Monopsony in Sub-Saharan Africa:
The Effect of Small Firms, Self-Employment, and Migration

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How Competitive are Labor Markets in Sub-Saharan Africa?

- Firms with labor market power pay workers below their marginal product
  - Wage markdowns $w = \mu MRPL$
- In the US between 65% and 87% (Yeh *et al.*, 2022; Berger *et al.*, 2022b)
- Important differences in context:
  - **Excess labor supply**: *e.g.* disguised unemployment through self-employment
  - **Spatial frictions**: high costs of migration
  - **Size distribution of firms** $\sim 70\%$ of firms < 10 employees

This Paper

- **How large are wage markdowns in Tanzania?**
- **Data**: Combine migration data with a novel dataset of Tanzanian firms
  - Annual census of firms: the Employment and Earnings Survey (EES)
- **Identification**: Tanzania's 2010 sectoral minimum wage law
  - Specified a minimum for 20 sectors and a national floor for all others
- **Estimation**: structural model that incorporates
  - Self-employment
  - Fixed-costs of migration
  - The size distribution of firms in Tanzania

Preview of Results

- **Markdowns** are determined by
  - η the elasticity of substitution between firms **within** a location
  - θ the elasticity of substitution between firms **across** locations
  - s_d the locations share of the total labor market
- Wages in small firms are close to the competitive level ∼79% of MRPL
  - Self-employment reduces (already small) market share of most firms
- **Spatial frictions**
  - Wages less competitive in rural districts
  - Larger share of workers in self-employment

  → Eliminating migration frictions ↑ 23% increase in output

Related Literature

- Minimum Wages
  - Employment effects (Almeida & Carneiro, 2012; Magruder, 2013; Cengiz *et al.*, 2019; Monras, 2019; Dustmann *et al.*, 2020; Holtemöller & Pohle, 2020; Derenoncourt *et al.*, 2021)
  - Lack of enforcement (Rani *et al.*, 2013; Bhorat *et al.*, 2017; Mansoor & O'Neill, 2021)

  → **Find high levels of compliance when accounting for firm-level exposure**

- Monopsony
  - Minimum Wages (Manning, 2006, 2019; Berger *et al.*, 2022b)
  - Development markdowns: 98% in Peru (Amodio *et al.*, 2022); 70% in Colombia (Amodio & de Roux, 2021); 50% in Brazil (Felix, 2022) **This paper: 79% in atomistic firms in Tanzania**
  - Spatial Models (Manning, 2003; Berger *et al.*, 2022a)

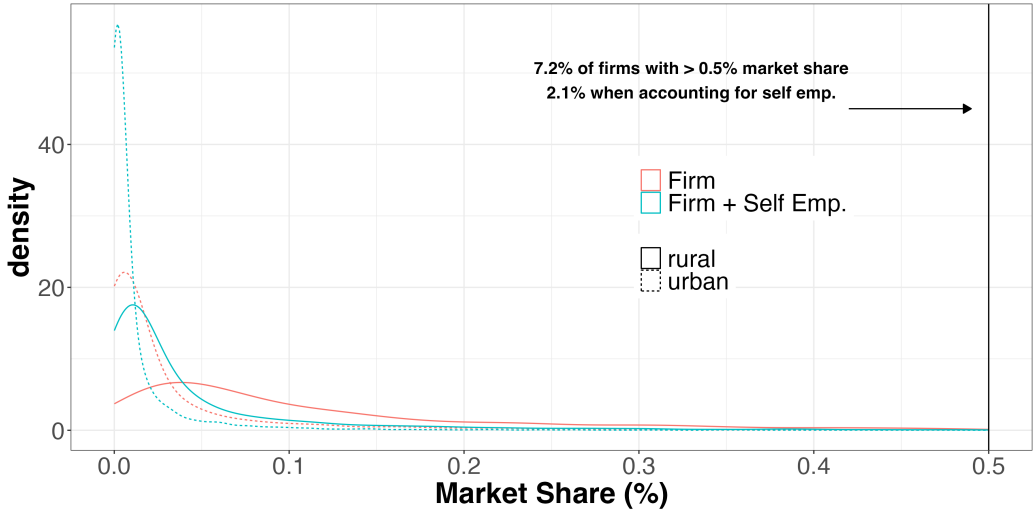
  → **Add amenities, migration costs, and self-employment**

- Internal migration in developing countries
  - Sorting (Young, 2013; Gollin *et al.*, 2014; Hicks *et al.*, 2021)
  - High migration costs (Bryan *et al.*, 2014; Morten, 2019; Lagakos *et al.*, 2020)
  - Non-monetary costs (Lagakos *et al.*, 2023; Imbert & Papp, 2020; Lagakos, 2020; Bryan *et al.*, 2021)

  → **Explain what causes rather than what prevents migration**

Plan

Market Share When Accounting for Self-Employment



Employment by Type

	(1) employed	(2) wage worker	(3) self-employed	(4) self-emp ag.
rural	0.765	0.051	0.904	0.797
	(0.000)	(0.000)	(0.000)	(0.000)
urban	0.612	0.295	0.673	0.281
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	2342746	1660341	1660341	1660341

Notes: Reporting the shares of employment in the 2012 census by activity type among prime aged (15-65) workers. Columns (2) and (3) report the share of workers conditional upon being employed. The excluded category is unpaid family workers and individuals who report their employment type as other.

Data

- **Migration**
  - LSMS 2008, 2010, 2012, 2014 $\sim$ 13K - 22K observations per survey
  - Integrated Labor Force Survey (ILFS) 2014 $\sim$ 40K observations
  - Estimate 5-year migration flow between districts before and after 2010
- **Employment and Earnings**
  - EES 2005-2007, 2010-2017 $\sim$ 9,000 firms in each year
  - All firms with ≥ 50 employees; Sample of smaller firms
  - Total payments by worker type and number of employees
  - Number of workers in wage bands *e.g.* 60K-80K TSH
  - Labor force size from the 2002 and 2012 Census
- **Minimum Wages**: Tanzanian Government Gazette (GN 172 of 2010) Details Compliance

Minimum Wage Exposure Map | annual migration by sample | Immigration Map | wage summary statistics | employment by type
Average Wage by dataset | Employment in the EES and Census | Firm size distribution | Market share with self-employment

Plan

Model

Workers

- Endowed with a birth location o
- **Migration decision** Choose a location d and firm i in sector j
- **Self-employment** one additional 'firm' in each location

Firms

- Endowed with productivity $A_{ijd} \sim F(A)$
- Compete for workers in **Cournot competition**

- **Labor supply** to each firm is governed by
  - η the substitutability between firms within a location
  - θ the substitutability between locations
  - $s_d(B_d, \tau_{od}, N_d)$ the market's share of total labor supply

Markdowns in the Model

- Firms pay a markdown μ_{ijd} on workers' marginal product

$$w_{ijd} = \mu_{ijd} \alpha A_{ijd} n_{ijd}^{\alpha-1} \quad , \quad \mu_{ijd} = \frac{\varepsilon_{ijd}}{1+\varepsilon_{ijd}}$$

- Where ε_{ijd} is the labor supply elasticity

$$\varepsilon_{ijd} = \left(\frac{1}{\eta}(1 - s_{ijd}) + \frac{1}{\theta} s_{ijd} - \frac{1+\theta}{\theta} s_{ijd} s_d\right)^{-1}$$

$$s_{ijd} := \frac{w_{ijd} n_{ijd}}{\sum_{k \in d} w_{kjd} n_{kjd}} \quad , \quad s_d := \sum_o \frac{\sum_i w_{ijd} n_{ijdo}}{\sum_d \sum_i w_{ijd} n_{ijdo}} = \sum_o \left(\frac{W_d B_d \tau_{od}}{W_o}\right)^{1+\theta}$$

- **Markdowns are** $\downarrow$ migration costs τ_d and $\uparrow$ amenities B_d $\uparrow$ number of firms W_d

- **Self employment reduces the market share of each firm**

Plan

Structural labor supply elasticity

$$\varepsilon_{ijd} = \left(\frac{1}{\eta}(1 - s_{ijd}) + \frac{1}{\theta} s_{ijd} \Big(1 - (1 + \theta) s_d \Big) \right)^{-1}$$

- Large firm do not respond to changes in wages at atomistic firms
- Identify η from size zero firms in the reduced form labor supply elasticity

$$\lim_{s_{ijd} \to 0} \varepsilon_{ijd} = \eta$$

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$$\lim_{s_{ijd} \to 0} \varepsilon_{ijd} = \eta$$

- Identify θ and $s_d(B_d, \tau_{od}, W_d)$ using structural model

$\rightarrow$ counterfactuals in migration costs and amenities

Firm Exposure to the Minimum Wage

- Define the GAP between current and $\underline{w}_j$-compliant wage-bill (Card & Krueger, 1994)

$$GAP_{ijdt} = \frac{\sum_{r \in i} n_{rijdt} \min\{0, \underline{w}_j - \bar{w}_{rijdt}\}}{\sum_{r \in i} n_{rijdt} \bar{w}_{rijdt}}$$

- $\bar{w}_{rijdt}$ is the average wage of workers in wage range r
- GAP$= 0$ if all employees paid at least $\underline{w}_j$
- Similarly define the ENC to be the employment weighted exposure to the minimum wage

$$ENC_{ijdt} = \frac{\sum_{r \in i} n_{rijdt} \mathbf{1}\{\underline{w}_j - \bar{w}_{rijdt} > 0\}}{\sum_{r \in i} n_{rijdt}}$$

- Predict exposure prior to the minimum wage law using data from 2005-2007

Reduced Form Labor Supply Elasticity

- Reduced form estimation of $\hat{\varepsilon}(s_{ijd})$ in 2010

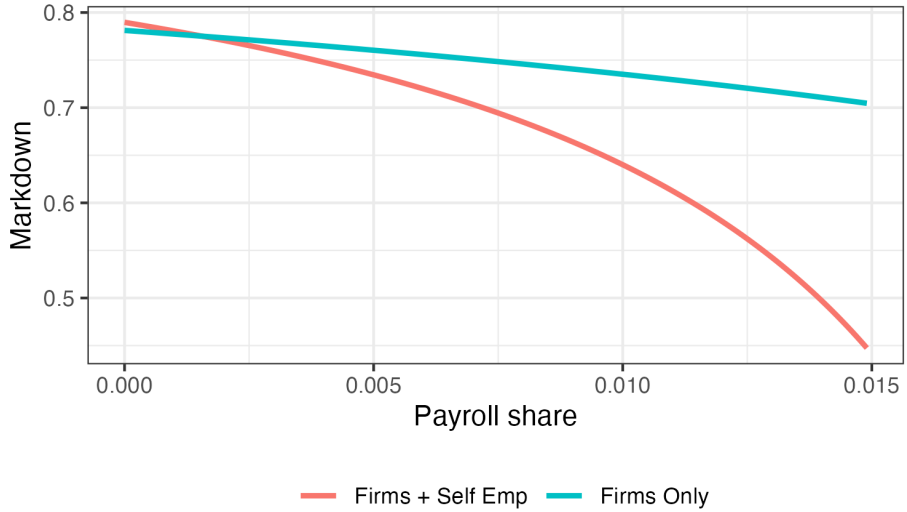
$$\log n_{ijdt} = \beta_0 + \beta_1 \log w_{ijdt} + \beta_2 \log w_{ijdt} \times s_{ijdt} + \beta_3 s_{ijdt} + \boldsymbol{\mu}_j + \boldsymbol{\lambda}_d + \epsilon_{ijdt} \quad (1)$$

- Instrument for $\log w_{ijdt}$ and $\log w_{ijdt} \times s_{ijdt}$ using $\widehat{GAP}_{ijd}$ and $\widehat{ENC}_{ijd}$
- Large firms do not respond to marginal changes in atomistic firms
- Labor supply elasticity between firms within a location

$$\eta = \lim_{s_{ijd} \to 0} \hat{\varepsilon}(s_{ijd}) = \beta_1$$

Reduced Form Markdowns Estimation

Estimation Results



Structural Estimation

Link with structural model

- Following Bryan & Morten (2019) I estimate τ_{od} using flows from the 2012 census as

$$\tau_{od} = \left(\frac{n_{od}}{n_{oo}} \times \frac{n_{do}}{n_{dd}} \right)^{\frac{1}{2(1+\theta)}}$$

- The main estimating equation is then given by

$$n_{od} = n_{oo} \exp \left[\alpha_1 \log \left(\frac{W_d}{W_o} \right) + \alpha_2 \log \left(\frac{n^c_{od}}{n^c_{oo}} \frac{n^c_{do}}{n^c_{dd}} \right) + \mu_o \right] + \varepsilon_{od} \tag{2}$$

- n_{od} is the annualized number of migrants from $o - d$ between 2010-2014
- Calibrate $\eta = 3.76$
- Instrument for log-wage-index-ratio using the CES aggregator of minimum wages

$$\log \left(\frac{\underline{w}_d}{\underline{w}_o} \right) = \log \left(\frac{\sum_{i=1}^{M_d} \underline{w}_{ijd}^{1+\eta}}{\sum_{i=1}^{M_o} \underline{w}_{ijo}^{1+\eta}} \right)$$

Estimated Migration Elasticities

Employment model of migration

- IV estimates larger

$\rightarrow$ wages negatively correlated with amenities

- $\theta = 1.448$

	(1)	(2)	(3)
$\underline{w}_d/\underline{w}_o$	2.511***		
	(0.084)		
W_d/W_o		2.331***	2.448***
		(0.085)	(0.077)
$\log \tau_{od}$	0.457***	0.464***	0.463***
	(0.015)	(0.014)	(0.014)
F-statistic			3.5e+04
District Pairs	15252	15252	15252
Origin FE	Y	Y	Y

Notes: Columns (1)-(2) report the Poisson (GMM) results. Columns (3) reports the IV-Poisson results. Robust standard errors weighted by destination population in parenthesis. The sample include migration data from the LSMS and ILFS for 2010-2014. Reporting the Kleibergen & Paap (2006) cluster robust F-statistic. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

Estimated Migration Elasticities

Employment model of migration

- IV estimates larger

→ wages negatively correlated with amenities

- $\theta = 1.448$
- Employment weights
- Alternative calibrations Firm weights Job weights
- Flexible elasticity origin destination θ
- Minimum wage Firm weights Job weights

	(1)	(2)	(3)
$\underline{w}_d/\underline{w}_o$	2.511***		
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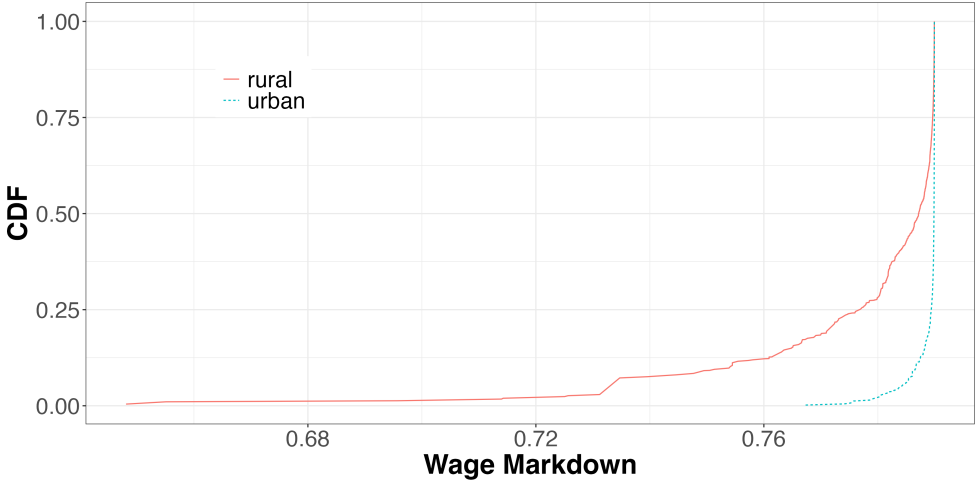
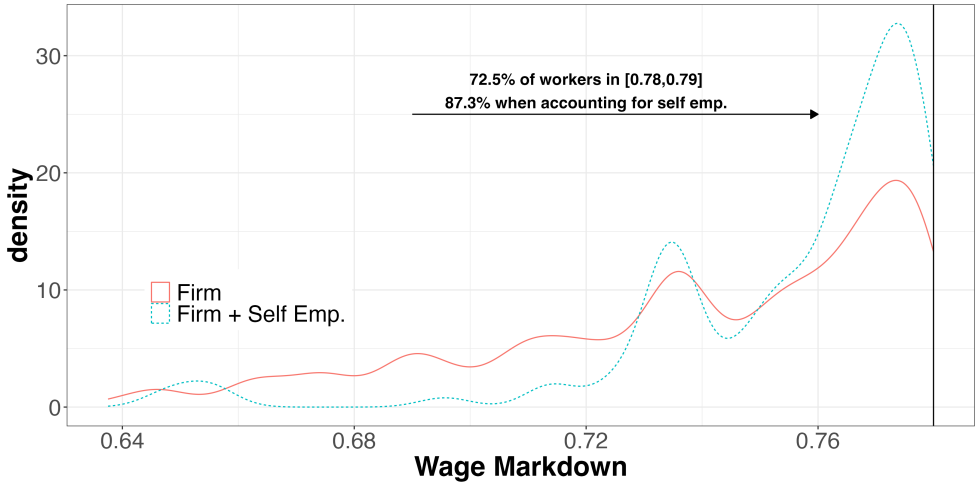
CDF of Wage Markdowns in Rural and Urban Districts



Notes: Displaying the distribution of wage markdowns faced by workers. A wage markdown of 1 implies perfectly competitive labor markets. The limiting case, due to the within market labor supply elasticity is 0.872.

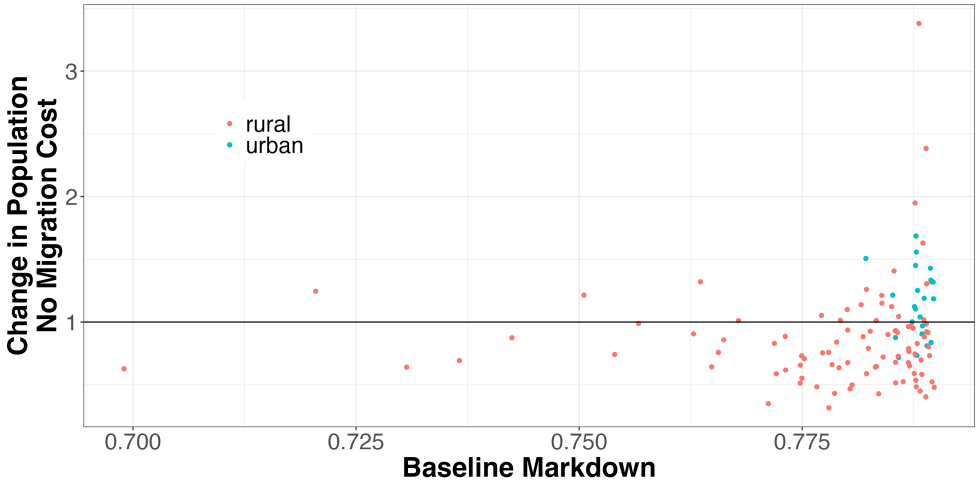
Plan

Markdown across Workers



Notes: Displaying the distribution of wage markdowns faced by workers. A wage markdown of 1 implies perfectly competitive labor markets. The limiting case, due to the within market labor supply elasticity is 0.872.

Change in Population by Baseline Markdown



Output Gain from Eliminating Frictions

	Baseline	$\tau_{od} = 1$	$B_d = 1$	$\tau_{od} = 1$ and $B_d = 1$
	(1)	(2)	(3)	(4)
Output	1.000	1.232	1.271	1.741
Urban	-	1.292	1.335	1.922
Rural	-	0.956	0.975	0.911
Rural (%)	19.0	14.9	14.7	10.2

Reporting the predicted changes in total output and share of the population in rural areas from eliminating migration frictions $\tau_{od} = 1$ in column (2), equalizing amenities across districts $B_o = B_d = 1$ in column (2), and eliminating migration frictions and equalizing amenities in column (3).

- 23% ↑ in output when eliminating migration costs
- 4% decline in rural population
- Important role of amenities in allocation of workers

Plan

Conclusion

- **How competitive are labor markets in Tanzania?**
- Wage markdowns comparable to those in the US
  - For very different reasons
- **Labor markets more competitive because of self-employment**
- $\sim$87% of workers paid 79% of MRPL
- **Spatial frictions increase the labor market power** of firms in rural districts

  $\rightarrow$ self-employment more attractive; larger share of workers in self-employment
  - Offers one explanation for the persistance of rural-urban wage gap

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Tanzania's Minimum Wage Laws back

- First law enacted in 2010
  - specific levels for 20 sectors
  - All others subject to a national floor
- 80K TSH $\approx$ 60 USD
- Agriculture $<$ All others
- The penalty for violating the law was up to 5 million shillings, imprisonment for up to one year, or both (Employment and Labour Relations Act, 2004, p. 79)

All Sectors Minimum to Median Wage Ratio

Table: 2010 Sectoral Minimum Wages

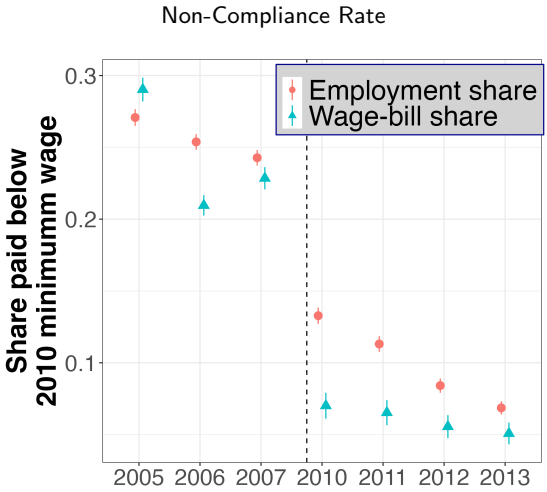
Sector	Minimum Wage
Health Services	80
Agricultural	70
Education	80
Transport & Communication	
Aviation	350
Clearing & Forwarding	230
Telecommunications	300
Inland Transport	150
⋮	⋮
Other sectors	80

Notes: Reporting nominal monthly minimum wages in thousands of Tanzanian Shillings for the 2010 wage order for a selection of covered sector.

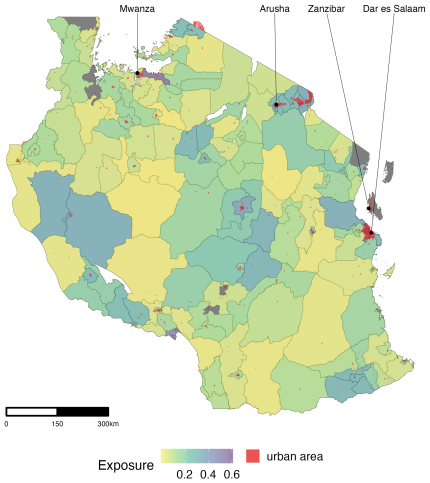
Minimum Wage Compliance back

- 24% of workers affected by the minimum wage
- 13% of employees paid below minimum wage in 2010
- Fell below 7% by 2013
- Wage-bill share is the gap between current wages and compliant wages

Measures Details | Alternative Measures | Local Employment Elasticity



Minimum Wage Exposure back



Notes: Displaying the average level of firm exposure to the minimum wage law in 2007.

- Variation in exposure to min wage across space

  (% by which firms would need to raise wage-bill to be compliant)

- $0 =$ All workers paid at least min wage

- Spatial variation due to
  - Current wage bill of firms
  - Sectoral compostion

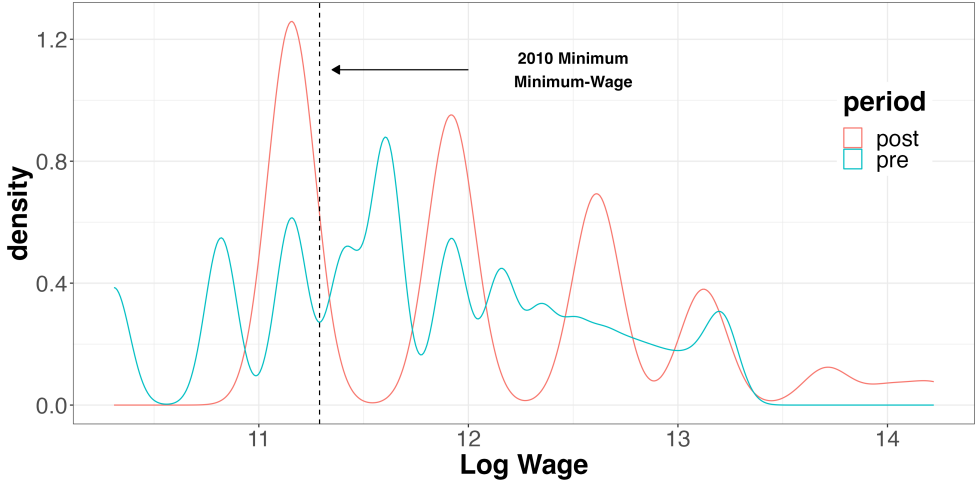
2010 Minimum Wage Summary Statistics

back

Sector	Minimum Wage (1)	Employment Share (%) 2007 (2)	Employment Share (%) 2010 (3)	Median to Minimum Wage Ratio 2007 (4)	Median to Minimum Wage Ratio 2010 (5)
Other	80	66.60	52.81	2.50	3.40
Agricultural Services	70	4.46	5.19	1.39	3.32
Marine and Fishing	165	0.17	0.22	0.70	1.54
Mining Primary Licenses	150	0.58	0.90	0.81	1.68
Mining License/ Prospecting licenses	350				
Mining Dealers licenses	250				
Mining Brokers licenses	150				
Trade, Industry and Commerce	80	14.00	21.09	1.00	1.87
Transport Services: Inland Transport	150	0.90	1.54	0.85	1.47
Transport Services: Aviation	350	0.20	0.10	0.94	1.11
Transport Services: Clearing and Forwarding	230	1.59	2.39	0.52	0.90
Hotels: Medium Hotels	100		3.92		1.49
Hotels: Potential and Tourists hotel	150				
Hotels: Restaurants, Guest Houses and Bars	80	4.08	4.03	0.58	2.74
Telecommunication	300	0.94	0.18	0.83	1.61
Private security: other	80		0.50		1.17
Private security: International or potential security Companies	105				
Health Services	80	6.47	7.14	1.34	2.74
Domestic Services: Other	65				
Domestic Services: Diplomats	90				
Domestic Services: Entitled Officers	80				

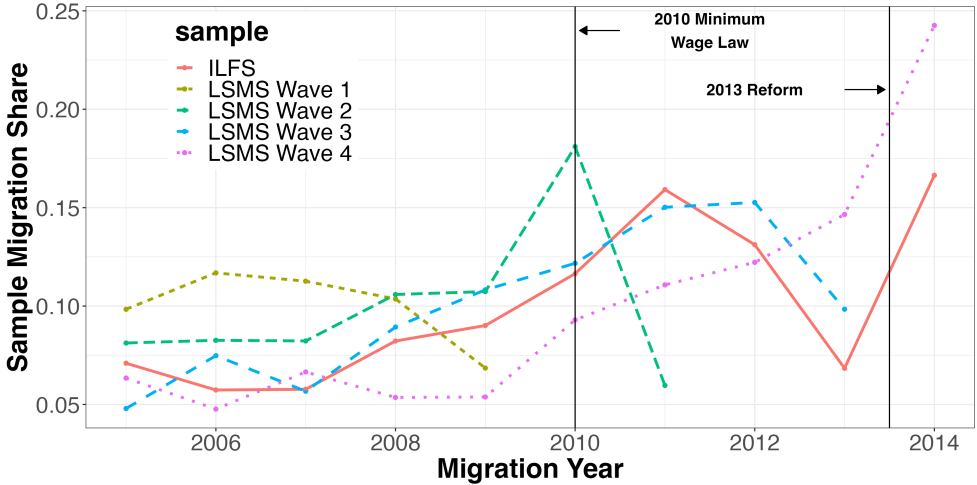
Notes: Reporting the 2010 minimum wage in thousands of Tanzanian Shillings (TSH). Rows with missing data are sectors for which there was a minimum wage but that could not be distinguished by ISIC code in the data.

The Distribution of Wages in 2007 and 2010 back



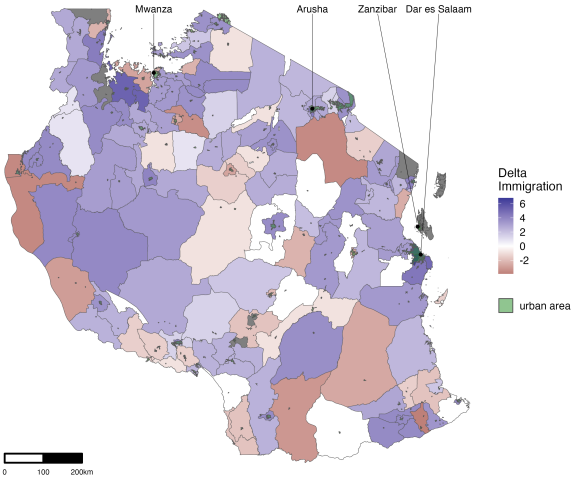
Notes: Displaying the distribution of wages for workers paid at least x in each wage range in 2007 and 2010. *e.g.* employees paid between 70K and 90K TSH are counted as earning 70K. The humps are artifacts of the data caused by the banding of employees into wage ranges. The ranges were updated in 2010 and do not align exactly with those in 2007.

Share of Migrants by Year across Samples back



Notes: Displaying the share of migrants who migrated after 2005. Rates are scaled by the number of years in the sample after 2005 so that the sums do not add to one. The two black lines indicate the point in time at which the two minimum wage laws were passed.

Change in immigration after the minimum wage implementation back



Notes: Displaying the inverse hyperbolic sine of the change in immigration in the five-year window before and after 2010.

Private Sector Employees Monthly Wages back

Year	2005	2006	2007	2010	2011	2012	2013	2014
Wage	308.1	341.4	288.9	269.1	263.1	325	340.4	335.9
	(1455.3)	(1311)	(1237.6)	(258.6)	(267.2)	(364.1)	(377.5)	(359.1)
Wage + inkind	394.1	452.9	379.2	314.8	302.2	362.8	374.5	367.3
	(2016.2)	(1979.5)	(1722.9)	(324.5)	(317.5)	(401.5)	(410.9)	(389.6)
Minimum Wage	0	0	0	89.6	78.6	68.4	63.5	94.6
	(0)	(0)	(0)	(33.8)	(28.7)	(26.2)	(24.1)	(42.3)

Notes: Source: EES. Reporting real average monthly wages in Thousands of TSH. Standard deviations in parenthesis. Wages are deflated using the Tanzanian CPI. All values are weighted by firm weight and the number of employees at the firm.

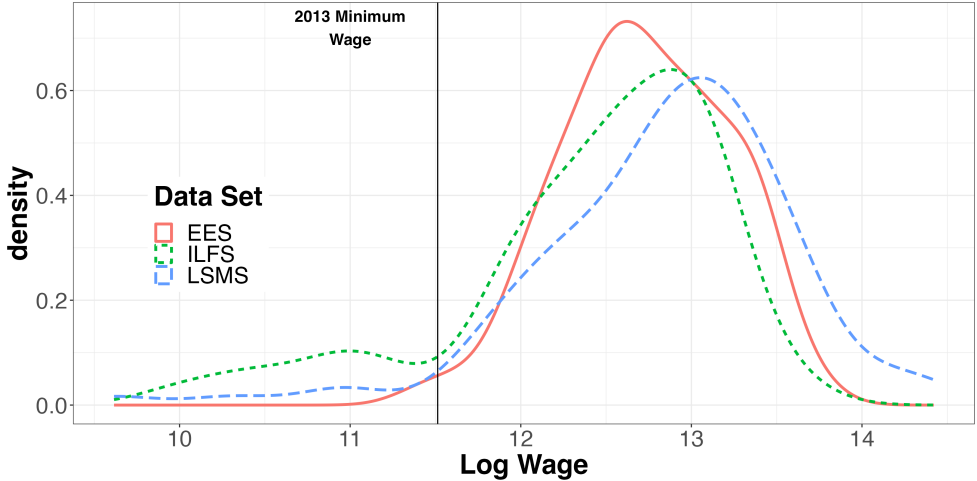
Table: Employment by Type in 2012

	(1) U	(2) Ag	(3) Self	(4) E
log min wage	0.282***	-0.032***	-0.831***	0.572***
	(0.041)	(0.003)	(0.076)	(0.045)
Constant	-1.082***	0.158***	4.396***	-2.454***
	(0.183)	(0.016)	(0.333)	(0.192)
Observations	123	123	123	123

Notes: Reporting employment rate by type across districts in the 2012 census as a function of the averge minimum wage in employment in that district. Robust standard errors weighted by population in parenthesis. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

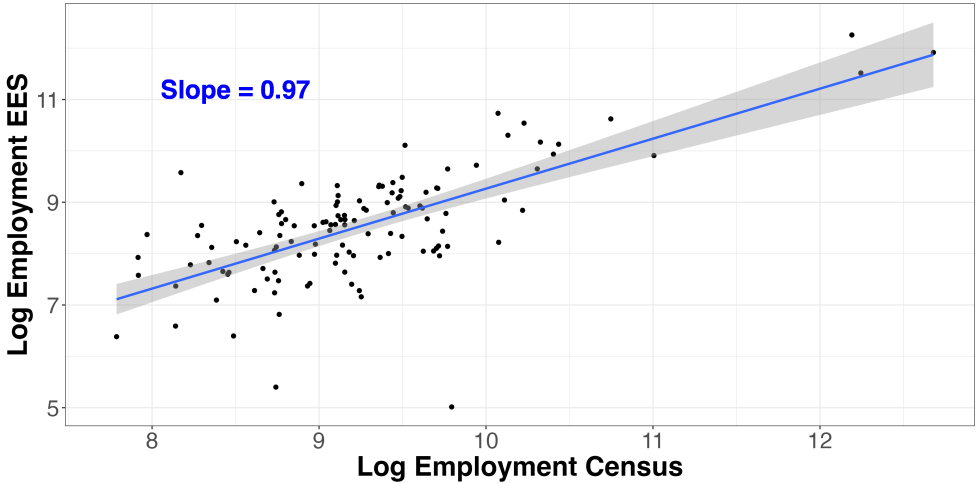
back

2014 Average Monthly Wage in Three Datasets back



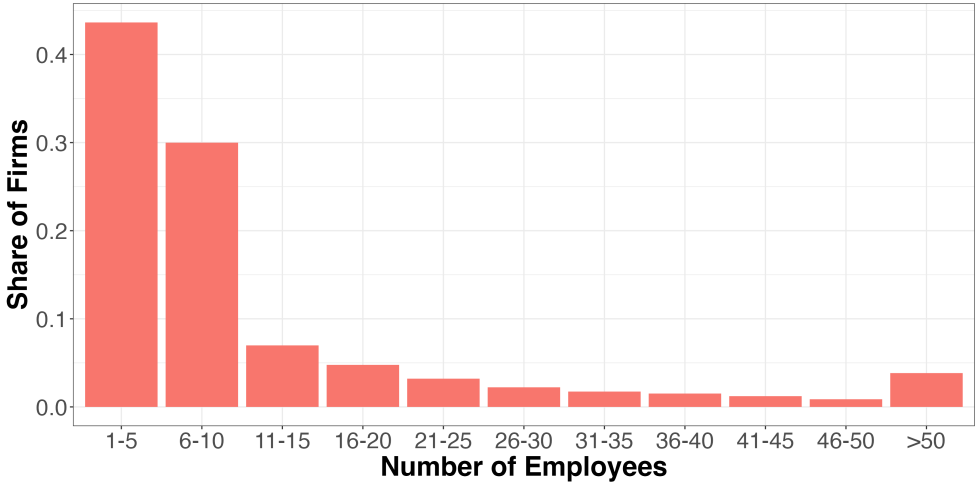
Notes: Plotting the distribution of log nominal mean wages across districts in the three datasets. The black line indicates the 2013 national minimum wage level. All values are weighted by their respective survey weights. Excluding casual workers and public employers.

District Employment in the EES and Census back



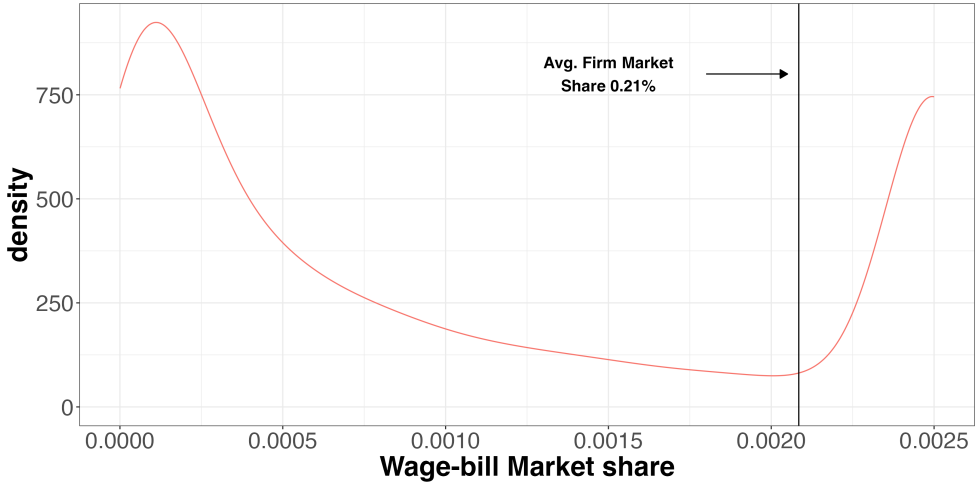
Notes: Displaying log employment in 2012 by district as measured using the EES and Census. All values are weighted by their respective survey weights.

Firm Size Distribution back



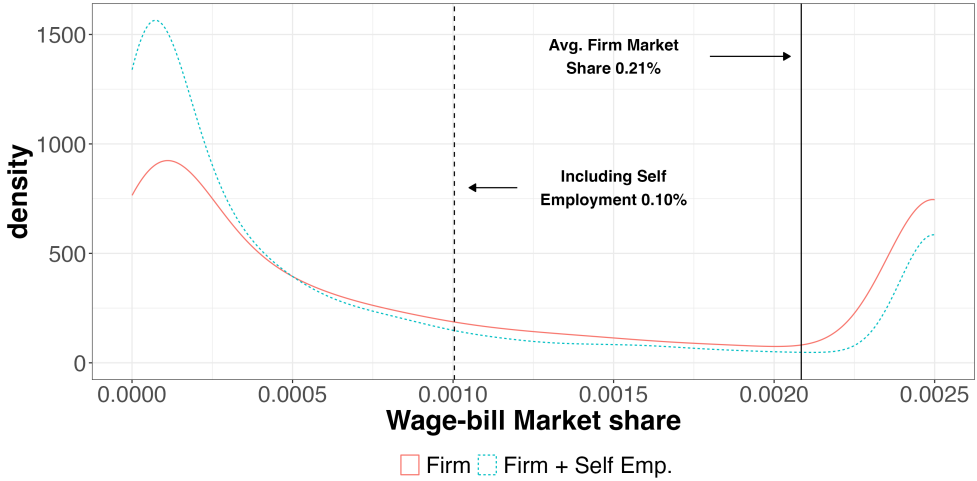
Notes: Displaying the average number of firms by bins of five employees in the period 2005-2007. Counts are the average of the total in each year.

Market Share when accounting for Self Employment back



Notes: Displaying the wage-bill market share in 2014.

Market Share when accounting for Self Employment back



Notes: Displaying the wage-bill market share in 2014.

Compliance Measures Definitions back

- Define the Employment Non-Compliance (ENC) rate as

$$ENC_{ijdt} = \frac{\sum_{r \in i} n_{rijdt} \mathbf{1}\left[\underline{w}_j - w_{rijdt} > 0\right]}{\sum_{r \in i} n_{rijdt}}$$

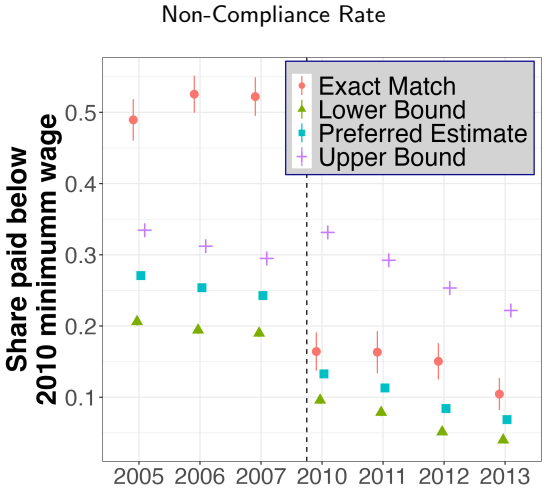
- firm i, sector j, location (district) d, wage range r
- ENC is the share of employees who are paid below the minimum wage
- GAP_{ijdt} is the proportional increase in a firm's wage bill needed to bring all workers up to the minimum wage level

$$GAP_{ijdt} = \frac{\sum_{r \in i} n_{rijdt} \min\{0, \underline{w}_j - \bar{w}_{rijdt}\}}{\sum_{r \in i} n_{rijdt} \bar{w}_{rijdt}}$$

- Measures the percent by which a firm would need to raise wages to be fully compliant
- $\bar{w}_{rijdt}$ is the average wage of workers in wage range r
  - Assuming a uniform distribution of wages in each range

Alternative Measures of Employment Non-Compliance

- Some wage ranges overlap with the minimum wage level, $\underline{w}_j$
- **Preferred Estimate**: Assumes a uniform distribution of workers in ranges that overlap with$\underline{w}_j$ to calculate share below
- **Exact Match**: only sectors for which $\underline{w}_j$ aligned exactly with a wage-range cutoff
- **Lower Bound**: only workers in wage ranges strictly below $\underline{w}_j$
- **Upper Bound**: All workers in wage ranges that overlap with $\underline{w}_j$ back



Local Employment Elasticity

- Harris & Todaro (1970) argue that minimum wages above the free market wage lead to substantial unemployment
- The minimum wage is much less than the average wage
  - The indirect effect on employment through wages may be small
  - Any disemployment effects are likely to be strongest among less skilled workers (Monras, 2019; Neumark & Munguía Corella, 2021)
- If firms have monoposony power, the elasticity will be positive
- I estimate the elasticity of employment with respect to wages as:

$$\Delta \log e_{slt} = \beta_0 + \beta_1 \Delta \log w_{slt} + \boldsymbol{\mu}_s + \boldsymbol{\lambda}_l + \Gamma \mathbf{X}_{islt} + \varepsilon_{slt} \tag{3}$$

$$\Delta \log w_{slt} = \alpha_0 + \alpha_1 \overline{GAP}_{slt} + \boldsymbol{\mu}_s + \boldsymbol{\lambda}_l + \kappa \mathbf{X}_{islt} + \nu_{slt} \tag{4}$$

- $\overline{GAP}_{sl}$ is the average pre-policy exposure in sector s in district l

- (1) First stage–not a measure of the compliance rate
- Average wage covers all workers. Wages above the mw may also rise
- Captures the wage elasticity of the bite of the minimum wage

Table: Local Employment Elasticity

	$\Delta \log$ wage	$\Delta \log$ employment		
	(1)	(2)	(3)	(4)
GAP	0.806***	0.456**		
	(0.114)	(0.209)		
$\Delta \log$ wage			0.006	0.566**
			(0.124)	(0.230)
F-statistic				49.93
District-Sector pairs	521	521	521	521
Estimation	OLS	OLS	OLS	IV

Notes: $\Delta \log$ wage is the change in real wages between 2007 and 2010. All columns include district and sector fixed effects as well as controls for the log HHI, log employment share in the largest industry, and the log number of firms. Robust standard errors clustered by sector in parenthesis. Reporting the Kleibergen & Paap cluster robust F-statistic. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$ back

- (1) First stage–not a measure of the compliance rate
- Average wage covers all workers. Wages above the mw may also rise
- Captures the wage elasticity of the bite of the minimum wage
- (4) Positive labor supply elasticity
  - Indicative of monopsony power

Table: Local Employment Elasticity

	$\Delta \log$ wage	$\Delta \log$ employment		
	(1)	(2)	(3)	(4)
GAP	0.806***	0.456**		
	(0.114)	(0.209)		
$\Delta \log$ wage			0.006	0.566**
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Migration Cost Weights back

- Migration from o to d depends upon origin migration cost τ_{od}
- Define the migration cost weights $\{\tau_d\}$ by

$$\frac{{\tau_d}^{\theta}\left(\sum_{i=1}^{M_d}\left(B_d w_{ijd}\right)^{1+\eta}\right)^{\frac{1+\theta}{1+\eta}}}{\sum_{d=1}^{D}{\tau_d}^{1+\theta}\left(\sum_{i=1}^{M_d}\left(B_d w_{ijd}\right)^{1+\eta}\right)^{\frac{1+\theta}{1+\eta}}} = \sum_o L_o \frac{{\tau_{od}}^{\theta}\left(\sum_{i=1}^{M_d}\left(B_d w_{ijd}\right)^{1+\eta}\right)^{\frac{1+\theta}{1+\eta}}}{\sum_{d=1}^{D}{\tau_{od}}^{1+\theta}\left(\sum_{i=1}^{M_d}\left(B_d w_{ijd}\right)^{1+\eta}\right)^{\frac{1+\theta}{1+\eta}}}$$

- Weights depend upon the starting population distribution $\{L_o\}$ and migration costs $\{\tau_{od}\}$
- For D large, denominator of RHS approx constant and

$$\tau_d \approx \left[\sum_o L_o \tau_{od}^{\theta}\right]^{\frac{1}{\theta}}$$

Representative Agent Model Preferences back

- Equivalent labor supply can be derived from Berger *et al.* (2022b)
- A single house that supplies one unit of labor across firms and markets
- **Add** ammenities B_d and migration costs τ_d (implicitly a function of population and costs)
- Household chooses consumption C and labor supply to each firm n_{ijd}

$$U = \max_{C,\{n_{ijd}\}} C - \log N \tag{5}$$

$$C := \sum_{d=1}^{D}\sum_{i=1}^{m_d} B_d \tau_d c_{ijd} \qquad N := \left(\sum_{d=1}^{D} N_d^{\frac{\theta+1}{\theta}}\right)^{\frac{\theta}{\theta+1}} \qquad N_d := \left(\sum_{i=1}^{m_d} n_{ijd}^{\frac{\eta+1}{\eta}}\right)^{\frac{\eta}{\eta+1}}$$

- Maximization is subject to the household budget and rationing constraint

$$\sum_{d=1}^{D}\sum_{i=1}^{m_d} c_{ijd} = \sum_{d=1}^{D}\sum_{i=1}^{m_d} w_{ijd} n_{ijd} + \Pi \qquad n_{ijd} \leq \bar{n}_{ijd} \tag{6}$$

- Where firm profits Π are rebated lump sum to the household

Equilibrium Definition back

Given a minimum wages $\{\underline{w}_j\}$, an *oligopsonistic Nash-Cournot* equilibrium is

1. A household inverse labor supply curve $w(n_{ijd}, \bar{n}_{ijd}, N_d, N)$
2. wages $\{w_{ijd}\}$
3. quantities of labor $\{n_{ijd}\}$
4. rationing constraints $\{\bar{n}_{ijd}\}$
5. profits Π
6. aggregate employment N and market level employment N_d

That satisfy the following conditions

1. Given wages $\{w_{ijd}\}$, rationing constraints $\{\bar{n}_{ijd}\}$, and profits Π, household optimization implies the inverse labor supply curve $w(n_{ijd}, \bar{n}_{ijd}, N_d, N)$
2. For every firm i in market d: given competitor employment $\{n_{-ijd}\}$, the aggregate employment index N and the inverse labor supply curve, firm ijd's optimization yields rationing constraint $\bar{n}_{ijd}$, wage w_{ijd} and employment n_{ijd}.
3. Firm employment decisions are consistent with the aggregate and market employment indices, N and N_d as well as profits Π
4. Markets clear $w_{ijd} = w(n_{ijd}, \bar{n}_{ijd}, N_d, N)\ \forall i, j, d$

Region 1: the firm is not constrained by the minimum wage

- The firm is unconstrained by $\underline{w}_j$ and the household is on its labor supply curve
  - The rationing constraint is not binding $\rightarrow p_{ijd} = 1$, and $\tilde{w}_{ijd} = w_{ijd}$ and $\tilde{\mu}_{ijd} = \mu_{ijd}$
- Wages and markdown can be written in terms of the shadow wage-bill share as:

$$\tilde{w}_{ijd} = \tilde{\mu}_{ijd}\alpha A_{ijd} n_{ijd}^{\alpha-1}, \quad \tilde{\mu}_{ijd} = \frac{\varepsilon_{ijd}}{1+\varepsilon_{ijd}}, \quad \varepsilon_{ijd} = \left(\frac{1}{\theta}\tilde{s}_{ijd} + \frac{1}{\eta}(1-\tilde{s}_{ijd})\right)^{-1}, \quad \tilde{s}_{ijd} = \frac{\partial N_d}{\partial n_{ijd}}\,|_{n_{-ijd}}$$

- Employment can be read off of the household's labor supply curve

$$n_{ijd} = \left(\frac{\tilde{w}_{ijd}}{\tilde{W}_d}\right)^{\eta} \left(\frac{B_d \tau_d \tilde{W}_d}{\tilde{W}}\right)^{\theta} \tilde{W}^{\psi}$$

- Firms in this region are only affected by the minimum wage indirectly

Region 2 & 3: the firm is constrained by the minimum wage back

- **Region 2**: the firm is constrained by $\underline{w}_j$ but the household is **on its labor supply curve**
  - The rationing constraint is not binding $\rightarrow p_{ijd} = 1$
- Wages, markdowns and employment are

$$\tilde{w}_{ijd} = \underline{w}_j \quad , \quad \tilde{\mu}_{ijd} = \frac{\underline{w}_j}{\alpha A_{ijd} n_{ijd}^{\alpha-1}} \quad , \quad n_{ijd} = \left(\frac{\underline{w}_j}{\tilde{W}_d}\right)^{\eta} \left(\frac{B_d \tau_d \tilde{W}_d}{\tilde{W}}\right)^{\theta} \tilde{W}^{\psi}$$

- **Region 3**: the firm is constrained by $\underline{w}_j$ and the household is **off its labor supply curve**
  - The rationing constraint is binding $\rightarrow p_{ijd} < 1$
- Wages, markdowns and employment are

$$w_{ijd} = \underline{w}_j \quad , \quad \tilde{\mu}_{ijd} = p_{ijd} \quad , \quad n_{ijd} = \left(\frac{\underline{w}_j}{\alpha A_{ijd}}\right)^{\frac{1}{\alpha-1}}$$

Firms back

- Firms operate a value added production function that takes labor n_{ijd} as its sole input
- Firms face several constraints
  - Must respect the sectoral minimum wage $w_{ijd} \geq \underline{w}_j$
  - Its self-imposed rationing constraint $n_{ijd} \leq \bar{n}_{ijd}$
  - The household inverse labor supply schedule $w(n_{ijd}, \bar{n}_{ijd}, N_d, N)$

Firm's Problem

$$\max_{n_{ijd}, \bar{n}_{ijd}, w_{ijd}} \quad A_{ijd} n_{ijd}^{\alpha} - w_{ijd} n_{ijd}$$

Subject to

$$w_{ijd} \geq \underline{w}_j \qquad n_{ijd} \leq \bar{n}_{ijd} \qquad w_{ijd} = w(n_{ijd}, \bar{n}_{ijd}, N_d(n_{ijd}, n_{-ijd}), N)$$

- Where $\alpha > 0$
- Cournot competition $\rightarrow \partial w(n_{ijd}, \bar{n}_{ijd}, N_d, N)/\partial n_{ijd} \neq 0$ and $\partial N_d/\partial n_{ijd} \neq 0$

Inverse Labor Supply Curve

Equilibrium Definition

- Let ν_{ijd} be the multiplier on the rationing constraint
- The optimality conditions define the inverse labor supply curve

$$w(n_{ijd}, \bar{n}_{ijd}, N_d, N) = \left(\frac{n_{ijd}}{N_d}\right)^{\frac{1}{\eta}} \left(\frac{N_d}{N}\right)^{\frac{1}{\theta}} \frac{N^{\frac{1}{\psi}}}{B_d \tau_d} + \nu_{ijd} \qquad \nu_{ijd}(\bar{n}_{ijd} - n_{ijd}) = 0 \tag{7}$$

- η^{-1} is the elasticity between firms within a market and θ^{-1} between markets
- Wages are **lower** in locations with high amenities
- Wages are **higher** in locations with high migration costs

The Rationing Constraint

- Firms will never hire beyond the point at which $MRPL = \underline{w}_j$
- This defines the firm's rationing constraint

$$\bar{n}_{ijd} = \left(\frac{\underline{w}_j}{\alpha A_{ijd}} \right)^{\frac{1}{\alpha - 1}} \tag{8}$$

- Let p_{ijd} be a normalization of the multiplier on the rationing constraint ν_{ijd}

$$\nu_{ijd} = w_{ijd} p_{ijd} \quad , \qquad p_{ijd} = \frac{w_{ijd} - \nu_{ijd}}{w_{ijd}}$$

- The rationing constraint is strictly binding when $\nu_{ijd} > 0$ and $n_{ijd} = \bar{n}_{ijd}$
- It is weakly slack when $\nu_{ijd} = 0$ and $n_{ijd} \leq \bar{n}_{ijd}$

$\rightarrow$ $p_{ijd} \in (0, 1]$ and $p_{ijd} < 1$ iff the rationing constraint binds

Shadow Wage Characterization

- Define the shadow wage $\tilde{w}_{ijd} := p_{ijd} w_{ijd} = \left(\frac{n_{ijd}}{N_d}\right)^{\frac{1}{\eta}} \left(\frac{N_d}{N}\right)^{\frac{1}{\theta}} \frac{N^{\frac{1}{\psi}}}{B_d \tau_d}$
- Shadow markdown $\tilde{\mu}_{ijd} =: \frac{\tilde{w}_{ijd}}{\alpha A_{ijd} n_{ijd}^{\alpha-1}}$
- Shadow wage-bill share $\tilde{s}_{ijd} := \frac{\tilde{w}_{ijd} n_{ijd}}{\sum_{k \in d} \tilde{w}_{kjd} n_{kjd}}$
- The equilibrium is defined by **firms in three regions**

Characterization of the Equilibrium Details

- The equilibrium is defined by firms in three regions
- Region 1: the firm is unconstrained by $\underline{w}_j$ and the household is on its labor supply curve

$$\tilde{w}_{ijd} = \tilde{\mu}_{ijd}\alpha A_{ijd} n_{ijd}^{\alpha-1} \quad , \quad \tilde{\mu}_{ijd} = \frac{\varepsilon_{ijd}}{1+\varepsilon_{ijd}} \quad , \quad \varepsilon_{ijd} = \left(\frac{1}{\theta}\tilde{s}_{ijd} + \frac{1}{\eta}(1-\tilde{s}_{ijd})\right)^{-1}$$

- Region 2: the firm is constrained by $\underline{w}_j$ and the household is on its labor supply curve

$$\tilde{w}_{ijd} = \underline{w}_j \quad , \quad \tilde{\mu}_{ijd} = \frac{\underline{w}_j}{\alpha A_{ijd} n_{ijd}^{\alpha-1}}$$

- Region 3: the firm is constrained by $\underline{w}_j$ and the household is off its labor supply curve

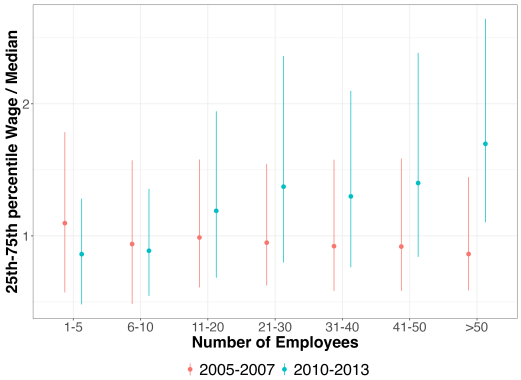
$$w_{ijd} = \underline{w}_j \quad , \quad \tilde{\mu}_{ijd} = p_{ijd}$$

Wage effects of the minimum wage by firm size

back

- Prior to the law all firms were in region 1
  - More productive firms have more employees
  - Pay larger markdowns
  - No relationship b/w firm size and wage
- Positive relationship following the law
  - Less productive firms in region 2 and 3
  - In region 3 cannot pay a markdown
  - More productive firms markdown wages but above minimum

Wages by firm size



Notes: Displaying the 25th-75th percentile of wages by firm size relative to the median wage in each period. Results are the average of the values for each year in the period. The points represent the median wage. All results are weighted by firm weights.

Migration back

- Labor supply from o to each firm $n_{ijdo} = \left(\frac{w_{ijd}}{W_d}\right)^{\eta}\left(\frac{B_d \tau_{od} W_d}{W}\right)^{\theta} N$
- Total labor supply from o in location d

$$N_{od} = \sum_{i=1}^{M_d} n_{ijdo} = \left(\frac{B_d \tau_{od} W_d}{W}\right)^{\theta} N$$

- The ratio of labor supply from o in d to labor supply from o in o

$$\frac{\pi_{od}}{\pi_{oo}} = \frac{\left(B_d \tau_{od} W_d\right)^{\theta}}{\left(B_o W_o\right)^{\theta}}$$

$$W_k = \left(\sum_{i=1}^{M_k} w_{ijk}^{1+\eta}\right)^{\frac{1}{1+\eta}}$$

Reduced Form Labor Supply Elasticity Estimates

Back

dependent variable:	All Firms		Non-Ag Firms	
	log wage	log empl	log wage	log empl
	(1)	(2)	(3)	(4)
$\widehat{GAP}_{sijt-1}$	-0.849	-2.064	-0.841	-2.039
	(0.058)	(0.083)	(0.057)	(0.081)
$s_{ijt} \times \widehat{GAP}_{sijt-1}$	342.48	1092.679	427.286	1528.46
	(35.081)	(125.133)	(37.839)	(74.731)
s_{ijt}	0.833	16.789	0.811	16.56
	(0.162)	(0.859)	(0.165)	(0.833)
$\log \mathsf{HHI}_{sjt}$	0.022	0.071	0.014	0.065
	(0.012)	(0.017)	(0.012)	(0.018)
Firms	8027	8027	7732	7732
Sector FE	Y	Y	Y	Y
District FE	Y	Y	Y	Y

Notes: Reporting the estimation results for the first-stage estimates of the labor supply elasticity used to calculate the markdown. Sample includes 2010 only. All results weighted by survey weights.

Job-Weighted Migration Elasticity Estimates back

	(1)	(2)	(3)	(4)	(5)	(6)
$\underline{w}_d/\underline{w}_o$	0.839***	0.728***				
	(0.112)	(0.104)				
W_d/W_o			0.515***	0.481***	**0.725***	0.713***
			(0.064)	(0.060)	(0.091)	(0.078)
log distance	-0.620***	-0.625***	-0.611***	-0.608***	-0.569***	-0.574***
	(0.054)	(0.055)	(0.054)	(0.054)	(0.054)	(0.054)
F-statistic					1.1e+04	9467.107
District Pairs	15252	15252	15252	15252	15252	15252
Controls	Y	Y	Y	Y	Y	Y
η	6.8	6.8	6.8	6.8	6.8	6.8
Aggregation	Firms	Jobs	Firms	Jobs	Firms	Jobs

Notes: Columns (1)-(4) report the Poisson (GMM) results. Columns (5) and (6) report the IV-Poisson results. Robust standard errors weighted by destination population in parenthesis. The sample include migration data from the LSMS and ILFS for 2010-2014. Reporting the Kleibergen & Paap (2006) cluster robust F-statistic. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

- **Preferred Estimate**

Alternative η calibrations back

	(1)	(2)	(3)	(4)	(5)	(6)
W_d/W_o	0.808***	0.760***	0.725***	0.667***	0.576***	0.499***
	(0.096)	(0.094)	(0.091)	(0.083)	(0.067)	(0.056)
log distance	-0.559***	-0.565***	-0.569***	-0.577***	-0.589***	-0.595***
	(0.054)	(0.054)	(0.054)	(0.054)	(0.053)	(0.054)
F-statistic	8088.964	9557.089	1.1e+04	1.4e+04	2.1e+04	3.0e+04
District Pairs	15252	15252	15252	15252	15252	15252
Controls	Y	Y	Y	Y	Y	Y
η	10	8	6.8	5	3	2
Aggregation	Firms	Firms	Firms	Firms	Firms	Firms

Notes: The table presents the IV-Poisson results for various values of η. Robust standard errors weighted by destination population in parenthesis. The sample include migration data from the LSMS and ILFS for 2010-2014. Reporting the Kleibergen & Paap (2006) cluster robust F-statistic. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

Employment-Weighted Alternative η calibrations back

	(1)	(2)	(3)	(4)	(5)	(6)
W_d/W_o	0.799***	0.751***	0.713***	0.643***	0.540***	0.463***
	(0.084)	(0.081)	(0.078)	(0.071)	(0.059)	(0.050)
log distance	-0.566***	-0.571***	-0.574***	-0.579***	-0.582***	-0.584***
	(0.054)	(0.054)	(0.054)	(0.053)	(0.053)	(0.052)
F-statistic	7185.575	8350.320	9467.107	1.2e+04	2.0e+04	3.0e+04
District Pairs	15252	15252	15252	15252	15252	15252
Controls	Y	Y	Y	Y	Y	Y
η	10	8	6.8	5	3	2
Aggregation	Jobs	Jobs	Jobs	Jobs	Jobs	Jobs

Notes: The table presents the IV-Poisson results for various values of η. Robust standard errors weighted by destination population in parenthesis. The sample include migration data from the LSMS and ILFS for 2010-2014. Reporting the Kleibergen & Paap (2006) cluster robust F-statistic. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

Unrestricted θ estimation back

	(1)	(2)	(3)	(4)	(5)	(6)
W_d	1.212***	1.157***	1.108***	0.999***	0.806***	0.673***
	(0.147)	(0.145)	(0.142)	(0.131)	(0.107)	(0.090)
W_o	0.561***	0.538***	0.521***	0.487***	0.428***	0.376***
	(0.113)	(0.107)	(0.103)	(0.095)	(0.081)	(0.071)
log distance	-0.600***	-0.601***	-0.602***	-0.604***	-0.607***	-0.608***
	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)
F-statistic	6863.316	8526.940	1.0e+04	1.4e+04	2.4e+04	3.4e+04
District Pairs	15252	15252	15252	15252	15252	15252
Controls	Y	Y	Y	Y	Y	Y
η	10	8	6.8	5	3	2
χ^2-Test p-value: $\hat{\theta}_d = \hat{\theta}_o$	0.000	0.000	0.001	0.001	0.005	0.010

Notes: The table presents the IV-Poisson results for various values of η without the restriction that the elasticity at origin and destination are the same. Robust standard errors weighted by destination population in parenthesis. The sample include migration data from the LSMS and ILFS for 2010-2014. Reporting the Kleibergen & Paap (2006) cluster robust F-statistic. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

Minimum Wage Elasticity: alternative η calibrations

back

	(1)	(2)	(3)	(4)	(5)	(6)
$\underline{w}_d/\underline{w}_o$	0.870***	0.858***	0.839***	0.779***	0.627***	0.503***
	(0.117)	(0.115)	(0.112)	(0.102)	(0.079)	(0.062)
log distance	-0.624***	-0.622***	-0.620***	-0.616***	-0.612***	-0.610***
	(0.055)	(0.055)	(0.054)	(0.054)	(0.054)	(0.054)
District Pairs	15252	15252	15252	15252	15252	15252
Controls	Y	Y	Y	Y	Y	Y
η	10	8	6.8	5	3	2
Aggregation	Firms	Firms	Firms	Firms	Firms	Firms

Notes: The table presents the reduced form minimum wage elasticity results estimated via Poisson for various values of η where $\underline{w}_k = \left(\sum_{i=1}^{M_k} \underline{w}_{ijk}^{1+\eta}\right)^{\frac{1}{1+\eta}}$. Robust standard errors weighted by destination population in parenthesis. The sample include migration data from the LSMS and ILFS for 2010-2014. Reporting the Kleibergen & Paap (2006) cluster robust F-statistic. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

Job-Weighted Minimum Wage Elasticity: alternative η calibrations

back

	(1)	(2)	(3)	(4)	(5)	(6)
$\underline{w}_d/\underline{w}_o$	0.777***	0.752***	0.728***	0.671***	0.558***	0.461***
	(0.108)	(0.106)	(0.104)	(0.096)	(0.077)	(0.062)
log distance	-0.627***	-0.626***	-0.625***	-0.622***	-0.616***	-0.612***
	(0.055)	(0.055)	(0.055)	(0.055)	(0.054)	(0.054)
District Pairs	15252	15252	15252	15252	15252	15252
Controls	Y	Y	Y	Y	Y	Y
η	10	8	6.8	5	3	2
Aggregation	Jobs	Jobs	Jobs	Jobs	Jobs	Jobs

Notes: The table presents the reduced form minimum wage elasticity results estimated via Poisson for various values of η where $\underline{w}_k = \left(\sum_{i=1}^{M_k} \underline{w}_{ijk}^{1+\eta}\right)^{\frac{1}{1+\eta}}$. Robust standard errors weighted by destination population in parenthesis. The sample include migration data from the LSMS and ILFS for 2010-2014. Reporting the Kleibergen & Paap (2006) cluster robust F-statistic. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

Employment Model of Migration

- Account for the fixed cost of migration in distribution of amentities

$$F(b_{o1}, \ldots, b_{oJ}) = -\exp\Big[-\sum_{o,J\setminus o}\Big(\sum_{d} e^{-\theta b_{od}}\Big)^{\frac{\psi}{\theta}}\Big]$$

- The indirect utility of migrating from o to d is

$$V_{od}(\omega) = e^{b_{od}(\omega)}\frac{B_d}{\tau_{od}}\tilde{w}(w_d, e_d) \tag{9}$$

$$\tilde{w}(w_d, e_d) = \left(e_d\,\frac{w_d^{1-\rho}-1}{1-\rho} + (1-e_d)\,\frac{\bar{w}_d^{1-\rho}-1}{1-\rho}\right) \tag{10}$$

- e_d is the probability of employment
- w_d is the wage and $\bar{w}_d$ is the value of the outside option

Migration Shares

- Individuals choose d to maximize their log utility
- Distributional assumptions of $b_{od}(\omega)$ imply that migration shares are

$$\pi_{od} = \underbrace{\frac{\left(B_d \tau_{od}^{-1} \tilde{w}_d\right)^{\theta}}{\sum_{k \in L \setminus o} \left(B_k \tau_{ok}^{-1} \tilde{w}_k\right)^{\theta}}}_{\text{prob choose d}} \underbrace{\frac{\left(\sum_{k \in L \setminus o} \left(B_k \tau_{ok}^{-1} \tilde{w}_k\right)^{\theta}\right)^{\frac{\psi}{\theta}}}{\left(\sum_{k \in L \setminus o} \left(B_k \tau_{ok}^{-1} \tilde{w}_k\right)^{\theta}\right)^{\frac{\psi}{\theta}} + \left(B_o \tilde{w}_o\right)^{\psi}}}_{\text{prob migrate}} \tag{11}$$

$$\pi_{oo} = \frac{\left(B_o \tilde{w}_o\right)^{\psi}}{\left(\sum_{k \in L \setminus o} \left(B_k \tau_{ok}^{-1} \tilde{w}_k\right)^{\theta}\right)^{\frac{\psi}{\theta}} + \left(B_o \tilde{w}_o\right)^{\psi}} \tag{12}$$

Interpretation of θ and ψ

$$\frac{\pi_{od}}{\pi_{oo}} = \frac{\left(B_d \tau_{od}^{-1} \tilde{w}_d\right)^{\theta}}{\left(B_o \tilde{w}_o\right)^{\psi}} \left(\sum_{k \in L \setminus o} \left(B_k \tau_{ok}^{-1} \tilde{w}_k\right)^{\theta} \right)^{\frac{\psi - \theta}{\theta}} \tag{13}$$

- ψ the elasticity of migration out of origin
- θ the elasticity between locations, conditional upon emigration
- Expect $\psi < \theta$
  - Changes in local labor market less likely to induce migration

  $\rightarrow$ More elastic in choice of destination, conditional upon migrating

Migration Flows Estimation Strategy

$$n_{odt} = n_{oot} \exp\left(\theta \log \tilde{w}_d - \psi \log \tilde{w}_o + \kappa \log \tau_{od} + \chi_o + \delta_d + \Gamma X_{odt}\right) + \varepsilon_{odt}$$

$$\tilde{w}_k = e_{kt} \frac{w_{kt}^{1-\rho} - 1}{1-\rho}$$

- n_{odt} is the number of migrants from $o - d$
- τ_{od} is the distance between the centroids of the district pair
- X_{ot} includes log labor force size at origin and destination, log stock of migrants from o to d
- ε_{odt} captures the weighted sum of the value of migrating to all other destinations
- Calibrate $\rho = 2$
- Compare results with HT model

Estimated Migration Elasticities back

	(1)	(2)	(3)	(4)	(5)
θ	2.917***	0.148	1.133***	0.365***	0.393***
	(1.041)	(0.242)	(0.054)	(0.072)	(0.119)
ψ	2.132***	0.320*	-0.081	0.227***	0.337***
	(0.685)	(0.191)	(0.078)	(0.055)	(0.110)
log distance	-0.631***	-0.652***		-0.590***	-0.575***
	(0.055)	(0.057)		(0.057)	(0.058)
F-statistic					620.219
District Pairs	15252	15252	15252	15252	15252
Controls	Y	Y	N	Y	Y
Estimation	min wage	wage	HT	Poisson	IVP
χ^2-Test p-value: $\theta = \psi$	0.000	0.139	0.000	0.000	0.712
χ^2-Test p-value: $\theta = 1$			0.013		

Notes: The table presents the elasticity of migration (θ) and non-migration (ψ) for various measure of income. Column 1 reports the minimum wage elasticity. Column 2 reports the wage elasticity without controlling for the employment rate. Column 3 reports the estimation results for the Harris-Todaro model (excluding controls and assuming risk neutrality). Columns (4) and (5) report the expected income elasticity calibrated with ($\rho = 2$). Column (4) reports the poisson results and Column 5 reports the IV-Poisson (GMM) results, instrumenting for expected income using the average minimum wage in the origin and destination districts. Robust standard errors weighted by destination population in parenthesis.

Discussion back

- Poisson results may be biased if wages are correlated with amenities
- IV results are larger
  - Wages may be negatively correlated with high-amenity places
  - High amenity places can offer lower wages
- Minimum wage elasticity much larger than that of expected income
  - → Individuals are aware of the minimum wage law
  - Suggests that the minimum wage is driving migration
- Contrasts with evidence that migrants are not aware of labor market conditions at destination (Baseler, 2021)

Non-migration estimation | Conditional migration estimation | First Stage | Alternate ρ calibrations | Relation with other θ estimates

Estimated Income Elasticities for various values of ρ back

	Dependent variable: n_{od}				
	(1)	(2)	(3)	(4)	(5)
θ	0.387***	0.393***	0.393***	0.393***	0.393***
	(0.117)	(0.119)	(0.119)	(0.119)	(0.119)
ψ	0.337***	0.337***	0.337***	0.337***	0.337***
	(0.110)	(0.110)	(0.110)	(0.110)	(0.110)
log distance	-0.575***	-0.575***	-0.575***	-0.575***	-0.575***
	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)
F-statistic	631.088	620.362	620.219	620.218	620.218
District Pairs	15252	15252	15252	15252	15252
Controls	Y	Y	Y	Y	Y
χ^2-Test p-value: $\theta = \psi$	0.736	0.712	0.712	0.712	0.712
ρ	1	1.5	2	2.5	3

Notes: The table presents the IV-Poisson estimates of the elasticity of migration (θ) and non-migration (ψ) for various values of ρ. The model instruments for expected income using the average minimum wage in the origin and destination districts. The sample include migration data from the LSMS and ILFS for 2010-2014. Robust standard errors weighted by district starting population in parenthesis. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

Migration Model First Stage Results

back

	$\tilde{w}_d$	$\tilde{w}_o$	$\tilde{w}_d$
	(1)	(2)	(3)
log destination min wage	4.657***	-0.051	4.657***
	(0.118)	(0.114)	(0.118)
log origin min wage	-0.018	4.568***	
	(0.084)	(0.130)	
log distance	0.034***	0.044***	0.034***
	(0.008)	(0.013)	(0.008)
log migrant stock	0.080***	0.099***	0.080***
	(0.008)	(0.013)	(0.008)
log origin labor force size	-0.011	-0.731***	-0.010
	(0.011)	(0.017)	(0.011)
log destination labor force size	-0.623***	-0.009	-0.623***
	(0.012)	(0.014)	(0.012)
District Pairs	15252	15252	15252
Origin FE	Y	Y	Y
Destination FE	Y	Y	Y
F-Test p-value: Instrumental relevance	0.000	0.000	0.000

Notes: The dependent variable $\tilde{w}_k$ is defined as $\log(e_k \times (w_k)^{1-\rho} - 1)/(1-\rho))$. Columns 1 and 2 report the first-stage results for the jointly estimated model while column 3 reports the first stage results for the conditional migration model. Robust standard errors weighted by destination district starting population in parenthesis. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

Cross-Section Estimates of the Income Elasticity of Non-Migration

back

	Dependent variable: $\log \pi_{oo}/(1-\pi_{oo})$				
	(1)	(2)	(3)	(4)	(5)
ψ	1.573**	0.200	0.094**	0.219***	0.283***
	(0.758)	(0.181)	(0.046)	(0.053)	(0.094)
F-statistic					6.655
Districts	124	124	124	124	124
Controls	Y	Y	N	Y	Y
Estimation	min wage	wage	HT	OLS	IV

Notes: The table presents the elasticity of non-migration for non-migrants (θ) for various measure of income. Column 1 reports the minimum wage elasticity. Column 2 reports the wage elasticity without controlling for the employment rate. Column 3 reports the estimation results for the Harris-Todaro model (excluding controls and assuming risk neutrality). Columns (4) and (5) report the expected income elasticity calibrated with ($\rho = 2$). Column (4) reports the OLS results and Column 5 reports the IV results, instrumenting for expected income using the average minimum wage in the district. The sample include migration data from the LSMS and ILFS for 2010-2014. Reporting the Kleibergen & Paap (2006) cluster robust F-statistic. Robust standard errors weighted by destination district starting population in parenthesis. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

Estimated Income Elasticity of Migration among Migrants

back

	(1)	(2)	(3)	(4)	(5)
θ	2.769***	0.155	1.134***	0.396***	0.375***
	(0.988)	(0.245)	(0.062)	(0.072)	(0.121)
log distance	-0.682***	-0.689***		-0.657***	-0.659***
	(0.052)	(0.052)		(0.052)	(0.052)
F-statistic					1564.975
District Pairs	15252	15252	15252	15252	15252
Controls	Y	Y	N	Y	Y
Estimation	min wage	wage	HT	Poisson	IVP
χ^2-Test p-value: $\theta = 1$			0.030		

Notes: The table presents the elasticity of migration (θ) for various measure of income. Column 1 reports the minimum wage elasticity. Column 2 reports the wage elasticity without controlling for the employment rate. Column 3 reports the estimation results for the Harris-Todaro model (excluding controls and assuming risk neutrality). Columns (4) and (5) report the expected income elasticity calibrated with $(\rho = 2)$. Column (4) reports the poisson results and Column 5 reports the IV-Poisson (GMM) results, instrumenting for expected income using the average minimum wage in the district. The sample include migration data from the LSMS and ILFS for 2010-2014. Robust standard errors weighted by destination district starting population in parenthesis. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

Relation with the other estimates back

- Harris & Todaro model assumes that the migration elasticity $\theta = 1$
  - Supported by the data (fail to reject at 99% confidence level)
  - This model adds: migration costs, amenities, risk aversion
- Bryan & Morten (2019) estimate $\theta = 3.2$ for Indonesia
  - Do not account for employment probability
  - Comparable to the minimum wage estimates
- Berger *et al.* (2022a) estimate $\theta = 0.45$ in the US
  - Estimated using monopsony GE framework