Rural Migrants and Urban Informality: Evidence from Brazil

Clement Imbert
Sciences Po

Gabriel Ulyssea
UCL

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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).

Rural-urban migration is a major contributor of urban growth (Jedwab et al., 2017), will increase with climate change (Rigaud et al., 2018).

Key question: Can developing country cities generate enough good jobs to accommodate this fast growing workforce?

Enough reasons for pessimism:

- Traditional "Harris-Todaro-Fields" view predicts that rural-urban migration leads to higher unemployment and informality in urban destinations.
- These predictions are supported by empirical evidence on the short-run effects of rural-urban migration (e.g. Kleemans and Magruder, 2018).
- Consistent with ample evidence on frictions facing firms and workers, low firm growth, high informality and unemployment.

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This paper

Question: What are the economic effects of rural-urban migration on local urban economies in Brazil?

1. Shift-share IV design to identify the causal effects of immigration at destination in Brazil using decadal changes:
   (i) Local labor markets: ↑ formality, ↓ informality and ↓ wages (formal and informal); no effects on non-employment
   (ii) Formal firms' dynamics: ↑ formal firms, ↑jobs, ↑entry and ↑exit.
   (iii) Results are due to the long time horizon: short-run specification gives the informality-increasing effects documented in the literature.

2. Develop and estimate a model of firm dynamics and informality.
   (i) Model replicates the IV results qualitatively and quantitatively
   (ii) Transition dynamics with sluggish formal wage adjustment: ↑ informality in the short run following a migration shock.
   (iii) Informality serves as "stepping-stone" for firms, but reduces the overall dividends from immigration.

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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.

$$\begin{aligned} \text{Informal firms} &= (1) \quad \approx 70\% \text{ of firms in Brazil} \\ \text{Informal workers} &= (1)+(2) \quad 30\text{-}80\% \text{ of workers in LAC} \end{aligned}$$

The intensive margin accounts for 40-44% of informal employment in Latin American countries!

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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

Outline

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 $\rightarrow$ 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). ▸ Shocks-Construction ▸ Shocks-Maps
  - Alternatively: drought shocks (SPEI drought index).

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)
- $\Delta y_d = y_{d,\text{2011-12}} - y_{d,\text{1999-00}}$ (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: $Z_d = \sum_o \underbrace{\lambda_{o,d}}_{\text{mig.matrix 90's}} \times \underbrace{s_o}_{\text{price shifters}}$

▸ First Stage

Dynamic effects:

$$\Delta y_{dt} = y_{d,t} - y_{d,\text{1999-00}},$$

for $t =$ 1997-98 and $t =$ 2011-12, ..., 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	0.105	−0.068	0.062	0.031	0.034
	(0.019)	(0.023)	(0.014)	(0.076)	(0.068)	(0.092)
Panel B: IV-Price						
Immigration	0.102	0.397	-0.294	−1.575	−2.149	−1.864
	(0.101)	(0.147)	(0.099)	(0.568)	(0.667)	(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	3545	3545	3545	3545	3545	3545

- 1p.p. $\uparrow\uparrow$ in $Mig_d(18.5\%SD) \rightarrow \uparrow\uparrow$ 0.4 p.p. in share of formal workers (avg. employment share of 23%) $\approx$ 1.7% 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.

▸ LF composition ▸ Employment effects by skill ▸ Wage effects by skill ▸ Occup. composition

Effects on Firms

	# firms (1)	Entry (2)	Exit (3)	Nb jobs (4)	Firm wage (5)
Panel A: OLS					
Immigration	1.344	0.746	0.864	1.071	0.370
	(0.109)	(0.263)	(0.434)	(0.269)	(0.101)
Panel B: IV - Price					
Immigration	2.395	7.205	6.563	2.178	−3.403
	(0.615)	(2.402)	(3.118)	(0.843)	(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? ▸ Dynamic Effects

Further implications for local economies

- Firm composition shifts towards retail, services and construction, and away from manufacturing (similar effects on jobs). ▸ Composition-Industries
- New entrants are small in size: $\uparrow\uparrow$ share of firms ≤ 5 employees. ▸ Composition-Firm Size
- Expansion occurs in the middle of the productivity distribution, with a relative decline in the share of top-productivity firms. ▸ Composition-Firm Quality

  $\Rightarrow$ Similar to the "urbanization without industrialization" in Gollin et al. (2016).

- Effects driven by municipalities in the bottom and, to a lesser extent, middle terciles of the GDP per capita distribution.
  - Top tercile's avg. income is $2\times$ higher than middle's and $4.5\times$ larger than bottom tercile's.

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 price shocks at destination and shocks to neighboring regions weighted by distance.
- Capital Channel: Control for exposure through bank network. ▸ Results
- Estimate all results using Borusyak, Hull and Jaravel (2021)

Discussion: Short vs Long Run

For a subset of destination municipalities (705), we can construct a yearly panel using data from the National Household Survey (Corbi et al., 2023).

Short-run, y-o-y specification: $\Delta y_{dt} = \beta_0 + \beta_1 Mig_{dt} + \beta_2' X_d + \gamma_t + u_d$

We need a higher frequency shifter: drought shocks using SPEI (Albert et al., 2023; Corbi et al., 2023). ▸ Drought Shock ▸ Shocks-Maps

Results using drought shocks:

- Benchmark specification (decadal changes), full sample: results unchanged ▸ results
- Benchmark specification, restricted sample: results unchanged ▸ results
- Short-run specification (y-o-y): standard "Harris-Todaro-Fields" results ↓↓ wage employment and formality ▸ short run

Outline

Model: Overview

- Dynamic setting that differentiates firms' initial conditions and transitory shocks to productivity $\rightarrow$ heterogeneous growth profiles across firms
- Selection in/out of two margins of informality can occur both upon entry and over the life cycle of firms $\rightarrow$ informality can be a stepping-stone.
- 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.
- Frictions: regulations that are imperfectly enforced, giving rise to informality
  - 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.
- No aggregate shocks, homogeneous labor, and labor supply is fixed.

▸ Model: details

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: $E\left[V_s\left(\theta, w\right)\middle|\nu\right]$, $s = i, f$.
- After entry in either sector occurs, the productivity process is given by:

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

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

Outline

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

▸ Estimates ▸ Model Fit

Counterfactuals:

1. Immigration: once and for all 10% labor supply shock ($\approx$ 80th percentile immigration rate).
2. Transition dynamics: sluggish (downward) wage adjustment in the formal sector.
3. 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).

	IV Estimation	Model
Share Informal Workers ($\Delta\%$)	-3.9	-4.1
Wages ($\Delta\%$)	-5.7	-3.4
Number Formal Firms ($\Delta\%$)	14.7	16.3
Newly created firms	–	9.9
Previously informal firms	–	6.4
Share Informal Firms ($\Delta\%$)	–	-5.3
Average Firm Productivity ($\Delta\%$)	–	-1.4
Output ($\Delta\%$)	–	7.1
Taxes ($\Delta\%$)	–	8.7

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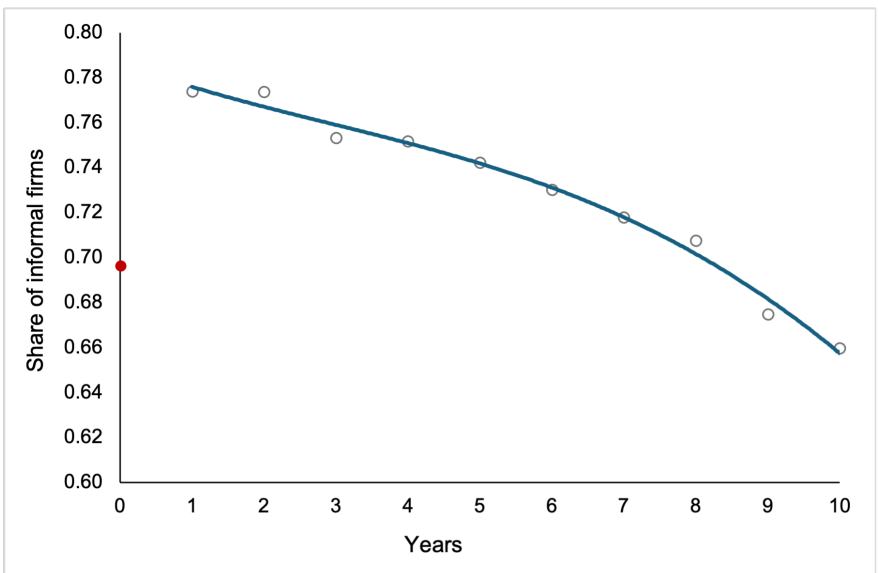
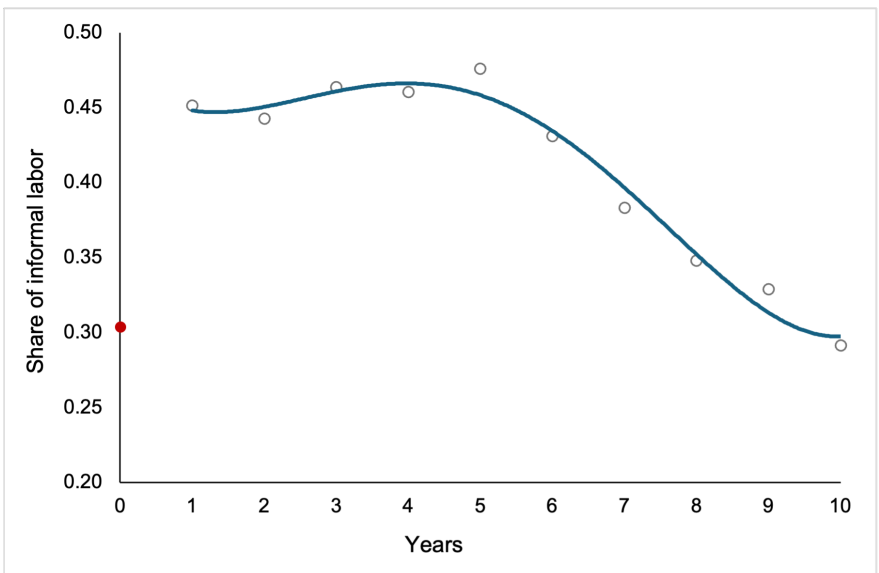
Transition Dynamics

- Treat labor supply shock as a "MIT shock" that hits in $t = 1$. Focus on the equilibrium along a perfect-foresight path.
- Downward formal wage rigidity: $w_{f,t} = \gamma w_{t-1}$, $\gamma = 0.996$ following (Schmitt-Grohé and Uribe, 2016). Informal wages are fully adjustable.



(a) Firm informality



(b) Labor informality

What if we (nearly) shut down the informal sector?

	Baseline	LS Shock	LS Shock + Enforcement
Share Informal Labor	0.304	0.291	0.188
Share Informal Firms	0.696	0.660	0.221
Wages	1.000	0.966	0.979
# of Firms	1.000	1.038	0.889
# of Formal Firms	1.000	1.163	2.280
Avg. Firm Productivity	1.000	0.986	1.025
Output	1.000	1.071	1.083
Taxes	1.000	1.087	1.309

Outline

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.
  - Negative results are observed in the short- but not the the long-run.
- Our results thus suggest that developing countries might experience long-run demographic dividends, in particular from internal migration.
- However, empirical results and counterfactuals indicate that these gains do not accrue to the most productive firms $\rightarrow$ 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.
  - Broader lesson for the role of frictions?

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

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

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and

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

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

Back

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:

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

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.

Back

- 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:

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

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

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

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

$$E_\nu\left[V_s(\theta', w)\middle|\underline{\theta}_s\right] = 0, \quad s = i, f$$
$$E_\nu\left[V_f(\theta', w) - V_i(\theta', w)\middle|\overline{\theta}_i\right] = \tilde{c}^e$$

Back

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: $E\left[V_s\left(\theta, w\right)\middle|\nu\right]$.
- Entry is characterized by the following threshold rule:

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

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

Back

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.

Back

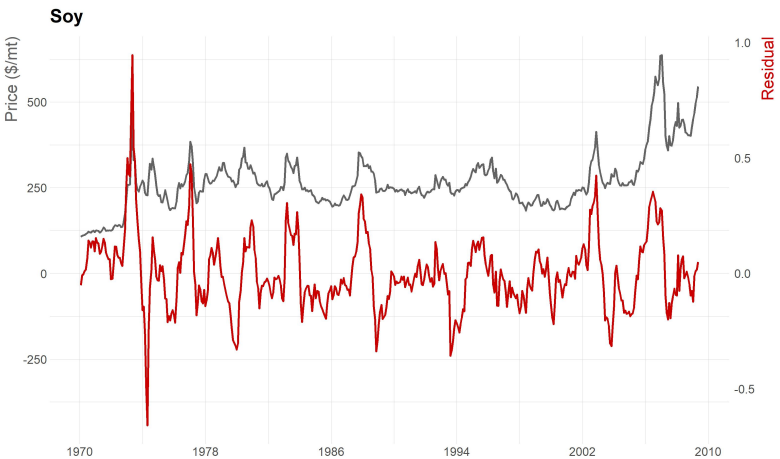
Push Shocks: Crop Prices

Price shocks:

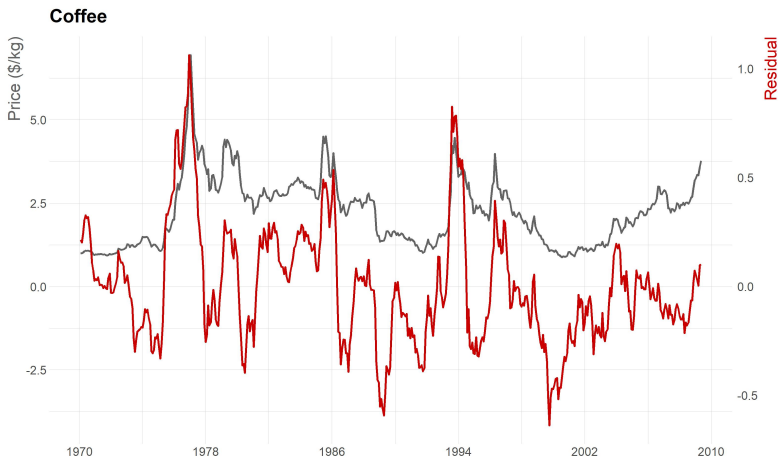
- Source: World Bank Commodity Price Data (The Pink Sheet) 1972-2020.
- 12 Crops: bananas, cocoa, coffee, cotton, maize, orange, rice, soybeans, sugar, tobacco, wheat and wood.
- Crop×month-level price shock, ε_{cm}: residual from AR(1) process.
- Municipality×year level shock: sum of crop-level shocks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

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

Maps Back



(c) Soy



(d) Coffee

▶ Maps ▶ Back

Push Shocks: Droughts

- SPEI (Standardized Precipitation and Evapotranspiration Index), geo-localised measures of water balance linked to rainfall and temperature (Vicente-Serrano et al., 2010).
- Municipality$\times$month-level shock, D_{om}: indicator for a drought if SPEI < 0.
- Municipality$\times$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).

$$s_{ot}^{drought} = \sum_{m} \sum_{c} (\pi_{oc} \times g_{ocm} \times D_{om})$$

▸ Maps ▸ Back ▸ Back to SR

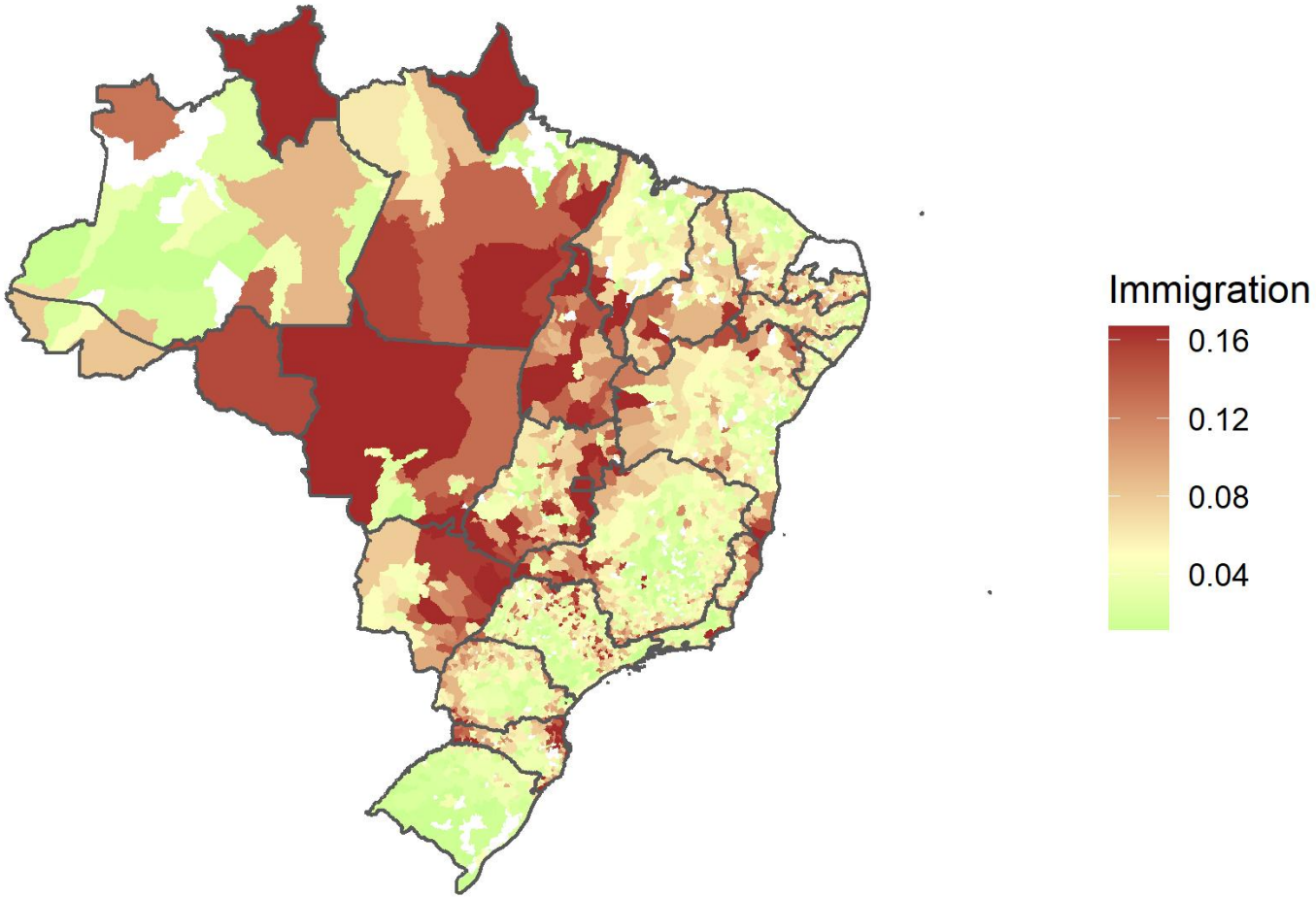
Table 1: Descriptive Stats - Census

	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.

Back

Immigration, 2000-2010



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

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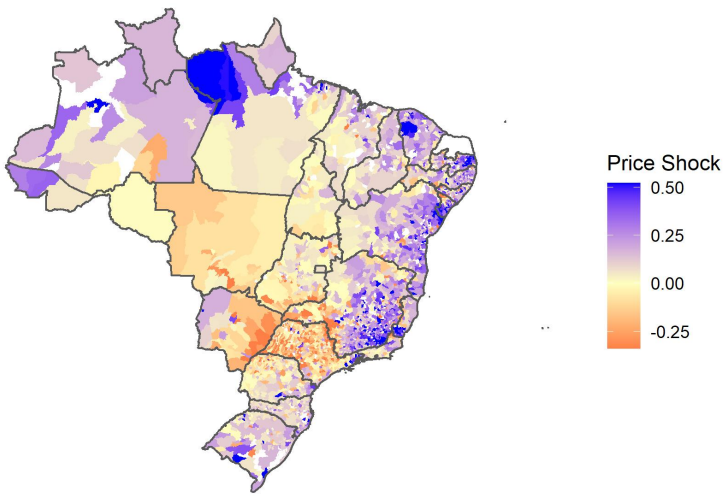
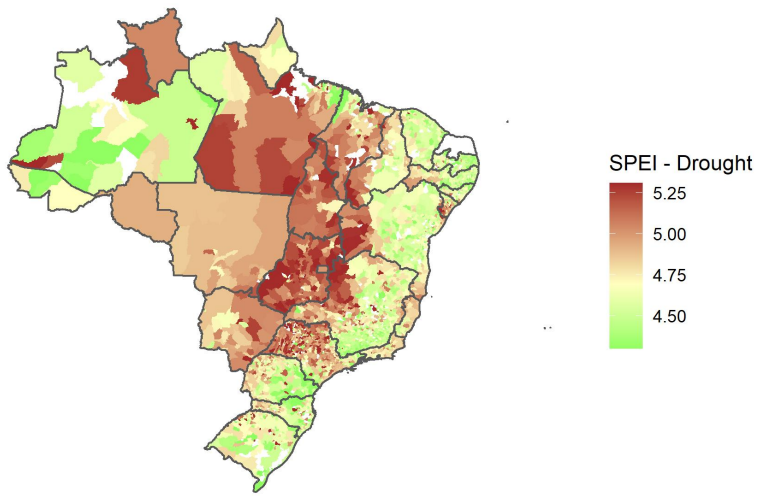
Figure 1: Migration Push Shocks



(a) Price Shocks



(b) Drought Shocks

Back Back to Main Back to SR

First Stage

	Immigration	
	(1)	(2)
Price	−0.053	
	(0.006)	
Drought		0.077
		(0.004)
Observations	3545	3545

Back

Composition effects at destination

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

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Labor Market Effects by Skill

	Wage employment			Log monthly wage		
	Overall (1)	Formal (2)	Informal (3)	Overall (4)	Formal (5)	Informal (6)
Panel A: High-Skilled Workers						
Immigration	0.130	0.364	−0.235	−1.313	−1.610	−1.076
	(0.125)	(0.172)	(0.104)	(0.455)	(0.524)	(0.670)
Observations	3,545	3,545	3,545	3,545	3,524	3,511
Panel B: Low-Skilled Workers						
Immigration	0.039	0.325	−0.286	−1.876	−2.268	−2.462
	(0.107)	(0.109)	(0.096)	(0.746)	(0.791)	(0.994)
Observations	3,545	3,545	3,545	3,545	3,543	3,545

Back

Wage Effects by Skill

Back

Occupational composition

	Formal (1)	Informal (2)	Non-emp (3)	Self-emp (4)
Immigration	0.394	−0.294	0.092	−0.041
	(0.149)	(0.100)	(0.129)	(0.047)
Baseline Mean	0.229	0.103	0.435	0.119
Observations	3545	3545	3545	3545
	Employer (5)	Domestic (6)	Public (7)	Non-remun (8)
Immigration	−0.040	0.020	−0.102	−0.029
	(0.020)	(0.031)	(0.061)	(0.022)
Baseline Mean	0.019	0.046	0.038	0.012
Observations	3,545	3,545	3,545	3,545

Back

Share of migrants by firm ownership

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

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

Back

Sectoral composition

Industries:	Retail and Services (1)	Construction (2)	Manufacturing (3)	Other Sectors (4)
		Panel A: Shares of Firms		
Immigration	0.226	0.176	−0.303	−0.099
	(0.150)	(0.053)	(0.136)	(0.136)
Baseline Mean	0.738	0.033	0.111	0.118
		Panel B: Shares of Jobs		
Immigration	0.373	−0.114	−0.341	0.082
	(0.402)	(0.109)	(0.257)	(0.408)
Baseline Mean	0.465	0.041	0.185	0.309
Observations	3,545	3,545	3,545	3,545

Back

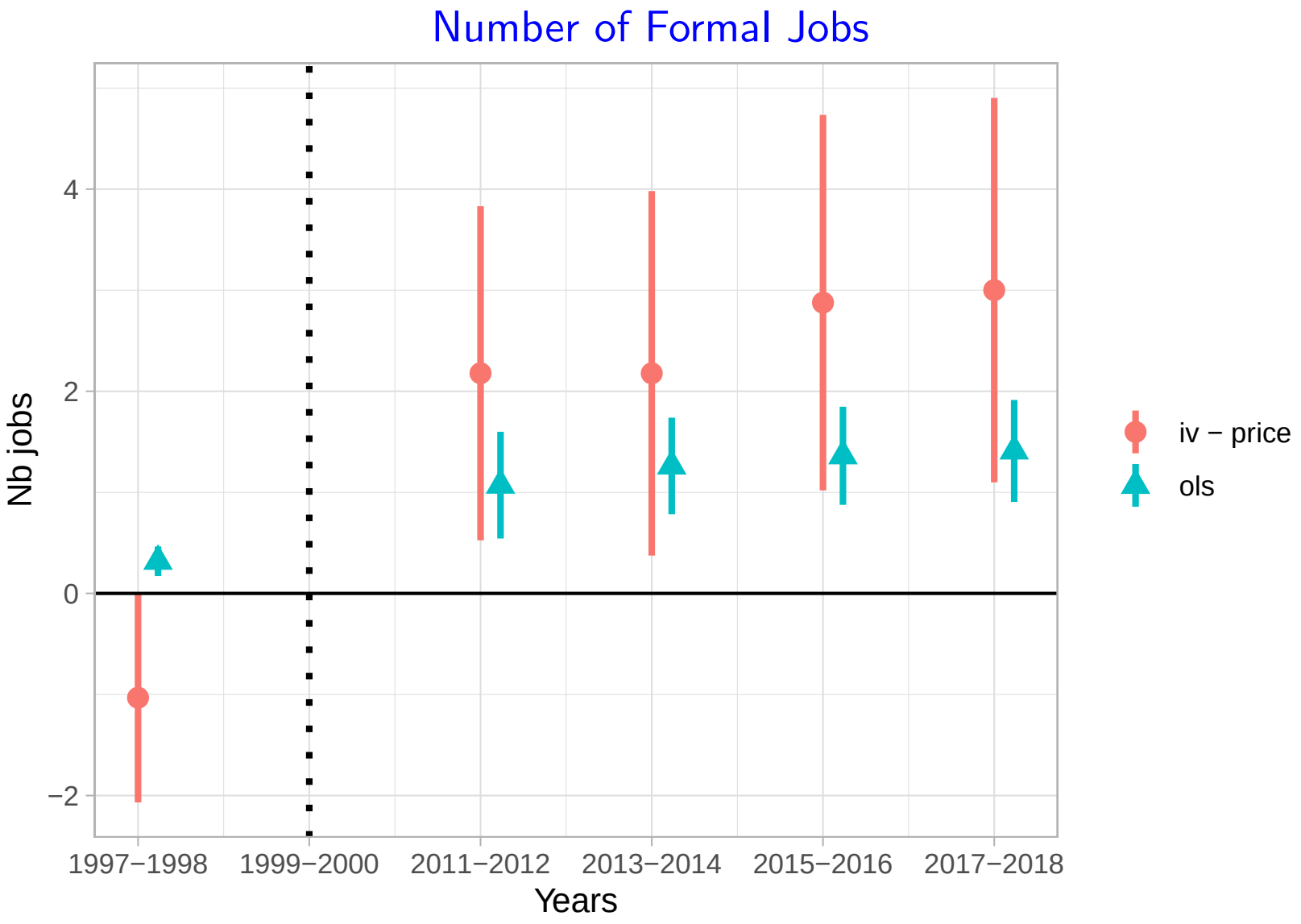
Sizes of firms:	$\leq$5	6 to 10	11 to 20	21 to 50	$>$50
	(1)	(2)	(3)	(4)	(5)
			Panel A: Shares of Firms		
Immigration	0.367	−0.161	−0.122	−0.079	−0.005
	(0.138)	(0.068)	(0.048)	(0.041)	(0.033)
Baseline Mean	0.706	0.131	0.078	0.048	0.036
			Panel B: Shares of Jobs		
Immigration	0.050	−0.067	−0.136	−0.087	0.240
	(0.095)	(0.062)	(0.072)	(0.103)	(0.258)
Baseline share	0.129	0.079	0.086	0.112	0.594
Observations	3,545	3,545	3,545	3,545	3,545

Back

Dynamic effects

Back

Dynamic effects



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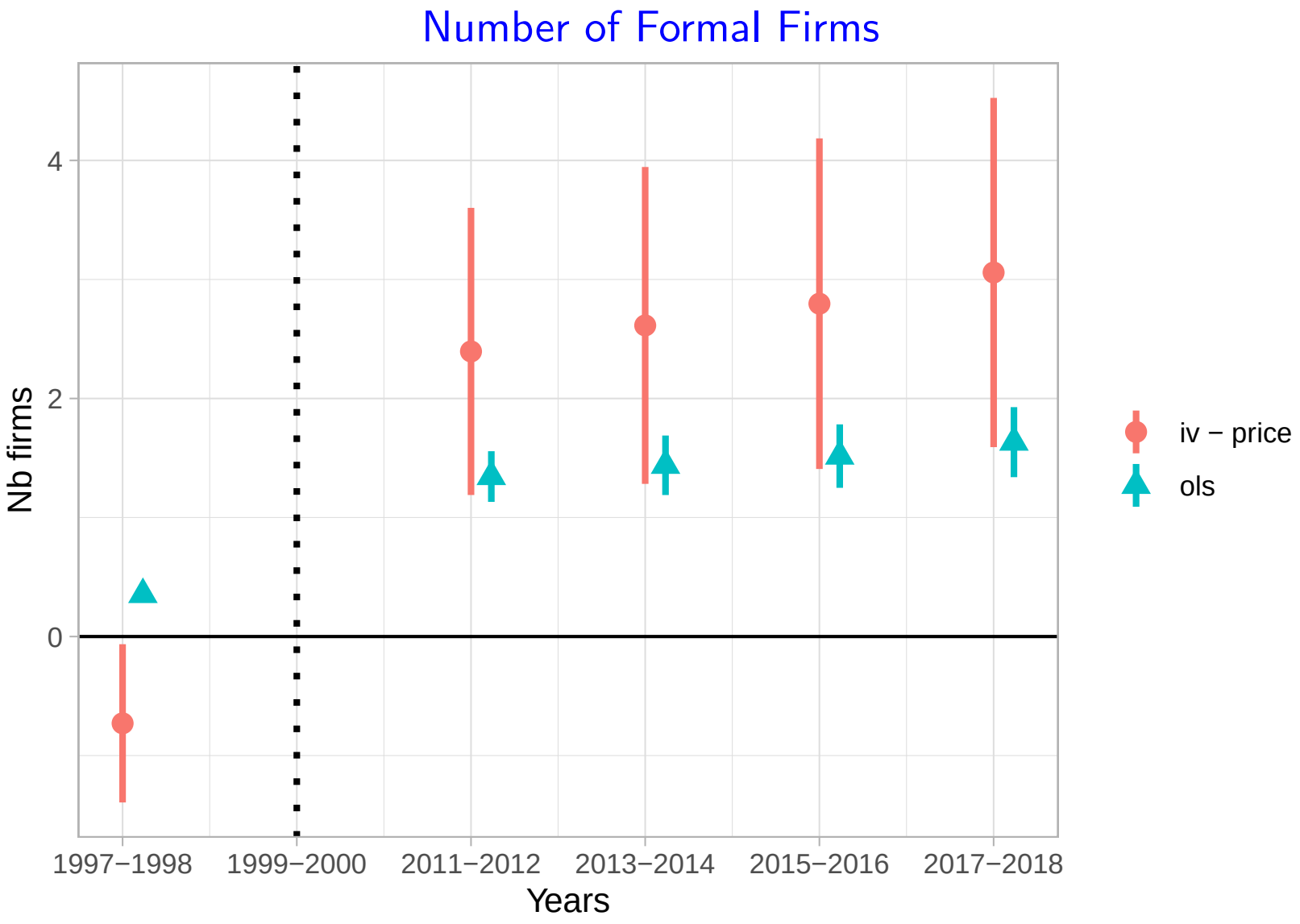
Dynamic effects



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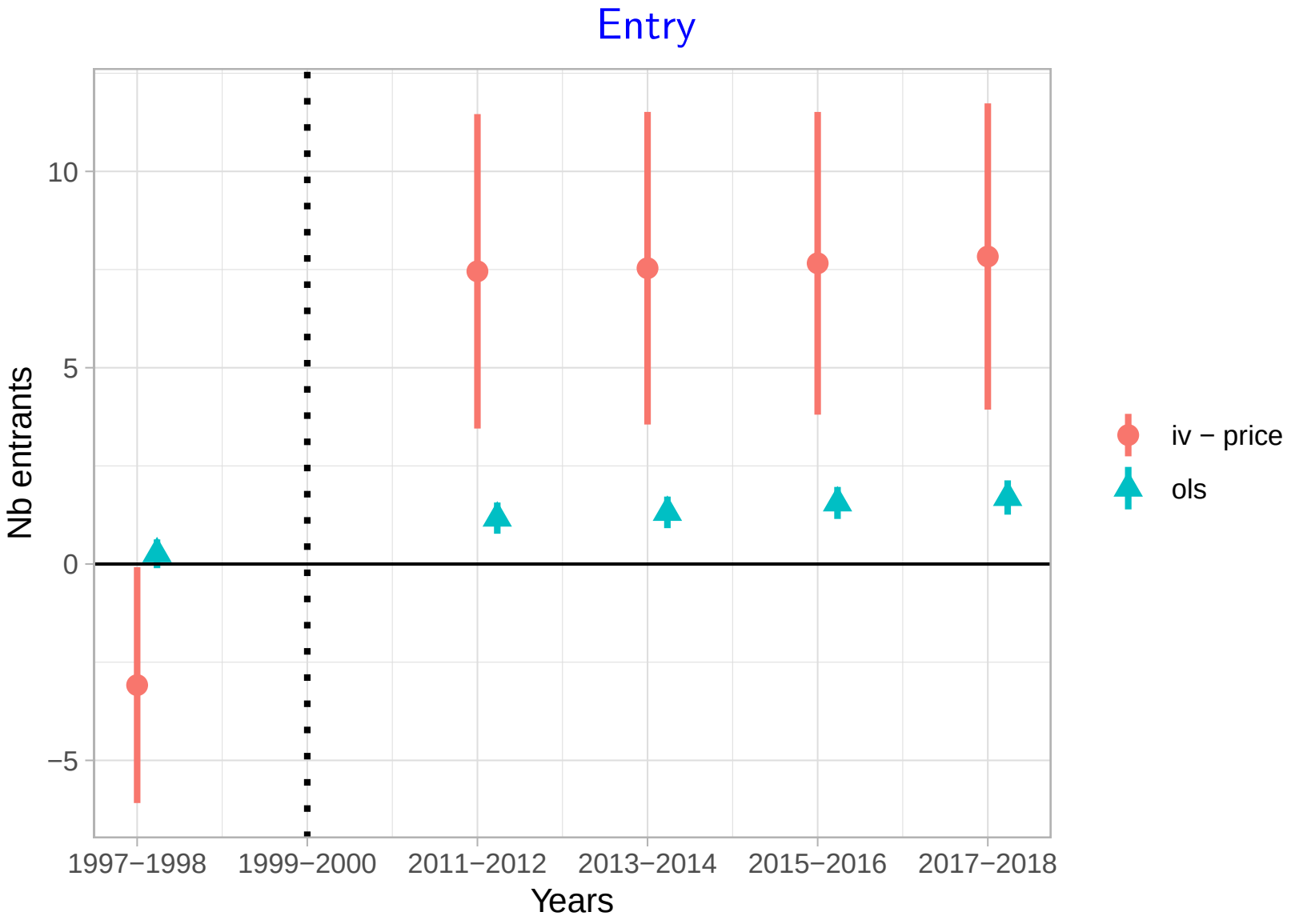
Dynamic effects



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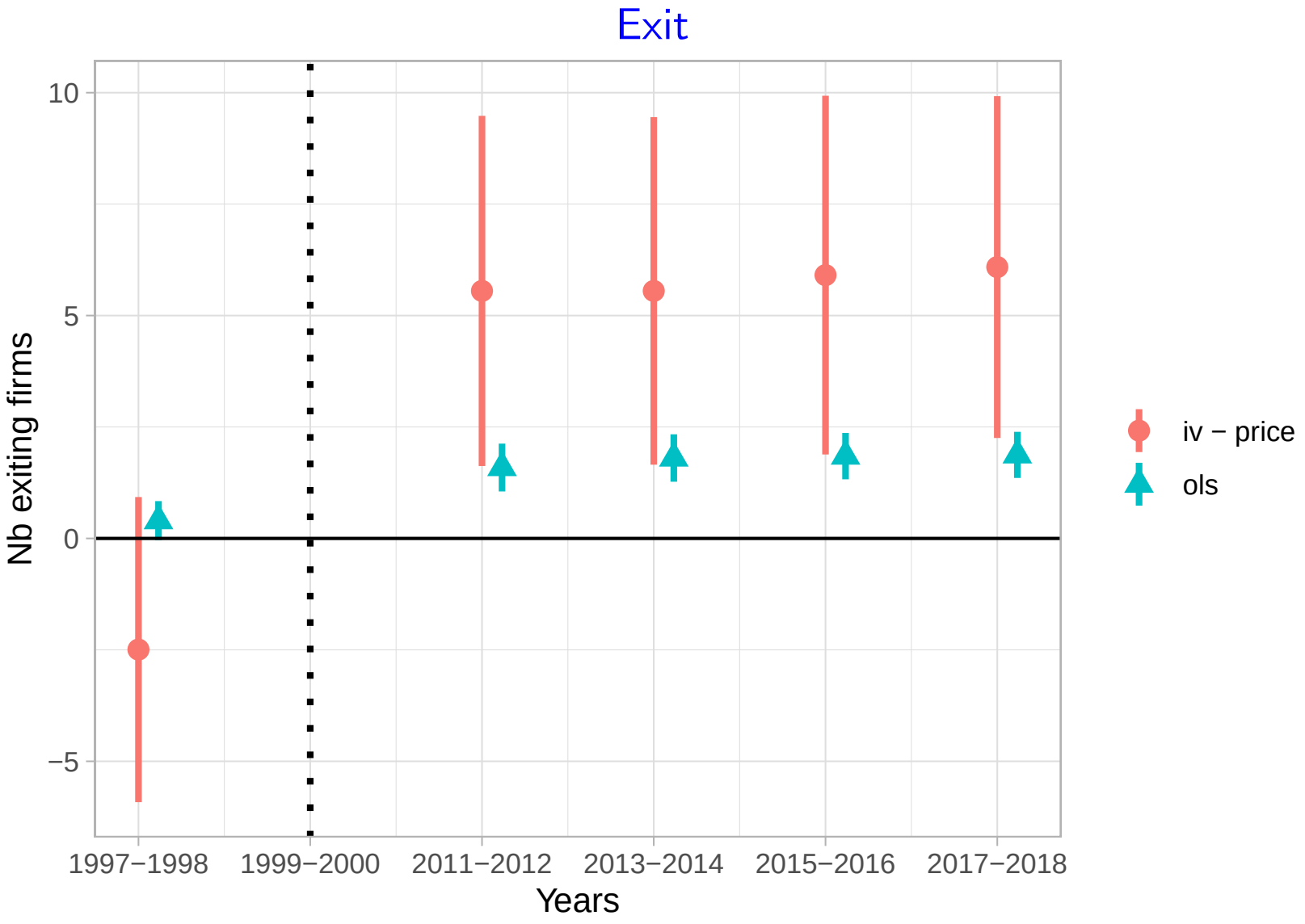
Dynamic effects



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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).

Panel A: Shares of Firms				
	Q1	Q2	Q3	Q4
Immigration	−0.407	2.664	1.153	−3.410
	(0.617)	(0.958)	(1.223)	(1.439)
Panel B: Shares of Jobs				
	Q1	Q2	Q3	Q4
Immigration	−0.159	0.922	1.052	−1.814
	(0.304)	(0.427)	(0.721)	(1.046)
Observations	3545	3545	3545	3545

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Effects by firm quartile

Quartiles:	Bottom (1)	Mid-bottom (2)	Mid-top (3)	Top (4)
	Panel A: Shares of Firms			
Immigration	−0.393	2.686	1.250	−3.543
	(0.626)	(0.976)	(1.239)	(1.487)
	Panel B: Shares of Jobs			
Immigration	−0.165	0.951	1.083	−1.869
	(0.310)	(0.440)	(0.733)	(1.072)
Observations	3,545	3,545	3,545	3,545

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Results with drought shock: benchmark specification

	Wage employment			Log monthly wage		
	Overall	Formal	Informal	Overall	Formal	Informal
	(1)	(2)	(3)	(4)	(5)	(6)
IV-Drought						
Immigration	−0.014	0.271	−0.284	−0.126	−0.671	−0.200
	(0.060)	(0.089)	(0.072)	(0.284)	(0.336)	(0.352)
F Statistic (IV)	18.11	18.11	18.11	18.11	18.11	18.11
Observations	3,545	3,545	3,545	3,545	3,545	3,545

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Results with drought shock: benchmark specification

	Nb firms (1)	Entry (2)	Exit (3)	Nb jobs (4)	Firm wage (5)
IV - Drought					
Immigration	1.625	2.555	2.758	2.031	−0.747
	(0.306)	(0.877)	(1.123)	(0.624)	(0.554)
F Statistic (IV)	18.11	18.11	18.11	18.11	18.11
Observations	3,545	3,545	3,545	3,545	3,545

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Drought shock: benchmark specification w/restricted sample

	Wage employment			Log monthly wage		
	Overall	Formal	Informal	Overall	Formal	Informal
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: OLS						
Immigration	0.004	0.067***	−0.062***	0.059	0.024	0.044
	(0.022)	(0.023)	(0.018)	(0.099)	(0.086)	(0.124)
Panel B: IV-Price						
Immigration	−0.091	0.148	−0.239**	−1.663**	−2.102***	−1.906**
	(0.103)	(0.119)	(0.101)	(0.682)	(0.792)	(0.831)
F Statistic (IV)	11.16	11.16	11.16	11.16	11.16	11.16
Baseline Mean	0.338	0.243	0.095	-	-	-
Observations	700	700	700	700	700	700

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

Back

Drought shock: benchmark specification w/restricted sample

	Nb firms	Entry	Exit	Nb jobs	Firm wage
	(1)	(2)	(3)	(4)	(5)
Panel A: OLS					
Immigration	1.215***	1.296***	1.870***	0.922***	0.498***
	(0.119)	(0.283)	(0.365)	(0.319)	(0.134)
Panel B: IV-Price					
Immigration	2.310***	6.632***	5.126**	2.089**	−2.609**
	(0.644)	(2.234)	(2.223)	(0.910)	(1.203)
F Statistic (IV)	11.16	11.16	11.16	11.16	11.16
Observations	700	700	700	700	700

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

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Drought shock: short run specification – workers

	Wage employment			Log monthly wage		
	Overall	Formal	Informal	Overall	Formal	Informal
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: OLS						
Immigration	0.099**	0.087**	0.011	0.162	0.285	−0.176
	(0.040)	(0.040)	(0.022)	(0.175)	(0.188)	(0.343)
Panel B: IV-Drought						
Immigration	−1.233**	−1.199**	−0.034	0.512	1.226	−1.890
	(0.624)	(0.576)	(0.324)	(2.080)	(2.507)	(3.256)
F Statistic (IV)	21.53	21.53	21.53	21.53	21.53	21.61
Baseline Mean	0.335	0.242	0.092	-	-	-
Observations	6,407	6,407	6,407	6,407	6,381	6,377

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

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Drought shock: short run specification – firms

	Nb firms	Entry	Exit	Nb jobs	Firm wage
	(1)	(2)	(3)	(4)	(5)
Panel A: OLS					
Immigration	0.106	−0.081	−0.246	−0.011	0.077
	(0.024)	(0.105)	(0.063)	(0.076)	(0.042)
Panel B: IV-Drought					
Immigration	0.704	2.921	3.079	−14.425	−0.609
	(0.332)	(4.115)	(0.996)	(5.211)	(0.528)
F Statistic (IV)	21.52	21.52	21.52	21.52	21.52
Observations	6,382	6,382	6,382	6,382	6,382

Back

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	7.412	3.838	2.045	−3.410
	(0.593)	(1.991)	(0.933)	(0.792)	(1.153)
Panel B: Controlling for Population Lag					
Immigration	2.435	7.345	5.916	2.089	−2.984
	(0.646)	(2.086)	(2.065)	(0.882)	(1.020)
Panel C: Controlling for Immigration Lag					
Immigration	5.303	29.224	20.135	6.163	−15.124
	(3.212)	(13.644)	(10.284)	(4.112)	(8.432)
Panel D: Controlling for log(GDP) Lag					
Immigration	2.486	8.472	6.908	2.263	−2.887
	(0.683)	(2.443)	(2.476)	(0.907)	(0.971)
Panel E: IV-Price - Controlling for Industries Lag					
Immigration	1.945	6.595	5.167	2.155	−2.549
	(0.531)	(1.851)	(1.860)	(0.811)	(0.932)
Observations	3545	3545	3545	3545	3545

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Robustness: Control for Alternative Channels

	Nb firms (1)	Entry (2)	Exit (3)	Nb jobs (4)	Firm wage (5)
Panel A: Controlling for local and neighboring municipalities' price shocks					
Immigration	2.158	4.697	2.667	2.219	−3.920
	(0.530)	(1.370)	(1.411)	(0.739)	(1.181)
Observations	3,545	3,545	3,545	3,545	3,545
Panel B: Controlling for capital reallocation channel					
Immigration	2.415	7.391	4.979	2.527	−3.494
	(0.692)	(2.266)	(2.223)	(0.941)	(1.336)
Observations	2,627	2,627	2,627	2,627	2,627
Panel C: Excluding firms that produce agricultural goods					
Immigration	2.785	7.513	5.542	2.395	−3.823
	(0.648)	(2.054)	(2.039)	(0.885)	(1.247)
Observations	3,545	3,545	3,545	3,545	3,545

Model's parameters

Parameter	Description	Source	Value	SE
First Step				
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	–
Second Step				
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
$c_f^{e\,\dagger}$	Formal sector's entry cost	SMM Estimation	7,400	3,383
$c_i^{e\,\dagger}$	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.

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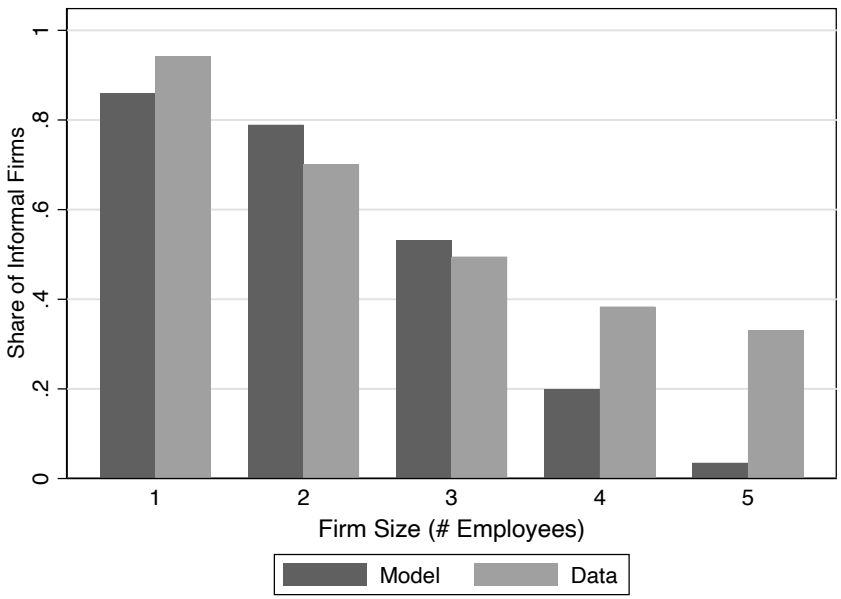
Model Fit (1/4): Targeted moments

Table 1: Model Fit – Targeted moments

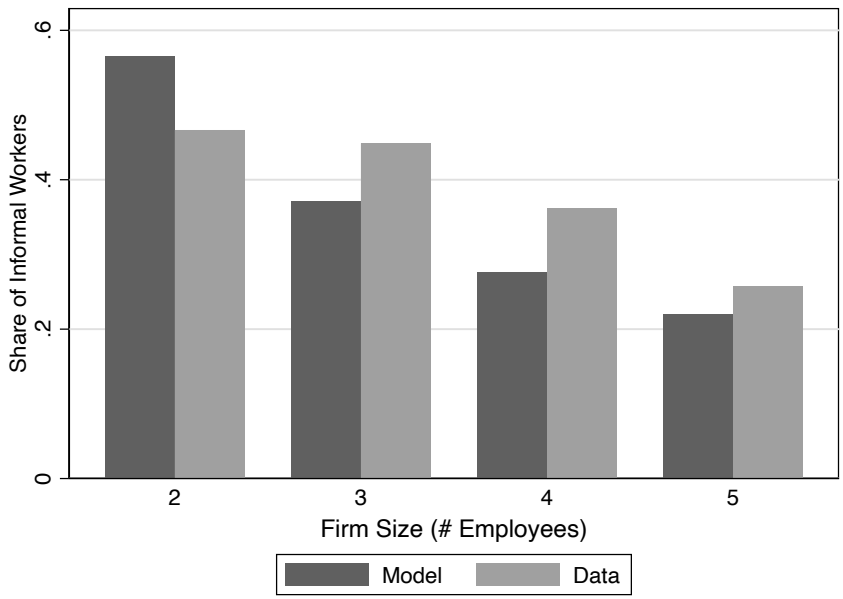
	Model	Data
Share Informal workers	0.304	0.298
Share Informal Firms	0.696	0.696
Informal Firms Size Distribution		
≤ 2 employees	0.933	0.957
≤ 5 employees	0.999	0.998
Formal Firms Size Distribution		
≤ 5 employees	0.658	0.697
6 to 10	0.136	0.144
11 to 20	0.092	0.083
21 to 50	0.053	0.048
> 50	0.023	0.028

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

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

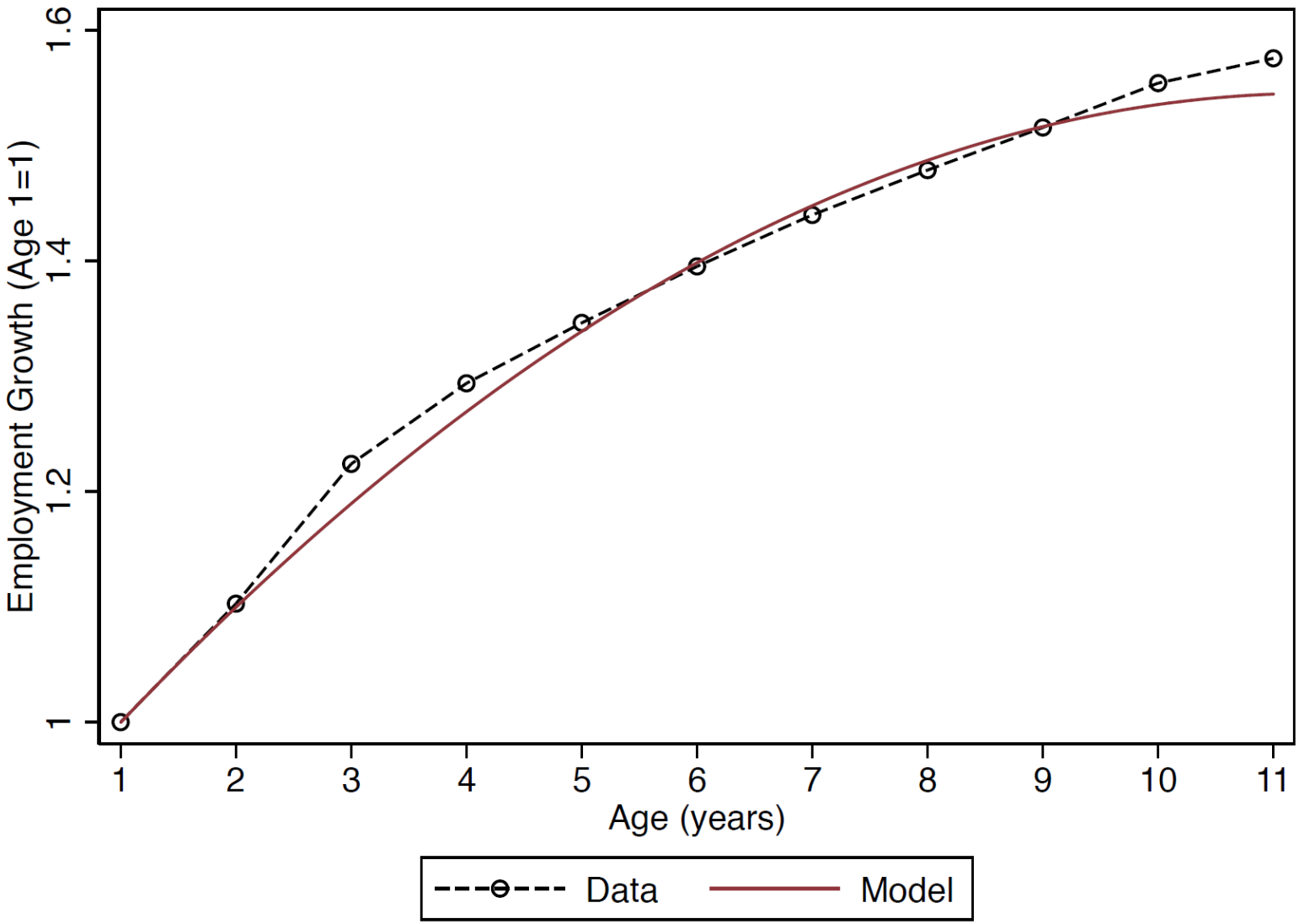


(c) Extensive Mg.

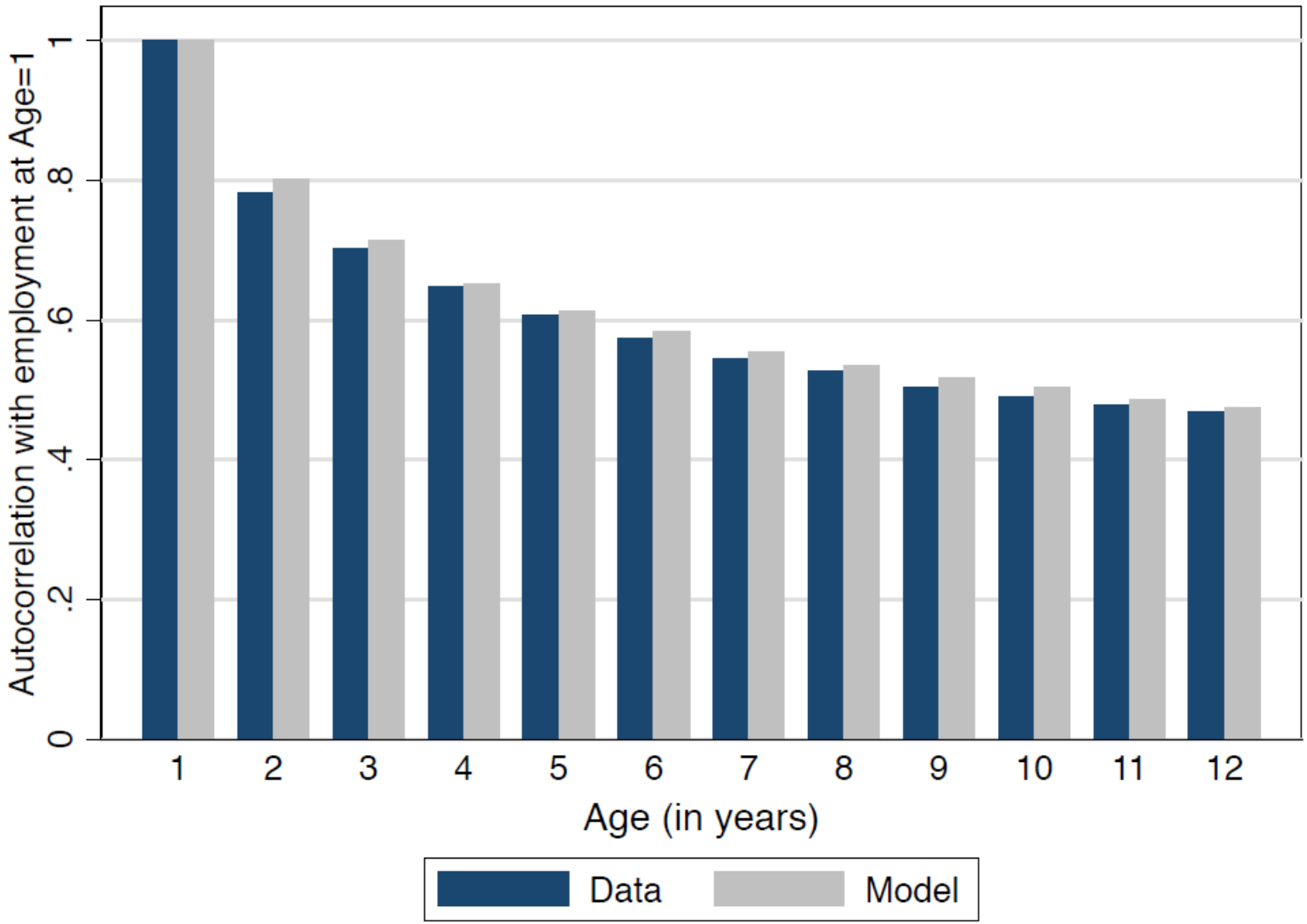


(d) Intensive Mg.

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



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



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