

Back

Monthly earnings distribution, private sector

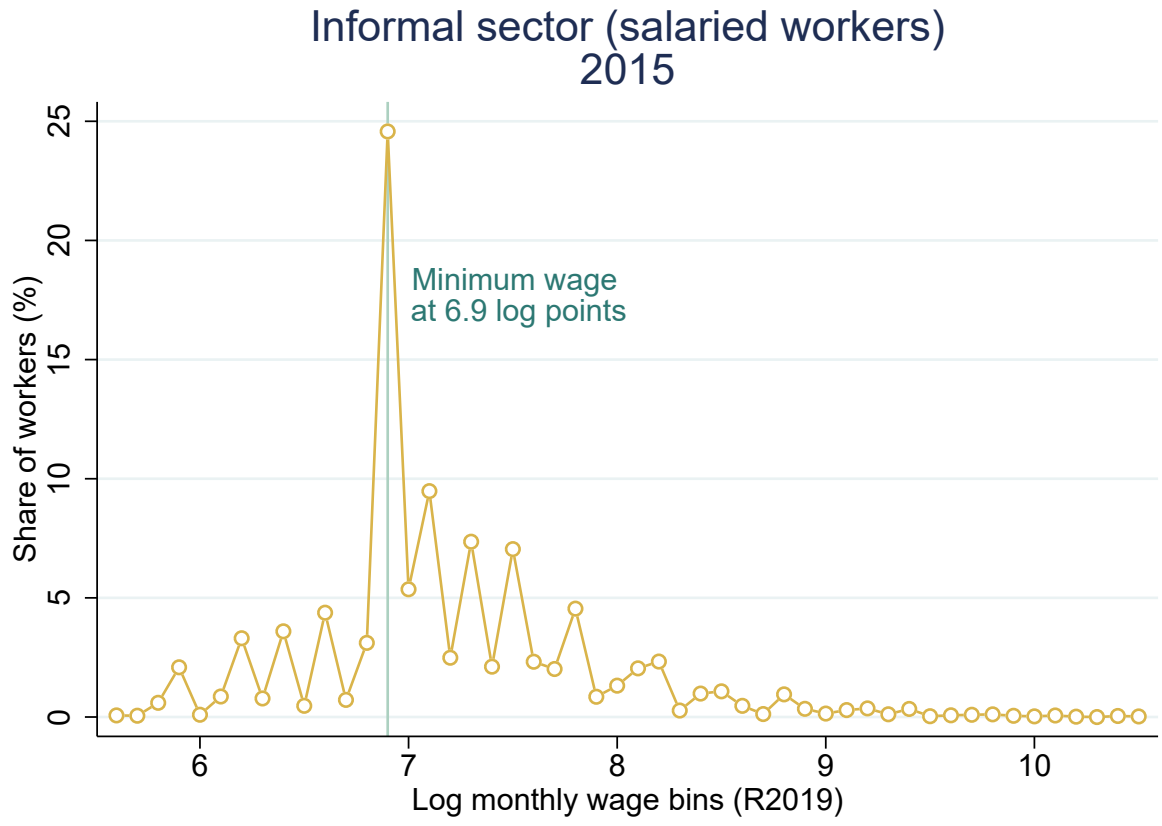




→ Self-employed and employers make up 63% of all informal full-time workers (vs. 56% of all informal workers) in 2015.

▸ Back

Monthly earnings distributions, informal employees

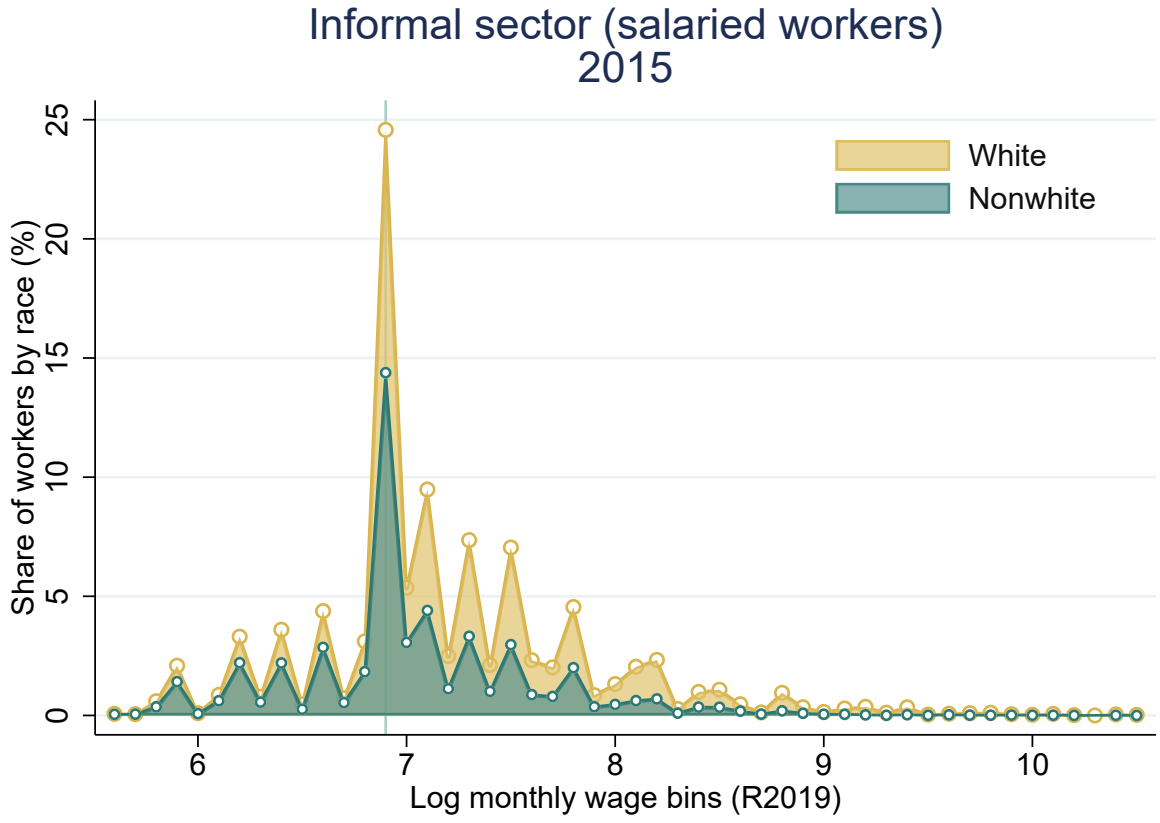


→ ≈ 25% of these workers at the min. wage, ≈ 20% below.

→ Share below ↘ 13% when removing agri. and domestic workers.

▸ Back

Monthly earnings distributions, informal employees



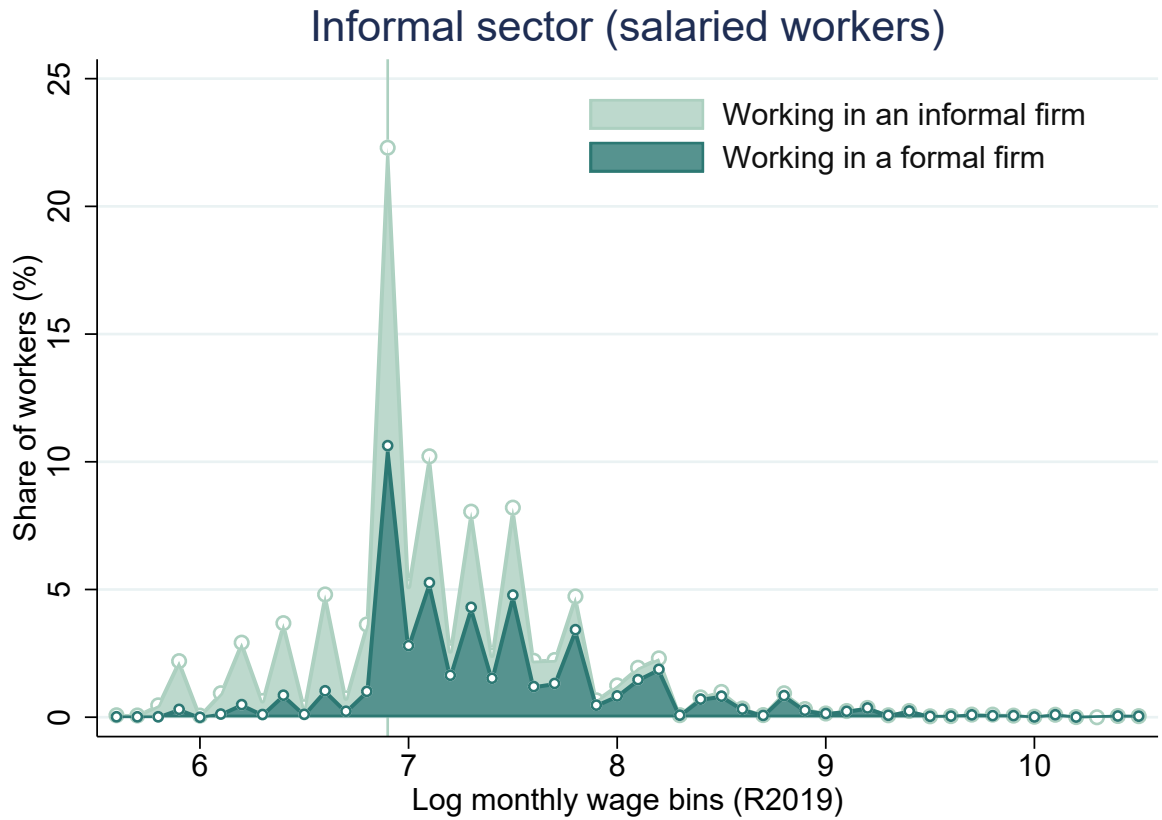
→ Overrepresentation of nonwhite workers in informal sector

→ Overrepresentation of nonwhite workers at the min. wage

⇒ Spillover effects of mw to informal sector matter for racial inequality.

▸ Back

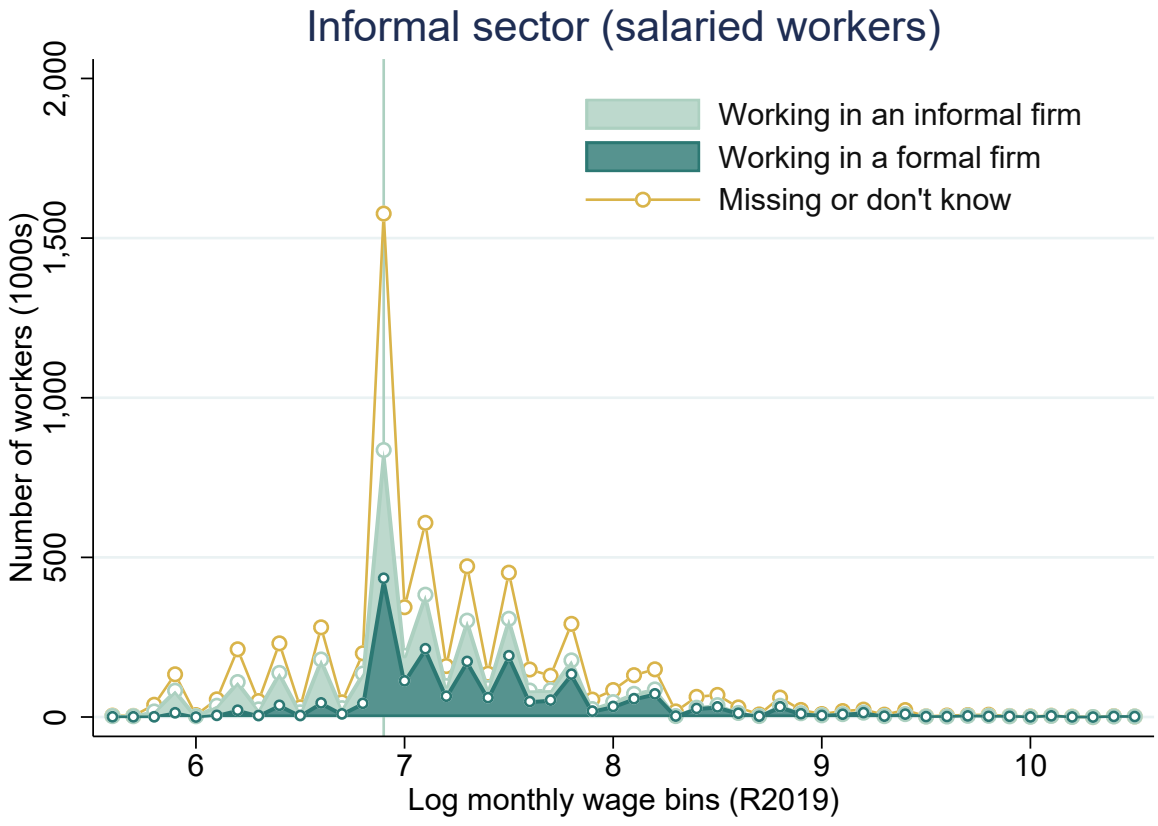
Monthly earnings distributions, informal employees



→ Non-compliance with min. wage concentrated on extensive margin of informality.

→ Compliance with mw in formal firms for both types of workers consistent with null within-firm formal-informal wage gap (Ulyssea, 2018). ▸ nb ▸ Back

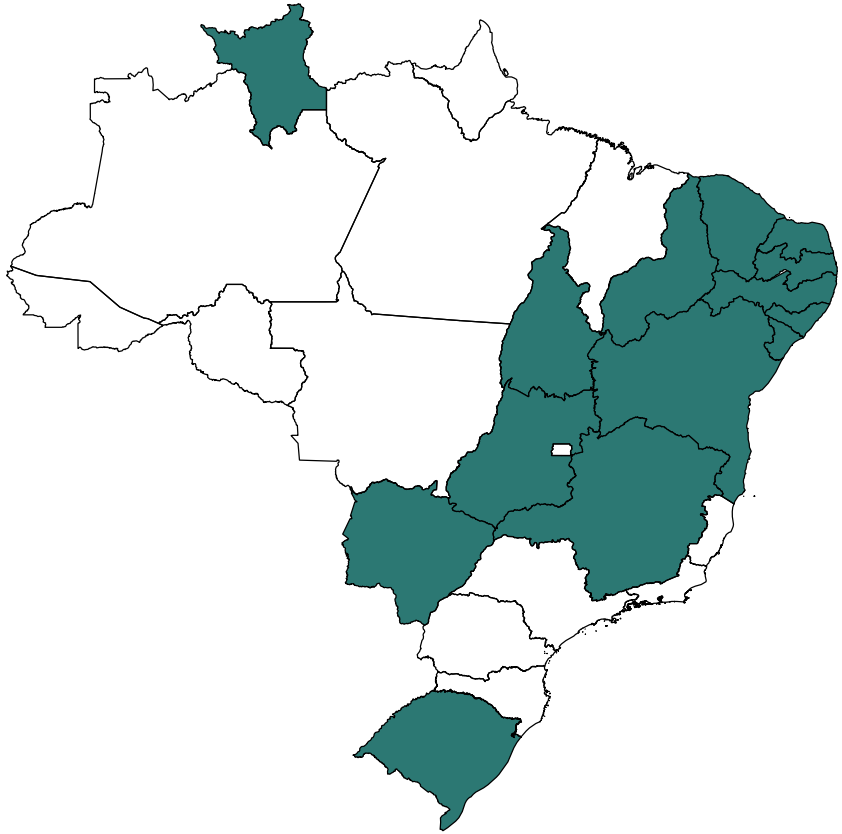
Monthly earnings distributions, informal employees



$\rightarrow \approx 40\%$ of non-response among full-time informal salaried workers.

▸ Back

Map of strongly treated states



→ Using minimum wage to median ratio for white workers in 1999, private formal sector >=36.3%.
→ Strongly treated states (14): Alagoas, Bahia, Ceará, Goiás, Minas Gerais, MatoGrosso do Sul, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, Roraima, Rio Grande do Sul, Sergipe, Tocantins.
→ Similar picture when using fraction of workers below min. wage ▸ affected

▸ Back

Map of strongly treated states



→ Using fraction of white workers below 1999 minimum wage, private formal sector >=6.6%.

→ Strongly treated states (13): Acre, Alagoas, Amapá, Bahia, Ceará, Maranhão, Minas Gerais, Paraíba, Pernambuco, Rio Grande do Norte, Roraima, Sergipe, Tocantins. Back

Step 1: Quantifying effects on earnings in formal sector

$$\text{Monthly Earnings}_{ist} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

	All	Nonwhite	White
Strongly treated state × 2001-2009			
All	0.114***	0.096**	0.116***
	(0.031)	(0.036)	(0.029)
By percentiles			
Bottom 80%	0.108***	0.097***	0.099***
	(0.030)	(0.034)	(0.025)
Top 20%	-0.005	-0.029	0.001
	(0.009)	(0.019)	(0.013)
By education			
Low-education	0.119***	0.126**	0.124***
	(0.033)	(0.049)	(0.031)
High-education	0.057*	0.024	0.042**
	(0.030)	(0.032)	(0.017)

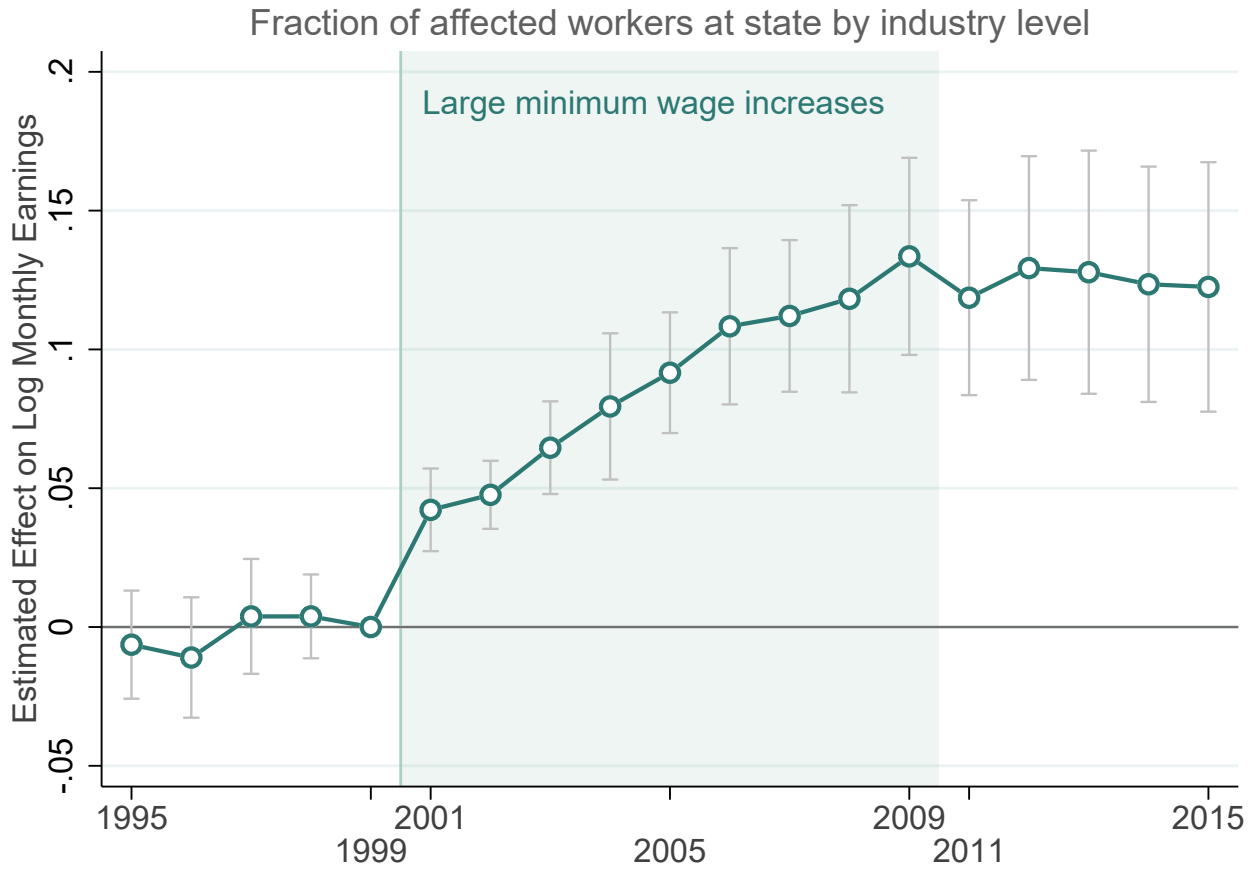
Upcoming robustness tests:

- Alternative design using fraction below min. wage by state × industry cells.
- Differentiate effect between families with and w/o children.

Back

Step 1: Quantifying effects on earnings in formal sector

$$\text{Monthly Earnings}_{isjt} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \eta_j \times \lambda_k + \varepsilon_{ijst}$$

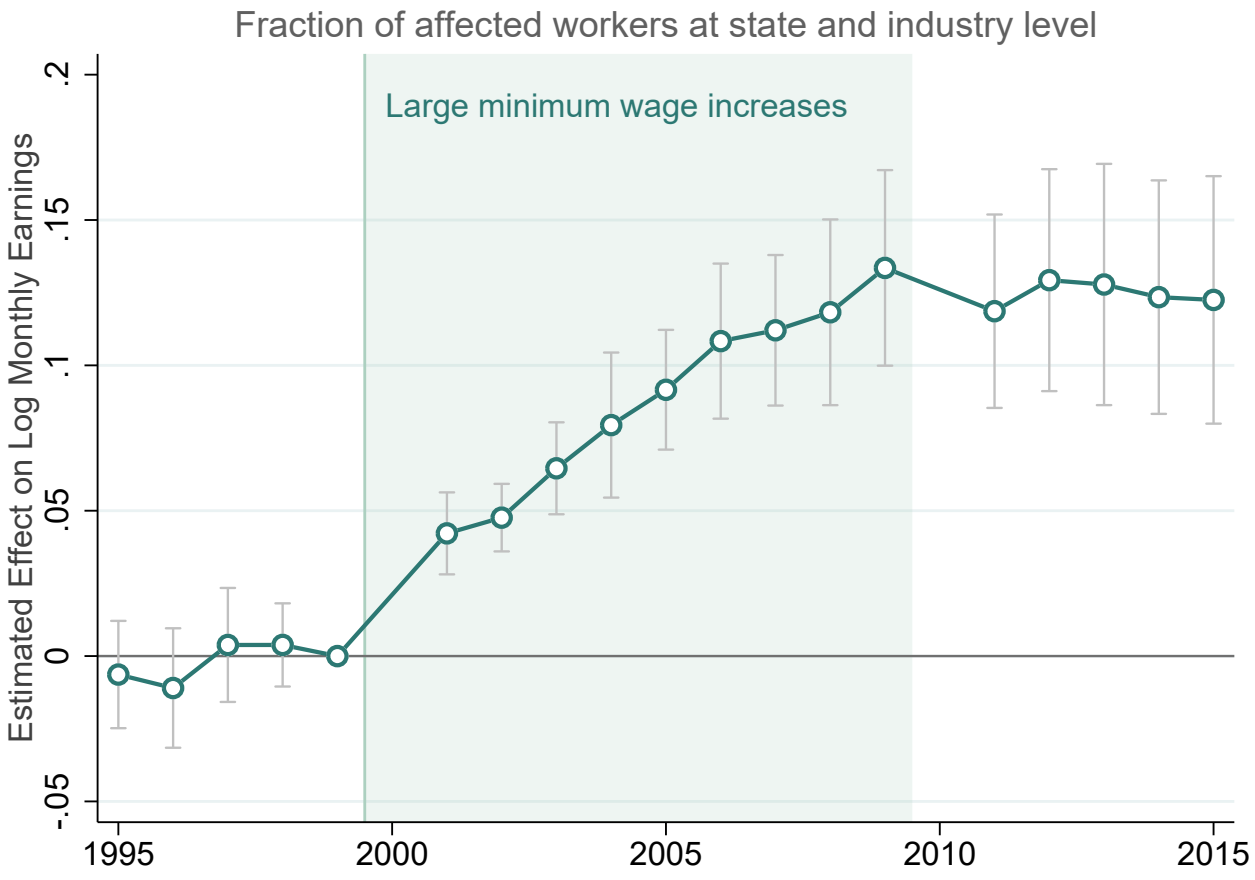


→ Robust to industry × state design.

▸ Back

Step 1: Quantifying effects on earnings in formal sector

$$\text{Monthly Earnings}_{ist} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

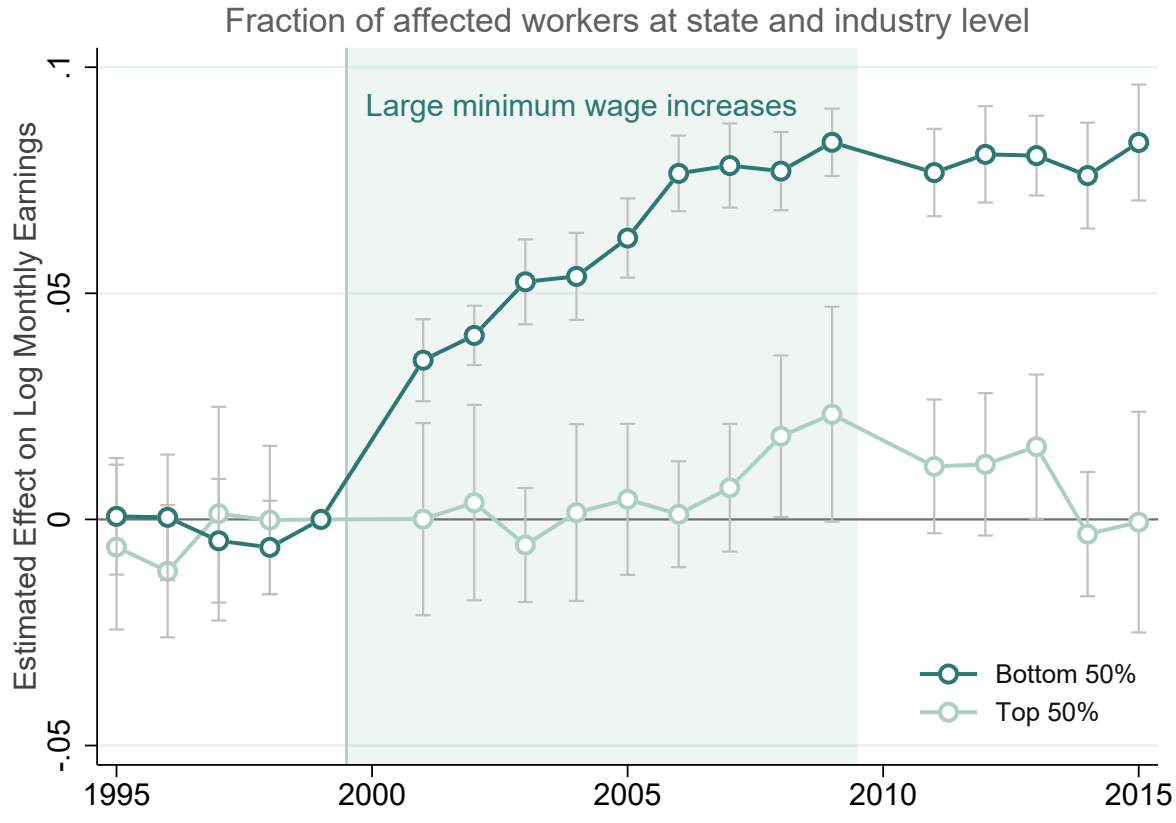


→ Overall effect: ∼+11 log pts in strongly treated states.

back

Step 1: Quantifying effects on earnings in formal sector

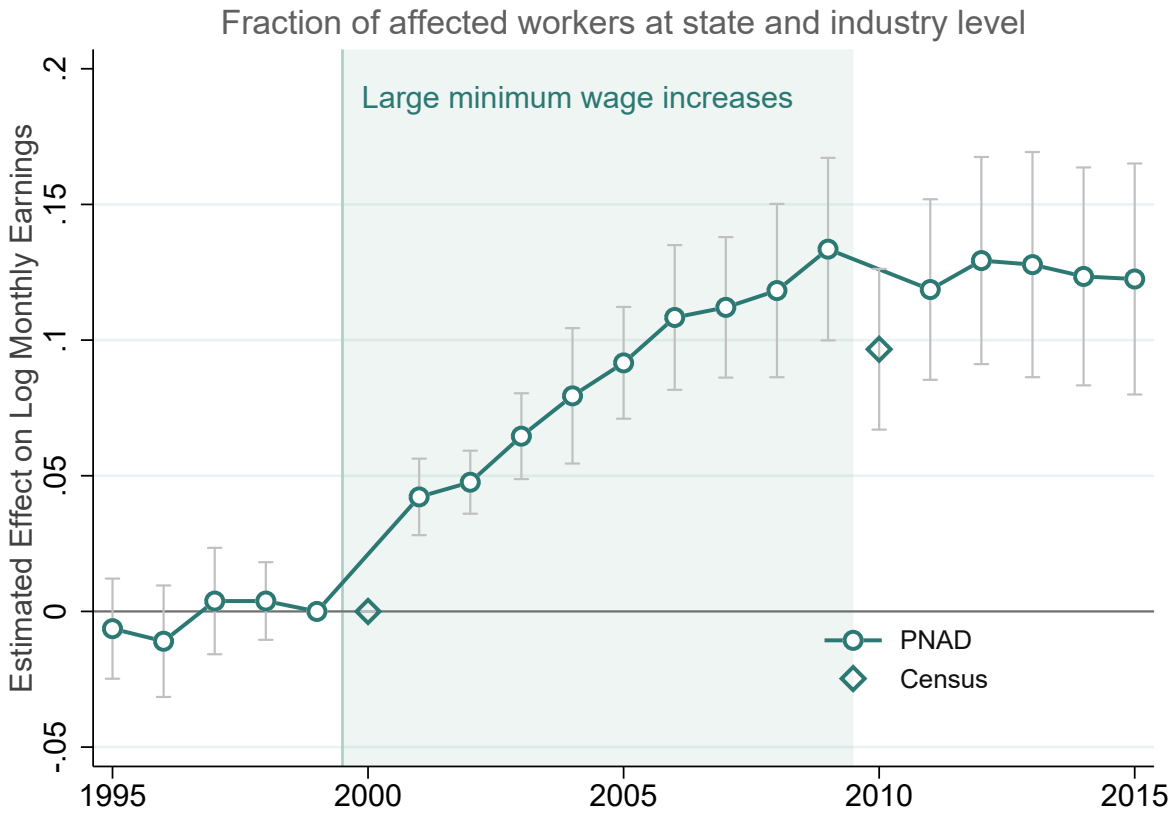
$$\text{Monthly Earnings}_{ist} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$



→ Effects concentrated in part of distribution not affected by min. wage increases. ▸ back

Step 1: Quantifying effects on earnings in formal sector

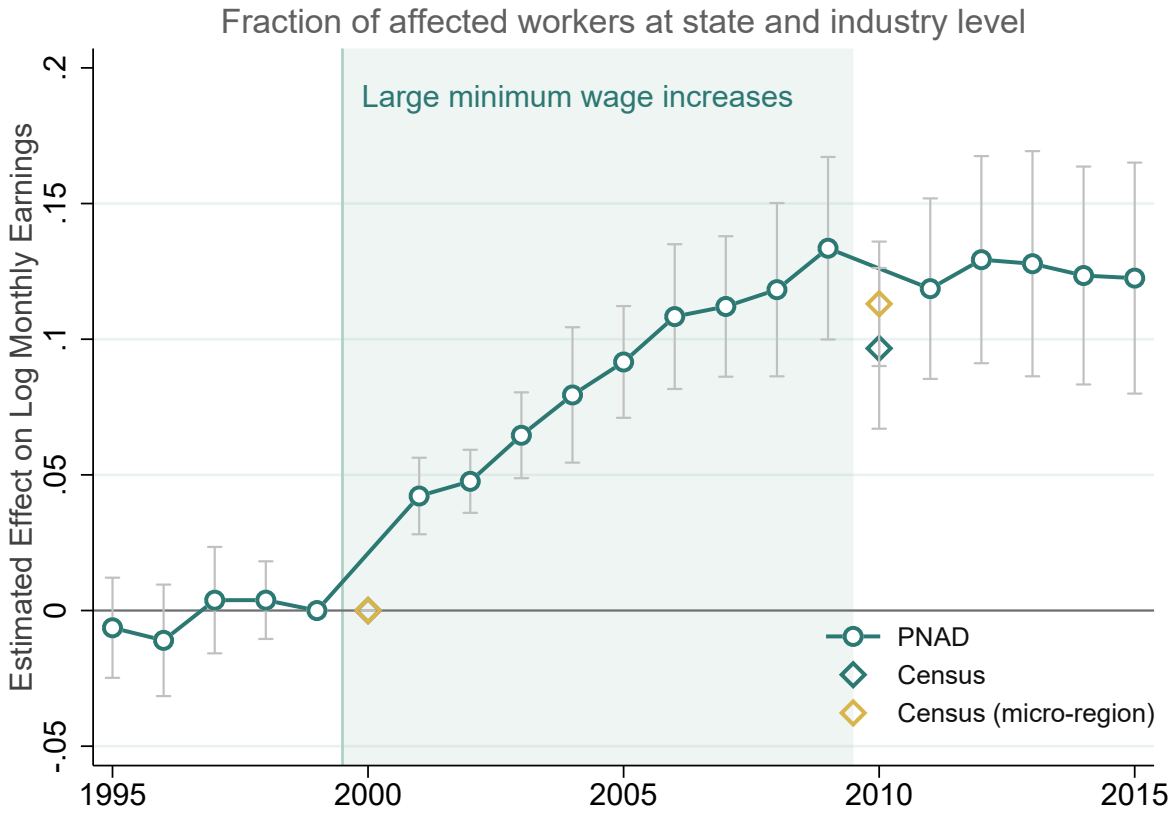
$$\text{Monthly Earnings}_{ist} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$



→ Robust to other data sets (Census) back

Step 1: Quantifying effects on earnings in formal sector

$$\text{Monthly Earnings}_{ist} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$



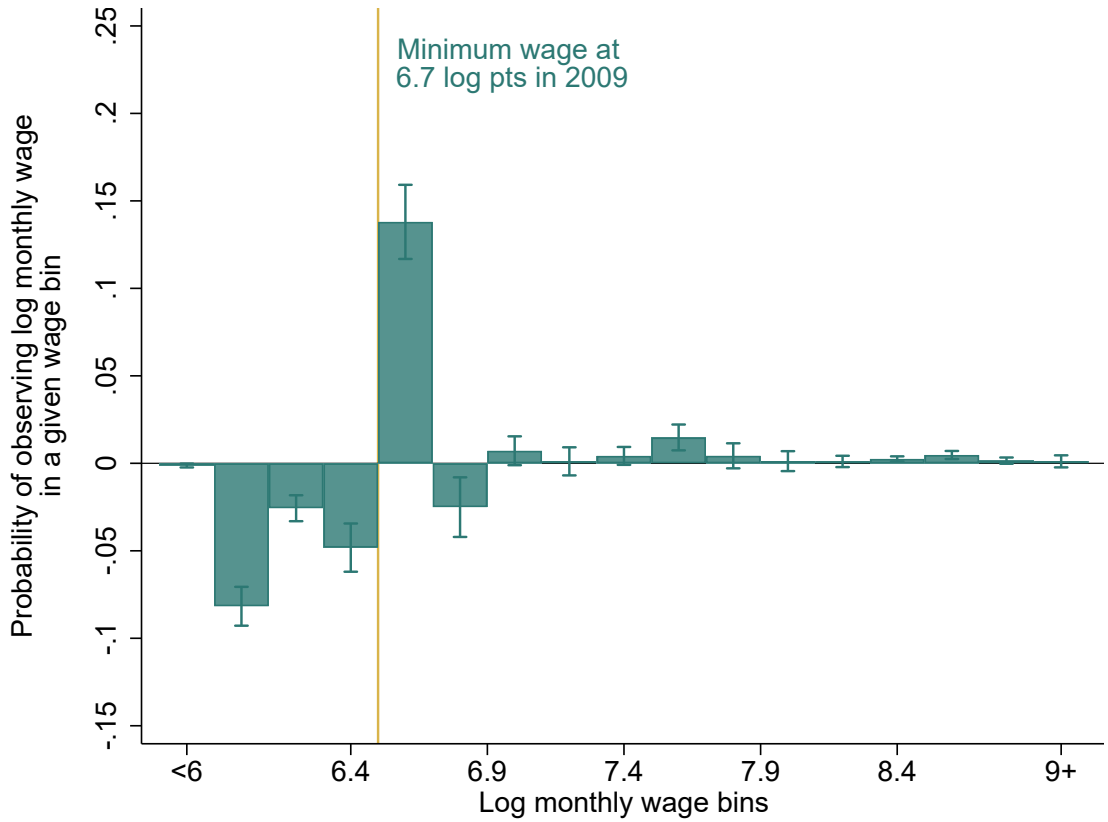
→ Robust to treatment variable at a finer level (micro-region × industry). back

Step 1: Quantifying effects on earnings in formal sector

Proba Monthly Earnings $\text{bin}_{isjt} =$

$\alpha + \delta_k + \sum_k \beta_k \text{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \eta_j \times \lambda_k + \varepsilon_{ijst}$

Outcome = indicator for wage falling within a specific wage bin,
with separate regressions for each bin.



→ Post-period wages concentrated at level of 2009 min. wage

→ Higher bite of mw pre-reform associated w/ ↗ in proba of wages at exactly 2009 mw in 2009 (↗ by 14 ppts).

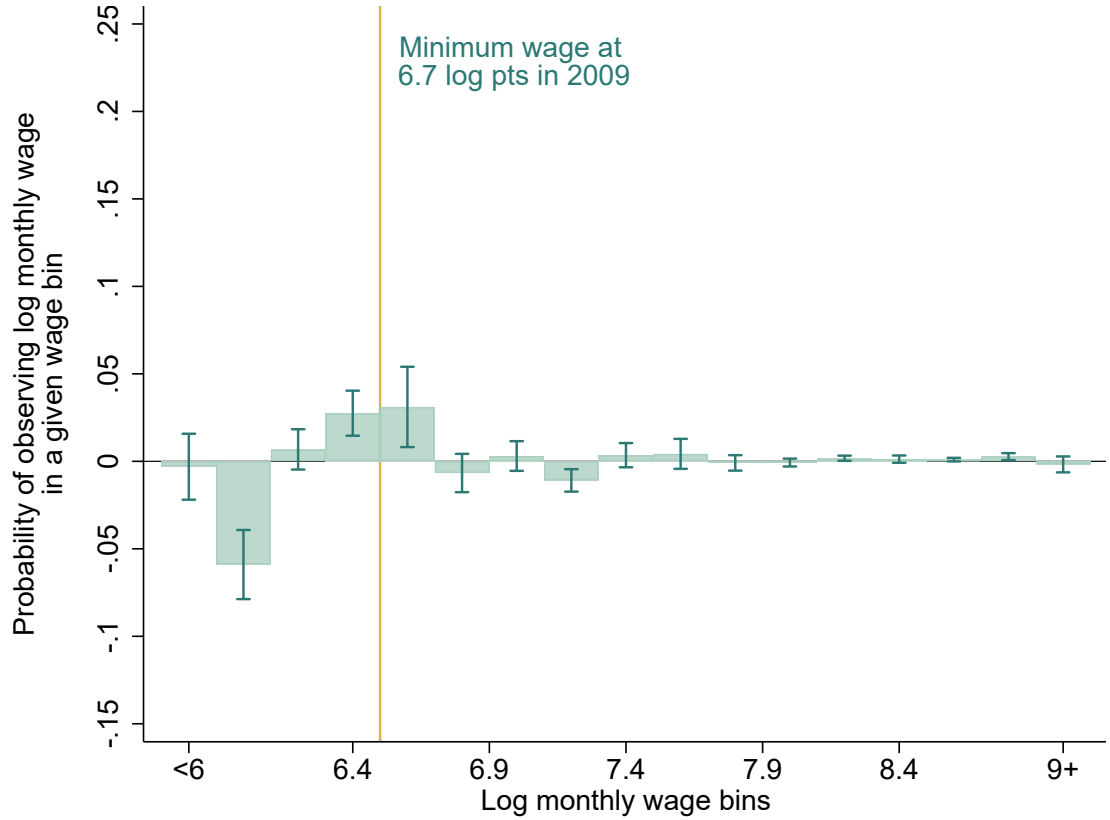
Back

Step 2: Quantifying effects on earnings in informal sector

Proba Monthly Earnings bin$_{isjt}$ =

$$\alpha + \delta_k + \sum_k \beta_k \text{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \eta_j \times \lambda_k + \varepsilon_{ijst}$$

Outcome = indicator for wage falling within a specific wage bin,
with separate regressions for each bin.



→ Post-period wages concentrated at level of 2009 min. wage

→ Also shows there's no full compliance with the min. wage.

▸ Back

Effects on monthly earnings in formal sector: robustness

$\forall$ period $k \in$ [1995-1999], [2001-2009] & [2011-2015],

$$\text{Monthly Earnings}_{ijst} = \alpha + \sum_k \beta_k \text{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \delta_t \times \delta_j + \varepsilon_{ijst}$$

	Baseline	**Robustness checks**			
	(1)	(2)	(3)	(4)	(5)
Strongly treated state × industry					
× **2001-2009**	0.087***	0.096***	0.111***	0.111***	0.109***
	(0.010)	(0.011)	(0.015)	(0.015)	(0.015)
× **2011-2015**	0.107***	0.127***	0.127***	0.127***	0.125***
	(0.016)	(0.017)	(0.016)	(0.016)	(0.016)
Observations	748,006	693,652	693,652	693,652	724,180
Controls	X		X	X	X
State FEs	X	X		X	X
Industry × year FEs	X	X	X	X	X
State × Year FEs	X	X	X	X	X
Bolsa Familia as controls				X	
# of inspectors as controls					X

Back

Spillover effects to informal employees

$\forall$ period $k \in$ [1995-1999], [2001-2009] & [2011-2015],

$$\text{Monthly Earnings}_{ijst} = \alpha + \sum_k \beta_k \text{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \delta_t \times \delta_j + \varepsilon_{ijst}$$

	2001-2009			2011-2015		
	All	White	Nonwhite	All	White	Nonwhite
Formal employees	0.087***	0.100***	0.077***	0.107***	0.126***	0.094***
	(0.010)	(0.014)	(0.008)	(0.016)	(0.022)	(0.013)
	748,006	383,189	364,817	748,006	383,189	364,817
Informal employees	0.021	0.038*	0.018	0.038*	0.063**	0.035
	(0.015)	(0.016)	(0.018)	(0.018)	(0.021)	(0.019)
	295,458	116,551	178,907	295,458	116,551	178,907
Cross-sector wage elast.	0.241	0.380**	0.239	0.359**	0.502***	0.369*
se	(0.153)	(0.132)	(0.222)	(0.136)	(0.136)	(0.176)
lower bound	-0.059	0.121	-0.059	0.091	0.235	0.024
upper bound	0.541	0.640	0.541	0.626	0.769	0.714
Controls	X	X	X	X	X	X
State FEs	X	X	X	X	X	X
Industry $\times$ year FEs	X	X	X	X	X	X

Back

Spillover effects to the self-employed

$\forall$ period $k \in$ [1995-1999], [2001-2009] & [2011-2015],

$$\text{Monthly Earnings}_{ijst} = \alpha + \sum_k \beta_k \text{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \delta_t \times \delta_j + \varepsilon_{ijst}$$

	2001-2009			2011-2015		
	All	White	Nonwhite	All	White	Nonwhite
Formal employees	0.087***	0.100***	0.077***	0.107***	0.126***	0.094***
	(0.010)	(0.014)	(0.008)	(0.016)	(0.022)	(0.013)
	748,006	383,189	364,817	748,006	383,189	364,817
Self-employed	-0.017	0.013	-0.051***	0.003	0.041	-0.051*
	(0.022)	(0.032)	(0.012)	(0.027)	(0.034)	(0.020)
	425,926	223,145	202,777	425,926	223,145	202,777
Cross-sector wage elast.	-0.200	0.132	-0.658**	0.030	0.325	-0.542*
se	(0.274)	(0.305)	(0.204)	(0.252)	(0.228)	(0.267)
lower bound	-0.738	-0.466	-1.057	-0.463	-0.122	-1.065
upper bound	0.337	0.730	-0.259	0.523	0.773	-0.020
Controls	X	X	X	X	X	X
State FEs	X	X	X	X	X	X
Industry $\times$ year FEs	X	X	X	X	X	X

Back

Spillover effects to informal employees & self-employed

$\forall$ period $k \in$ [1995-1999], [2001-2009] & [2011-2015],

$$\text{Monthly Earnings}_{ijst} = \alpha + \sum_k \beta_k \text{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \delta_t \times \delta_j + \varepsilon_{ijst}$$

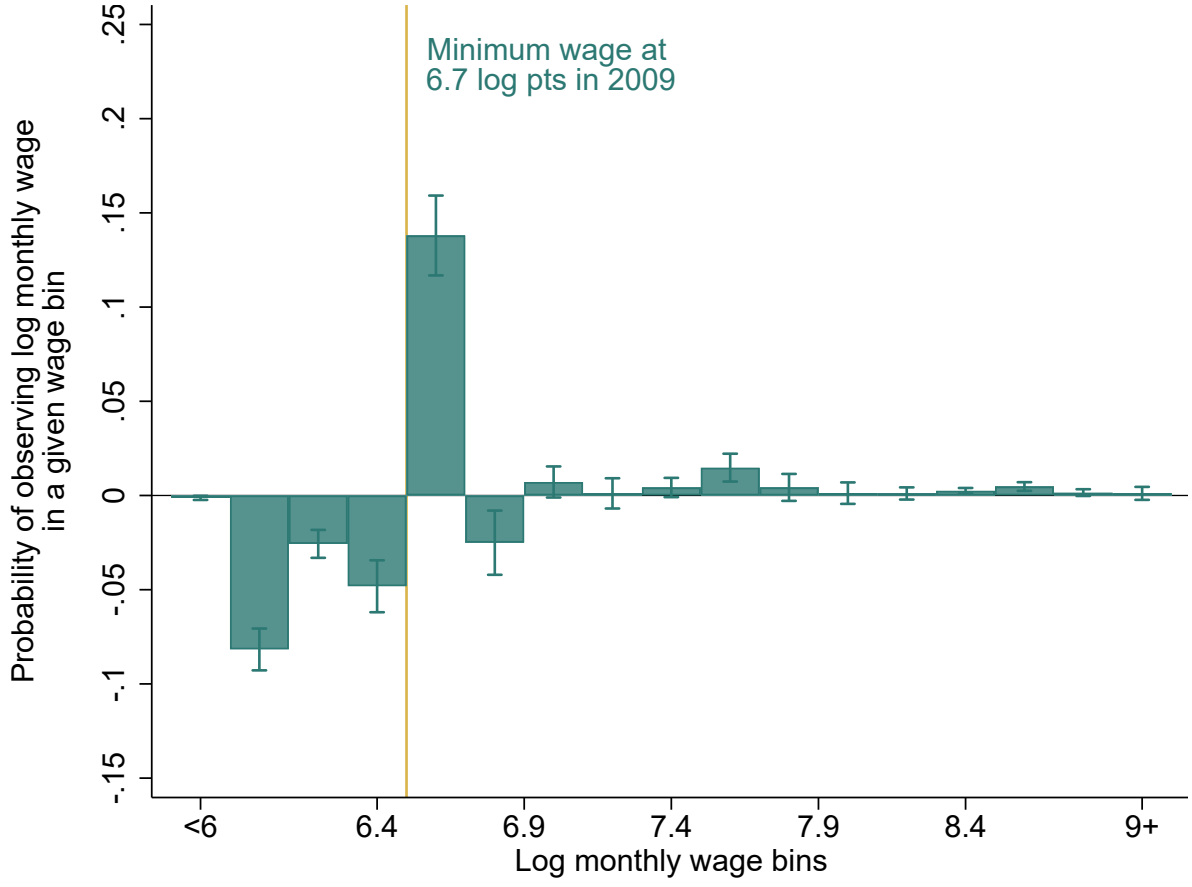
	2001-2009			2011-2015		
	All	White	Nonwhite	All	White	Nonwhite
Formal employees	0.087***	0.100***	0.077***	0.107***	0.126***	0.094***
	(0.010)	(0.014)	(0.008)	(0.016)	(0.022)	(0.013)
	748,006	383,189	364,817	748,006	383,189	364,817
Informal and self-employed	0.000	0.021	-0.012	0.017	0.044	-0.003
	(0.017)	(0.023)	(0.014)	(0.022)	(0.027)	(0.020)
	721,384	339,696	381,688	721,384	339,696	381,688
Cross-sector wage elast.	0.005	0.213	-0.158	0.160	0.348*	-0.030
se	(0.200)	(0.213)	(0.196)	(0.185)	(0.173)	(0.211)
lower bound	-0.386	-0.205	-0.542	-0.203	0.008	-0.444
upper bound	0.397	0.630	0.226	0.523	0.688	0.383
Controls	X	X	X	X	X	X
State FEs	X	X	X	X	X	X
Industry $\times$ year FEs	X	X	X	X	X	X

Back

Step 1: Quantifying effects on earnings in formal sector

$$Y_{ijst} = \alpha + \sum_k \beta_k \text{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \delta_t \times \delta_j + \varepsilon_{ijst}$$

with Y_{ijst} = indicators for a formal worker's wage falling in a specific wage bin.

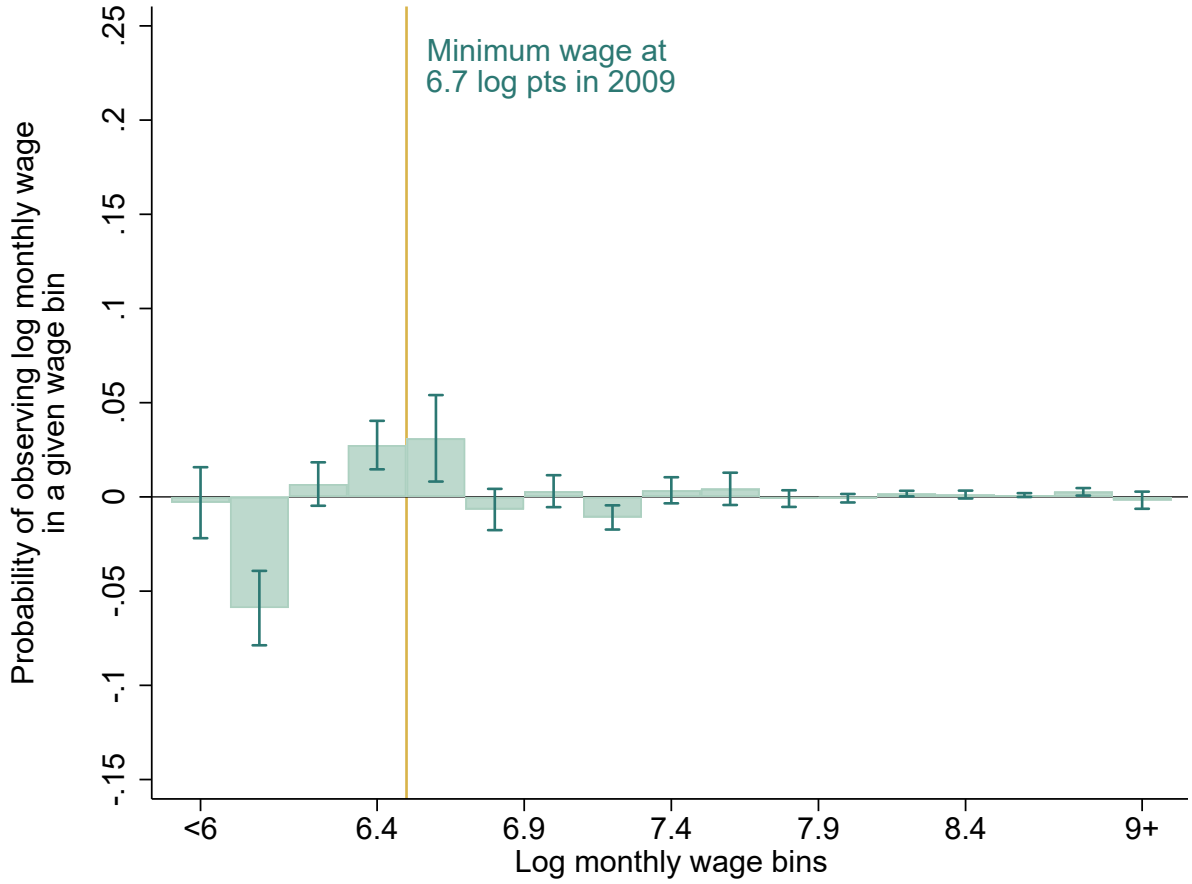


→ Monthly earnings increases concentrated at the minimum wage level.

Step 2: Quantifying effects on earnings in informal sector

$$Y_{ijst} = \alpha + \sum_k \beta_k \text{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \delta_t \times \delta_j + \varepsilon_{ijst}$$

with Y_{ijst} = indicators for a informal employee's wage falling in a specific wage bin.



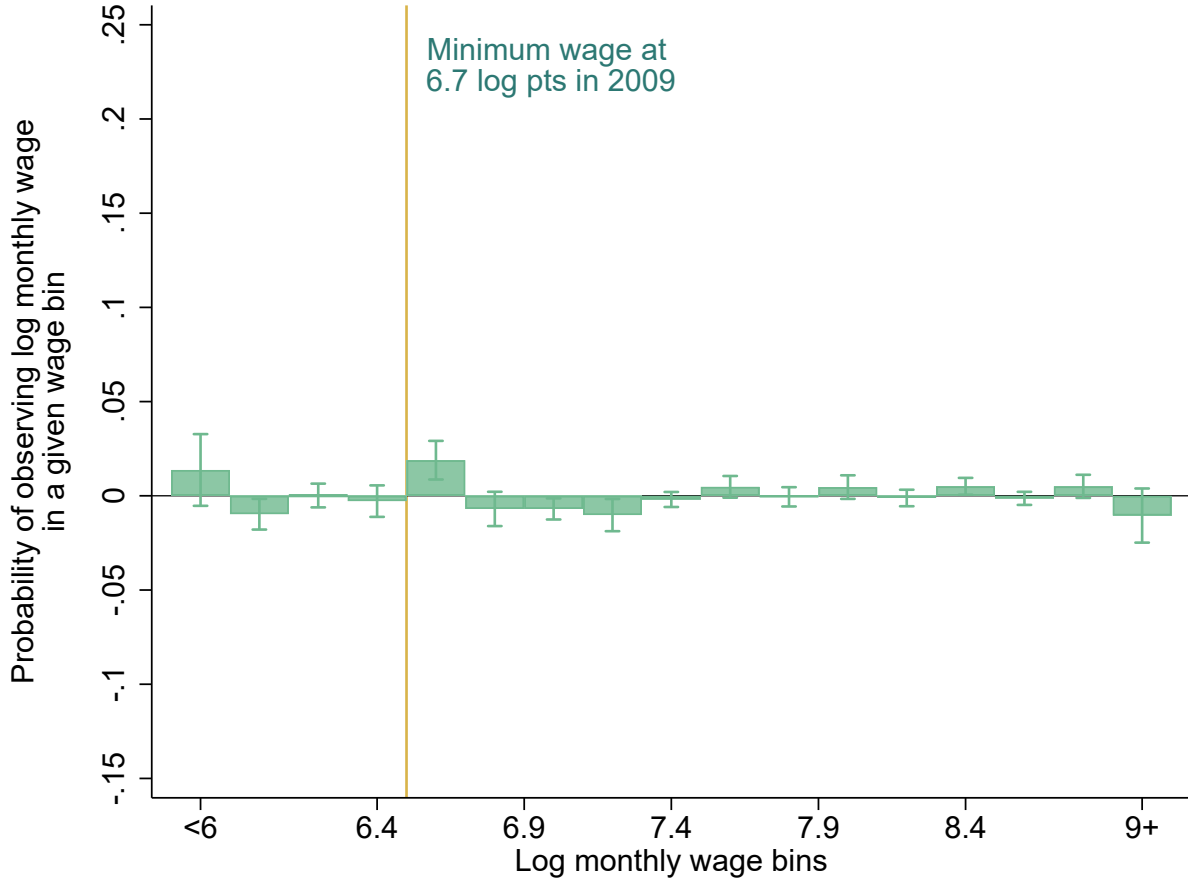
→ Some employers of informal workers tend to match the min. wage in the formal sector.

→ Others are paying below the min. wage of the covered sector.

Step 2: Quantifying effects on earnings in informal sector

$$Y_{ijst} = \alpha + \sum_k \beta_k \text{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \delta_t \times \delta_j + \varepsilon_{ijst}$$

with Y_{ijst} = indicators for self-employed's wage falling in a specific wage bin.



→ No relative changes in the wage in the formal sector.

→ Self-employed can be seen as a never treated group.

Step 2: Quantifying effects on earnings among employees

$$Y_{ijst} = \alpha + \sum_k \beta_k \text{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \delta_t \times \delta_j + \varepsilon_{ijst}$$

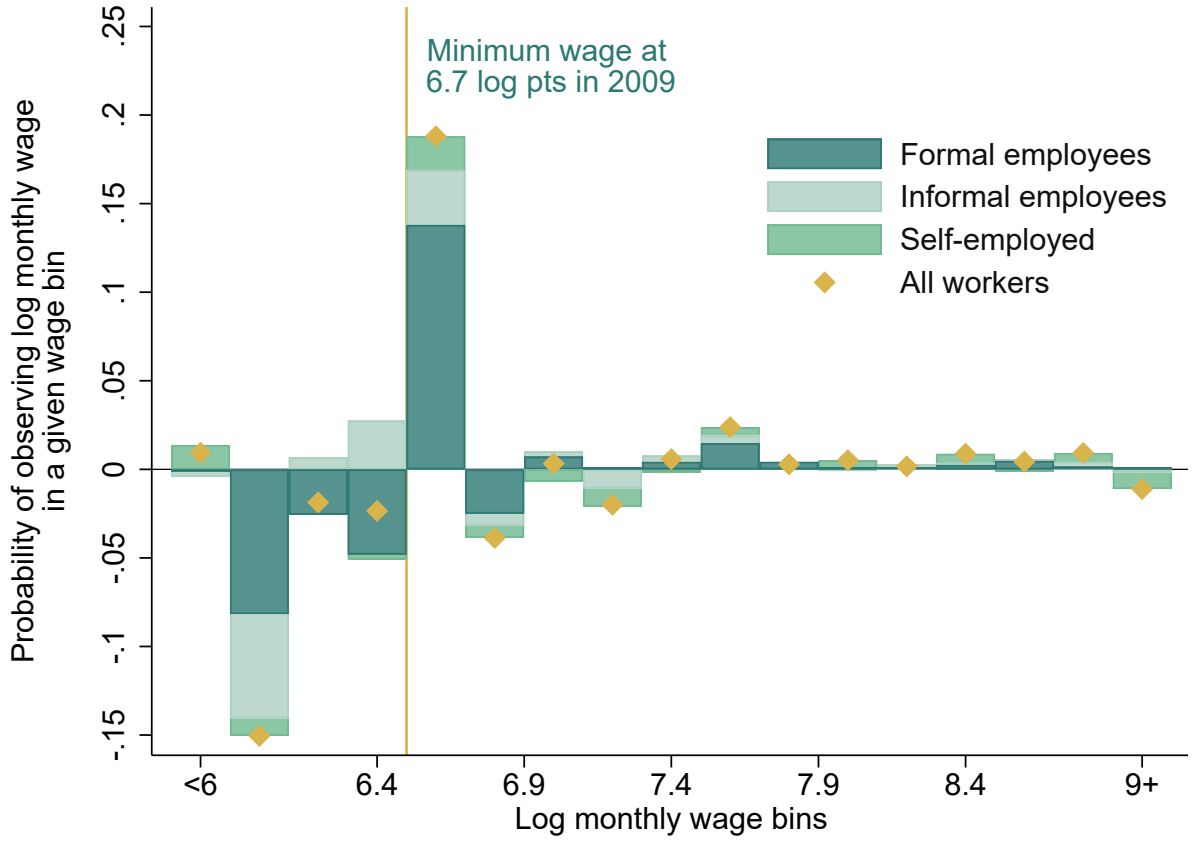
with Y_{ijst} = indicators for a worker's wage falling in a specific wage bin.



Step 2: Quantifying effects on earnings among all workers

$$Y_{ijst} = \alpha + \sum_k \beta_k \text{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \delta_t \times \delta_j + \varepsilon_{ijst}$$

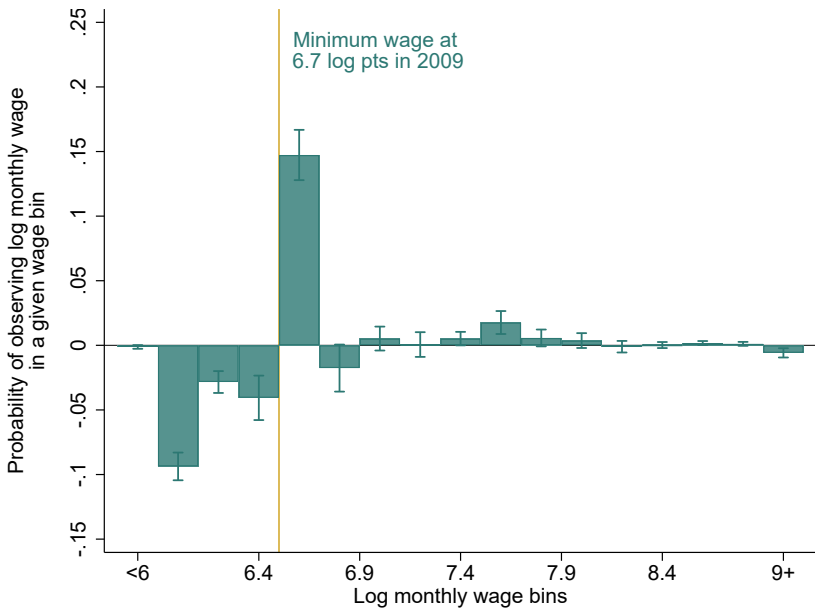
with Y_{ijst} = indicators for a worker's wage falling in a specific wage bin.

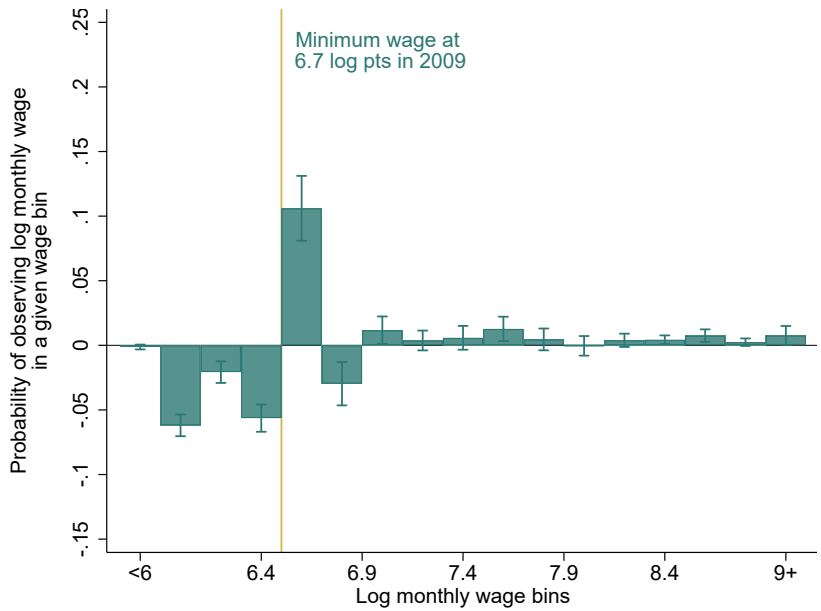


Step 2: Quantifying effects on earnings among formal workers

$$\mathsf{Y}_{ijst} = \alpha + \sum_k \beta_k \mathsf{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \delta_t \times \delta_j + \varepsilon_{ijst}$$

with Y_{ijst} = indicators for a worker's wage falling in a specific wage bin.

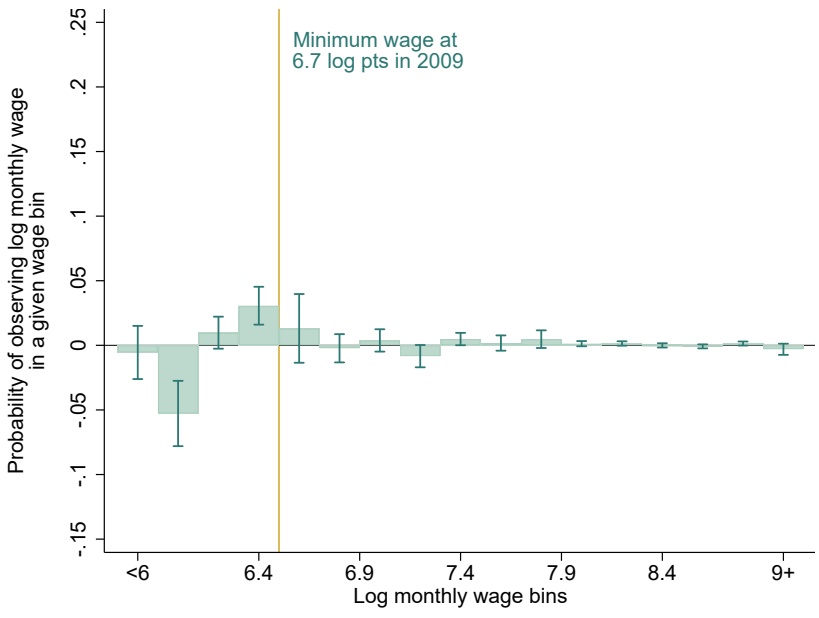


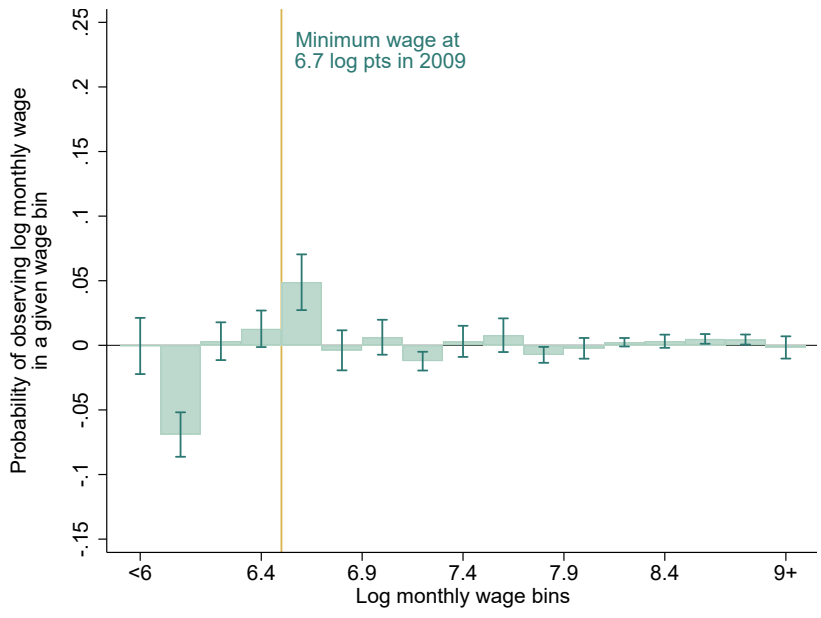


Step 2: Quantifying effects on earnings among informal employees

$$\mathsf{Y}_{ijst} = \alpha + \sum_k \beta_k \mathsf{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \delta_t \times \delta_j + \varepsilon_{ijst}$$

with Y_{ijst} = indicators for a worker's wage falling in a specific wage bin.

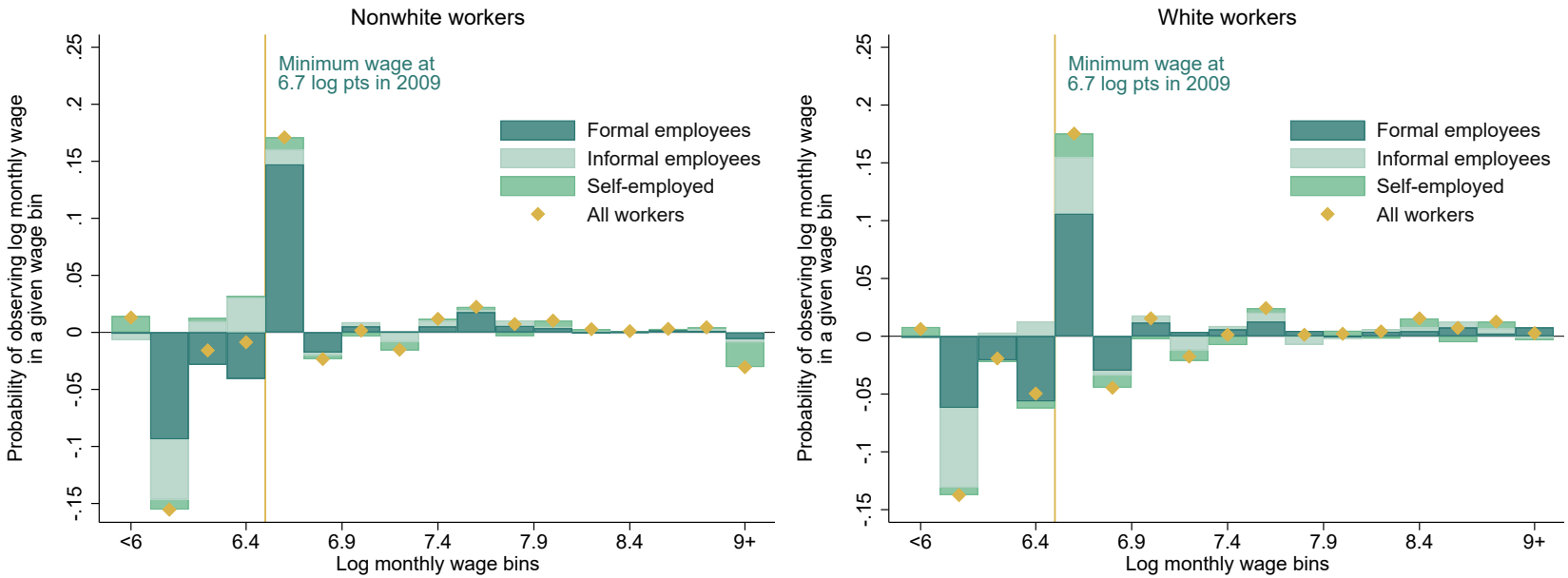




Step 2: Quantifying effects on earnings among informal employees

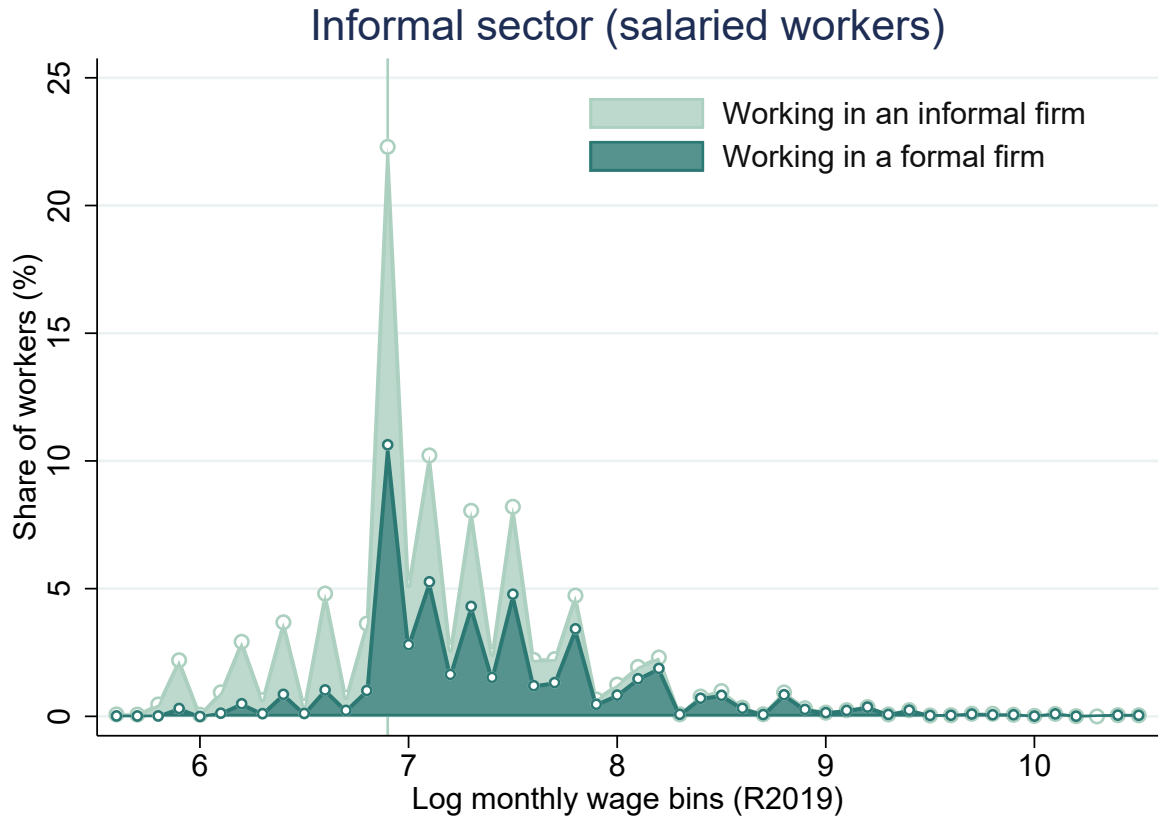
$$\mathsf{Y}_{ijst} = \alpha + \sum_k \beta_k \mathsf{Strongly}_{js} \times \delta_{t+k} + \mathbb{X}'_{ijst}\Gamma + \delta_s + \delta_t \times \delta_j + \varepsilon_{ijst}$$

with Y_{ijst} = indicators for a worker's wage falling in a specific wage bin.



1. Constraints in firm wage setting or norms

Monthly earnings distributions, informal employees



→ Non-compliance with min. wage concentrated on extensive margin of informality.

→ Evidence of wage setting constraints within firms, across ≠ types of contracts, complementing Hjort, Li, Sarsons (2020) and Hazell, Patterson, Sarsons & Taska (2021). ▸ Back

2. Competitive mechanisms

Shares of formal and informal employees, by **occupation** (2015)

	Formal workers	**Informal workers**	
		at formal firms	at informal firms
Occupation			
Managerial	0.05	0.04	0.01
Scientific and artistic	0.07	0.09	0.01
Mid-level technicians	0.08	0.08	0.01
Administrative service workers	0.15	0.09	0.02
Service workers	0.21	0.19	0.09
Retail service workers	0.10	0.13	0.05
Agricultural workers	0.04	0.08	0.34
Manufacturing, constr. & repair	0.29	0.30	0.47
Armed forces	0.00	0.00	0.00
Other	0.00	0.00	0.00

→ Formal workers and informal workers working at formal firms work in similar occupations.

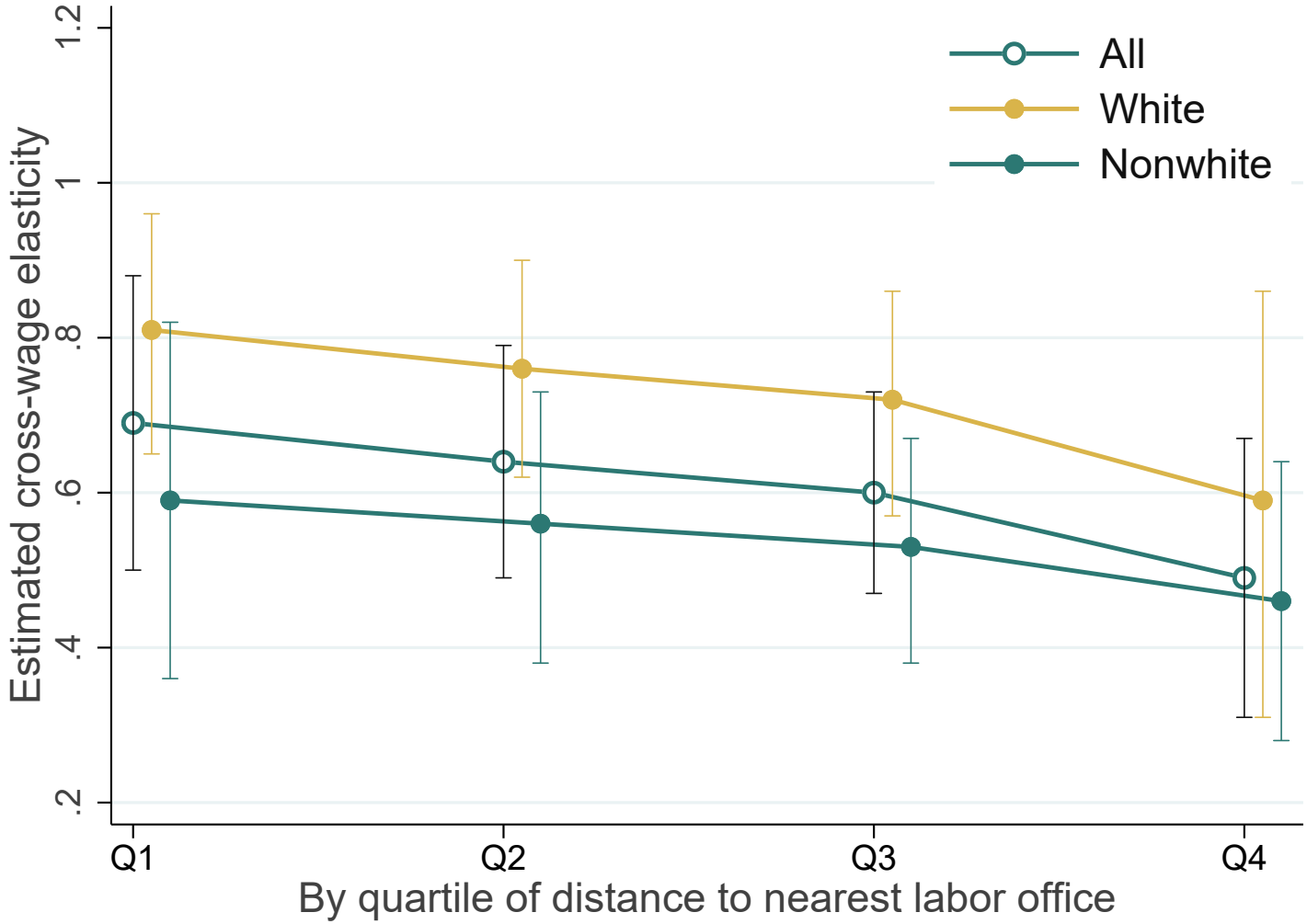
→ Informal workers working at informal firms have $\neq$ profile.

▸ Back

3. Differences in enforcement

$\forall$ period k in Census $\in$ 2000 and 2010, and micro-regions m ▸ map

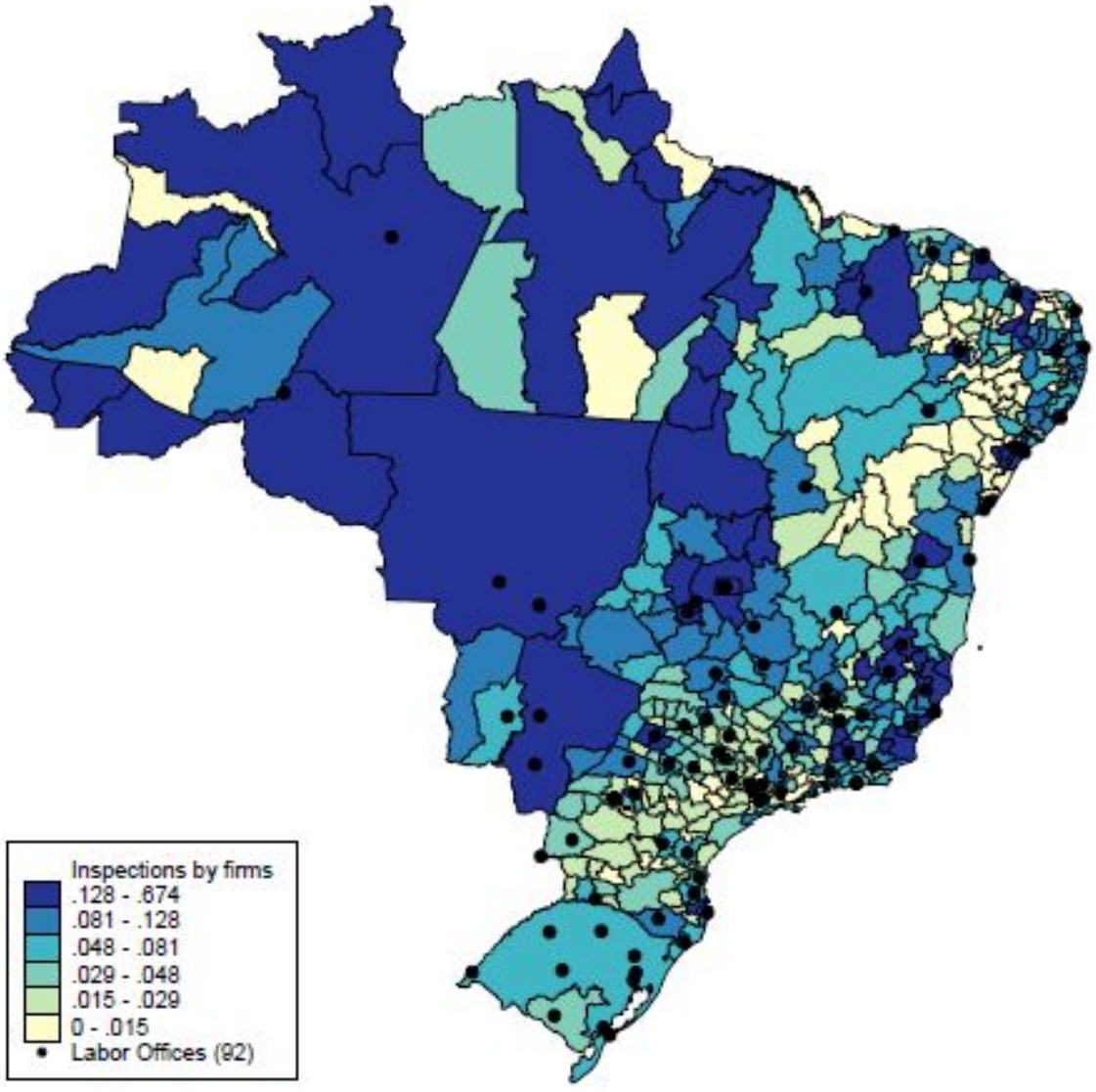
$$\text{Monthly Earnings}_{imt} = \alpha + \delta_k + \sum_k \beta_k \text{Kaitz}_m \times \delta_{t+k} + \gamma \text{Dist}_m \times \delta_{t+k} + \sum_k \eta_k \text{Kaitz}_m \times \text{Dist}_m \times \delta_{t+k} + \mathbb{X}'_{imt}\Gamma + \delta_m + \varepsilon_{imt}$$



→ Magnitude of spillovers ↗ w/ higher enforcement.

→ Pattern true across white and nonwhite workers. ▸ Back

Regional distribution of inspections and labor offices



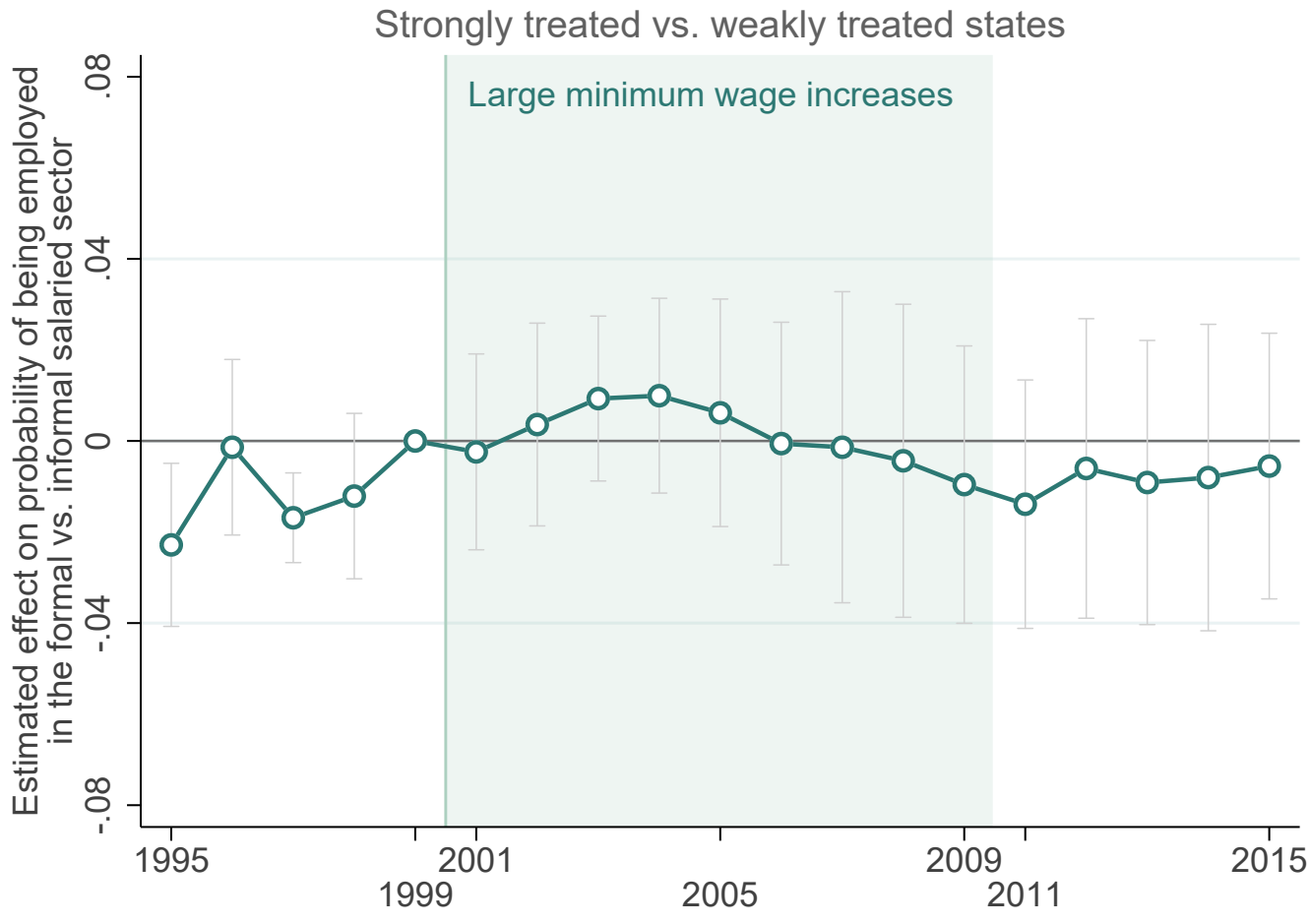
Source: Ponczek and Ulyssea (2021), Figure 2(b)

Back

Reallocation from formal to informal employment

$$\mathbb{1}\{\text{Formal}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \delta_s + \varepsilon_{ist}$$

With $\mathbb{1}\{\text{Formal}_{ist}\} = 1$ if private formal; $= 0$ if informal employee
No controls

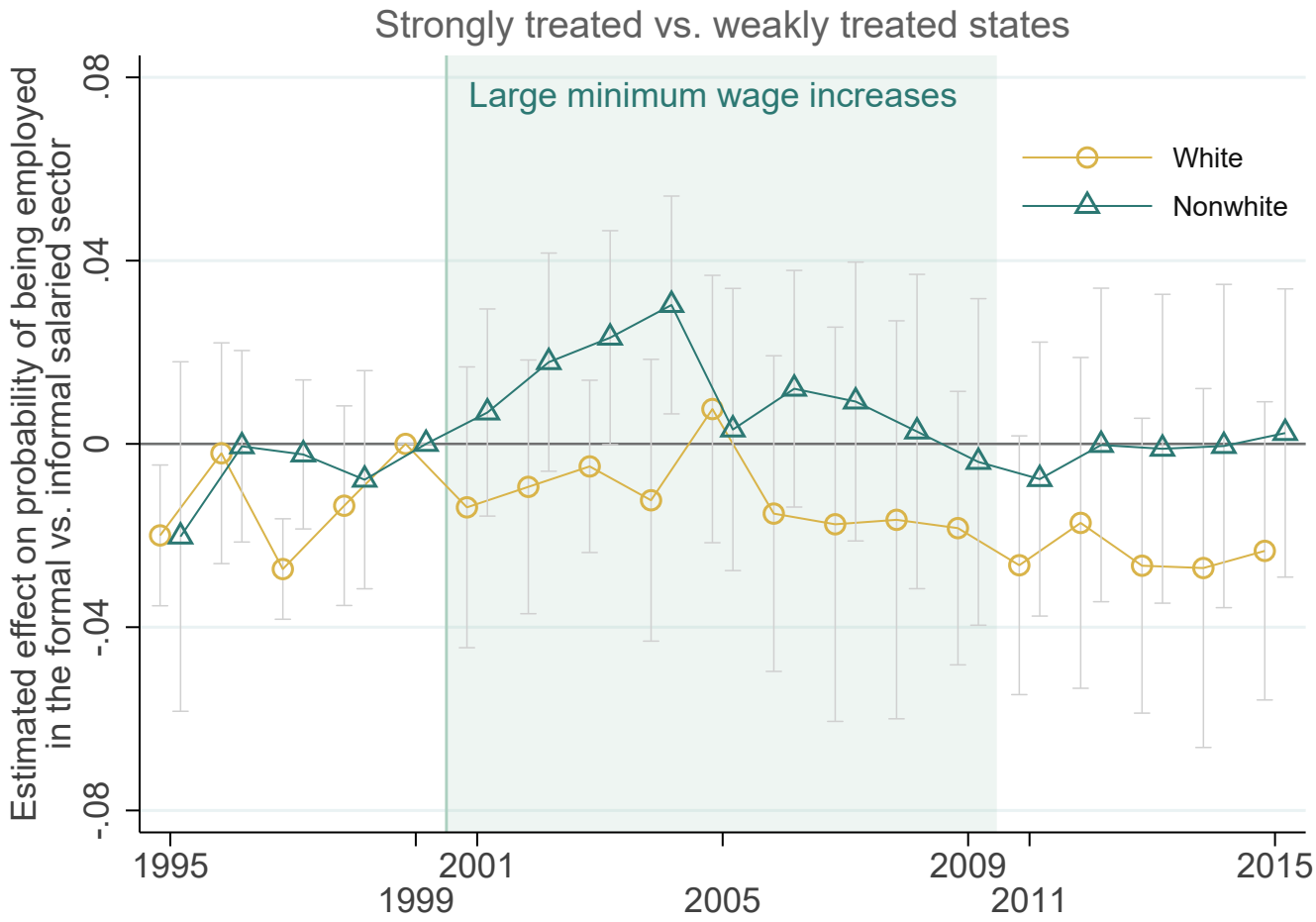


▸ Back

Reallocation from formal to informal sector by race

$$\mathbb{1}\{\text{Formal}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \delta_s + \varepsilon_{ist}$$

With $\mathbb{1}\{\text{Informal}_{ist}\} = 1$ if private formal; $= 0$ if informal employee
No controls



→ No relative increase in informal sector in strongly vs. weakly treated states.

▸ Back

Results on cross-sector reallocations

$\forall$ period $k \in$ [1995-1999], [2001-2009] & [2011-2015],

$$\mathbb{1}\{\text{Formal}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

With $\mathbb{1}\{\text{Formal}_{ist}\} = 1$ if private formal; $= 0$ if informal

Controls = gender, educ., log gdp per capita by state ($+^2$)

	All	Nonwhite	White
Strongly treated state × 2001-2009			
Reallocation effect	0.008	0.013	0.006
	(0.008)	(0.011)	(0.009)
	1,702,800	864,110	838,690
Monthly earnings	0.114***	0.096**	0.116***
Among formal workers	(0.031)	(0.036)	(0.029)
	706,028	342,185	363,843
Corss-sector emp. elasticity	0.16	0.32	0.11
se	(0.18)	(0.31)	(0.17)
lower bound	-0.19	-0.29	-0.22
upper bound	0.50	0.94	0.44

$\rightarrow$ Can rule out cross-sector elasticity wrt earnings < -0.29 (< -0.22) among nonwhite (white) workers.

Back

Results on displacement from employment to unemp./nilf

$\forall$ period $k \in$ [1995-1999], [2001-2009] & [2011-2015],

$$\mathbb{1}\{\text{Formal}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

With $\mathbb{1}\{\text{Formal}_{ist}\} = 1$ if employed formal; $= 0$ if unemp. or nilf
Controls [Model (1)] = gender, educ., log gdp per capita by state $(+^2)$
Controls [Model (2)] = (1) + log bolsa familia exp. per capita by state ▸ Graph

	Model (1)	Model (2)	Family w/o kids	Family w/ kids
Strongly treated state × 2001-2009				
Reallocation effect	-0.010	-0.010	-0.007*	-0.010
	(0.008)	(0.008)	(0.004)	(0.010)
	1,516,951	1,516,951	640,707	876,244
Monthly earnings	0.114***	0.116***	0.118***	0.115***
	(0.031)	(0.031)	(0.037)	(0.028)
	706,028	706,028	296,893	409,135
Elast.	-0.16	-0.17	-0.11	-0.16
se	(0.12)	(0.12)	(0.05)	(0.15)
lower bound	-0.39	-0.39	-0.20	-0.46
upper bound	0.07	0.06	-0.01	0.14

→ Similar elasticities when controlling or not for bolsa familia expenditures. ▸ Back

Results on displacement from employment to unemp./nilf

$\forall$ period $k \in$ [1995-1999], [2001-2009] & [2011-2015],
$\mathbb{1}\{\text{Formal}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$

With $\mathbb{1}\{\text{Formal}_{ist}\} = 1$ if employed formal; $= 0$ if unemp. or nilf
Controls [Model (1)] = gender, educ., log gdp per capita by state $(+^2)$
Controls [Model (2)] = (1) + log bolsa familia exp. per capita by state ▸ Graph

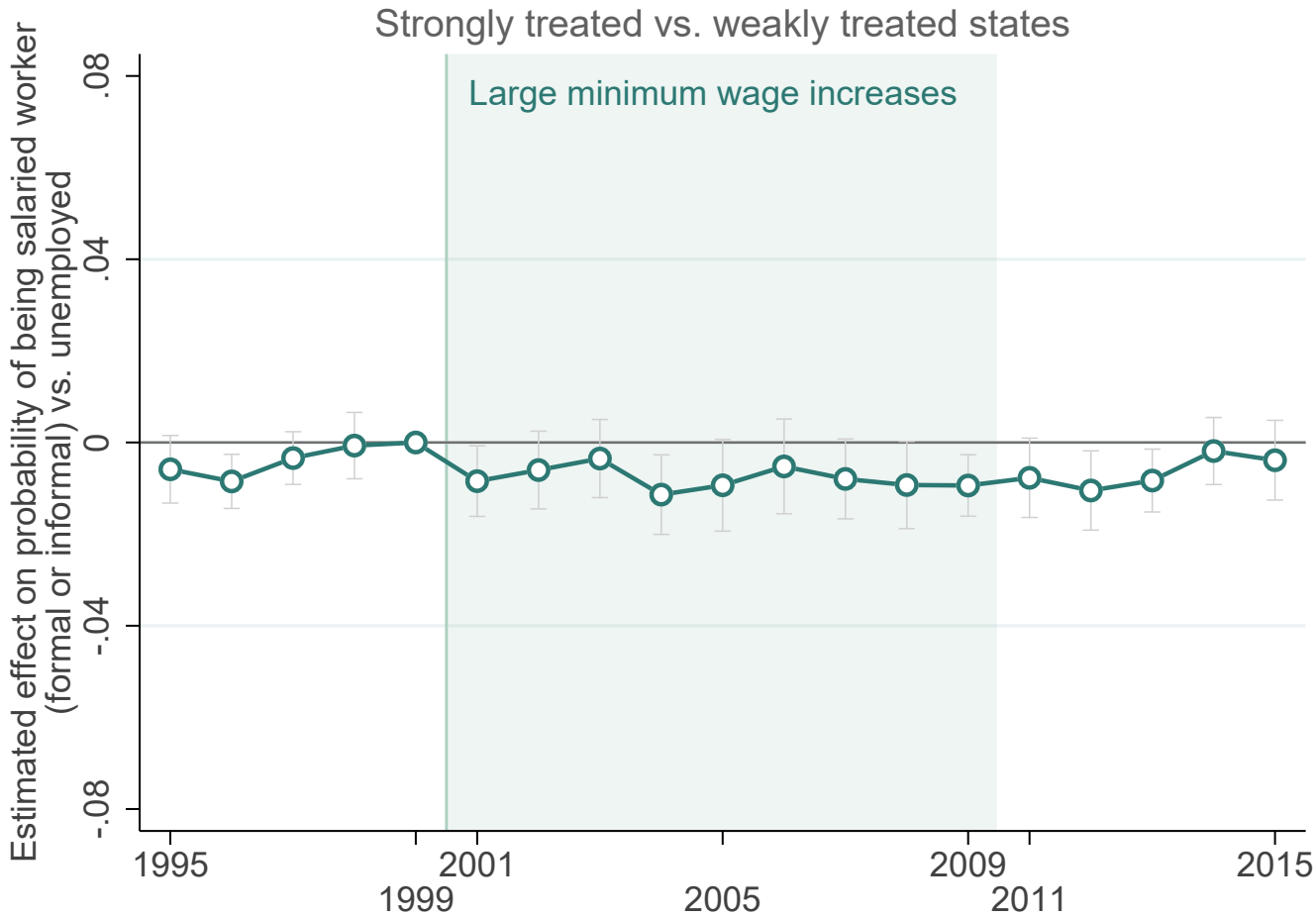
	Model (1)	Model (2)	Family w/o kids	Family w/ kids
Strongly treated state × 2001-2009				
Reallocation effect	-0.010	-0.010	-0.007*	-0.010
	(0.008)	(0.008)	(0.004)	(0.010)
	1,516,951	1,516,951	640,707	876,244
Monthly earnings	0.114***	0.116***	0.118***	0.115***
	(0.031)	(0.031)	(0.037)	(0.028)
	706,028	706,028	296,893	409,135
Elast.	-0.16	-0.17	-0.11	-0.16
se	(0.12)	(0.12)	(0.05)	(0.15)
lower bound	-0.39	-0.39	-0.20	-0.46
upper bound	0.07	0.06	-0.01	0.14

$\rightarrow$ Similar elasticities across families with and w/o kids. ▸ Back

Reallocation from employement to unemp.

$$\mathbb{1}\{\text{Employed}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \delta_s + \varepsilon_{ist}$$

With $\mathbb{1}\{\text{Employed}_{ist}\} = 1$ if employee (formal or informal); $= 0$ if unemployed
Controls $=$ gender, race, educ., log gdp per capita by state $(+^2)$



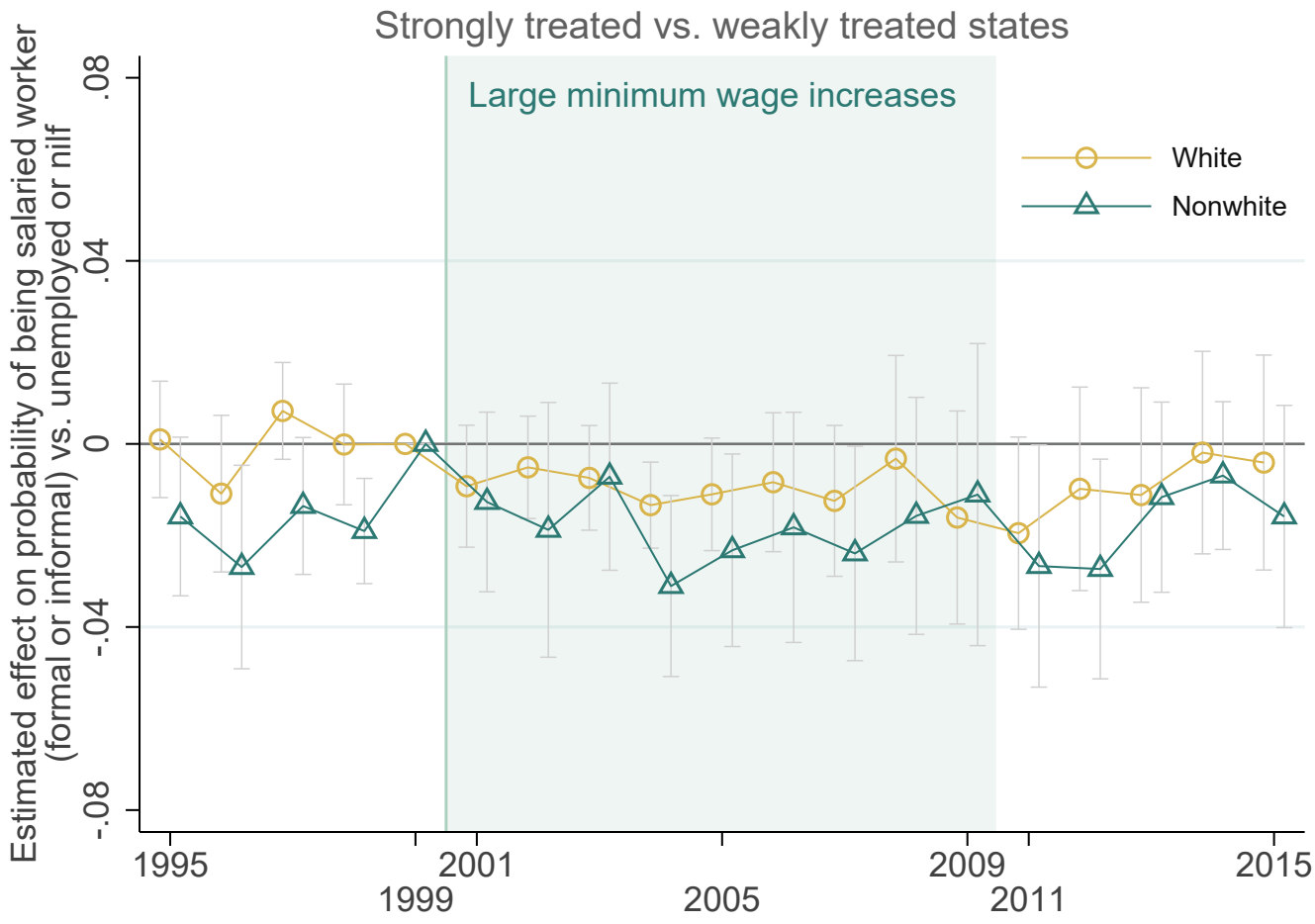
$\rightarrow$ No differential effects on unemployment across racial groups.

▸ Back

Reallocation from employment to unemp. or nilf

$$\mathbb{1}\{\text{Employed}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

With $\mathbb{1}\{\text{Employed}_{ist}\} = 1$ if employed; $= 0$ if unemp. or nilf
Controls $=$ gender, educ., log gdp per capita by state $(+^2)$



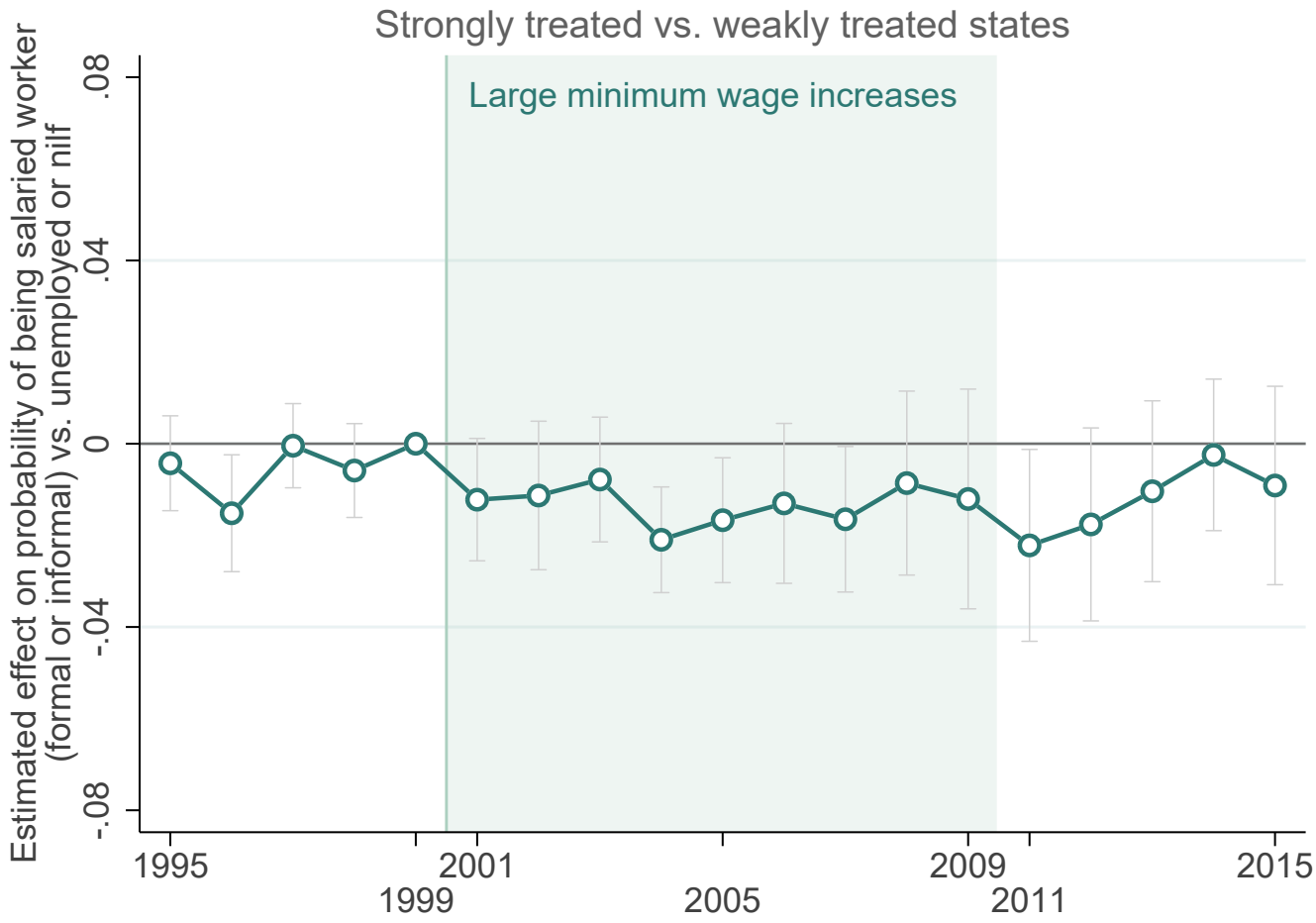
▸ Back

Reallocation from employment to unemp./nilf

$$\mathbb{1}\{\text{Employed}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

With $\mathbb{1}\{\text{Employed}_{ist}\} = 1$ if employee (formal or informal); $= 0$ if unemployed or nilf

Controls $=$ gender, race, educ., log gdp per capita by state $(+^2)$



Back

Results on displacement from employment to unemp./nilf

$\forall$ period $k \in$ [1995-1999], [2001-2009] & [2011-2015],

$$\mathbb{1}\{\text{Employed}_{ist}\} = \alpha + \delta_k + \sum_k \beta_k \text{Strongly}_s \times \delta_{t+k} + \mathbb{X}'_{ist}\Gamma + \delta_s + \varepsilon_{ist}$$

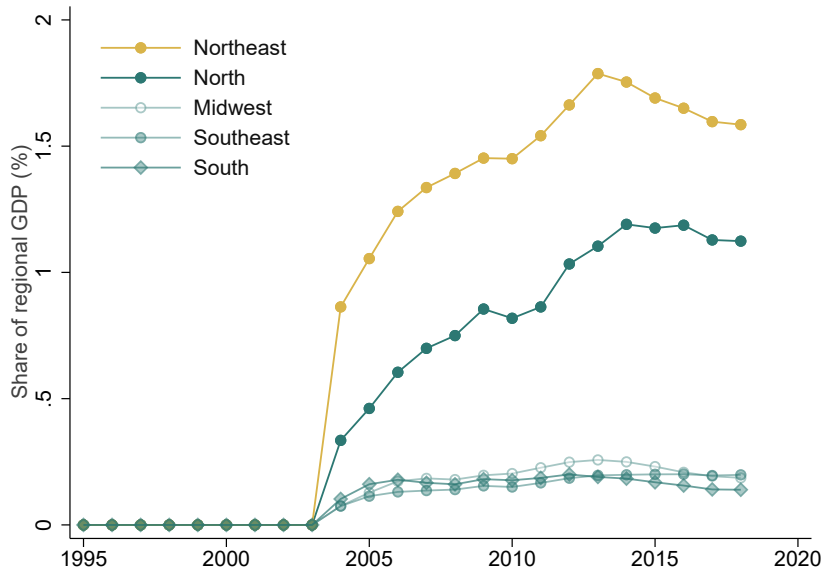
With $\mathbb{1}\{\text{Employed}_{ist}\} = 1$ if employed (formal or informal); $= 0$ if unemp. or nilf

Controls = gender, educ., log gdp per capita by state ($+^2$)

	All	Nonwhite	White
Strongly treated state × 2001-2009			
Emp. vs. unemp./nilf	-0.009	-0.004	-0.010
	(0.007)	(0.011)	(0.006)
	2,662,337	1,397,119	1,265,218
Monthly earnings	0.114***	0.096**	0.116***
Among formal workers	(0.031)	(0.036)	(0.029)
	706,028	342,185	363,843
Elasticity	-0.11	-0.06	-0.12
se	(0.08)	(0.15)	(0.06)
lower bound	-0.27	-0.35	-0.24
upper bound	0.05	0.24	0.01

$\rightarrow$ Can rule out elast. wrt earnings < -0.35 among nonwhite workers. Back

Bolsa Famila expenditures, by region 1995-2020



$\rightarrow$ Generosity of Bolsa Famila highest in Northeast and North.

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