

Rural Migrants and Urban Informality: Evidence from Brazil

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Motivation

Urban population in developing countries grew by **12.5%** between 2015-2020; it is projected to grow by **64.7%** until 2050 ([UNCTAD, 2021](#)).

These countries are also characterized by low firm growth (e.g. [Hsieh and Klenow, 2014](#)), high informality, underemployment and unemployment, especially among young workers ([Bandiera et al., 2021](#)).

Will developing economies be able to generate enough good jobs to accommodate this fast growing urban workforce?

Rural-urban migration accounts for a substantial fraction of population growth in urban areas ([Jedwab et al., 2017](#)).

Dominant view ([Fields, 1975](#); [Harris and Todaro, 1970](#)): rural migrants join the urban pool of unemployed or informal workers.

Recent evidence seems consistent with this view, at least in the short-run ([Corbi et al., 2021](#); [Kleemans and Magruder, 2018](#))

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However...

Harris-Todaro-Fields framework: perfect wage rigidity in the formal sector.
Unlikely to hold in the long(er) run.

Immigration often represents a sizable **labor supply shock** → potentially large effects on firm dynamics, in particular via firm entry.

- Mirror image of the start-up deficit in the US (e.g. [Karahan et al., 2019](#)).

Formal and informal sectors are highly integrated – **no duality**

- Higher immigration can increase dynamism in the formal sector, even if immigrants are initially absorbed in the informal sector.

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Informality

Definitions:

- (i) **Extensive margin**: whether entrepreneurs register or not their *business* .
- (ii) **Intensive margin**: whether firms that are formally registered hire their workers with or without a formal contract.

Negative consequences of informality:

- Tax avoidance, hindering the provision of public goods.
- Misallocation of resources.
- Informal workers have no job stability, no unemployment insurance, nor employer provided social security.

Informality may also : (i) provide *de facto* flexibility to firms and workers; (ii) be a stepping-stone into the formal sector; and (iii) be an employment buffer.

This paper

Question: What are the labor market and aggregate effects of rural-urban migration in urban **destinations** ?

What we do:

- ④ Shift-share IV design to identify the causal effects of immigration at **destination** in Brazil:
 - (i) Local labor markets: \uparrow formality, \downarrow informality and \downarrow wages (formal and informal); no effects on non-employment
 - (ii) **Formal firms'** dynamics: \uparrow formal firms, \uparrow jobs, \uparrow entry and \uparrow exit.
- ④ Develop a model of firms dynamics with both margins of informality and heterogeneous growth profiles across firms.
- ④ Estimate the model + counterfactuals: equilibrium effects of migration at **destination** with more/less enforcement, with/without formal wage rigidity.

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Contributions

Rural-urban migration and urban labor markets: theory (Fields, 1975; Harris and Todaro, 1970) and evidence (e.g. Corbi et al., 2021; Kleemans and Magruder, 2018).

- We show that rural-urban migration can lead to **lower informality**.

Labor market frictions in developing countries (e.g Abebe et al., 2021; Alfonsi et al., 2020; Carranza et al., 2022; Donovan et al., 2020; Franklin, 2018).

- We show that labor supply shocks can create formal jobs in equilibrium.

Population growth and firm dynamics in the US (Karahan et al., 2019; Pugsley and Sahin, 2019).

- Our findings are the mirror image + new model of formal and informal firm dynamics + first empirical evidence in a developing country context.

Immigration and firms: developed (e.g. Dustmann and Glitz, 2015; Kerr et al., 2015; Lewis, 2011; Peri, 2012) and developing countries (Albert et al., 2021; Imbert et al., 2022)

- We focus on aggregate effects, the role of informality and firm dynamics.

Outline

- 1 Empirical Analysis
- 2 Model
- 3 Model Estimation and Counterfactuals
- 4 Final remarks

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Data sources

- **Migration and Labor Market Outcomes:** Decennial Population Census, 1991-2010
 - ▶ Demo. Census
 - ▶ Desc. Stats
 - Migrants = in their current location ≤ 10 years; we use the accumulated immigration rate 2000-2010.
 - Focus migration to urban areas (88% of all migration), and cross-state borders (40% of migration to urban areas). ▶ Map
- **Firms:**
 - Matched employer-employee, admin data set from the Ministry of Labour → universe of formal firms and workers (RAIS) ▶ RAIS
 - Matched employer-employee, survey data on small (up to 5 employees) formal and informal firms (ECINF)
- **Push Shocks:**
 - International Agricultural Commodity Price Shocks \times crop shares at the municipality level (in 1980).
 - Alternatively: SPEI drought index \times growing season by crop \times crop shares.
 - ▶ Shocks-Construction
 - ▶ Shocks-Maps

Empirical Design

$$\Delta y_d = \beta_0 + \beta_1 Mig_d + \beta_2' X_d + u_d$$

where

- $\Delta y_d = y_{d,2010} - y_{d,2000}$ (Dem. Census) or $y_{d,2011-12} - y_{d,1999-00}$ (RAIS)
- $Mig_d = \sum_o \sum_{t=2001}^{2010} \frac{Mig_{o,d,t}}{Pop_d,2000}$;
- X_d : share of male, young and high skill (completed HS) in 2000.

Instrument: $Z_d = \sum_o \underbrace{\lambda_{o,d}}_{\text{shares}} \underbrace{s_o}_{\text{shift}}$

► First Stage

To study the dynamics of effects (firms only):

$$y_{d,t} - y_{d,1999-00} = \gamma_{0,t} + \gamma_{1,t} Mig_d + \gamma_{2,t} X_d + \varepsilon_{r,t},$$

for $t = 1997 - 98, 2011 - 12, \dots, 2017 - 18$.

Effects of Immigration on Workers

	Wage employment			Log monthly wage		
	Overall (1)	Formal (2)	Informal (3)	Overall (4)	Formal (5)	Informal (6)
Panel A: OLS						
Immigration	0.037 (0.019)	0.105 (0.023)	-0.068 (0.014)	0.062 (0.076)	0.031 (0.068)	0.034 (0.092)
Panel B: IV-Price						
Immigration	0.102 (0.101)	0.397 (0.147)	-0.294 (0.099)	-1.575 (0.568)	-2.149 (0.667)	-1.864 (0.726)
F Statistic (IV)	16.87	16.87	16.87	16.87	16.87	16.87
Baseline Mean	0.332	0.229	0.103	-	-	-
Observations	3548	3548	3548	3548	3548	3548

- 1p.p. $\uparrow\uparrow$ in $Mig_d(14.5\%SD) \rightarrow \uparrow\uparrow$ 0.4 p.p. in share of formal workers (avg. employment share of 19%) \approx 2.1% increase.

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- Formalization effect driven by workers moving from informal to formal jobs; if anything, a slight increase in total wage employment.

Effects on Firms

	# firms (1)	Entry (2)	Exit (3)	Nb jobs (4)	Firm wage (5)
Panel A: OLS					
Immigration	1.344 (0.109)	0.746 (0.263)	0.864 (0.434)	1.071 (0.269)	0.370 (0.101)
Panel B: IV - Price					
Immigration	2.395 (0.615)	7.205 (2.402)	6.563 (3.118)	2.178 (0.843)	-3.403 (1.147)
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- 1p.p. $\uparrow\uparrow$ in $Mig_d \rightarrow \uparrow\uparrow$ 2.4% in the number of firms, 2.2% in the number of formal jobs and $\downarrow\downarrow$ 3.4% in wages.

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- There is greater churn, effect on entry is slightly higher.

▶ Are migrants creating firms?

▶ Composition-Industries

▶ Composition-Firm Quality

▶ Composition-Firm Size

▶ Dynamic Effects

Robustness

- **Pre-trends**: dynamic effects + Include lagged changes in outcomes as a control
- **Potential confounders**: Control for population, industry shares and log GDP per capita at baseline + driving distance to capital
- **Persistence of migration** (the shares): Control for lagged migration rates
▶ Results
- **Demand Channel**: Control for local price shocks and shocks to neighboring regions weighted by distance.
- **Capital Channel**: Control for exposure through bank network. ▶ Results
- **Drought** push shock ▶ Drought IV
- Estimate all results using Borusyak, Hull and Jaravel (2021)

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Model: Overview

- Continuum of firms indexed by their individual productivity, θ .
- All firms have the same technology, use labor as their only input, operate in the same industry, produce a homogeneous good and are price takers.
- Tradeoffs are driven by regulations and enforcement:
 - **Informal firms**: lower entry costs and no regulatory costs (e.g. taxes); **but** cost of operation is increasing in firm's size.
 - **Formal firms**: face all regulatory costs, but constant marginal costs; can evade labor regulations by hiring informal workers.
- Endogenous exit + exogenous death shock (different across sectors).
- No aggregate shocks, **homogeneous labor**, and labor supply is fixed.

Key feature: Firms' productivity process

- **Dynamics** are driven by the evolution of firms' **productivity**.
- Firms differ in terms of their **current productivity**, θ_{jt} , and their **long-run productivity** $\nu \sim H$, which is observed before entry occurs.
- The expected value of entry depends on ν : $E[V_s(\theta, w) | \nu]$, $s = i, f$.
- After entry in either sector occurs, the productivity process is given by:

$$\ln \theta_{j,1} = \ln \nu_j + \ln \epsilon_{j,1}$$

$$\ln \theta_{j,t} = \rho_s \ln \theta_{j,t-1} + (1 - \rho_s) \ln \nu_j + \ln \epsilon_{j,t}, \quad t \geq 2$$

where j indexes firms, $s = i, f$ denotes the sector, and $\ln \epsilon \sim \ln \mathcal{N}(0, \sigma_\epsilon^2)$.

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Estimation and counterfactuals

Estimation:

- We use a two-step Simulated Method of Moments (SMM) procedure.
 - 1 First step: System GMM and panel data for productivity process parameter + statutory values of taxes.
 - 2 Second step: 12 remaining parameter estimated using SMM

Counterfactuals:

- **Immigration**: once and for all 10% labor supply shock + increase in consumption (\approx 80th percentile immigration rate).
- **Immigration + Harris-Todaro-Fields**: formal wages perfectly rigid.
- **Immigration + enforcement**: government intensifies enforcement.

Aggregate effects of a labor supply shock

Once-and-for-all increase in labor supply of 10% (\approx 80th percentile immigration rate).

	Baseline Economy	Labor Supply Shock (LSS)
% Informal Workers	0.291	0.277
% Informal Firms	0.696	0.682
Wages	1.000	0.971
Mass of formal firms	1.000	1.064
Avg. firm productivity	1.000	0.994
Output	1.000	1.059
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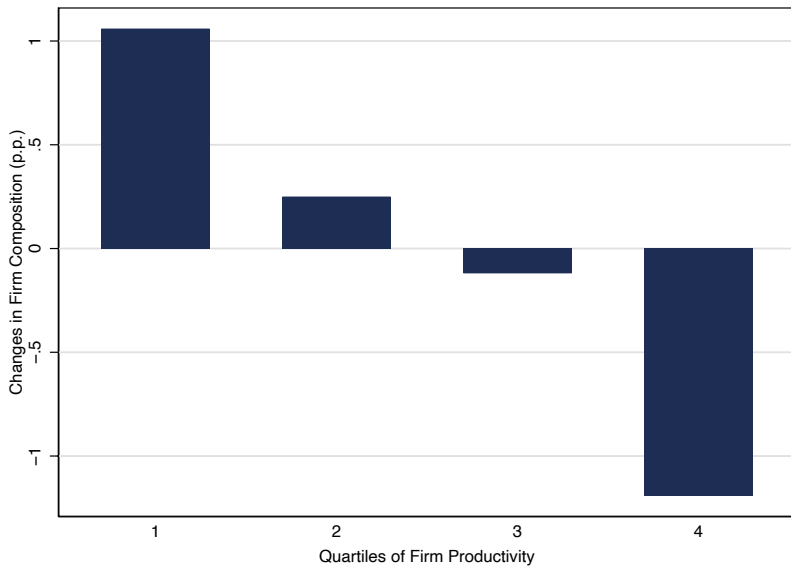
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Changes in firm composition: formal sector



Harris-Todaro-Fields Scenario: Wage rigidity in the formal sector

	Baseline Economy	Labor Supply Shock (LSS)	LSS + Formal Wage Rigidity
% Informal Workers	0.291	0.277	0.432
% Informal Firms	0.696	0.682	0.783
Wages	1.000	0.971	–
Formal	1.000	–	1.000
Informal	1.000	–	0.847
Mass of formal firms	1.000	1.064	0.949
Avg. firm productivity	1.000	0.994	0.882
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Aggregate effects with stricter enforcement

	Baseline Economy	Labor Supply Shock (LSS)	LSS + Enforcement
Labor Informality	0.293	0.277	0.1805
Firms Informality	0.701	0.682	0.204
Wages	1.000	0.971	0.978
Avg. firm productivity	1.000	0.994	1.025
Output	1.000	1.059	1.083
Taxes	1.000	1.072	1.296

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Final remarks

- Immigration leads to a decrease in wages, and an increase in entry of formal firms, number of formal firms, jobs and formality share at destination.
- These contrast with the common narrative that rural-urban migration increases informality or under-employment in developing country cities.
- Instead, they suggest that developing countries might experience demographic dividends in general, and in particular from internal migration.
- However, empirical results and counterfactuals indicate that these gains do not accrue to the most productive firms → output per worker falls.
- Increasing enforcement could lead to higher dividends from immigration, but at the expense of a potentially large displacement of informal firms.
- The typical Harris-Todaro-Fields result arises with downward wage rigidity in the formal sector: higher informality + lower output gains.

SUPPORT SLIDES

Model: Set Up

- Continuum of firms indexed by their individual productivity, θ . Formal and informal firms have the same technology and use labor as their only input:

$$f(\ell) = \theta q(\ell), \quad q' > 0, q'' < 0$$

- Formal and informal firms operate in the same industry, produce an homogeneous good and are price takers.
- *Incumbents* pay a per-period fixed cost to operate, \bar{c}_s , $s = i, f$. *Entrants* pay a cost of entry into both sectors: $c_f^e > c_i^e$.
- In addition to endogenous exit, firms in both sectors face a death shock every period, denoted by δ_s .
- No industry-wide shocks + continuum of firms \rightarrow all aggregate vars. are deterministic.
- Labor supply is fixed.

Incumbents: Profit functions

- Informal firms:

$$\Pi_i(\theta, w) = \max_{\ell} \{\theta q(\ell) - \tau_i(\ell) w\}$$

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$$\Pi_i(\theta, w) = \max_{\ell} \{\theta q(\ell) - \tau_i(\ell) w\}$$

where $\tau_i', \tau_i'' > 0$ and $\tau_i(0) = 0$.

Incumbents: Profit functions

- **Formal firms:** $\Pi_f(\theta, w) = \max_{\ell} \{(1 - \tau_y) \theta q(\ell) - C(\ell)\}$

where

$$C(\ell) = \begin{cases} \tau_{fi}(\ell) w, & \ell \leq \tilde{\ell} \\ \tau_{fi}(\tilde{\ell}) w + (1 + \tau_w) w (\ell - \tilde{\ell}), & \ell > \tilde{\ell} \end{cases}$$

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and

$$\tau'_{fi}, \tau''_{fi} > 0 \text{ and } \tau_{fi}(0) = 0.$$

$$\tilde{\ell} \text{ is such that } \tau'_{fi}(\tilde{\ell}) = 1 + \tau_w.$$

Dynamics

- Dynamics are driven by the evolution of firms' idiosyncratic productivity, θ .
- Firms differ in terms of their current productivity, θ_{jt} , and their long-run productivity $\nu \sim H$, which is observed before entry occurs and drawn from:

$$H(\nu \geq x) = \begin{cases} \left(\frac{\nu_0}{x}\right)^\xi & \text{for } x \geq \nu_0 \\ 1 & \text{for } x < \nu_0 \end{cases}$$

- After entry in either sector occurs, the productivity process is given by:

$$\begin{aligned} \ln \theta_{j,1} &= \ln \nu_j + \ln \epsilon_{j,1} \\ \ln \theta_{j,t} &= \rho_s \ln \theta_{j,t-1} + (1 - \rho_s) \ln \nu_j + \ln \epsilon_{j,t}, \quad t \geq 2 \end{aligned}$$

where j indexes firms, $s = i, f$ denotes the sector, and $\ln \epsilon \sim \ln \mathcal{N}(0, \sigma_s^2)$.

- This structure implies that firms' first productivity draw – given by $\theta_1 = \nu \epsilon_1$ – has a Pareto-Lognormal distribution.

- Formal firms cannot become informal. Informal firms can pay the difference between formal and informal entry costs, $\tilde{c}^e = c_f^e - c_i^e$, and formalize.

- The value functions of formal and informal *incumbents*, respectively:

$$V_f(\theta, w) = \pi_f(\theta, w) + (1 - \delta_f) \beta \max \{0, E_\nu [V_f(\theta', w) | \theta]\}$$

$$V_i(\theta, w) = \pi_i(\theta, w) + \beta \max \{0, (1 - \delta_i) E_\nu [V_i(\theta', w) | \theta], (1 - \delta_f) E_\nu [V_f(\theta', w) | \theta] - \tilde{c}^e\}$$

where β is the discount factor, δ_s the exogenous exit.

- Exit decisions and informal-to-formal transitions follow cutoff rules:

$$E_\nu [V_s(\theta', w) | \underline{\theta}_s] = 0, \quad s = i, f$$

$$E_\nu [V_f(\theta', w) - V_i(\theta', w) | \bar{\theta}_i] = \tilde{c}^e$$

Entry

- Entrants in both sectors must pay a fixed cost of entry, denoted by c_s^e , $s = f, i$.
- These parameters will be estimated, but we expect that $c_f^e > c_i^e$.
- The expected value of entry for a firm with long-run productivity ν : $E [V_s(\theta, w) | \nu]$.
- Entry is characterized by the following threshold rule:

$$\begin{aligned} E [V_i(\theta, w) | \underline{\nu}_i] &= c_i^e \\ E [V_f(\theta, w) - V_i(\theta, w) | \underline{\nu}_f] &= c_f^e - c_i^e \end{aligned}$$

where $\underline{\nu}_s$ characterizes the last firm to enter sector $s = i, f$.

Migration and Labor Market Outcomes

- ◇ Unit of analysis: Brazilian municipalities
- ◇ Data source: [Decennial Population Census](#), 1991-2010
- ◇ Definitions:
 - We restrict the sample to 15-64 years old.
 - Migrants = those who came to their current location ≤ 10 years.
 - We compute the accumulated immigration rate between 2000 and 2010 and obtain a squared migration matrix between 3,658 municipalities.
 - Focus on flows to urban areas (88% of all migration), and across state borders (40% of migration to urban areas). [▶ Map](#)
 - We define formal workers as private sector employees with a formal contract, and informal ones are those without a formal contract. [▶ back](#)

Formal firms' outcomes

- ◇ Data source: *Relação Anual de Informações Sociais* (RAIS)
 - Matched employer-employee, admin data set from the Ministry of Labour in Brazil → universe of formal firms and workers.
 - Moments at the municipality level: (i) entry and exit; (ii) avg. firm size (as # employees); (iii) total number of establishments and formal workers; and (iv) the firm-level average wage.

Push Shocks: Crop Prices and Climate

Price shocks:

- Source: World Bank Commodity Price Data (The Pink Sheet) 1972-2020.
- 12 Crops: bananas, cocoa, coffee, cotton, maize, orange, rice, soybeans, sugar, tobacco, wheat and wood.
- Crop×month-level price shock, ε_{cm} : residual from AR(1) process.
- Municipality×year level shock: sum of crop-level shocks weighted by the share of each crop in value of production in 1980 Agricultural Census, π_{oc} .

$$s_o^{prices} = \sum_m \sum_c (\pi_{oc} \times \varepsilon_{cm})$$

Push Shocks: Crop Prices and Climate

Drought shock:

- Source: SPEI (Standardized Precipitation-Evapotranspiration Index), geo-localised measures of water balance linked to rainfall and temperature (Vicente-Serrano et al., 2010).
- Municipality×month-level shock, D_{om} : indicator for a drought if $\text{SPEI} < 0$.
- Municipality×year-level shock: sum of month-level shock weighted by the share of agricultural production, π_{oc} , that is in its growing season, g_{ocm} (1980 Agricultural Census).

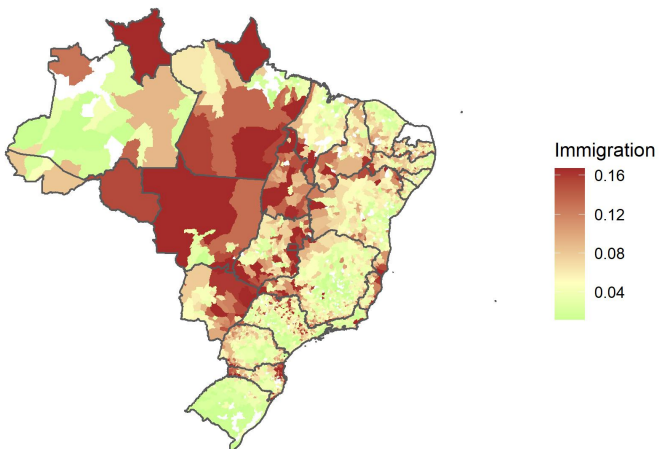
$$s_o^{drought} = \sum_m \sum_c (\pi_{oc} \times g_{ocm} \times D_{om})$$

Table 1: Descriptive Stats - Census

	2010				2000			
	Mean	SD	Med.	N	Mean	SD	Med.	N
Population	24,380	141,257	4,890	3,548	18,064	167,356	3,743	3,453
% High Skill	0.253	0.079	0.241	3,548	0.172	0.062	0.171	3,453
Out-mig.	0.319	0.249	0.281	3,548	0.254	0.173	0.213	3,453
Out-mig. S-to-S	0.112	0.155	0.074	3,548	0.095	0.104	0.059	3,453
% Formal	0.194	0.120	0.165	3,548	0.138	0.118	0.106	3,453
% Informal	0.150	0.064	0.146	3,548	0.074	0.042	0.068	3,453
% non-employed	0.446	0.091	0.438	3,548	0.432	0.072	0.426	3,453
Formal wage	4.356	1.466	4.094	3,548	3.181	1.373	3.006	3,453
Informal wage	2.753	1.013	2.493	3,548	2.328	1.146	2.069	3,453

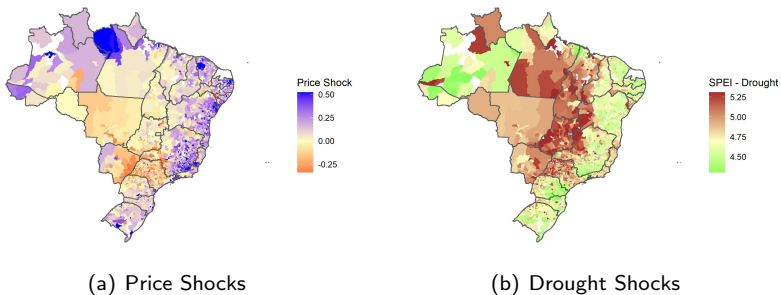
Notes: Weighted by the population at the destination municipality in the previous census; we compute the share of formal and informal as a proportion of total hours worked.

Immigration, 2000-2010



Notes: Computed using the Decennial Population Census. Darker areas denote higher immigration rates.

Figure 1: Migration Push Shocks



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▶ Back to Main

First Stage

	Immigration	
	(1)	(2)
Price	-0.024 (0.003)	
Drought		0.016 (0.003)
Observations	3548	3548

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Composition effects at destination

IV-Price			
Dep. var. (share of):	Female	Low Skill	Young
	(1)	(2)	(3)
Immigration	-0.083 (0.030)	0.029 (0.210)	0.257 (0.058)
Baseline Mean	0.483	0.720	0.128
Observations	3,548	3,548	3,548

Labor Market Effects by Skill

	High-Skilled Workers			Low-Skilled Workers		
	Formal (1)	Informal (2)	Non-employed (3)	Formal (4)	Informal (5)	Non-employed (6)
Panel A: OLS						
Immigration	0.052 (0.026)	-0.045 (0.014)	-0.01 (0.016)	0.153 (0.024)	-0.063 (0.013)	-0.072 (0.018)
Panel B: IV-Price						
Immigration	0.372 (0.171)	-0.239 (0.103)	0.018 (0.135)	0.329 (0.108)	-0.284 (0.094)	0.096 (0.122)
Observations	3548	3548	3548	3548	3548	3548

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Wage Effects by Skill

	High-Skilled Workers		Low-Skilled Workers	
	Formal wage (1)	Informal wage (2)	Formal wage (3)	Informal wage (4)
Panel A: OLS				
Immigration	-0.066 (0.08)	-0.174 (0.157)	0.094 (0.105)	0.19 (0.087)
Panel B: IV-Price				
Immigration	-1.202 (0.448)	-0.475 (0.654)	-2.023 (0.73)	-2.059 (0.907)
Observations	3527	3514	3546	3548

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Share of migrants by firm ownership

Share of Migrants:	Self-emp. (1)	Firm Owner (2)	Small Firm Owner (3)	Big Firm Owner (4)
Immigration	-0.257 (0.195)	0.173 (0.288)	0.160 (0.330)	-0.062 (0.459)
Observations	3,547	3,076	2,969	2,061

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

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Sectoral composition

Industries:	Service (1)	Construction (2)	Manufacturing (3)	Other Sectors (4)
<i>Panel A: Shares of Firms</i>				
Immigration	0.232 (0.149)	0.174 (0.052)	-0.310 (0.135)	-0.097 (0.134)
Baseline Mean	0.738	0.033	0.111	0.118
<i>Panel B: Shares of Jobs</i>				
Immigration	0.364 (0.394)	-0.111 (0.107)	-0.339 (0.253)	0.085 (0.402)
Baseline Mean	0.465	0.041	0.185	0.309
Observations	3548	3548	3548	3548

Sizes of firms:	≤ 5 (1)	6 to 10 (2)	11 to 20 (3)	21 to 50 (4)	> 50 (5)
<i>Panel A: Shares of Firms</i>					
Immigration	0.358 (0.135)	-0.165 (0.067)	-0.119 (0.047)	-0.079 (0.040)	0.005 (0.034)
Baseline Mean	0.706	0.131	0.078	0.048	0.036
<i>Panel B: Shares of Jobs</i>					
Immigration	0.049 (0.093)	-0.065 (0.061)	-0.134 (0.071)	-0.088 (0.101)	0.237 (0.254)
Baseline Mean	0.129	0.079	0.086	0.112	0.594
Observations	3548	3548	3548	3548	3548

Dynamic effects

Effects on the composition of firms

We compute firm-level average wages and remove year and region fixed effects.

We compute the quartiles of firms' residual average wage distribution at baseline (1996-1999).

The effects on composition across quartiles:

Panel A: Shares of Firms				
	Q1	Q2	Q3	Q4
Immigration	-0.407 (0.617)	2.664 (0.958)	1.153 (1.223)	-3.410 (1.439)
Panel B: Shares of Jobs				
	Q1	Q2	Q3	Q4
Immigration	-0.159 (0.304)	0.922 (0.427)	1.052 (0.721)	-1.814 (1.046)
Observations	3548	3548	3548	3548

Effects by firm quartile

	Nb firms (1)	Entry rate (2)	Exit rate (3)	Nb jobs (4)	Firm wage (5)
Panel A: IV-Price - Q1					
Immigration	2.877 (0.783)	8.075 (1.985)	5.462 (1.870)	2.603 (1.631)	-2.243 (1.080)
Observations	3548	3548	3548	3548	3443
Panel B: IV-Price - Q2					
Immigration	5.726 (1.625)	13.255 (3.484)	12.295 (3.353)	0.454 (1.546)	-3.795 (1.506)
Observations	3548	3548	3548	3548	3509
Panel C: IV-Price - Q3					
Immigration	0.805 (1.170)	5.608 (2.387)	4.241 (2.454)	3.733 (2.341)	-2.920 (1.376)
Observations	3548	3548	3548	3548	3356
Panel D: IV-Price - Q4					
Immigration	0.511 (0.967)	3.506 (2.003)	1.490 (2.387)	0.414 (2.431)	-4.061 (1.392)
Observations	3548	3548	3548	3548	3425

Results with drought shock

	Nb firms (1)	Entry rate (2)	Exit rate (3)	Nb jobs (4)	Firm wage (5)
IV - Drought Immigration	1.634 (0.307)	1.944 (1.122)	1.925 (1.774)	2.037 (0.626)	-0.756 (0.557)
F Statistic (IV)	18.05	18.05	18.05	18.05	18.05
Observations	3548	3548	3548	3548	3548

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Robustness: Control for Omitted Variables

	Nb firms (1)	Entry (2)	Exit (3)	Nb jobs (4)	Firm wage (5)
Panel A: Controlling for Outcome Lag					
Immigration	2.439 (0.593)	7.412 (1.991)	3.838 (0.933)	2.045 (0.792)	-3.410 (1.153)
Panel B: Controlling for Population Lag					
Immigration	2.435 (0.646)	7.345 (2.086)	5.916 (2.065)	2.089 (0.882)	-2.984 (1.020)
Panel C: Controlling for Immigration Lag					
Immigration	5.303 (3.212)	29.224 (13.644)	20.135 (10.284)	6.163 (4.112)	-15.124 (8.432)
Panel D: Controlling for log(GDP) Lag					
Immigration	2.486 (0.683)	8.472 (2.443)	6.908 (2.476)	2.263 (0.907)	-2.887 (0.971)
Panel E: IV-Price - Controlling for Industries Lag					
Immigration	1.945 (0.531)	6.595 (1.851)	5.167 (1.860)	2.155 (0.811)	-2.549 (0.932)
Observations	3548	3548	3548	3548	3548

Robustness: Control for Alternative Channels

	Nb firms (1)	Entry rate (2)	Exit rate (3)	Nb jobs (4)	Firm wage (5)
<i>Panel A: Controlling for Local and Neighborhood Price Shocks</i>					
Immigration	2.217 (0.539)	4.041 (1.649)	2.795 (2.221)	2.239 (0.746)	-4.067 (1.212)
Observations	3538	3538	3538	3538	3538
<i>Panel B: Controlling for Capital Reallocation</i>					
Immigration	2.455 (0.685)	6.702 (2.571)	5.560 (3.379)	2.515 (0.928)	-3.414 (1.298)
Observations	2630	2630	2630	2630	2630
<i>Panel C: Excluding Firms That Produce Agricultural Goods</i>					
Immigration	2.807 (0.642)	6.805 (2.353)	6.382 (3.123)	2.381 (0.873)	-3.779 (1.222)
Observations	3548	3548	3548	3548	3548

Model's parameters

Parameter	Description	Source	Value	SE
<i>First Step</i>				
τ_w	Payroll Tax	Statutory values	0.375	–
τ_y	Revenue Tax	Statutory values	0.293	–
ρ	Productivity Process: Persistence Parameter	GMM Estimation	0.92	–
ν_0	Pareto's Location Parameter	Calibrated	7.3	–
γ_f	Per-period fixed cost of operation (Formal)	Calibrated	0.7	–
<i>Second Step</i>				
φ_f	Intensive margin: $\tau_f = \left(1 + \frac{\ell}{\varphi_f}\right)\ell$	SMM Estimation	6.450	0.228
φ_i	Extensive margin: $\tau_i = \left(1 + \frac{\ell}{\varphi_i}\right)\ell$	SMM Estimation	5.427	0.303
δ_i	Informal death shock	SMM Estimation	0.148	0.015
δ_f	Formal death shock	SMM Estimation	0.066	0.011
γ_i	Informal, per-period fixed cost of operation	SMM Estimation	0.350	0.161
ξ	Pareto shape parameter	SMM Estimation	3.801	0.092
c_f^e [†]	Formal sector's entry cost	SMM Estimation	7,400	3,383
c_i^e [†]	Informal sector's entry cost	SMM Estimation	2,800	598
α	Span-of-control	SMM Estimation	0.643	0.218
σ_i	Informal productivity process: SD	SMM Estimation	0.144	0.053
σ_f	Formal productivity process: SD	SMM Estimation	0.148	0.032
ρ_i	Informal productivity process: persistence	SMM Estimation	0.935	0.091

[†] Estimates and SD expressed in R\$ of 2003.

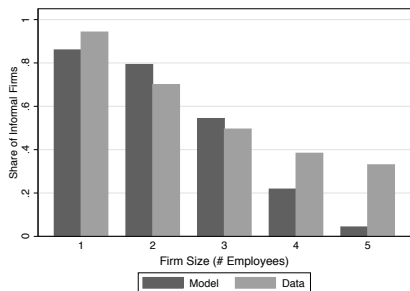
Model Fit (1/4): Targeted moments

Table 1: Model Fit – Targeted moments

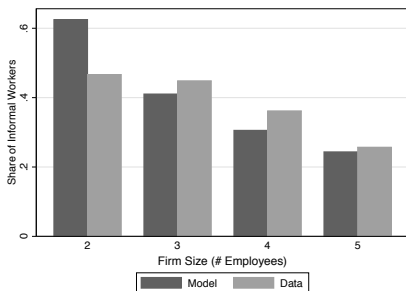
	Model	Data
Share Informal workers	0.305	0.298
Share Informal Firms	0.704	0.696
Informal Firms Size Distribution		
≤ 2 employees	0.929	0.957
≤ 5 employees	1.000	0.998
Formal Firms Size Distribution		
≤ 5 employees	0.694	0.697
6 to 10	0.134	0.144
11 to 20	0.092	0.083
21 to 50	0.056	0.048
> 50	0.024	0.028

Notes: Data moments computed using the RAIS, ECINF and PNAD data sets.

Model Fit (2/4): Extensive and intensive margins of informality

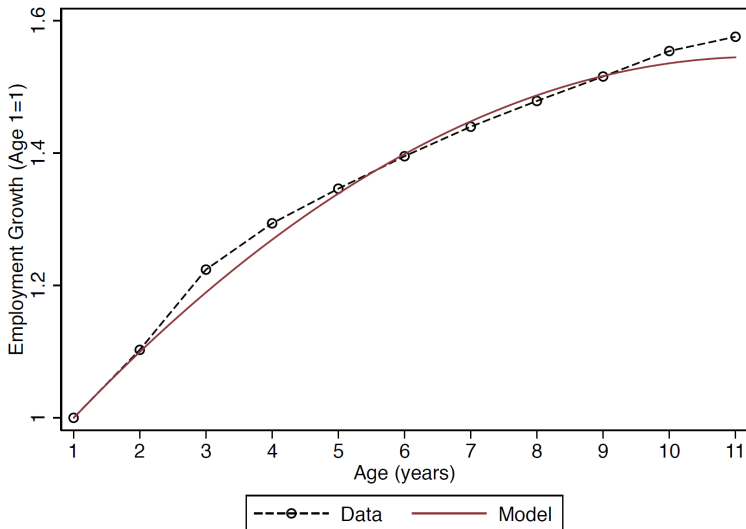


(c) Extensive Mg.

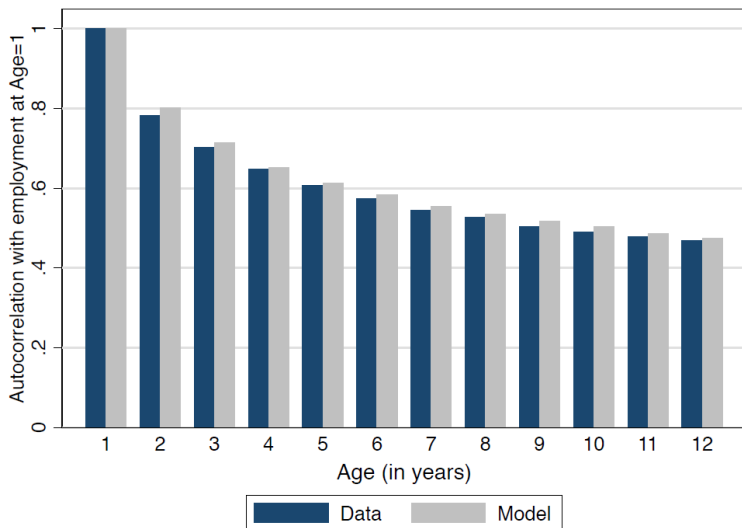


(d) Intensive Mg.

Model Fit (3/4): Firm Growth – Formal Sector



Model Fit (4/4): Autocorrelations – Formal Sector



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