Boom-bust cycles and stabilisation policy – monetary and macroprudential rules: a loss function approach

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1. Summary

The recent financial crises have posed a challenge to the conduct of financial stability and monetary policy. The international debate mainly focused on the potential benefits of reducing procyclicality in financial intermediation in order to avoid boom and bust cycles in the supply of credit. We study the stabilisation benefits of macroprudential and monetary policy rules that react to indicators of financial imbalances. In particular, we contribute to an investigation of the benefits of dampening credit cycles and explore the effectiveness of alternative policy instruments, such as the interest rate and the loan-to-value ratio (LTV henceforth), for macroeconomic and financial stabilisation.

Lambertini et al (2010) show that expectation of future macroeconomic developments can generate boom-bust cycles in housing prices and credit.[2] Housing-market cycles driven by expectations on future developments in the demand and supply of houses are characterised by boom-bust dynamics in both housing prices and housing investment. However, only expectations of a future reduction in the supply of houses also generate boom-bust cycles in all aggregate quantities such as output, consumption and investment, as in the data.[3]

Relying on a model that allows for macroeconomic booms and busts driven by expectations on the supply of houses, we draw some policy implications. In particular, we evaluate the performance of macroprudential and monetary policy in terms of macroeconomic stabilisation. We postulate that, apart from inflation and output stabilisation, the policymaker also aims to dampen credit cycles. Our findings highlight a role for LTV ratios that respond in a countercyclical manner to indicators of financial imbalances. LTV ratio rules that actively respond to credit growth reduce the volatility of credit-to-GDP and other macroeconomic variables. In the presence of an active LTV ratio policy, we find no gains from an interest-rate response to credit aggregates. Pursuing financial stability goals with policy instruments other than the policy rate delivers a better outcome in terms of both macroeconomic and financial stabilisation.

The goal of this article is to provide insight into the role of monetary and macroprudential policy in leaning against boom-bust cycles. This article relies on recent research by Lambertini et al (2011) that evaluates monetary and macroprudential policy in terms of both macroeconomic stabilisation and welfare. Differently from Lambertini et al (2011), we

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[2] A recent strand of the business cycle literature investigates the importance of expectation-driven cycles in generating economic fluctuations. See, for instance, Beaudry and Portier (2004, 2006, 2007), Jaimovich and Rebelo (2009), and Schmitt-Grohe and Uribe (2008). In particular, Christiano et al (2008) show that macroeconomic boom-bust cycles coupled with similar dynamics in asset prices can be generated by expectations of future development in productivity.

[3] For stylised facts during periods of booms in house prices, see Lambertini et al (2010), Kannan et al (2009), Ahearne et al (2005) and Borio and Lowe (2002).

document the importance of an active LTV ratio policy based on a simplified analysis that relies on a loss function approach. The rest of the paper is organised as follows. Section 2 presents the model. Section 3 illustrates boom-bust cycles as generated by expectations for housing market trends. Section 4 explores the effectiveness of stabilisation policy in the presence of boom-bust cycles.

2. The model

In this section we briefly describe the model economy. The framework follows Iacoviello and Neri (2010). The economy is populated by two types of households: savers and borrowers. They both consume c_t, accumulate housing h_t, and work in the production of consumption goods $n_{c,t}$ and housing $n_{h,t}$. They differ in their discount factor. Borrowers (denoted by ') feature a relatively lower subjective discount factor that in equilibrium generates an incentive to anticipate future consumption to the current period through borrowing. Hence, the ex-ante heterogeneity induces credit flows between the two types of agents. This modelling feature was introduced in macro models by Kiyotaki and Moore (1997).

Borrowers maximise the utility function

$$U_t = E_t \sum_{t=0}^{\infty} \beta' [\ln(c'_t - \varepsilon' c'_{t-1}) + j_t \ln h'_t - \frac{\tau}{1+\eta'} ((n'_{c,t})^{1+\xi'} + (n'_{h,t})^{1+\xi'})^{\frac{1+\eta'}{1+\xi'}}]$$

subject to the budget constraint

$$c'_t + q_t [h'_t - (1-\delta_h) h'_{t-1}] - b'_t \leq \frac{w'_{c,t} n'_{c,t}}{X'_{wc,t}} + \frac{w'_{h,t} n'_{h,t}}{X'_{wh,t}} - \frac{R_{t-1} b'_{t-1}}{\pi_t}.$$

Except for the gross nominal interest rate R, all the variables are expressed in real terms; π_t is gross inflation (P_t/P_{t-1}), $w'_{c,t}$ and $w'_{h,t}$ are the wages paid in the two sectors of production, and q_t is the price of housing in real terms. Houses depreciate at rate δ_h. The parameter j_t is an AR(1) shock that represents a shift in preference for housing with respect to consumption and leisure. The degree of habit persistence in consumption is measured by ε'. Borrowers are allowed to collateralise the value of their homes:

$$b'_t \leq m E_t \left(\frac{q_{t+1} \pi_{t+1} h'_t}{R_t} \right).$$

Limits on borrowing are introduced through the assumption that households cannot borrow more than a fraction m of the next-period value of the housing stock.

The savers face a similar problem. However, they also invest in capital and receive the profits of the firms. As in Smets and Wouters (2007), households supply labour to unions that differentiate labour services and sell them to wholesale labour packers in a monopolistic market. Wages can be adjusted subject to a Calvo scheme with a given probability every period. The wholesale labour packers transform the services into homogeneous labour composites, $n_{c,t}$, $n'_{c,t}$, $n_{h,t}$, $n'_{h,t}$, to be sold to final producing firms in a competitive market.

Final good producing firms produce non-durable goods (Y) and new houses (IH) facing Cobb-Douglas production functions and use capital, k, and labour supplied by the savers, n, and the borrowers, n' as inputs of production

$$Y_{\mathrm{t}} = (n^{\alpha}{}_{\mathrm{c,t}} + (n'^{(1-\alpha)}{}_{\mathrm{c,t}})^{1-\mu_{\mathrm{c}}} (z_{\mathrm{c,t}} k_{\mathrm{c,t-1}})^{\mu_{\mathrm{c}}}$$

$$IH_t = A_{h,t}(n^{\alpha}{}_{h,t} + (n'^{(1-\alpha)}{}_{h,t})^{1-\mu_h}(z_{h,t}k_{h,t-1})^{\mu_h} k_b^{\mu_b} l_{t-1}{}^{\mu_l})$$

The housing sector also uses land l and an intermediate input k_b, to produce new houses. $A_{h,t}$ measures productivity in the housing sector and is assumed to follow an AR(1) process. Firms pay the wages to households and repay the rented capital to the savers. Retailers, owned by the savers, differentiate final goods and act in a competitive monopolistic market. Prices can be adjusted with probability $1-\theta_{\pi}$ every period, by following a Calvo-setting. In contrast, housing prices are assumed to be flexible.

We assume that the central bank follows a Taylor-type rule as estimated by Iacoviello and Neri (2010)

$$R_t = R_{t-1}^{r_R} \pi_t^{(1-r_R)r_\pi} \left(\frac{GDP_t}{GDP_{t-1}} \right)^{(1-r_R)r_Y} rr^{(1-r_R)} \frac{u_{R,t}}{A_{s,t}}$$

where rr is the steady state real interest rate, $u_{R,t}$ is a monetary policy shock, GDP is defined as the sum of consumption and investment at steady state prices, and the central bank's target is assumed to be time varying and subject to a persistent shock, $A_{s,t}$.

3. Introducing boom-bust cycles into the model

According to Iacoviello and Neri (2010), fluctuations in the housing market are mainly generated by shocks to the demand and supply of houses. However, housing market shocks lead to an increase in housing prices, but cannot generate either hump-shaped dynamics, or the co-movement in consumption, investment and GDP observed during house price booms.

According to Lambertini et al (2010), expectations of future macroeconomic developments can generate boom-bust cycles in housing prices and credit in accordance with the empirical evidence. In the following, we report the dynamics of the model in response to expectations of future changes in housing demand and supply.[4] Figure 1 shows the model response to expectations of lower productivity in the housing sector. We illustrate the case in which agents anticipate a shock that hits the economy only in period $T= 4$ that turns out to be wrong and at time $T=4$ there are no changes.[5]

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4 Housing demand and supply shocks follow an AR(1) process $z_t = \rho_z z_{t-1} + u_{z,t}$, where $z = \{j_t, A_{h,t}\}$. We set the persistence and standard deviation of the shocks as in Iacoviello and Neri (2010), such that j_t and $A_{h,t}$ equal 0.0416 and 0.0193, respectively.

5 We introduce expectations of future macroeconomic developments as in Christiano et al (2008) and assume that the error term of the AR(1) shock consists of an unanticipated component $\varepsilon_{z,t}$, and an anticipated

Expectations of a future decline in housing productivity generate expectations of rising house prices. Borrowers increase their current housing demand for speculative purposes. Household indebtedness increases, reinforcing the increase in current expenditures in both housing and consumption goods. Due to increased housing demand, current housing prices and housing investment rise. Moreover, agents increase their current labour supply in order to smooth the negative future effect of the shock on future labour income. When news about a future change in productivity spreads, firms start adjusting the stock of capital in order to reduce the future cost of adjusting capital as an input of production, induced by the presence of adjustment cost in capital. The stock of capital used as an input of production in the housing sector decreases over time. In contrast, firms in the consumption-good sector start increasing their stock of capital. Despite the decline in capital used in the housing sector, current business investment slightly increases. As a result, GDP rises. A four-period anticipated decline in productivity generates a boom in housing prices, housing investment, consumption, GDP, hours and indebtedness. The peak response of all aggregate variables corresponds to the time in which expectations are realised. If expectations are not realised, there is a dramatic drop in both quantities and prices. Thus, expectations of a negative housing supply shock that are not realised generate a housing market boom-bust cycle.

Expectations of future increases in housing demand generate a boom dynamic in housing prices and investment, but fail to account for co-movement between residential and non-residential investment. In fact, in anticipation of a shift in preference towards consumption, the stock of capital declines in the consumption-good sector. As a result, business investment falls. See Lambertini et al (2010) for further discussion on the sources of booms and busts in the housing market.

4. Macroeconomic and financial stabilisation

In the following, we assume that fluctuations in the model are driven by housing demand and supply shocks. In order to allow for booms and busts in house prices and credit we also introduce expectations related to housing supply. Given the difficulty in identifying the source of fluctuations, we characterise monetary and macroprudential policy under a mixture of changes into both current and expected economic conditions. The model's parameters are set according to the estimated mean values presented by Iacoviello and Neri (2010) for the US economy.

Macroeconomic and financial stability goals are summarised by the following loss function

$$L = k_b \sigma^2_{\Delta_b} + k_\pi \sigma^2_{\Delta_\pi} + k_y \sigma^2_{\Delta_y},$$

where σ^2 is the variance of credit growth, inflation and GDP growth.

First, we investigate the effectiveness of macroprudential policy in providing a stable provision of credit over the cycle. In particular, we explore the role of the loan-to-value ratio that responds counter-cyclically to credit growth as an observable indicator of financial imbalances. Thus,

$$m_t = v_m m_{t-1} + (1 - v_m) m + (1 - v_m) v_x (b_t - b_{t-1})$$

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change n quarters in advance $\varepsilon_{z,t-n}$, so that, $u_{z,t} = \varepsilon_{z,t} + \varepsilon_{z,t-n}$, where $\varepsilon_{z,t}$ is *i.i.d.* and $z = \{h, j\}$. Thus, at time t, agents receive a signal about future macroeconomic conditions at time $t + n$: if the expected movement doesn't occur, then $\varepsilon_{z,t} = -\varepsilon_{z,t-n}$ and $u_{z,t} = 0$.

where m is the steady state value for the LTV ratio, v_m is an autoregressive parameter that we set equal to 0.5, and v_x is the response to credit growth. We choose the parameters of the LTV rule that minimises the volatility of credit aggregates ($k_b > 0$, $k_\pi = k_y = 0$) assuming that the monetary authority follows the estimated Taylor-type rule (see Table 1).

Responding to credit growth is successful in dampening credit cycles. A strong countercyclical response to credit growth directly counters the boom in credit driven by expectations of rising house prices and the subsequent bust. Thus, compared to the benchmark case, it better stabilises credit aggregates without increasing the volatility of inflation and GDP. Table 2 shows the unconditional standard deviation of few key variables in the model.

Second, we investigate how, in the absence of an active macroprudential policy, monetary policy can reduce macroeconomic fluctuations and affect the magnitude of credit cycles. We consider alternative interest rate rules in which the central bank also reacts to changes in credit aggregates

$$R_t = R_{t-1}^{r_R} \pi_t^{(1-r_R)r_\pi} \left(\frac{GDP_t}{GDP_{t-1}} \right)^{(1-r_R)r_Y} \frac{b_t}{b_{t-1}} rr^{(1-r_R)r_X}$$

Under a passive macroprudential policy, an interest rate response to credit growth yields sizable gains in terms of financial stabilisation. However, interest rate rules that aim at financial stability goals ($k_b \neq 0$) do not deliver the best outcome in terms of macroeconomic and financial stabilisation. The optimal countercyclical LTV rule that responds to credit growth is more successful than an interest rate response to credit growth in reducing the volatility of credit-to-GDP and it also reduces fluctuations in GDP and inflation.

In the interaction between macroprudential and monetary policy we find that pursuing financial stability goals with LTV ratios delivers the lowest volatility of credit-to-GDP. Moreover, it is also more successful in lowering the volatility of inflation and GDP. The use of countercyclical LTV ratio policies improves macroeconomic and financial stabilisation and there are no gains from an interest rate response to credit aggregates. However, compared to the benchmark case, none of these policies significantly affects the volatility of house prices.

To summarise, in the presence of expectation-driven boom-bust cycles in housing prices and credit, the use of the LTV ratio as a macroprudential tool improves upon interest-rate rules that respond to credit growth in terms of both macroeconomic and financial stabilisation. Thus, these findings highlight the beneficial effect of macroprudential tools in mitigating credit cycles. Our results suggest that further work on macroprudential policy frameworks aimed at damping the build-up of financial imbalances should, indeed, remain a priority.

Figure 1: Boom-Bust

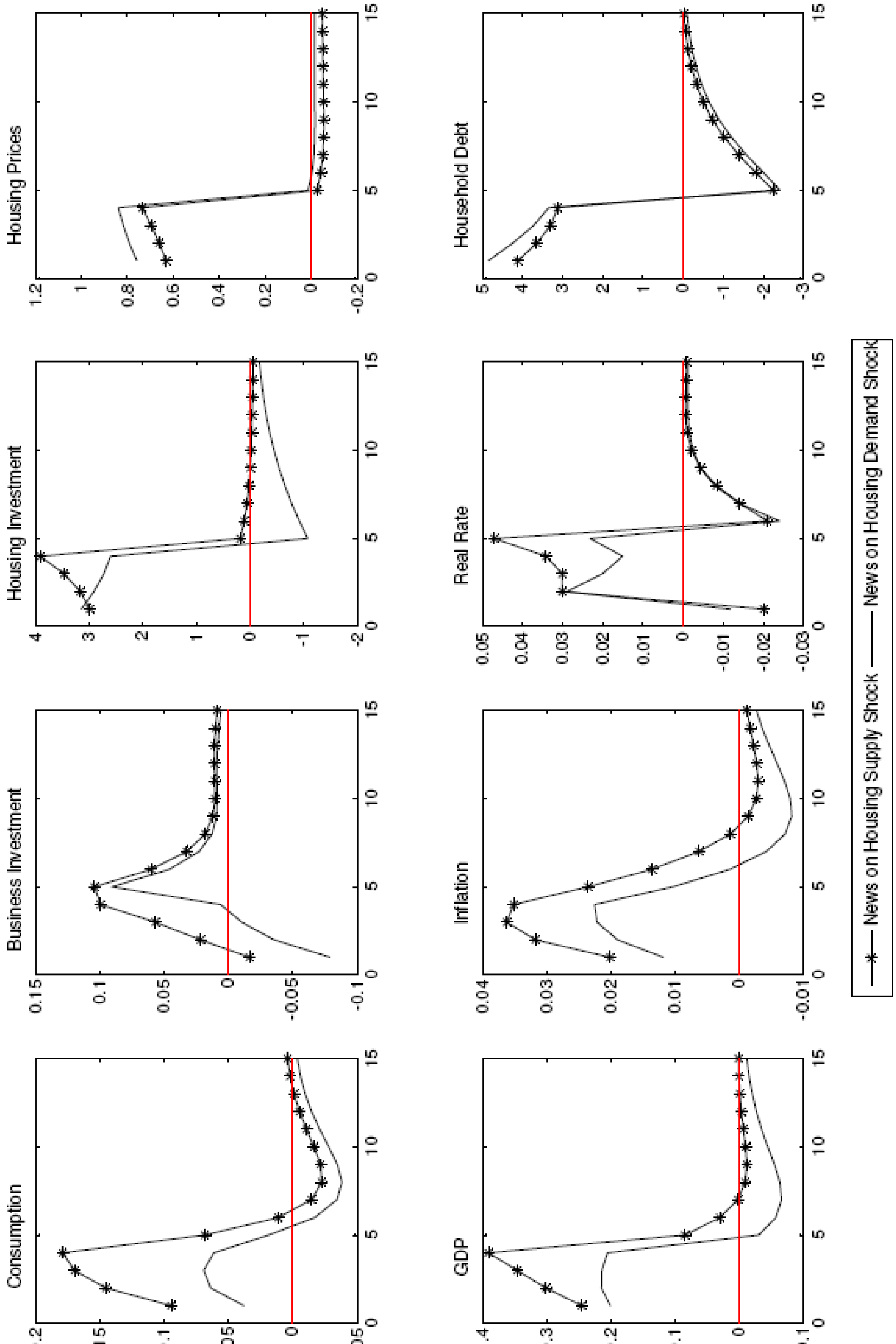

Table 1

Optimal stabilisation policy

Loss functions

LTV	k_b=1, k_π=k_y=0	k_b=0, k_π=k_y=1	k_b=k_π=k_y=1
$v_{b=}$ -136.865	1.21371e-007		
R			
α_π= 37.6331, α_y=38.2875		1.5121e-006	
α_π= 16.9345, α_y=12.7969 (α_R= 0)		1.42644e-006	
α_π= 10.7144, α_y=1.73584			0.00580687
α_π=1.85184 , α_y= -0.333143, α_b=2.71008			0.00022085
R & LTV			
v_b= -165.406, α_π= 969.023, α_y=971.556			1.50494e-006
v_b=-10.2081 , α_π= 4.02385, α_y=2.36347 , α_b=-0.932216			2.47229e-005

Table 2

Optimal stabilisation policy

Volatility

Benchmark (estimated interest rate rule)	***b/GDP***	***q***	***π***	***GDP***
α_π= 1.40444 , α_y= 0.51261, α_R= 0.59913	0.1471	0.2346	0.0010	0.0208
LTV				
$v_{b=}$ -136.865	0.0361	0.2349	0.0007	0.0207
R				
α_π= 37.6331, α_y=38.2875 (α_R= 0.59913)	0.1323	0.2344	0.0009	0.0185
α_π=1.85184 , α_y= -0.333143, α_b=2.71008	0.0518	0.2342	0.0038	0.0253
R & LTV				
v_b= -165.406, α_π= 969.023, α_y=971.556	0.0320	0.2348	0.0008	0.0187
v_b=-10.2081 , α_π= 4.02385, α_y=2.36347 , α_b=-0.932216	0.0715	0.2346	0.0014	0.0190

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