Economic Stability in Small Open Economy under the Shadow of International Financiers

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Introduction

- Policy makers in emerging economies worry about destabilizing capital flows
  - After the 2008 crisis: massive capital inflows in emerging economies.
- The Uncovered Interest Parity (UIP)
  - The high yield currency tends to depreciate.
  - Cancel destabilizing capital flows issue.
- Empirical studies: The high yield currency tends to appreciate instead.
- Macro models usually assume UIP to hold.

Introduction

- The microstructure literature questions the continuous use of the UIP
  - Short to medium run exchange rate are driven by postion and risk in the Foreign Exchang (FX) market.
- Gabaix and Maggiori (2015) propose a macroeconomic model in which the exchange rate is determined in the FX market.

Aim of this paper

Introduce short to medium run deviations from UIP in a tractable macroeconomic framework.

Introduction
The paper

- We use a micro founded New-Keynesian small open economy model
  - The exchange rate is determined in the FX market.
- We simulate demand and supply shocks under different monetary policy frameworks
  - Which monetary policy is able to stabilize SOEs in a risky environment?
- Estimate the model with Bayesian Markov Switching for South Africa:
  - The switch is driven by the risk (VIX)
  - How shocks affect the South African economy?

Introduction
Contributions

1. We propose a tractable macroeconomic model with realistic deviations from the UIP
   - Relevant for policy making.
2. The model reproduces:
   - The persistent depreciation observed in indebted countries
   - The appreciation observed in countries receiving capital.
3. The monetary policy is able to mitigate the destabilizing effect of capital flows.
4. An optimal monetary policy appears to be the best at stabilizing those economies.
5. During high risk period, an optimal policy responding to exchange rate does not prevent South Africa to observe a large exchange rate volatility.

The exchange rate
Economic intuition

- The SOE trades with the rest of the world and has access to international financial markets
- Financial institutions act as intermediaries in the international financial markets
  - Their ability to bear risk is limited
  - Risk premium.
- The SOE finances its imports by borrowing to financial markets
  - Households sell domestic bonds labeled in domestic currency
  - The financier is long in the SOE currency
  - The domestic currency depreciates today and appreciates further
  - The tighter the risk-bearing capacity, the larger the current depreciation.

The exchange rate
In the model

- The financier maximizes the value of her firm V_t:

$$V_t = E_t\left[\beta(R_t - R_t^* \frac{\epsilon_{t+1}}{\epsilon_t}),\right] q_t, \quad (1)$$

  - q_t is the financier demand for domestic currency and ϵ_t the nominal exchange rate.
  - R_t and R_t^* are the domestic and foreign interest rates respectively,

- Under the constraint:

$$V_t \geq \Gamma \frac{q_t^2}{\epsilon_t}, \quad (2)$$

  - With Γ the risk-bearing capacity.

- Substituting (1) into (2) and using $\beta = \frac{1}{R}$ one obtains the aggregate financiers' demand for assets:

$$Q_t = \frac{1}{\Gamma} E_t\left[\epsilon_t - \frac{R_t^*}{R_t}\epsilon_{t+1}\right]. \quad (3)$$

The exchange rate
In the model

- The equilibrium demand for the domestic currency is:

$$\begin{aligned} \xi_t \epsilon_t - \nu_t + Q_t &= 0, \\ \xi_{t+1} \epsilon_{t+1} - \nu_{t+1} - R_t Q_t &= 0. \end{aligned} \tag{4}$$

  - ξ_t represents exports value and ν_t imports value.

- The expected depreciation in the domestic cureency is:

$$\frac{\epsilon_{t+1} - \epsilon_t}{\epsilon_t} = \frac{(R_t - \Gamma - 1)R_t\nu_t + (\Gamma + R_t - 1)}{(1 + \Gamma)R_t\nu_t + E_t\nu_{t+1}}. \tag{5}$$

- Expected changes in the exchange rate in log:

$$\Delta e_{t+1} = (1 - \Gamma)r_t + (\Gamma - 1)m_{t+1} - (1 + \Gamma)m_t, \tag{6}$$

- Where $m_t = log(\nu_t)$, and $e_t = log(\epsilon_t)$.

Standard equations linearized

- The CPI inflation (in log) is:

$$\pi_t = \pi_{Ht} + \alpha \Delta e_t + u_t. \tag{7}$$

- The domestic inflation comes from the micro founded model and is standard:

$$\pi_{Ht} = \beta E_t \pi_{Ht+1} + \kappa x_t + u_{Ht}, \tag{8}$$

- The IS curve also comes from the micro founded model:

$$x_t = E_t[x_{t+1}] - \frac{1}{\sigma}\Big(r_t - E_t[\pi_{t+1}] - \bar{r}r_t\Big) + \phi E_t[\Delta e_{t+1}] + g_t. \tag{9}$$

  - Expected exchange rate movements affect the output gap ($\phi > 0$).

The monetary policies

1. Taylor rules:

$$r_t = \gamma_\pi \pi_t + \gamma_x x_t, \tag{10}$$

2. Optimal monetary policy:

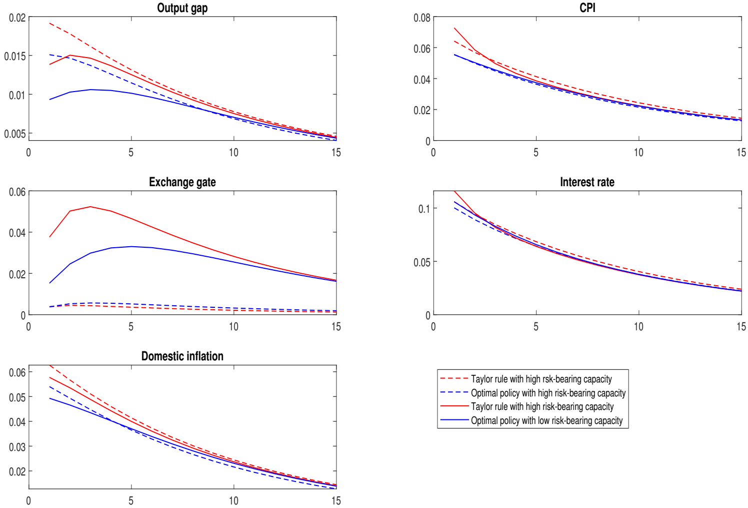
$$max - \frac{1}{2} E_t \left[\sum_{i=0}^{\infty} \beta^i [\psi(x_{t+i} - \bar{x})^2 + (\pi_{t+i} - \bar{\pi})^2] \right].$$

- Using the FOC, we get the following reaction function:

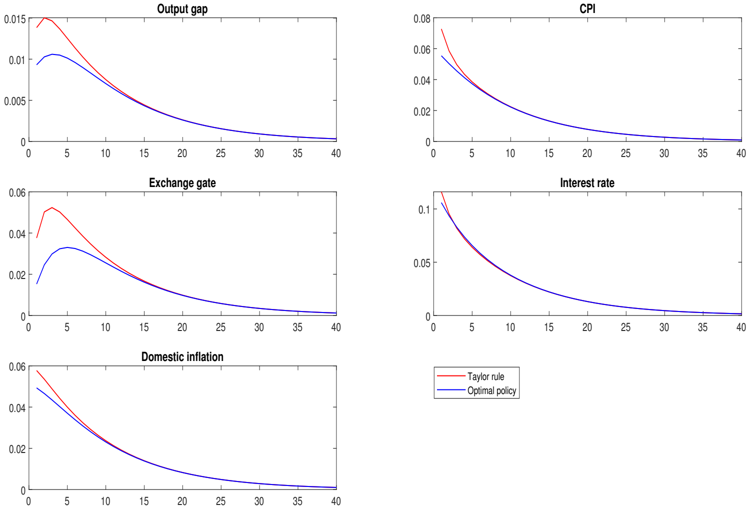
$$r_t = \sigma E_t x_{t+1} + E_t \pi_{t+1} + \gamma_{\pi h} E_t \pi_{Ht+1} + \gamma_{e1} \Delta E_t e_{t+1} + \gamma_e \Delta e_t + \bar{r r}_t + \gamma_u u_t, \tag{11}$$

- $\gamma_{\pi h}$, γ_{e1} and γ_e are positive.
- The central bank responds to current and expected exchange rate changes.

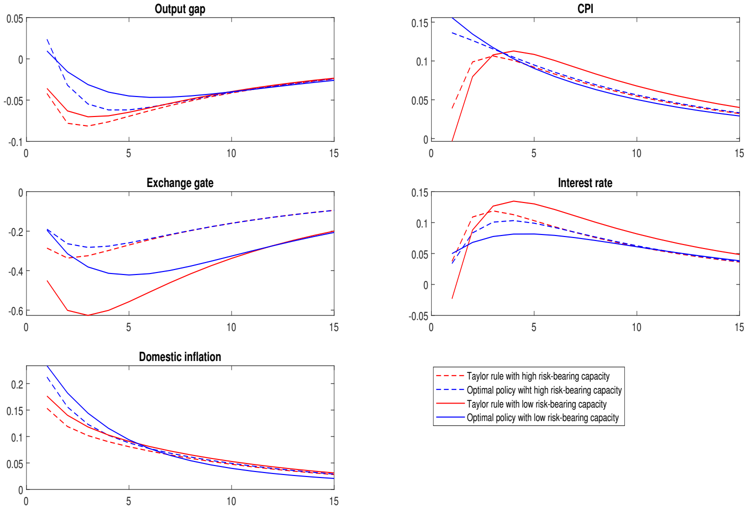
Demand shock



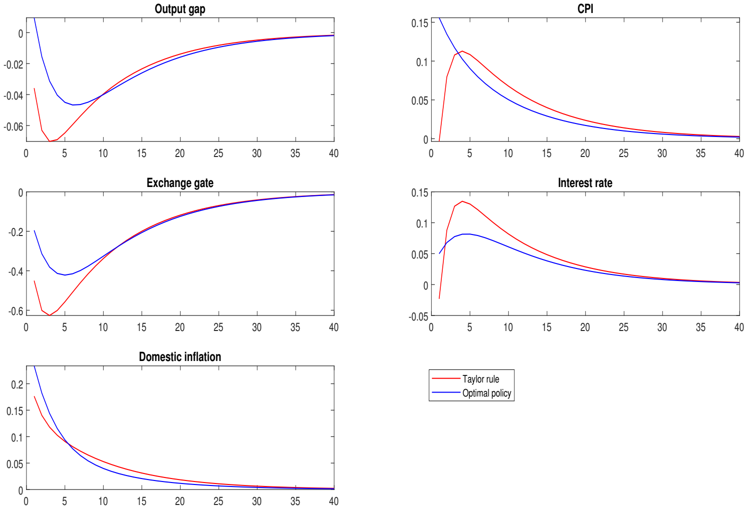
Demand shock
Low risk-bearing capacity



Supply shock



Supply shock
Low risk-bearing capacity



Monetary policy performance

Table: Policies comparison

	Demand shock	Supply shock
High risk-bearing capacity $(\Gamma = 0.1)$		
Taylor rule CPI	$0,02239$	$0,05573$
Taylor rule domestic inflation	$0,02236$	$0,06921$
Optimal monetary policy	$0,01941$	$0,05857$
Low risk-bearing capacity $(\Gamma = 10)$		
Taylor rule CPI	$0,02207$	$0,05684$
Taylor rule domestic inflation	$0,02162$	$0,08519$
Optimal monetary policy	$0,01868$	$0,05531$

- In average, the optimal monetary policy always better performs.
- Demand shock: Optimal monetary policy performs better at stabilizing the output gap and prices.
- For a supply shock, it depends on the level of risk.

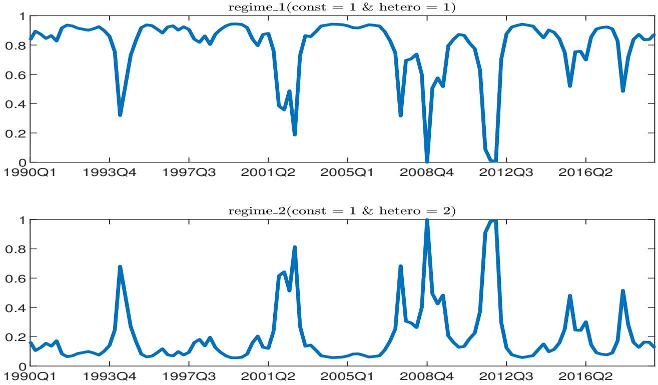
Estimation: South Africa

1. Quarterly data from 1990 to 2019
   - From the QPM: output gap, nominal interest and exchange rates and the CPI.
   - From Fred database: PPI and the VIX.
2. Estimate our New-Keynesian model using Bayesian methods allowing for Markov Switching (Method of Liu, Waggoner and Zha (2011)):
   - The regime switching is driven by risk (VIX):

$$\Gamma_t = \rho_\Gamma \Gamma_{t-1} + \sigma_\Gamma(s_t)\epsilon_{\Gamma t}, \quad (12)$$

   - σ_Γ is the standard deviation of the innovation $\epsilon_{\Gamma t}$.
   - The shock volatility $\sigma_\Gamma(s_t)$varies with the regime $s_t = 1, 2$.
   - The regime switches when the shock volatility reaches a certain threshold.

Regime switching



Results

Table: Prior and posterior distributions of structural parameters

	Prior				Posterior	
Parameters	Distribution	Low	High	Initial	Mode	Mode Std
γ_π	Gamma(a,b)	0.825	2.275	1.5	0.882	0.0068
γ_x	Gamma(a,b)	0.825	2.275	0.5	0.085	0.0023
β	Beta(a,b)	0.920	0.980	0.99	0.967	0.0019
γ	Gamma(a,b)	1.750	3.250	2.9	1.448	0.0025
σ	Gamma(a,b)	1.325	3.775	1	1.265	0.0051
α	Beta(a,b)	0.215	0.405	0.3	0.348	0.0020
$\sigma_\Gamma(coef, 1)$	InvGamma(a,b)	0.0001	2	0.01	0.068	0.0033
$\sigma_\Gamma(coef, 2)$	InvGamma(a,b)	0.0001	2	0.08	0.138	0.0063
$coeftp12$	Beta(a,b)	0.215	0.7761	0.0206	0.117	0.0029
$coeftp21$	Beta(a,b)	0.215	0.7761	0.0338	0.419	0.0029

Optimal monetary policy parameters

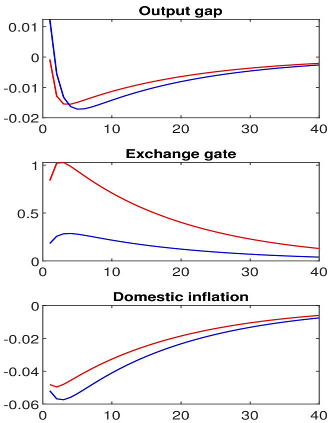
Table: Optimal monetary policy parameters

Parameters	Calibration	Estimation
γ_x	1	1.27
γ_π	1	1
$\gamma_{\pi,h}$	0.0323	0.0756
γ_e	0.0326	0.0782
γ_{e1}	0.4974	0.6625

- The estimated parameters lead to a stronger response of the central bank.

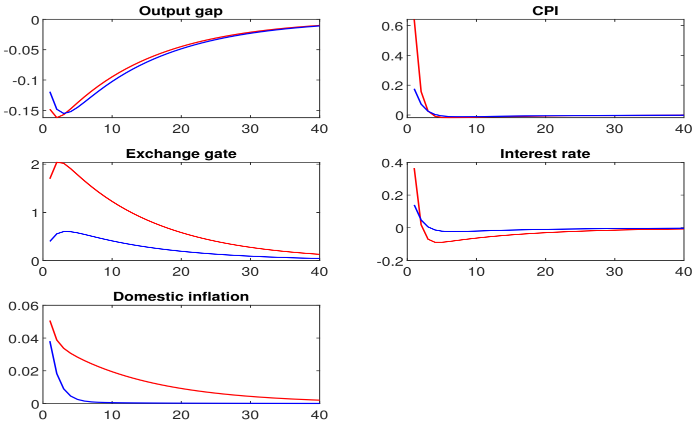
Optimal reaction function

Figure: **Demand shock.** In red: low risk-bearing capacity, in blue: UIP.



Optimal reaction function

Figure: **Supply shock.** In red: low risk-bearing capacity, in blue: UIP.

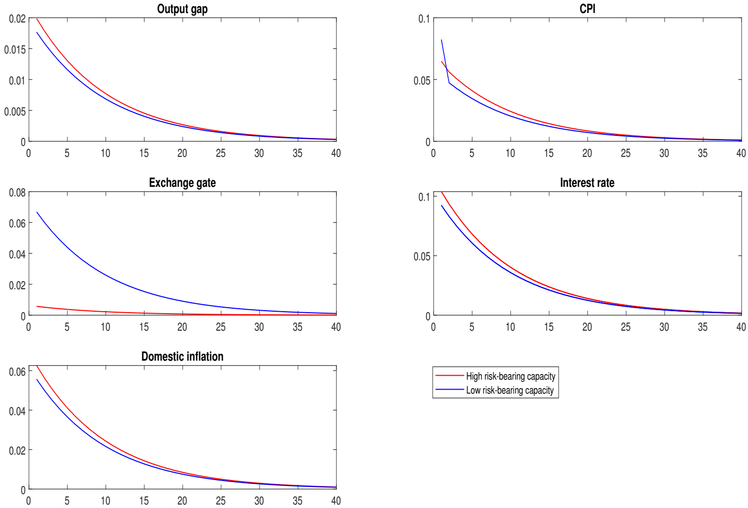


Conclusion

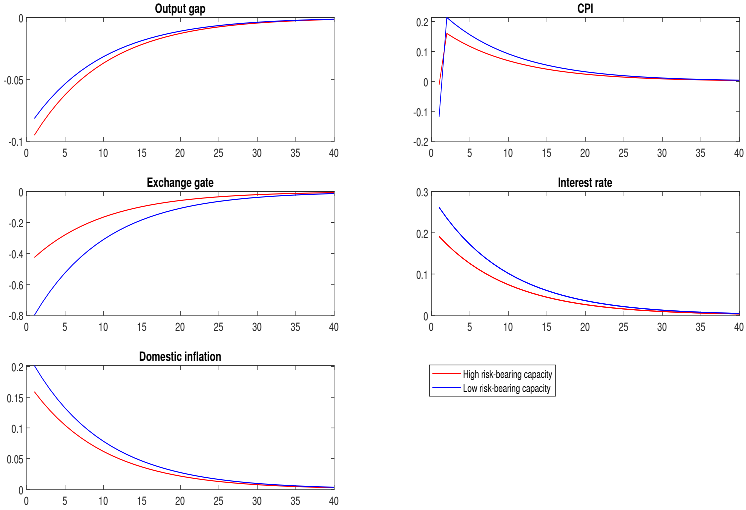
- Capital flows could destabilize emerging economies.
- We introduce this effect in a New-Keynesian model
  - The exchange rate is driven by position and risk in the FX market.

1. Currencies of indebted countries depreciate.
2. The monetary policy has the ability to mitigate the destabilizing effect of capital flows.
3. In a risky environment, the optimal monetary policy brings more stability
   - The central bank responds to exchange rate changes.
4. In crisis periods, this policy does not prevent large exchange rate volatility in South Africa.

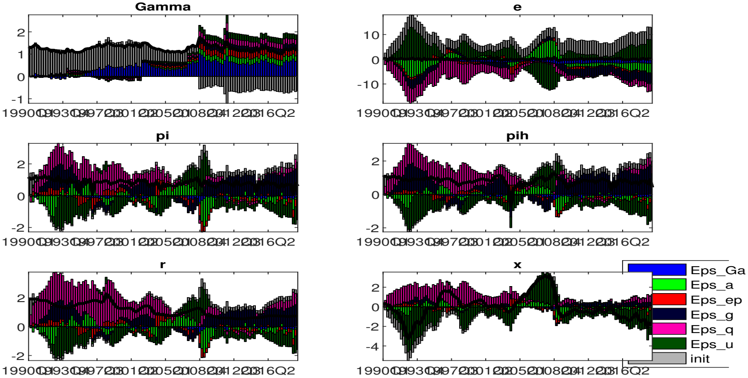
Demand shock
Taylor rule domestic inflation



Supply shock
Taylor rule domestic inflation



Shock decomposition



Consumption

- Dynamic maximization problem leads to the Euler equation (in log):

$$c_t = E_t[c_{t+1}] - \frac{1}{\sigma}\Big(r_t - E_t[\pi_{t+1}] - \mu\Big). \tag{13}$$

- Agents consume domestic and foreign tradable goods and non tradable.
  - We assume that non tradable are produced by an endowment process:

$$Y_{Nt} = \chi_t; \qquad C_{Nt} = \chi_t.$$

- The consumption of tradable is:

$$C_{Tt} = \Big[(1-\alpha)^{\frac{1}{\eta}} C_{Ht}^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} C_{Ft}^{\frac{\eta-1}{\eta}}\Big]^{\frac{\eta}{\eta-1}}, \tag{14}$$

  - With C_{HT} the consumption of domestic goods and C_{Ft} imported goods.
  - α is the share of foreign goods.
  - η is the elasticity of substitution between domestic and foreign goods.

Imports, exports

- Households choose how to compose their basket of goods by maximizing:

$$\max_{C_{Nt}, C_{Ht}, C_{Ft}} C_{Nt}^{\chi_t} C_{Ht}^{a_t} C_{Ft}^{\nu_t} + \lambda_t \Big[C_t - C_{Nt} - P_{Ht} C_{Ht} - P_{Ft} C_{Ft} \Big]. \qquad (15)$$

  - With χ, a and ν stochastic preference parameters.
  - C_t is the aggregate consumption.

- The first order conditions are:

$$\frac{\chi_t}{C_{Nt}} = \lambda_t \text{ and } \frac{\nu_t}{C_{Ft}} = \lambda_t P_t.$$

  - The South African value of SA imports is:

$$P_{Ft} C_{Ft} = \nu_t.$$

- For simplicity, we assume exports equal to 1.

- The nominal exchange rate is the ratio between foreign and domestic prices

$$P^*_{Ht} = \epsilon_t P_{Ht}$$

- In the long run, imported prices are equal to foreign prices.
- The nominal exchange rate is:

$$\epsilon_t = \frac{P_{Ft}}{P_{Ht}}$$

The exchange rate
In the model

- Households optimally value the currency trade according to its excess return.
- The financier can divert its fund and maximizes the expected value of her firm:

$$V_t = E_t\left[\beta(R_t - R_t^* \frac{\epsilon_{t+1}}{\epsilon_t})\right]q_t.$$

  - q_t is the financier demand for domestic currency and ϵ_t the nominal exchange rate.
  - R_t and R_t^* are the domestic and foreign interest rates respectively,

- When the financier diverts the funds:
  - Her firm is unwound and the households that has lent to her recover a portion $1 - \Gamma|\frac{q_t}{\epsilon_t}|$ of its credit position $|\frac{q_t}{\epsilon_t}|$.
  - Γ is the risk-bearing capacity.
  - The financier is subject to a credit constraint:

$$\frac{V_t}{\epsilon_t} \geq \left|\frac{q_t}{\epsilon_t}\right| \Gamma \left|\frac{q_t}{\epsilon_t}\right| = \Gamma\left(\frac{q_t}{\epsilon_t}\right)^2. \tag{16}$$