Aggregate Effects of Workfare Programs

Arnav Deshpande

New York University

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Question

- Cash-for-work ('workfare') programs are pervasive in developing countries (World Bank, 2015)
  - Income in exchange for short-term labor provided to public works
- I want to understand the macroeconomic impacts of cash-for-work
- Recent evidence from India: a workfare expansion $\uparrow$ market wages and employment
  - Claim that this could reflect reduced employer market power
- I build a model of labor market power with workfare
  - Can a reasonable parameterization reproduce the evidence from India?

Literature

Evidence

- NREGS, 2007
  - Guarantees upto 100 days of work/year on demand at state-mandated wage
- Muralidharan et al (2022) randomize improvements to NREGS in Indian districts
  - Digital payments improved program access
- Findings
  - **Fact 1:** Workfare employment $\uparrow$ 30%, market wages $\uparrow$ 10% and employment $\uparrow$ 18%
  - **Fact 2:** Employment increased more in more concentrated markets
  - **Fact 3:** Increased spending, uptake of loans, entry of new non-agricultural firms
  - **Fact 4:** Minimal asset creation
- What is the relative importance of the market power channel?
  - If small, do transfers instead?

Overview

- A model of oligopsonistic competition (Berger et al 2022, 2025) accomodates
  - Workfare expansion $\rightarrow$ market wages and employment $\uparrow$
  - Effects bigger in markets with higher HHI
- Model mechanism
  - Workfare expansion $\rightarrow$ firm-level labor supply elasticity $\uparrow$
  - Market employment and wage $\uparrow$ if the markdown reduction is big enough
- Quantify model to match salient features of rural India
  - Model predicts 1.3% to 3.9% increase in market wages (data: 10%)
  - Model predicts 1.4% to 4.3% increase in market employment (data: 18%)

Model overview

- Representative household with identical workers; dislikes labor
- Continuum of villages $j \in [0, 1]$; each village contains a 'private' sector and a 'workfare' sector
- Market sector $\rightarrow m_j$ firms, productivity $z_{ij} \sim F$
- Workfare sector $\rightarrow$ exogenously given wage $\bar{w}_j$
- Labor imperfectly substitutable across firms, workfare-market and villages
- Experiment: improve workfare access

Household's problem: consumption

$$\max_{\{c_{ij}, n_{ij}, n_j^w\}} \quad \frac{C^{1-\sigma}}{1-\sigma} - \frac{N^{1+\nu}}{1+\nu}$$

$$\text{s.t.} \quad C = \int_0^1 \left(\sum_{i=1}^{m_j} w_{ij} n_{ij} + \bar{w}_j n_j^w \right) dj + (1-\tau)\Pi$$

$$C = \int_0^1 \sum_{i=1}^{m_j} c_{ij} \, dj$$

- Consumption good perfect substitute across villages j and firms $1 \leq i \leq m_j$
- Profits rebated lump-sum to household; subject to tax τ

Household's problem: labor

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$$C = \int_0^1 \sum_{i=1}^{m_j} c_{ij} \, dj$$

$$N = \left(\int_0^1 n_j^{\frac{\theta+1}{\theta}} \, dj \right)^{\frac{\theta}{\theta+1}}$$

$$n_j = \left(\left(n_j^p\right)^{\frac{\gamma+1}{\gamma}} + \delta \left(n_j^w\right)^{\frac{\gamma+1}{\gamma}} \right)^{\frac{\gamma}{\gamma+1}}$$

$$n_j^p = \left(\sum_{i=1}^{m_j} \left(n_{ij}\right)^{\frac{\eta+1}{\eta}} \right)^{\frac{\eta}{\eta+1}}$$

- Nested CES: private and workfare within village (γ), firms within private (η), across villages (θ).
- δ is the program access friction.
- $\frac{1}{\nu}$ is Frisch elasticity of labor supply.

Firm's problem

$$\max_{n_{ij}} \left\{ z_{ij} n_{ij}^{\alpha} - w_{ij}\left(n_{ij}, n_j^p, n_j^w, N, W\right) n_{ij} \right\}$$

$$\text{subject to} \quad w_{ij}\left(n_{ij}, n_j^p, n_j^w, N, W\right) = \left(\frac{n_{ij}}{n_j^p}\right)^{\frac{1}{\eta}} \left(\frac{n_j^p}{n_j}\right)^{\frac{1}{\gamma}} \left(\frac{n_j}{N}\right)^{\frac{1}{\theta}} W$$

and W is defined as

$$w_j^p n_j^p = \sum_{i=1}^{m_j} w_{ij} n_{ij}$$

$$w_j n_j = w_j^p n_j^p + \bar{w}_j n_j^w$$

$$W N = \int_0^1 w_j n_j \, dj \qquad W = \left(\int_0^1 w_j^{1+\theta} dj\right)^{\frac{1}{1+\theta}}$$

CES wage index equations

Equilibrium

Given $\{\bar{w}_j\}_{\forall j}$, an equilibrium consists of $\{w_{ij}, n_{ij}, n_j^w\}_{\forall i,j}$, household consumption C, output Y, government spending G and a tax rate τ such that

1. each $\left\{w_{ij}, n_{ij}, n_j^w\right\}$ is consistent with the labor supply curve
2. each n_{ij} solves the firm's problem
3. the government's budget is balanced

$$
\begin{aligned}
G &= \int_0^1 \bar{w}_j n_j^w dj = WN - W^p N^p \\
G &= \tau \Pi
\end{aligned}
$$

4. the goods market clears

$$
\begin{aligned}
C &= WN + (1-\tau)\Pi \\
C &= WN + Y - W^p N^p - \tau\Pi \\
C &= Y
\end{aligned}
$$

Markdowns

Assumption: $\bar{\mathbf{w}}_{\mathbf{j}} = \phi w_j^p$

Markdowns

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Result (block recursivity): Markdowns in market j, $\{\mu_{ij}\}_{i=1}^{m_j}$, can be recovered without knowing aggregates.

$$s_{ij} = \frac{n_{ij} w_{ij}}{\sum_i^{m_j} n_{ij} w_{ij}} = \frac{\left[\mu(s_{ij}) z_{ij}\right]^{\frac{\eta+1}{1+\eta(1-\alpha)}}}{\sum_i^{m_j} \left[\mu(s_{ij}) z_{ij}\right]^{\frac{\eta+1}{1+\eta(1-\alpha)}}} \qquad \text{share}$$

$$\mu(s_{ij}) = \frac{1}{1+\varepsilon(s_{ij})^{-1}} \qquad \text{markdown}$$

$$\varepsilon(s_{ij})^{-1} = \left((1-s_{ij})\frac{1}{\eta} + s_{ij}(1-\Phi^{-(1+\gamma)})\frac{1}{\gamma} + s_{ij}\Phi^{-(1+\gamma)}\frac{1}{\theta}\right) \qquad \text{inv elast. labor supply}$$

where

$$\Phi = \left(1 + \frac{\phi^{1+\gamma}}{\delta\gamma}\right)^{\frac{1}{1+\gamma}} \qquad \text{index of workfare performance}$$

and $\Phi^{-\gamma}$ is the private market share. Details

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$$s_{ij} == \frac{n_{ij} w_{ij}}{\sum_i^{m_j} n_{ij} w_{ij}} = \frac{[\mu(s_{ij}) z_{ij}]^{\frac{\eta+1}{1+\eta(1-\alpha)}}}{\sum_i^{m_j} [\mu(s_{ij}) z_{ij}]^{\frac{\eta+1}{1+\eta(1-\alpha)}}} \quad \text{share}$$

γ: subs. private/workfare $\quad \theta$: subs. villages

$$\mu(s_{ij}) = \frac{1}{1+\varepsilon(s_{ij})^{-1}} \quad \text{markdown}$$

$$\varepsilon(s_{ij})^{-1} = \left((1-s_{ij})\frac{1}{\eta} + s_{ij}\left(1-\Phi^{-(1+\gamma)}\right)\frac{1}{\gamma} + s_{ij}\Phi^{-(1+\gamma)}\frac{1}{\theta}\right) \quad \text{elast. labor supply}$$

where

$$\frac{1}{\gamma} < \frac{1}{\theta} \Rightarrow \varepsilon^{-1}\downarrow \Rightarrow \mu\uparrow$$

$$\uparrow\Phi = \left(1+\frac{\phi^{1+\gamma}}{\delta\gamma}\right)^{\frac{1}{1+\gamma}} \quad \text{index of workfare performance}$$

and $\Phi^{-\gamma}$ is the private market share.

Details

Aggregation

Result (aggregation): The following system pins down $\{Y, C, W^p, N^p, W, N\}$:

$$Y = \Omega Z \left(N^p\right)^\alpha \qquad W^p = \alpha \frac{\mu}{\Omega} \frac{Y}{N^p} \qquad W = \frac{-U_N}{U_C}$$

$$W = \Phi W^p \qquad N = \Phi^\gamma N^p \qquad C = Y$$

Ω : *misallocation*, μ : *markdown*

Private sector indices Agg constants Proofs outline

Simpler model: competitive benchmark

Suppose every village contains a single firm and workfare

n: **private employment,** w: **private wage,** μ: **markdown,** Φ: **index of workfare performance**

In the competitive benchmark ($\mu = 1$),

$$\frac{d \log n}{d \log \Phi} = (\mathbf{1} - \gamma\nu) \frac{1}{\alpha(\sigma - 1) + \nu + 1}$$

$$\frac{d \log w}{d \log \Phi} = (\gamma\nu - \mathbf{1}) \frac{1 - \alpha}{\alpha(\sigma - 1) + \nu + 1}$$

Workfare expansion $\rightarrow$ n and w move in opposite directions.

ν: **inverse Frisch** γ: **private vs. workfare substitution**

Details

Simpler model: markdown inefficiency

Suppose every village contains a single firm and workfare

n: private employment, w: private wage, μ: markdown, Φ: index of workfare performance

In the model featuring markdown inefficiency ($\mu < 1$),

$$\frac{d\log n}{d\log\Phi} = (1-\gamma\nu)\frac{1}{\alpha(\sigma-1)+\nu+1} + \frac{1}{\alpha(\sigma-1)+\nu+1}\frac{d\log\mu}{d\log\Phi}$$

$$\frac{d\log w}{d\log\Phi} = (\gamma\nu-1)\frac{1-\alpha}{\alpha(\sigma-1)+\nu+1} + \frac{\alpha\sigma+\nu}{\alpha(\sigma-1)+\nu+1}\frac{d\log\mu}{d\log\Phi}$$

Workfare expansion $\rightarrow$ n and w go up if $\frac{d\log\mu}{d\log\Phi}$ big enough

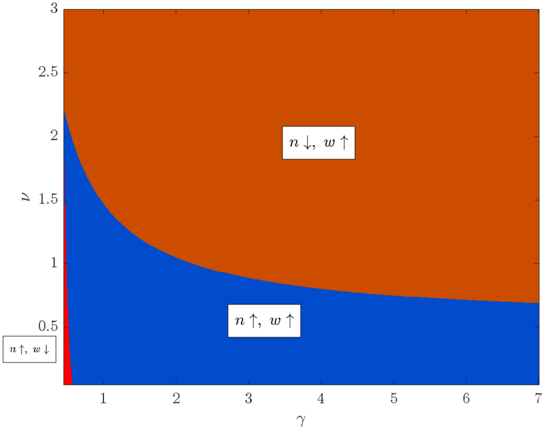
ν: inverse Frisch $\quad$ γ: private vs. workfare substitution

Details

Reallocation and efficiency

- When γ is big, workfare expands $\rightarrow$ big markdown reduction ($\uparrow$ ***n***, $\uparrow$ ***w***)

$$\varepsilon^{-1} = \left(\frac{1}{\gamma} + \Phi^{-(1+\gamma)}\left(\frac{1}{\theta} - \frac{1}{\gamma}\right)\right)$$

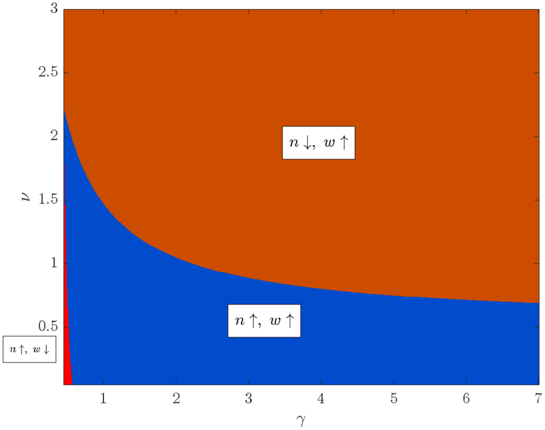


$\sigma = 2,\ \alpha = 0.8,\ \theta = 0.45,\ \phi = 1,\ \delta = 1$

ν: inverse Frisch **γ: subs. private/workfare** **θ: subs. villages**

Reallocation and efficiency

- When γ is big, workfare expands $\rightarrow$ big markdown reduction ($\uparrow$ ***n***, $\uparrow$ ***w***)
- When γ is big, workfare expands $\rightarrow$ labor reallocates away from market ($\downarrow$ ***n***, $\uparrow$ ***w***)
- Need ν small enough to compensate



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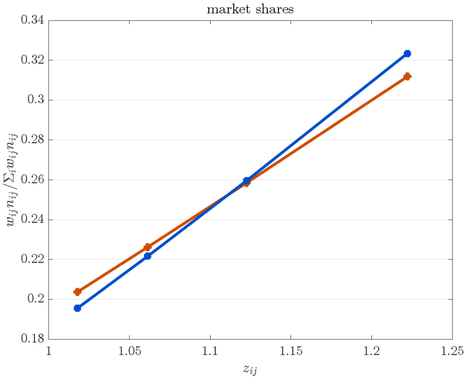
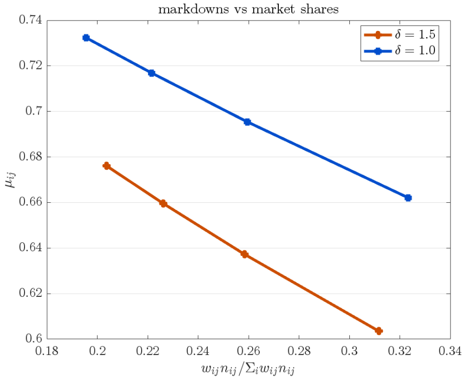
Firm size, market power, and misallocation





$\delta = 1.5 \rightarrow \delta = 1$

Workfare expansion $\rightarrow$ productive firms expand at the expense of unproductive firms

Firm size, market power, and misallocation

- What explains the reallocative effects of workfare?

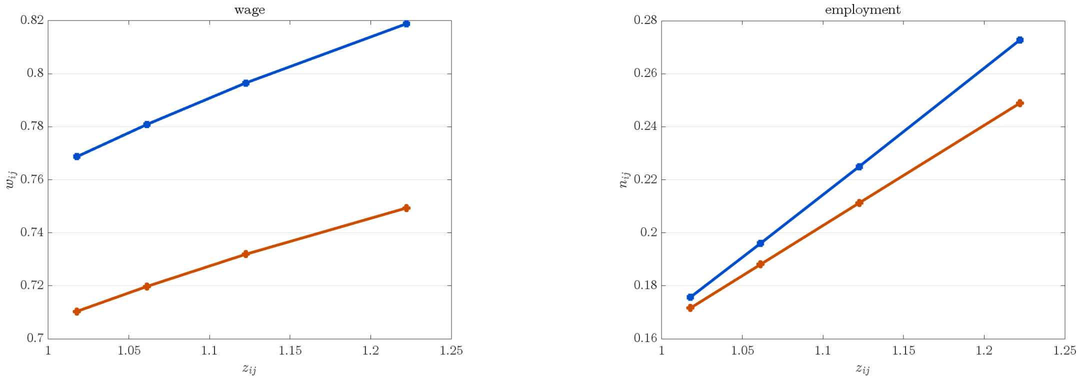
$$\varepsilon(s_{ij}) = \left((1 - s_{ij}) \frac{1}{\eta} + s_{ij} (1 - \Phi^{-(1+\gamma)}) \frac{1}{\gamma} + s_{ij} \Phi^{-(1+\gamma)} \frac{1}{\theta} \right)^{-1}$$

where

$$\Phi = \left(1 + \frac{\phi^{1+\gamma}}{\delta\gamma} \right)^{\frac{1}{1+\gamma}}$$

- As $s \to 0$, workfare does not matter
- As $s \to 1$, the firm competes for labor with workfare

Wage and employment margins

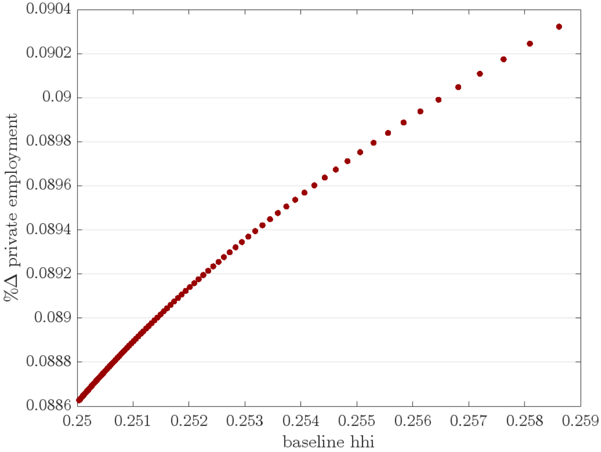


$$\delta = 1.5 \rightarrow \delta = 1$$

Relative adjustment at high versus low firms ambiguous

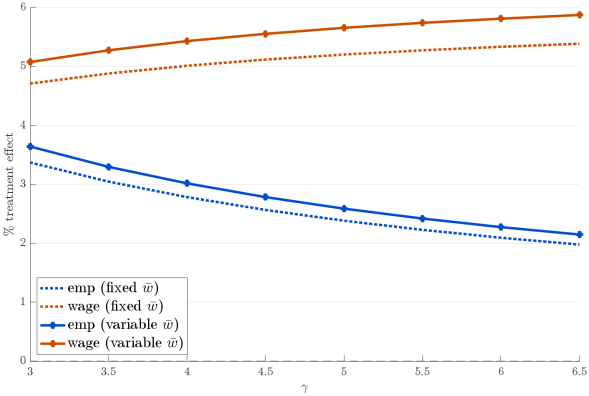
Workfare in more concentrated markets

- With Pareto draws, high HHI markets have high productive firms
- Payroll shares of productive firms ↑, relative treatment effects at high versus low firms ambiguous



Quantitative effects of workfare

- With $\bar{w}_j = \phi w_j^p$ workfare expansions endogenously increase workfare wage
- Computation: guess the wedge $\phi_j = \frac{\bar{w}}{w_j^p}$, and iterate on the guess



With $\bar{w}_j$ fixed, employment and wage effects attenuated

Quantitative experiment

What is the biggest market employment and wage effect plausible in a calibration?

- Parameters: $A = \{\sigma, \xi\}$, $B = \{\nu, \eta, \gamma\}$, $C = \{\phi, \delta, m_j, \alpha, \theta, \Delta\delta\}$
- Given A and B, pick C to match 6 moments
- Choose B to maximize market employment and wage treatment effects
    - treatment effect $= \int_0^1 \frac{y^p_{j,post} - y^p_{j,pre}}{y^p_{j,pre}} dj$

ν: inverse Frisch η: subs. firms γ: subs. private/workfare ξ: Pareto shape θ: subs. villages m_j: no. of firms α: DRS, θ: subs. villages

Calibration

Parameters	Interpretation	Targets	Source
Assigned			
σ	curvature in consumption	log utility	
ξ	Pareto shape		
Calibrated			
ν	inverse Frish		
η	substitution across firms		
γ	substitution workfare vs private		
$m_j = m$	number of firms	mean HHI (0.030)	Muralidharan et al (2022)
ϕ	$\bar{w}_{j,baseline} = \phi w^p_{j,baseline}$	workfare/market wage (1)	Muralidharan et al (2022)
δ	workfare disutility shifter	workfare/market labor (0.57)	Muralidharan et al (2022)
α	exponent on n	labor share (0.52)	Jat and Ramaswami (2024)
θ	substitution across villages	wage markdown ($\mu = 0.72$)	Soundararajan et al (2024), Brooks et al (2021)
$\Delta\delta$	program improvement	workfare treat effect (0.30)	Muralidharan et al (2022)

Calibration results

Targeted

Moment	Model	Data
workfare/market wage ratio	1	1
workfare/market labor ratio	0.57	0.57
mean HHI	0.033	0.03
labor share	0.52	0.52
markdown μ	0.72	0.72
workfare labor treat effect	0.30	0.30

Parameters

Parameter	Interpretation	Value
σ	risk aversion	1
ξ	Pareto shape	6
ν	inverse Frisch	0.1
η	subs. firms (BHM, 6.96)	10
γ	subs. workfare-private	10
m	no. of firms	33
ϕ	workfare/private wage	1
δ	workfare disutility	1.06
α	DRS	0.7
θ	subs. villages (BHM, 0.45)	0.08
$\Delta\delta$	workfare improvement	-0.04

Moment	Model	Data
Market emp effect	0.014	0.18
Market wage effect	0.013	0.10
Emp effect with ↑ HHI	0.22	0.59

Notes

- Employment effect with ↑ HHI is relative to baseline mean employment

Discussion

- Through the lens of the model, a 30% workfare expansion in the context of India is *too small*
  - 1.4% $\uparrow$ in market employment, 1.3% $\uparrow$ in market wage
- mean HHI, markdown poorly measured
  - HHI comes from landholdings survey data
  - Markdown estimate is for rural manufacturing
- Alternative markdown targets
  - Match Guner et al, 2025 estimate $\mu = 0.54$ Guner calibration
  - Match Brooks et al, 2021 lower bound $\mu = 0.30$ Brooks lower bound calibration

Conclusion

- I study workfare in a static model of oligopsonistic competition (Berger et al, 2022, 2025)
- Model replicates key empirical patterns
  - Workfare expansion $\rightarrow$ market wages and employment $\uparrow$
  - Bigger effects in more concentrated markets
- The model accounts for 1.3 to 3.9% of the wage effect, 1.4 to 4.3% of the employment effect

Thanks!

Literature

- Development
  - Employment guarantees: Besley-Coate (1992), Basu-Kanbur-Chau (2009)
  - NREGS: Muralidharan-Sukhtankar-Niehaus (2023, 2016), Kloner-Oldiges (2022), Imbert-Papp (2015, 2020)
- Macro
  - Labor market power: Berger-Herkenhoff-Mongey (2025, 2022)
  - Using causal evidence to identify macro-models: Nakamura-Stiensson (2018)
- Macro-development
  - Labor market power: Amodio-Medina-Morlacco (2025), Armangue Jubert-Guner-Ruggieri (2025), Brooks-Kaboski-Li-Qian (2021)
  - Micro to macro: Buera-Kaboski-Shin (2021)

Back

Markdowns

We define the private payroll share:

$$s_{ij} = \frac{n_{ij} w_{ij}}{\sum_i^{m_j} n_{ij} w_{ij}}$$

Result (within-village markdowns): Markdowns in market j are the solution to:

$$s_{ij} = \frac{\left[\mu(s_{ij}) z_{ij}\right]^{\frac{\eta+1}{1+\eta(1-\alpha)}}}{\sum_i^{m_j} \left[\mu(s_{ij}) z_{ij}\right]^{\frac{\eta+1}{1+\eta(1-\alpha)}}} \qquad \text{share}$$

$$\mu(s_{ij}) = \frac{1}{1+\varepsilon(s_{ij})^{-1}} \qquad \text{markdown}$$

$$\varepsilon(s_{ij})^{-1} = \left((1-s_{ij}) \frac{1}{\eta} + s_{ij} \left(1 - \left(\frac{n_j^p}{n_j} \right)^{\frac{\gamma+1}{\gamma}} \right) \frac{1}{\gamma} + s_{ij} \left(\frac{n_j^p}{n_j} \right)^{\frac{\gamma+1}{\gamma}} \frac{1}{\theta} \right) \qquad \text{inv elast. labor supply}$$

CES wage index equations

$$w_j^p n_j^p = \sum_{i=1}^{m_j} w_{ij} n_{ij} \quad w_j^p = \left(\sum_i^{m_j} w_{ij}^{1+\eta} \right)^{\frac{1}{1+\eta}}$$

$$w_j n_j = w_j^p n_j^p + \bar{w}_j n_j^w \quad w_j = \left(\left(w_j^p\right)^{1+\gamma} + \left(\frac{1}{\delta\gamma}\right) \left(\bar{w}_j\right)^{1+\gamma} \right)^{\frac{1}{1+\gamma}}$$

$$WN = \int_0^1 w_j n_j \, dj \quad W = \left(\int_0^1 w_j^{1+\theta} dj \right)^{\frac{1}{1+\theta}}$$

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Aggregate private wage index

Let

$$N^p = \left(\int_0^1 \left(n_j^p \right)^{\frac{\theta+1}{\theta}} \right)^{\frac{\theta}{\theta+1}} \qquad W^p N^p = \int_0^1 w_j^p n_j^p dj$$

which implies

$$W^p = \left(\int_0^1 \left(w_j^p \right)^{1+\theta} \right)^{\frac{1}{1+\theta}}$$

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Appendix: Aggregation constants

$$\tilde{Z} = \left[\int_0^1 z_j^{\frac{1+\theta}{1+\theta(1-\alpha)}} \, dj\right]^{\frac{1+\theta(1-\alpha)}{1+\theta}}, \quad z_j = \left[\sum_{i=1}^{m_j} z_{ij}^{\frac{1+\eta}{1+\eta(1-\alpha)}}\right]^{\frac{1+\eta(1-\alpha)}{1+\eta}}$$

$$\mu = \left[\int_0^1 \left(\frac{z_j}{\tilde{Z}}\right)^{\frac{1+\theta}{1+\theta(1-\alpha)}} \mu_j^{\frac{1+\theta}{1+\theta(1-\alpha)}} \, dj\right]^{\frac{1+\theta(1-\alpha)}{1+\theta}}, \quad \mu_j = \left[\sum_{i=1}^{m_j} \left(\frac{z_{ij}}{z_j}\right)^{\frac{1+\eta}{1+\eta(1-\alpha)}} \mu_{ij}^{\frac{1+\eta}{1+\eta(1-\alpha)}}\right]^{\frac{1+\eta(1-\alpha)}{1+\eta}}$$

$$\Omega = \int_0^1 \left(\frac{z_j}{\tilde{Z}}\right)^{\frac{1+\theta}{1+\theta(1-\alpha)}} \left(\frac{\mu_j}{\mu}\right)^{\frac{\alpha\theta}{1+\theta(1-\alpha)}} \omega_j dj, \quad \omega_j = \sum_{i=1}^{m_j} \left(\frac{z_{ij}}{z_j}\right)^{\frac{1+\eta}{1+\eta(1-\alpha)}} \left(\frac{\mu_{ij}}{\mu_j}\right)^{\frac{\eta\alpha}{1+\eta(1-\alpha)}}$$

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Appendix: Aggregation Formulas (BHM)

In market j, we have the following six conditions (four firm-level optimality and two market-level aggregation):

$$y_{ij} = z_{ij} n_{ij}^{\alpha} \quad n_{ij} = \left(\frac{w_{ij}}{w_j}\right)^{\eta} n_j \quad w_{ij} = \mu_{ij} mrpl_{ij}$$

$$mrpl_{ij} = \alpha z_{ij} n_{ij}^{\alpha-1} \quad y_j = \sum_{i=1}^{m_j} y_{ij} \quad w_j = \left(\sum_{i=1}^{m_j} w_{ij}^{1+\eta}\right)^{\frac{1}{1+\eta}}$$

which deliver

$$y_j = \omega_j z_j n_j^{\alpha} \quad w_j = \mu_j \alpha z_j n_j^{\alpha-1}$$

where z_j, ω_j, μ_j have the appropriate expressions. Back

Appendix: Aggregation Formulas (D)

In market j, we have the following six conditions (four firm-level optimality and two market-level aggregation):

$$y_{ij} = z_{ij} n_{ij}^{\alpha} \quad n_{ij} = \left(\frac{w_{ij}}{w_j^p}\right)^{\eta} n_j^p \quad w_{ij} = \mu_{ij} mrpl_{ij}$$

$$mrpl_{ij} = \alpha z_{ij} n_{ij}^{\alpha-1} \quad y_j = \sum_{i=1}^{m_j} y_{ij} \quad w_j^p = \left(\sum_{i=1}^{m_j} w_{ij}^{1+\eta}\right)^{\frac{1}{1+\eta}}$$

which deliver

$$y_j = \omega_j z_j \left(n_j^p\right)^{\alpha} \quad w_j^p = \mu_j \alpha z_j \left(n_j^p\right)^{\alpha-1}$$

where z_j, ω_j, μ_j have the appropriate expressions. Back

Appendix: Aggregation formulas (BHM)

Across markets, we have the following six conditions (four market-level aggregation and two economy-level aggregation)

$$y_j = \omega_j z_j n_j^{\alpha} \quad n_j^p = \left(\frac{w_j}{W}\right)^{\theta} N \quad w_j = \mu_j mrpl_j$$

$$mrpl_j = \alpha z_j n_j^{\alpha-1} \quad Y = \int_0^1 y_j dj \quad W = \left(\int_0^1 w_j^{1+\theta}\right)^{\frac{1}{1+\theta}}$$

which deliver

$$Y = \Omega Z N^{\alpha} \quad W = \mu \alpha Z N^{\alpha-1}$$

where Z, Ω, μ have the appropriate expressions. Back

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Across markets, we have the following six conditions (four market-level aggregation and two economy-level aggregation)

$$y_j = \omega_j z_j \left(n_j^p\right)^{\alpha} \quad n_j^p = \left(\frac{w_j^p}{W^p}\right)^{\theta} N^p \quad w_j^p = \mu_j mrpl_j$$

$$mrpl_j = \alpha z_j \left(n_j^p\right)^{\alpha-1} \quad Y = \int_0^1 y_j dj \quad W^p = \left(\int_0^1 \left(w_j^p\right)^{1+\theta}\right)^{\frac{1}{1+\theta}}$$

which deliver

$$Y = \Omega Z \left(N^p\right)^{\alpha} \quad W = \mu \alpha Z \left(N^p\right)^{\alpha-1}$$

where Z, Ω, μ have the appropriate expressions. Back

Firms dont all pay the same wage

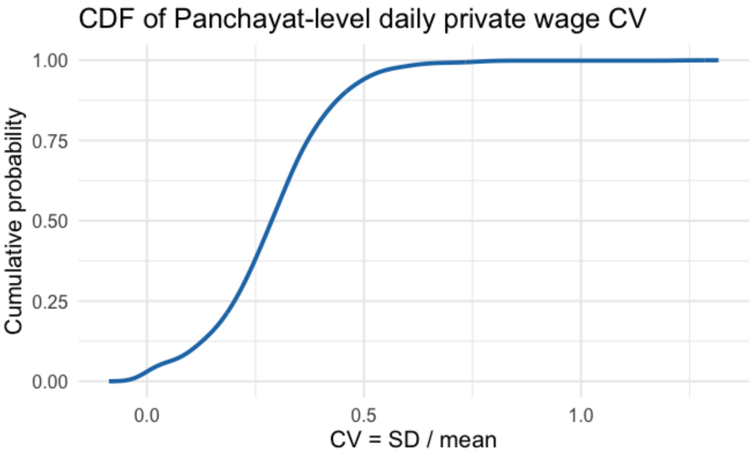

Figure: Source: Muralidharan et al baseline data; top 5% winsorized

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Simpler model: equations

Result (single firm): Suppose every village contains a single firm and workfare. $\{w, y, n, \mu\}$ are a solution to:

$$y = zn^{\alpha} \qquad w = \frac{\mu y}{n} \qquad \Phi^{1-\gamma\nu} w = n^{\nu} y^{\sigma} \qquad \mu = \frac{1}{1+\varepsilon^{-1}} \qquad \varepsilon^{-1} = \left(\frac{1}{\gamma} + \Phi^{-(1+\gamma)}\left(\frac{1}{\theta} - \frac{1}{\gamma}\right)\right)$$

where $\Phi = \left(1 + \frac{\phi^{\gamma+1}}{\delta\gamma}\right)^{\frac{1}{\gamma+1}}$.

Result (competitive benchmark): Suppose every village contains a single firm and workfare. $\{w, y, n, \mu\}$ are a solution to:

$$y = zn^{\alpha} \qquad w = \frac{\mu y}{n} \qquad \Phi^{1-\gamma\nu} w = n^{\nu} y^{\sigma} \qquad \mu = 1$$

where $\Phi = \left(1 + \frac{\phi^{\gamma+1}}{\delta\gamma}\right)^{\frac{1}{\gamma+1}}$. Competitive Inefficiency

Calibration results (Guner et al, 2025)

Targeted

Moment	Model	Data
workfare/market wage ratio	1	1
workfare/market labor ratio	0.57	0.57
mean HHI	0.099	0.03
labor share	0.52	0.52
markdown μ	0.53	0.54
workfare labor treat effect	0.30	0.30

Parameters

Parameter	Interpretation	Value
σ	risk aversion	1
ξ	Pareto shape	6
ν	inverse Frisch	0.1
η	subs. firms	10
γ	subs. workfare-private	10
m	no. of firms	11
ϕ	workfare/private wage	1
δ	workfare disutility	1.05
α	DRS	0.9
θ	subs. villages	0.08
$\Delta\delta$	workfare improvement	-0.05

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Moment	Model	Data
Market emp effect	0.025	0.18
Market wage effect	0.028	0.10
Emp effect with $\uparrow$ HHI	0.016	0.59

Notes

- Employment effect with $\uparrow$ HHI is relative to baseline mean employment

Calibration results (Kaboski et al, 2025 lower bound)

Targeted

Moment	Model	Data
workfare/market wage ratio	1	1
workfare/market labor ratio	0.57	0.57
mean HHI	0.26	0.03
labor share	0.26	0.52
markdown μ	0.31	0.30
workfare labor treat effect	0.30	0.30

Parameters

Parameter	Interpretation	Value
σ	risk aversion	1
ξ	Pareto shape	6
ν	inverse Frisch	0.1
η	subs. firms	9
γ	subs. workfare-private	10
m	no. of firms	4
ϕ	workfare/private wage	1
δ	workfare disutility	1.05
α	DRS	0.8
θ	subs. villages	0.08
$\Delta\delta$	workfare improvement	-0.063

Moment	Model	Data
Market emp effect	0.043	0.18
Market wage effect	0.039	0.10
Emp effect with $\uparrow$ HHI	0.024	0.59

Notes

- Employment effect with $\uparrow$ HHI is relative to baseline mean employment

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Empirical Specification in Muralidharan et al

$$Y_{ipmd} = \alpha + \beta_T T_{md} + \beta_N N^R_{pmd} + \gamma \bar{Y}^0_{pmd} + \delta_d + \lambda PC_{md} + \epsilon_{ipmd}$$

- **Outcome:** Y_{ipmd} is the outcome for individual i in GP p, mandal m, district d.
- **Direct effect ($\hat{\beta}_T$):** Effect of assignment to treatment ($T_{md} = 1$).
- **Neighborhood exposure ($\hat{\beta}_N$):** Effect of treatment intensity in nearby GPs outside the mandal (N^R_{pmd}).
- **Controls:** Baseline GP mean $\bar{Y}^0_{pmd}$, district fixed effects, and mandal PC used for stratification.
- **Adjusted total effect (AdjTE):** $\hat{\beta}_T + \hat{\beta}_N \cdot \bar{N}_T$, where $\bar{N}_T = 36\%$ (mean exposure among treated GPs).
- **Reporting:** We report $\hat{\beta}_T$ (main effect) and $\hat{\beta}_N \cdot \bar{N}_T$ (spillover) separately.

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Results from Muraidharan et al

Table 2: Employment and wages in June

	Wage			Employment		
	(1) Reservation wage	(2) Wage realization	(3) Wage realization (weighted)	(4) Days self-employed or not working	(5) Days worked in NREGS	(6) Days worked in private sector
Adjusted TE	6.9**	13***	10**	-2.4***	1.3**	1.4*
$(\beta_T + 0.36 * \beta_N)$	(3.2)	(4.3)	(5)	(.79)	(.55)	(.8)
	{3.5}	{4.6}	{5.2}	{.81}	{.56}	{.78}
Main effect	5.8**	8.8**	7.9*	-1.5**	.89*	.74
(β_T)	(2.8)	(3.6)	(4.1)	(.59)	(.47)	(.57)
	{2.9}	{3.6}	{4.1}	{.6}	{.51}	{.57}
Nbhd effect	1.1	4.3*	2.5	-.95**	.39	.71*
$(0.36 * \beta_N)$	(1.7)	(2.4)	(3)	(.42)	(.27)	(.4)
	{1.7}	{2.6}	{3.1}	{.41}	{.24}	{.38}
Control mean	97.2	127.9	128	17.3	4.5	7.9
Adjusted R^2	.054	.076	.058	.073	.076	.020
Observations	12,677	7,016	6969	13,951	14,009	14,278

The unit of analysis is an adult. "Wage realization" is the average daily wage, in Rs. per day, received by adults who worked (for "weighted," we weight by days worked). "Reservation wage" is the wage at which an individual would have been willing to work for someone else. The outcome in Columns 4-6 is the number of days out of the past 30 spent in the respective occupations (including partial days). Estimation is as described in Section 2.3. Appendices J and G discuss recall and sensitivity to outliers in more detail. Standard errors in parentheses are clustered by mandal; those in brackets are spatial as in Conley (2008). Significance based on the former is denoted: $^{*}p < .10, ^{**}p < .05, ^{***}p < .01$.

Results from Muraidharan et al

Table 6: Heterogeneous effects on days worked by land concentration

	Raw HHI (full sample)	Raw HHI (above 1 acre)	Standardized (full sample)	Standardized (above 1 acre)
	(1)	(2)	(3)	(4)
Treatment	.46	.45	.6	.6
	(.57)	(.57)	(.55)	(.55)
	{.58}	{.58}	{.55}	{.56}
H^*	-4.7**	-6.2*	-.56**	-.63*
	(2.1)	(3.2)	(.25)	(.33)
	{2.6}	{2.9}	{.3}	{.3}
Treatment × H^*	4.6**	6.5*	.55**	.66*
	(2.3)	(3.4)	(.27)	(.34)
	{3}	{3.2}	{.35}	{.33}
Control Mean	7.9	7.9	7.9	7.9
Adjusted R^2	.019	.020	.019	.020
Observations	13,827	13,798	13,827	13,798

The unit of analysis is an adult. The outcome variable is the same as Column 5 of Table 2. "H^*" is the Herfindahl index of land ownership in the village, and each column represents a different measure of the index; for both the full sample and a restricted sample of those who own above 1 acre, both normalized (raw) and standardized separately for treatment and control areas. Estimation is as described in Section 2.3. Standard errors in parentheses are clustered by mandal; those in brackets are spatial as in Conley (2008). Significance based on the former is denoted: $^* p < .10, ^{**} p < .05, ^{***} p < .01$.

Figure: Back