Workforce Composition, Productivity, and Labor Regulations in a Compensating Differentials Theory of Informality

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The Nature of Labor Market Informality

- Discussions on labor informality sometimes framed in terms of competing views.

 - ▶ Dual labor markets.

  - ▶ Regulatory distortions.

Dual Labor Markets

- Economies in developing countries composed of two "sectors."
    - Formal: modern and capitalist, abiding to regulations.
    - Informal: traditional, associated with subsistence and archaic production techniques.
        - Based on observation that informal workers are less skilled, firms less productive and smaller.
- Sectors as separate markets, with virtually no communication or mobility across them: segmentation.
- Workers in informal sector losing skills and being stuck in low-productivity jobs **because** of informality.
    - Doeringer and Piore (1971), Cain (1976).

Dual Labor Markets

- At odds, among other things, with labor market flows.

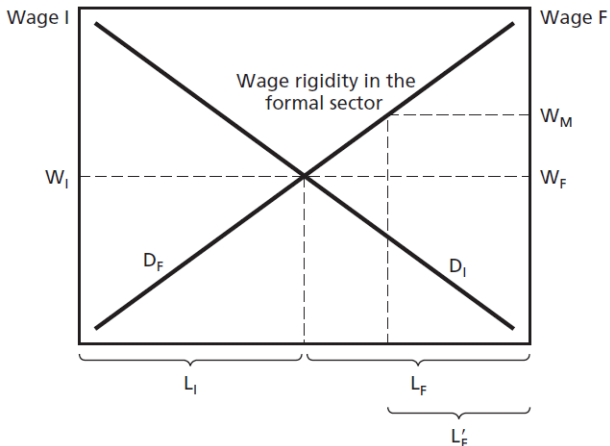## Formal-Informal Flows and Unemp.Rate
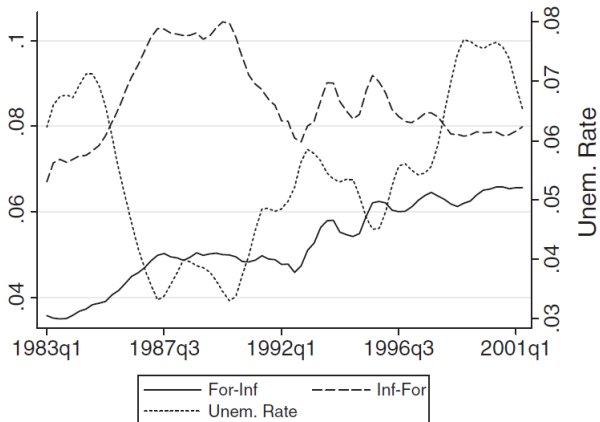
Source: Perry et al (2007).

Regulatory Distortions

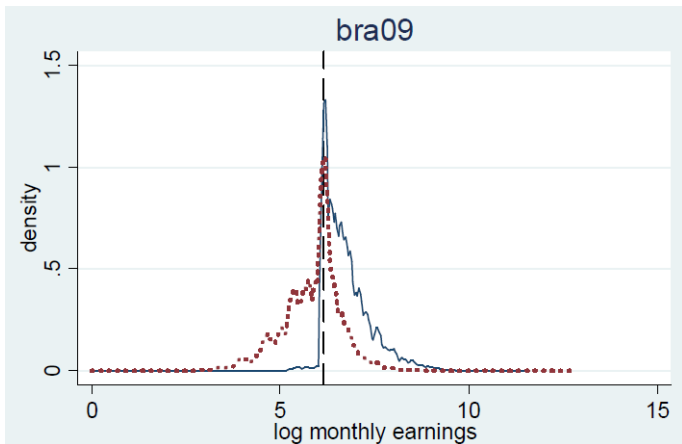- Labor regulations impose market distortions that lead to informality.

Relative sector sizes and wages under a nominal wage rigidity

Source: Perry et al (2007).

Regulatory Distortions

- At odds, among other things, with overlap of wage distributions.

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Source: Tornarolli et al. (2014).

  ▶ In addition: informal firms are smaller, tend to grow less.

Heterogeneities Within and Across Sectors

- Both views take formal and informal sectors as given and imply stark heterogeneity across them.

- Observed heterogeneity–and overlap–within and across sectors hard to reconcile with either:

Sample	Wages in 2003 (R$)		Wage growth (%)		Formal wage gap (%)		Informality (%)	
	Formal	Informal	Formal	Informal	2003	2012	2003	2012
All	2.54	1.93	28.5	48.5	31.4	13.7	28.1	17.3
By schooling:								
Less than 8 years	1.87	1.37	29.8	44.8	36.2	22.1	33.8	23.9
8 to 10 years	2.04	1.48	24.1	44.6	38.0	18.4	31.7	22.8
H.S., college drop.	2.69	2.17	13.4	25.8	23.9	11.7	24.0	14.1
College or more	8.23	6.36	−9.8	11.6	29.4	4.6	16.8	11.9

Source: Haanwinckel and Soares (2021).

- + firm size wage premium rising on skill level, share of skilled workers increasing on firm size (in both sectors), etc.

Key Ingredients to Reconcile these Patterns

- Worker heterogeneity: skilled and unskilled.

- Firm heterogeneity: skill-biased productivity.

- Formal sector: labor regulations, including minimum wage.

- Informal sector: penalty associated with firm size.

- In addition, from a modeling perspective:

  - Unemployment: search and matching frictions (Pissarides, 2000).

  - Complementarity between different types of workers within firms: intra-firm bargaining (Cahuc et al., 2008).

  - Firm-size wage premium: convex job-posting costs (Acemoglu and Hawkins, 2014).

Haanwinckel and Soares (2021)

- A model with these ingredientes reproduces the patterns mentioned and match well other dimensions of the Brazilian labor market in the 2000s.

- Equilibrium patterns across and within sectors consistent with compensating differentials equilibrium under search and regulatory wedges.

  ▶ Less productive firms self-select into informal sector, choose smaller sizes, and a lower fraction of skilled workers.
  ▶ Skilled and unskilled workers employed in formal and informal sectors.
  ▶ Lower wages in informal sector due to composition, firm size, and regulations.
  ▶ In general, workers prefer formal jobs.
  ▶ But compensating differentials logic holds at the margin of informality when minimum wage does not bind.

Features of Both Extreme Stories

- Market imperfections from regulations and search frictions endogenously generate observed differences across formal-informal sectors.

- In equilibrium, with binding minimum wage, rationing of unskilled formal jobs.

- But skilled an unskilled workers present in both sectors.

- Idea of informal sector composed of two distinct tiers reproduced as an equilibrium outcome (Fields, 1975, 1990; Rauch, 1991).
  - Structure of this equilibrium is intimately linked to various features of the cross-sectional wage distribution observed in the data.

Model Structure

- Workers: skilled (s) and unskilled (u), exogenous % skilled (η).
- Firms: $F^z(n_s, n_u)$, heterogeneous in skill-biased productivity $z \sim G_z(z)$.
- Search frictions: θ_i is ratio of vacancies to unemployed for skill i.
  - Pr(Vacancy is filled in dt) $= q(\theta_i)dt$.
  - Pr(Unemployed worker finds job in dt) $= \theta_i q(\theta_i)dt$.
  - Vacancy posting: cost $\Xi_i^j(v)$ convex, with $j \in \{for, inf\}$.
  - Jobs destroyed at exogenous rates: λ_i^j.
- Wage-setting through intra-firm bargaining: $w_i^{z,k,j}(n_s, n_u)$, for skill level i, in firm (z, k), operating in sector j.
- Formal firms: payroll tax τ and minimum wage $\overline{w}$.
- Informal firms: informality penalty $\rho^k(n_s + n_u), k \sim G_k(k)$.

Model: Problem of the Firm

Instantaneous profits:

$$
\psi^{z,k,j}(\mathbf{n}, \mathbf{v}) = \begin{cases} F^z(n_s, n_u) - \sum_{i=s,u} \left[(1+\tau) n_i w_i^{z,for}(n_s, n_u) + \Xi_i^{for}(v_i) \right] & \text{if } j = for \\ F^z(n_s, n_u) - \sum_{i=s,u} \left[n_i w_i^{z,k,inf}(n_s, n_u) + \Xi_i^{inf}(v_i) \right] - \rho^k (n_s + n_u) & \text{if } j = inf \end{cases}
$$

Problem of the firm:

$$
\begin{aligned}
\Pi^{z,k} &= \max_{j \in \{for, inf\}} \Pi^{z,k,j}(n_s, n_u) \\
\Pi^{z,k,j}(n_s, n_u) &= \max_{\{v_s, v_u\}} \left(\frac{1}{1+rdt} \right) \left\{ \psi^{z,k,j}(n_s, n_u, v_s, v_u) \, dt + \Pi^{z,k,j}(n_s^+, n_u^+) \right\} \\
\text{s.t.} \quad n_i^+ &= n_i + \dot{n}_i dt = \left(1 - \lambda_i^j dt \right) n_i(t) + v_i q(\theta_i) \, dt, \quad i = s, u
\end{aligned}
$$

Model: Problem of the Firm

First order conditions for type $i = s, u$:

$$\frac{\partial \Pi^{z,k,j}(n_s, n_u)}{\partial n_i} = \frac{\partial \Xi_i^j(v_i)}{\partial v_i} \frac{1}{q(\theta_i)}$$

$$(r + \lambda_i^j) \frac{\partial \Pi^{z,k,j}(n_s, n_u)}{\partial n_i} = \begin{cases} F_i^z(n_s, n_u) - (1+\tau) \left[w_i^{z,for}(n_s, n_u) + \sum_{l=s,u} n_l \frac{\partial w_l^{z,for}(\cdot)}{\partial n_i} \right] \\ F_i^z(n_s, n_u) - w_i^{z,k,inf}(n_s, n_u) - \sum_{l=s,u} n_l \frac{\partial w_l^{z,k,inf}(\cdot)}{\partial n_i} - \frac{\partial \rho^k(n_s + n_u)}{\partial n_i} \end{cases}$$

Substituting for the derivative and rearranging, in formal sector:

$$\underbrace{F_i^z(n_s, n_u)}_{\substack{\text{Marginal} \\ \text{productivity}}} = (1+\tau) \underbrace{w_i^{z,for}(n_s, n_u)}_{\text{Own wage}} + (1+\tau) \underbrace{\sum_{l=s,u} n_l \frac{\partial w_l^{z,for}(\cdot)}{\partial n_i}}_{\substack{\text{Effect on other} \\ \text{workers' wages}}} + \underbrace{\frac{(r + \lambda_i^{for})}{q(\theta_i)} \frac{\partial \Xi_i^j(v_i)}{\partial v_i}}_{\text{Hiring costs}}$$

Model: Wage-Setting

- Firms and workers take θ_i, U_i as given. Nash bargaining equation:

$$(1 - \sigma) \left[J_i^j \left(w_i^{z,k,j}(n_s, n_u) \right) - U_i \right] = \sigma \frac{\partial \Pi^{z,k,j}(n_s, n_u)}{\partial n_i} (n_s, n_u),$$

  Worker valuations:

$$
\begin{aligned}
r J_i^{for}(w) &= a_i w + b_i + \lambda_i^{for} \left[U_i - J_i^{for}(w) \right] \\
r J_i^{inf}(w) &= w + \lambda_i^{inf} \left[U_i - J_i^{inf}(w) \right]
\end{aligned}
$$

- System of differential equations, extension of Cahuc et al. (2008).
  - If formal wages are below the minimum wage–say, for unskilled in firm z–then minimum wage binds: $w_u^{z,for} = \bar{w}$.

Model: Compensating Differentials Logic

For formal and informal firms of similar size–at margin of informality–with non-binding minimum wage:

$$w_i^{inf} \approx \frac{r + \lambda_i^{inf}}{r + \lambda_i^{for}} \left(a_i w_i^{for} + b_i\right) - \frac{rU_i \left(\lambda_i^{inf} - \lambda_i^{for}\right)}{r + \lambda_i^{for}}$$

- Informal workers are compensated for lack of benefits through higher wages.
- But this does not hold in general, since wages also vary across formal-informal sectors for other reasons:
  - Composition: formal firms have higher share of skilled workers.
  - Firm size premium: larger firms pay more.
  - Minimum wage: lack of wage flexibility for unskilled in small formal firms.
    - Workers typically prefer formal jobs.
- Marginal formal and informal firms virtually identical.

Empirical Exercises

- Model is estimated using labor market data in 2003.
  - ▶ Target moments disaggregated by 6 metropolitan regions covered by the Brazilian Monthly Employment Survey.
    - ★ Skill level×region: job finding rate, % formal vacancies, reservation w, mean $ln(w)$, formal premium, % workers in firms 6-10; % workers in firms 11+.
    - ★ Aggregate: labor share, (% formal workers in firms 500+)/(% in 100+), enforcement-elasticity of informality (Almeida e Carneiro, 2012).

- Input changes (2003-2012) in workforce composition, enforcement of regulation, taxes, mandated benefits, minimum wage, and productivity.
  - ▶ Validate the model using out of sample predictions.
    - ★ Model reproduces changes observed during the period (**no time to show**).
  - ▶ Use the model as of 2012 to conduct a policy experiment.
    - ★ Progressive payroll taxes as a tool to reduce informality (**no time to show**).
  - ▶ Shed light on determinants of reductions in informality.

Model: Equilibrium
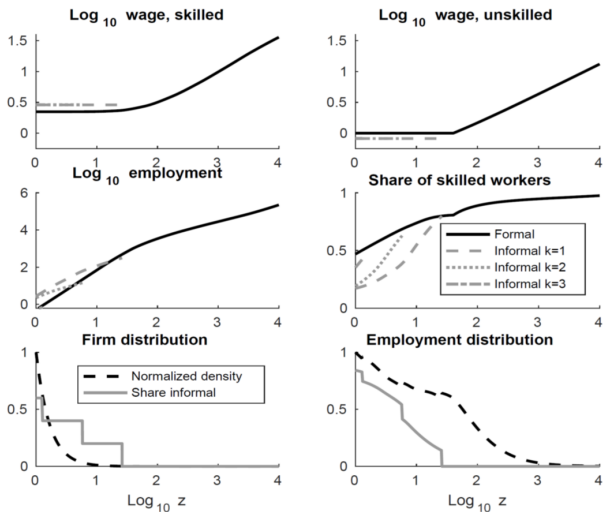
Figure 1 – Cross-Sectional Features of the Equilibrium, Recife Metropolitan Region, 2003

Note: The top four panels show firm choices in equilibrium for different values of firm productivity z and informality cost shifter k. Conditional on being formal, k is irrelevant, and thus there is a single curve for formal firms in each panel. Different curves for informal firms reflect different values of k. These curves do not cover the whole range of productivities because, when z is high enough, firms choose to comply with regulations. Because firms with $k=4$ and $k=5$ are formal for all values of z, there are only three such curves. The bottom two panels show distributions of firms and total employment by firm productivity z. They also show shares of firms of a given z, or shares of workers employed in those firms, that are informal.

Counterfactuals

Table 5 – Counterfactuals Holding Constant Each Factor One at a Time, Changes in Brazilian Labor Market Outcomes from 2003 to 2012

Outcomes:	(1) All changes	(2) Fraction skilled	(3) Minimum wage	(4) Enforcement	(5) A	(6) B_1
		All changes, except:				
					Productivity/Demand	
Informality	-0.0603	0.0342	-0.0840	-0.0473	-0.0154	-0.0261
Unemployment	-0.0434	0.0132	-0.0730	-0.0455	-0.0136	-0.0247
Wages (ln)	0.3437	0.2620	0.3112	0.3436	0.1013	0.3421
Skilled	0.0774	0.2242	0.0756	0.0768	-0.1931	0.1167
Unskilled	0.5152	0.2933	0.4778	0.5202	0.2751	0.3752
Formal Wage Premium	-0.0353	0.1270	-0.0947	-0.0348	0.0873	0.0322
Firm Size Premium $(6-10)$	-0.0065	-0.0091	-0.0167	-0.0057	-0.0042	-0.0027
Firm Size Premium (≥ 11)	-0.0017	0.0124	0.0096	-0.0025	0.0334	0.0107

Note: Column 1 shows 2003-2012 changes predicted by our validation exercise (i.e., the same values from Table 4, Column 5). The remaining columns show changes predicted by the model if all of the parameters changed in the same way as in the validation exercise, but for one parameter (which is held constant at the 2003 level).

Discussion

- Patterns mentioned before arise as equilibrium outcomes.
  - In particular: declining formal wage premium and increasing firm size wage premium (on skill) as byproducts of the structure of the equilibrium.
    - ★ Minimum wage compresses wage distribution along different margins.

- Labor force composition determining the equilibrium level of informality.
  - Through relative wages.

- Big picture: labor market regulations as distortions, under a given productivity distribution.
  - Informality as the outcome of a market distortion, not as the distortion itself.

- Productive differences across sectors are not intrinsic characteristics.
  - But firms are affected in ways that have implications for productivity.
    - ★ Likely even more relevant in a context with firm growth.