Banking Frictions and Endogenous Firms Exit

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Aim of the Paper

- **A DSGE model with:**
  - endogenous firms' entry and exit
  - monopolistically competitive banking sector
- **Study:**
  1. **Model Dynamics (Today Presentation)**
     - the relationship between firms dynamics and banking
     - Endogenous versus Exogenous exit model
  2. **Macroprudential Policies and Model Estimation (Next Step)**
     - Basel II versus Basel III
     - the effects of alternative TR targeting also capital requirements

Motivation

STARTING POINTS. Recent empirical evidence

1. **The role played by firms dynamics in the business cycle:** propagating real shocks**.**
2. **The role played by the banking sector:** loans to firms increase in booms and decrease in downturns
3. **The literature on firms dynamics:**
   - The exit rate is exogenous and constant $\Longrightarrow$ The number of firms exiting the market is acyclical or mildly procyclical!
   - Financial market are perfect

Evidence on Firms Dynamics

CORRELATION between GDP and FIRMS ENTRY and EXIT

1. **Firm entry is procyclical.** Jaimovich and Floetotto (2008), Bilbiie, Ghironi, and Melitz (2012), Lewis V. and Poilly C. (2010 JME).
2. **Firm exit is countecyclical.** Campbell (1998), Vilmi (2009), Totzek (2009), Rossi L. (2014)
3. **Campbell (1998):** correlation between GDP growth and exit rates is negative and stronger than that with entry rates (0.28 versus -0.51)
4. **Recent financial crisis:** firms' net change became NEGATIVE from 2008 to 2010 (peak 2009)

Evidence on Bank Lending to Firms

- **FRED data on C&I loans:**
  - about 15% reduction in between 2001 and 2003
  - 25% reduction in between 2008 and 2010
- **C&I loan rate spread:**
  - *Countercyclical Bank Spread.* (Hannan and Berger, 1991, Leuvenstein et al. 2008)
  - Recent financial crisis: the C&I loan rate spread about 66 basis points higher (or 23% higher) than its long-term average. Kwan (2010):
- **Bank Markup:**
  - *Countercyclical Bank markup* (Dueker and Thornton 1997, Cetorelli 2003, Aliaga-Diaz & Olivero 2006, Claessens et al. 2000)

Main Results of the model: it replicates all these stylized facts

The model with both endogenous firms entry and exit shows

- **Countercyclical exit** (both of rates and n° of firms), in line with the empirical evidence.
- **Countercyclical banks' markups,** in line with the empirical evidence.
- **Countercyclical loan spread**, in line with the empirical evidence. The loan spread is procyclical or acyclical in the model with exogenous exit
- **Firms net change becomes negative** in response to a financial shock (bank capital shock)
- **Stronger propagation mechanism** than the model with exogenous exit

The Model

Four agents:

1. Firms: Intermediate sector $\longrightarrow$ **Endogenous firms' exit and entry**
2. Households
3. Monopolistic Banking: Markup and Markdown
4. A Monetary Authority: set the interest rate

The Intermediate good-producing firms

- N firms producing an intermediate good, $i \in (0, N)$
- Monopolistic competition with sticky prices
- **Two types of firms:**
  1. **New entrants**
  2. **Incumbent firms**

The Intermediate good-producing sector

- The production function of firm i is

$$y^{I}_{i,t} = A_t z_{i,t} l_{i,t}$$

- A_t: aggregate productivity
- $l_{i,t}$: labor hours employed by firm i;
- $z_{i,t}$ **is a firm specific productivity,** as in Ghironi and Melitz (2005) **.**

Entry and Exit

Timing:

- **New Entrants**
  - **Entry condition:**
$$\tilde{v}_t = f^E \tag{1}$$
  - **Upon entry, firms draw their productivity** z_i from the common Pareto distribution with CDF $G(z_i) = 1 - \left(\frac{z_{\min}}{z_i}\right)^{\xi}$ with support $z_i \in [z_{\min}, \infty)$.

Entry and Exit

Timing:

- **Incumbents**
  - borrow $b_{i,t}$ from the banking sector to pay the fixed cost f^F
  - **Firms exit**: before producing, if $z_{i,t} < \bar{z}_t$
  - $\bar{z}_t$ is cut-off level: the one that equals profits to zero.
- **Average productivity:**

$$\tilde{z}_t \equiv \left[\frac{1}{1 - G\left(\bar{z}_t\right)} \int_{\bar{z}_t}^{\infty} z_{i,t}^{\theta-1} g\left(z_i\right) dz_i \right]^{\frac{1}{\theta-1}}$$

with: $$\frac{d\tilde{z}_t}{d\bar{z}_t} > 0$$

- **Endogenous death probability:** $\eta_t = 1 - \left(\frac{z_{\min}}{\bar{z}_t} \right)^{\xi}$

Firms Dynamics

- $\begin{cases} N_t^E : \text{new entrants at t} \\ N_t : \text{firms already producing at t} \end{cases}$
- **Time to build**. Entrants in period t start producing in period $t+1$
- The law of motion of firms is:

$$\Rightarrow N_{t+1} = (1 - \eta_{t+1}) \left(N_t + N_t^E \right)$$

- with $\eta_{t+1} = 1 - \left(\frac{z_{\min}}{\overline{z}_{t+1}} \right)^{\xi}$

Households

- Builds on BGM (2012). Households maximize:

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \varepsilon_t^P \left[\ln C_t - \frac{L_t^{1+\phi}}{1+\phi} \right]$$

- Households: consume, work, decide how much to invest in new firms and in the shares of incumbent firms and how much to deposit to the banking sector.

Retail Branch for Loans

- The optimal interest rate on Loans, under flexible rate
  - **Exiting Firms do not pay back the interest rates on loans**

$$r_t^b = \frac{\varepsilon_t^b}{\left(\varepsilon_t^b - 1\right)\left(1 - \eta_{t+1}\right)} r_t$$

  - r_t^b is a mark-up over marginal costs, r_t.
  - **Exiting Firms do not pay back both the interest rates and the notional value of loans**

$$r_t^b = \frac{\varepsilon^b}{\left(\varepsilon^b - 1\right)\left(1 - \eta_{t+1}\right)} \left(r_t + \eta_{t+1}\right)$$

Retail Branch for Deposits

- The optimal interest rate for deposits, under flexible rate is

$$r_t^d = \frac{\varepsilon^d}{\varepsilon^d - 1} r_t$$

- the interest rate on deposits is mark-down over the policy rate r_t. Remember the non-arbitrage condition!

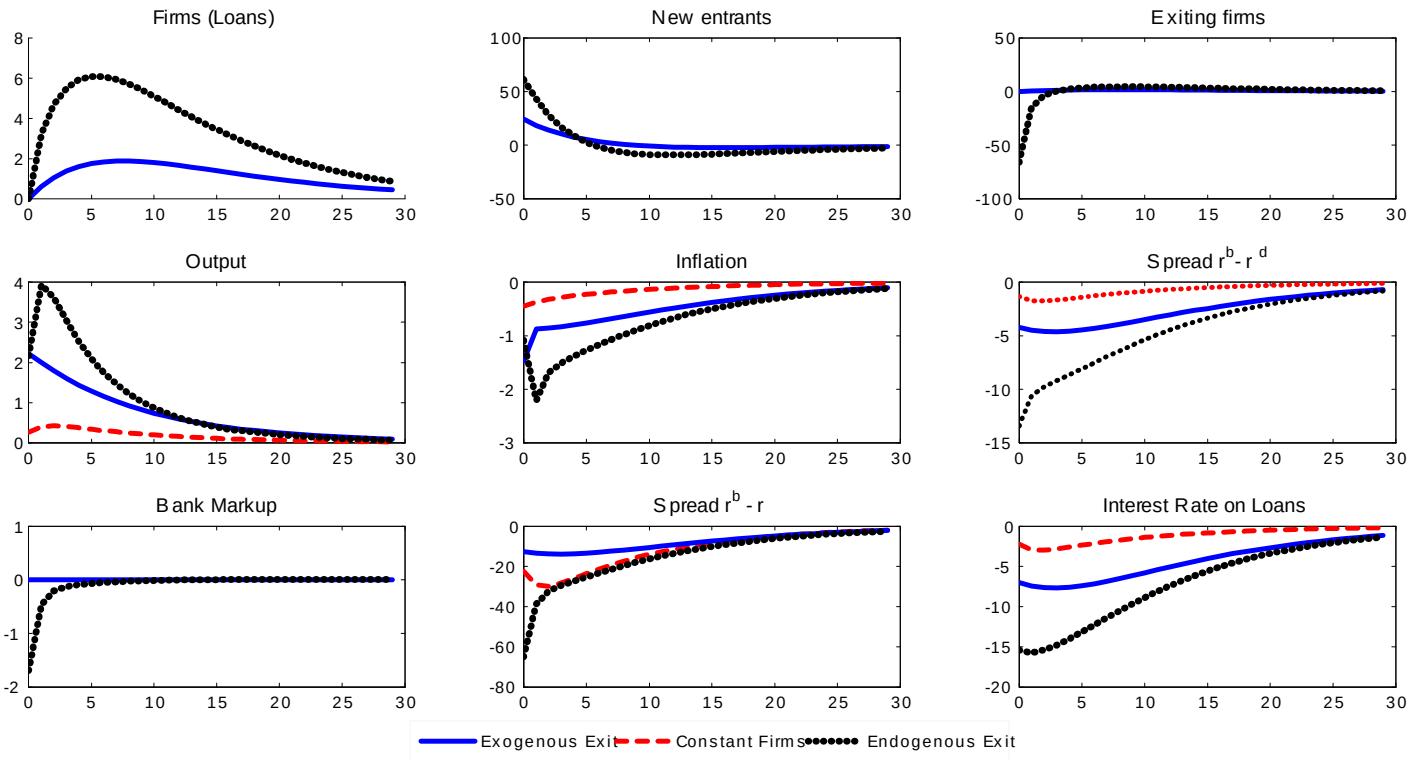
Central Bank

- The central bank sets the interest rate prevailing in the interbank market r_t using the following Taylor rule
- $\ln\left(\frac{1+r_t}{1+r}\right) = \phi_R \ln\left(\frac{1+r_{t-1}}{1+r}\right) +$
  $(1-\phi_R)\left[\phi_\pi \ln\left(\frac{\pi_t}{\pi}\right) + \phi_y \ln\left(\frac{Y_t}{Y}\right)\right] + \ln \varepsilon_t^r$

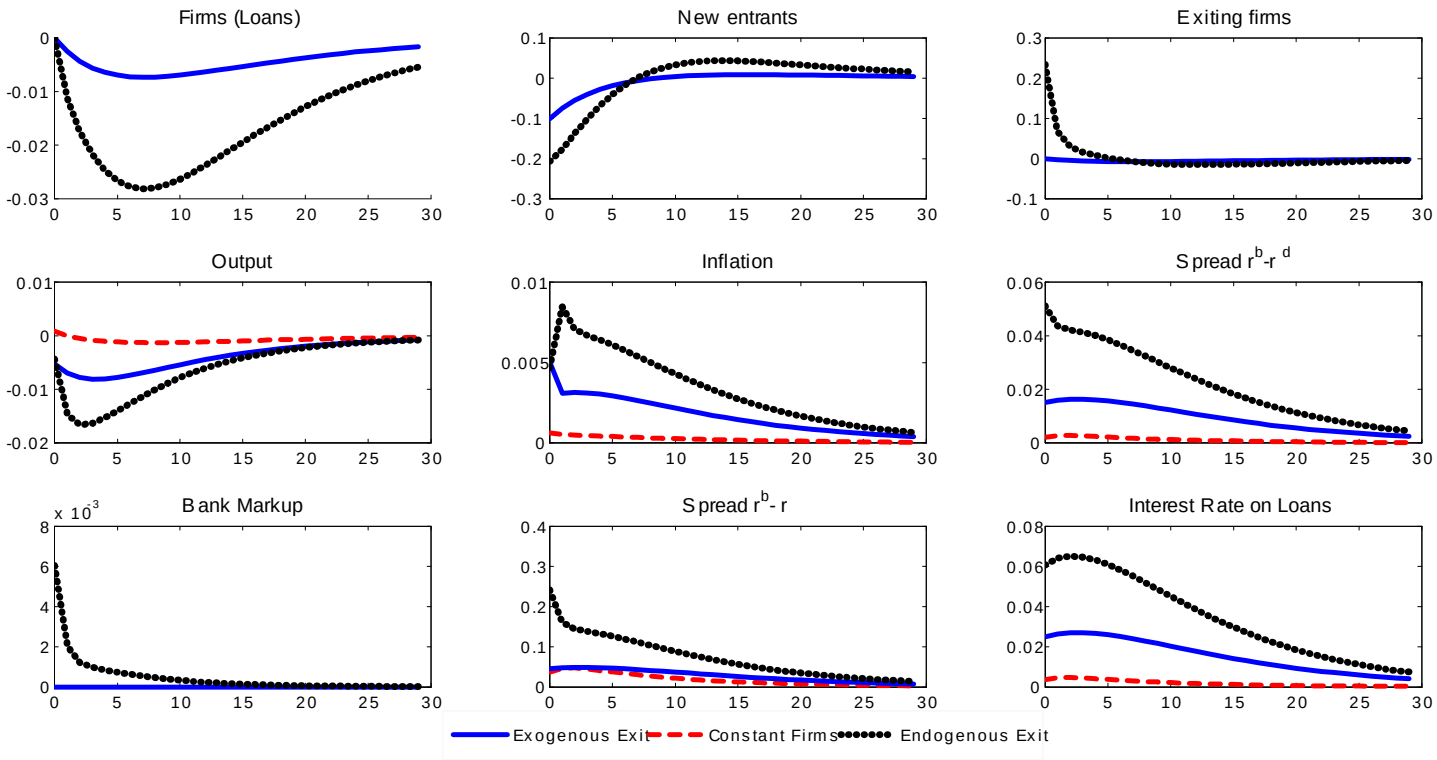
Business Cycle Analysis

- **Impulse response functions to:**
  - productivity shocks
  - shocks to bank capital
- **We compare the performance of three models:**
  1. a standard DSGE model with a fixed number of firms: *Constant Firms*
  2. a model with firms exogenous exit: *Exogenous Exit*
  3. a model with firms endogenous exit: *Endogenous Exit*

Positive Technology Shock



Negative Bank Capital Shock



Unconditional BC Correlations with Output (US data 1992q3-2013q4)

Correlations with Y	**Data**	**Endo Exit**	**Exo Exit**
Loans	0.25	0.55	0.26
Exit rate	-0.34 (-0.36)	-0.30	0
Exit Number	-0.10 (-0.58)	-0.32	0.26
Bank Markup	-0.37(-0.29)	-0.40	0
Loan Spread	-0.20	-0.78	-0.92

Conclusions

Models with endogenous firms exit and monopolistic banking:

- *stronger propagation mechanism* in response to both real and financial variables than a standard DSGE as well as a model with exogenous exit.
- *endogenous countercyclical exit of both rates and number of firms* in line with the empirical evidence;
- *endogenous countercyclical banks markup* in line with the empirical evidence;
- *endogenous countercyclical spread* in line with the empirical evidence.
- *Firms net change becomes negative* in response to a financial shock (bank capital shock)

Future Research

- Macroprudential
- Alternative borrowing mechanism
- Comparison of model IRFs with SVAR IRFs in response to a credit spread shock or TFP shock?
- *Bayesian Estimation of the Model with Endogenous versus Exogenous Exit*
- Welfare: Optimal Monetary and Macroprudential Policy