Asset Price Bubbles and Monetary Policy in a Small Open Economy

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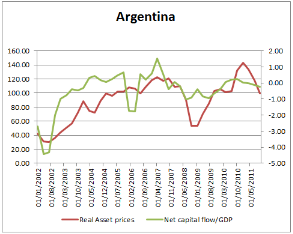
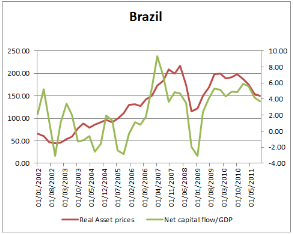
Outline

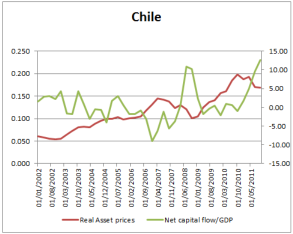
Motivation

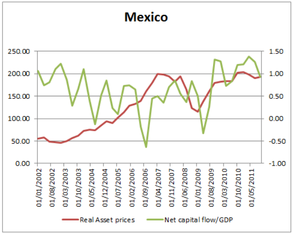
- The liberalization of financial markets and the globalization of capital markets
  - have improved the provision of financial services
  - and the allocation of resources
- But they have also related to more pronounced financial cycles.
- Financial cycles have usually came hand in hand with strong movements in asset prices, some times ending in banking and exchange market crises.
- This scenario is an especial concern for policy makers.

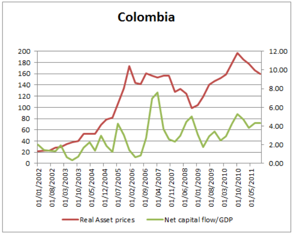
Asset prices and net capital inflows

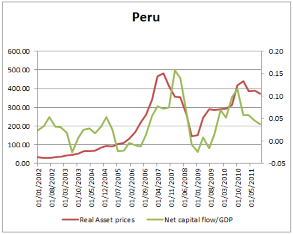












Goals

- Bernanke and Gertler (1999) address the question of "how central bankers ought to respond to asset price volatility, in the context of an overall strategy for monetary policy"
- Their findings show that it should not react to asset prices *per se*.
- I extended their model to account for capital inflows and real exchange rate appreciation in the context of a small open economy model (SOEM).
- I have two main goals:
    - Analyze if the conclusions of Bernanke and Gertler (1999) remain in the case of a SOEM
    - Compare the results in terms of macroeconomic volatillity of the case of a CEM versus the SOEM.

Bernanke-Gertler Model: Closed Economy Model (CEM)

- The model is a DSGE new Keynesian model with financial frictions and an exogenous bubble.
- Agents
  - Household sector: infinitely lived and decide labor supply, consumption and savings.
  - Business sector:
    - Enterpreneurs (investment decisions, wholesale goods and adcquisition of capital)
    - Retailers (differentiate the wholesale good and make price setting a la Calvo).
  - Government (conducts fiscal and monetary policy)

Bernanke-Gertler Model: Closed Economy Model (CEM)

- Flow of funds:
- Households demand bonds issued by entrepreneurs.
- Enterpreneurs finance purchases of capital partly with their own net worth and partly by issuing debt.
- Credit market frictions give rise to an external finance premium that depends on the levearage ratio of firms.
- It depends on the evolution of net worth and asset prices.

$$r^s_{t+1} - R_t = \psi(s_t + k_t - n_t) \tag{1}$$

- Financial accelerator mechanism: A monetary policy shock will have a multiplier effect through the additional effects of asset prices and net worth.

Adding Exogenous Asset Price Bubbles (I)

- Investment is related to the fundamental value of capital, Q_t. The fundamental value of capital is the present value of dividends the capital is expected to generate:

$$Q_t = E_t \left\{ [D_{t+1} + (1-\delta) Q_{t+1}] / R^Q_{t+1} \right\} \tag{2}$$

- Observed price of capital, S_t, may temporarily differ from fundamental values because of bubbles. A bubble exist whenever $S_t - Q_t \neq 0$. It is assumed that if a bubble exist at date t, it persist with probability p and grows as follows (with $p < a < 1$) :

$$S_{t+1} - Q_{t+1} = (a/p)(S_t - Q_t) R^Q_{t+1} \tag{3}$$

- When a is close to one this bubble specification can be made arbitrarily close to a rational bubble.

Adding Exogenous Asset Price Bubbles (II)

- It is possible to derive an expression for the evolution of the market price of capital inclusive of the bubble:

$$S_t = E_t\left\{\left[D_{t+1} + (1-\delta)S_{t+1}/R^s_{t+1}\right]\right\} \tag{4}$$

- The return on capital stock, R^S_{t+1}, is related to the fundamental return on capital, R^Q_{t+1}, by (with $b \equiv a(1-\delta)$):

$$R^S_{t+1} = R^Q_{t+1}\left[b + (1-b)\frac{Q_t}{S_t}\right] \tag{5}$$

- When there is a positive bubble, $S_t > Q_t$, therefore the expected return on market price will be below the fundamental return, $R^S_{t+1} < R^Q_{t+1}$.

Macroeconomic responses under alternative policy rules

- The model is calibrated with some parameters of the Colombian economy in order to do simulations and to compare them with the SOEM.
- The model is closed with two alternative policy rules:
  - The baseline policy rule is a Taylor rule that responds only to inflation:

$$R_t = \alpha_\pi \pi_t \tag{6}$$

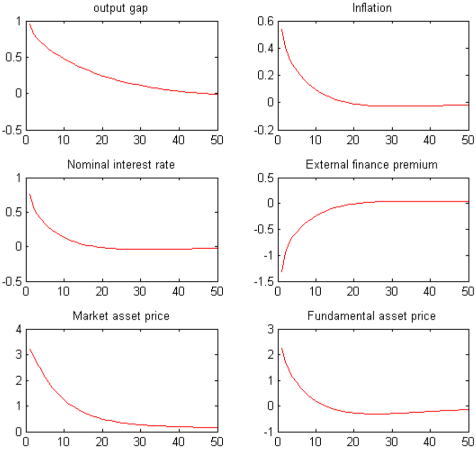
  - The alternative monetary policy rule responds to the once-lagged log level of the stock price, relative to its steady-state value:

$$R_t = \alpha_\pi \pi_t + 0.3 \left(\frac{S_{t-1}}{S} \right) \tag{7}$$

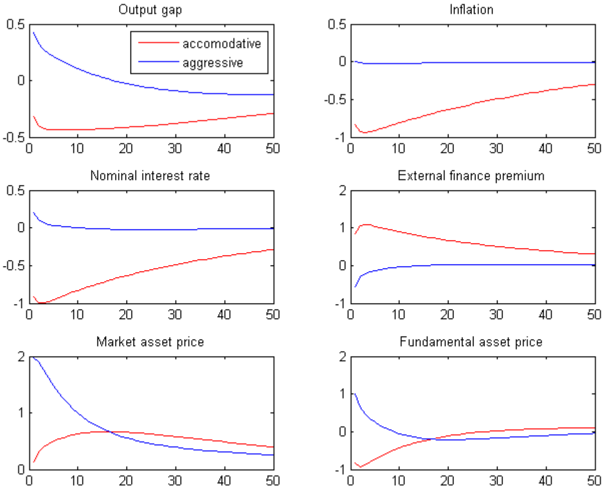
  - Accomodative: $\alpha_\pi = 1.4$
  - Aggressive: $\alpha_\pi = 3.0$

Effects of an asset bubble when monetary policy only responds to inflation (accomodative)

Figura 4



Effects of an asset bubble when monetary policy responds to both asset prices and inflation



Small Open Economy Model: SOEM

- Financial market imperfections and also the macroeconomics effects of the exchange rate in a small open economy.
- We introduce a small friction in the world capital market (Schmitt-Grohe and Uribe (2001)).
- Households demand
  - Domestic bonds from entrepreneurs and
  - Foreign bonds from abroad: foreign interest rate and country external finance premium. The later depends on the net foreign indebtedness in the economy.
- The first order condition for the foreign bonds along with the one for domestic bonds results in an uncovered interest parity condition.
- The consumption bundle is composed by domestic and foreign goods (CPI index).

Small Open Economy Model: SOEM

- Foreign sector: we distinguish between
  - The wholesale (import) price of foreign goods and the retail price in the domestic market by allowing for imperfect competition and pricing-to-market in the local economy.
  - We assume that foreign demand for the home tradable good depends on international prices and external real output gap.

Aggregate Demand

$$((1-\gamma)q_{\mathbf{1}}-1)c_t=\gamma\lambda_t+(q_{\mathbf{2}}(r_{ss}-1)/r_{ss})(b_t+(\gamma-1)m_t)-\gamma e_t \quad (8)$$

$$\lambda_{t+\mathbf{1}}=\lambda_t-R+\pi_{t+\mathbf{1}} \quad (9)$$

$$(\gamma * R_t/r_{ss}-1)=b_t+c_t+m_t \quad (10)$$

$$h_{ss}h_t=(1-h_{ss})(w_t-\lambda_t+x_t^h) \quad (11)$$

$$c_t^h=c_t-x_t^h \quad (12)$$

$$c_t^f=c_t-x_t^f \quad (13)$$

$$c_t=\alpha_h c_t^h+(1-\alpha_h)c_t^f \quad (14)$$

$$q_t=\chi(i_t-k_{t-\mathbf{1}})-x_t^h \quad (15)$$

$$x^f-x_{t-\mathbf{1}}^f=\pi_t^f-\pi_t \quad (16)$$

Aggregate Demand

$$R_t - \pi_{t+1} = premf + R_t^* + rer_{t+1} - rer_t \tag{17}$$

$$dev_t - \pi_t = rer_t - rer_{t-1} \tag{18}$$

$$c_t^{h*} = \nu(\tau x_t^{h*} + y_t^*) + (1-\nu) c_{t-1}^{h*} \tag{19}$$

$$x_t^{h*} = x_t^h - rer_t \tag{20}$$

$$y_{ss} y_t^h = c_{ss}^h c_t^h + c_{ss}^{h*} c_t^{h*} + i_{ss} i_t \tag{21}$$

$$b_{ss}^* b_t^* + (x_{ss}^h c_{ss}^{h*})(x_t^h c_t^{h*}) - (x_{ss}^f c_{ss}^f)(x_t^f c_t^f) = (b_{ss}^* r_{ss}^*)(b_{t-1}^* + R_{t-1}^* + premf_{t-1} + rer_t - rer_{t-1})$$

$$premf_t = \Omega\left(rer_t \frac{b_t^*}{y_t} - b_{ss}^*\right) + epremf_t \tag{22}$$

$$epremf_t = 0.4 epremf_{t-1} + \varepsilon_{premf} \tag{23}$$

$$y = y_t^h + ap_t^h \tag{24}$$

Returns to Stocks and Capital

$$r_t^q = \frac{rk_{ss}}{f_{ss}}(rk_t + x_t^h) + ((1-\delta)/f_{ss})q_t - q_{t-1} \tag{25}$$

$$r_t^s = \frac{rk_{ss}}{f_{ss}}(rk_t + x_t^h) + ((1-\delta)/f_{ss})s_t - s_{t-1} \tag{26}$$

$$r_t^s = r_t^q - (1-b)(s_t - q_t) \tag{27}$$

$$r_{t+1}^s = R_t - \pi_{t+1} + \psi(s_t + k_t - n_t) \tag{28}$$

Equation (25) defines the fundamental return to capital as the sum of the current return to capital and the increase in fundamental value, where rk_t is the real rental rate of capital in terms of domestic goods and $x_t^h = \frac{p_t^h}{p_t}$. (26) defines the returns to stocks analogously. (27) describes the expected evolution of the bubble. Equation (28) links the spread between safe returns and stock returns to firm leverage, where n_t is the log-deviation of firms' internal equity from its steady-state value.

Aggregate Supply

$$y = \alpha k_{t-1} + (1-\alpha)h_t + (1-\alpha)A_t \tag{29}$$

$$w = y + mc_t^h - h_t \tag{30}$$

$$r_t^k = y + mc_t^h - k_{t-1} \tag{31}$$

$$\pi_t^h = \left(\frac{\beta}{(1+\beta\gamma^h)}\right)\pi_{t+1}^h + \left(\frac{\gamma^h}{(1+\beta\gamma^h)}\right)\pi_{t-1}^h + \left(\frac{(1-\phi)(1-\beta\phi)}{\phi(1+\beta\gamma^h)}\right)mc_t^h \tag{32}$$

$$\pi_t^f = \left(\frac{\beta}{(1+\beta\gamma^f)}\right)\pi_{t+1}^f + \left(\frac{\gamma^f}{(1+\beta\gamma^f)}\right)\pi_{t-1}^f + \left(\frac{(1-\phi)(1-\beta\phi)}{\phi(1+\beta\gamma^h)}\right)mc_t^f \tag{33}$$

$$mc_t^f = rer_t - x_t^f + p_t^{f*} \tag{34}$$

$$\pi_t = \alpha^h \pi_t^h + (1-\alpha_t^h)\pi_t^f \tag{35}$$

State variables and policy rule

Evolution of state variables and shock processes

$$k_{t+1} = \delta i_t + (1-\delta)k_t \tag{36}$$

$$\frac{1}{\Lambda_{ss} f_{ss}} n_t = \frac{k_{ss}}{n_{ss}} r_t^s - (\frac{k_{ss}}{n_{ss}} - 1)(R_{t-1} - \pi_t) - \psi(\frac{k_{ss}}{n_{ss}} - 1)(k_{t-1} + s_{t-1}) + (\psi(\frac{k_{ss}}{n_{ss}} - 1) + 1)n_{t-1} \tag{37}$$

Monetary Policy rule and Interest rate determination

$$R_t = \alpha_\pi \pi_t + \alpha_s s_t + e_t^R \tag{38}$$

$$r = R - \pi_{t+1} \tag{39}$$

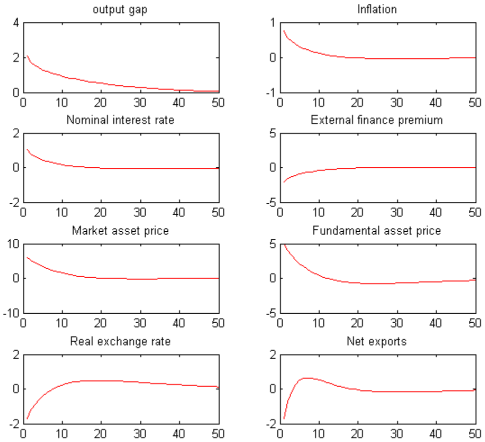
Key parameter values

$b = 0.3(1-\delta)$, $\Omega = 0.00000.3$, $\upsilon = 0.25$, $\gamma^f = 0.5$, $\gamma^h = 0.5$, $\gamma = 0.14$, $\chi = 0.57$, $\phi = 0.15$, $\alpha = 0.33$, $\psi = 0.05$, $\alpha^h = 0.76$, $\tau = 0.75$, $h_{ss} = 0.29$, $y_{ss} = 1.1966$, $c_{ss}^{h*} = 0.4721$, $c_{ss}^h = 0.7242$, $b_{ss}^* = 1.2$, $x_{ss}^h = 0.5665$, $x_{ss}^f = 0.0.6082$, $c_{ss}^f = 0.213$, $c_{ss} = 0.53$, $k_{ss} = 10.0294$, $i_{ss} = 0.2607$

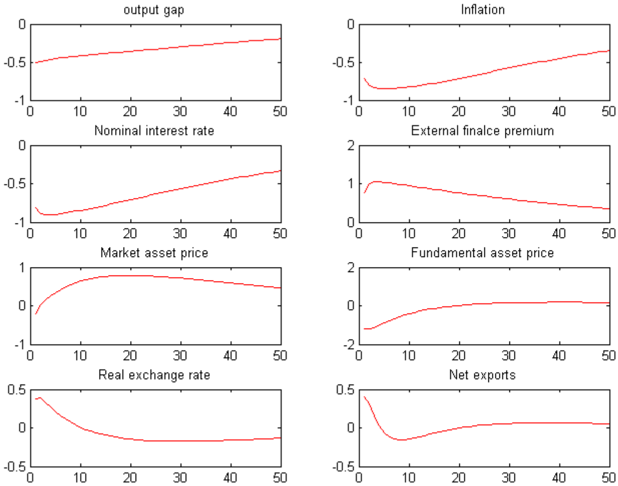
The description of the variables and any parameters not reported here are presented in López, Prada and Rodríguez (2009).

Effects of an asset bubble when monetary policy responds only to inflation(accomodative)

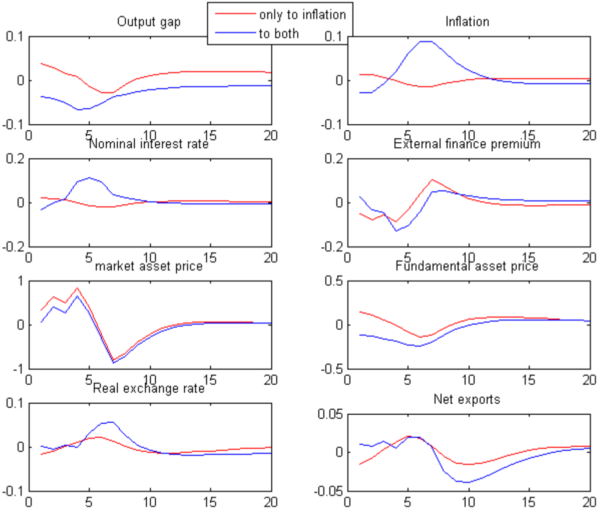
◂ Figura 2



Effects of an asset bubble when monetary policy responds to both inflation and asset prices



Effects of an asset boom followed by an asset bust



Effects of an asset boom followed by an asset bust

Table 1 — Bubble Shocks Only

Policy Rule (π, s, y)	σ_y	σ_π
1.4, 0, 0	0.0151	0.0012
1.4, 0.05, 0	0.0099	0.0043
1.4, 0.1, 0	0.0257	0.0290
1.4, 0, 0.5	0.0077	0.0149
2.2, 0, 0	0.0088	0.0004
2.2, 0.05, 0	0.0066	0.0012
2.2, 0.1, 0	0.0116	0.0074
2, 0, 0.5	0.0060	0.0014
3, 0, 1	0.0057	0.0007

Summary

- The presence of capital inflows results in an appreciation of the real exchange rate that causes a higher response of market asset prices relative to a CEM.
- This makes emerging markets more vulnerable to the bubble.
- However as in the CEM the monetary authority should not react to asset prices.
- If the asset bubble is followed by a crash in asset prices generating a negative asset price bubble the response of the monetary authority to asset prices generates higher output losses.
- Models like the one presented here call for the introduction of capital controls imposed for macroprudential reasons.
- Recently: Brazil in Oct. 24, 2009 after experiencing a 36 percent appreciation of its currency. Taiwan in November, 2009 and similarly in Colombia in May of 2007