Financial Frictions, Occupational Choice and Economic Inequality

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Overview

1. The Model
2. Time Allocation and Occupational Maps
3. Quantitative Analysis
4. Conclusions
Introduction

Research question
What is the impact of financial frictions on entrepreneurship, aggregate output and income distribution?

Contributions
Extension of the Lucas (1978) model. Innovation: households are heterogeneous in two skills: working and managerial. This allows the model to account for:

- Most firms are small and do not hire employees
- Median entrepreneurial income is no higher than median wage
The model is calibrated to Brazilian data. Baseline results show:

- Elimination of financial frictions would increase aggregate output by 48% and TFP by 9%
- Increase in TFP mostly due to reallocation of capital across entrepreneurs (intensive margin)
- Financial frictions lead to a small increase in income inequality but are an importance source of persistence
- Vast majority benefits from credit market reform, but lower skilled employers suffer

The results appear to be sensible to the value of the fixed costs of operation faced by entrepreneurs.
Households

- Overlapping generations, consisting of a continuum of households
- Endowment of one unit of time at every age, that can be allocated to working \((t_w)\) or managerial \((t_m)\) activities

\[
\ln(z_{jit}) = \beta_j X_t + \alpha_{ji} + u_{jit} \quad \text{for } j = w, m
\]
Moreover

\[ \alpha = (\alpha_w, \alpha_m) \sim N \left( \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma^2_w & \rho \alpha \sigma_w \sigma_m \\ \rho \alpha \sigma_w \sigma_m & \sigma^2_m \end{bmatrix} \right) \]

\[ u_{jit} = \rho_j u_{j(it-1)} + \epsilon_{jit} \quad \text{for } j = w, m \]
I. The Model

Production

- CRTS technology

\[ Y(m, k, n) = m^\gamma k^\eta n^\theta \quad \text{where} \quad \gamma + \eta + \theta = 1 \]

\[ m = z_m t_m \]

\[ n = n_d + (1 - t_m) z_w \]

- Workers: \( t_m = 0 \)
- Entrepreneurs: \( t_m > 0 \)
  - Employers: \( n_d > 0 \)
  - Self-employed: \( n_d = 0 \)
- Employers incur a fixed cost of operation \( c_f \)
Capital Markets

- Competitive financial intermediation industry, takes deposits from households, pays the international interest rate $r$, rents capital to entrepreneurs at the rate $r + \delta$ and loans employers the fixed cost of operation $c_f$

- Enforcement problems: after production entrepreneurs may renege on the financial contracts, keeping

$$ (1 - \phi) \left( Y(m, k, n) - wn_d + (1 - \delta)k - c_fI_{n_d>0} \right) $$

but losing the financial assets $(a)$ deposited with the intermediary

- $\phi \in [0, 1]$ indexes the strength of legal institutions

- No default in equilibrium: capital rented is limited by the largest amount $\bar{k}(a, z_m, z_w; \phi)$ consistent with entrepreneurs choosing to abide
Perfect Enforcement

1. The rates of return on skills do not vary across individuals, so income inequality is all due to heterogeneity in skills and assets.
2. If there is no fixed cost of operation, the optimal occupational choice is only determined by the skill ratio $\frac{z_m}{z_w}$.
3. If there is a fixed cost of operation, the optimal occupational choice is determined by the skill ratio $\frac{z_m}{z_w}$ and the absolute level of managerial ability $z_m$.

Imperfect Capital Markets

1. The rates of return vary across individuals, decrease with $\mu$, covary with asset holdings and income heterogeneity is due to heterogeneity in skills, assets and rates of return.
2. Occupational choices depend on the skill ratio, assets and the absolute level of skills.
III. Quantitative Analysis

Calibration

Parameters set exogenously

- International interest rate: $r = 3\%$
- CES utility function: $u(c) = \frac{c^{1-\sigma}}{1-\sigma}, \sigma = 1.5$
- Production function parameters: $\gamma = 0.198$, $\eta = 0.3256$, $\theta = 0.4764$
- Depreciation rate: $\delta = 0.06$

Calibrated parameters

1. $\beta$ chosen to match steady-state capital-income ratio of 2.4
2. $\phi$ chosen to match credit to GDP ratio of 43%
3. The parameters of the processes for working and managerial abilities are chosen to match the age profiles of income
4. The correlation between managerial and working skills $\rho_w$, is pinned down by the ratio of median earnings between entrepreneurs and workers
5. The fixed cost $c_f$ is set to match the fraction of employers among entrepreneurs
Calibration results

Table 2—Calibration Results-Model Aggregates

<table>
<thead>
<tr>
<th></th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>K/Y</td>
<td>2.4</td>
<td>2.3</td>
</tr>
<tr>
<td>Credit/GDP</td>
<td>43%</td>
<td>42%</td>
</tr>
<tr>
<td>Var Log(Earn)-Entrepreneurs</td>
<td>1.1</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Figure 2. Variance of Log(earnings)-Model vs Data
## Calibration results

### Table 3—Calibration Results—Occupational Structure

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers</td>
<td>68%</td>
<td>67%</td>
</tr>
<tr>
<td>Self-Employed</td>
<td>24%</td>
<td>24%</td>
</tr>
<tr>
<td>Employers</td>
<td>8%</td>
<td>9%</td>
</tr>
<tr>
<td>Emp to Emp</td>
<td>70%</td>
<td>68%</td>
</tr>
</tbody>
</table>
III. Quantitative Analysis

Performance of the baseline economy

<table>
<thead>
<tr>
<th>Transitions</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>E to W</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>E to SE</td>
<td>22%</td>
<td>24%</td>
</tr>
<tr>
<td>E to E</td>
<td>68%</td>
<td>70%</td>
</tr>
<tr>
<td>SE to W</td>
<td>15%</td>
<td>26%</td>
</tr>
<tr>
<td>SE to SE</td>
<td>77%</td>
<td>65%</td>
</tr>
<tr>
<td>SE to E</td>
<td>8%</td>
<td>9%</td>
</tr>
<tr>
<td>W to W</td>
<td>94%</td>
<td>89%</td>
</tr>
<tr>
<td>W to SE</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>W to E</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

*Note: In the table W stands for Workers, SE for Self-Employed and E for Employers.*
Performance of the baseline economy

**Figure 3. Distribution of Earnings-Data vs Model I**
III. Quantitative Analysis

Performance of the baseline economy

Figure 4. Distribution of Earnings-Data vs Model II
III. Quantitative Analysis

Experiment: Removing financial frictions

Occupational structure and financial frictions

Figure 1. Occupational Map
Experiment: Removing financial frictions

Output, resource allocation, and financial frictions

<table>
<thead>
<tr>
<th>Table 5—Eliminating Financial Frictions: Efficiency Gains in Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Baseline Economy</td>
</tr>
<tr>
<td>TFP gains</td>
</tr>
<tr>
<td>Employers</td>
</tr>
<tr>
<td>Self-employed</td>
</tr>
</tbody>
</table>

| Panel B: Economy High-Fixed Costs                             |
| TFP gains | Total | Intensive | Extensive | Avg. TFP | № Ent. |
| Employers | 27.3% | 13.0%     | 14.3%     | 0.8%     | 13.5%  |
| Self-employed | 1.1%  | 12.8%     | -11.7%    | 8.0%     | -19.7% |
Experiment: Removing financial frictions

Financial frictions and the distribution of income

<table>
<thead>
<tr>
<th></th>
<th>All Households</th>
<th>Employers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Ec.</td>
<td>$\phi = 1$</td>
</tr>
<tr>
<td>Capital Income</td>
<td>24%</td>
<td>5%</td>
</tr>
<tr>
<td>Skill returns</td>
<td>31%</td>
<td>81%</td>
</tr>
<tr>
<td>Covariance Term</td>
<td>44%</td>
<td>14%</td>
</tr>
</tbody>
</table>

The political economy of financial frictions

While most households benefit from the reform (91.3%), the majority of employers lose (two thirds). Households that lose tend to be older, richer, exhibit higher managerial skills and lower working skills. But among employers, those with higher managerial skills favor the reform.
Conclusions

- The paper innovates on the Lucas model of entrepreneurship by allowing for two types of skills (working and managerial) and by allowing entrepreneurs to allocate time between these two activities.

- The elimination of financial frictions in Brazil would increase aggregate output by 48% and TFP by 9%, mainly along the intensive margin.

- However, TFP gains are quite sensitive to the value of the fixed cost of operation faced by employers. An alternative calibration with high fixed costs yields TFP gains of 14.3% along the extensive margin.

- Self employment reduces output losses caused by credit market imperfections.

- Income from skills is more evenly distributed when there are financial frictions, because they depress the rents earned by high skill entrepreneurs.

- Most employers lose from capital markets reform and thus may have a vested interest in maintaining status quo.
Capital rental by an entrepreneur with wealth $a$ and skills $(z_m, z_w)$ is enforceable if and only if

$$\pi(z_m, z_w, a; k) \geq (1 - \phi) \max_{m,n,n_d,t_m} \left\{ m^\gamma k \eta n^\theta - wn_d + (1 - \delta)k - c_f l_{n_d} > 0 \right\}$$

subject to

$$m = t_m z_m$$
$$n = (1 - t_m) z_w + n_d$$
$$t_m \in [0, 1], n_d \geq 0$$

where

$$\pi(z_m, z_w, a; k) = \max_{n,n_d,t_m} \left\{ m^\gamma k \eta n^\theta - wn_d - r(k - a) + a - \delta k - c_f l_{n_d} > 0 \right\}$$

subject to

$$m = t_m z_m$$
$$n = (1 - t_m) z_w + n_d$$
$$t_m \in [0, 1], n_d \geq 0, k \text{ given}$$

The rental limit can be represented by a function $\bar{k}(a, z_m, z_\phi)$ which is increasing in all of its arguments.
The income of an entrepreneur in state \((z_m, z_w, a)\) making optimal production decisions given prices and borrowing limits is

\[
y_e (z_m, z_w, a) \equiv \max_k \left\{ \pi (z_m, z_w, a) - a \right\}
subject to
k \leq \bar{k}(a, z_m, z_\phi)
\]

The income of a worker in state \((z_m, z_w, a)\) is \(y_w (z_m, z_w, a) = wz_w + ra\). Thus, a household's income in state \((z_m, z_w, a)\) is

\[
y (z_m, z_w, a) = \max \{y_e (z_m, z_w, a), y_w (z_m, z_w, a)\}
\]

Households maximize expected discounted lifetime utility

\[
\max_{c_j, a_{j+1}} \mathbb{E} \left\{ \sum_{j=1}^{J} \beta^j U(c_j) \right\}
subject to
c_j + a_{j+1} = y (z_m, z_w, a)
c_j, a_{j+1} \geq 0
\]

\(\text{Capital markets}\)
Table 1—Calibrated Parameters

<table>
<thead>
<tr>
<th>$\rho_{w,m}$</th>
<th>$\rho_w$</th>
<th>$\rho_m$</th>
<th>$\sigma_{\alpha,w}^2$</th>
<th>$\sigma_{\alpha,m}^2$</th>
<th>$\sigma_{\epsilon,w}^2$</th>
<th>$\sigma_{\epsilon,m}^2$</th>
<th>$c_f$</th>
<th>$\phi$</th>
<th>$\beta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>0.98</td>
<td>0.78</td>
<td>0.38</td>
<td>1.59</td>
<td>0.03</td>
<td>0.99</td>
<td>0.10</td>
<td>0.23</td>
<td>0.995</td>
</tr>
</tbody>
</table>
Aggregate production function of employers

\[ Y_E = \left( \sum_{i \in E} z_i r_i^{-\frac{\eta}{\gamma}} \right)^{1-\theta} \frac{\theta - 1}{\eta} \left( \sum_{i \in E} z_i r_i^{-\frac{\theta - 1}{\gamma}} \right) \]

When capital is allocated optimally \((r_i = r)\)

\[ TFP_E^R = \left( \sum_{i \in E} z_i \right)^{1-\theta-\eta} = \left( \sum_{i \in E} z_i \right)^{\gamma} \]

The gains in production efficiency can be expressed as

\[
\log (TFP_{gains}) = \log (TFP_{\phi=1}) - \log (TFP_B) \\
= \gamma \left( \log (\bar{z}_{\phi=1}) - \log (\bar{z}) \right) + \gamma \left( \log (N_{\phi=1}) - \log (N_B) \right) \\
\]

\[
\text{avg TFP employers} \underbrace{\gamma \left( \log (\bar{z}_{\phi=1}) - \log (\bar{z}) \right)}_{\text{Extensive Margin}} + \underbrace{\gamma \left( \log (N_{\phi=1}) - \log (N_B) \right)}_{\text{number of employers}} \\
\]

\[
+ \log \left( \sum_{i \in E} z_i \right)^{\gamma} - \log \left( \sum_{i \in E} z_i r_i^{\frac{-\eta}{\gamma}} \right)^{1-\theta} \frac{\theta - 1}{\eta} \left( \sum_{i \in E} z_i r_i^{-\frac{\theta - 1}{\gamma}} \right)^{\eta} \\
\text{Intensive Margin} \\
\]