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?

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" issues 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

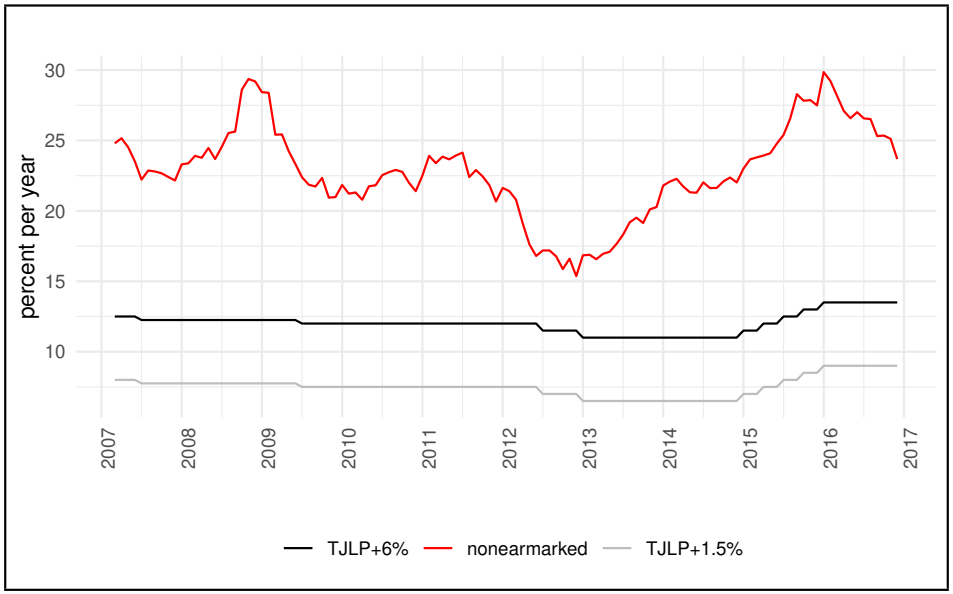
Misallocation induced by the idiosyncratic credit policies.

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

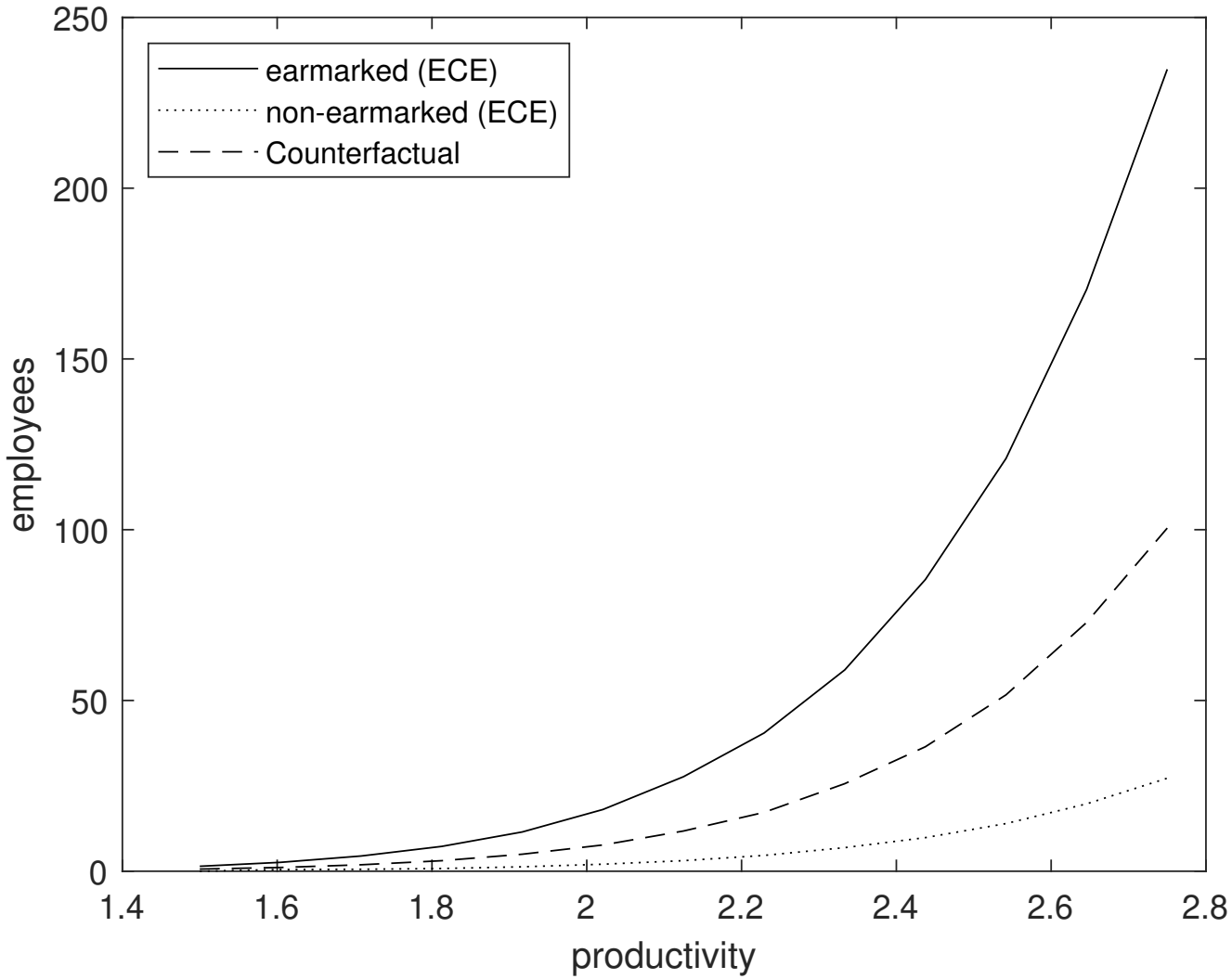


Preliminary Results

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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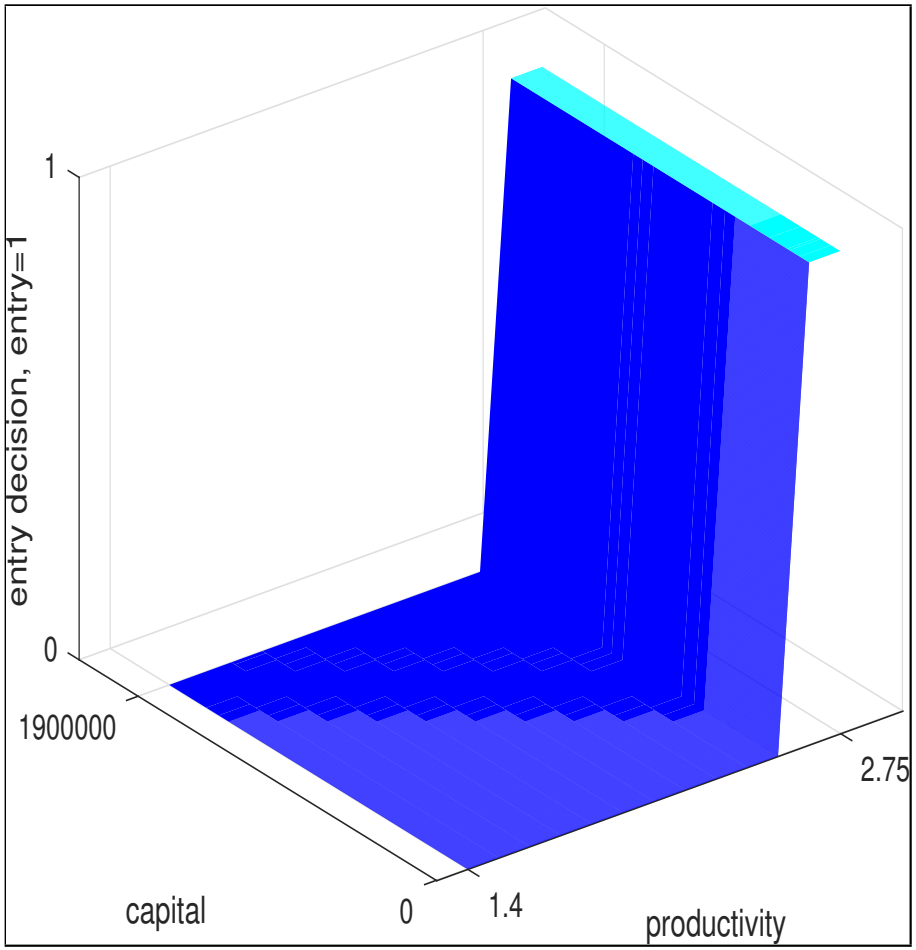
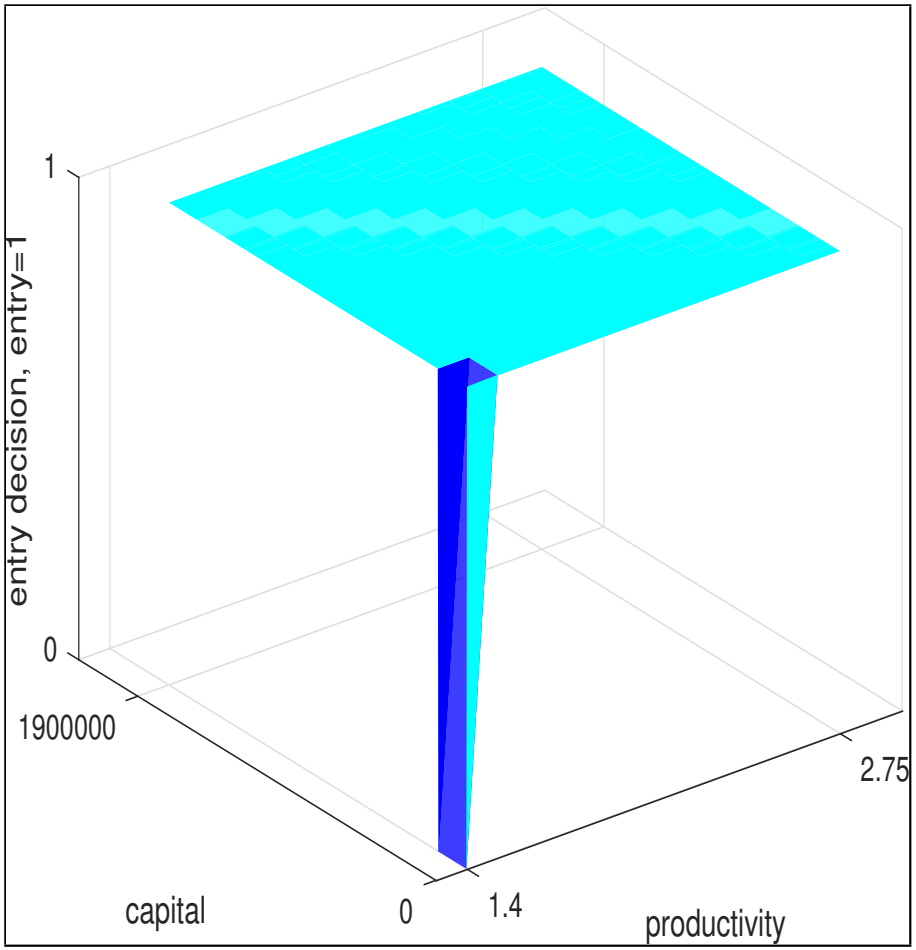
Entry Decision by Productivity Level



(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

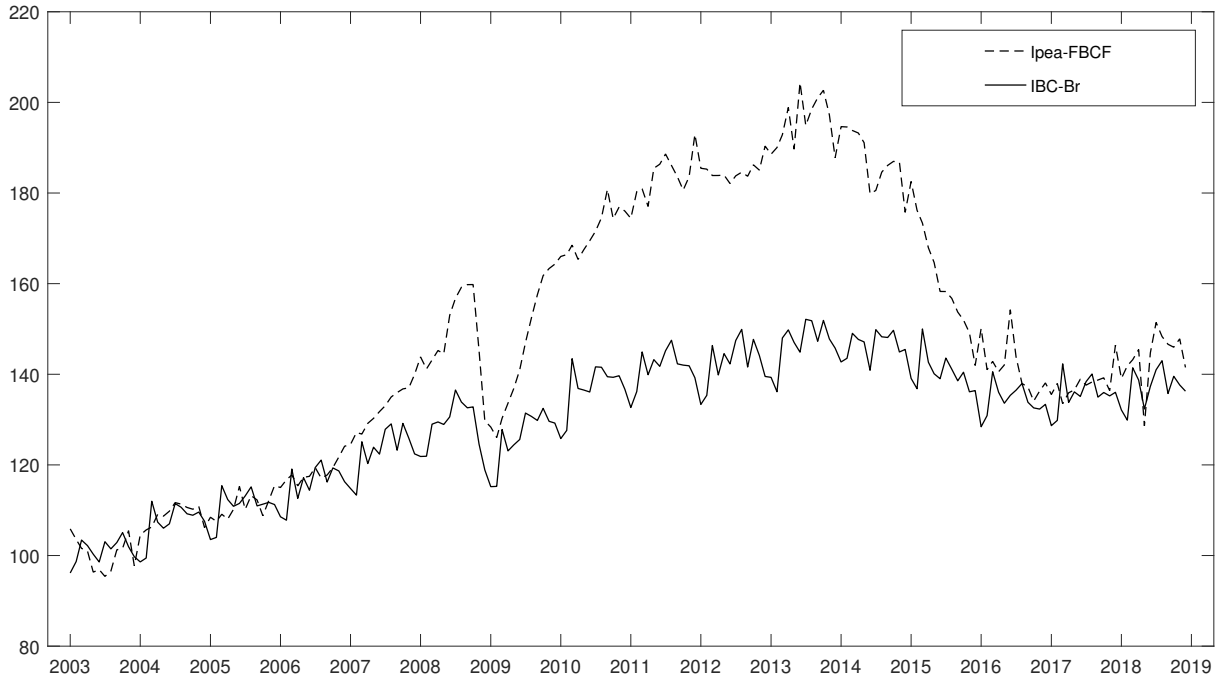

Figure: Index of Economic Activity of the Central Bank (IBC-Br) (2002=100) and Gross Fixed Capital Formation Ipea Index (1995=100)

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

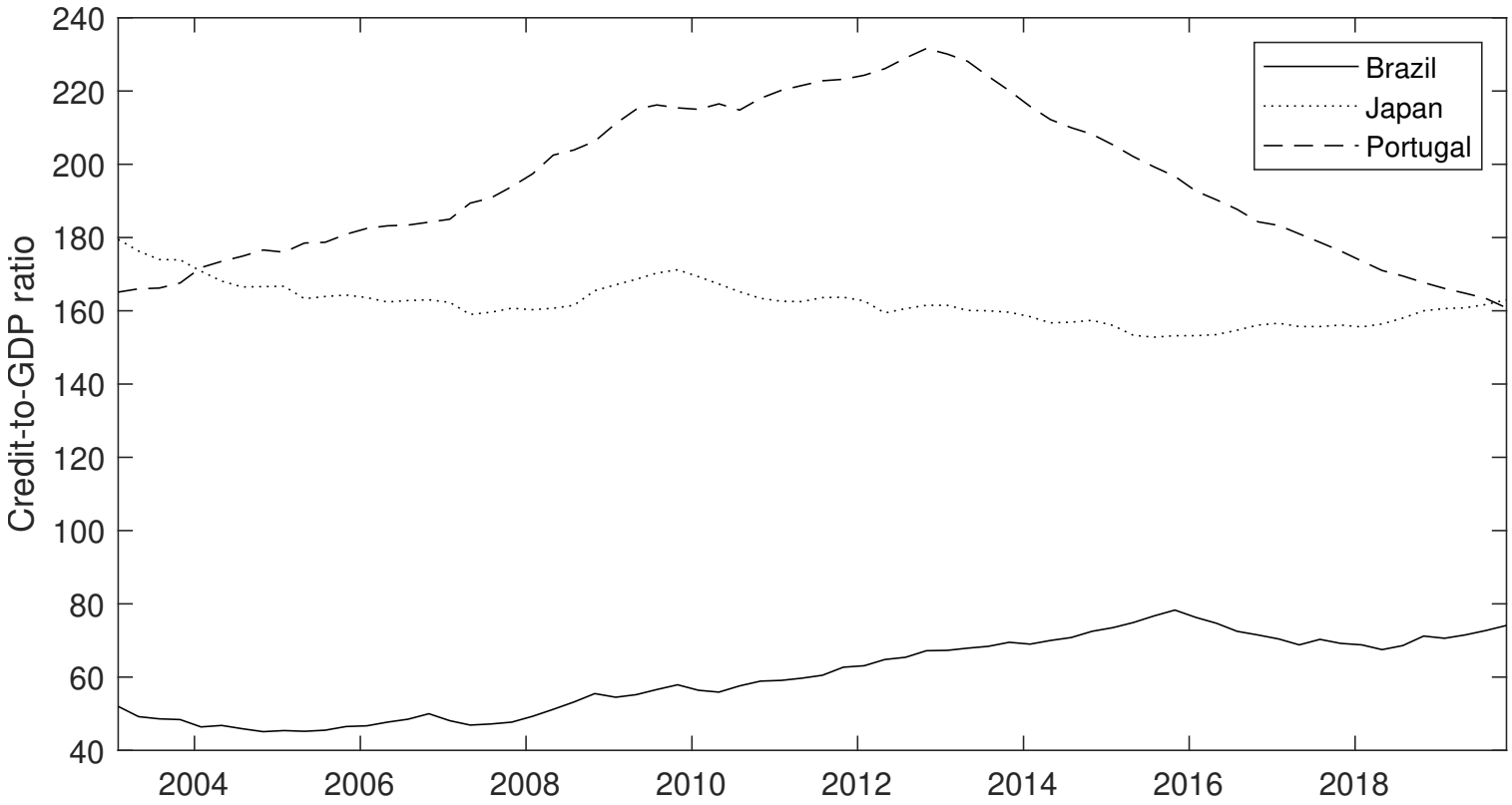

Figure: Credit-to-GDP ratios - Brazil, Japan and, Portugal

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

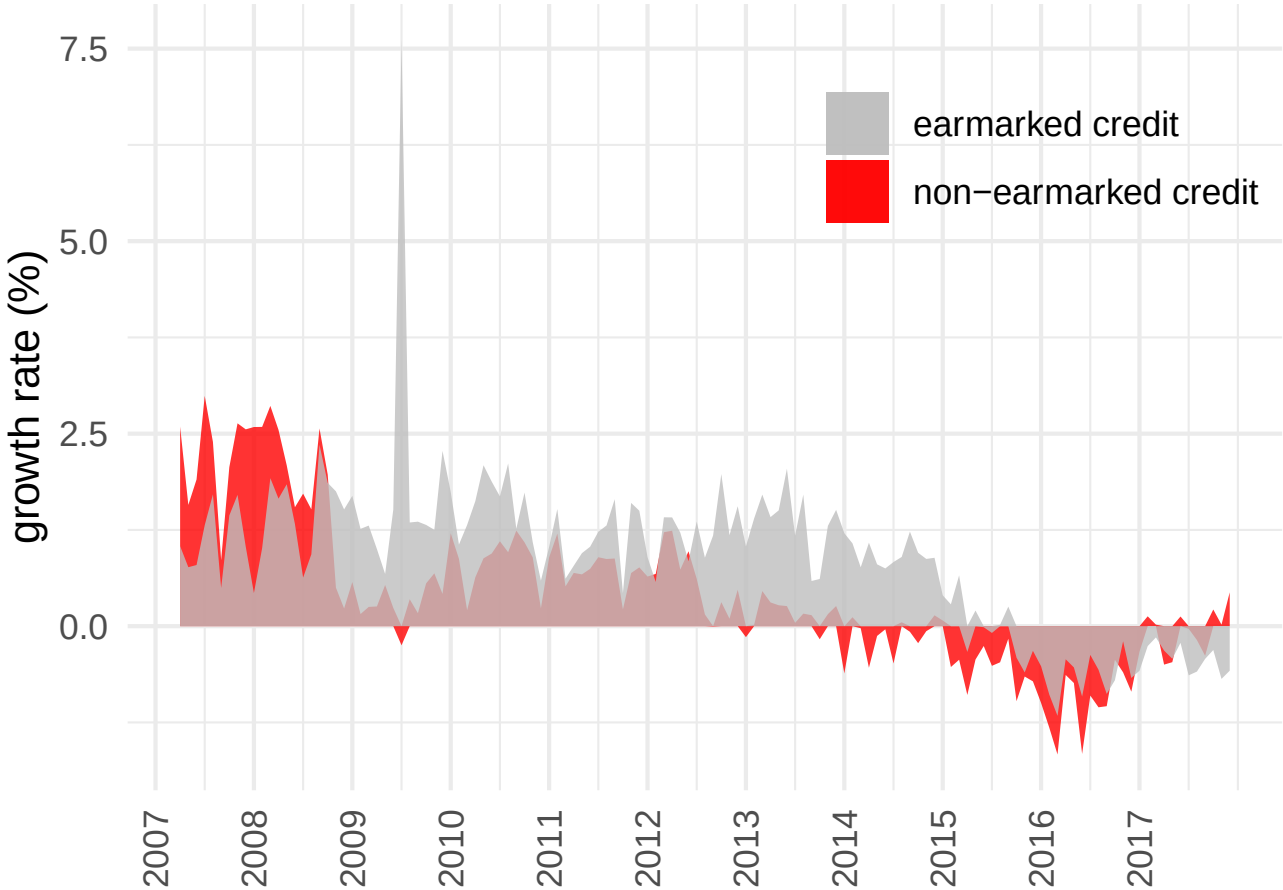

Figure: Credit Operations (2007–2017)

Share of the Earmarked Credit (2007–2017)

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

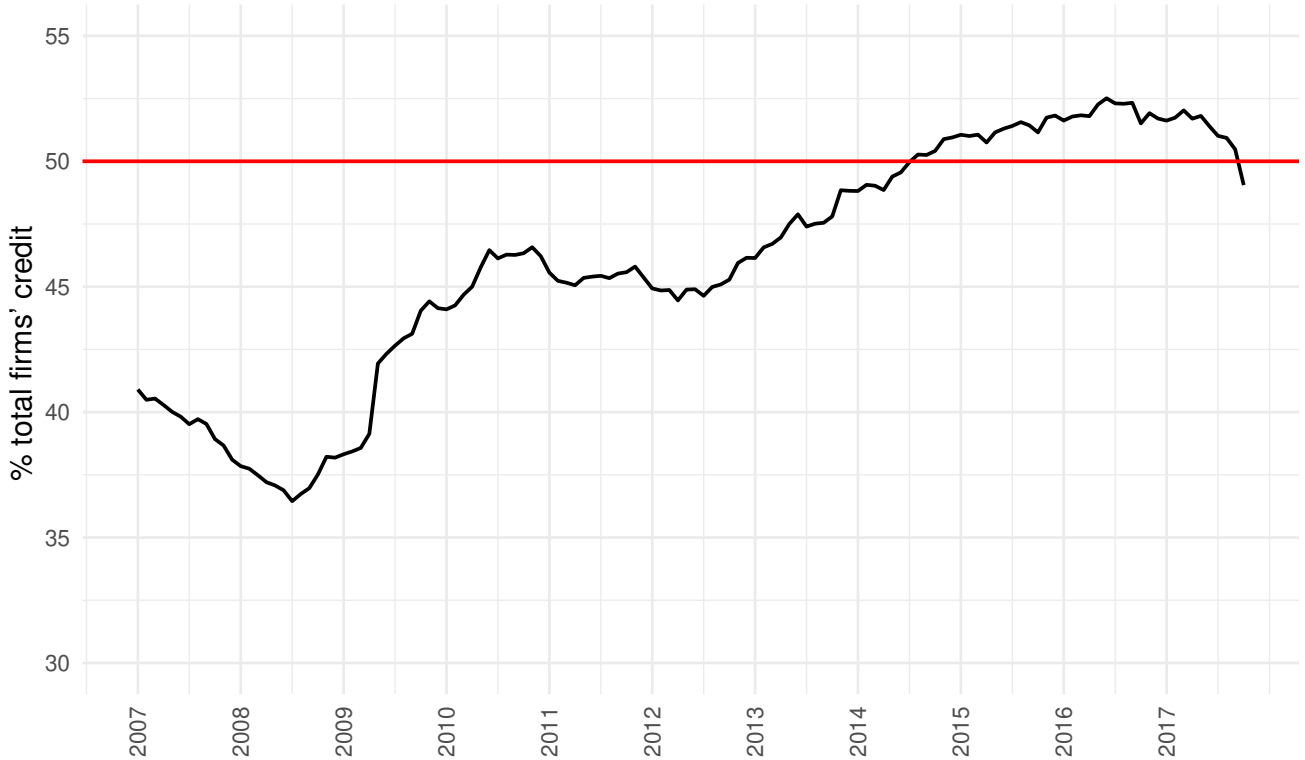

Figure: Credit for Firms (% total firms' credit)

Motivation

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BNDES disbursements Net Exports

The Model

- Time is discrete $t = 1, 2, \ldots$.
- 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

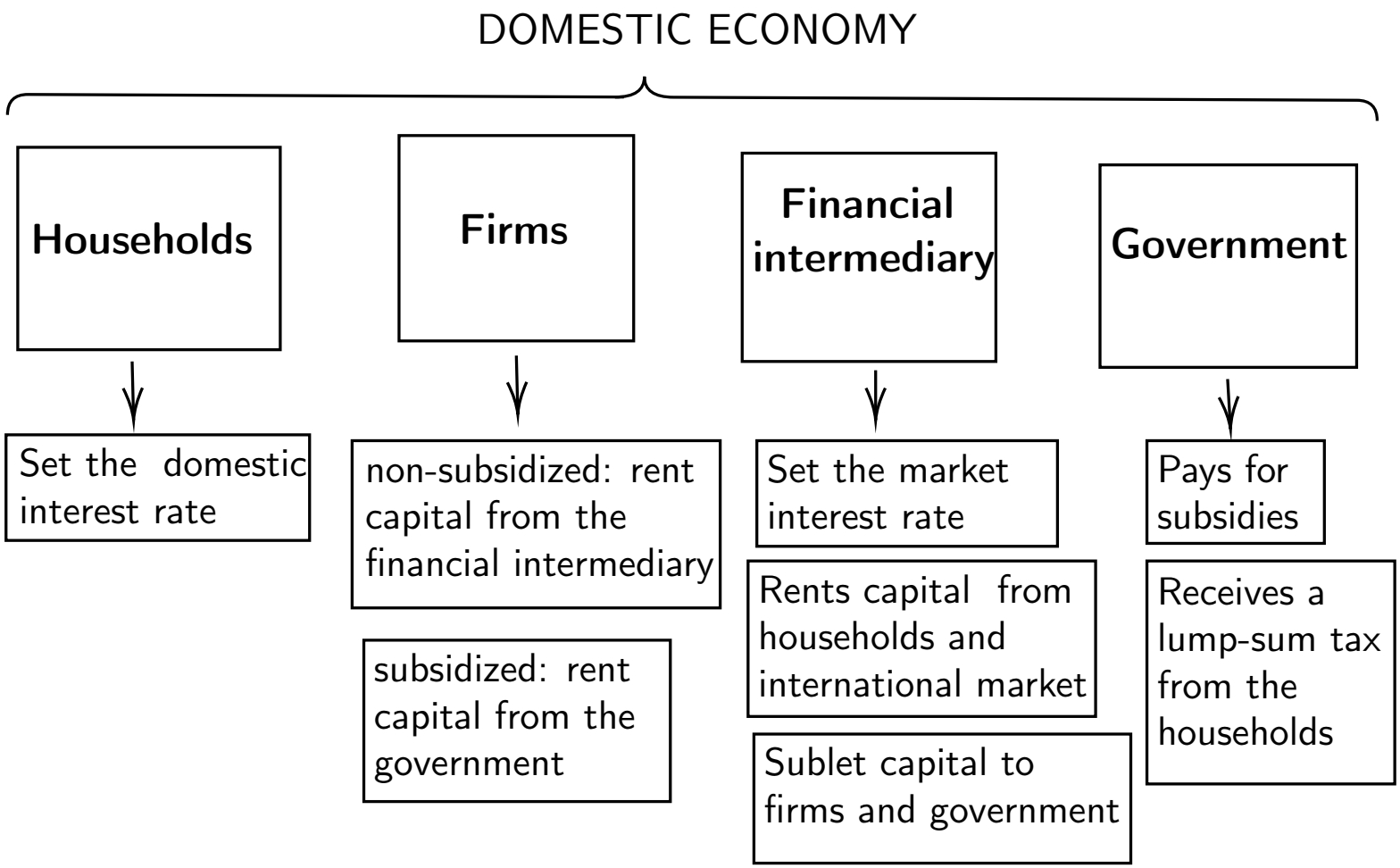
Capital and Interest Rates

- 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 perfect capital mobility, therefore:

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

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

Households

Households

Representative consumer maximizes:

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

subject to the period budget constraint

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

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

$$r^H = \frac{1}{\beta} - 1 - \delta \tag{3}$$

Firms

Production function and Profits

- Cobb–Douglas production function with a decreasing returns to scale

$$y = (s_t k_t^{\alpha} n_t^{\gamma}) \qquad 0 < \gamma + \alpha < 1. \tag{4}$$

- Static profits

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

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

where the capital adjustment costs is

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

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:

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

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):

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

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:

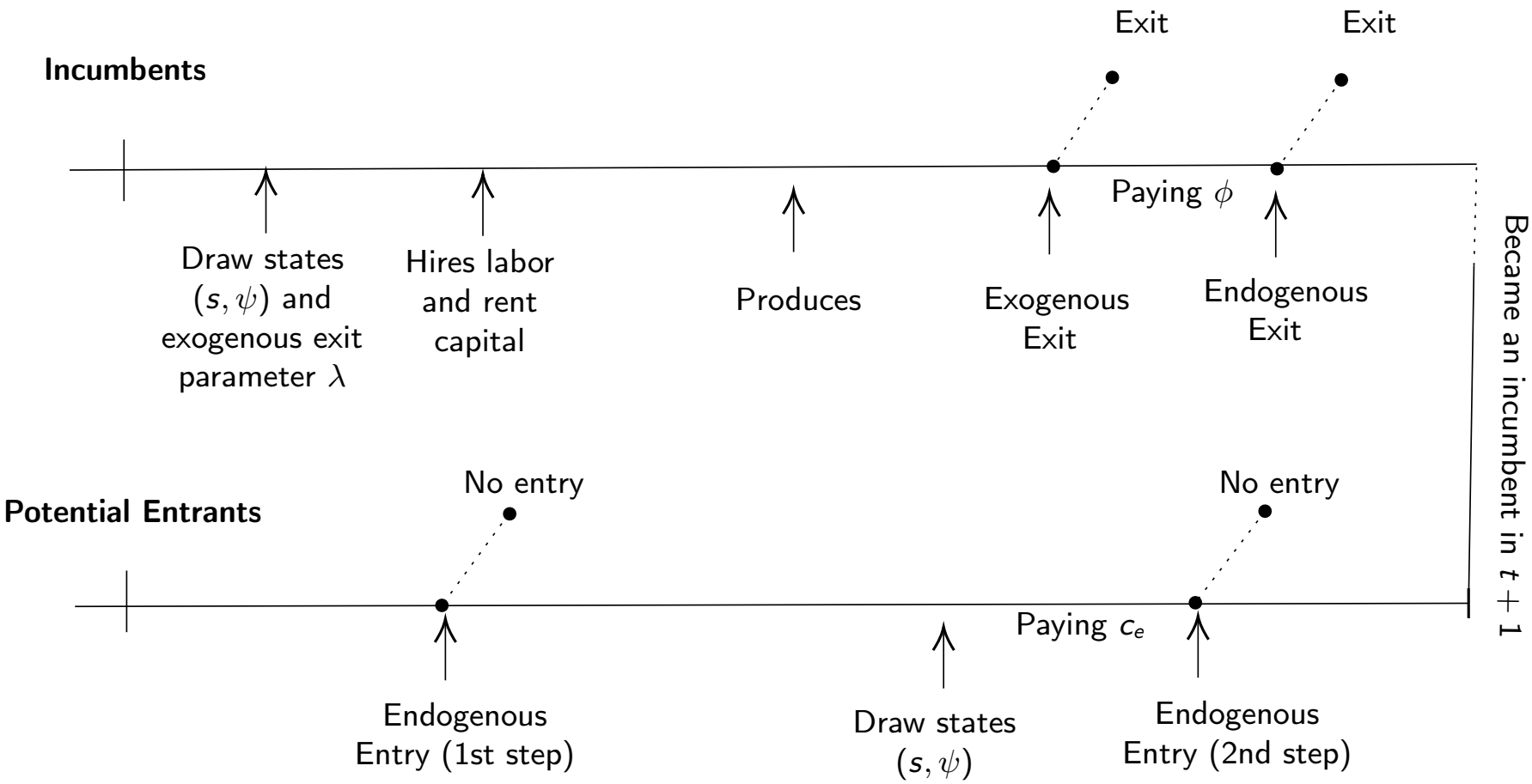
- Ex-ante identical.
- Two-step entry:
  1. Consider engage in production not knowing z.
  2. Draw z from the joint distribution G(k,z) and decides if engage in production by paying c_e.

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

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):

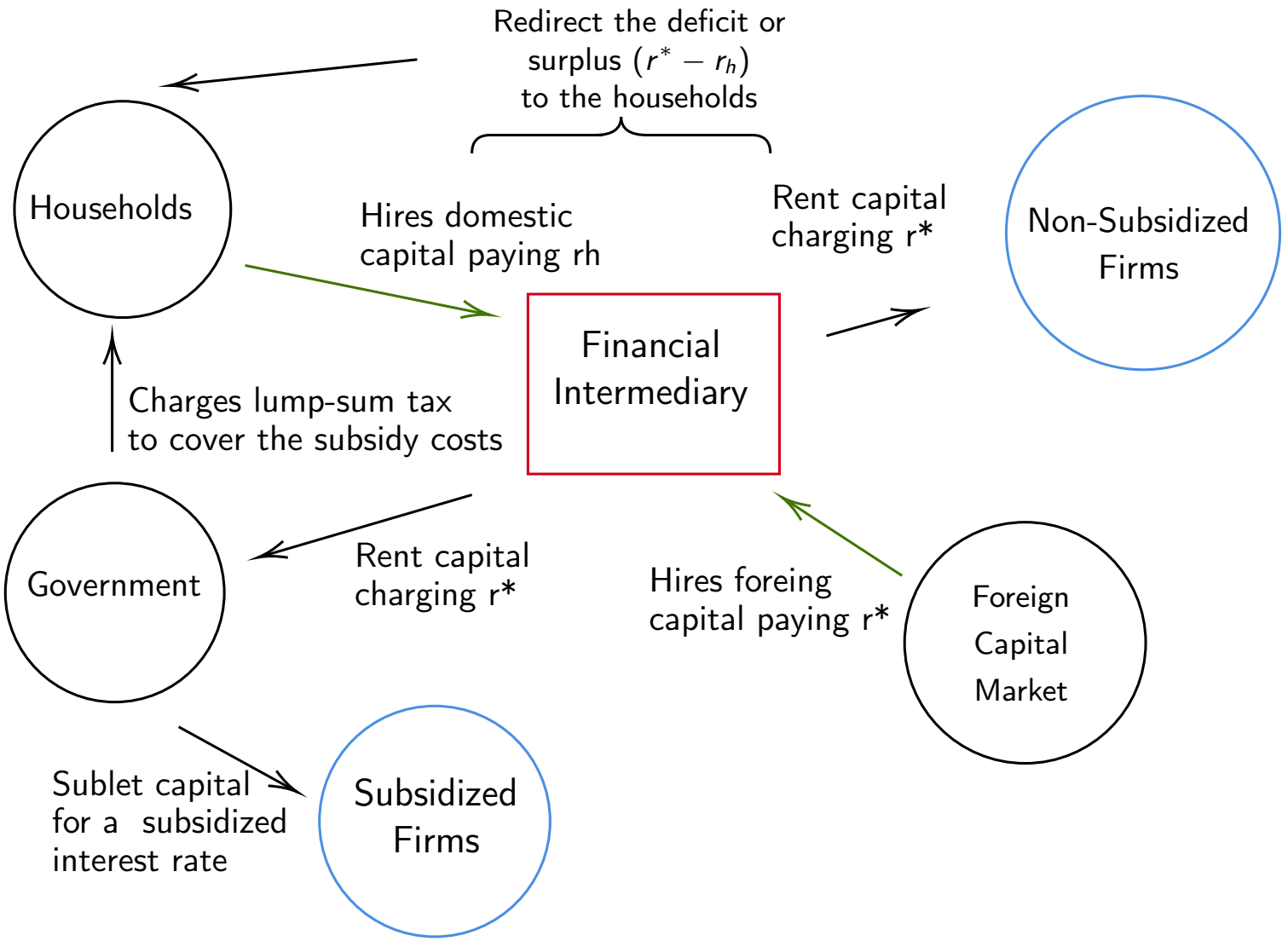
$$\mu_t(k', z') = \underbrace{\int \int \left[\tilde{\Gamma}(z', z)\right] \mathbb{1}_{[k'=g(k,z)]} d\mu_{t-1}(k, z)}_{\text{Surviving Incumbents}} + \tag{10}$$

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

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

$$K^{nfa} = K_t - K_t^H, \tag{12}$$

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

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

Government

Government

- Cost of subsidizing capital

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

- Government Budget Balance

$$T_t^G - c(K^{\psi}) = 0. \tag{15}$$

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 $\rightarrow$ 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.

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Market Clearing

$$K = \int \int k'(z) d\mu \tag{16}$$

$$1 = \int \int n'(z) d\mu, \tag{17}$$

$$C + \delta K + N c_f + N_e c_e = p \int \int s k'^{\alpha} n'^{\gamma} d\mu \tag{18}$$

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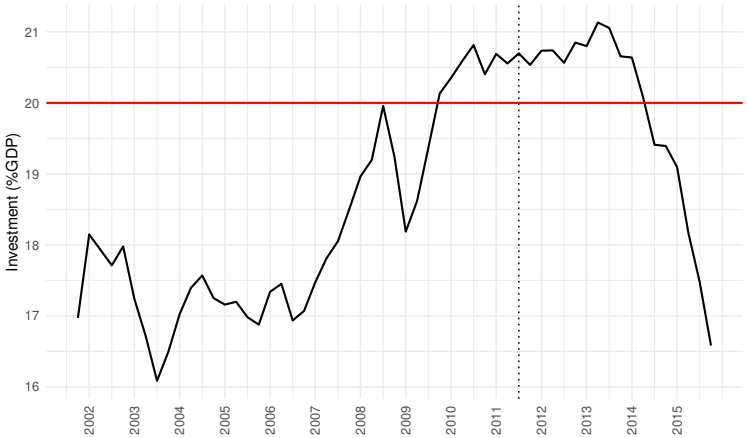
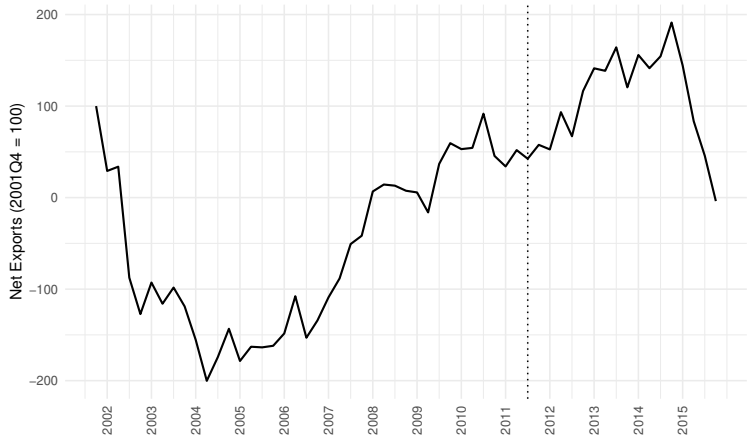
Investment and Net Exports



(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

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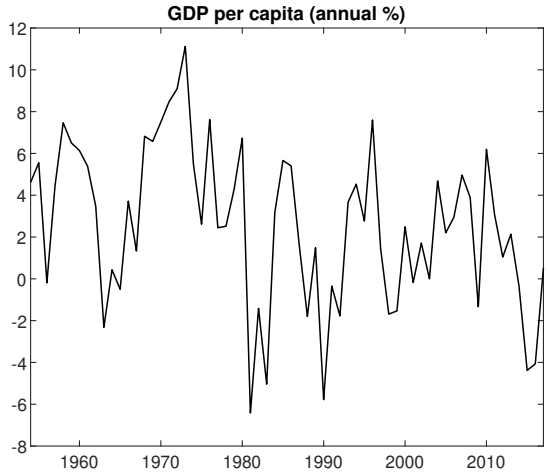
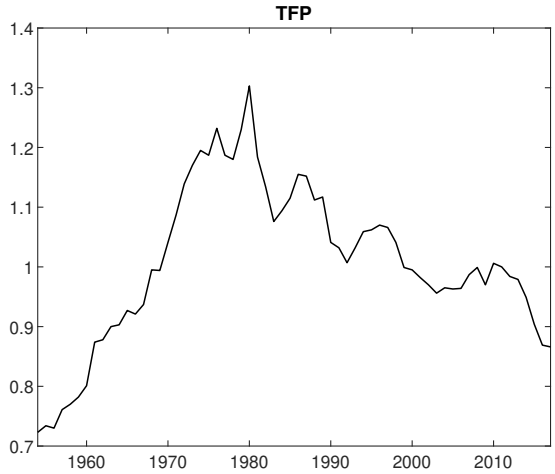
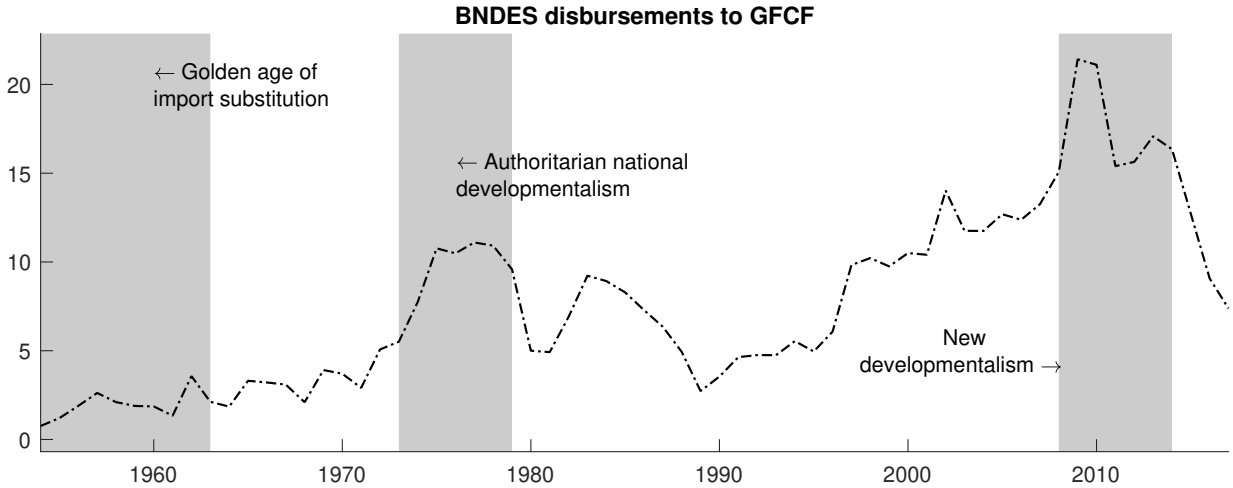
Brazil, 1954–2017







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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)

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