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

September, 2020

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
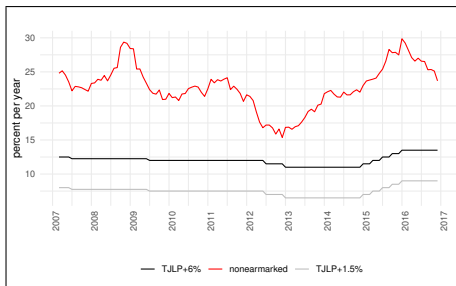Misallocation induced by the idiosyncratic credit policies.

literature

Calibration

Parameters Calibration

Distribution Statistics

|	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.
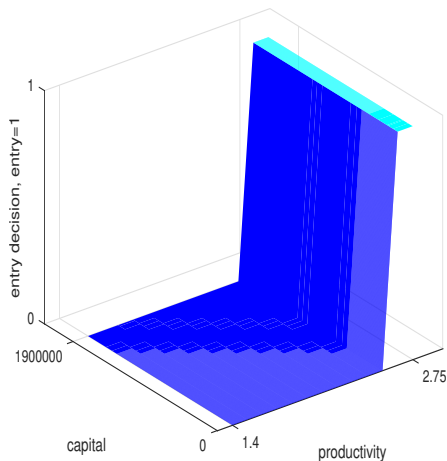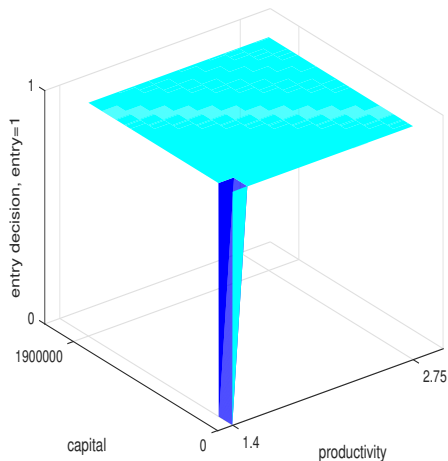
Productivity Distribution
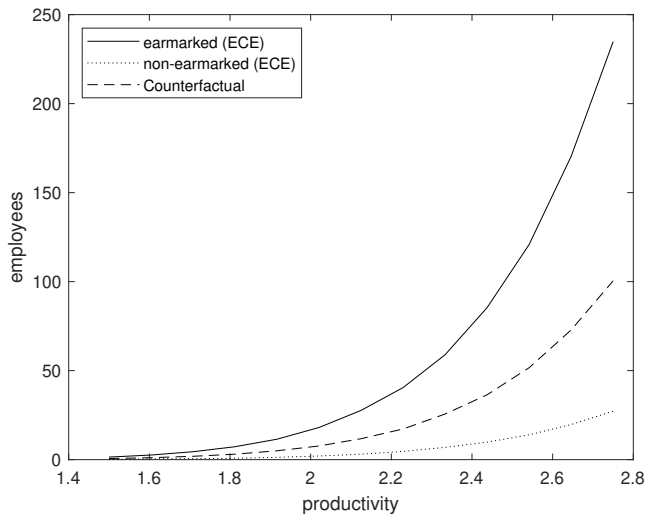
Preliminary Results

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.

Entry Decision by Productivity Level

(a) Non-earmarked Firms

(b) Earmarked Firms

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.

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

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.

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

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.

Low growth with capital deepening and credit expansion.

Motivation

Features of the Brazilian economy in the 2010s:

- Low growth went along with capital deepening;

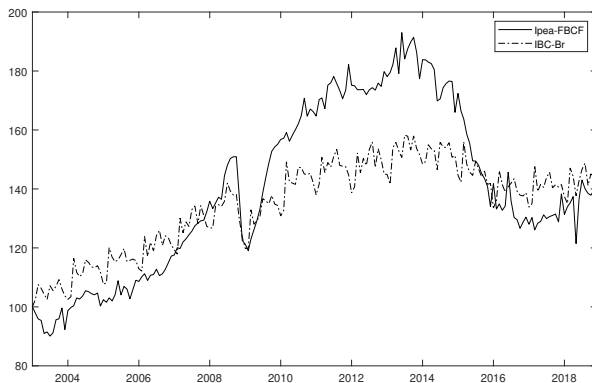# The Revival of Industrial Policy

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
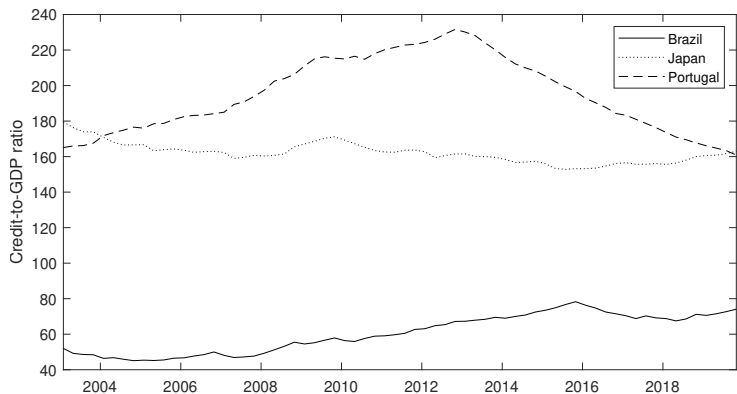
Credit-to-GDP ratios

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.
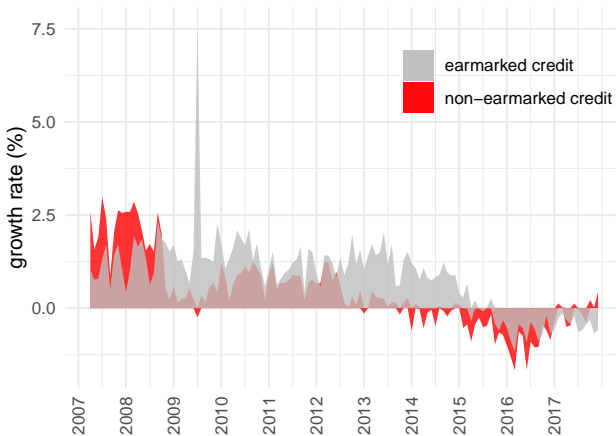
Credit Expansion

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:
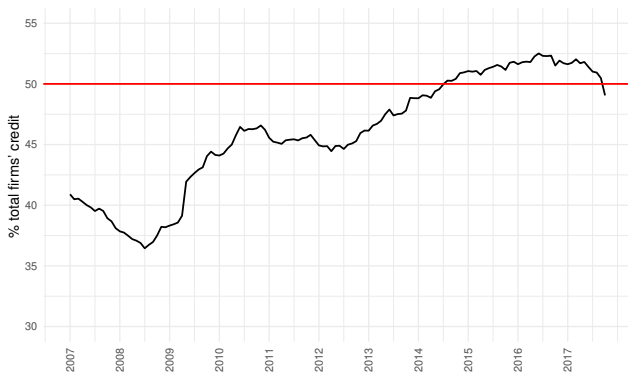

Figure: Credit for Firms (% total firms' credit)

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.

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
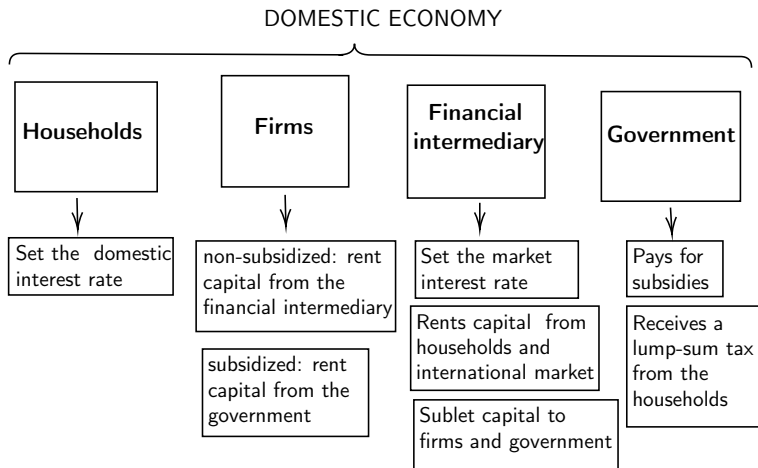
Capital and Interest Rates

- 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	Firms	Financial intermediary	Government

Set the domestic interest rate

non-subsidized: rent capital from the financial intermediary

subsidized: rent capital from the government

Set the market interest rate

Rents capital from households and international market

Sublet capital to firms and 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 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 cost is given by

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

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:

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

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

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:

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

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

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

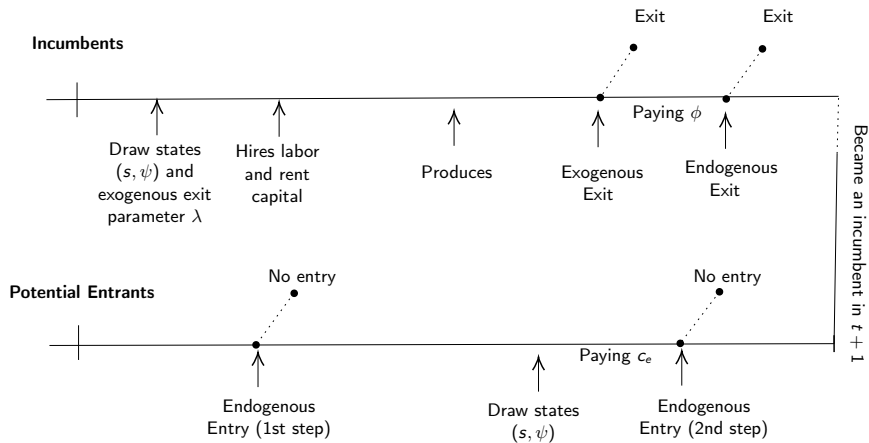The value of an incumbent, conditional to the status of exit, is given by:

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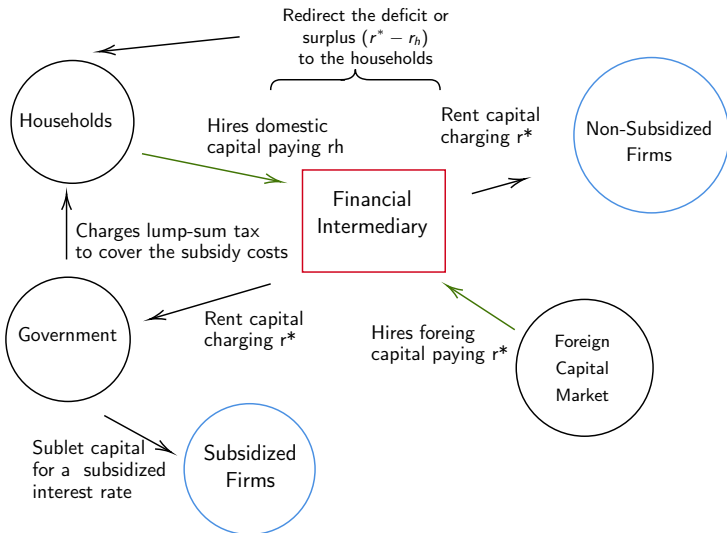
$$\mu_t(k', z') = \underbrace{\int \int \left[\tilde{\Gamma}(z', z) \right] \mathbb{1}_{[k'=g(k,z)]} d\mu_{t-1}(k, z)}_{\text{Surviving Incumbents}} + \qquad (10)$$

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

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 → 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

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

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

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

back

Investment and Net Exports

(a) Investment (%GDP)

(b) Net Exports

back

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

back

Brazil, 1954–2017

GDP per capita (annual %)

TFP

BNDES disbursements to GFCF

← Golden age of import substitution

← Authoritarian national developmentalism

New developmentalism →
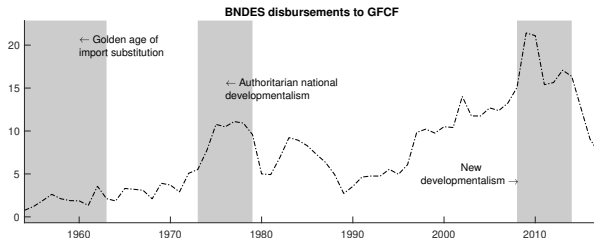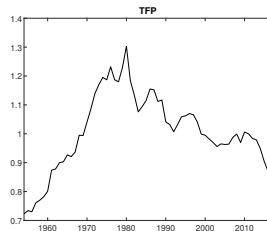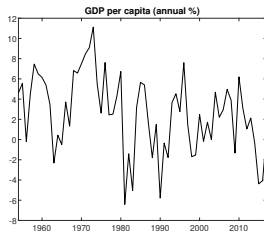
Related Literature

- **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)

References I

Bakker, B. B., Dell'Ariccia, G., Laeven, L., Vandenbussche, J., Igan, D. O., and Tong, H. (2012). Policies for Macrofinancial Stability; How to Deal with Credit Booms. IMF Staff Discussion Notes 12/06, International Monetary Fund.

Benczúr, P., Karagiannis, S., and Kvedaras, V. (2018). Finance and economic growth: financing structure and non-linear impact. *Journal of Macroeconomics*.

Gopinath, G., Kalemli-Özcan, Ş., Karabarbounis, L., and Villegas-Sanchez, C. (2017). Capital allocation and productivity in south europe. *The Quarterly Journal of Economics*, 132(4):1915–1967.

Gorton, G. and Ordonez, G. (2016). Good booms, bad booms. *Journal of the European Economic Association*.

References II

Hopenhayn, H. (1992). Entry, exit, and firm dynamics in long run equilibrium. *Econometrica: Journal of the Econometric Society*, pages 1127–1150.

Hopenhayn, H. and Rogerson, R. (1993). Job turnover and policy evaluation: A general equilibrium analysis. *Journal of political Economy*, 101(5):915–938.

Hung, F.-S. (2009). Explaining the nonlinear effects of financial development on economic growth. *Journal of Economics*, 97(1):41–65.

Reis, R. (2013). The portuguese slump and crash and the euro crisis. *Brookings Papers on Economic Activity*, pages 143–210.

Restuccia, D. and Rogerson, R. (2008). Policy distortions and aggregate productivity with heterogeneous establishments. *Review of Economic dynamics*, 11(4):707–720.

References III

Samaniego, R. M. (2009). Entry, exit, and investment-specific technical change. *American Economic Review*, 100(1):164–192.