Asset Prices, Collateral and Unconventional Monetary Policy in a DSGE model

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Motivation

What appears to be in substance a direct transfer of mortgage and mortgage-backed securities of questionable pedigree from an investment bank to the Federal Reserve seems to test the time honored central bank mantra in time of crisis-"lend freely at high rates against good collateral"-to the point of no return, (Volcker (April 8, 2008), Remarks by Paul Volcker at a Luncheon of the Economic Club of New York)

Motivating Questions

- Is a certain "collateral policy" of the central bank effective to stimulate the interbank market
- Does it have negative consequences and if yes, which ones?
- Should the central bank use this type of policy to react to asset prices

The Approach

- We are taking the basic set up of a DSGE model with financial frictions and add a microfounded interbank market
- Analysis of (un-)conventional monetary policy by the means of an additional instrument: haircut rule
- Simulating Boom-Bust cycles to examine "leaning against the wind"
- Deriving exit strategies for the central bank after a recession

Results to take away

- Central banks can use the institutional instrument of a haircut policy to stimulate the interbank market and therefore also the real economy
- this comes at the cost of higher inflation
- If the central bank wants to react to asset prices, it should use this rule to lean against the wind and not the interest rate rule
- an interbank market in the economy dampens certain shocks and amplifies others
- the optimal exit for the central bank is to announce a date beforehand and then credibly stick to it

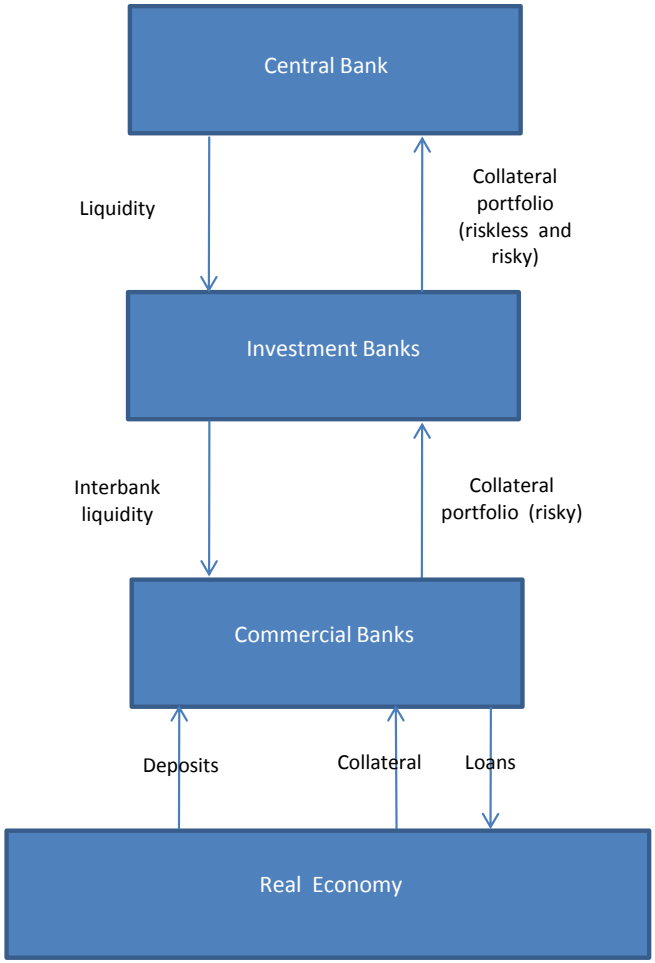
Related Papers

1. DSGE with Financial Sector
   - Angeloni,Faia (2009) include Diamond,Rajan(2001) into DSGE model
   - Gertler,Karadi (2009) simple banking structure
   - Gerali et al.(2009) only include one representative bank
   - DeWalque et al.(2009) have interbank market
2. "Leaning against the wind"
   - Bernanke,Gertler (1999) are against targeting asset prices
   - Cecchetti (2000) is in favor of the central bank targeting asset prices
   - Eichengreen et al. (2011) "Rethinking Central Bank"
3. Unconventional monetary policy
   - Ashcroft (2009) uses also a haircut rule
   - Schabert (2010) lets CB lend to households directly

Outline of Talk and Procedure

1. Model description
2. Calibration
3. Results

Overview



The real economy consists of households, firms, retailers and capital producers. This framework is rather standard in the financial accelerator literature. New in our set up is the way we model the interbank market and the relation to the central bank. As a result there are many different interest rates in the economy.

Households

The instantaneous utility function has the following form:

$$U_t = \frac{C_t(h)^{1-\gamma_c}}{1-\gamma_c} + \frac{(1-L_t(h))^{1-\gamma_h}}{1-\gamma_h} \tag{1}$$

The infinite sum of discounted utility is maximized by the households under the following budget constraint:

$$C_t(h) + D_t(h) = W_t L_t(h) + \frac{R^D_{t-1}}{\pi_t} D_{t-1}(h) + P_t(h) - T_t(h) \tag{2}$$

Firms

The production function is of the Cobb-Douglas type

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \tag{3}$$

$$B_t = Q_t K_{t+1} - N_t \tag{4}$$

The size of the markup for external financing depends on the ratio of the market value of capital over the net worth and is given by the following function:

$$R_{t+1}^S = \frac{R_t^B}{\pi_{t+1}} \left(\frac{S_t K_{t+1}}{N_t} \right)^{\psi} \tag{5}$$

The evolution of net worth and the provision of capital by capital producers as well as the retailer's problem follow the standard assumptions.

Commercial Banks I

Table: Balance sheet of commercial bank j

Assets	Liabilities
Loans to Entr. $B_t(j)$	Deposits $D_t(j)$
	Interbank Loans $IB_t(j)$

The demand for deposits and loans is given by:

$$D_t(j) = \left(\frac{R_t^D(j)}{R_t^D}\right)^{\epsilon_d} D_t \qquad B_t(j) = \left(\frac{R_t^H(j)}{R_t^H}\right)^{-\epsilon_h} B_t$$

Each commercial bank j maximizes then its profit which is given by the following equation:

$$\begin{aligned}\Pi_t^{CoB} &= \frac{R_{t-1}^B}{\pi_t} B_{t-1}(j) - \frac{R_{t-1}^D}{\pi_t} D_{t-1}(j) - \frac{R_{t-1}^{IB}}{\pi_t} IB_{t-1}(j) \\ &- \frac{\kappa_d}{2}\left(\frac{R_{t-1}^D}{R_{t-2}^D} - 1\right)^2 \frac{R_{t-1}^D}{\pi_t} D_{t-1}(j) - \frac{\kappa_b}{2}\left(\frac{R_{t-1}^B}{R_{t-2}^B} - 1\right)^2 \frac{R_{t-1}^B}{\pi_t} B_{t-1}(j)\end{aligned}$$

Commercial Banks II

Asset-backed securities are then defined as

$$ABS_t^{CoB}(j) = (K_t(j)E_t(S_{t+1}(j)))^{\tau} - (N_t(j))^{1-\tau}$$

The Commercial bank is also constraint with respect to the investment bank:

$$R_t^{IB} IB_t(j) \leq m_t ABS_t^{CoB}(j) \tag{6}$$

where m_t denotes the loan-to-value ratio.

Investment Banks

Table: Balance sheet of the Investment Bank k

Assets	Liabilities
Interbank Loans $IB_t(k)$	Loans from CB $M_t^D(k)$
Excess Reserves $X_t(k)$	
Government Bonds $G_t(k)$	

The profit function takes the following form:

$$\Pi_t^{PD}(k) = R_t^{Spread}\left(IB_t(k) + M_t^D(k) - X_t(k)\right) + R_t IB_t(k) - R_t^{IB} M_t^D(k) + R_t^{IB} X_t(k)$$

investment bank's demand for central bank liquidity (kind of an inverse Production function):

$$M_t(k) = IB_t(k)^{\zeta} X_t(k)^{1-\zeta}$$

The investment bank also faces a constraint when taking out a Repo loan from the central bank.

$$M_t^D(k) = G_t(k) + (1 - HC_t) ABS_t^{PD}(k)$$

The Central Bank

Table: Balance sheet of the Central Bank

Assets	Liabilities
Government Bonds G_t	Money in circulation M_t^{CB}
(Asset-backed securities ABS_t^{CB})	Equity E_t^{CB}

The haircut h_t follows the following rule

$$HC_t = \rho_h HC_{t-1} + cS_t$$

The interest rate follows the usual one proposed by Taylor (1993)

$$R_t = \rho_r R_{t-1} + \phi_\pi(\pi_{t+1} - \bar{\pi}) + \phi_y(Y - \bar{Y})$$

The profit function of the central bank is as follows:

$$\Pi_t^{cb} = \frac{R_{t-1}}{\pi_t} M_{t-1}^{cb} - \frac{R_{t-1}^{DF}}{\pi_t} X_{t-1}.$$

Exogenous Processes

Shock to the Loan-to-value ratio:

$$m_t = \rho_m m_{t-1} + \epsilon_t^m$$

Shock to Technology:

$$A_t = \rho_a A_{t-1} + \epsilon_t^A$$

Shock to Government Spending:

$$G_t = \rho_g G_{t-1} + \epsilon_t^G$$

Shock to the fundamental value of the Asset:

$$U_t = b \frac{R_{ss}^Q}{(1-\delta)} U_{t-1} + \epsilon_t^U$$

Shock to the Haircut rule:

$$HC_t = \rho_h HC_{t-1} + cS_t - \epsilon_t^{HC}$$

Shock to the Interest Rate Rule:

$$R_t = \phi_r R_{t-1} + \phi_\pi \pi_t + \phi_y Y_t + \epsilon_t^R$$

Calibrated Parameters I

Challenge: Real economy and financial sector in one model; Compromise: Calibration to monthly frequency

Real Economy:

Parameters	Description	Values
β	Degree of Impatience	0.997
α	Capital Intensity	0.33
δ	Depreciation Rate	0.008
ψ	Fin. Accelerator	0.0506
ν	Survival Probability	0.95
ϵ_y	Elasticity of Price	6
ξ_p	Calvo Parameter	0.85
Ω	Mass of Entrepreneurial Labor	0.01
Lev	Leverage	2
$\frac{G^{ss}}{Y^{ss}}$	Government Expenditure over GDP	0.2

Calibrated Parameters II

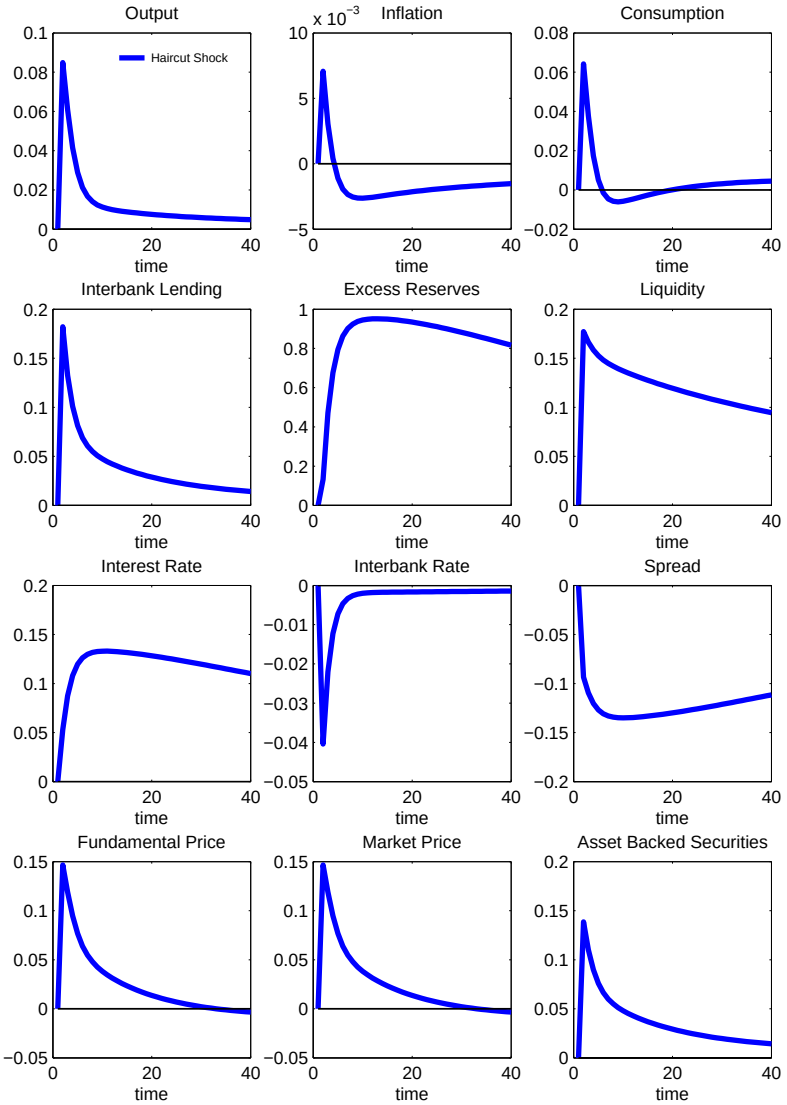
Financial Economy:

Parameters	Description	Values
a	AR parameter Market Value	0.98
HC^{ss}	Steady State Haircut	0.2
$b = a \cdot (1 - \delta)$	AR parameter Market Value	0.9722
ζ	IB ratio in Prod.function	0.95
κ_d	Adj. Costs Deposits	540
κ_b	Adj. Costs Loans	1125
ϵ_d	Elasticity of Deposit demand	852
ϵ_b	Elasticity of Loan demand	759
ρ_m	AR parameter loan-to-value ratio	0.9
ρ_r	AR parameter Interest Rate	0.99
ρ_h	AR parameter Haircut	0.99
ϕ_π	Inflation Coefficient	1.5

Order of results

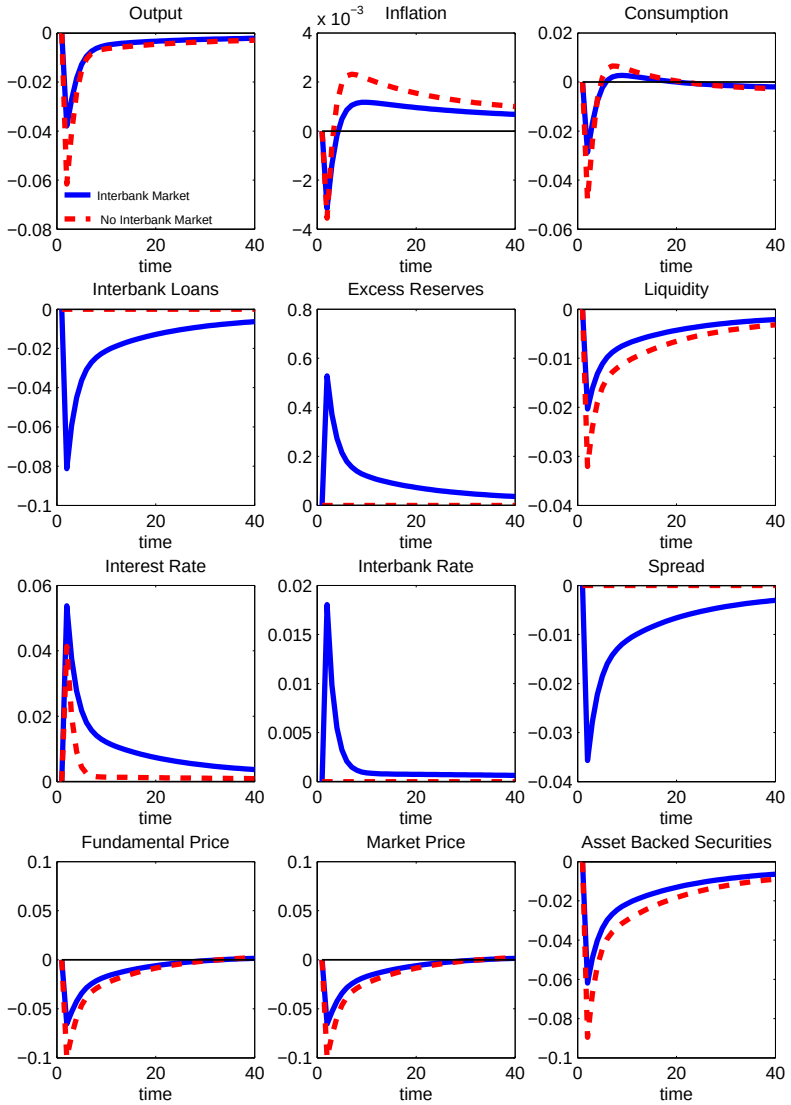
- Dynamic Analysis
  - Shock to Technology
  - Shock to the Interest Rate
  - Shock to the Haircut Rule
  - Role of the Interbank Market
- What instrument should lean against the wind
  - "Boom-Bust" cycles with Haircut rule
  - "Boom-Bust" cycles with Interest rate rule
- Exit strategies
  - Exit from haircut rule
  - Exit from haircut rule and interest rate rule
  - Exit from loan-to-value ratio

Shock to the haircut



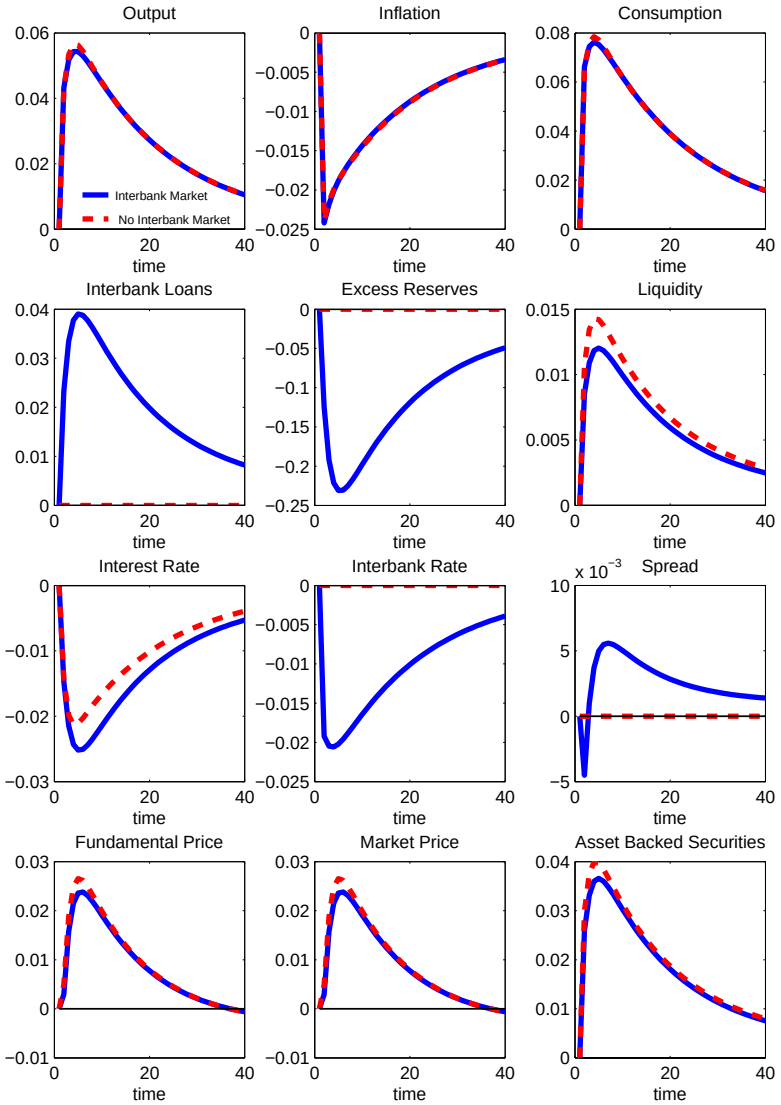
- Impulse Responses after a 10% decrease in the haircut rule
- The interbank market is stimulated
- $\longrightarrow$ Interbank lending and excess reserves both increase
- Also the real sector profits
- The disadvantage is a higher inflation rate on impact

Shock to the interest rate



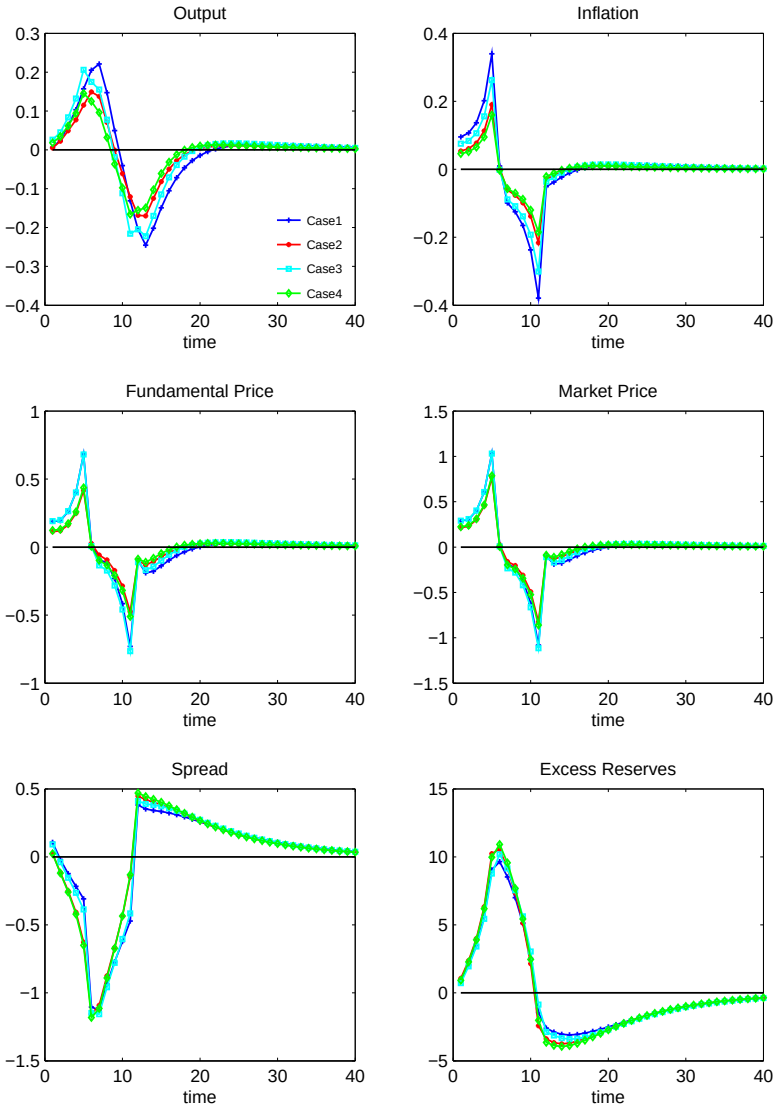
- Impulse Responses after a 25bp positive shock to the Interest Rate
- The real economy (inflation, output) is dampened as is the interbank market
- Interbank lending decreases and excess reserves go up
- The interbank market dampens the shock

Shock to technology



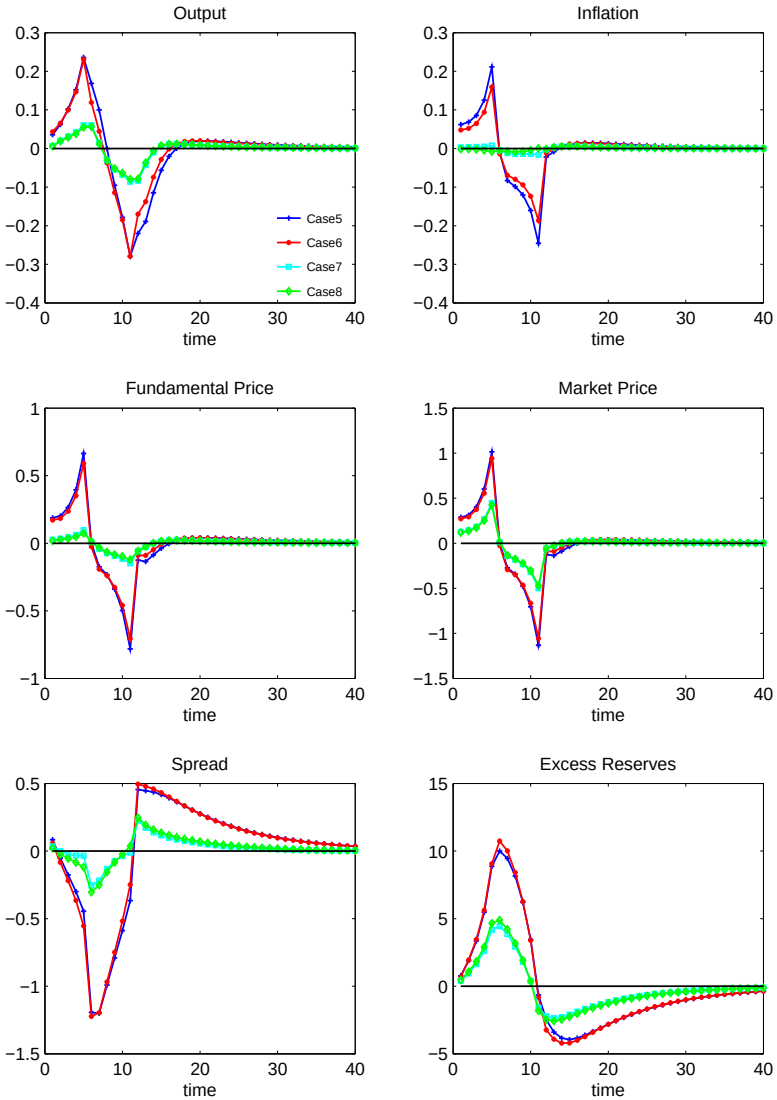
- A positive (1%) shock to technology
- The real sector is stimulated
- This positive shock translates itself also on the interbank market, which is also increasing its lending
- The Interbank is if anything dampening the shock, most variables react equally

Responding with Interest Rates?



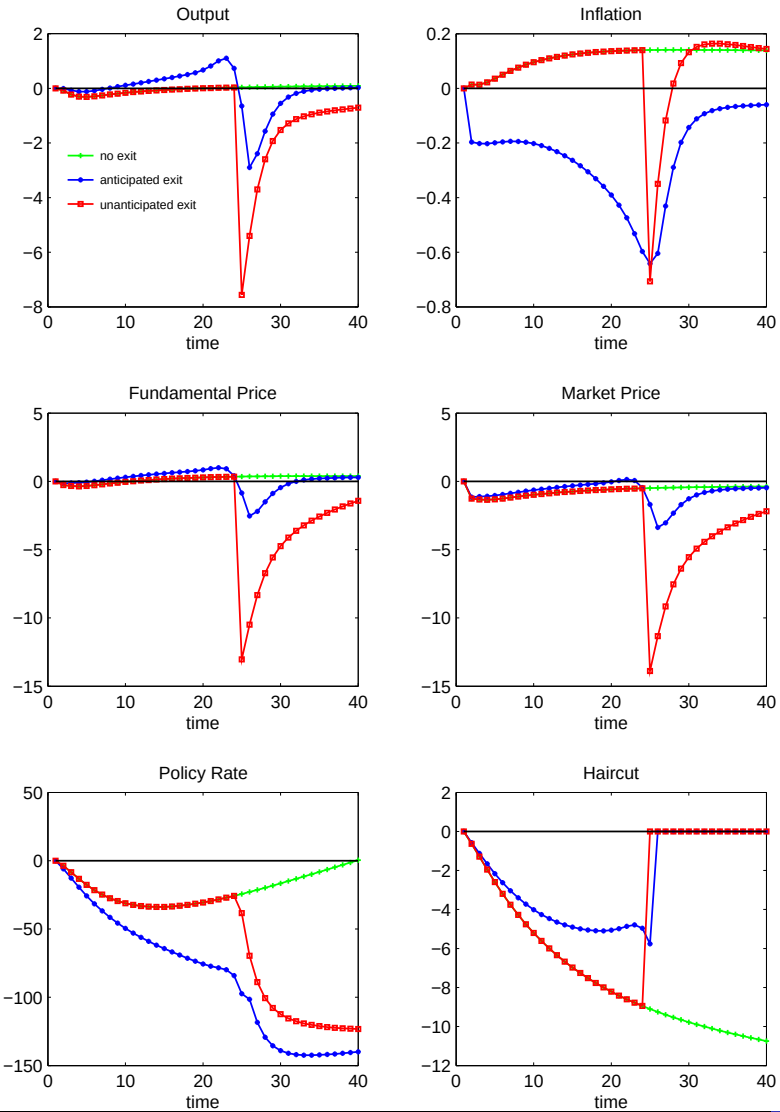
- Simulating Boom-Bust cycles a la Bernanke,Gertler (1999)
- the smaller the deviations the better the stabilization policy of the CB
- Interest rates reacting to asset prices does not yield big stabilization
- confirming Bernanke,Gertler

Respond with the haircut?



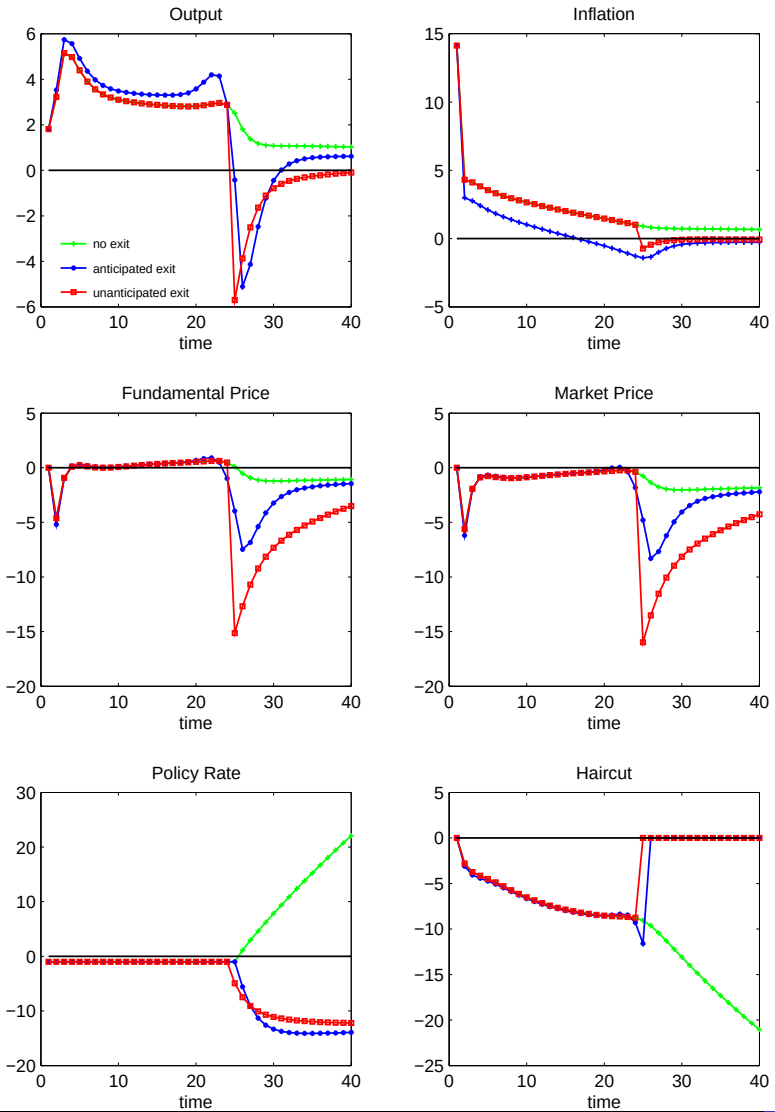
- Here the haircut rule serves as instrument for the response to asset prices
- Much better stabilization if haircut is allowed to react to asset prices
- confirming both Cecchetti and BG: Central Banks should lean against the wind, but not with interest rate, better instrument is haircut

Exit Strategy from Haircut



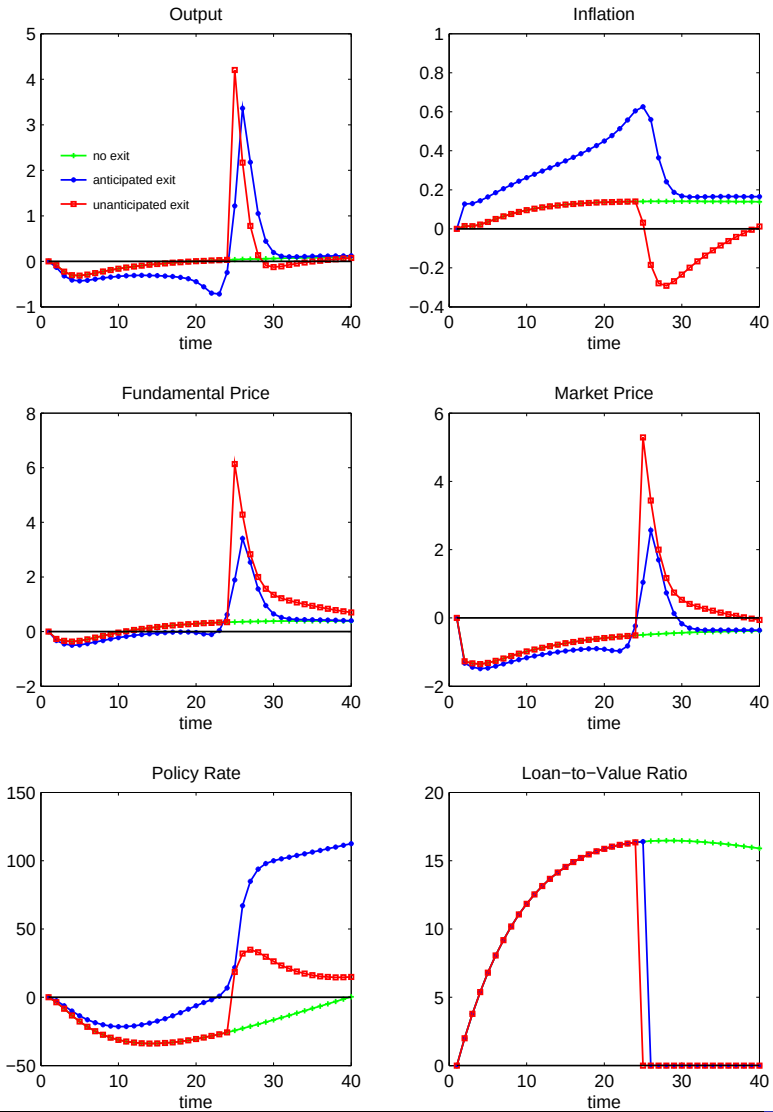
- Exit strategy along the lines of Angeloni, Faia, Winkler (2010)
- here only exit from a too low haircut
- the asset price is negatively shocked (corresponding to a bust)
- three different paths: no exit, unanticipated and anticipated exit
- the economy wide costs are least if the central bank announces the exit prematurely

Exit Strategy from Haircut and Interest Rate Rule



- In this case exit from a too low haircut and the interest rate at the zero-lower bound
- negative shock to the asset price
- here the results are more mixed
- less volatility in inflation comes at the cost of more volatility in the other variables.

Exit Strategy from Loan-to-Value Ratio



- Think of macroprudential authority (eg. within the central bank) that exits from a higher loan-to-value ration
- once again the example of an asset price bust
- very little macro-volatility in the no exit case
- if the exit was anticipated, the reaction of output and and inflation is stronger
- in an unanticipated exit output and the price of capital even increase

Concluding Thoughts

- Extends the existing literature along two lines:
  1. Proposing a different new-keynesian model with an interbank market
  2. analyzing various monetary and economic questions
- interbank market has influence (amplifying or dampening) on real economy
- haircut is the appropriate instrument to target asset prices
- losses from exit strategy are minimized if exit date is announced in advanced and central bank sticks to it

Further Research

- Estimating the DSGE model/taking it to the data and comparing the fit with other specifications of the interbank market
- business cycle analysis in more detail with this set up
- other micro-foundations for this banking structure
- Complementing the model with a complete fiscal sector
- ... implementing default risk?