

Trade and Informality in the Presence of Labor Market Frictions and Regulations

Rafael Dix-Carneiro

Duke University

Pinelopi Goldberg

Yale University

Costas Meghir

Yale University

Gabriel Ulyssea

University College London

NBER Summer Institute DEV

July 27th 2021

Introduction

- ▶ Informality is a major feature of labor markets in developing countries.
- ▶ It represents a substantial share of the labor force in developing countries. In South America: 35% (Chile) to 80% (Peru) – Perry et al (2007).
- ▶ Broadly speaking informality reflects an attempt to bypass taxes, regulations and bureaucratic complications associated with formal firms.
 - ▶ Informal sector jobs widely considered as low quality.

Introduction: Trade and Informality

- ▶ Shifts into/out of informality and unemployment are important margins of adjustment to trade (e.g. McCaig and Pavcnik, 2017; Dix-Carneiro and Kovak, 2019).
- ▶ Dix-Carneiro and Kovak (2019): Presence of a large informal sector acted as a buffer to trade-displaced workers.
- ▶ Labor market effects of trade depend on stringency of labor market regulations (Ponczek and Ulyseia, 2021).

Introduction

- ▶ Given recent empirical results (based on Diff-in-Diffs), studying the labor market and welfare effects of globalization in a model of trade with informality, unemployment and regulations is a first order question.
 - ▶ Aggregate effects
 - ▶ Welfare analysis
- ▶ Trade models typically abstract from informality, we fill this gap.

Informality

Definitions:

- (i) Informal firms: those that do not register with tax authorities, invisible to the government.
- (ii) Informal workers: not covered by labor regulations (no formal contract, “sem carteira assinada”).

Potential Consequences:

- ▶ Tax avoidance, hindering the provision of public goods.
- ▶ Misallocation of resources.
- ▶ Informal workers: no unemployment insurance, no employer social security contributions.
 - ▶ No job stability.
- ▶ However, informality may provide *de facto* flexibility for firms and workers to cope with adverse shocks.

Our approach

We develop an **equilibrium** model that builds on Cosar, Guner and Tybout (2016) and features:

- ▶ Heterogeneous firms choose to operate in the informal sector (but can be caught) or in the formal sector (and are subject to regulations).
- ▶ Search and matching frictions in the labor market.
- ▶ Rich institutional setting:
 - ▶ Government imposes minimum wages; firing costs; payroll and value added taxes; import tariffs.
- ▶ Taxes and labor market regulations are imperfectly enforced by the government → informality.
- ▶ International trade: (a) firms export subject to fixed export costs and variable trade costs (as in Melitz). (b) Imports affect **ALL** firms in the economy through aggregate demand and input-output links.

Our approach

- ▶ We estimate the model using several data sources from Brazil
 - ▶ ECINF / Economia Informal Urbana – “Informality Survey”
 - ▶ RAIS / All **formal** sector firms and workers – Admin Data
 - ▶ SECEX – Customs data
 - ▶ PIA, PAS, PAC – Firm-level Surveys
 - ▶ PME – Household Survey, worker level

- ▶ We use the estimated model to perform counterfactual simulations to understand and quantify the effects of trade in the presence of a large informal sector.

Five Facts on Formal and Informal Firms in Brazil

- ▶ **Fact 1:** (a) Brazil has a large informal sector (48% of employment).
(b) Transitions from Unemployment to Informal are more than twice as likely than transitions from Unemployment to Formal.
- ▶ **Fact 2:** The probability that a firm is informal declines sharply with its employment size.
- ▶ **Fact 3:** Informal firms are, on average, less productive than formal firms.
- ▶ **Fact 4:** The average informal worker is paid lower wages than the average formal worker.
- ▶ **Fact 5:** Firm-level labor turnover tends to decline with firm-level employment size. However, conditional on size, exporters tend to have higher turnover.

Fact 5: Turnover, Firm Size and Export Status

Table: Turnover, Firm Size and Export Status

	Dep. Variable: $Turnover_i$	
	C sector	S sector
Intercept	0.741 (0.008)	0.645 (0.003)
$\log(\ell_i)$	-0.126 (0.003)	-0.096 (0.002)
$Exporter_i$ (Dummy)	0.071 (0.019)	
Observations	20,342	147,936

Data Sources: 2003 and 2004 RAIS and 2003 SECEX. Turnover of firm i between 2003 and 2004 measured as $Turnover_i = \frac{|\ell_{i,2004} - \ell_{i,2003}|}{0.5 \times (\ell_{i,2004} + \ell_{i,2003})}$. Standard errors in parentheses.

The Model

- ▶ Economy is populated by homogeneous, infinitely-lived workers-consumers with utility

$$U = \sum_{t=1}^{\infty} \frac{C_t^{\zeta} S_t^{1-\zeta}}{(1+r)^t}$$

$$C_t = \left(\int_0^{N_{Ct}} c_t(n)^{\frac{\sigma_C-1}{\sigma_C}} dn \right)^{\frac{\sigma_C}{\sigma_C-1}}$$

$$S_t = \left(\int_0^{N_{St}} s_t(n)^{\frac{\sigma_S-1}{\sigma_S}} dn \right)^{\frac{\sigma_S}{\sigma_S-1}}$$

- ▶ C = Manufacturing / tradable
- ▶ S = Services / non-tradable

The Model

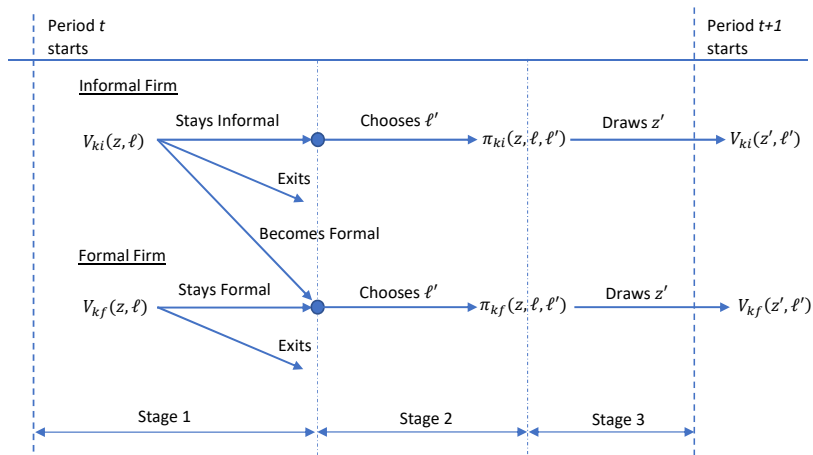
- ▶ Sector $k \in \{C, S\}$ goods are produced by heterogeneous firms, which produce a unique variety using labor ℓ and intermediate ι_k inputs:

$$q = z \ell^{\delta_k} \iota_k^{1-\delta_k}; \quad \iota_k = im_C^{\lambda_k} im_S^{1-\lambda_k}$$

- ▶ im_C and im_S are CES aggregates of tradables and non-tradables.
- ▶ Intermediate inputs play a key role in transmitting changes in trade openness to the entire economy
- ▶ Firm's productivity follows a AR(1) process:

$$\ln z' = \rho_k \ln z + \epsilon_k^z, \quad k = C, S$$

Timing: Incumbents



- ▶ Similar timing for entrants + Free entry.

▶ ValueFunctions

▶ Entry

Profit functions

- ▶ Formal firms:

$$\pi_{kf}(z, l, l') = (1 - \tau_y) VA_k(z, l') - C_{kf}(z, l, l') - \bar{c}_k$$

- ▶ Variable costs:

$$C_{kf}(z, l, l') = \begin{cases} (1 + \tau_w) \max\{w_{kf}(z, l'), \underline{w}\} l' + H_{kf}(l, l') & \text{if } l' > l \\ (1 + \tau_w) \max\{w_{kf}(z, l'), \underline{w}\} l' + \kappa(l - l') & \text{if } l' \leq l \end{cases}$$

- ▶ Wage bill is bounded below by the minimum wage
- ▶ Expanding firms pay hiring costs
- ▶ Contracting firms pay firing costs

Profit functions

► Informal firms:

$$\pi_{ki}(z, \ell, \ell') = VA_k(z, \ell') - K^{inf}(z, \ell') - C_{ki}(z, \ell, \ell') - \bar{c}_k,$$

$$C_{ki}(z, \ell, \ell') = \begin{cases} w_{ki}(z, \ell') \ell' + H_{ki}(\ell, \ell') & \text{if } \ell' > \ell \\ w_{ki}(z, \ell') \ell' & \text{if } \ell' \leq \ell, \end{cases}$$

► No minimum wage, No firing costs and No taxes

Revenues and Value Added

- ▶ Monopolistic Competition + Intermediate Input Usage \Rightarrow Value Added of firm with productivity z and employment ℓ :

$$VA_k(z, \ell) = \Theta_k \Psi_k \left(z \ell^{\delta_k} \right)^{\Lambda_k}$$

- ▶ Demand shifter Ψ_k depends on both P_C and P_S (intermediates) and aggregate income.

▶ Details

Hiring costs

- ▶ Cost of expanding from ℓ to ℓ' workers

$$H_{kj}(\ell, \ell') = (\mu_{kj}^v)^{-\gamma_{k1}} \times \left(\frac{h_k}{\gamma_{k1}} \right) \times \left(\frac{\ell' - \ell}{\ell^{\gamma_{k2}}} \right)^{\gamma_{k1}}$$

$\mu_{kj}^v = \text{Prob. of filling a vacancy in } k, j$

- ▶ Nature of hiring costs is important to generate:
 - ▶ Fact 5: firm-level turnover declines with firm size.
 - ▶ Wage dispersion across firms.

Search and Matching

- ▶ Workers are matched to firms/vacancies randomly (random matching).
- ▶ Wages are determined by Nash bargaining.
- ▶ Search frictions \Rightarrow informal/unproductive firms are able to keep workers at lower wages (as long as they are above the worker's reservation wage).

▶ Details

Open Economy

- ▶ Small open economy model: aggregate conditions abroad are fixed + set of imported goods is fixed.
- ▶ Manufacturing (C) sector firms choose how much to export given foreign demand. Need to pay fixed cost f_x to export.
- ▶ Export decision

$$\mathcal{I}_C^x(z, \ell') = \begin{cases} 1 & \text{if } VA_C^x(z, \ell') - f_x > VA_C^d(z, \ell'), \text{ Export} \\ 0 & \text{otherwise} \end{cases}$$

- ▶ Intermediate inputs / IO linkages \Rightarrow Direct transmission of trade shocks to S and informal sector firms.

Open Economy

- ▶ Value Added Domestic Producers:

$$VA_C^d(z, \ell) = \Theta_C \Psi_C (z \ell^{\delta_C})^{\Lambda_C}$$

- ▶ Value Added Exporters:

$$VA_C^x(z, \ell) = (\exp(d_F))^{\frac{\sigma_C}{\sigma_C - 1} \Lambda_C} \times VA_C^d(z, \ell)$$

- ▶ Trade costs / tariffs affect domestic demand shifters Ψ_C (for formal and informal firms) and foreign demand d_F .
 - ▶ But also Ψ_S .

▶ VA Expression

Equilibrium

- ▶ Firms act optimally and make entry, exit decisions and post vacancies.
- ▶ Free entry.
- ▶ Wages solve bargaining problem between workers and the firm.
- ▶ Labor markets clear.
- ▶ Goods markets clear.
- ▶ Steady state: distribution of firms, number of firms, number of workers in each sector are stable.

Mechanisms

- ▶ Several mechanisms, pushing effects of trade in different directions.
- ▶ Melitz-type effects / Productivity thresholds
 - ▶ $\tau_a, \tau_c \downarrow \Rightarrow$ demand for purely domestic firms \downarrow , but \uparrow for exporters.
 - ▶ Least productive *formal* firms exit, replaced by informal firms $\Rightarrow \uparrow$ informality.
 - ▶ Least productive *informal* firms exit $\Rightarrow \downarrow$ informality.
 - ▶ Cheaper intermediates $\Rightarrow \uparrow$ worker productivity
 - ▶ Most productive informal firms grow and formalize $\Rightarrow \downarrow$ informality.
 - ▶ Higher income and demand $\Rightarrow \uparrow$ entry low productivity informal firms $\Rightarrow \uparrow$ informality.

Mechanisms

- ▶ Channels linking trade to unemployment have implications for the relative size of the informal sector. Transitions $U \rightarrow I$ twice as likely as transitions $U \rightarrow F$.
 - ▶ Turnover at exporters is larger, conditional on size.
 - ▶ Lower trade barriers reallocate resources toward exporters, who also become more sensitive to idiosyncratic shocks ($d_F \uparrow$)
 - ▶ \uparrow Turnover in C , increasing unemployment.

Estimation Strategy

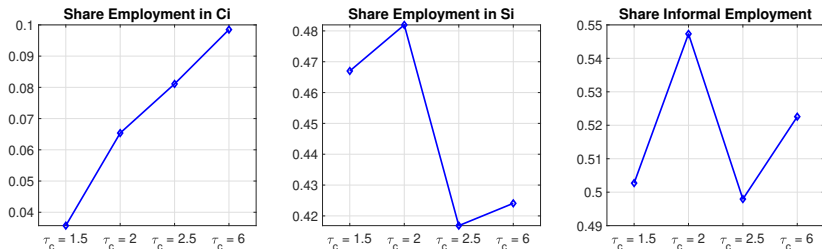
We use **Indirect Inference** to estimate 27 parameters using 84 data moments and auxiliary model coefficients.

▶ Estimates

▶ ModelFit

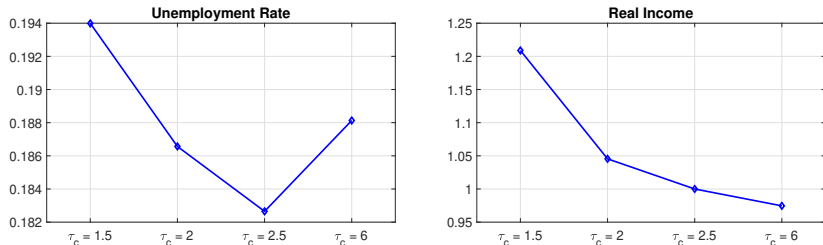
▶ FixedParameters

Figure: Trade and Informality



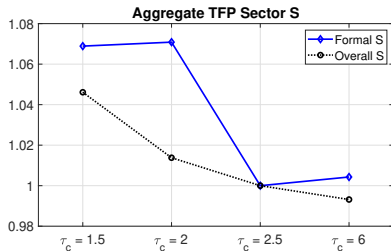
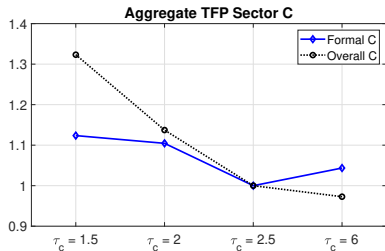
- ▶ In C : reduction in demand for purely-domestic firms \Rightarrow low-productivity formal firms \rightarrow informality, but also low-productivity informal firms exit.
- ▶ In S : increased income and demand propelled by C sector \Rightarrow entry of low-productivity informal firms, but also formalization of high-productivity informal firms.

Figure: Trade, Unemployment and Welfare



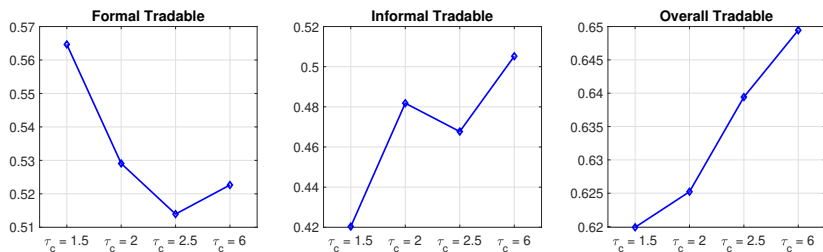
- ▶ $\tau_c \downarrow \Rightarrow$ resources reallocated toward larger firms (both in C and S)
 \Rightarrow less turnover as larger firms tend to be more stable.
- ▶ However, resources reallocated towards exporters, and $d_F \uparrow \Rightarrow$ more turnover.
- ▶ \uparrow turnover associated with \uparrow unemployment.

Figure: Trade and Aggregate TFP



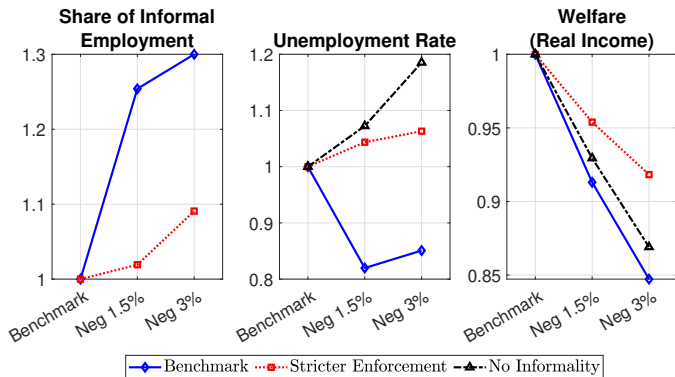
- ▶ Trade drives highly unproductive informal C sector firms out of the market, freeing up resources to be reallocated to more productive formal ones.
- ▶ In S: $\tau_c \downarrow \Rightarrow$ unproductive informal firms enter. Mitigates productivity gain in the formal S.

Figure: Trade and the Std. Dev. of log-Wages Across Workers in the C sector



- ▶ $\tau_c \downarrow \Rightarrow$ Wage inequality \uparrow in the formal C sector. Wage exporter premium \uparrow .
- ▶ Consistent with Cosar et al (2016), Helpman et al (2017).
- ▶ However, inequality within the informal sector \downarrow + between-sector differences \downarrow

Figure: Negative Productivity Shocks, Informality, Unemployment and Welfare



- ▶ Aggregate negative productivity shock:
 - ▶ Benchmark: Informality \uparrow , but unemployment does NOT increase.
 - ▶ Informality repressed: muted informality response, unemployment increases.
 - ▶ Informal sector: “unemployment buffer”, but not “welfare buffer”.

Conclusions

- ▶ Important to carefully model both the informal sector and the non-tradable sector to obtain an accurate and comprehensive picture of the effects of trade in developing countries.
- ▶ Our model is consistent with empirical patterns in the literature, based on Diff-in-Diff's:
 - ▶ Trade openness leads to declines in informality in the tradable sector (McCaig and Pavcnik, 2018)
 - ▶ Informal sector acts an “employment buffer” in face of negative shocks (Dix-Carneiro and Kovak, 2019)
- ▶ But new insights that cannot be obtained with Diff-in-Diff's:
 - ▶ Trade openness leads to **ambiguous** effects in aggregate informality.
 - ▶ Informal sector does not act as a “welfare buffer” in face of negative shocks.

Conclusions

- ▶ Repressing informality increases productivity at the expense of welfare, whereas trade leads to the same productivity gains and also increases welfare.
- ▶ Trade increases wage inequality in the formal tradable sector, but this effect is reversed when we include the informal sector in the analysis.
- ▶ The effect of trade on productivity is understated if the informal sector is left out.
- ▶ Large welfare gains from trade, robust to different scenarios in which informality is either completely or partially repressed.

Fact 1: Informality and Transitions

Table: Employment Shares and Transition Rates

	Share of Workers	Transition Rates From Unemp.
Informal Tradable (C_i)	0.059	0.064
Formal Tradable (C_f)	0.106	0.050
Informal Non-Tradable (S_i)	0.351	0.389
Formal Non-Tradable (S_f)	0.334	0.161
Unemployment	0.150	0.336
Share of Informal Employment		0.482
Transition Rate from Unemp. to Informal Employment		0.453
to Formal Employment		0.211
Ratio		2.146

Data source: 2003 PME.

▶ Back

Fact 2: Informality Status by Firm Size

Table: Firm-Level Informality Status vs. Firm-Level Employment

	Dep. Variable: <i>Informal Status Indicator_i</i>	
	C sector	S sector
Intercept	1.135 (0.028)	1.130 (0.012)
ℓ_i	-0.179 (0.025)	-0.204 (0.009)
Observations	1,194	7,273

Data source: 2003 ECINF. Standard errors in parentheses.

▶ Back

Facts 3 and 4: Productivity and Wages

Table: Firm-Level log-Revenue per Worker and log-Wages vs. log-Employment

Sector / Firm Type	A. Dep. Variable: $\log(\text{Revenue}_i / \ell_i)$				B. Dep. Variable: $\log(\text{wage}_i)$			
	<i>Cf</i>	<i>Sf</i>	<i>Ci</i>	<i>Si</i>	<i>Cf</i>	<i>Sf</i>	<i>Ci</i>	<i>Si</i>
Intercept	10.118 (0.013)	10.004 (0.005)	8.391 (0.037)	8.825 (0.015)	8.509 (0.006)	8.436 (0.002)	8.013 (0.033)	8.417 (0.014)
$\log(\ell_i)$	0.000 (0.005)	-0.128 (0.003)	0.342 (0.114)	0.321 (0.050)	0.117 (0.003)	0.105 (0.001)	0.292 (0.103)	0.231 (0.048)
<i>Exporter_i</i>	1.462 (0.021)				0.462 (0.014)			
Observations	16,986	43,861	1,070	6,202	20,075	145,981	1,071	6,205
Dataset	PIA + SECEX	PAS + PAC	ECINF	ECINF	RAIS + SECEX	RAIS	ECINF	ECINF

Standard errors in parentheses.

▶ Back

Firms' value functions

$$V_{kf}(z, \ell) = (1 - \alpha_{kf}) \max \left\{ 0, \max_{\ell'} \left\{ \pi_{kf}(z, \ell, \ell') + \frac{1}{1+r} E_{z'|z} V_{kf}(z', \ell') \right\} \right\}$$

$$V_{ki}(z, \ell) = (1 - \alpha_{ki}) \max \left\{ \begin{array}{l} 0, \max_{\ell'} \left\{ \pi_{ki}(z, \ell, \ell') + \frac{1}{1+r} E_{z'|z} V_{ki}(z', \ell') \right\}, \\ \max_{\ell'} \left\{ \pi_{kf}(z, \ell, \ell') + \frac{1}{1+r} E_{z'|z} V_{kf}(z', \ell') \right\} \end{array} \right\}.$$

Entry value functions

Value of entry into sector k / formal status j :

$$V_{kj}^e(z) = \max_{\ell'} \left\{ \pi_{kj}(z, 1, \ell') + \frac{1}{1+r} E_{z'|z} V_{kj}(z', \ell') \right\}$$

Expected value of entry into sector k , before drawing z is given by:

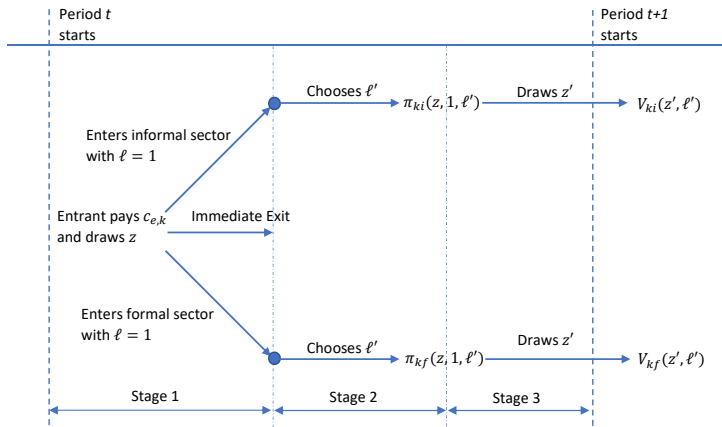
$$V_k^e = E_z \max \{ V_{ki}^e(z), V_{kf}^e(z), 0 \}$$

Free entry leads to:

$$V_k^e = c_{e,k}.$$

Entry

- ▶ Mass M_k of entrants into sector k pay an entry cost $c_{e,k}$, and draw z from the ergodic distribution of productivities.



Revenues and Value Added

- ▶ Revenues under Monopolistic Competition:

$$R_k(q) = \left(\frac{X_k}{P_k^{1-\sigma_k}} \right)^{\frac{1}{\sigma_k}} q^{\frac{\sigma_k-1}{\sigma_k}}$$

- ▶ Expenditure on tradables: $X_C = \zeta I + X_C^{int}$, and
- ▶ Expenditure on non-tradables: $X_S = (1 - \zeta) I + X_S^{int} + E_S$.
- ▶ X_k^{int} is expenditure on intermediates and E_S expenditures on nontradables to cover entry, hiring and export costs.
- ▶ Value added: $VA_k(z, \ell) = \Theta_k \Psi_k (z \ell^{\delta_k})^{\Lambda_k}$

Search and Matching

- ▶ To expand (in expectation) from ℓ to ℓ' firms post vacancies
- ▶ Firm vacancies and the number of unemployed workers determine the number of matches that will occur through the matching function.

- ▶ Total number of matches in the economy:

$$m(v_{Cf}, v_{Ci}, v_{Sf}, v_{Si}, L_u) = \phi \tilde{v}^\xi L_u^{1-\xi}$$

$$\tilde{v} = v_{Cf} + v_{Ci} + v_{Sf} + v_{Si}$$

- ▶ Matches in each sector are proportional to the relative number of vacancies they post

$$m_{kj} = \frac{v_{kj}}{\tilde{v}} m(v_{Cf}, v_{Ci}, v_{Sf}, v_{Si}, L_u)$$

Search and Matching

- ▶ Probability of filling a vacancy in k [sector]- j [formal status]:

$$\mu_{kj}^v \equiv \frac{m_{kj}}{v_{kj}} = \phi \left(\frac{L_u}{\tilde{v}} \right)^{1-\xi} = \mu^v$$

- ▶ Probability of unemployed worker find a job in k [sector]- j [formal status]:

$$\mu_{kj}^e \equiv \frac{m_{kj}}{L_u} = \frac{v_{kj}}{\tilde{v}} \left(\frac{\phi}{(\mu^v)^\xi} \right)^{\frac{1}{1-\xi}}$$

▶ Back

Wage Determination

- ▶ Wages are driven by a Nash bargain between workers and firms (collective bargaining) – β is the bargaining power of the union/workers

$$S_{kf}^u(z, l') = \beta (S_{kf}^e(z, l') + S_{kf}^u(z, l'))$$

- ▶ The total surplus of the match accounts for the option value of employment: the surplus depends both on the flow of wages and profits today and on the value of preserving an employment relationship.
- ▶ Similar problem for informal firms.

▶ Surplus

▶ Wages

Surplus Functions

$$S_{kf}^e(z, \ell') = (1 - \tau_y) VA_k(z, \ell') - (1 + \tau_w) w_{kf}(z, \ell') \ell' + \frac{1}{1+r} E_{z'|z} V_{kf}(z', \ell')$$

$$S_{kf}^u(z, \ell') = \left[w_{kf}(z, \ell') + \frac{1}{1+r} J_{kf}^e(z, \ell') - \left(b + b^u + \frac{1}{1+r} J^u \right) \right] \ell'$$

▶ Back

Wage functions

- ▶ The solution to union wages in the formal sector take the form

$$\begin{aligned}w_{kf}^u(z, \ell') &= \frac{1 - \beta}{1 + \beta\tau_w} \left(b + b^u + \frac{1}{1 + r} J^u \right) \\ &+ \frac{\beta(1 - \tau_y)}{1 + \beta\tau_w} \frac{VA_k(z, \ell')}{\ell'} \\ &+ \frac{1}{1 + r} \left(\frac{\beta}{1 + \beta\tau_w} E_{z'|z} \frac{V_{kf}(z', \ell')}{\ell'} - \frac{(1 - \beta)}{1 + \beta\tau_w} J_{kf}^e(z, \ell') \right).\end{aligned}$$

- ▶ Formal firms will not offer below reservation wage or below the minimum wage:

$$w_{kf}(z, \ell') = \max \{ w_{kf}^u(z, \ell'), w_{kf}^{res}(z, \ell'), \underline{w} \}$$

- ▶ There is an analogous bargaining solution for the informal sector, but minimum wages play no direct role

$$w_{ki}(z, \ell') = \max \{ w_{ki}^u(z, \ell'), w_{ki}^{res}(z, \ell') \}$$

Value Added, Domestic Firms

$$VA_k(z, \ell) = \Theta_k \Psi_k \left(z \ell^{\delta_k} \right)^{\Lambda_k}$$

$$\Psi_k \equiv (P_k^m)^{-(1-\delta_k)\Lambda_k} (\exp(d_{H,k}))^{\frac{\sigma_k}{\sigma_k-1}\Lambda_k}.$$

$$P_k^m \equiv \frac{P_C^{\lambda_k} P_S^{1-\lambda_k}}{\lambda_k^{\lambda_k} (1-\lambda_k)^{1-\lambda_k}},$$

$$d_{H,k} = \log \left(\left(\frac{X_k}{P_k} \right)^{\frac{1}{\sigma_k}} \right)$$

▶ Back

Fixed Parameters

Table: Fixed Parameters

Parameter	Description	Value
τ_c	Iceberg Trade Cost	2.50
ζ	Share of final expend. on C	0.283
λ_C	Prod. Function	0.645
λ_S	Prod. Function	0.291
r	Interest rate	0.08
τ_y	Value Added Tax	0.293
τ_w	Payroll Tax	0.375
$\tau_a - 1$	Import Tariff	0.12
κ	Firing Costs (in R\$)	1,956.7
\underline{w}	Min. Wage (in R\$)	2,880
b_u	Unemployment Benefit	1,644
ξ	Matching Function	0.5
ϕ	Matching Function	0.576
β	Workers' Bargaining Weight	0.5

Estimates

Table: Parameter Estimates

Parameter	Description	$k = C$	$k = S$
\tilde{a}_k	Cost of Informality, Intercept	0.161	0.373
\tilde{b}_k	Cost of Informality, Convexity	0.131	0.013
h_k	Hiring Cost, Level	559.7	2,348.9
γ_k^1	Hiring Cost, Convexity	2.067	4.896
γ_k^2	Hiring Cost, Scale Economies	0.139	0.192
σ_k	Elasticity of Substitution	5.321	3.281
ρ_k	Productivity AR(1) Process, Pers. Coeff.	0.978	0.977
σ_k^z	Productivity AR(1) Process, Var. of Shock	0.199	0.296
α_k	Exogenous Exit Probability	0.067	0.063
\bar{c}_k	Fixed Cost of Operation	23.071	27.047
δ_k	Labor Share in Production	0.266	0.54
c_k^e	Entry Cost	5,332.2	2,067.1
f_x	Fixed Cost of Exporting	55,856.9	
b	Utility Value of Unemployment	-8,662.5	
$(D_F^*)^{\frac{1}{\sigma_C}}$	Foreign Demand Shifter	969.2	

Table: Effects of Increasing the Cost of Informality

	Benchmark	Stricter Enforcement	No Informality
Unemployment Rate	0.183	0.184	0.326
Share Emp. C_i	0.081	0.050	0
Share Emp. C_f	0.100	0.124	0.201
Share Emp. S_i	0.417	0.313	0
Share Emp. S_f	0.402	0.514	0.799
Share Informal Emp.	0.498	0.362	0
$N_C = N_{Cf} + N_{Ci}$	1	0.813	0.268
$N_S = N_{Sf} + N_{Si}$	1	1.137	0.574
Aggregate TFP C	1	1.085	1.317
Real V.A. per worker C	1	0.988	0.856
Aggregate TFP S	1	0.993	1.397
Real V.A. per worker S	1	0.940	0.987
P_C^m	1	1.030	1.061
P_S^m	1	1.013	1.027
Real Income	1	0.950	0.787
Real Income 2	1	0.938	0.541

Model Fit

Table: Employment Shares and Transition Rates from Unemployment

Moment	Dataset	Model	Data
Share of Employment C_i	PME	0.067	0.059
Share of Employment C_f	PME	0.083	0.106
Share of Employment S_i	PME	0.360	0.351
Share of Employment S_f	PME	0.315	0.334
Share Unemployment	PME	0.176	0.150
Share Informal Workers (Conditional on Working)	PME	0.518	0.482
Trans. Rate from Unemp. to C_i	PME	0.062	0.064
Trans. Rate from Unemp. to C_f	PME	0.051	0.050
Trans. Rate from Unemp. to S_i	PME	0.383	0.389
Trans. Rate from Unemp. to S_f	PME	0.167	0.161
Trans. Rate from Unemp. to Unemp	PME	0.336	0.336
Ratio Trans. to Informal job / Trans. To Formal job	PME	2.042	2.146

▶ Back

Model Fit

Table: Turnover-Related Moments and Auxiliary Models

	Dataset	C sector		S sector	
		Model	Data	Model	Data
Exit Rate	RAIS	0.091	0.103	0.089	0.125
Average Firm-level Turnover	RAIS	0.231	0.505	0.198	0.525
$Corr(\ell_{t+1}, \ell_t)$	RAIS	0.947	0.929	0.942	0.914
<i>Exit</i> _{<i>i</i>} = $\alpha + \beta \log(\ell_i)$					
Intercept	RAIS	0.154	0.188	0.137	0.185
$\log(\ell_i)$	RAIS	-0.028	-0.045	-0.040	-0.049
<i>Turnover</i> _{<i>i</i>} = $\alpha + \beta \log(\ell_i) + \gamma \text{Exporter}_i$					
Intercept	RAIS	0.435	0.741	0.315	0.645
$\log(\ell_i)$	RAIS	-0.095	-0.126	-0.097	-0.096
<i>Exporter</i> _{<i>i</i>}	RAIS	0.071	0.071		
<i>Turnover</i> _{<i>i</i>} = $\alpha + \beta \log(\ell_i) + \gamma \text{Exporter}_i$, Conditional on Expansions					
Intercept	RAIS	0.410	0.692	0.278	0.690
$\log(\ell_i)$	RAIS	-0.105	-0.138	-0.098	-0.150
<i>Exporter</i> _{<i>i</i>}	RAIS	0.119	0.116		
<i>Turnover</i> _{<i>i</i>} = $\alpha + \beta \log(\ell_i) + \gamma \text{Exporter}_i$, Conditional on Contractions					
Intercept	RAIS	0.456	0.744	0.335	0.624
$\log(\ell_i)$	RAIS	-0.077	-0.101	-0.064	-0.064
<i>Exporter</i> _{<i>i</i>}	RAIS	0.056	0.056		

Model Fit

Table: Firm-Size Distribution

	Dataset	C sector		S sector	
		Model	Data	Model	Data
Avg. Firm-Level log-Emp.	RAIS	2.249	1.918	1.213	1.237
Std Dev log-Emp	RAIS	0.915	1.416	0.685	1.175
Avg. Exporter log-Emp.	RAIS+SECEX	3.555	4.014		

▶ Back

Model Fit

Table: Trade-Related Moments

	Dataset	Model	Data
Fraction of Exporters	RAIS + SECEX	0.129	0.073
Total Exports / (Total Manuf. Rev.)	SECEX + IBGE	0.133	0.134

▶ Back

Model Fit

Table: Formal-Sector Wages

		C sector		S sector	
	Dataset	Model	Data	Model	Data
Avg. log-Wages	RAIS	8.635	8.769	8.413	8.567
$\log(w_i) = \alpha + \beta \log(\ell_i) + \gamma \text{Exporter}_i$					
Intercept	RAIS	8.301	8.509	8.288	8.436
$\log(\ell_i)$	RAIS	0.117	0.117	0.103	0.105
Exporter_i	RAIS	0.542	0.462		

▶ Back

Model Fit

Table: Formal-Sector Revenues

	Dataset	C sector		S sector	
		Model	Data	Model	Data
Avg. log-Revenues	IBGE	12.652	12.726	10.898	10.814
Std. Dev. log-Revenues	IBGE	1.278	1.874	0.916	1.440
$Corr(Rev_t, Rev_{t+1})$	IBGE	0.727	0.929	0.630	0.845
$Rev_i = \alpha + \beta \log(\ell_i) + Exporter_i$					
Intercept	IBGE	9.995	10.118	9.500	10.004
$\log(\ell_i)$	IBGE	1.149	1.000	1.152	0.872
$Exporter_i$	IBGE	0.561	1.462		

▶ Back

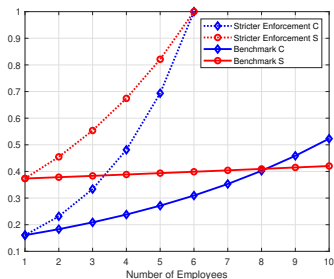
Model Fit

Table: Informal Sector Moments and Auxiliary Moments

	Dataset	C sector		S sector	
		Model	Data	Model	Data
Average log-Employment	ECINF	0.189	0.105	0.244	0.097
Std. Dev. log-Employment	ECINF	0.316	0.303	0.355	0.274
Avg. log-Revenue	ECINF	9.596	8.531	9.253	8.953
Avg. log-Wages	ECINF	7.825	8.043	7.660	8.440
<i>Informal_i = $\alpha + \beta\ell_i$</i>					
Intercept	ECINF	1.308	1.135	1.212	1.130
ℓ_i	ECINF	-0.179	-0.179	-0.202	-0.204

▶ Back

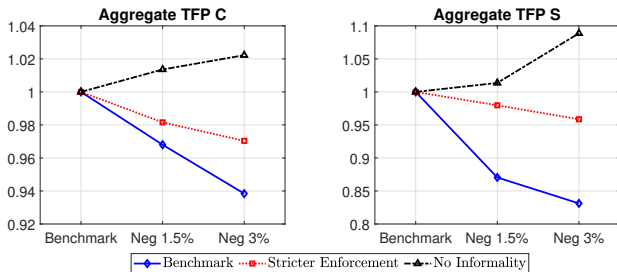
Figure: Costs of Informality: Benchmark and Stricter Enforcement



Notes: $p_{Ci}(\ell)$ and $p_{Si}(\ell)$ are plotted against ℓ under the benchmark case and under the stricter enforcement policy.

▶ Back

Figure: Negative Productivity Shocks and Aggregate TFP



▶ Back