Minimum Wages, Inequality, and the Informal Sector

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Most recent slides:



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Introduction

- Long-standing debate on the economic effects of the minimum wage
- Minimum wage important driver in reducing earnings inequality in Brazil in the 2000s
- Large share of employment in developing world operates informally
 - Economic agents responding to incentives
- However... quantitative work on the minimum wage disregards the informal sector

How the minimum wage affects income inequality in countries with a large informal sector?



Empirics: 1996-2012 Brazil

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 - Driven by relative increases in informal inequality and the informal share of labor

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 - Some firms become informal, readjust wages and employment, increasing informal inequality

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Quantification: bring in skill heterogeneity and skill bias in the production technology

• Calibrate the model to Brazil in 1996 and 2012 \Rightarrow realistic distribution of earnings

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 - ...undoing the unintended consequence of minimum wage

Outline

Data and stylized facts

Cross-state variation, minimum wage, inequality, and the informal sector

A benchmark model of the informal sector and minimum wages

Quantitative analysis

Conclusion

Data and stylized facts

Data and definitions

- Main data source: 1996-2012 PNAD RAIS ECINF
 - Labor market survey with socioeconomic info on representative sample of Brazilian workers
- Informal worker: employee without a signed working card Favela Census
 - Working card, when signed by the firm, guarantees access to formal labor legislation
- Sample of individuals highly attached to the labor force
 - All genders, 18-54 years old
- Earnings measure: real monthly earnings from main job Contract hours
 - <5% of workers declare to have more than one job \bigcirc Shares
 - Deflated by the CPI and expressed in 2012 Brazilian Reais
- Minimum wage in Brazil is a federal floor on monthly earnings of formal workers

The large informal sector in Brazil, 1996-2012

- Informality represents large share of labor force
- Informal workers are less paid, less educated, more female, and younger

	1996		2012	
	Formal	Informal	Formal	Informal
Share	60.9	39.1	69.1	30.9
Mean earnings	1,387	673	1,388	840
Share with HS	31.5	14.6	61.2	38.4
Male	63.8	55.2	58.6	50.0
Age	32.5	31.0	33.7	33.5

Notes: Earnings are deflated by CPI and expressed in 2012 values. Sources: PNAD.

Shift share ind

Mean/median earnings

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Earnings inequality and the minimum wage: aggregate time series

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Earnings inequality and the minimum wage: aggregate time series

- Substantial 36% decrease in aggregate inequality (\equiv variance of log earnings)
- Formal inequality fell by 50%; Informal inequality fluctuated around 0.65
- Sharp increase in share of formal workers at min wage, particularly after 1999 (7% ≥ 16%)



Cross-state variation, minimum wage, inequality, and the informal sector

• Compare ineq/inf in 3 states with most/least share of min wage workers in 1999 • Shares



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- States most exposed to the minimum wage hike experienced...
 - Stronger formal inequality decreases (60% vs. 40% in least exposed)
 - 40% increase in informal inequality vs. mild decline in least exposed states
 - Milder reductions in the informal share of labor (13.6% vs. 33.6% in least exposed)



Cross-state variation, minimum wage, and aggregate inequality

- States most exposed to minimum wage experienced milder reductions in overall inequality
 - 10% vs. 30% in least exposed states



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Taking stock

Econometric analysis: controlling for state heterogeneity

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- Effects of the minimum wage vary widely across treatment groups 💽
 - Minimum wage reduces formal inequality in all states
 - The more exposed a state is, the stronger are the responses in the informal sector
 - Minimum wage reduces overall inequality in Rio de Janeiro, but increases it in Ceará!

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- 3 stylized facts on Brazil:
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- 3 stylized facts on Brazil:
 - Sizable informal sector, represents over 30% of employment
 - Substantial increase in the minimum wage, particularly after 1999
 - Differently from formal sector, informal inequality moved sideways
- Cross-state evidence that the minimum wage hike
 - Reduced formal inequality
 - Increased informal inequality and the informal share
 - As a consequence, increased in overall inequality!
 - Robustness: DiD analysis controlling for other drivers of inequality and informality

A benchmark model of the informal sector and minimum wages

A bird's-eye view of the model

• Homogeneous workers consume final good and choose firm that offers highest utility

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- After observing productivity, firms choose formality status:
 - Formal firms subject to the minimum wage
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- Profits and gov't revenues owned by absentee households that consume final good
- Equilibrium: aggregate wage index that clears the labor market

• Measure 1 of homogeneous workers

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- Worker *i* at firm $j \in \Omega$ has indirect utility (price of good normalized to one):

 $V_i(j) = w(j)A_i(j), A_i(j) \sim \text{Frechet}(\eta)$, iid across workers and firms

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• Upward-sloping labor supply curve for firm $j \in \Omega$:

$$I(j) = W^{-\eta} w(j)^{\eta}$$

with $W\equiv \left[\int_{j'\in\Omega}w(j')^\eta
ight]^{1/\eta}$ denoting the aggregate wage index of the economy

• Measure 1 of heterogeneous producers with labor productivity $z \sim F[z_0,\infty), \ F'>0$

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- Competitive in goods market and monopsonists in labor market
- Maximize profits choosing employment, wages, and formality status:

$$\pi^{\textit{form}}(z) = \max_{l,w} \left\{ zl - wl \mid l = \left(rac{w}{W}
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- Threshold solution: $Informal Bunched at \underline{w}$ Formal unrestricted \underline{z} \overline{z} \overline{z}
 - Selection of low paying jobs to informal sector and bunching at the minimum wage
 - Informality cutoff \underline{z} increases with \underline{w} and decreases with ρ .

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 - Selection of low paying jobs to informal sector and bunching at the minimum wage
 - Informality cutoff \underline{z} increases with \underline{w} and decreases with ρ .
- There exists a unique equilibrium where $L^D(W) = L^S = 1$

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Proposition

Assume that the minimum wage (\underline{w}) is low enough, such that $\underline{w} \in (\underline{w}_0, \underline{w}_0 + \varepsilon)$, where $\underline{w}_0 : \underline{z}(\underline{w}_0) = z_0$ and small ϵ . Then, the marginal effect of the minimum wage on the variance of log earnings (V) is:

 $\frac{\partial V}{\partial w} =$

• Welfare

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If $z \sim Pareto(\nu > \eta)$, Without informality, increasing \underline{w} reduces inequality: $\frac{\partial V}{\partial \underline{w}} = \frac{\partial V^{form}}{\partial \underline{w}} < 0$.

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If $z \sim Pareto(\nu > \eta)$,

Without informality, increasing \underline{w} reduces inequality: $\frac{\partial V}{\partial \underline{w}} = \frac{\partial V^{\text{form}}}{\partial \underline{w}} < 0$. With informality, increasing \underline{w} increases inequality: $\frac{\partial V}{\partial w} > 0$.

- Heterogeneous workers with skill h = 1, ..., H (fraction N_h of population)
 - \Rightarrow Skill-specific labor supply curve: $I_h(j) = N_h [w_h(j)/W_h]^{\eta}$, $W_h = \left[\int_{j \in \Omega} w_h(j)^{\eta} dj \right]^{1/\eta}$

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- CES aggregation: $\ell(z) = \left[\sum_{h} \xi_{h}(z) I_{h}(z)^{(\varepsilon-1)/\varepsilon}\right]^{\varepsilon/(\varepsilon-1)}$, $q = z\ell(z)$

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- Same \underline{w} vs. ρ tradeoff (now $w_h(z) \ge \underline{w}$ for all h)
- Two-component labor productivity: z =
 u heta (Ulyssea, 2018)
 - First component drawn: $u \sim F_{
 u}$
 - Formality decision before realization of second term: $\mathbb{E}_{z}[\pi^{form}(z)|\nu] \gtrsim \mathbb{E}_{z}[\pi^{inf}(z)|\nu]$
 - Second component $heta \sim F_{ heta}$ and productivity z =
 u heta are realized

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- Equilibrium: aggregate wages indices W_h that clear labor markets for every h = 1, ..., H

Calibration and validation

• Map skills to educational levels, obtain shares directly from data:

		N _h	
Years of education	Degree	1996	2012
\leq 4	No degree	38.0	15.8
(4,8]	Primary	30.3	22.9
(8, 11]	Secondary	22.6	42.7
> 11	Tertiary	9.1	18.7

Notes: Fraction of workers within each group of years of education. Sources: PNAD.

- Elasticity of labor supply η internally calibrated to match formal/informal mean wage ratio

• Wage distributions • Relative wages

Labor demand

- Elasticity of substitution arepsilon=1.875 (Katz and Murphy, 1992 and Fernández and Messina, 2018)
- Demand shifters (Burstein and Vogel, 2017):

$$\xi_h(z) = rac{z^{\phi_h}}{\sum_{h'} z^{\phi_{h'}}}, \quad \sum_h \phi_h = 0$$

internally calibrated to match relative wages across skills

• Pareto-LogNormal distribution of productivities (Colombi, 1990):

$$\mathsf{z} =
u heta, \quad
u \sim \mathsf{LogNormal}(0, \sigma^2), \quad heta \sim \mathsf{Pareto}(\kappa), \quad
u \perp heta$$

internally calibrated to match formal and informal earnings inequality

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Government

- Min wage and informality cost internally calibrated to match min wage and informal shares
- Allow a dollar of formal earnings to be worth more/less than a dollar of informal earnings
 - Valuation/costs of labor legislation (access to social security programs, payroll taxes)

$$w_h^{hh}(j) = (1 + \varsigma_h(j))w_h(j), \quad w_h^{firm}(j) = (1 + \tau(j))w_h(j), \quad \text{if } j \text{ is formal}$$

		<u>Firms</u>			
	ς_1	<i>s</i> ₂	<i>s</i> ₃	54	τ
1996	29.1	28.6	27.8	24.6	71 4
2012	29.4	29.2	28.7	24.3	11.4

Notes: Follow Haanwinckel and Soares (2016) and Souza et al. (2012), accounting for direct and indirect firm-worker transfers like retirement, unemployment and disability benefits, severance payments, vacation stipends, etc. Sources: Labor legislation and PNAD.

Internal calibration

Parameter	Description	1996	2012	Target
W	Minimum wage	4.04	8.87	Share at min wage
ho	Detection probability	0.258	0.321	Informal share
$\phi_{ extsf{4}}$		0.079	0.115	Relative wages (tert/sec)
ϕ_{3}	Skill shifters	0.014	0.056	Relative wages (sec/prim)
ϕ_2		-0.028	-0.043	Relative wages (prim/no deg)
η	Labor supply elast.	4.52	4.22	Relative wages (form/inf)
σ	Standard deviation	1.01	1.29	Formal inequality
κ	Pareto tail	6.02	6.33	Informal inequality
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ϕ_{4}		0.079	0.115	Relative wages (tert/sec)
ϕ_{3}	Skill shifters	0.014	0.056	Relative wages (sec/prim)
ϕ_2		-0.028	-0.043	Relative wages (prim/no deg)
η	Labor supply elast.	4.52	4.22	Relative wages (form/inf)
σ	Standard deviation	1.01	1.29	Formal inequality
κ	Pareto tail	6.02	6.33	Informal inequality

Internal parameters replicate moments/features in the economy:

• +120% in \underline{w} vs. +106% in real minimum wage

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- Skill biased technical change (+45% in ϕ_4) (Haanwinckel, 2020)
- Labor supply elasticity $\eta \approx$ 4 in line with labor literature (Lamadon, Mogstad, and Setzler, 2019) Brotherhood and Machado Parente

Model-implied overall earnings distribution



Distribution of earnings by formality status





▶ By skills

Counterfactual exercises

The impact of the minimum wage

- Δw = generates the observed bunching of formal workers in 2012, all else equal
- Minimum wage decreases formal inequality by 12.1% but increases agg inequality by 6.4%

	1996	$\begin{array}{ c c c c c } \hline & \underline{Joint\ counterfactuals}\\ \hline \Delta\underline{w} & +\Delta\rho = 24\% & +\Delta\rho = 85\% & +\Delta\Lambda\end{array}$			$+\Delta N_h$
V(log earnings)					
overall	0.78	0.83	0.84	0.78	0.77
formal	0.58	0.51	0.50	0.49	0.54
informal	0.73	0.83	0.81	0.78	0.74
Fraction at <u>w</u>	7.74	15.2	15.8	17.8	7.50
Informal share	39.1	72.8	57.6	23.6	47.4

▶ All but <u>w</u> ▶ Inf share 1996-2012

Parasites

Model with unemp

Complementing min wage with formalization and education policies

• Estimated increase in enforcement does little in preventing unintended consequences

	1996	Δ <u>w</u>	$\Delta \underline{w} + \Delta \rho = 24\% + \Delta \rho = 85\% + \Delta$		
V(log earnings)					
overall	0.78	0.83	0.84	0.78	0.77
formal	0.58	0.51	0.50	0.49	0.54
informal	0.73	0.83	0.81	0.78	0.74
Fraction at <u>w</u>	7.74	15.2	15.8	17.8	7.50
Informal share	39.1	72.8	57.6	23.6	47.4

▶ All but <u>w</u> ▶ Inf share 1996-2012 ▶ Model with unemp

Parasites

Complementing min wage with formalization and education policies

+ $\Delta \rho = 85\%$ offsets the unintended consequences of min wage on inequality

	1996	Δ <u>w</u>	$\Delta \underline{w} + \Delta \rho = 24\% + \Delta \rho = 85\% + \Delta$		
V(log earnings)					
overall	0.78	0.83	0.84	0.78	0.77
formal	0.58	0.51	0.50	0.49	0.54
informal	0.73	0.83	0.81	0.78	0.74
Fraction at <u>w</u>	7.74	15.2	15.8	17.8	7.50
Informal share	39.1	72.8	57.6	23.6	47.4

→ All but <u>w</u> → Inf share 1996-2012 → Model with unemp

Parasites

Complementing min wage with formalization and education policies

• Educational attainment undoes the unintended consequences of the minimum wage

	1996	Δw	$+\Delta \rho = 24\%$	$\frac{\text{counterfactuals}}{+\Delta \rho = 85\%}$	$+\Delta N_{h}$
V(log earnings)		<u> </u>	+ = = = = = = = = = = = = = = = = = = =	+ = = = = = = = = = = = = = = = = = = =	+ 210
overall	0.78	0.83	0.84	0.78	0.77
formal	0.58	0.51	0.50	0.49	0.54
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Fraction at <u>w</u>	7.74	15.2	15.8	17.8	7.50
Informal share	39.1	72.8	57.6	23.6	47.4

• All but <u>w</u> • Inf share 1996-2012

Parasites

Model with unempl

Conclusion

- Long-standing debate on the effects of the minimum wage on inequality
- Middle/low income countries have substantial share of informal workers
 - Endogenous compositional changes between formal and informal economies potentially shape the impacts of the minimum wage
- New theory and evidence on the importance of the informal margin in understanding the effects of the minimum wage
 - Cross-state: min wage raises overall inequality, due to more informality and inf. inequality
 - Theoretical model highlights the unintended consequences of the minimum wage
 - Quantitative work: the minimum wage hike increased aggregate inequality by 6.4%
- Potential implications for other debates
 - Federal vs. regional minimum wages; non-conventional work arrangements (Uber, Lyft, etc.)

Thank you!

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Appendix

Contract hours in RAIS are lumped at 44 hours a week



Notes: Histogram of contracted hours in the formal sector. I restrict analysis to male workers 25-55 not in the public sector. Sources: 2000 and 2010 RAIS.

Literature

1. Informality

Rauch (1991), La Porta and Shleifer (2008), Ulyssea (2010), La Porta and Shleifer (2014), Meghir, Narita, and Robin (2015), Ulyssea (2018), Ulyssea (2020), Gomes, Iachan, and Santos (2020)

2. Minimum wage effects on the formal sector

Card and Krueger (1994), DiNardo, Fortin, and Lemieux (1996), Burdett and Mortensen (1998), Lee (1999), Flinn (2010), Autor, Manning, and Smith (2016), Harasztosi and Lindner (2019), Haanwinckel (2020), Engbom and Moser (2021)

3. Minimum wages and the informal sector

Lemos (2009), Haanwinckel and Soares (2016), Jales (2018), Jales and Yu (2020), Derenoncourt et al. (2021)

Contributions:

- 1. Reduced form evidence on the impact of minimum wage on inequality and the informal sector
- 2. Develop quantitative framework to assess the aggregate effects of minimum wage

IBGE surveys capture well the distribution of employment across employment status in the favelas

-

	2010 IBGE Census	Favela Census
Rocinha	69,356	73,410
Alemão	69,143	69,586
Manguinhos	36,160	27,073

Notes: Estimated population for 2010 IBGE Census (sample weights used) versus total number of respondents in 2010 Favela Census.



Notes: Comparison of occupation distribution between IBGE Census and Favela Census.

Validation exercise: distribution of earnings by skill (1/2)







Validation exercise: distribution of earnings by skill (2/2)







Reduced form evidence across earnings distribution

• Min wage helps low-paid formal workers [Autor, Manning, and Smith, 2016, Engbom and Moser, 2021]

$$\log\left(\frac{w_{st}^{p}}{w_{st}^{50,Agg}}\right) = \beta_{1}kaitz_{st} + \beta_{2}kaitz_{st}^{2} + \alpha(s,t) + \varepsilon_{st}$$



Reduced form evidence across earnings distribution

• Min wage increases distance between low-paid informal workers and the rest

$$\operatorname{og}\left(\frac{w_{st}^{p}}{w_{st}^{50,Agg}}\right) = \beta_{1}kaitz_{st} + \beta_{2}kaitz_{st}^{2} + \alpha(s,t) + \varepsilon_{st}$$



Comparison with Engbom and Moser, 2021



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Robustness: regression specifications



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The informal sector across industries

	Share informal	Share of total employment
Manufacturing	16.5	18.1
Other activities	16.5	9.8
Transport, storage, and communic.	20.1	5.8
Commerce and repair	24.5	18.2
Undefined	30.4	0.0
Education, health, and social serv.	32.8	9.5
Restaurant and accommodation	38.8	5.6
Construction	43.5	6.5
Other services	46.4	3.5
Public admin	55.2	3.5
Agriculture	61.6	7.8
Domestic services	69.4	11.7

Notes: Table restricts data to 2001-2012 period, as industry definitions are consistent across surveys. The second column shows the share of employment that is informal in each industry. The third column shows the size of each industry in terms of total employment. Sources: PNAD.

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Comparison of earnings in RAIS and PNAD



Notes: Comparison between earnings distributions in PNAD (black) and RAIS (grey) across different years (patterns). Sources: PNAD and RAIS.

Minimum wage, inequality, and the informal sector $_{p90-Kaitz index}$



Unemployment versus informality, 1996-2012



Notes: Solid line shows the fraction of informal workers. Long dashes display the evolution of the unemployment rate. Sources: PNAD.

Distribution of earnings across skills, 1996-2012



Notes: Kernel density estimates for the distribution of log earnings relative to the minimum wage, by skill, for 1996 and 2012. Sources: PNAD.

Relative wages by skill, 1996-2012



Notes: Mean earnings of different educational groups relative to mean earnings of no-degree workers. Sources: PNAD.

Inequality between vs. within firms

- Variance decomposition: $Var(y_{ij}) = Var(\overline{y_j}) + Var(y_{ij}|i \in j)$, worker *i*, firm *j*
- Both sectors, +50% of variance is accounted for by variance of wages between firms

Retween

• Changes in overall variance are accounted for by changes in between-firms inequality

	Formal (RAIS)		Informa	al (ECINF)
	Total	Between	Total	Between
1997	0.624	0.364	0.535	0.460
		(58%)		(86%)
2003	0.484	0.272	0.545	0.485
		(56%)		(89%)
2012	0.373	0.183		
		(49%)		

Within

Notes: Decomposition of total variance into the variance of mean earnings across firms (Between) and mean of variances within firms (Within): $Var(y_{ijt}) = Var(\overline{y_{ijt}}) + \overline{Var(y_{ijt}| i \in j)}$. The numbers in parentheses represent the respective shares over total variance. Sources: 1997, 2003, and 2012 RAIS and 1997 and 2003 ECINF.

Bunching at the minimum wage vs. inequality and informality

• Share of formal workers at the minimum wage as main explanatory variable

Outcomes	Formal	Informal	Aggregate
Variance P90/P10	-0.521*** -1.647***	0.520*** 0.463*	0.302** 1.447***
Informal share:		020	

 $y_{st} = \beta \cdot \operatorname{atminw}_{st} + \alpha_s + \alpha_t + \varepsilon_{st}$

Notes: Each cell represents a separate regression. All regressions control for state and time fixed effects, and the unemployment rate. All regressions are employment-weighted. Standard errors are clustered at the state level.

Comparison of wage distributions in PNAD and ECINF



Notes: Panel (a) displays the percentiles of earnings in the informal sector using PNAD (black) and ECINF (grey) data, for 1997 (solid) and 2003 (long dashes). Sources: PNAD and ECINF.

Counterfactual - all parameters at 2012 except for the minimum wage

- Minimum wage explains 8.5% of the decrease in agg earnings inequality (vs. 23% of formal ineq)
- Why muted effects? Real increase in the minimum wage increases informal share by 23.8pp

	1996	all but <u>w</u>	2012
V(log earnings)			
overall	0.78	0.50	0.46
formal	0.58	0.43	0.33
informal	0.73	0.46	0.51
Fraction at <u>w</u>	7.74	2.72	15.8
Informal share	39.1	7.1	30.9


Shift-share analysis on the evolution of informality: by industry



Notes: Shift share decomposition of the informal share across industries: $(L_t^t/L_t) = \sum_j (L_{jt}/L_t) \cdot (L_{jt}^t/L_{jt})$ where *j* is industry, *t* is time and superscript *l* denotes informal. Solid curve is the informal share of labor. Long dash plots a counterfactual curve fixing the informal share within industries (L_{jt}^t/L_{jt}) in 2001. Short dash plots a counterfactual curve fixing industry composition of the labor force (L_{jt}/L_t) in 2001. Sources: PNAD. Back

Brotherhood and Machado Parente

Shift-share analysis on the evolution of informality: by education



Notes: Shift share decomposition of the informal share across educational groups: $(L_t^i/L_t) = \sum_j (L_{jt}/L_t) \cdot (L_{jt}^i/L_{jt})$ where *j* is educational group, *t* is time and superscript *I* denotes informal. Solid curve is the informal share of labor. Long dash plots a counterfactual curve fixing the informal share within education (L_{jt}^i/L_{jt}) in 1996. Short dash plots a counterfactual curve fixing educational composition of the labor force (L_{jt}/L_t) in 1996. Sources: PNAD.

Brotherhood and Machado Parente

Inequality decomposition by formal-informal sectors



Notes: Within-between decomposition of aggregate inequality in Brazil. Sources: PNAD.

Kaitz analysis: minimum wage, inequality, and the informal sector

Closely follow minimum wage literature [Lee (1999) and Autor, Manning, and Smith (2016)]:

$$y_{st} = \beta_1 kaitz_{st} + \beta_2 kaitz_{st}^2 + \alpha(s, t) + \varepsilon_{st}, \quad kaitz_{st} \equiv \log\left(\frac{w_t}{w_{st}^{50, F}}\right)$$

Variation: across states (s) and over time (t)

- y_{st} : different measures of inequality
- α(s, t): control for state and national level changes in shape of wage dist unrelated to min wage [Engbom and Moser (2021); Haanwinckel (2020)]
- Additional control: unemployment rate
 - Proxy for heterogeneous shocks to a state's labor market

Marginal coefficient on the minimum wage: $\rho = \hat{\beta}_1 + 2\hat{\beta}_2 \overline{kaitz}$

Bacl

Minimum wage, inequality, and the informal sector

- Negative relationship between min wage and formal inequality
- Positive relationship between min wage and informal inequality (and informal share)
- (Weak) Negative relationship between min wage and aggregate inequality



Brotherhood and Machado Parente

Scatter plots: inequality and informality vs. initial exposure to min wage

- Negative relationship between exposure and formal inequality (red diamonds)
- Positive relationship between exposure and informal share and informal inequality (green squares)
- Positive relationship between exposure and overall inequality (blue circles)



Bac

Evolution of informal share in levels across states



Notes: Panel (a) displays the evolution of the average informal share in states most and least exposed to the minimum wage. Panel (b) displays the evolution of the informal shares in excess to the share in 1999. Sources: PNAD.

Share of formal/informal workers with more than one job, 1996-2012



Notes: Share of workers in the formal and informal sectors with more than one job in the reference week. Sources: PNAD.

Cross-state variation and earnings inequality - hourly wages



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Cross-state variation and inequality - including self employed



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Cross-state variation and the informal sector - including self employed





DiD results - median split of states



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DiD results - hourly earnings



DiD results - including self employed



DiD results in levels



DiD results - robustness to different estimators



DiD results - robustness to different estimators



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DiD results

• Effects are stronger in most binding groups

	$\log(V^{agg})$	$\log(V^{form})$	$\log(V^{inf})$	log(InfShare)
$\beta_6 \times Post$	-0.008	-0.222	-0.020	0.013
	(0.063)	(0.091)**	(0.091)	(0.033)
$\beta_7 imes Post$	0.085	-0.265	0.173	0.043
	(0.065)	(0.110)**	(0.075)**	(0.043)
$eta_{8} imes$ Post	0.213	-0.261	0.297	0.055
	(0.052)***	(0.075)***	(0.093)***	(0.021)**
$eta_9 imes Post$	0.200	-0.253	0.316	0.073
	(0.077)**	(0.063)***	(0.078)***	(0.032)**
High skill	0.485	0.447	0.582	-0.466
	(0.177)**	(0.373)	(0.254)**	(0.106)***
Young	-0.561	-0.511	-0.742	0.219
	(0.165)***	(0.320)	(0.198)***	(0.143)
White	-0.083	-0.233	-0.200	0.052
	(0.165)	(0.204)	(0.172)	(0.064)
Female	0.218	0.446	0.558	-0.059
	(0.147)	(0.269)	(0.220)**	(0.226)
Observations	405	405	405	405
R^2	0.854	0.891	0.642	0.966

1996 min wage vs. informal workers



Notes: Each circle represents a state in Brazil, where circle area is proportional to total employment in 1999. Y-axis plots the informal share and X-axis plots the formal share bunched at the minimum wage. Sources: PNAD.

Informal share over time



Notes: Each circle represents a state in Brazil, where circle area is proportional to total employment in 1996. Y-axis plots the informal share in 2012, and X-axis plots the informal share in 1996. Sources: PNAD.

Fraction of employment/informality in each group $_{1=\text{least binding}}$





Evolution of mean/median earnings across sectors



Notes: Evolution of mean and median earnings in the formal and informal sectors. Sources: PNAD.

Breaking down informal inequality

- Increase in informal inequality in most exposed states driven by median earnings
 - P5010 increased sharply, P9050 decreased mildly



	1996		2012	
	Data	Model	Data	Model
Mean earnings				
Formal/Informal	2.06	2.11	1.65	1.67
Primary/No degree	1.39	1.39	1.19	1.19
Secondary/Primary	1.46	1.49	1.21	1.21
Tertiary/Secondary	2.49	2.41	2.15	2.15
Variance of log-earnings				
Overall	0.78	0.78	0.50	0.46
Formal	0.65	0.58	0.33	0.33
Informal	0.66	0.73	0.62	0.51
Formal bunching at min wage	7.74	7.74	15.8	15.8
<u>Min wage</u> Mean wage	0.22	0.26	0.45	0.47
Informal share of labor	0.39	0.39	0.31	0.31

Calibration results: model vs. data on targeted moments

The model

- Unemployment sector that gives utility $b \cdot A_i(b)$ to household i
 - Unemployment benefits *b*; independent unemployment amenity shock $A_i(b) \sim \operatorname{Frechet}(\eta)$
- Unemployment sector "competes" with firms for workers in the economy
- Share of households out of labor force:

$$U = \sum_{h} U_{h}, \quad U_{h} = N_{h} \left(\frac{b}{W_{h}}\right)^{\eta}, \quad W_{h} = \left[b^{\eta} + \int_{j \in \Omega} \left[(1 + \varsigma(j))w_{h}(j)\right]^{\eta} dj\right]^{1/\eta}$$
(2)

Calibration: parameters

• Calibrate *b* to match unemployment rate; other parameters calibrated the same way

Parameter	Description	1996	2012	Target
W	Minimum wage	3.985	8.623	Share at min wage
ho	Probability of detection	0.269	0.327	Informal share
Ь	Unemployment benefits	0.620	1.237	Unemployment rate
$\phi_{ extsf{4}}$		0.089	0.118	Relative wages (terc/sec)
ϕ_{3}	Demand shifter parameters	0.014	0.044	Relative wages (sec/prim)
ϕ_2		-0.027	-0.046	Relative wages (prim/no deg)
η	Labor supply elast.	4.856	4.121	Formal wage premium
σ	Standard deviation	0.957	1.324	Formal inequality
κ	Pareto tail	6.523	6.236	Informal inequality

Calibration: moments

	1996		2012	
	Data	Model	Data	Model
Mean earnings				
Formal/Informal	2.06	2.13	1.65	1.68
Primary/No degree	1.39	1.39	1.19	1.20
Secondary/Primary	1.46	1.45	1.21	1.21
Tertiary/Secondary	2.49	2.49	2.15	2.15
Variance of log-earnings				
Overall	0.78	0.73	0.50	0.46
Formal	0.65	0.52	0.33	0.33
Informal	0.66	0.66	0.62	0.51
Formal bunching at min wage Informal share of labor Unemployment share	0.077 0.390 0.065	0.077 0.386 0.065	0.158 0.299 0.062	0.159 0.299 0.062

The effects of the minimum wage hike

- Unintended consequences of the minimum wage increase persist
- Minimum wage hike increases unemployment by 9%
 - Firms becoming informal generates a surplus of workers to be reallocated in the economy
 - Some of them are hired by operating firms, but some end up unemployed!
 - Low levels of unemployment means only a small fraction of workers lose their jobs

		All parameters at 1996 values, except		
		$\overline{\Delta w} = 120\%$	Δho	N _h
	1996	(minimum wage)	(enforcement)	(skill comp)
V(log earnings)				
overall	0.73	0.81	0.72	0.71
formal	0.52	0.43	0.52	0.56
informal	0.66	0.81	0.65	0.58
Fraction at <u>w</u>	0.077	0.211	0.072	0.045
Informal share	0.390	0.871	0.275	0.205
Unemployment rate	0.065	0.071	0.073	0.016

Informality response to minimum wage: a break down



• 27.7% of labor force thrown into informality work at firms that are profitable in the formal sector



List of states in each group

Group	State	Group	State
1	São Paulo	6	Pará
1	Santa Catarina	6	Paraíba
1	Distrito Federal	6	Acre
2	Amapá	7	Maranhão
2	Paraná	7	Pernambuco
2	Amazonas	7	Ceará
3	Mato Grosso	8	Alagoas
3	Rio de Janeiro	8	Tocantins
3	Rio Grande do Sul	8	Rio Grande do Norte
4	Rondônia	9	Bahia
4	Mato Grosso do Sul	9	Sergipe
4	Roraima	9	Piauí
5	Goiás		
5	Espírito Santo		
5	Minas Gerais		

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• Construct 9 treatment groups according to share of formal min wage workers in 1999

- Construct 9 treatment groups according to share of formal min wage workers in 1999
- Event study specification (state *s*, treatment group *g*, time *t*):

$$y_{sgt} = \alpha + \sum_{k \neq 1999} \sum_{g \neq 1} \beta_{kg} \cdot \delta_g \cdot \delta_{t+k} + X'_{st} \Gamma + \delta_s + \delta_t + \varepsilon_{st}$$
(3)

 β_{kg} tracks evolution of outcomes in group g before and after 1999 relative to group 1

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- Control for other drivers of inequality:
 - δ : fixed effects over state and time
 - X_{st} : education, age, race, and gender compositions of labor force and unemployment rate
- Identification: absent increase in federal min wage, outcomes would follow parallel trends



► List of states

DiD results: most vs. least exposed states (β_{k9})

Most exposed states experienced...

• 25pp stronger decrease in formal inequality



Brotherhood and Machado Parente

DiD results: most vs. least exposed states (β_{k9})

Most exposed states experienced...

- 25pp stronger decrease in formal inequality
- 31pp larger increase in informal inequality and 7pp relative increase in informal share



Brotherhood and Machado Parente
DiD results: most vs. least exposed states (β_{k9})

Most exposed states experienced...

- 25pp stronger decrease in formal inequality
- 31pp larger increase in informal inequality and 7pp relative increase in informal share
- 20pp relative increase in overall inequality



DiD results: average treatment effects across treatment groups

• Minimum wage reduces formal inequality in all treatment groups (relative to group 1)



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- Minimum wage reduces formal inequality in all treatment groups (relative to group 1)
- Stronger informal margins of adjustment in states that are more exposed



DiD results: average treatment effects across treatment groups

- Minimum wage reduces formal inequality in all treatment groups (relative to group 1)
- Stronger informal margins of adjustment in states that are more exposed
- Effects of min wage on overall inequality ranges from negative (grp 2) to positive (grps 7-8)



DiD results: controlling for evolution of informality

$$y_{sgt} = \alpha + \sum_{g \neq 1} \beta_g \cdot \delta_g \cdot \delta_{t>1999} + X'_{st} \Gamma + InfShare_{1999} \times \delta_t + \delta_s + \delta_t + \varepsilon_{st}$$



▶ Back

(4)

Other measures for the minimum wage



Back

Proposition

Let $l^{inf}(z)$ and $l^{\underline{w}}$ denote labor allocation at informal and minimum-wage firms. Assume that the minimum wage (\underline{w}) is such that $\underline{w} < z_0 < \underline{z} < \overline{z}$. Then, the marginal effect of the minimum wage on labor demand (L^D) is:

 $\frac{\partial L^D}{\partial \underline{w}} =$

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If $z \sim Pareto(\nu > \eta)$, Without informality, IR = 0, and increasing \underline{w} increases worker welfare: $\frac{\partial L^{D}}{\partial \underline{w}} > 0$. With informality, increasing \underline{w} reduces worker welfare: $\frac{\partial L^{D}}{\partial \underline{w}} < 0$. (5)