The Brazilian Slump and the Government-Driven Credit Expansion

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Research question

My paper addresses the following questions:

What are the dynamic effects of misallocation on productivity growth that can arise from an idiosyncratic government-driven credit expansion?

Could the misallocation induced by idiosyncratic credit policy be a contributing factor to the dismal performance of the Brazilian economy in the 2010s?

Brazilian Data

The Revival of Industrial Policy

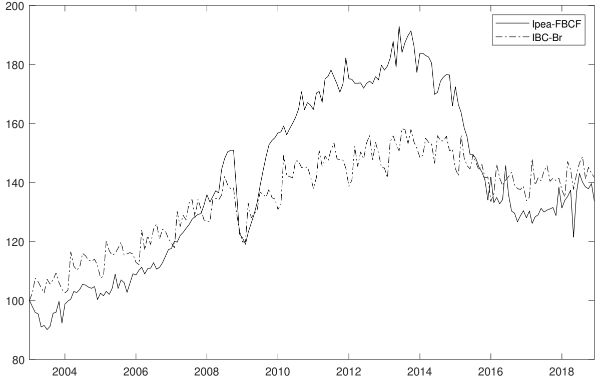


Figure: Index of Economic Activity of the Central Bank (IBC-Br) and Gross Fixed Capital Formation Ipea Index (Jan/2003=100)

Credit-to-GDP ratios

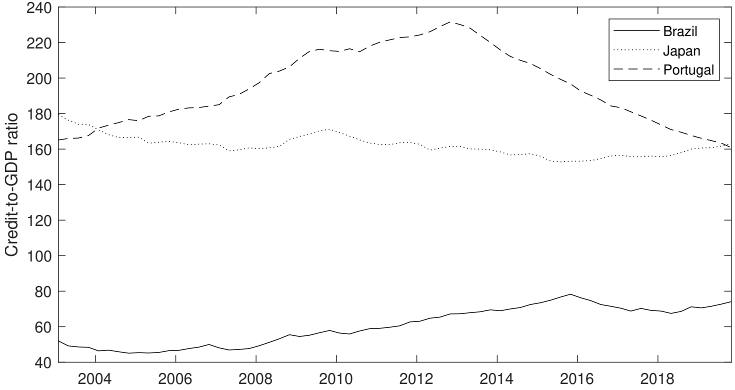


Figure: Credit-to-GDP ratios - Brazil, Japan and, Portugal

Share of the Earmarked Credit (2007–2017)

Share of the credit directed by government interventions with compulsory allocation or predetermined interest rate or both:

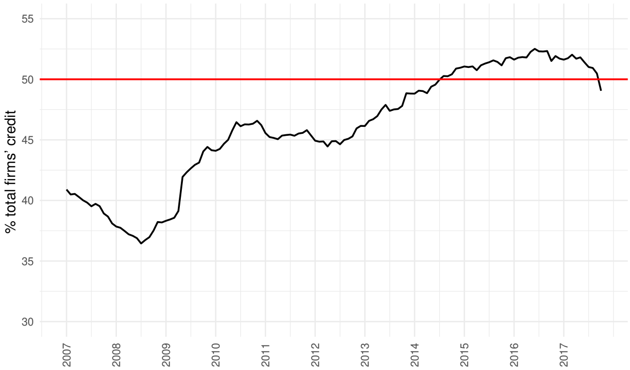


Figure: Credit for Firms (% total firms' credit)

What "big picture" issue does the paper address?

- Financial markets literature: nonlinear relation between credit and growth
- Why this non-linear relation exists?
  - Limits to borrow in countries with high credit-to-GDP ratios.
  - Limit the allocation of credit toward higher productivity firms and diverge the credit to unproductive ones (Reis, 2013).
- **How do explain this in countries with low credit-to-GDP?**

Hypothesis

Misallocation induced by the idiosyncratic credit policies.

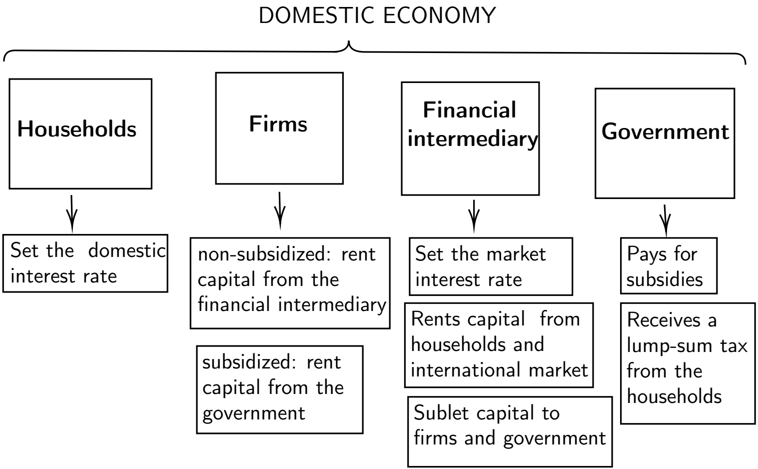
literature

The Model

- Time is discrete $t = 1, 2, \dots$.
- Firms may receive a credit subsidy $\psi \in \Psi \equiv \{0, 1\}$ (constant over time).
- Idiosyncratic productivity s_t is independent among firms and follows a bounded Pareto distribution.
- Entry and exit.

The exogenous states of an agent is the pair $(s, \psi) = z \in Z = S \times \Psi$, that follows a Markov-chain with transition matrix Γ mapping from Z to Z

The Model


DOMESTIC ECONOMY
Households
Set the domestic interest rate
Firms
non-subsidized: rent capital from the financial intermediary
subsidized: rent capital from the government
Financial intermediary
Set the market interest rate
Rents capital from households and international market
Sublet capital to firms and government
Government
Pays for subsidies
Receives a lump-sum tax from the households

Capital and Interest Rates

- There are two types of capital:
  1. Domestic (k^H); and
  2. Foreign ($k^\star$)

- Four interest rates:
  1. Domestic Interest Rate (r^H);
  2. Market Interest Rate (r^{market}); and
  3. International Interest Rate ($r^\star$)
  4. Earmarked Interest Rate (r^ψ)

We assume a small open economy with perfect capital mobility, therefore:

$$r^{market} = r^\star$$

Production function and Profits

- Cobb–Douglas production function with decreasing returns to scale

$$y = (s_t k_t^{\alpha} n_t^{\gamma}) \qquad 0 < \gamma + \alpha < 1. \tag{1}$$

- Static profits

$$\begin{aligned}\pi_t(k,z) =& p_t y - w_t n_t - \boxed{\left[\psi r^{\psi} + (1-\psi) r_t^{market}\right]} k_t \quad (2)\\ & - g(k_t, k_{t-1}) \mathbb{1}_{(k_t=0)} - c_f, \quad (3)\end{aligned}$$

where the capital adjustment cost is given by

$$g\left(k_t, k_{t-1}\right) = \begin{cases} \frac{\chi}{2}\left[\frac{i_t}{k_{t-1}} - \delta\right]^2 & \text{if } k_{t-1} > 0, \\ 0 & \text{otherwise.} \end{cases} \tag{4}$$

Incumbent's problem

After realizing pair (s_t, ψ_t) and the exit shock λ

- Firms decide how much to produce by hiring labor and renting capital. The value of an incumbent is given by:

$$W(k,z) = \max_{k',n' \geq 0} \chi \left[\pi(k',z) + \beta(1-\lambda) \int W(z,k') d\Gamma(z',z) \right]. \quad (5)$$

Entrant's problem

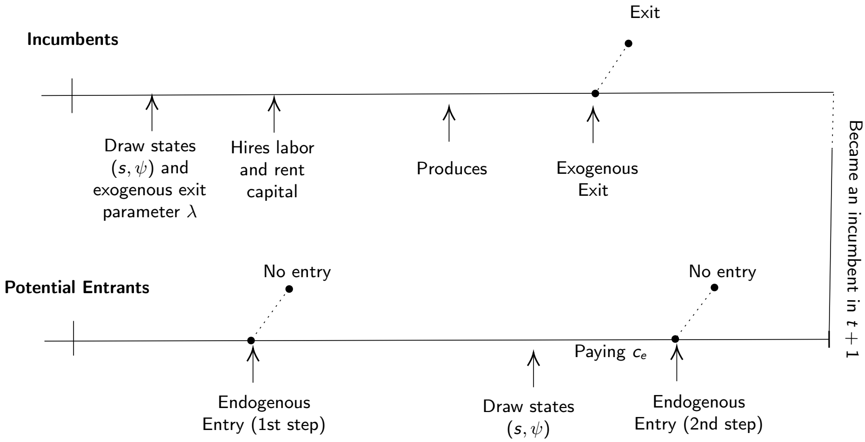
- Ex-ante identical.
- Two-step entry:
  1. Consider engage in production not knowing z.
  2. Draw z from the joint distribution G(k,z) and decides if engage in production by paying c_e.

$$W^e = \int \max_{\bar{e}\in\{0,1\}} \left\{ \bar{e}(z) W(k,z) dG(k,z) - c_e \right\}. \tag{6}$$

In equilibrium

Free entry will guarantee that $W^e = 0$

Timing within period with entry and exit



Stationary distribution

Financial Intermediary

- Net foreign assets

$$K^{nfa} = K_t - K_t^H, \tag{7}$$

where $K_t^H = \int\int g_{p,r^H}(z) d\mu_t(k,z)$ and $K_t = \int\int g_{p,r^{market}}(z) d\mu_t(k,z)$

- Financial Intermediary budget balance

$$T^{nfa} - \int\int (1-\psi)(r^H - r^\star)k' d\mu(k,z) = 0 \tag{8}$$

Households, government and market clearing

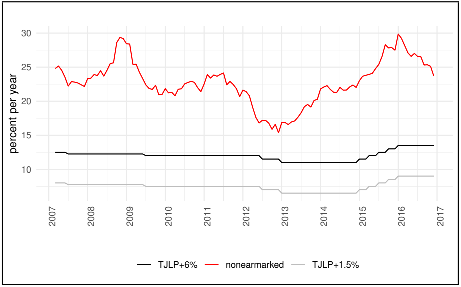
Households | Government | Market Clearing

Calibration

Parameters Calibration

Distribution Statistics

	BR2010	BR2014	Counterfactual
Subsidized interest rate	2.9	2.6	0
Non-subsidized interest rate	5.0	5.1	3.6
Share of subsidized Firms	43.4	50.3	0

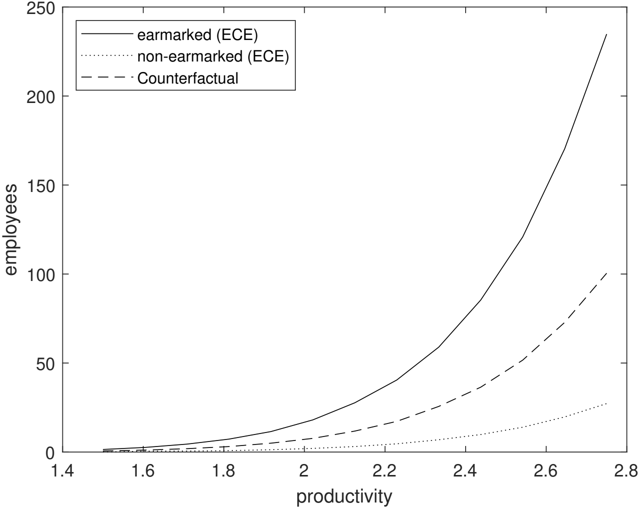


Preliminary Results

Main findings:

1. Subsidized establishments become larger;
2. Productivity cut-off for entering the market is lower for subsidized firms; and
3. Expansion of the subsidized credit increases the spending pressure on the government budget.

Productivity Distribution



Note: ECE is the earmarked credit expansion and the calibration is set to 2014.

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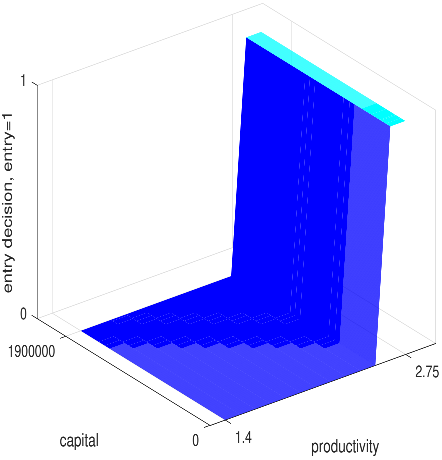
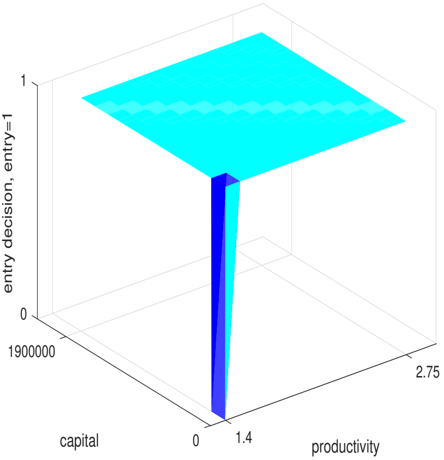
Entry Decision by Productivity Level



(a) Non-earmarked Firms



(b) Earmarked Firms

Preliminary Results

Main findings:

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Aggregates Relative to Benchmark (BR2010) Economy

	BR2014	Counterfactual
Relative productivity	0.960	1.119
Relative labor	1.000	1.000
Relative capital	1.098	0.820
Relative subsidy cost	1.323	0.000
Relative Y/L	0.997	1.034
Relative K/L	1.101	0.793

Preliminary Results

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Low growth with capital deepening and credit expansion.

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Market Clearing

$$K = \int \int k'(z) d\mu \tag{9}$$

$$1 = \int \int n'(z) d\mu, \tag{10}$$

$$C + \delta K + Nc_f + N_e c_e = p \int \int sk'^{\alpha} n'^{\gamma} d\mu \tag{11}$$

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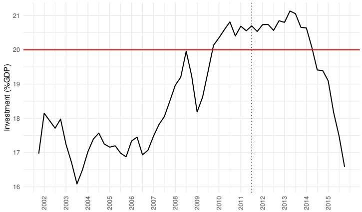
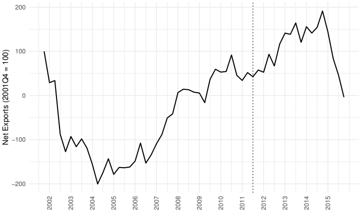
Investment and Net Exports



(a) Investment (%GDP)



(b) Net Exports

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Calibration

Parameter	Value	Description
β	0.9798	discount factor
α	0.399	capital share
γ	0.491	labor share
δ	0.025	depreciation rate
λ	0.0501	exogenous exit rate
χ	3.210	adjustment cost parameter
s range	$[1.5, 2.75]$	relative productivity range
k range	$[1, 1900000]$	relative capital range
c_e	1.05	entry cost
c_f	0.2	exit cost
ρ_s	0.9	persistence parameter
χ_s	5.8	shape parameter

back

Calibration

Data from 2010		
Number of Employees	Share of establishments	Share of labor
less than 5	41.03	3.35
5 to 49	51.59	26.42
50 or more	7.38	70.24
Benchmark Steady-State		
Number of Employees	Share of establishments	Share of labor
less than 5	41.06	4.24
5 to 49	49.16	26.64
50 or more	9.78	69.13

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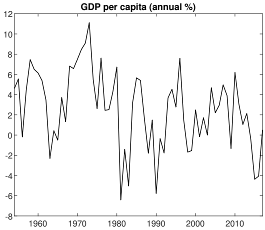
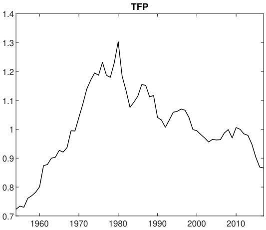
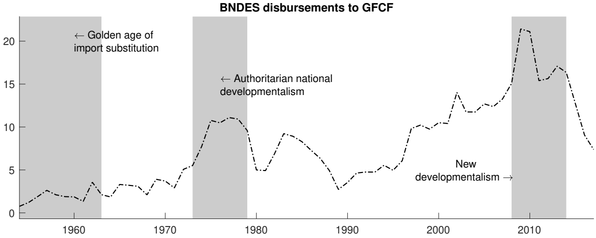
Brazil, 1954–2017







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Related Literature

- **Methodological**

  General equilibrium model with idiosyncratic productivity shocks to individual firms, in line with:
  - Hopenhayn (1992),
  - Hopenhayn and Rogerson (1993),
  - Restuccia and Rogerson (2008) and
  - Samaniego (2009).

Related Literature

- **Financial Markets**

  Inefficient allocation of resources when financial markets are imperfect:

  - Reis (2013); and
  - Gopinath et al. (2017)

  Nonlinear relation between credit and growth:

  - Hung (2009)
  - Benczúr et al. (2018)

  Rapid credit expansion and economic turbulence:

  - Gorton and Ordonez (2016) and
  - Bakker et al. (2012)

back

Households

Representative consumer maximizes:

$$E_t \sum_{t=0}^{\infty} \beta^t \left(u(.)\right) \tag{12}$$

subject to the period budget constraint

$$c_t + k_{t+1}^H - (1-\delta)k_t^H = r_t^H k_t^H + w_t n_t + \Pi_t - T_t^G - T_t^{nfa} \tag{13}$$

where Π_t, T_t^{nfa} and T_t^G denote the lump-sum profits, net taxes, and lump-sum transfers from the financial intermediary.

In steady state

$$r^H = \frac{1}{\beta} - 1 - \delta \tag{14}$$

back

Government

- Cost of subsidizing capital

$$c(K^{\psi}) = \int\int \psi(r^{market} - r^{\psi})k_t d\mu(k,z), \qquad r_t^{market} > r^{\psi} \quad \forall t. \tag{15}$$

- Government Budget Balance

$$T_t^G - c(K^{\psi}) = 0. \tag{16}$$

back

Stationary distribution

The endogenous entry and exit decisions, together with the decisions of incumbents, imply a law of motion for the distribution of firms over the states (k, z):

$$\mu_t(k', z') = \underbrace{\int\int \left[\tilde{\Gamma}(z', z)\right] \mathbb{1}_{[k'=g(k,z)]} d\mu_{t-1}(k, z)}_{\text{Surviving Incumbents}} + \tag{17}$$

$$\underbrace{N_t^e G(k', z')\bar{e}(z')}_{\text{Surviving Entrants}} \tag{18}$$

where the mass of agents evolve as $N_t = N_t^e + (1 - P^{exit})N_{t-1}$

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