

# The Brazilian Slump and the Government-Driven Credit Expansion

Denise Manfredini

Ph.D. Candidate in Economics, Federal University of Santa Catarina, Florianópolis, Santa Catarina, Brazil

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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?

# Contributions

## ① Methodological

- Formulates a version of the firms dynamics model with idiosyncratic credit policy – a share of the credit is directed by government with a subsidized interest rate.

## ② Literature on Misallocation

- Attempts to quantify the relative importance of the idiosyncratic credit policy for the productivity and growth using observed data.

# 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

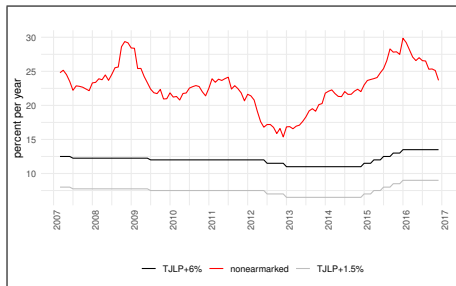
Misallocation induced by the idiosyncratic credit policies.

literature

# Calibration

calibration

	Benchmark	ECE	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

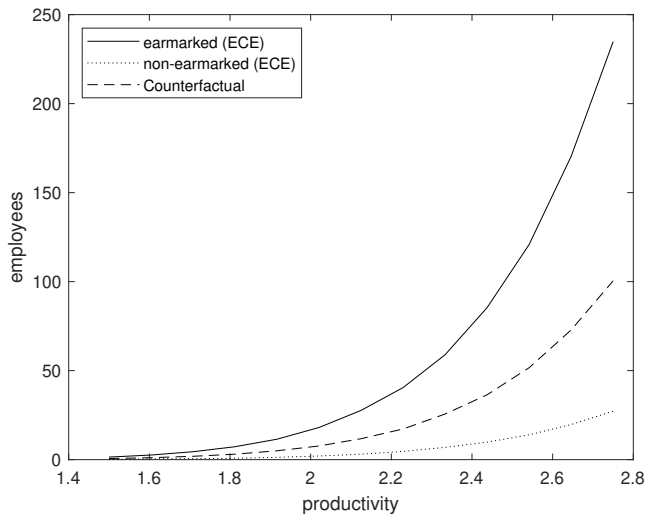


# Preliminary Results

## Main findings:

- 1 Subsidized establishments become larger;
- 2 Productivity cut 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



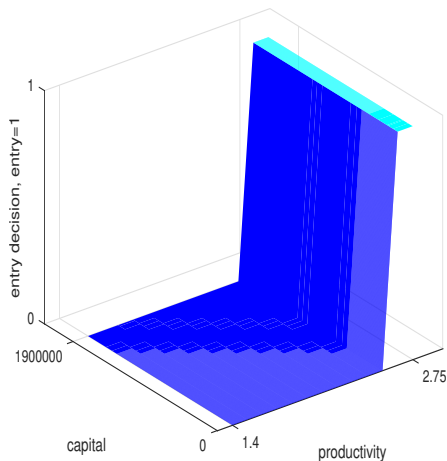
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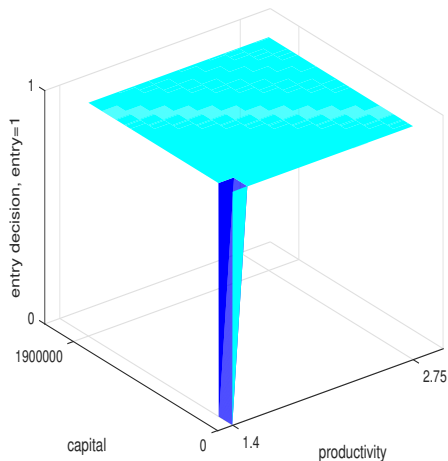
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# Entry Decision by Productivity Level



(a) Non-earmarked Firms



(b) Earmarked Firms

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# Aggregates Relative to Benchmark Economy

	ECE	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

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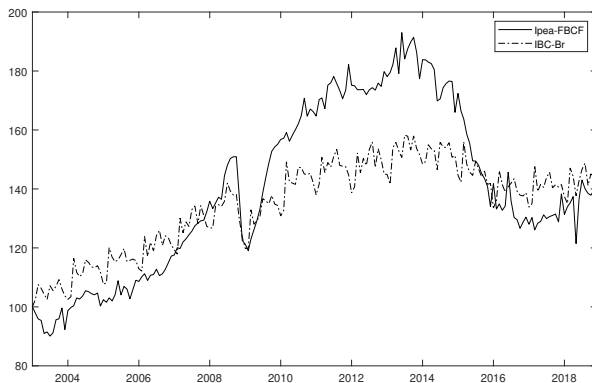
Low growth with capital deepening and credit expansion.

# Motivation

Features of the Brazilian economy in the 2010s:

- Low growth went along with capital deepening;

# 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)



# Motivation

Features of the Brazilian economy in the 2010s:

- Low growth went along with capital deepening;
- Credit-to-GDP remains relatively low by international standards; and

# Credit-to-GDP ratios

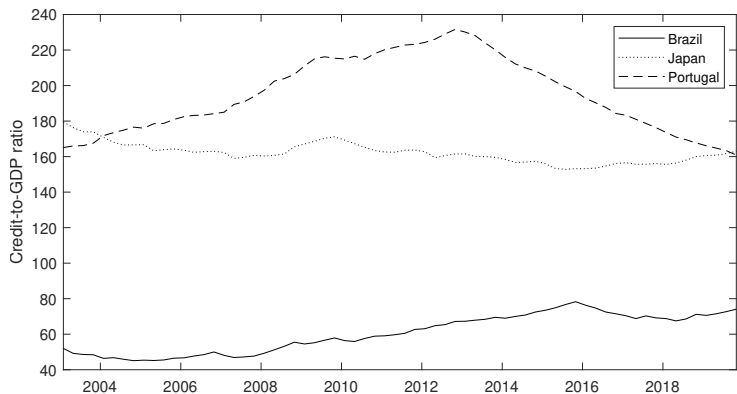


Figure: Credit-to-GDP ratios - Brazil, Japan and, Portugal

# Motivation

Features of the Brazilian economy in the 2010s:

- Low growth went along with capital deepening;
- Credit-to-GDP remains relatively low by international standards; and
- Strong expansion of earmarked credit.

# Credit Expansion

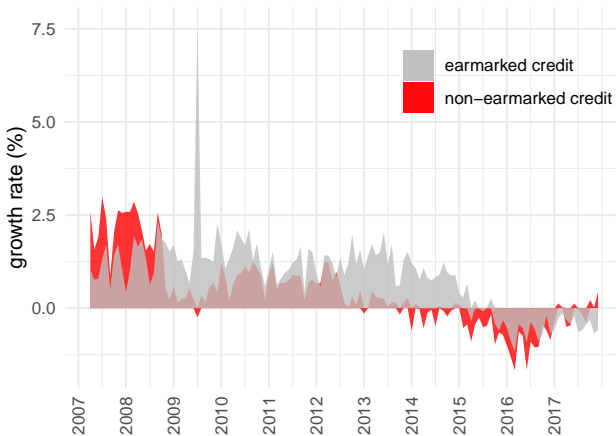


Figure: Credit Operations (2007–2017)

## Share of the Earmarked Credit (2007–2017)

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

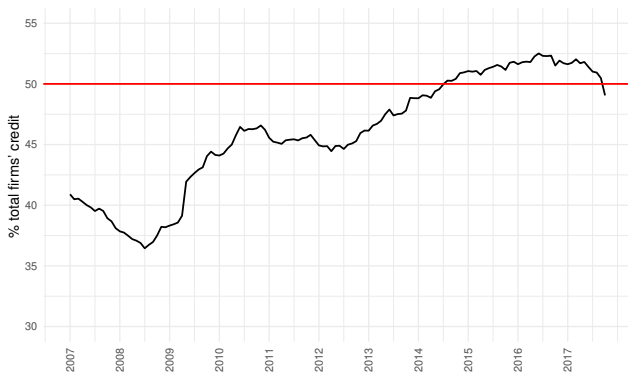


Figure: Credit for Firms (% total firms' credit)

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BNDES disbursements

Net Exports

# The Model

- Time is discrete  $t = 1, 2, \dots$
- 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  $\Gamma$  mapping from  $Z$  to  $Z$

# Capital and Interest Rates

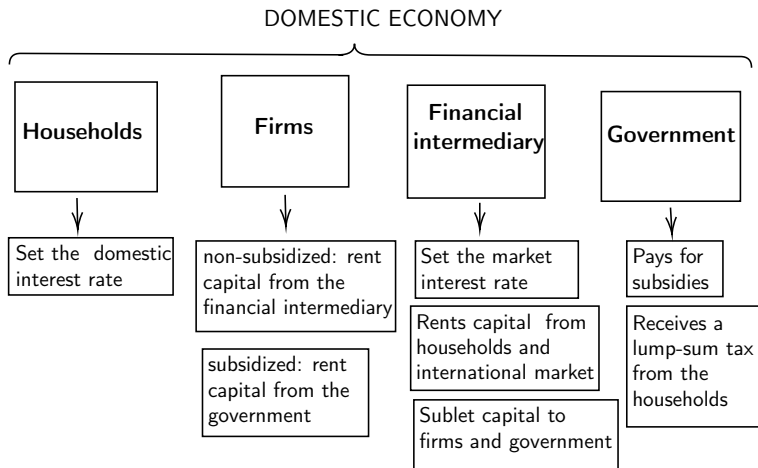
- There are two types of capital:
  - 1 Domestic ( $k^H$ ); and
  - 2 Foreign ( $k^*$ )
- Four interest rates:
  - 1 Domestic Interest Rate ( $r^H$ );
  - 2 Market Interest Rate ( $r^{market}$ ); and
  - 3 International Interest Rate ( $r^*$ )
  - 4 Earmarked Interest Rate ( $r^\psi$ )

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

$$r^{market} = r^*$$



# The Model



Households

# Households

Representative consumer maximizes:

$$E_t \sum_{t=0}^{\infty} \beta^t (u(.)) \quad (1)$$

subject to the period budget constraint

$$c_t + k_{t+1}^H - (1 - \delta)k_t^H = r_t^H k_t^H + w_t n_t + \Pi_t - T_t^G - T_t^{nfa} \quad (2)$$

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

In steady state

$$r^H = \frac{1}{\beta} - 1 - \delta \quad (3)$$

Firms

# Production function and Profits

- Cobb–Douglas production function with decreasing returns to scale

$$y = (s_t k_t^\alpha n_t^\gamma) \quad 0 < \gamma + \alpha < 1. \quad (4)$$

- Static profits

$$\pi_t(k, z) = p_t y - w_t n_t - \left[ \psi r^\psi + (1 - \psi) r_t^{\text{market}} \right] k_t \quad (5)$$

$$- g(k_t, k_{t-1}) \mathbb{1}_{(k_t=0)} - c_f, \quad (6)$$

where the capital adjustment cost is given by

$$g(k_t, k_{t-1}) = \begin{cases} \frac{\chi}{2} \left[ \frac{i_t}{k_{t-1}} - \delta \right]^2 & \text{if } k_{t-1} > 0, \\ 0 & \text{otherwise.} \end{cases} \quad (7)$$

# Incumbent's problem

- Three status of exit  $\lambda = \{\lambda_1, \lambda_2, \lambda_3\}$  with associate probabilities  $P_\lambda = \{p_1, p_2, p_3\}$  and  $\sum P_\lambda = 1$ .
- Before realizing the exit shock, the firms optimization problem is:

$$W^0(k, z) = \underbrace{p_1 W^1(k, z)}_{\text{exogenous exit}} + \underbrace{p_2 W^2(k, z)}_{\text{endogenous exit}} + \underbrace{p_3 W^3(k, z)}_{\text{no exit}}, \quad (8)$$

Each period incumbent firms are informed of their respective status of exit.

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# Incumbent's problem

- ① Exogenous exit (*probability*  $p_1$ ):

$$W^1(k, z) = \max_{k', n' \geq 0} \{ \pi(k', z) \}.$$

- ② Endogenous exit (*probability*  $p_2$ ):

$$W^3(k, z) = \max_{\substack{\chi \in \{0,1\} \\ k', n' \geq 0}} \left\{ \pi(k', z) + \chi \left[ \beta \int W(z, k') d\Gamma(z', z) - \phi \right] \right\}.$$

- ③ No exit (*probability*  $p_3$ ):

$$W^2(k, z) = \max_{k', n' \geq 0} \left\{ \pi(k', z) + \beta \int W(z, k') d\Gamma(z', z) \right\}.$$



## Entrant's problem

The value of an incumbent, conditional to the status of exit, is given by:

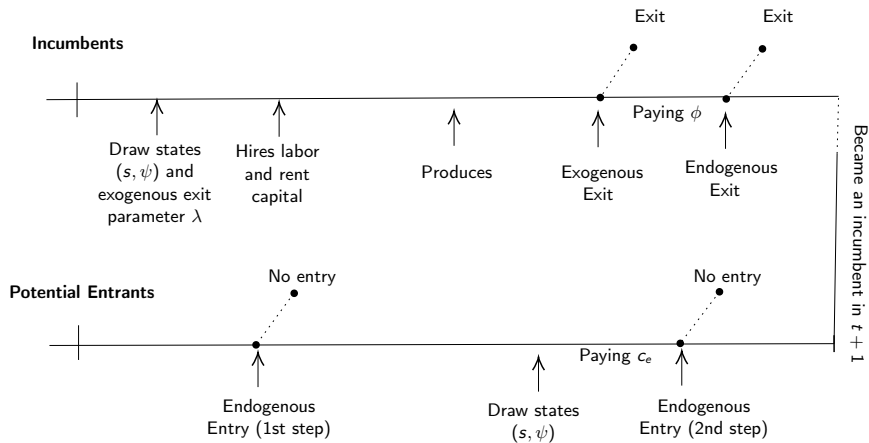
- Ex-ante identical.
- Two-step entry:
  - ① Consider engage in production not knowing  $z$ .
  - ② Draw  $z$  from the joint distribution  $G(k,z)$  and decides if engage in production by paying  $c_e$ .

$$W^e = \int \max_{\bar{e} \in \{0,1\}} \{ \bar{e}(z) W^0(k, z) dG(k, z) - c_e \}. \quad (9)$$

In equilibrium

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

# Timing within period with entry and exit



# 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  $(k, z)$ :

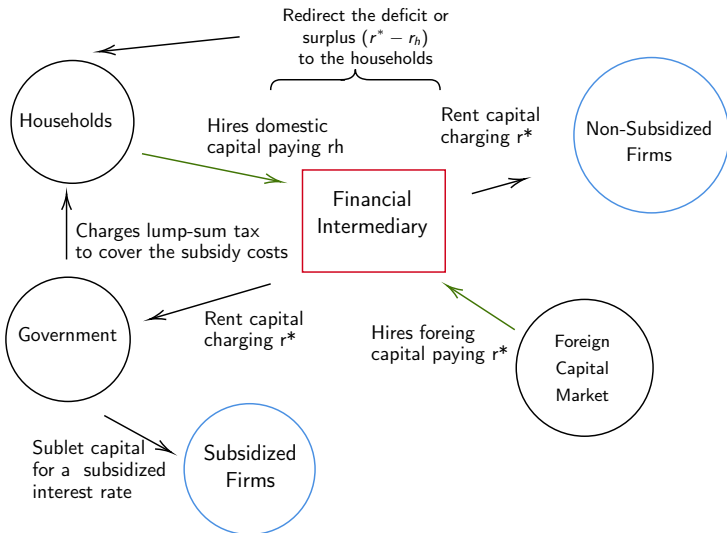
$$\mu_t(k', z') = \underbrace{\int \int \left[ \tilde{\Gamma}(z', z) \right] \mathbb{1}_{[k'=g(k, z)]} d\mu_{t-1}(k, z)}_{\text{Surviving Incumbents}} + \quad (10)$$

$$\underbrace{N_t^e G(k', z') \bar{e}(z')}_{\text{Surviving Entrants}} \quad (11)$$

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

Financial Intermediary

# Financial Intermediary



# Financial Intermediary

- Net foreign assets

$$K^{nfa} = K_t - K_t^H, \quad (12)$$

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

$$T^{nfa} - \int \int (1 - \psi)(r^H - r^*) k' d\mu(k, z) = 0 \quad (13)$$

Government

# Government

- Cost of subsidizing capital

$$c(K^\psi) = \int \int \psi(r^{\text{market}} - r^\psi) k_t d\mu(k, z), \quad r_t^{\text{market}} > r^\psi \quad \forall t. \quad (14)$$

- Government Budget Balance

$$T_t^G - c(K^\psi) = 0. \quad (15)$$

Market Clearing



## Conclusion

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

- Subsidized firms have lower productivity cut for entering the market, higher productivity cut for exiting the market, and are larger than efficiency would dictate → lower aggregate productivity.

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

- Misallocation induced by subsidized credit can qualitatively account for low growth with capital deepening and credit expansion.

Denise Manfredini  
Ph.D. Candidate in Economics  
Federal University of Santa Catarina  
`manfredini.denise@gmail.com`

# Market Clearing

$$K = \int \int k'(z) d\mu \quad (16)$$

$$1 = \int \int n'(z) d\mu, \quad (17)$$

$$C + \delta K + Nc_f + N_e c_e = p \int \int sk'^{\alpha} n'^{\gamma} d\mu \quad (18)$$

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# Investment and Net Exports



(a) Investment (%GDP)



(b) Net Exports

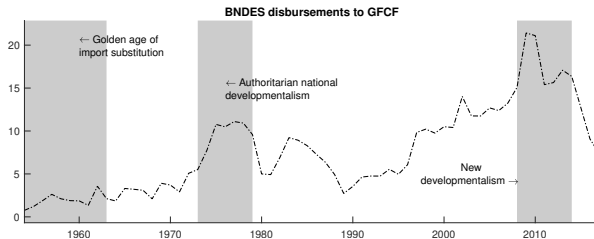
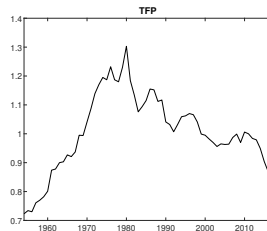
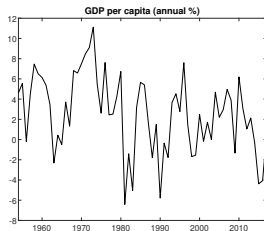
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# Calibration

Parameter	Value	Description
$\beta$	0.9798	discount factor
$\alpha$	0.399	capital share
$\gamma$	0.491	labor share
$\delta$	0.025	depreciation rate
$\lambda$	0.0501	exogenous exit rate
$\chi$	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
$\rho_s$	0.9	persistence parameter
$\chi_s$	5.8	shape parameter

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# Brazil, 1954–2017



# 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 Ordóñez (2016) and
- Bakker et al. (2012)

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