# Financial and Price Stability in Emerging Markets: The Role of the Interest Rate


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**Joint work with Lorenzo Menna**

BANCO DE MÉXICO


* The opinions expressed here do not necessarily reflect the view of Banco de Mexico.

# 1. Introduction

- Prior to the Global Financial Crisis (GFC), the concept of financial stability was mainly associated with individual risk-taking. However, this concept proved narrow and insufficient as financial imbalances accumulated in the run up to the GFC.

- Thus, the concept was extended to consider that financial institutions interactions, even though they may not affect individual risk-taking, they create negative externalities that amplify the risk for the system as a whole, i.e. “systemic risk.”
  - These negative externalities are reflected, for instance, over a domestic financial cycle according to which financial conditions exhibit a cyclical behavior. For instance, excessive credit growth in the upturn leads to massive deleveraging in the downturn, reducing asset prices and amplifying initial capital losses.

- The new concept of financial stability created a new policy goal, the need for diminishing systemic risk, for instance, by dampening the accumulation of imbalances over the domestic financial cycle. Thus, a new policy instrument has been promoted, i.e. the use of macro-prudential tools.

# 1. Introduction

- However, some argue that macro-prudential tools foster shadow banking and are subject to arbitrage, being insufficient to tackle systemic risk. Considering these flaws, the view "leaning against the wind" claims that monetary policy should address financial stability concerns by increasing the interest rate to dampen the accumulation of imbalances in the upturn of the domestic financial cycle (Borio & Lowe, 2002; Woodford, 2012).

- In addressing this "leaning against the wind" view, research has introduced financial considerations in macro-models and investigated its implications for monetary policy:
  - Cúrdia & Woodford (2016) introduce a role for credit in a basic New Keynesian framework by considering two types of households in a closed-economy model: "borrowers," with high preferences for current consumption and elasticity of intertemporal substitution and "savers," with low preferences and elasticity of intertemporal substitution.
  - Ajello et al. (forthcoming) consider a New-Keynesian model in its reduced form and augment it with credit, i.e., could be in principle micro-founded with Cúrdia & Woodford (2016), and show that it is optimal for the U.S. to increase the interest rate to dampen the accumulation of credit growth (financial imbalances) and diminish the financial crisis probability.

# 1. Introduction

- However, the discussion has mostly focused on advanced countries (AEs). In EMEs, domestic financial markets tend to be less sophisticated and complex, implying that EMEs are much less exposed to the financial risk considered in the discussion.
- Instead, domestic financial markets in EMEs tend to be narrower and less efficient, among others due to smaller contract enforceability and acute asymmetric information problems (Mishkin, 1996); hence, EMEs rely more strongly on foreign credit implying that credit and other money aggregates in these countries are smaller relative to the capital flows they receive (Claessens & Ghosh, 2013). Hence, financial risks in EMEs are largely driven by capital flows.
    - In contrast to AEs, EMEs face financial stability risks stemming from the direction and volatility of capital flows.
- Given that EMEs have different characteristics and face different financial risks of a different form there is a need for setting a debate on the link between monetary policy and financial stability that applies exclusively to these countries.

# 1. Introduction

- This paper extends the debate to EMEs by borrowing features from the "leaning against the wind" literature, and by using them to make contributions:
  - Borrowing several features from Cúrdia & Woodford's closed-economy setup (2016), it develops a non-linear open-economy model with borrowers and savers in which savers are given access to global financial markets.
    - ✓ This creates a new link between capital flows and **DOMESTIC** credit.
    - ✓ When borrowers access global markets the link is between capital flows and **TOTAL** credit.
    - ✓ Model's Unique mechanism.
      - ❑ **Closed economy:** a rise in the interest rate diminishes aggregate demand and thus credit.
      - ❑ **Open economy**: this rise attracts capital flows and may thus end up fueling rather than reducing credit. Hence, the ability of the interest rate to "lean against the wind" is diminished and it may not be optimal for an EME to do it.
  - Using the non-linear theoretical setup, the paper derives a reduced-form linear model and calibrates it for Mexico by using the same strategy of Ajello et al. (forthcoming) for the U.S. and a closed-economy setup.

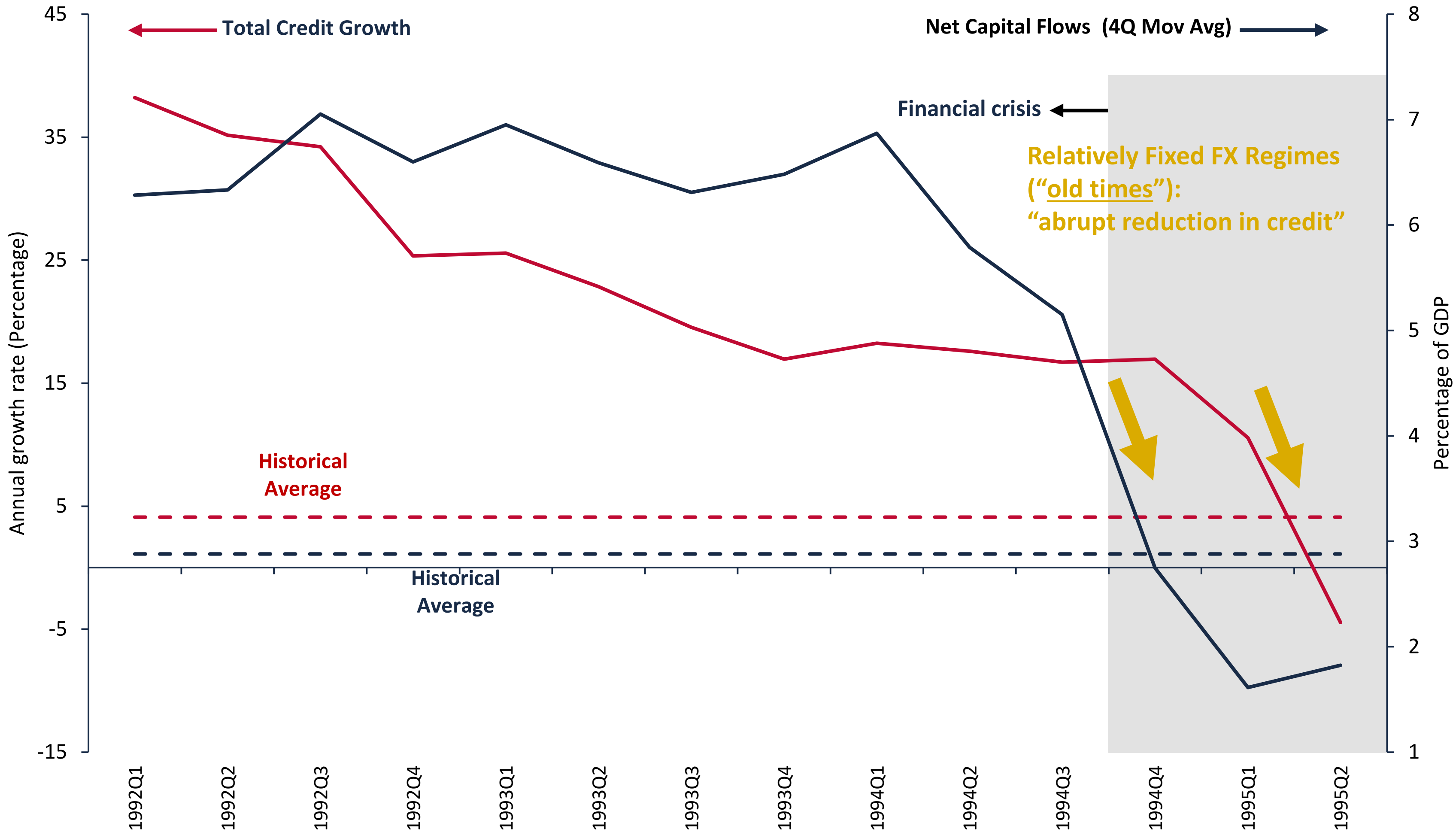
# Outline

# 2. Capital Flows and Financial Stability in EMEs

- The importance of capital flows for domestic financial conditions and financial stability is supported by experiences in contemporaneous economic history, but also by formal research:
  - Relatively Fixed FX Regimes ("old times"): currency crises studies share a common narrative: after periods of large inflows, sudden stops cause capital flow reversals, forcing authorities to defend the peg until FX reserves are deployed and a strong devaluation occurs. In response to reduced foreign credit, **aggregate demand must fall** to reduce imports, and the devaluation passes-through into prices raising inflation (Calvo, 1998; Calvo & Reinhart, 2000).
  - Relatively Flexible FX Regimes ("modern times"): There is a **global financial cycle** in which EME's domestic financial variables are driven by capital flows, which are in turn affected by global factors, e.g. monetary conditions of financial centers and appetite for global risk (Bruno & Shin, 2014; Rey, 2015).

# 2. Capital Flows and Financial Stability in EMEs

## Net Capital Flows-to-GDP Ratio and CREDIT Growth in Mexico

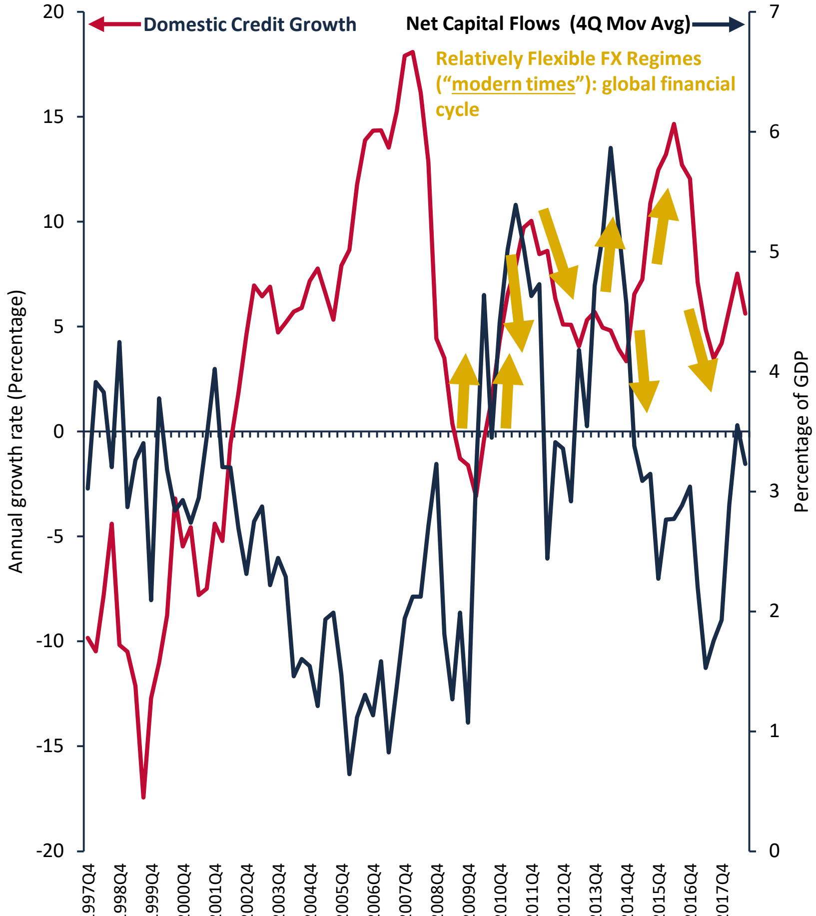



Source: Authors' calculations with data from Banco de México, Bank of International Settlements, INEGI and Haver Analytics.

Notes: Net capital flows are calculated by dividing the balance of the financial account (excluding reserve assets) of the balance of payments over GDP, and were smoothed by using a 4-quarter moving average (4Q Mov Avg). Total credit growth refers to the annual growth rate of the total funding to the non-financial private sector in real terms.

# 2. Capital Flows and Financial Stability in EMEs

## Net Capital Flows-to-GDP ratio and DOMESTIC CREDIT (savers' access to global markets)

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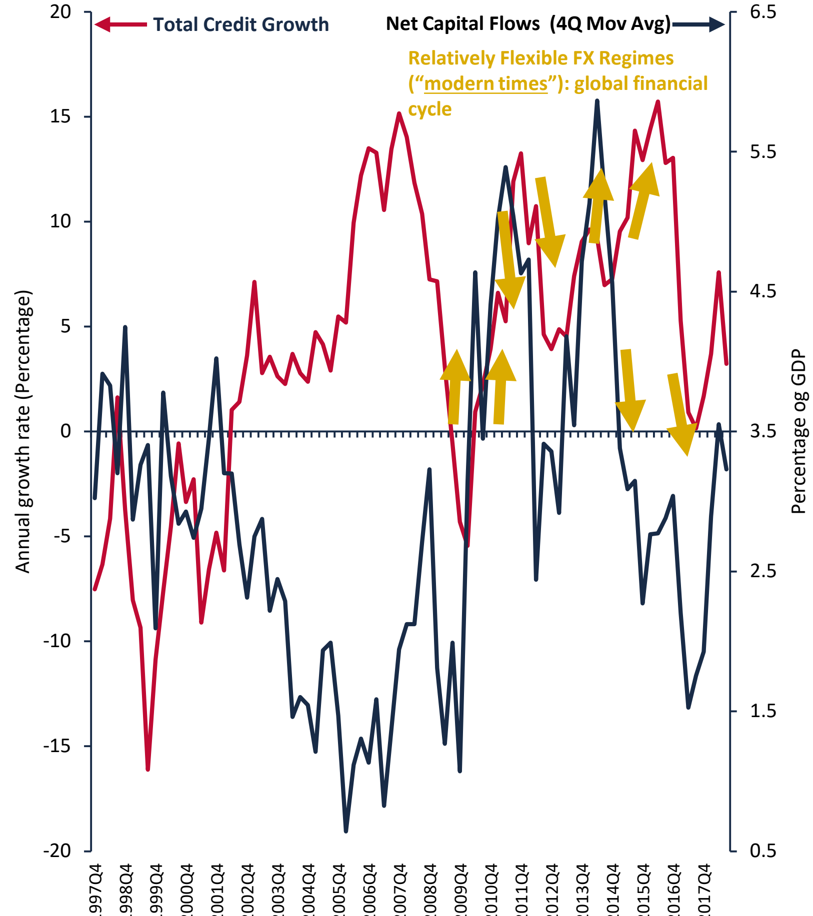
Notes: Net capital flows are calculated by dividing the balance of the financial account (excluding reserve assets) of the balance of payments over GDP, and were smoothed by using a 4-quarter moving average (4Q Mov Avg). Domestic credit growth refers to the annual growth rate of the domestic funding to the non-financial private sector in real terms. Net capital flows seems to lead the growth rate of real domestic credit since the fourth quarter of 2009; hence, when performing impulse response functions the period is divided in two: 1997Q4-2009Q4 and 2010Q1-2018Q3.

## Net Capital Flows-to-GDP Ratio and TOTAL CREDIT (borrowers' access to global markets)

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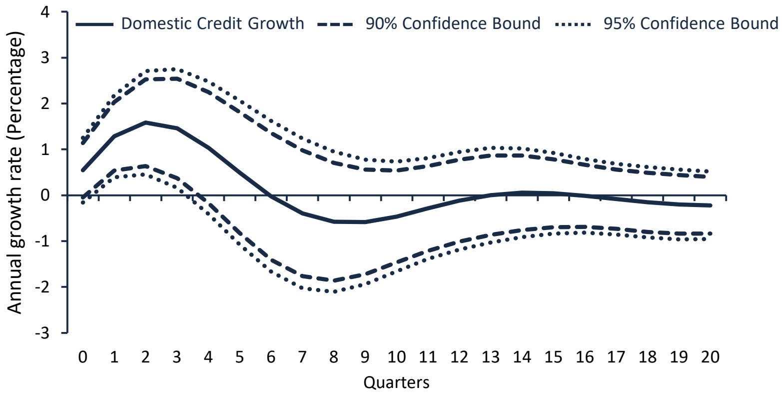
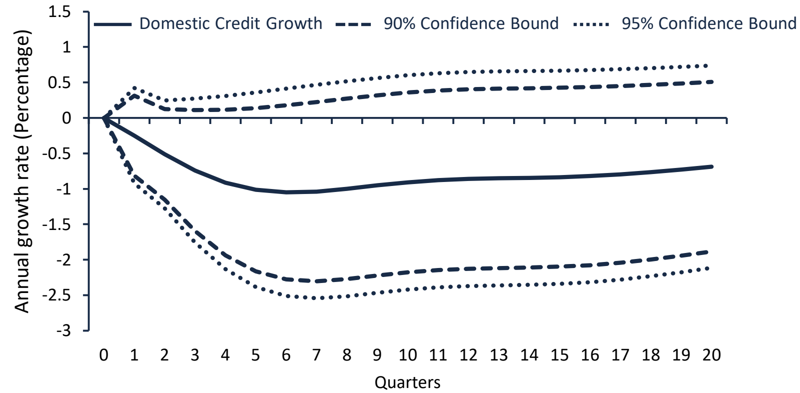
# 2. Closed and Open Economy Mechanisms

## First Period: Shock to Real GDP Growth




Source: Authors' calculations with data from Banco de México, INEGI and Haver Analytics.
Notes: To obtain impulse-response functions, a Vector Autoregression Model (VAR) with real GDP growth, real domestic credit growth and net capital flows was estimated using data over 1997Q4-2009Q4. Shocks were identified by using a Cholesky decomposition and the following ordering: real GDP growth, real domestic credit growth and net capital flows. Results are robust to ordering the variables as follows: real GDP growth, net capital flows and real domestic credit growth. The lag length was chosen based on the Bayesian information criterion.

## First Period: Shock to Net Capital Flows

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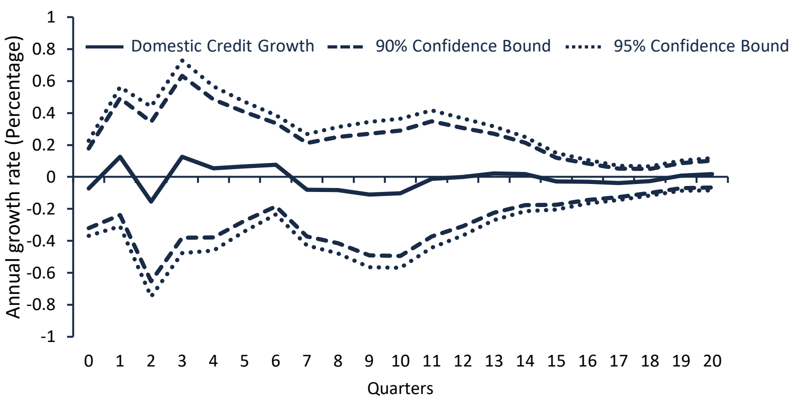
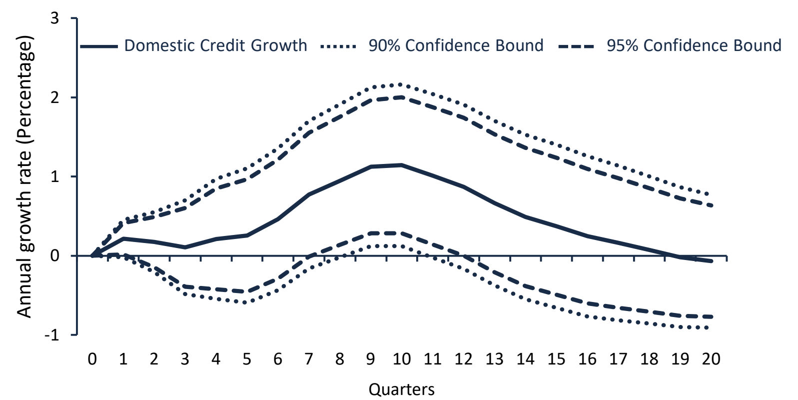
## Second Period: Shock to Real GDP Growth




Source: Authors' calculations with data from Banco de Mexico, INEGI and Haver Analytics.
Notes: To obtain impulse-response functions, a Vector Autoregression Model (VAR) with real GDP growth, real domestic credit growth and net capital flows was estimated using data over 2010Q1-2018Q3. Shocks were identified by using a Cholesky decomposition and the following ordering: real GDP growth, real domestic credit growth and net capital flows. Results are robust to ordering the variables as follows: real GDP growth, net capital flows and real domestic credit growth. The lag length was chosen based on the Bayesian information criterion.

## Second Period: Shock to Net Capital Flows

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# Outline

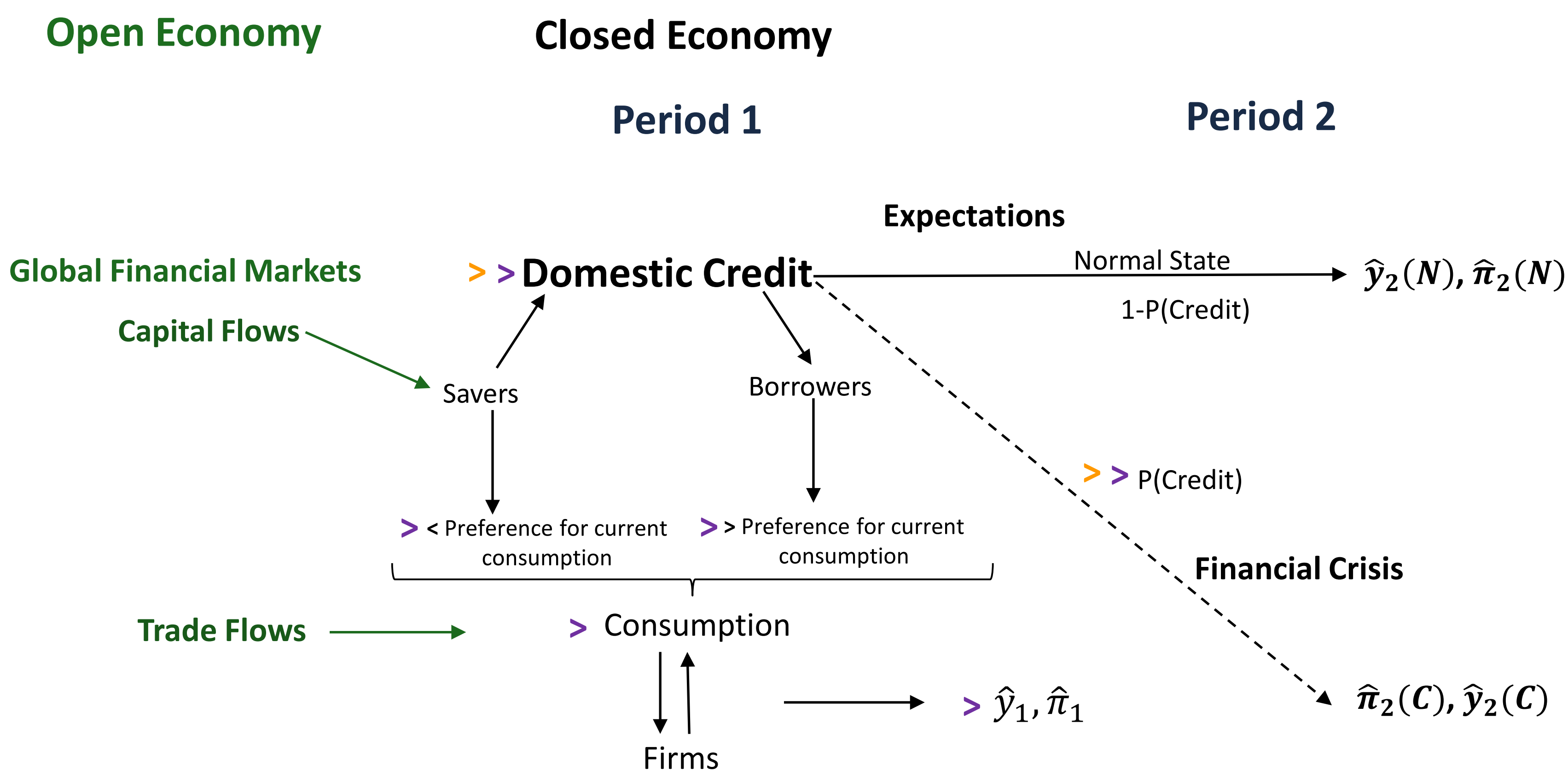
# 3. The model

- The model has three modelling blocks:

1. **New Keynesian (NK)**. The model must identify the extent to which the domestic financial cycle deviates the central bank from its traditional objective, i.e., it must jointly generate inflation and credit growth. In NK frameworks, demand shocks generate inflation but they do not give role for credit and, thus, no way to model credit growth or a domestic financial cycle.
2. **Credit and Systemic Risk**. Thus, we incorporate borrowers and savers as in Cúrdia and Woodford (2016). Then, demand shocks increase inflation but also the output and credit, representing the accumulation of systemic risk in the upturn of the domestic financial cycle. To link this increase to higher probability that a financial crisis occurs, we follow of Ajello et al. (forthcoming) and consider a logistic function in which crisis probability rises with credit and a two-period setup, to make the endogenous transition between the non-crisis and the crisis states computationally feasible. In this context, demand shocks increase inflation, credit and the crisis probability.
3. **Open Economy**. We develop an open-economy non-linear model by borrowing from Cúrdia & Woodford (2016) and then micro-founding domestic access to global financial markets and international trade. In this setup, an increase in the interest rate attracts capital flows, generating an increasing effect on credit.

- Taking into account these blocks, I consider three scenarios: (i) only the NK block to represent the pre-GFC world; (ii) the NK and the Credit block to represent the post-GFC world in AEs; and (iii) the three blocks to represent this world in EMEs.

# 3. The Model




Agents expect to be in the normal state in period 2, as in Ajello et al. (forthcoming).

# 3. The (non-linear) model

- One of the paper's contributions is to borrow several modelling features from Cúrdia & Woodford (2016) and to use them in developing an open-economy setup through the introduction of domestic access to global financial markets and international trade.

- Financial Markets. Benchmark: savers have access to global markets.

Domestic Market $\frac{1}{\beta}\tilde{E}_t(\frac{c^s_{t+1}}{c^s_t})^{\sigma^s} = \frac{1}{\beta}\tilde{E}_t(\frac{c^b_{t+1}}{c^b_t})^{\sigma^b} = \frac{R_t}{\tilde{E}_t(\pi_{t+1})}$ Global Market $\frac{1}{\beta}\tilde{E}_t(\frac{c^s_{t+1}}{c^s_t})^{\sigma^s} = R_f\tilde{E}_t(\frac{X_{t+1}}{X_t})$

$\frac{1}{\sigma^b} > \frac{1}{\sigma^s}$: elasticity of intertemporal substitution, borrowers and savers $\beta$: discount factor $R_f$: foreign interest rate

$X_t$: exchange rate $R_t$: domestic interest rate $\pi_{t+1}$: inflation rate

  - Since $\frac{1}{\beta}\tilde{E}_t(\frac{c^b_{t+1}}{c^s_t})^{\sigma^b} = R_f\tilde{E}_t(\frac{X_{t+1}}{X_t})$ giving access to borrowers preserves the results.
  - The model's unique mechanism is *in action.*

- International Trade. Standard in the literature: as in Gali and Monacceli (2015): foreign good, a domestic good and Home Bias.

# 3. First Scenario: NK Block

- I present the linear model in changes that results from log-linearizing the setup around an approximation point.
- Just as in any NK framework, there is nominal rigidities: monopolistic competition firms optimize with respect to output ($y$) and price ($p$), but face price Rotenberg adjustment cost ($\chi_p$). This gives rise to a Phillips curve:
  - $\hat{\pi}_1 = \delta(.)\,\hat{y}_1 + \beta \tilde{E}_1 \hat{\pi}_2$

  $\delta(\chi_p(-),.) > 0$ : the smaller $\chi_p$, the greater the slope of the Phillips Curve.

- Aggregate demand is described by a standard IS curve:
  - $\hat{y}_1 = \tilde{E}_1 \hat{y}_2 - \bar{\sigma}\left(\hat{R}_1 - \tilde{E}_1 \hat{\pi}_2\right) + \boldsymbol{\epsilon_1}$

In the basic NK model, a demand shock increases output and inflation, calling for an increase in the interest rate. Higher rates are sufficient to completely stabilize both output and inflation, a result known as **divine coincidence**.

# 3. Second Scenario: NK Block + Credit Block

- Because we keep the NK block, the second scenario features the same Phillips and IS Curves. Nonetheless, the IS curve is obtained from the optimization of two household types.
- Borrowers have a higher propensity to consum, $s^b > s^s$, and their elasticity of inter-temporal substitution are $\frac{1}{\sigma^b} > \frac{1}{\sigma^s}$. This gives rise to credit accumulation:
  - $\tilde{b}_1 - \frac{1}{\beta}\left(\tilde{b}_0 + b\hat{R}_0 - b\hat{\pi}_1\right) = s_{\aleph}(.)\hat{y}_1$

  $s_{\aleph} = \alpha\left[\frac{s^b}{\sigma^b} - \frac{s^s}{\sigma^s}\right] > 0$: demand shocks increases inflation and output but also credit.

- Just as in Ajello et al. (forthcoming), and as empirically founded by Schularick and Taylor (2012), credit growth raises the crisis probability:
  - $P\left(\tilde{b}_1\right) = \frac{e^{p+\kappa\tilde{b}_1}}{1+e^{p+\kappa\tilde{b}_1}}$

  $p$; $\kappa$: average crisis probability and elasticity of crisis probability to credit are estimated.

# 3. Third Scenario: The Three Blocks

- **Phillips curve**. Inflation is also affected by $\hat{X}_1$:
  - $\hat{\pi}_1 = \phi_1(.)\hat{X}_0 + \phi_2(.)\boldsymbol{\hat{X}_1} + \phi_3(.)\hat{y}_1 + \beta\left[\tilde{E}_1\hat{\pi}_2 - \phi_1(.)\tilde{E}_1\hat{X}_2\right]$

  $\phi_2(.) > 0$: an appreciation in period 1 diminishes inflation.

  Due to this the effect, monetary policy is more effective at reducing inflation in an open economy.

- **IS curve**.
  - $\hat{y}_1 = \tilde{E}_1\hat{y}_2 - \gamma\left(\tilde{E}_1\hat{X}_2 - \boldsymbol{\hat{X}_1}\right) - (1-\gamma)\bar{\sigma}\left(\hat{R}_1 - \tilde{E}_1\hat{\pi}_2\right) + \epsilon_1$

  $\gamma > 0$ : an appreciation decreased aggregate demand.

- **Credit accumulation**. Depreciations create surpluses in the current account, and deficit in the financial account (“capital outflows), reducing credit accumulation:
  - $\tilde{b}_1 - \frac{1}{\beta}\left(\tilde{b}_0 + b\hat{R}_0 - b\hat{\pi}_1\right) = s'_{\aleph}(.)\hat{y}_1 - \phi_4(.,\gamma(+))\boldsymbol{\hat{X}_1}$

  $\phi_4(.) > 0$: appreciations are associated with capital inflows and thus credit accumulation.

  $\gamma$: openness degree

- **Uncovered interest parity.** An increase in the interest rate attracts capital inflows:
  - $\hat{R}_1 - \hat{R}_1^f = \tilde{E}_1\hat{X}_2 - \hat{X}_1 + \tilde{E}_1\hat{\pi}_2$

- Unique mechanism. Demand shock: both savers and borrowers want to increase current consumption, savers borrow abroad, attracting inflows and, thus, domestic credit.

# 3. The model: policy objectives

- The central bank optimally sets the interest rate in period 1 to minimize a quadratic loss function.

$$L = \frac{1}{2}\left(\phi_y \hat{y}_1^2 + \phi_\pi \hat{\pi}_1^2\right) + \frac{1}{2}\beta P\left(\tilde{b}_1\right)\left(\phi_y \hat{y}_2(C)^2 + \phi_\pi \hat{\pi}_2(C)^2\right)/(1 - \beta\tau)$$

$\tau$: adjusted to target adjusted to target crisis duration.

- There is a trade-off between optimality in period 1, which requires minimizing the deviations of inflation and output from target, and optimality in period 2, which requires reducing the probability that a financial occurs.

# 3. The model: calibration

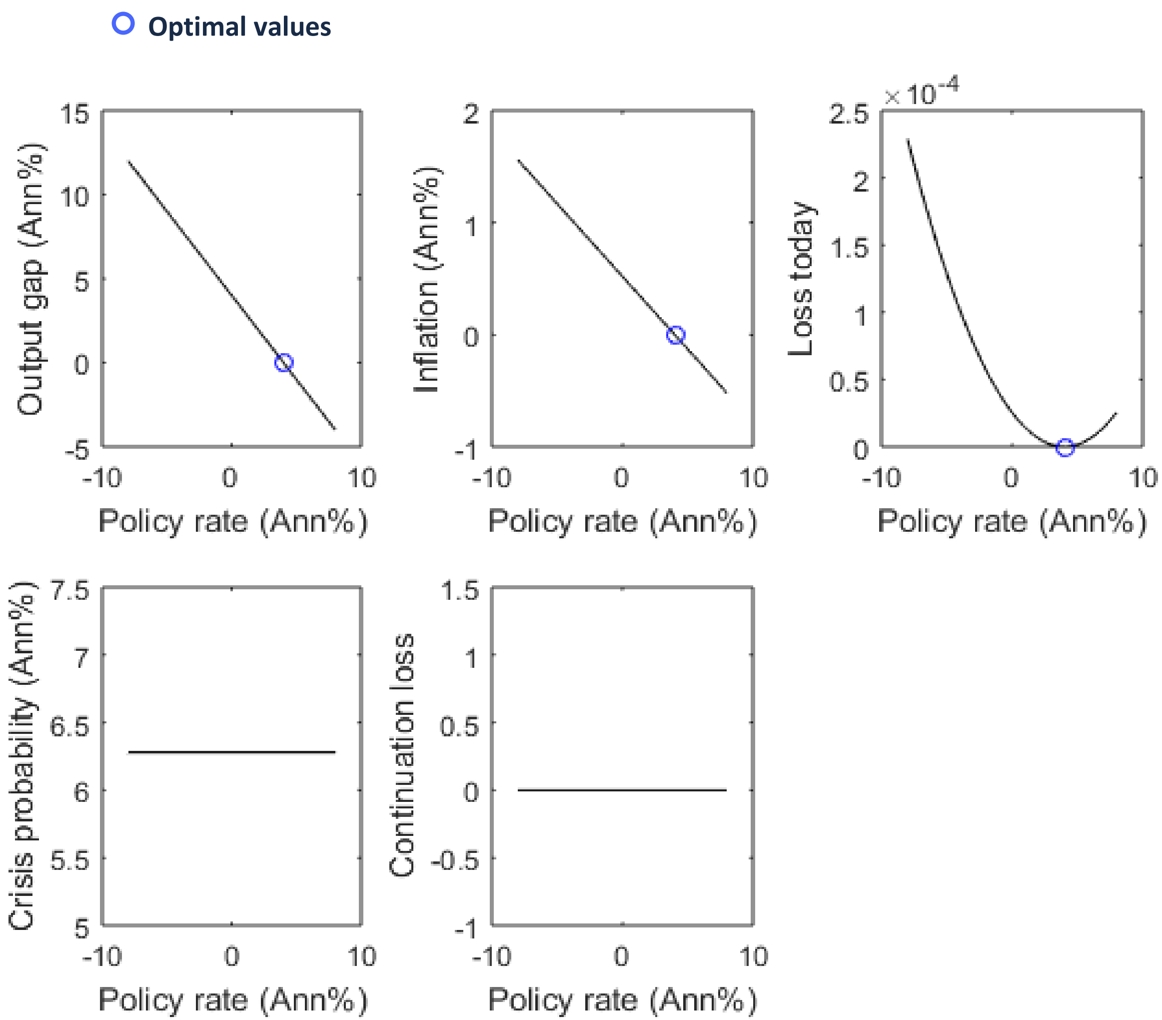
**Parameter Calibration**

| Parameter | Parameter Value | Description |
|---|---|---|
| $\hat{y}_2(C)$ | -2.4% (-9.6% annualized) | Crisis State Output Gap (Mexico) |
| $\hat{\pi}_2(C)$ | 9.1% (36.4% annualized) | Crisis State Inflation (Mexico) |
| $\zeta$ | 6 | Elasticity of Substitution Among Home Goods |
| $\chi_P$ | 77 | Rotemberg Parameter |
| **$\gamma$** | **0.3** | **Openess degree (Mexico)** |
| $\nu$ | 1 | Elasticity of Exports (Mexico) |
| $\pi^b$ | 0.5 | Share of Borrowers (Cúrdia & Woodford) |
| $\beta$ | 0.99 | Discount Factor |
| $\sigma^b$ | Set to obtain $\bar{\sigma} = 1$ | Inverse Intertemporal Elasticity of Subs. of Borrowers (Cúrdia & Woodford) |
| $\sigma^s$ | $5\sigma^b$ | Inverse Intertemporal Elasticity of Subs. of Savers (Cúrdia & Woodford) |
| $s^b$ | 1.4 | Expenditure Share of Borrowers (Cúrdia & Woodford) |
| $s^s$ | 0.6 | Expenditure Share of Savers (Cúrdia & Woodford) |
| $b$ | 1.17 | Steady State Debt (Mexico) |
| $p$ | -4.1137 | Coefficient on Crisis Probability (Latin America) |
| $\kappa$ | 1.1625 | Coefficient on Crisis Probability (Latin America) |
| $\phi_y$ | 1/2 | Loss Function Coefficient on Output Gap (Ajello) |
| $\phi_\pi$ | 1/2 | Loss Function Coefficient on Inflation (Ajello) |
| $\tau$ | 0.7537 | Coefficient to Set Crisis Duration (Mexico) |

# Outline

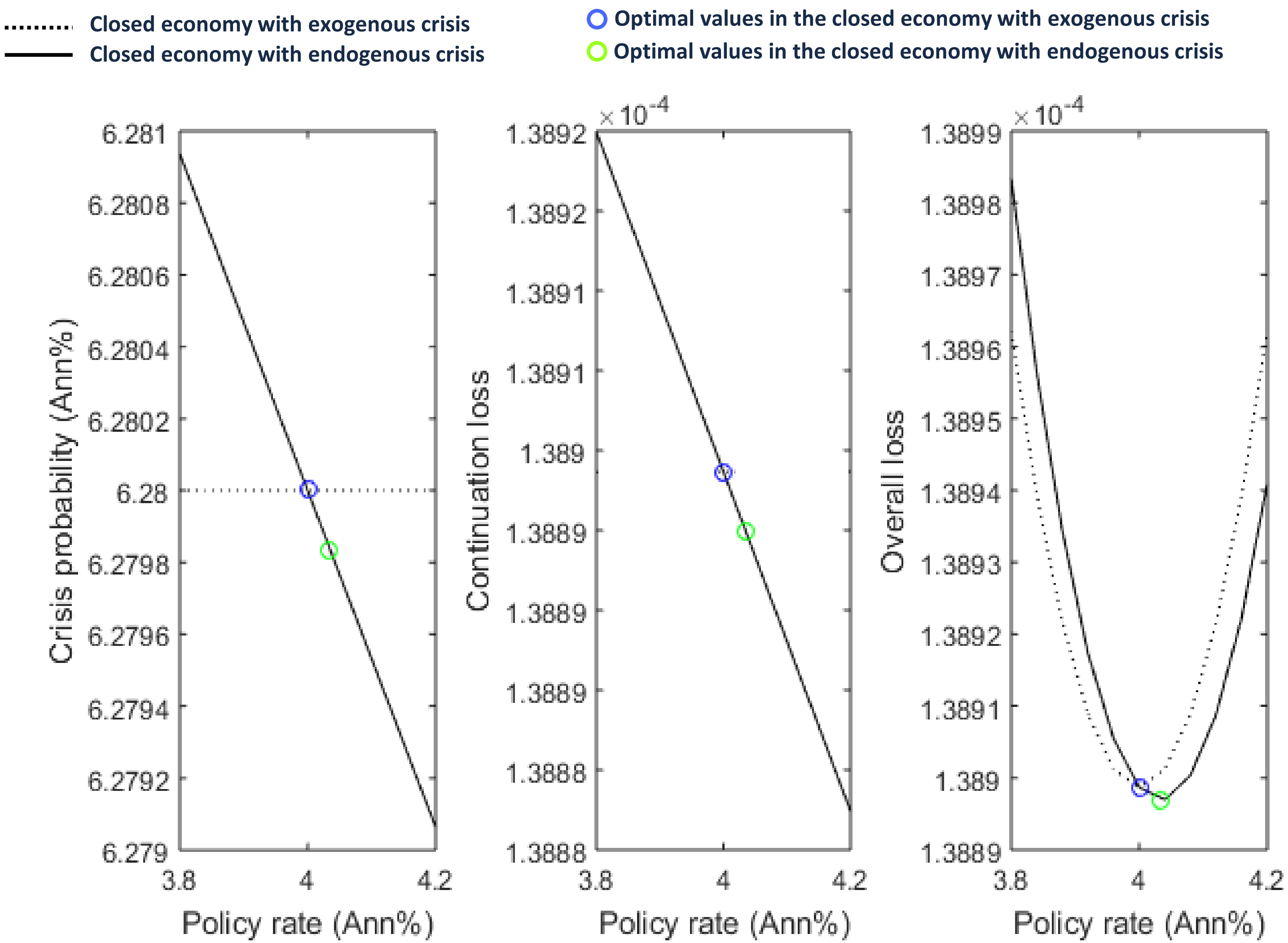
# 4. Results: Divine Coincidence

## Closed Economy with Exogenous Crisis Probability



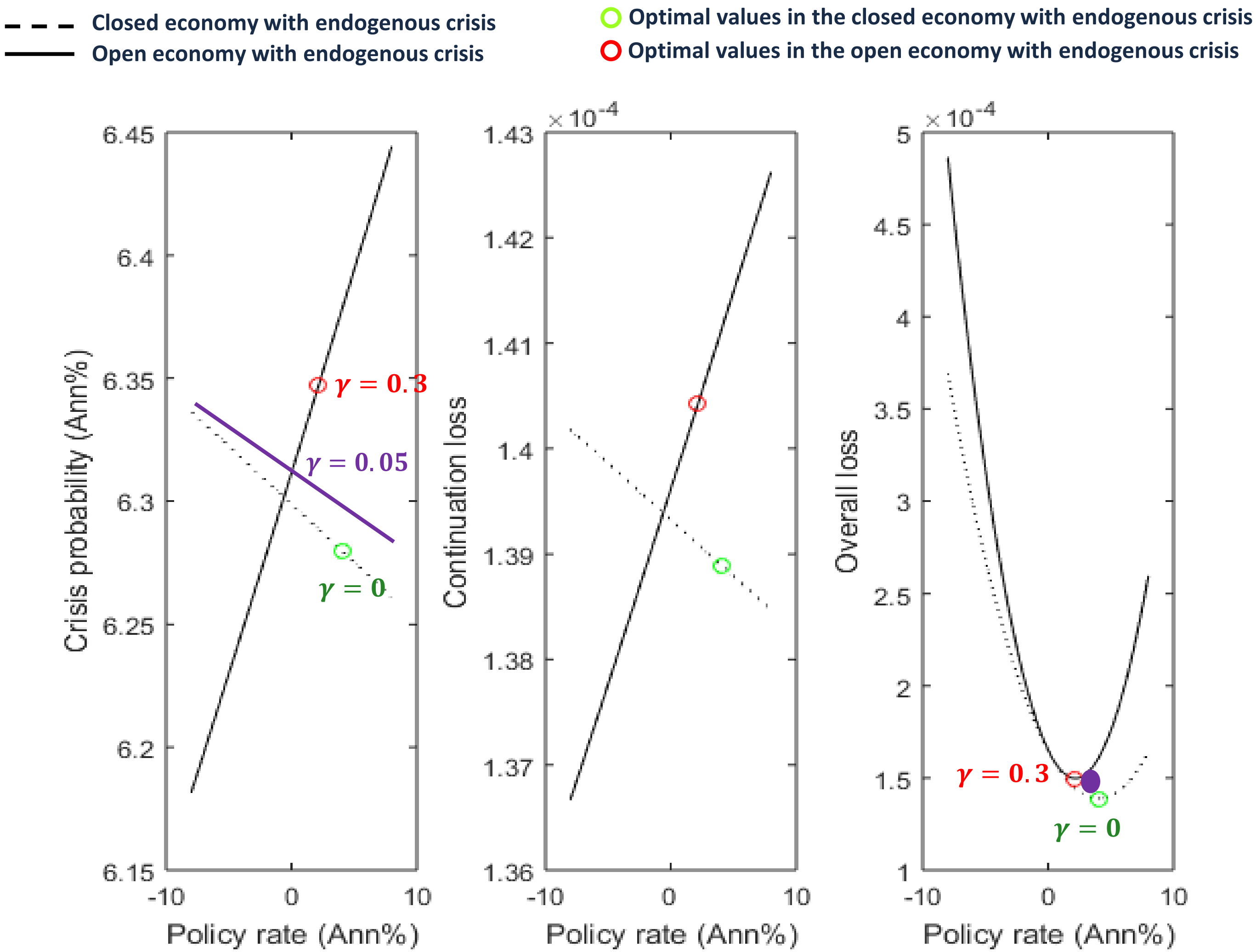
# 4. Results: Leaning against the Wind

## Closed Economies with Exogenous and Endogenous Crisis Probability



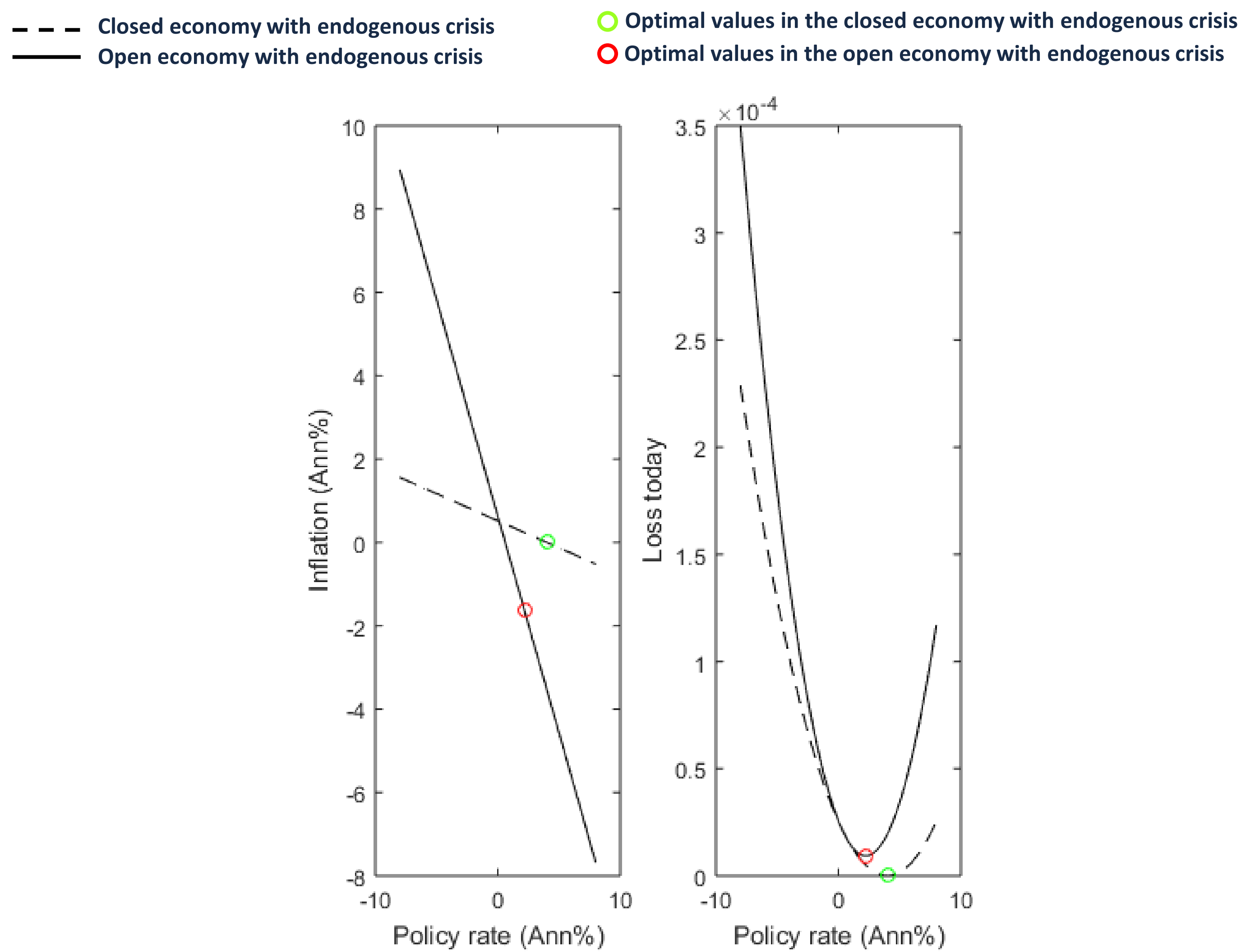
# 4. Results: Open Economy

## Closed and Open Economies with Endogenous Crisis Probability



# 4. Results: Open Economy

## Closed and Open Economies with Endogenous Crisis Probability



# 4. Extensions

- **Uncertainty**: the differences in the interest rate among the 3 scenarios are small. Yet, they may be underestimated if the policy-maker is uncertain on the model's parameters. Thus, we consider a **Robust** and a **Bayesian policy-maker**. The robust policy-maker minimizes the loss function in the worst case scenario. The Bayesian policy-maker assigns a probability to each parameter value and minimizes the expected loss under risk-aversion. Differences are widened: endogeneous crisis probability implies an even higher interest rate, and openness in the capital account reduces it by even more.
- **Flexible VS Fixed FX Regimes**: Regardless of whether the crisis is endogenous, FX flexibility enables the policy-maker to choose the interest rate that she wants and this, in turn, implies that she can reduce welfare losses in response to the demand shock. This is consistent with: (i) the classic trilemma in international economic and (ii) Obstfeld (2017): even in the presence of the global financial cycle, FX flexibility helps insulate the economy. Nonetheless, endogenous financial crisis increases welfare losses even with FX flexibility, being consistent with Rey (2015).

# 4. Conclusions

- The financial risks face that EMEs face, as well as the policy constraints they envisage, make small them different from AEs. This calls for a debate on the relationship between financial stability and monetary policy that applies only to small economies with open capital accounts, among which EMEs stand out.
- In this presentation, we have set the debate. The results show that, in the current context in which global financial markets are highly integrated, EMEs should introduce global financial cycle considerations more than domestic financial consideration in the conduct of monetary policy, unlike advanced economies.
- This implies that the arguments of the leaning against the view are weaker for EMEs, <u>the more open the referred emerging economy is</u>.

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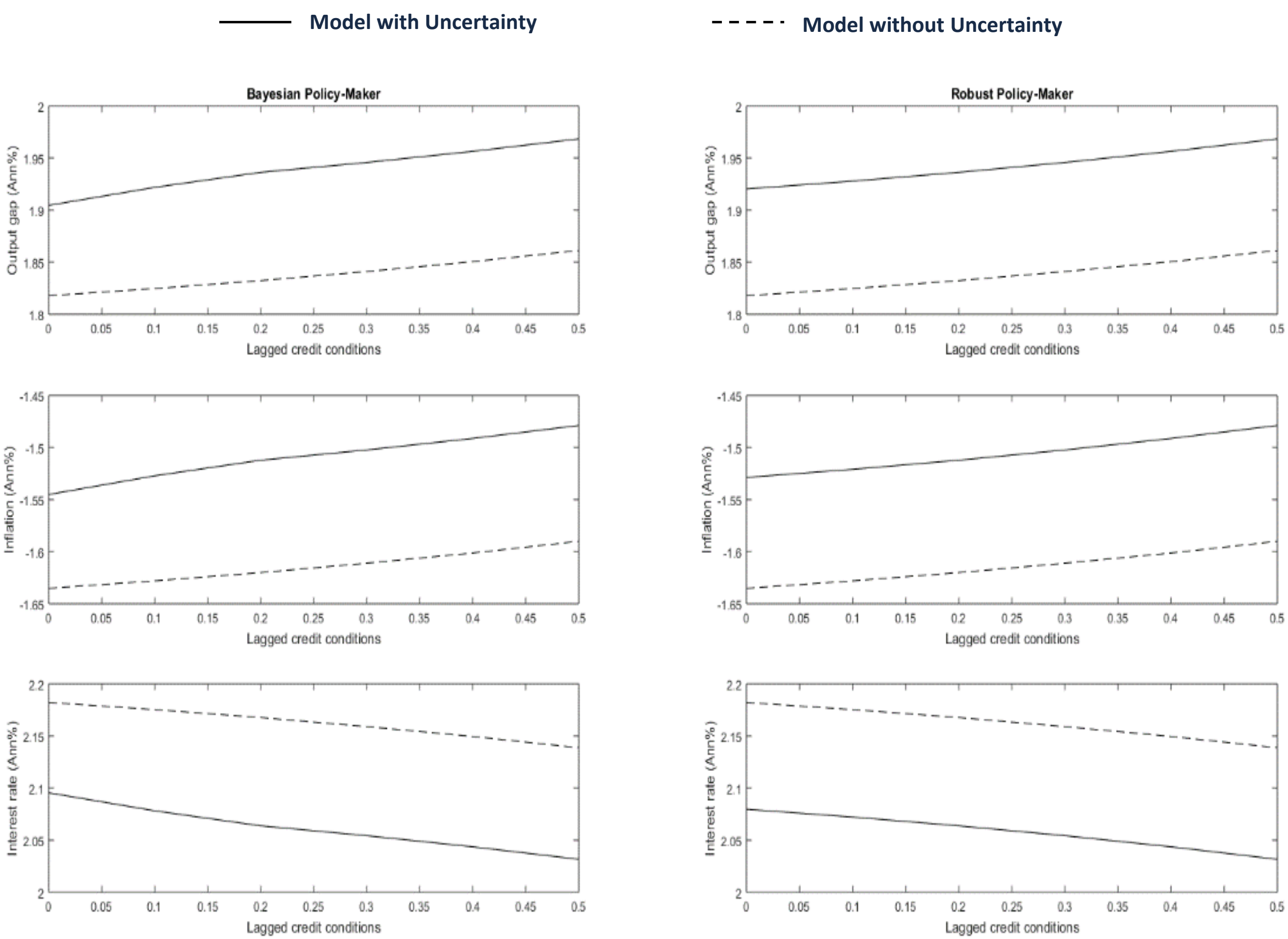
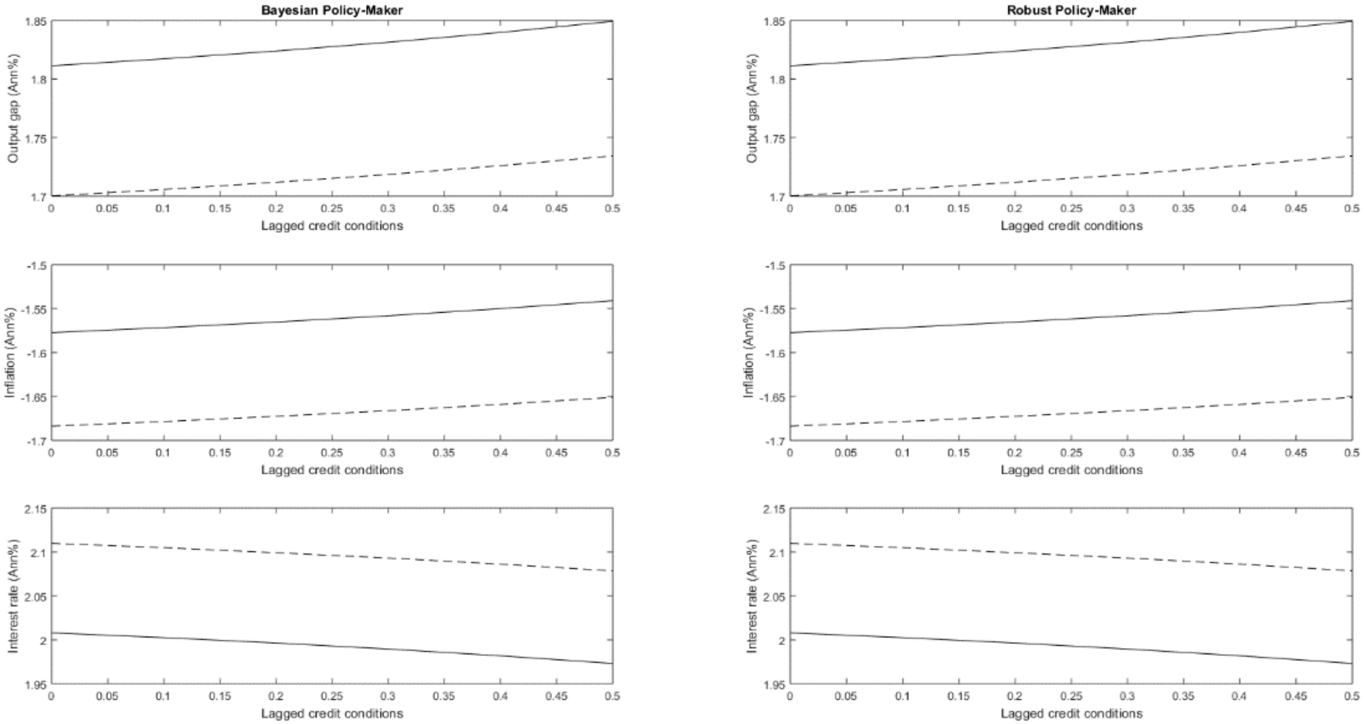
# uncertain effects of the crisis

## Uncertain Economic Effects of a Financial Crisis



# Uncertainty about openess degree



# FIXED VS FLEXIBLE REGIMES

Loss as a function of the interest rate in the simplified model in the exogenous and in the endogenous crisis case

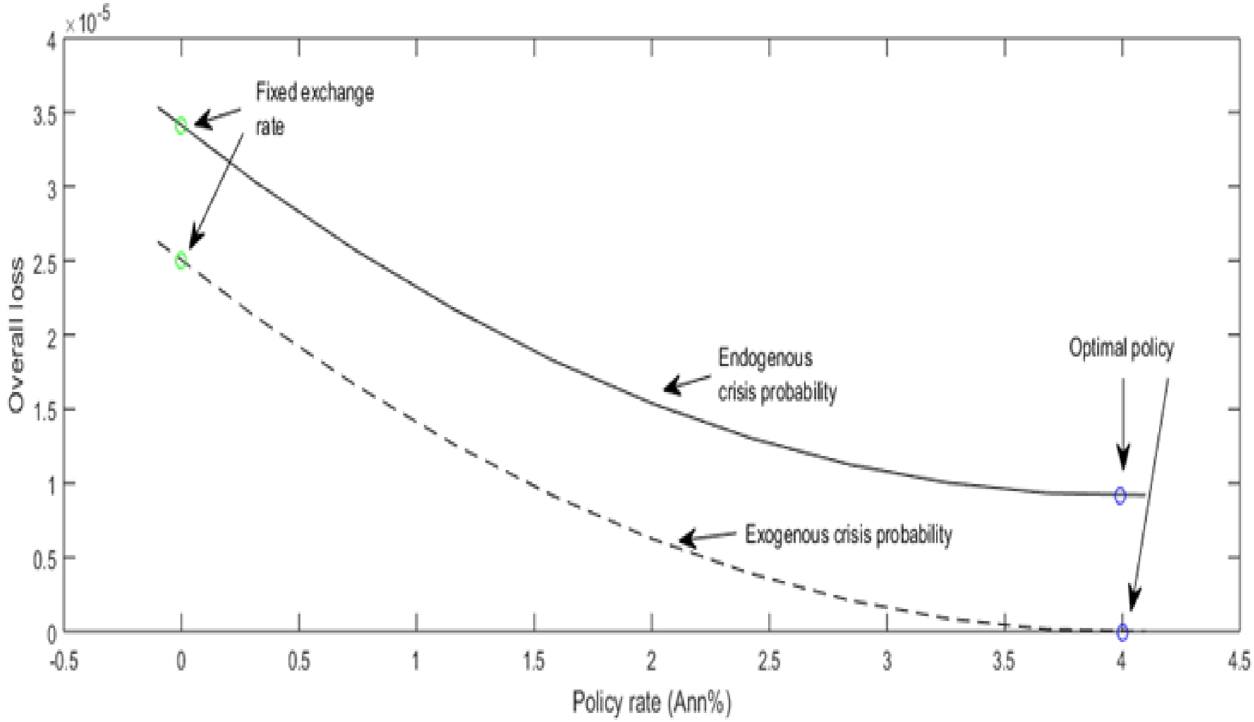
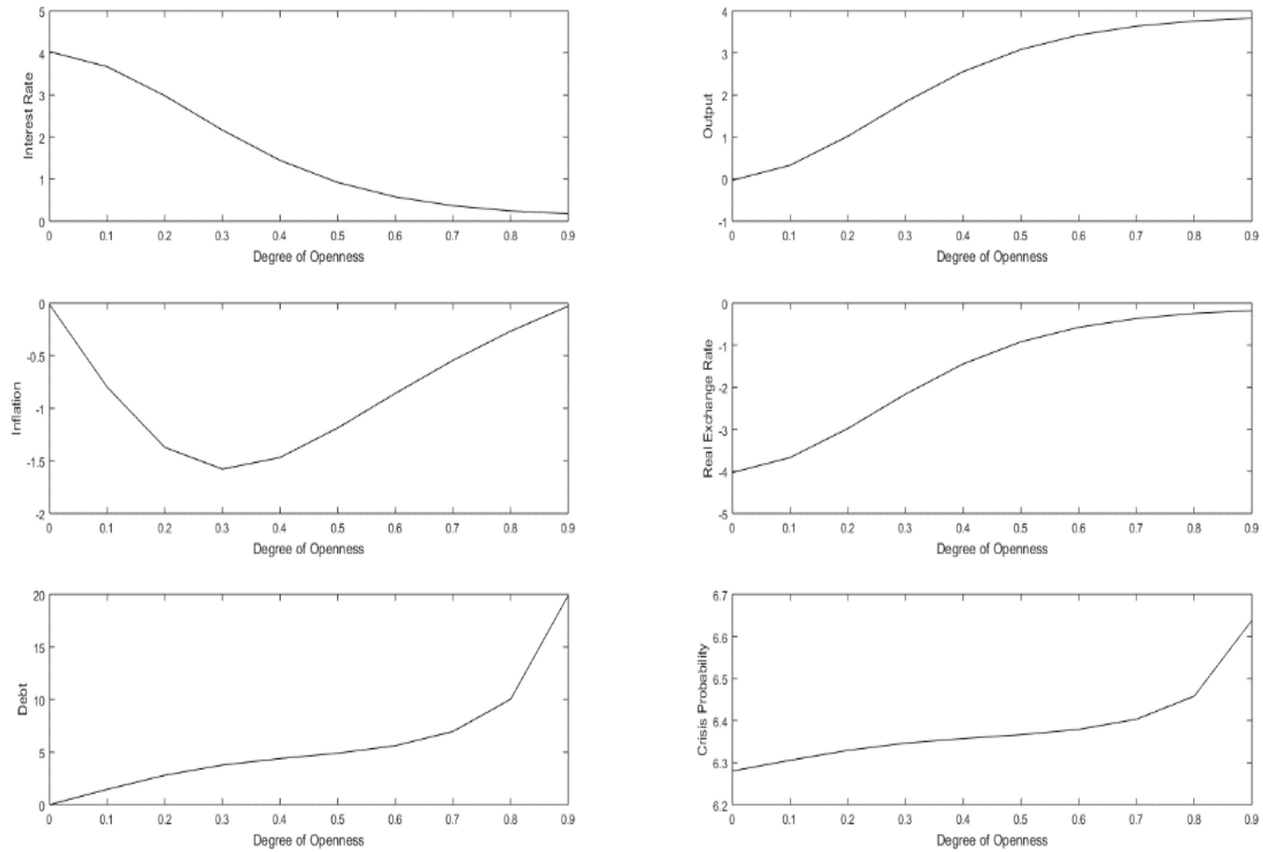
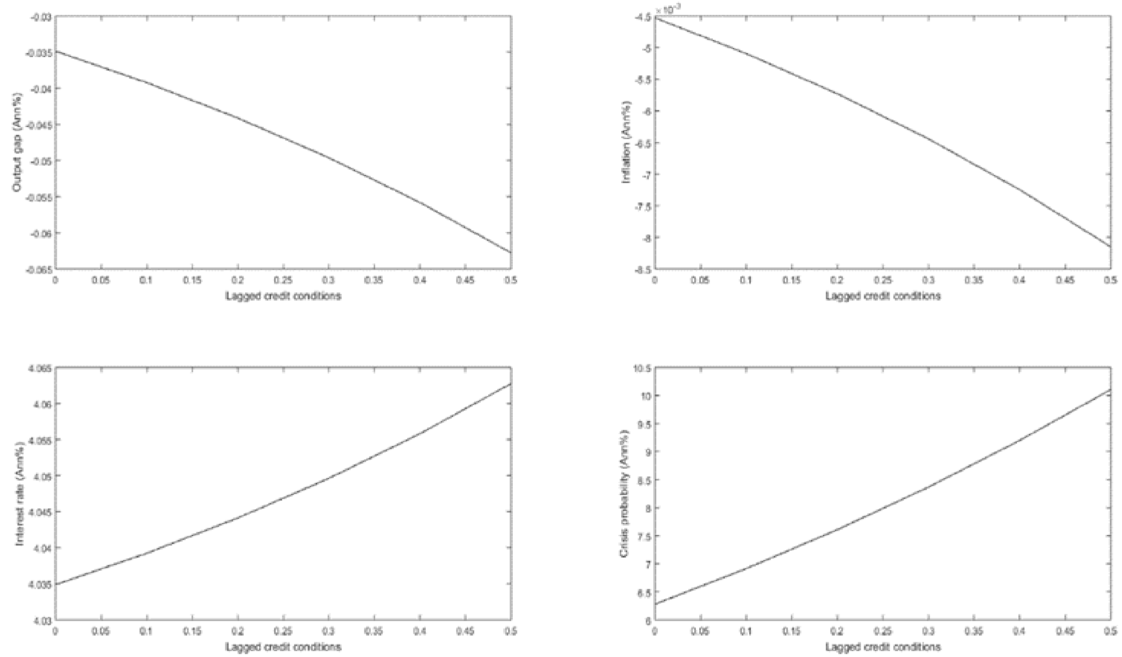


*Figure 1 - Optimal values for different values of γ.*

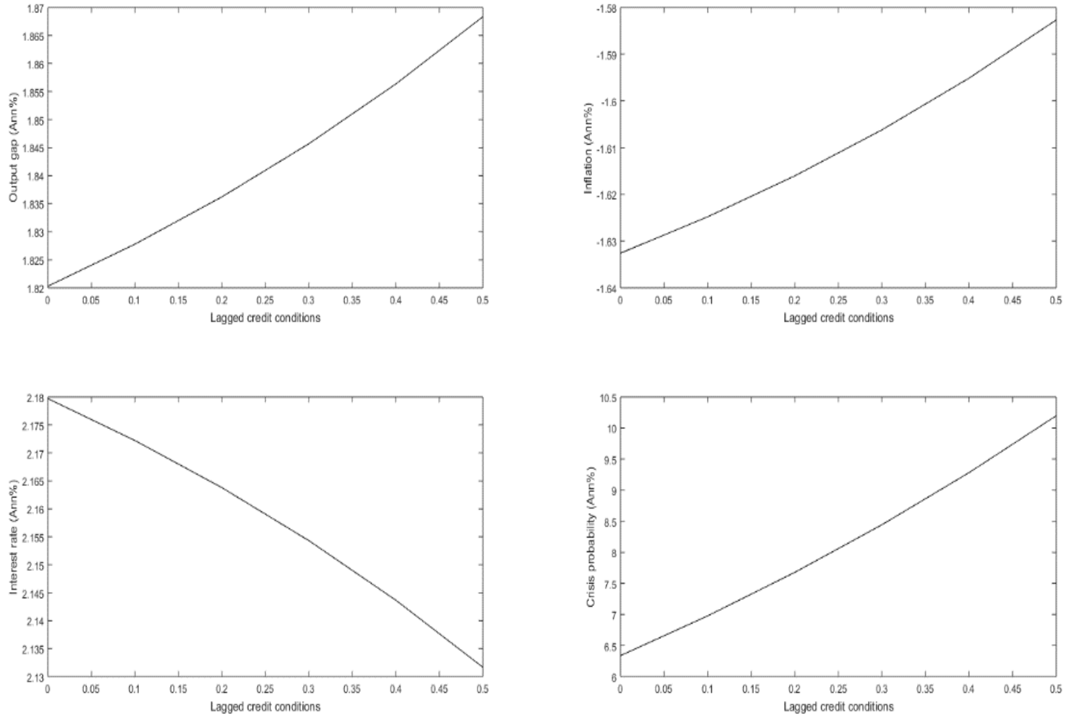


# Lagged Credit Conditions, Closed Economy

Optimal values as a function of lagged credit conditions in the closed economy model with endogenous crisis probability.



# Lagged Credit Conditions, open Economy



# Altenative credit accumulation specification

$$\frac{1}{(1-\pi^b)\pi^b}\left[\tilde{b}_t - \frac{1}{\beta}\left(\tilde{b}_{t-1} + b\hat{R}_{t-1}\right)\right]$$
$$= s^b\hat{c}_t^b - s^s\hat{c}_t^s - \frac{b}{\beta(1-\pi^b)\pi^b}\hat{\pi}_t - \frac{1}{1-\pi^b}\left[\tilde{b}_t^f - \frac{1}{\beta}\tilde{b}_{t-1}^f\right]$$

Table 1. Net Capital Flows/Credit to the Non-Financial Sector

| | 2000-2007 | 2008-2016 |
|---|---|---|
| EMEs [1/] | 1.14 | 2.65 |
| AE [2/] | -0.70 | -0.69 |

1/ This measures Net financial capital inflows into each groups as a percentage of the total credit to non-financial sector.
2/ This set is composed by: Argentina, Brazil, Colombia, Chile, China, India, Indonesia, Mexico, Poland, Turkey and South Africa
3/ This set is composed by: Australia, Canada, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Israel, Japan, Korea, Netherlands, Norway, Singapore, Sweden, Switzerland, United Kingdom and United States.