Minimum Wages and the Spatial Distribution of Economic Activity

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The Role of Job Finding in Migration Decisions

- 20-25% of individuals in low-income countries emigrate from their place of birth (Young, 2013)
- The literature typically explains migration flows through three mechanisms:
  1. **Wage differentials** (Young, 2013; Bryan & Morten, 2019)
  2. **Amenities** (Rosen, 1974; Roback, 1982; Redding & Rossi-Hansberg, 2017)
  3. **Migration costs** (Bryan *et al.*, 2014; Imbert & Papp, 2020; Lagakos, 2020)

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  3. **Migration costs** (Bryan *et al.*, 2014; Imbert & Papp, 2020; Lagakos, 2020)
- A less explored determinant of migration is the **likelihood of finding a job**

  → A high-wage high-amenity location with one job is not very appealing

Minimum Wages as a Policy Tool

- In recent years many sub-Saharan African countries have adopted minimum wage laws

→ Can facilitate migration by increasing expected urban income (Harris & Todaro, 1970)

- However, rates of compliance are low (Rani *et al.*, 2013)
- Ambiguous employment effects
  - Positive (Almeida & Carneiro, 2012; Magruder, 2013; Mansoor & O'Neill, 2021)
  - Negative (Bhorat *et al.*, 2017; Marshall, 2025a)

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  - Negative (Bhorat *et al.*, 2017; Marshall, 2025a)
- **How do minimum wages affect the location decision of migrants?**

How do minimum wages affect the spatial distribution of labor?

- **Data**: Annual census of Tanzanian firms: the Employment and Earnings Survey (EES)
  - Includes information on employment, hires and vacancy posting
  - Combine with migration data from the 2012 census

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- **Minimum Wages**: Tanzania's 2010 minimum wage law
  - Specified 20 unique minimum wage levels across industries
- **Estimation**: spatial search and matching model
  1. Worker's outside option is self-employment
  2. Migration is costly
  3. Spatial variation in the distribution of job productivity
  4. Partial enforcement of the minimum wage

Preview of Results

- **How do minimum wages affect the spatial distribution of workers?**
- Two counteracting effects:
  1. From the perspective of the firm: **the value of posting a vacancy falls**
  2. From the perspective of the worker, the expected wage rises

  $\Longrightarrow$ **Ambiguous effect on vacancy posting and employment**

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  $\Longrightarrow$ Ambiguous effect on vacancy posting and employment
- **Where do workers migrate?**
  1. High productivity locations are unconstrained $\Longrightarrow$ emigration
  2. Firms in the lowest productivity locations may be too constrained $\Longrightarrow$ emigration
  3. **Largest population gains in medium productivity locations where employment rises**
- **A high-wage location has no value if there are no jobs**

Related Literature

- Search and Matching models (Mortensen & Pissarides, 1994; Burdett & Mortensen, 1998)
  - Minimum wages (Flinn, 2006)
  - Multiple labor markets (Kennan & Walker, 2011; Baum-Snow & Pavan, 2012; Manning & Petrongolo, 2017; Schmutz & Sidibé, 2019; Heise & Porzio, 2022)

  → **Develop the first tractable model of directed migration to search with large N labor markets**

- Minimum Wages and Development
  - Non-Compliance (Ashenfelter & Smith, 1979; Basu *et al.*, 2010; Bhorat *et al.*, 2017; Sharma, 2024)
  - Employment Effects (Harris & Todaro, 1970; Almeida & Carneiro, 2012; Magruder, 2013; Derenoncourt *et al.*, 2021; Mansoor & O'Neill, 2021)

  → **Heterogeneous employment effects across space due to the bite of the minimum wage**

- Migration
  - Wages and human capital (Young, 2013; Hicks *et al.*, 2021; Bryan & Morten, 2019)
  - High migration costs (Bryan *et al.*, 2014; Morten, 2019; Imbert & Papp, 2020; Lagakos *et al.*, 2020)
  - Amenities (Rosen, 1974; Roback, 1982; Redding & Rossi-Hansberg, 2017)

  → **Incorporate the probability of finding a job on migration decisions**

Plan

Data

- **Firm Data**: the Employment and Earnings Survey
  - All firms with at least 50 employees, representative sample of smaller firms
  - $\sim$ 10,000 firms in each year
  - Data on hires, vacancies, total employment, number of workers in wage bands

  $\rightarrow$ Use data from 2012
- **Migration Data**: 2012 Census - migration flows in the past year
- **Minimum Wages**: The Tanzanian Government gazette

Tanzania's 2010 Sectoral Minimum Wage Law

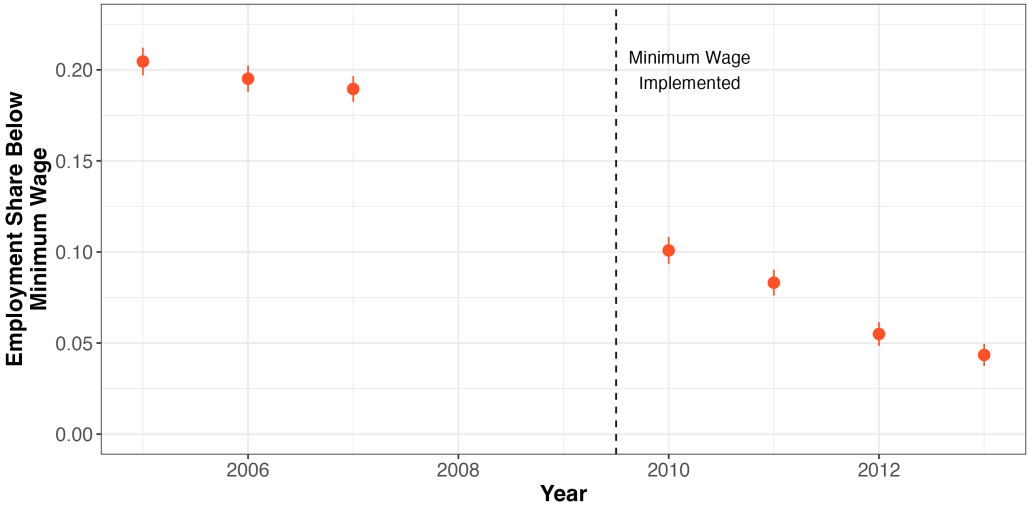
All Sectors

- 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)

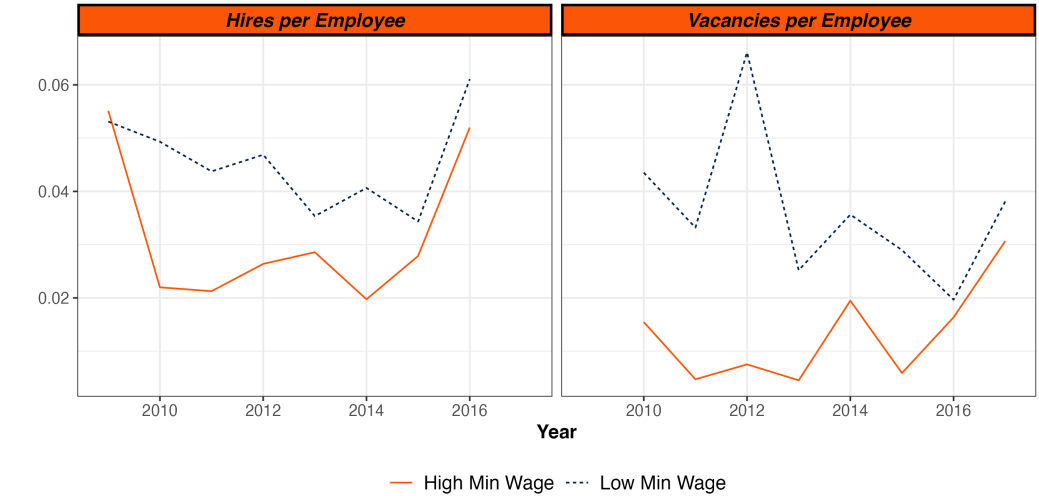
Sector	Minimum Wage
Health Services	80
Agricultural	70
Education	80
Transport & Communication	
Aviation	350
Clearing & Forwarding	230
Telecommunications	300
Inland Transport	150
⋮	⋮
Other sectors	80

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

Partial Compliance with the Minimum Wage



Hires and Vacancies by Minimum Wage Level



Notes: High minimum wage industries are those whose minimum wage was at least double the standard level of 80K TSH.

The Roles of Employment and Wages on Immigration

	log immigration		log wage	log empl	log immigration
	(1)	(2)	(3)	(4)	(5)
log wage	-0.017	0.521**			1.278**
	(0.284)	(0.240)			(0.594)
log employment		0.415***			0.488***
		(0.062)			(0.106)
log min wage			0.958***	3.303	
			(0.354)	(2.332)	
$\widehat{GAP}$			-1.222***	6.346***	
			(0.242)	(1.182)	
F-statistic					10.08
Districts	119	119	119		119
Estimation	OLS	OLS	OLS	OLS	IV

Notes: Estimation results for the log district level immigration in the 2012 census. Robust standard errors in parenthesis. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

Plan

Model Overview

equilibrium model details

- Time is continuous
- **Labor markets** (o) vary in the distribution of job productivities $F_o(y)$ and population (L_o)
- **Firms** post vacancies (v) subject to a cost details

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- **Workers** are employed (e) or self-employed (s) details
  - Have a vector of time-varying idiosyncratic migration costs $\{\zeta_d\}$
  - Self-employed workers can **only** be matched with a job in their local labor market

    $\rightarrow$ The probability of a match depends upon total vacancies, and total self-employment

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- When a match occurs the wage is determined via Nash bargaining with the worker

$\Longrightarrow$ heterogeneous wage distributions and employment rates across space

The Migration Decision

- In each period workers' vector of idiosyncratic migration costs $\{\zeta_d\}$ are updated
- Self-employed workers choose between:
  1. Searching for a job in their own labor market
  2. Migrating to another labor market (d) and searching there
- Workers choose the labor market with the highest value net of migration costs:

$$V_o^m = \max\left\{V_o^s,\ \zeta_o^{-1}\max_{d\neq o}\left\{\tau_{od}\zeta_d V_d^s\right\}\right\}$$

- Where $\zeta_d\tau_{od}/\zeta_o$ is the total cost of migrating

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- Where $\zeta_d\tau_{od}/\zeta_o$ is the total cost of migrating
- In expectation, the **value of having the option to migrate** is:

$$E[V_o^m] = V_o^s(1+\psi_o)$$

- Where $\psi_o > 0$ is the additional value of having the option to migrate details

The Effects of a Minimum Wage

- **Assumption**: government only enforces the minimum wage in jobs with $y > m$
  - Limits the negative employment effects of a minimum wage
  - For a range of jobs the minimum wage binds

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- **Minimum wages increase the expected value of employment**

  $\implies$ workers' reservation wage rises $\implies$ workers accept fewer jobs

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$\Longrightarrow$ **Wage and employment effects will depend upon whether pop rises or falls**

Vacancy Posting

- In equilibrium, without a minimum wage, vacancies are determined by:

$$\underbrace{(1-\eta)\left(E\left[y|\bar{w}_o \leq y\right]-\bar{w}_o\right)}_{\text{value of a match}} - \underbrace{\frac{\kappa_o(r+\delta_o)}{q(\theta_o)p_o}}_{\text{cost of posting}} = 0$$

- $\theta_o = v_o/(s_o L_o) \implies$ immigration reduces the expected time to fill a vacancy

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- With a minimum wage, the value of posting a vacancy falls:

$$(1-\eta)\left(E\left[y|\bar{w}_o \leq y\right]-\bar{w}_o\right) + \eta\left(E\left[y|\bar{w}_o \leq y < \hat{y}_o\right]-\hat{y}_o\right) - \frac{\kappa_o(r+\delta_o)}{q(\theta_o)p_o} = 0$$

- Where $\hat{y}_o$ is the maximum productivity for which the minimum wage binds:

$$m_o = \eta\hat{y}_o + (1-\eta)(1+\psi_o)rV_o^s$$

The Self-Employment Value Function

equilibrium

- **Without migration or a minimum wage**, the present value of self-employment is:

$$rV_o^s = A(\theta_o, 0)w_{so} + (1 - A(\theta_o, 0))E\left[y|y \geq \bar{w}_o\right]$$

- Where the weights are given by: $A(\theta_o, \psi_o) = \frac{(r+\delta_o)}{r+\delta_o+\eta p_o \theta_o q_o(\theta_o)(1+\psi_o)}$

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- **With migration** the value of being self-employed rises because of the option to migrate:

$$rV_o^s = \Upsilon\left(A(\theta_o, \psi_o)w_{so} + (1 - A(\theta_o, \psi_o))\frac{E\left[y|y \geq \bar{w}_o\right]}{(1+\psi_o)}\right)$$

$$\Upsilon = \frac{r}{r - A(\theta_o, \psi_o)\psi_o(1 + p_o\theta_o q_o(\theta_o))} > 1$$

- And $\partial A(\cdot,\cdot)/\partial\psi_o < 0 \implies$ more weight on the expected job productivity

The Self-Employment Value Function

equilibrium

- The minimum wage increases the expected job productivity for the worker:

$$rV_o^s = \Upsilon\left(A(\theta_o,\psi_o)w_{so} + (1-A(\theta_o,\psi_o))\frac{(E\left[y|y\geq \bar{w}_o\right] + \hat{y}_o - E[y|m_o < y \leq \hat{y}_o])}{(1+\psi_o)}\right)$$

- **For migrants**, locations where the minimum wage has more 'bite' become more attractive
- *i.e.* where $\hat{y}_o - E[y|m_o < y \leq \hat{y}_o]$ is large

The Self-Employment Value Function

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- For migrants, locations where the minimum wage has more 'bite' become more attractive
- *i.e.* where $\hat{y}_o - E[y|m_o < y \leq \hat{y}_o]$ is large
- **For workers in** o the minimum wage increases their bargaining power:

$$w_o(y,m_o) = (1-\eta)(1+\psi_o)rV_o^s + \eta y \quad \forall\, y \notin [m_o,\hat{y}_o]$$

- Directly through rV_o^s and indirectly through ψ_o

Plan

Estimation Overview

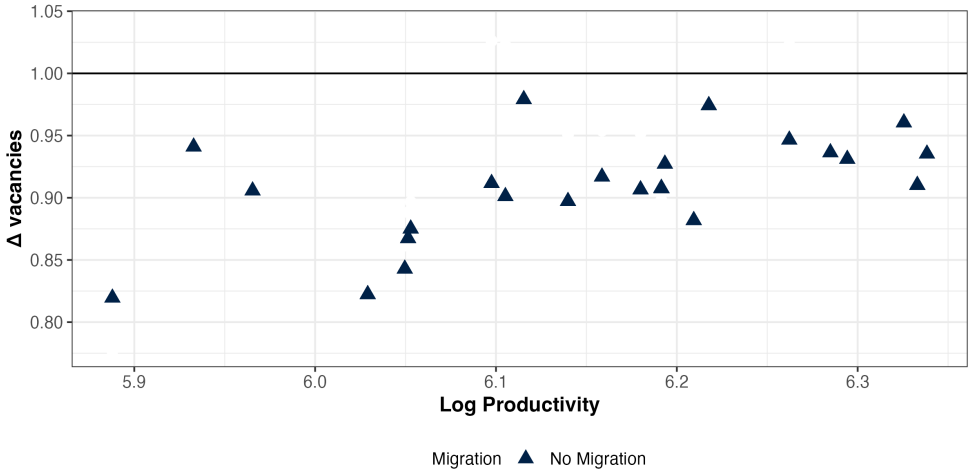
- Estimate $q_o(\theta) = Z_o\theta^{-\alpha}$ using hires and vacancy from the EES 2010-2014 details
  - Match elasticity $\alpha = 0.6$ consistent with the literature (e.g. Shimer (2005))
  - Matching productivity much lower than developed countries (Abebe *et al.*, 2020)
- Estimate $F_o(y)$ using employment in each wage band details
  - Assume a log normal distribution of wages in each industry X location pair
  - Calibrate $\eta = 0.7$ (Marshall, 2025b): wages $\rightarrow$ productivity
- Simulate model to find fixed point for rV_o^s
- Update migration costs (τ_{od}) until fixed population (L_o)

Counterfactual Exercises

- Quantify the effect of a minimum wage on migration, employment, and wages
  - Simulate the model with and without a minimum wage
  - Compare to benchmark no-migration model

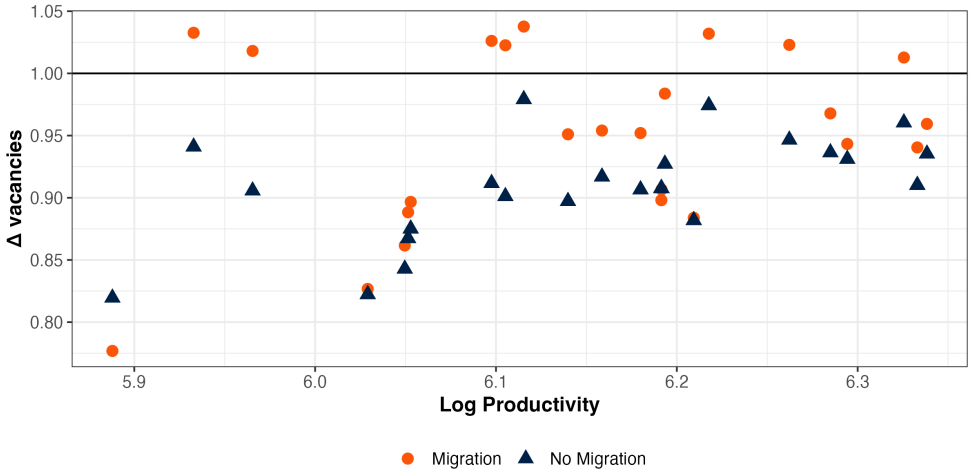
1. **What happens to vacancies?**

Without Migration, Vacancy Posting Falls



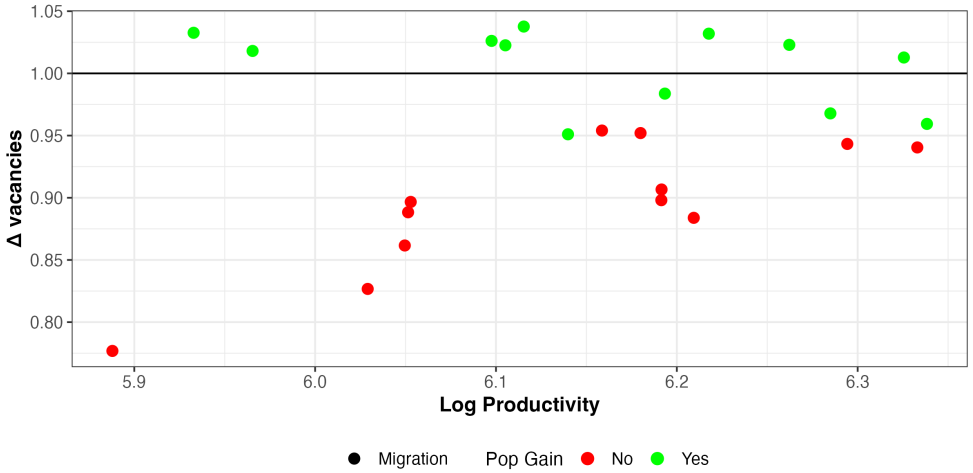
- With no change in population, the expected value of positing a vacancy is weakly lower

Migration Affects Vacancy Posting through Labor Market Tightness



- Locations that gain in population have more workers searching

Rising Population Increases the Value of Positing a Vacancy



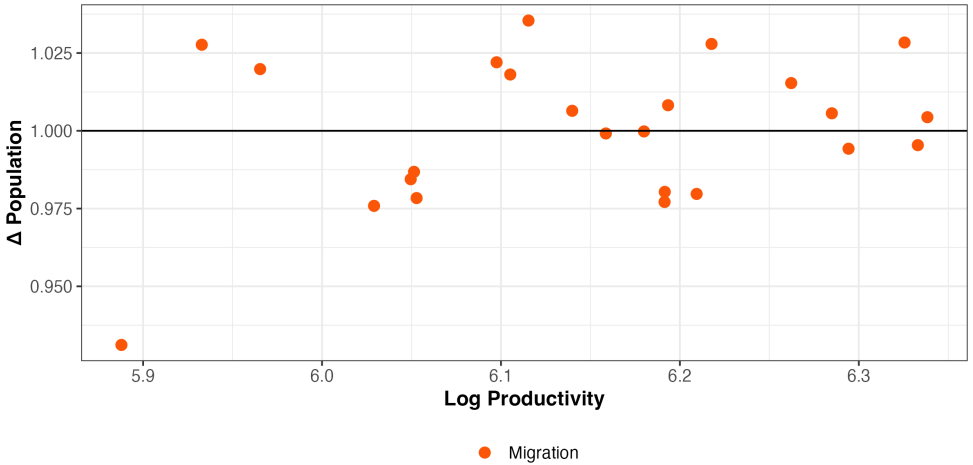
- Rising population offsets the effect of the minimum wage

Counterfactual Exercises

- Quantify the effect of a minimum wage on migration, employment, and wages
  - Simulate the model with and without a minimum wage
  - Compare to benchmark no-migration model

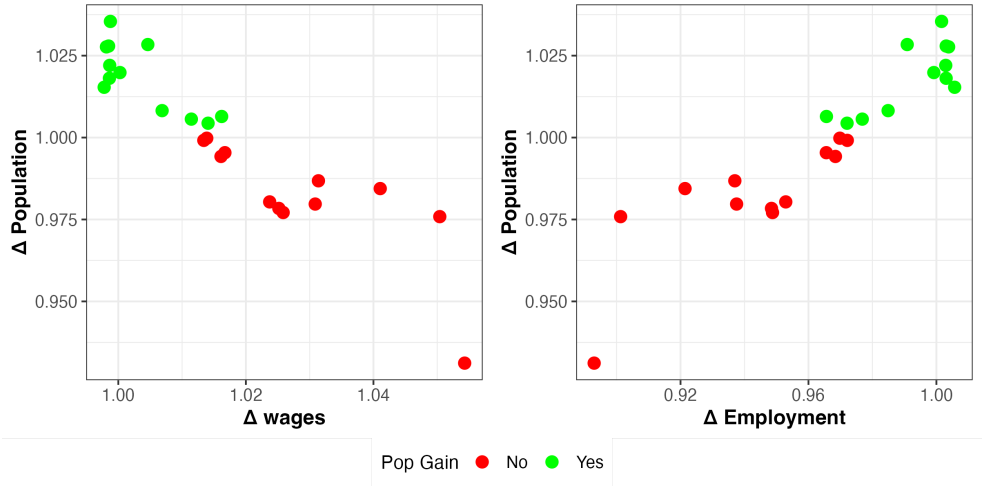
1. What happens to vacancies?
   - Vacancy creation rises in some locations that gain population
2. **What determines migration?**

Workers Do Not Move to the Most Productive Locations



- Minimum wages have less bite in high-productivity locations

Changes in Employment, Not Wages Drive Immigration



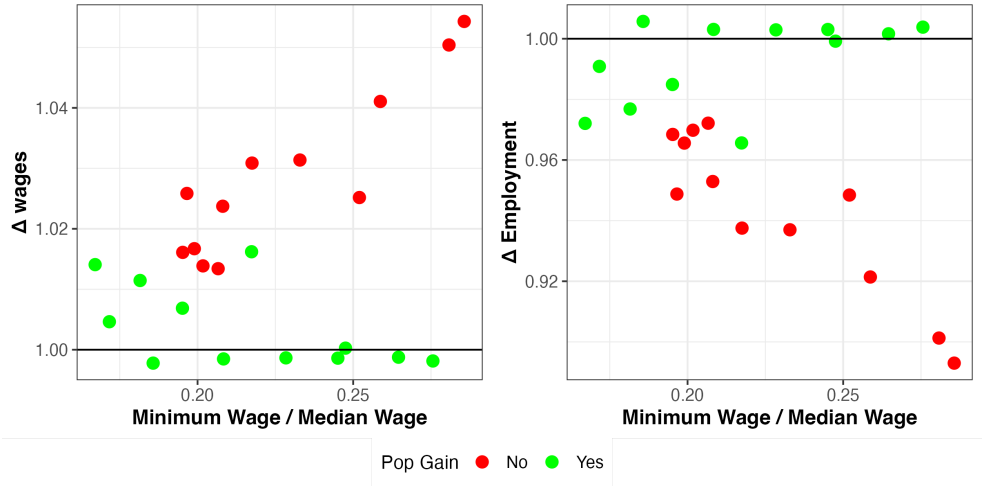
- High wages are not important if there are no jobs!

Counterfactual Exercises

- Quantify the effect of a minimum wage on migration, employment, and wages
  - Simulate the model with and without a minimum wage
  - Compare to benchmark no-migration model

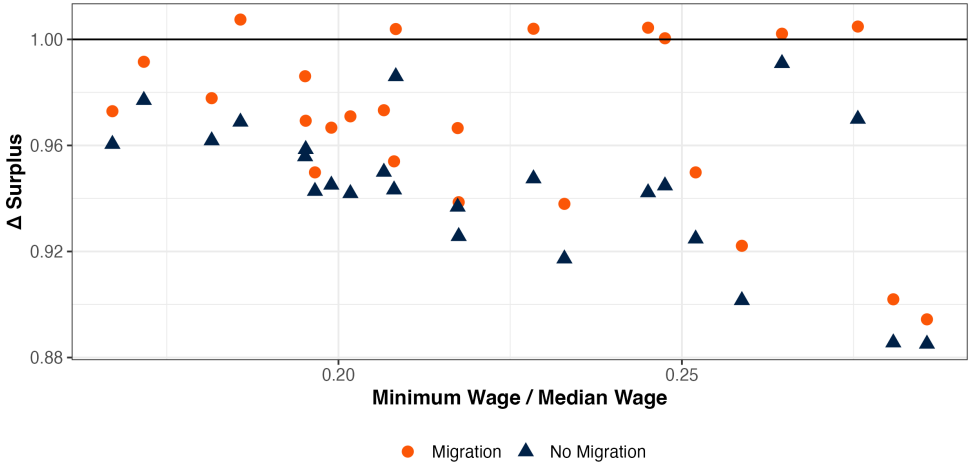
1. What happens to vacancies?
   - Vacancy creation rises in some locations that gain population
2. What determines migration?
   - Migration largely driven by employment
3. **How does the minimum wage affect wages and employment?**

Minimum Wage Effects Depend upon Population Movement



- Standard wage and employment effects only hold in locations that lose population

Migration Limits Surplus Losses from the Minimum Wage



Plan

Conclusion

- **How do minimum wages affect the spatial distribution of workers?**
- Changes the relative value of labor markets in two ways:
  1. Reduces the value of posting a vacancy
  2. Increases the expected wage of a job match

  $\rightarrow$ Heterogeneous net effect across space
- More bite $\implies$ less value of a vacancy for a firm, but more for a worker
- Net immigration driven by employment, not wages

$\implies$ **Minimum wages do not induce migration into the most productive locations**

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2010 Industry Minimum Wage

back

Industry	ISIC Code	Minimum Wage
Agricultural Services	1-2	70000
Marine and Fishing	3	165000
Mining Primary Licenses	5-9	150000
Mining License/ Prospecting licenses	NA	350000
Mining Dealers licenses	NA	250000
Mining Brokers licenses	NA	150000
Trade, Industry and Commerce	10-33	80000
Transport Services: Inland Transport	49, 491-493	150000
Transport Services: Aviation	51	350000
Transport Services: Clearing and Forwarding	52	230000
Hotels: Medium Hotels	55	100000
Hotels: Potential and Tourists hotel	NA	150000
Hotels: Restaurants, Guest Houses and Bars	56	80000
Telecommunication	61-63	300000
Private security: other	80	80000
Private security: International or potential security Companies	NA	105000
Health Services	86-88	80000
Domestic Services: Other	97 98	65000
Domestic Services: Diplomats	NA	90000
Domestic Services: Entitled Officers	NA	80000
Other	35, 36-39, 50, 52, 53	80000

Environment

back

- Labor markets (o, d) are characterized by:
  - A measure of workers (L_o) and a measure of firms (M_o)
  - A distribution of potential job productivities $y_o \sim \log \text{Normal}(\bar{y}_o, \sigma_o^2)$
  - A vacancy posting cost (κ_o) and job destruction rate (δ_o)
  - A constant returns to scale matching function $R_o(sL, v) = A_o(sL)^\alpha v^{1-\alpha}$

    $\implies$ The vacancy filling rate is $q_o(\theta) = R_o/(vL) = A_o\theta^{-\alpha}$
- In equilibrium vacancy creation is determined by: details

$$E[y - w(y)|w(y) \geq \bar{w}_o] - \frac{\kappa_o(r + \delta_o)}{q(\theta_o)p_o} = 0$$

  - Where p_o is the probability that the match wage $w(y)$ exceed the reservation wage $\bar{w}_o$

Workers

back

- **Endowments**: birth location o, time-varying vector of idiosyncratic migration costs $\{\zeta_d\}$
- Only the self-employed can migrate. The total cost of migrating is: $\zeta_d \tau_{od} / \zeta_o$
- The value of migrating is:

$$V_o^m = \max \left\{ V_o^s,\, \zeta_o^{-1} \max_{d \neq o} \{\tau_{od} \zeta_d V_d^s\} \right\}$$

- The value of self-employment is

$$r V_o^s = w_{so} + V_o^s \psi_o (1 + p_o \theta_o q_o(\theta_o)) + p_o \theta_o q_o(\theta_o) \left(\int_y V_o(w(y)) \partial F_o(y) - V_o^m \right)$$

- The value of a wage-paying job is

$$V_o(w) = \frac{w + \delta_o V_o^m}{r + \delta_o}$$

Vacancy Posting

back

- The present value of posting a vacancy (V) is:

$$rV = -\kappa_o + q_o(\theta_o)(p_o E[J] - V)$$

- where p_o is the probability that the match wage exceed the reservation wage $\bar{w}_o$
- The expected value of a job to a firm is:

$$E[J] = \frac{E[y - w(y)|w(y) \geq \bar{w}_o]}{r + \delta_o}$$

- where $w(y)$ is the negotiated wage
- $\implies$ In equilibrium vacancy creation is determined by:

$$E[y - w(y)|w(y) \geq \bar{w}_o] - \frac{\kappa_o(r + \delta_o)}{q(\theta_o)p_o} = 0$$

Equilibrium Expression for ψ_o back

$$
\begin{aligned}
E[V_o^m] =& V_o^s \left(\Gamma \left(\sum_d \left(\frac{\tau_{od} V_d^s}{V_o^s} \right)^{\phi} \right)^{\frac{1}{\phi}} + (1-\Gamma) \frac{(V_o^s)^{\phi}}{\sum_d \left(\tau_{od} V_d^s \right)^{\phi}} \right) \\
E[V_o^m] =& V_o^s (1+\psi_o) \\
\psi_o =& \left(\Gamma \left(\sum_d \left(\frac{\tau_{od} V_d^s}{V_o^s} \right)^{\phi} \right)^{\frac{1}{\phi}} + (1-\Gamma) \frac{(V_o^s)^{\phi}}{\sum_d \left(\tau_{od} V_d^s \right)^{\phi}} \right) - 1 \\
\Gamma =& \frac{\pi/\phi}{\sin(\pi/\phi)}
\end{aligned}
$$

Steady-State Equilibrium

back

A steady-state equilibrium in this economy is a set $\{w_o(y, m_o), \theta_o, v_o, s_o, L_o\}$ for each o such that:

1. The number of vacancies (v_o) in each labor market is determined by:

$$(1-\eta)\left(E\left[y|\bar{w}_o \leq y\right] - \bar{w}_o\right) + \eta\left(E\left[y|\bar{w}_o \leq y < \hat{y}_o\right] - \hat{y}_o\right) - \frac{\kappa_o(r+\delta_o)}{q(\theta_o)p_o} = 0$$

2. Wages are determined by:

$$w_o(y, m_o) = \begin{cases} (1-\eta)(1+\psi_o)rV_o^s + \eta y & \text{if } y < m_o \text{ or } y > \hat{y}_o \\ m_o & \text{if} \quad y \in [m_o, \hat{y}_o] \end{cases}$$

3. The Beveridge curve: $s_o = \frac{\delta_o}{\delta_o + p_o\theta_o q(\theta_o)}$
4. Net migration flows lead to fixed population shares: $L_o s_o(1-\pi_{oo}) = \sum_{d\neq o}\pi_{do}L_d s_d$
5. The value of self-employment is consistent with the productivity distribution:

$$rV_o^s = \Upsilon\left(A(\theta_o, \psi_o)w_{so} + (1 - A(\theta_o, \psi_o))\frac{\left(E\left[y|y \geq \bar{w}_o\right] + \hat{y}_o - E[y|m_o < y \leq \hat{y}_o]\right)}{(1+\psi_o)}\right)$$

Equilibrium without a Minimum Wage

back

- The value of self-employment (V_o^s) is:

$$rV_o^s = w_{so} + V_o^s \psi_o (1 + p_o \theta_o q_o(\theta_o)) + p_o \theta_o q_o(\theta_o) \left(\int_y V_o(w(y)) \partial F_o(y) - V_o^m \right)$$

- Self-employment earnings today plus the expected returns to migration plus...
- Where ψ_o is the additional value of having the option to migrate:

$$E[V_o^m] = V_o^s (1 + \psi_o) \quad ; \quad \psi_o = \left(\sum_d \left(\frac{\tau_{od} V_d^s}{V_o^s} \right)^{\phi} \right)^{\frac{1}{\phi}} - 1$$

Equilibrium without a Minimum Wage

back

- The value of self-employment (V_o^s) is:

$$rV_o^s = w_{so} + V_o^s \psi_o (1 + p_o \theta_o q_o(\theta_o)) + p_o \theta_o q_o(\theta_o) \left(\int_y V_o(w(y)) \partial F_o(y) - V_o^m \right)$$

- Self-employment earnings today plus the expected returns to migration plus
- The probability of not getting a job today times the value of being self-employed tomorrow
- Where ψ_o is the additional value of having the option to migrate:

$$E[V_o^m] = V_o^s (1 + \psi_o) \quad ; \quad \psi_o = \left(\sum_d \left(\frac{\tau_{od} V_d^s}{V_o^s} \right)^{\phi} \right)^{\frac{1}{\phi}} - 1$$

Equilibrium without a Minimum Wage

back

- The value of self-employment (V_o^s) is:

$$rV_o^s = w_{so} + V_o^s\psi_o(1 + p_o\theta_o q_o(\theta_o)) + p_o\theta_o q_o(\theta_o)\left(\int_y V_o(w(y))\partial F_o(y) - V_o^m\right)$$

- Self-employment earnings today plus the expected returns to migration plus
- The probability of not getting a job today times the value of being self-employed tomorrow
- Plus the probability of getting a job today times the the expected value of employment
- Where ψ_o is the additional value of having the option to migrate:

$$E[V_o^m] = V_o^s(1 + \psi_o) \quad ; \quad \psi_o = \left(\sum_d \left(\frac{\tau_{od}V_d^s}{V_o^s}\right)^{\phi}\right)^{\frac{1}{\phi}} - 1$$

Estimation of the Vacancy Filling Rate

back

- The vacancy filling rate is: $q_o(\theta) = A_o \theta^{-\alpha}$
- Total hires in o is: $h_o = s_o L_o A_o \theta_o^{1-\alpha}$
- Estimate the matching elasticity α using EES data from 2010-2014

$$\log\left(\frac{h_{ot}}{s_{ot} L_{ot}}\right) = \beta_0 + \beta_1 \log \theta_{ot} + \varepsilon_{ot}$$

- Estimate the self-employment rate in each year using the 2002 and 2012 Censuses
- $\implies \alpha = 1 - \beta_1$

Estimated Match Elasticity

back

	log hires $/sL_o$		log hires $/s$	
	(1)	(2)	(3)	(4)
$\log(v/(sL_o))$	0.600***	0.701***		
	(0.126)	(0.161)		
$\log(v/s)$			0.601***	0.676***
			(0.127)	(0.173)
Region FE	Y	N	Y	N
Year FE	Y	N	Y	N
Regions	120	24	120	24

Notes: Columns 1 and 3 report the two-way fixed effect regressions for the period between 2010-2014, while columns 2 and 4 report the OLS results for 2012 only. Standard errors are clustered by region. $^{*}p < .1, ^{**}p < .05, ^{***}p < .01$

Estimation of the Productivity Distribution

back

- **Assumption**: wages in each industry x location are distributed log-Normal$(\bar{w}_{oi}, \sigma^2_{oi})$
- Estimate the parameters using the observed shares in each wage band as:

$$\sigma^2_{oi} = \sum_k \left(\frac{empl_{oi,k}}{empl_{oi}} \right) \frac{\log(w_{ub,k}) - \log(w_{lb,k})}{\Phi^{-1}(P_{oi}(w \leq \log(w_{ub,k}))) - \Phi^{-1}(P_{oi}(w \leq \log(w_{lb,k})))}$$

$$\bar{w}_{oi} = \sum_k \left(\frac{empl_{oi,k}}{empl_{oi}} \right) \left(\log(w_{ub,k}) - \sigma_{oi} \Phi^{-1}(P_{oi}(w \leq \log(w_{ub,k}))) \right)$$

- Use estimated wage markdowns in each labor market from Marshall (2025a) to estimate productivity $\bar{y}_o = \bar{w}_o - \log(\mu_o)$
- Calculate self-employment income using per-capita consumption in the 2012 LSMS

Simulated Parameters

back

Parameter	Mean (1)	Min (2)	Max (3)
y_o	5.939	5.660	6.176
σ_o	0.648	0.558	0.820
Z_o	0.030	0.006	0.077
w_{so}	19.808	16.506	22.178
δ_o	0.081	0.015	0.377
κ_o	84.276	14.145	262.411
ψ_o	0.017	0.008	0.037
Share constrained	0.017	0.000	0.100