

Public Works Program, Labor Supply, and Monopsony

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November 2024

NEUDC

Motivation

- ▶ Significant market power in the labor markets
 - Elasticity of labor supply to an individual firm (e.g., Manning, 2003; Bachmann et al., 2021; Bassier et al., 2022; Caldwell and Oehlsen, 2022; Datta, 2023), wage markdowns (e.g., Berger et al., 2022; Yeh et al., 2022), and HHI (e.g., Azar et al., 2019)
- ▶ Labor reallocation, mobility, wage collusion, automation threat → Labor market power
 - Trade (e.g., Felix, 2022; Kondo et al., 2022), infrastructure investments (Brooks et al., 2021; Perez et al., 2022), employer collusion (Delabastita and Rubens, 2023), and robot exposure (Byambasuren, 2024)

Motivation

- ▶ Public works programs: India's NREGA, Ethiopia's UPSNP, etc.
 - Direct effects of NREGA → Public employment (Azam, 2012; Imbert and Papp, 2020b), agricultural wages (Berg et al., 2018), incomes of the rural poor (Muralidharan et al., 2023)
 - Indirect effects of NREGA → Child labor (Islam and Sivasankaran, 2015; Li and Sekhri, 2020), private works (Imbert and Papp, 2015; Muralidharan et al., 2023; Zimmermann, 2024), urban labor markets (Imbert and Papp, 2020b), and environment (Behrer, 2023)
- ▶ Implications of public works programs are **substantial** due to indirect effects

Research Questions

- ▶ Q1. Do public work programs offset employer market power in the private sector?
- ▶ Q2. What are the associated mechanisms?

Research Questions

- ▶ Q1. Do public work programs offset employer market power in the private sector?
 - Quantify plant-level markdowns (ratio of MRPL to wage)
 - Estimate the causal impact of NREGA on wage markdowns
- ▶ Q2. What are the associated mechanisms?

Research Questions

- ▶ Q1. Do public work programs offset employer market power in the private sector?
- ▶ Q2. What are the associated mechanisms?
 - Provide a monopsony model featuring the program
 - Estimate heterogeneous effects guided by the conceptual model

Public Works Program in India

- ▶ Some facts about employment, wage, and other benefits
 - Raised rural households' earnings by 14% and reduced poverty by 26% (Muralidharan et al., 2023)
 - Positive impacts on public employment and real wages (Imbert and Paap, 2020b), driven by female workers (Azam, 2012)
 - Boosted the growth rate of real daily agricultural wages by 4.3% per year (Berg et al., 2018)
Increased private sector wages via crowding out
- ▶ Spillover effects in the manufacturing sector is understudied (Agarwal et al., 2021)

Preview of Findings

- ▶ Employers in India enjoy market power (workers earn 0.72 rupees on the marginal rupee, on average)
- ▶ Markdown effect is positive among manufacturing establishments, particularly those with low labor productivity
- ▶ The effect is most salient in urban districts with greater mobility
- ▶ The evidence suggest a composition story—public works program attracts mobile workers, leaving only workers who are immobile and thus with lower labor supply elasticity

Common Conceptual View

- ▶ Public employment guarantee is synonymous with a contestable labor market (Basu et al., 2009)
- ▶ Flattening the labor supply curve, and thus improve workers' bargaining power (Muralidharan et al., 2023)

Conceptual Model

- Firm-specific labor supply setup (Card et al., 2018; Manning, 2021)
- Heterogeneous workers with origins $o = \{u, r\}$ and skills $s = \{H, L\}$
- NREGA in the model

		<u>Skills</u>	
		Skilled	Unskilled
<u>Firms</u>	Urban	Unaffected	No change
	Rural	Unaffected	Positive

		<u>Skills</u>	
		Skilled	Unskilled
<u>Firms</u>	Urban	No change	No change
	Rural	No change	No change

Conceptual Model

- For large \mathcal{I} , the approximate firm-specific labor supply schedule of firm i is

$$\ell_i^{os}(w_i^{os}) \approx \beta^s [(w_i^{os} - \bar{w}^{os}) + (a_i^{os} - \bar{a}^{os}) + (\tau_i^{os} - \bar{\tau}^{os})] + \ell^{os} \quad (1)$$

- The average **markdown** among employers of unskilled workers from both urban and rural settlements is

$$\bar{\mu}_i^{os} = (1 - \theta_i^{rL})\mu_i^{uL} + \theta_i^{rL}\mu_i^{rL}, \quad (2)$$

where $\theta_i^{rL} = L_i^{rL} / (L_i^{uL} + L_i^{rL})$ is the employment share \rightarrow **Composition effect**

- Average wage and marginal product of labor in these firms also change with worker composition

Data

- ▶ NREGA data (Imbert and Papp, 2015)
 - Rollout of the program across districts in three phases ▶ NREGA phases
- ▶ Firm-level data
 - ASI establishment panel (1999-2008)
 - Annual nationally representative survey of all factories
 - Information necessary to estimate markdown using production approach
- ▶ Additional data
 - Weather conditions (rainfall)
 - Minimum wage and its enforcement
 - Migration (our measure of labor mobility)

Estimation Strategy

Empirical specification:

$$Y_{it} = \alpha + \beta \times \text{Post NREGA}_{dt} + \mathbf{X}'_{it}\gamma + \phi_i + \delta_{jst} + \varepsilon_{it}$$

- ▶ Y_{it} : Labor market outcomes for firm i at year $t \in [1999, 2008]$
- ▶ Post NREGA_{dt} : Treatment indicator for the post-NREGA period
- ▶ Main challenge: Policy endogeneity
- ▶ Strategy: DID design (Imbert and Paap, 2015; Agarwal et al., 2021; Behrer, 2023) ▶▶ Baseline design
 - Treated group: Phases 1 & 2
 - Control group: Phase 3 (never treated during our study period)
- ▶ SEs are clustered by districts

Identification Assumptions

1. Parallel trend

- Even-study analysis (Cook and Shah, 2022) [» Employment](#) [» Wage](#) [» Markdown](#)

$$Y_{it} = \alpha + \sum_{\tau \neq -1; \tau = -7}^{\tau=1} \gamma_{1\tau} \times I_{\tau} \times \mathbf{P1}_d + \sum_{\tau \neq -1; \tau = -8}^{\tau=0} \gamma_{2\tau} \times I_{\tau} \times \mathbf{P2}_d + \mathbf{X}'_{it}\gamma + \phi_i + \delta_{jst} + \varepsilon_{it}$$

2. No anticipation effect (Abbring and Van den Berg, 2003)

- Placebo test by shifting the treatment period [» Employment](#) [» Wage](#) [» Markdown](#)

3. Stable assignment (SUTVA)

- Alternative specifications by excluding never-treated districts immediately surrounded by treated districts from the control group [» Maps](#)

Estimated Wage Markdowns for Heterogeneous Workers

	Median	Mean	IQR ₇₅₋₂₅	SD	N
Panel A. Production and non-production workers					
Production workers	1.109	1.529	1.392	1.375	77378
Non-production workers	2.954	5.005	4.569	5.780	77378
Panel B. Workers at urban and rural firms					
Urban firms in high-mobility districts	1.018	1.354	1.108	1.158	27528
Urban firms in low-mobility districts	1.075	1.441	1.225	1.256	22063
Rural firms in high-mobility districts	1.069	1.465	1.225	1.280	17622
Rural firms in low-mobility districts	0.960	1.328	1.044	1.188	23988

Notes: The distributional statistics are calculated using sampling weights provided in the data.

Estimation Results: Average Effects

	(1) Employment	(2) Markdown	(3) Wage	(4) MRPL
Post-NREGA	-0.022 (0.020)	0.011 (0.021)	0.000 (0.014)	-0.001 (0.020)
Observations	72394	72394	68584	68584
R^2	0.97	0.88	0.91	0.89

Estimation Results: Heterogeneous Effects by Labor Productivity

	(1) Employment	(2) Markdown	(3) Wage	(4) MRPL
Post-NREGA \times Below median	-0.101*** (0.019)	0.094*** (0.030)	-0.018 (0.015)	0.074*** (0.025)
Below median	0.023 (0.014)	-0.009 (0.018)	-0.018* (0.010)	-0.002 (0.017)
Post-NREGA	0.025 (0.022)	-0.031 (0.026)	0.008 (0.018)	-0.033 (0.024)
Observations	71921	71921	68151	68151
R^2	0.97	0.88	0.91	0.89

►► Production workers

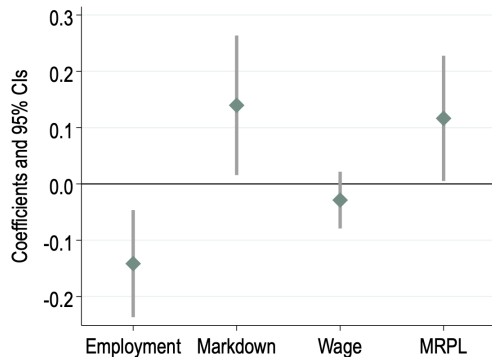
►► Non-production workers

Estimation Results: Heterogeneous Effects by Labor Intensity

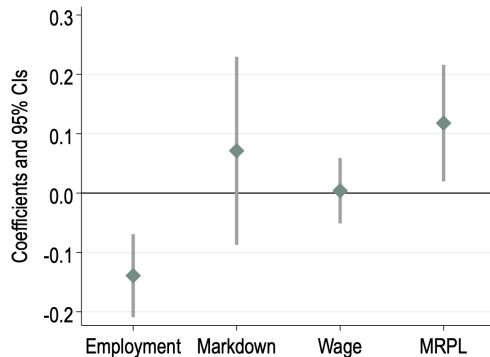
	(1) Employment	(2) Markdown	(3) Wage	(4) MRPL
Post-NREGA \times Above median	-0.087*** (0.018)	0.088*** (0.032)	-0.016 (0.015)	0.066** (0.026)
Above median	0.023 (0.017)	-0.010 (0.030)	0.004 (0.012)	0.011 (0.022)
Post-NREGA	0.016 (0.022)	-0.026 (0.025)	0.006 (0.017)	-0.027 (0.024)
Observations	71921	71921	68151	68151
R^2	0.97	0.88	0.91	0.89

Heterogeneous Effects by Labor Productivity: Urban Firms

(a) High mobility

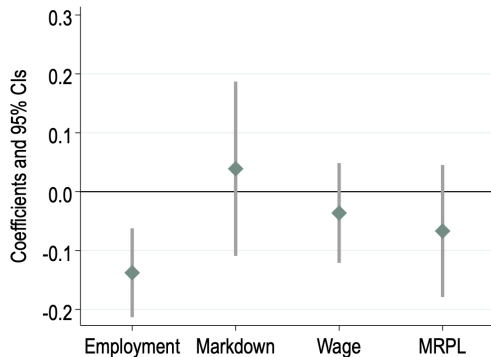


(b) Low mobility

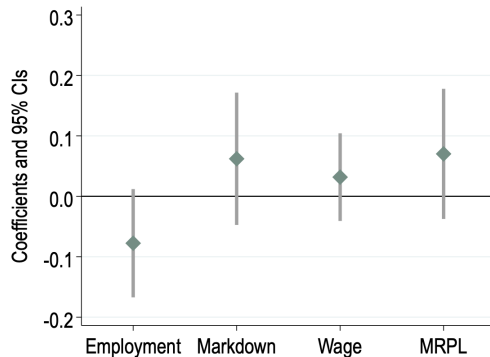


Heterogeneous Effects by Labor Productivity: Rural Firms

(a) High mobility



(b) Low mobility



Robustness Checks

- ▶ Heterogeneity by sample splitting ▶ Results
- ▶ Full sample ▶ Employment ▶ Wage
- ▶ Using mandays as a labor input ▶ All workers ▶ Production & Non-production workers ▶ Regular & Contract workers
- ▶ Event-study specifications ▶ Employment ▶ Markdown ▶ Wage ▶ MRPL
- ▶ Dropping control districts surrounded by treated districts ▶ All workers ▶ Production
▶ Non-Production ▶ Regular ▶ Contract

Conclusion

- ▶ Sizable labor market power in India's manufacturing
 - Average worker receives 0.72 rupees on marginal rupee
- ▶ Spillover effect on markdown is positive and particularly strong for manufacturing firms with low labor productivity
 - Markdown effect is concentrated in districts with greater labor mobility in urban areas
- ▶ Public works program crowds out employment in manufacturing firms → Labor composition changes
 - Composition effect → Employer power at crowded out firms ↑ due to high employer power over immobile workers with low labor supply elasticity

The surprising NREGA markdown consequences highlights the importance of the migrant workforce in manufacturing

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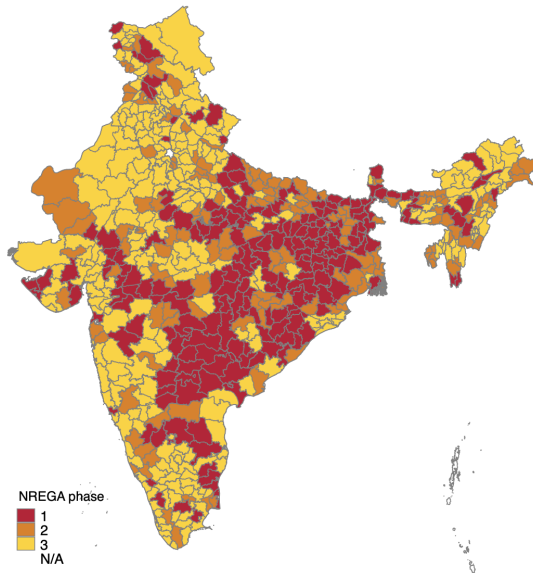
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Thank you!
Email: tb497@cornell.edu

Appendix

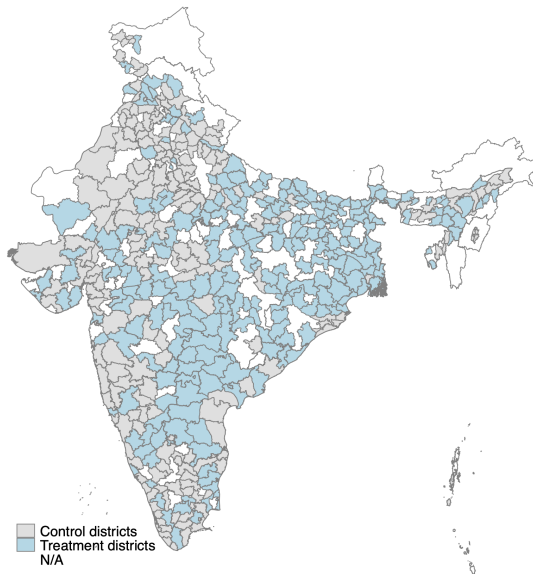
NREGA Phases

» Back



Baseline Treatment and Control Groups

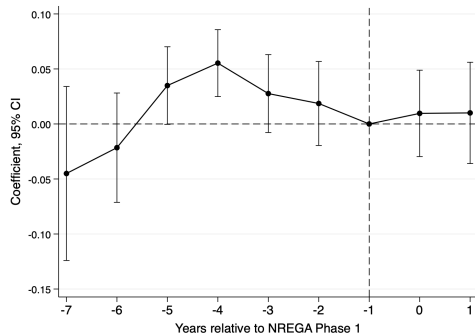
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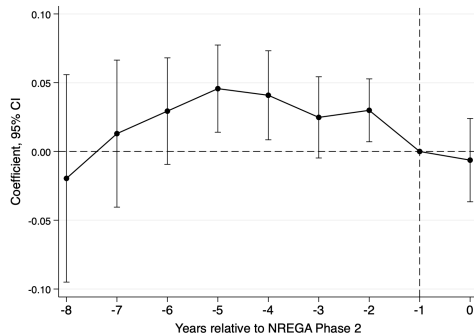
Parallel Pre-Trend in Employment

[▶ Back](#)

(a) Phase 1



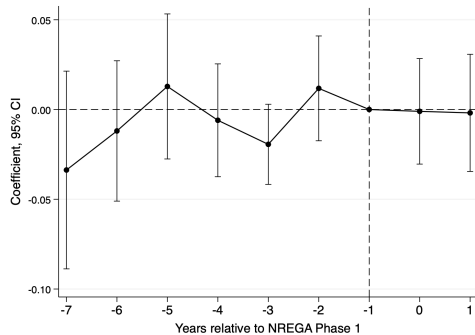
(b) Phase 2



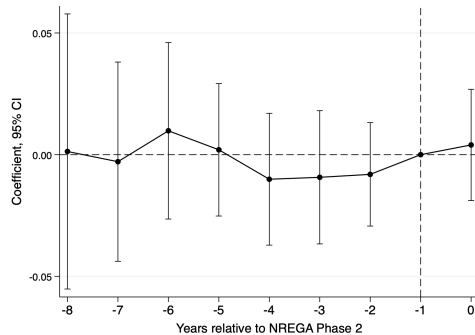
Parallel Pre-Trend in Wage

[▶ Back](#)

(a) Phase 1

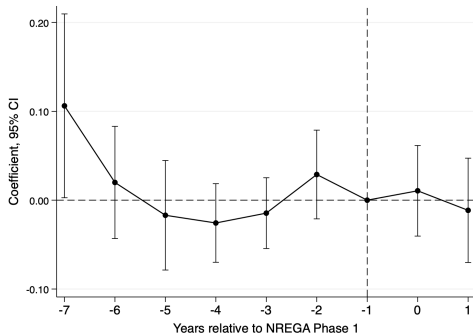


(b) Phase 2

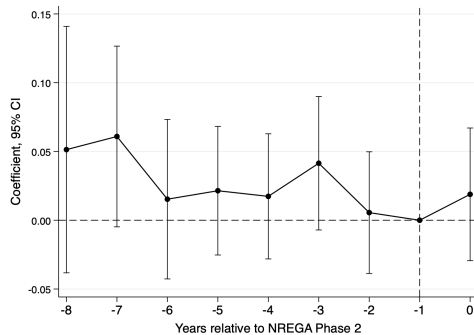


Parallel Pre-Trend in Markdown [▶ Back](#)

(a) Phase 1



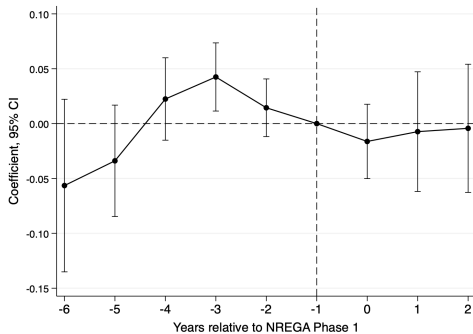
(b) Phase 2



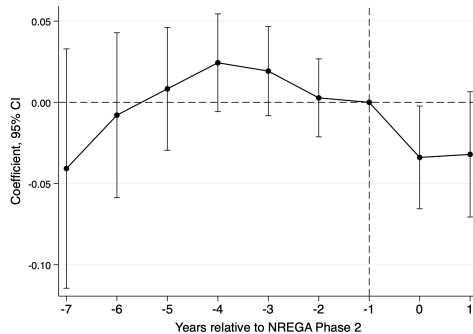
No Anticipation Effect in Employment

» Back

(a) Phase 1



(b) Phase 2

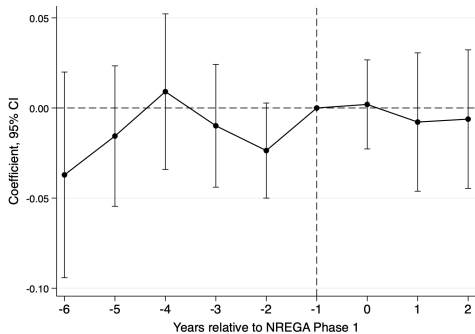


» Two-year lag

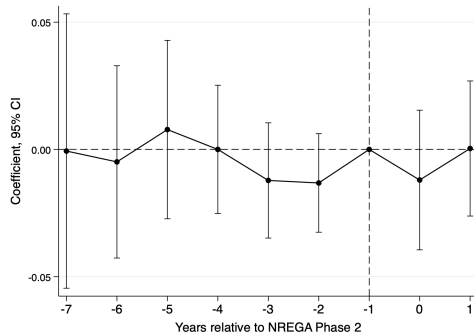
No Anticipation Effect in Wage

[» Back](#)

(a) Phase 1



(b) Phase 2

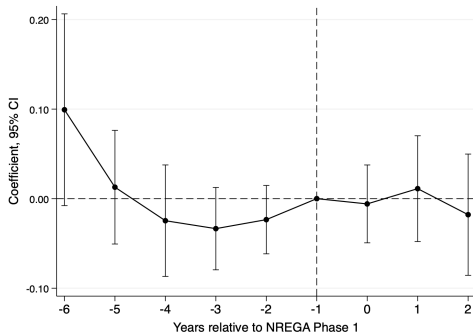


[» Two-year lag](#)

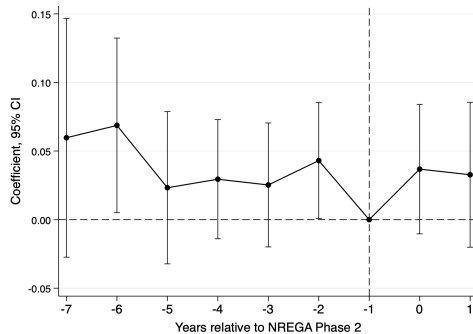
No Anticipation Effect in Markdown

[Back](#)

(a) Phase 1



(b) Phase 2

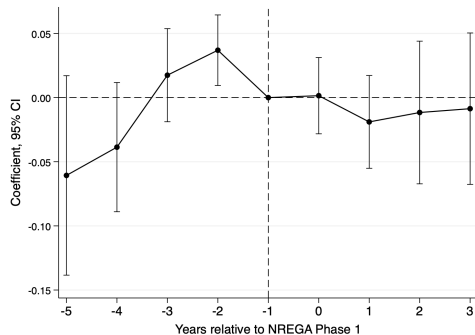


[Two-year lag](#)

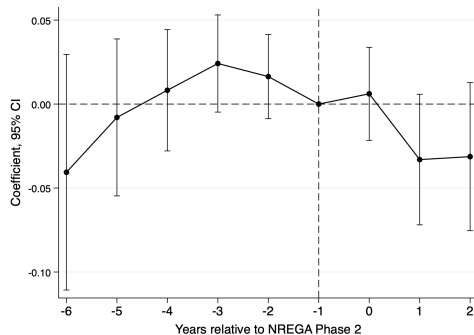
No Anticipation Effect in Employment (Two-Year Lag)

[» Back](#)

(a) Phase 1



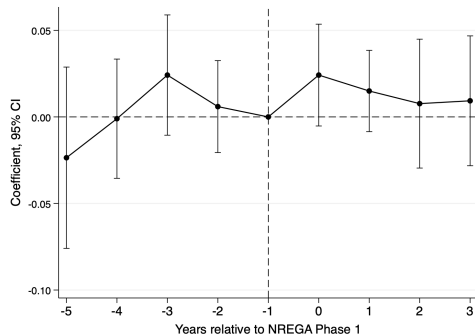
(b) Phase 2



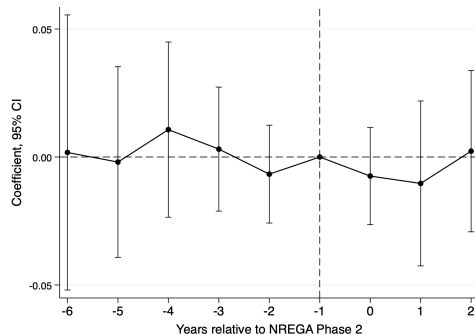
No Anticipation Effect in Wage (Two-Year Lag)

[▶ Back](#)

(a) Phase 1



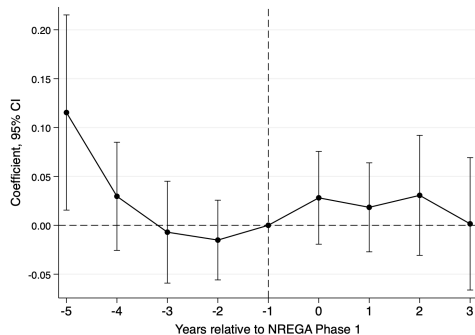
(b) Phase 2



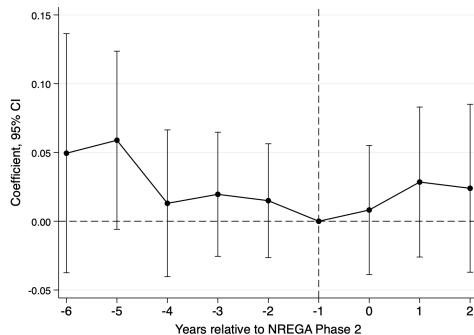
No Anticipation Effect in Markdown (Two-Year Lag)

[▶ Back](#)

(a) Phase 1



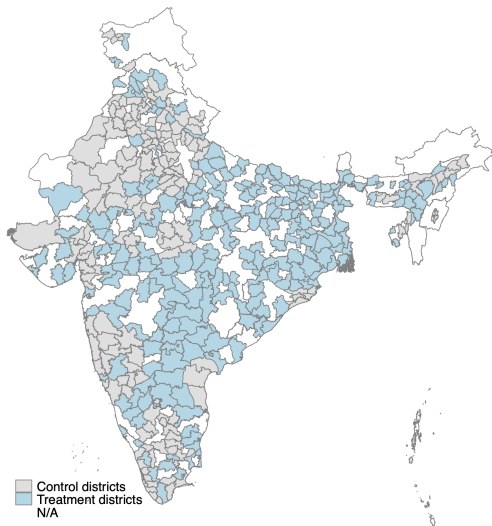
(b) Phase 2



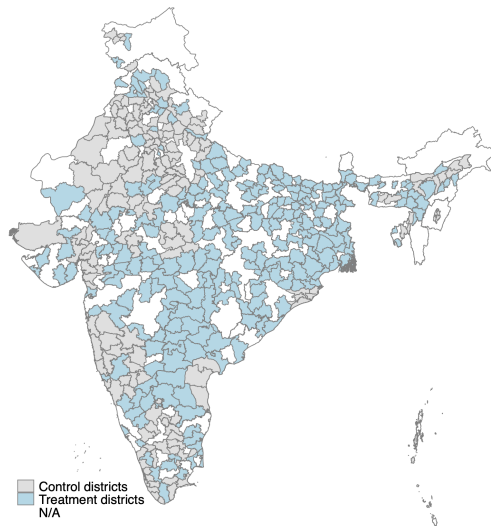
Alternative Control Groups

[» Back](#)

(a) First alternative



(b) Second alternative



Hetero. Effects on Production Workers by Labor Productivity

	(1) Employment	(2) Markdown	(3) Wage	(4) MRPL
Panel A. Below median				
Post-NREGA	-0.083*** (0.026)	0.099*** (0.028)	0.011 (0.017)	0.077** (0.030)
Observations	28244	28244	28241	28241
R^2	0.97	0.82	0.93	0.89
Panel B. Above median				
Post-NREGA	0.014 (0.027)	-0.015 (0.050)	-0.011 (0.020)	-0.034 (0.036)
Observations	30086	30086	30084	30084
R^2	0.96	0.84	0.91	0.84

Hetero. Effects on Non-Production Workers by Labor Productivity

	(1) Employment	(2) Markdown	(3) Wage	(4) MRPL
Panel A. Below median				
Post-NREGA	-0.027 (0.026)	0.129 (0.235)	0.001 (0.032)	0.043 (0.037)
Observations	28244	28244	28228	28228
R^2	0.93	0.86	0.86	0.89
Panel B. Above median				
Post-NREGA	0.003 (0.027)	-0.220 (0.250)	-0.011 (0.028)	-0.046 (0.031)
Observations	30086	30086	30080	30080
R^2	0.93	0.81	0.81	0.85

Sub-sampling Method: Hetero. Effects by Labor Productivity

	(1) Employment	(2) Markdown	(3) Wage	(4) MRPL
Panel A. Below median				
Post-NREGA	-0.059** (0.024)	0.046* (0.024)	0.021 (0.014)	0.047* (0.025)
Observations	33837	33837	30992	30992
R^2	0.97	0.83	0.92	0.89
Panel A. Above median				
Post-NREGA	0.018 (0.025)	-0.027 (0.030)	-0.010 (0.021)	-0.034 (0.032)
Observations	36144	36144	35210	35210
R^2	0.96	0.89	0.90	0.86

Full Sample: Hetero. Effects on Employment by Labor Productivity

	(1)	(2)	(3)	(4)	(5)
	Dependent variable: Employment				
Post-NREGA \times Below median	-0.146*** (0.018)	-0.146*** (0.018)	-0.135*** (0.017)	-0.130*** (0.016)	-0.134*** (0.016)
Below median	0.018 (0.013)	0.020 (0.013)	0.016 (0.012)	0.018 (0.012)	0.019 (0.012)
Post-NREGA	0.017 (0.023)	0.018 (0.023)	0.027 (0.021)	0.035* (0.019)	0.029* (0.018)
Observations	225808	221566	221566	221566	221215
R^2	0.95	0.95	0.95	0.95	0.95
Firm FE	✓	✓	✓	✓	✓
Year FE	✓	✓			
Additional covariates		✓	✓	✓	✓
Industry-Year FE			✓	✓	
State-Year FE				✓	
State-Industry-Year FE					✓

Full Sample: Hetero. Effects on Wage by Labor Productivity

	(1)	(2)	(3)	(4)	(5)
Dependent variable: Wage					
Post-NREGA \times Below median	-0.011 (0.012)	-0.011 (0.012)	-0.010 (0.012)	-0.007 (0.011)	-0.003 (0.011)
Below median	-0.003 (0.007)	-0.002 (0.007)	-0.003 (0.007)	-0.001 (0.007)	-0.000 (0.006)
Post-NREGA	-0.001 (0.015)	-0.001 (0.015)	0.003 (0.013)	-0.004 (0.013)	-0.002 (0.012)
Observations	196160	192520	192520	192520	192203
R^2	0.87	0.87	0.87	0.87	0.87
Firm FE	✓	✓	✓	✓	✓
Year FE	✓	✓			
Additional covariates		✓	✓	✓	✓
Industry-Year FE			✓	✓	
State-Year FE				✓	
State-Industry-Year FE					✓

Total Mandays: Hetero. Effects by Labor Productivity

	(1) Employment	(2) Markdown	(3) MRPL
Panel A. Below median			
Post-NREGA	-0.068*** (0.023)	0.087*** (0.026)	0.070*** (0.023)
Observations	35492	35492	32632
R^2	0.97	0.85	0.90
Panel B. Above median			
Post-NREGA	0.020 (0.026)	0.006 (0.036)	-0.012 (0.024)
Observations	37519	37519	36496
R^2	0.96	0.87	0.85

Total Mandays: Hetero. Effects by Labor Productivity (Production and Non-Production Workers)

» Back

	Production workers			Non-production workers		
	(1) Employment	(2) Markdown	(3) MRPL	(4) Employment	(5) Markdown	(6) MRPL
Panel A. Below median						
Post-NREGA	-0.091*** (0.025)	0.081*** (0.027)	0.073*** (0.027)	-0.043 (0.029)	0.086 (0.221)	0.061** (0.028)
Observations	28806	28806	28803	28806	28806	28792
R^2	0.97	0.83	0.89	0.93	0.87	0.91
Panel B. Above median						
Post-NREGA	0.009 (0.028)	-0.049 (0.050)	-0.036 (0.038)	0.017 (0.029)	-0.100 (0.199)	-0.039 (0.026)
Observations	30289	30289	30277	30289	30289	30272
R^2	0.96	0.84	0.84	0.93	0.81	0.86

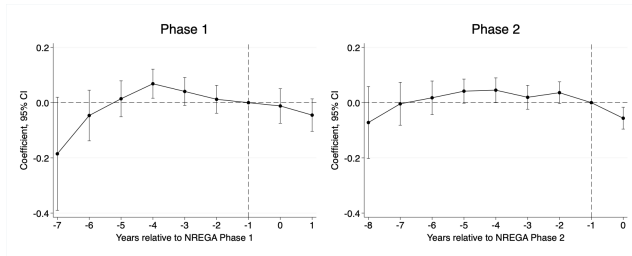
Total Mandays: Hetero. Effects by Labor Productivity (Regular and Contract Workers)

» Back

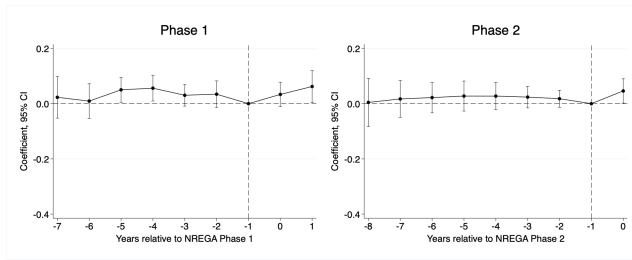
	Regular workers			Contract workers		
	(1) Employment	(2) Markdown	(3) MRPL	(4) Employment	(5) Markdown	(6) MRPL
Panel A. Below median						
Post-NREGA	-0.119** (0.051)	0.218*** (0.075)	0.130** (0.056)	-0.094 (0.068)	0.214 (0.154)	0.079 (0.065)
Observations	8006	8006	5961	8006	8006	8006
R^2	0.98	0.83	0.90	0.91	0.87	0.93
Panel B. Above median						
Post-NREGA	-0.016 (0.029)	0.045 (0.077)	0.039 (0.041)	0.078 (0.058)	0.031 (0.207)	-0.007 (0.057)
Observations	9144	9144	8806	9144	9144	9127
R^2	0.97	0.88	0.85	0.87	0.80	0.86

Event Study: Hetero. Effect on Employment by Labor Productivity

(a) Firms with low labor productivity [▶ Back](#)



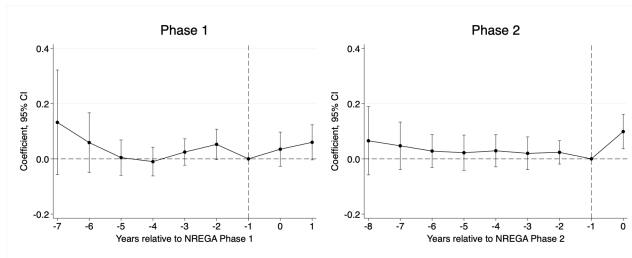
(b) Firms with high labor productivity



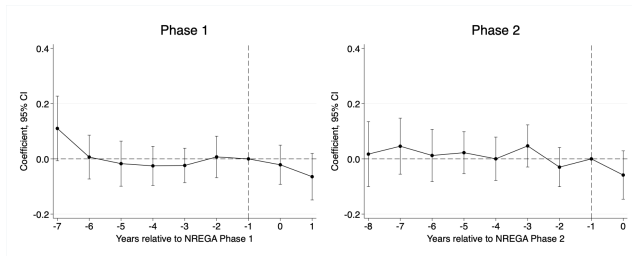
Event Study: Hetero. Effect on Markdown by Labor Productivity

[Back](#)

(a) Firms with low labor productivity



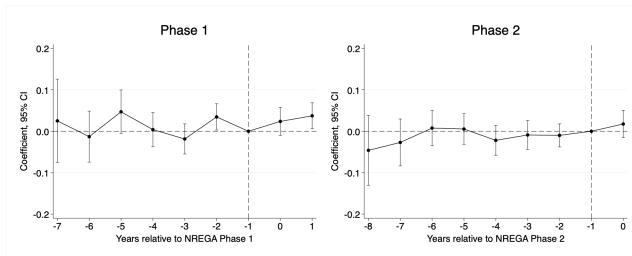
(b) Firms with high labor productivity



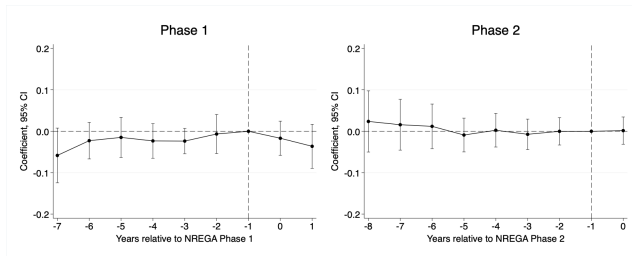
Event Study: Hetero. Effect on Wage by Labor Productivity

[» Back](#)

(a) Firms with low labor productivity



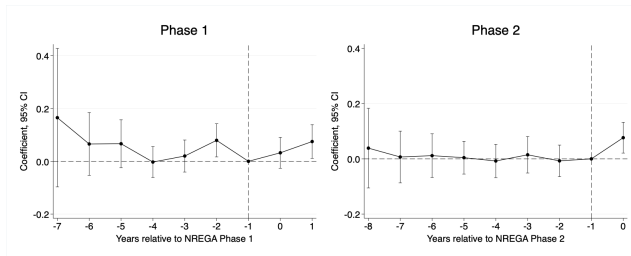
(b) Firms with high labor productivity



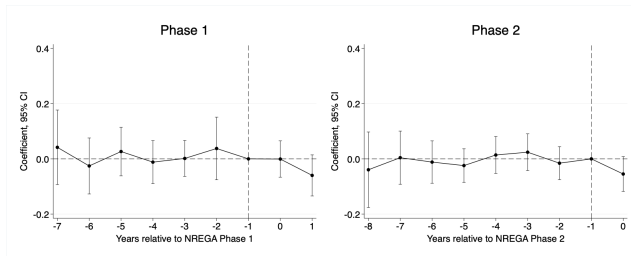
Event Study: Hetero. Effect on MRPL by Labor Productivity

[» Back](#)

(a) Firms with low labor productivity



(b) Firms with high labor productivity



Alternative Control Group 1: Hetero. Effects by Labor Productivity

	(1) Employment	(2) Markdown	(3) Wage	(4) MRPL
Post-NREGA \times Below median	-0.114*** (0.021)	0.110*** (0.030)	-0.019 (0.016)	0.082*** (0.026)
Below median	0.032** (0.016)	-0.018 (0.019)	-0.014 (0.010)	-0.010 (0.017)
Post-NREGA	0.014 (0.023)	-0.017 (0.025)	0.005 (0.018)	-0.036 (0.025)
Observations	59763	59763	59763	59763
R^2	0.97	0.88	0.92	0.89

Alternative Control Group 1: Hetero. Effects by Labor Productivity (Production Workers)

	(1) Employment	(2) Markdown	(3) Wage	(4) MRPL
Panel A. Production workers				
Post-NREGA \times Below median	-0.107*** (0.018)	0.105*** (0.038)	-0.035** (0.014)	0.061** (0.030)
Below median	0.027 (0.019)	0.009 (0.032)	-0.024** (0.011)	0.015 (0.024)
Post-NREGA	0.006 (0.024)	0.001 (0.039)	0.012 (0.018)	-0.003 (0.029)
Observations	52523	52523	52523	52523
R^2	0.96	0.84	0.93	0.89

Alternative Control Group 1: Hetero. Effects by Labor Productivity (Non-Production Workers)

	(1) Employment	(2) Markdown	(3) Wage	(4) MRPL
Panel B. Non-production workers				
Post-NREGA \times Below median	-0.071*** (0.025)	0.261 (0.202)	-0.083*** (0.028)	-0.059** (0.030)
Below median	-0.001 (0.022)	-0.077 (0.159)	0.024 (0.022)	0.022 (0.024)
Post-NREGA	0.014 (0.021)	-0.120 (0.196)	0.039 (0.026)	0.046* (0.026)
Observations	52523	52523	52523	52523
R^2	0.94	0.83	0.84	0.89

Alternative Control Group 1: Hetero. Effects by Labor Productivity (Regular Workers)

	(1) Employment	(2) Markdown	(3) Wage	(4) MRPL
Panel A. Regular workers				
Post-NREGA \times Below median	-0.093** (0.040)	0.146* (0.084)	-0.025 (0.036)	-0.017 (0.067)
Below median	0.018 (0.029)	0.013 (0.079)	-0.036 (0.031)	-0.042 (0.065)
Post-NREGA	-0.012 (0.027)	0.014 (0.082)	0.036 (0.030)	0.098** (0.046)
Observations	13453	13453	13453	13453
R^2	0.97	0.87	0.91	0.89

Alternative Control Group 1: Hetero. Effects by Labor Productivity (Contract Workers)

	(1) Employment	(2) Markdown	(3) Wage	(4) MRPL
Panel B. Contract workers				
Post-NREGA \times Below median	-0.082 (0.064)	0.185 (0.303)	-0.043 (0.031)	0.014 (0.070)
Below median	-0.007 (0.061)	-0.254 (0.258)	-0.010 (0.031)	-0.023 (0.063)
Post-NREGA	0.013 (0.061)	0.039 (0.296)	0.018 (0.030)	0.035 (0.052)
Observations	13453	13453	13453	13453
R^2	0.89	0.80	0.77	0.91