STABILIZATION POLICY AND BOOM-BUST CYCLES*

MONETARY AND MACRO-PRUDENTIAL RULES

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ABSTRACT

The recent financial crisis has posed a challenge to the conduct of financial stability and monetary policy. The international debate mainly focused on the potential benefits of reducing pro-cyclicality in financial intermediation in order to avoid boom and bust cycles in the supply of credit. We study the stabilization benefits of macro-prudential and monetary policy rules that react to an indicator of financial imbalances. In particular, we investigate the benefits of dampening credit cycles and explore the effectiveness of alternative policy instruments, such as the interest rate and the loan to value for macroeconomic and financial stabilization. We find that indeed it is appropriate to react to financial imbalances indicators, but such reaction should preferably be undertaken by macro-prudential instruments.

Should monetary policy lean against booms in asset prices and financial variables? Or should financial stability goals be pursued by other instruments, such as LTV ratio (LTV henceforth) ratios? The literature on asset-price movements and monetary policy mainly relies on models of exogenous bubbles, as in Bernanke and Gertler (2001) and Gilchrist and Leahy (2002). In this kind of models, the conduct of monetary policy cannot affect either the occurrence or the magnitude of boom-bust cycles in asset prices. Thus, the policy implication of these models is that the monetary authority does not need to pay attention to financial developments unless financial stability issues affect the outlook for inflation. Despite the limited effect of interest-rate policies on asset price bubbles, the conduct of monetary policy might have effects on agents' financing decisions. Thus, monetary policy could have important implications for excessive leverage and, in turn, financial stability.¹

In this article we evaluate if monetary policy should neglect the issue of financial stability and promote the development of other tools to deal with it. To this purpose, we rely on a model of credit-financed real estate booms. Lambertini, Mendicino and Punzi (2010) show that boom-bust cycles in housing and credit can be generated in a model of the housing market by introducing expectations about future macroeconomic developments.² For instance, housing-market cycles driven by expectations of future developments in the demand and supply of houses are characterized by boom-bust dynamics in both

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- 1 See Woodford (2011) for a review of the recent literature.
- **2** A recent strand of the business cycle literature investigates the importance of expectation-driven cycles in generating economic fluctuations. See, for instance, Beautry and Portier (2004, 2006, 2007), Jaimovich and Rebelo (2009), and Schmitt-Grohe and Uribe (2008). In particular, Christiano, Ilut, Motto, and Rostagno (2008) show that macroeconomic boom-bust cycle coupled with similar dynamics in asset prices can be generated by expectations of future development in productivity.

^{*} The opinions expressed are those of the authors and not necessarily those of Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the authors.

housing prices and housing investment. However, only expectations of a future reduction in the supply of houses can generate boom-bust cycles in all aggregate quantities such as output, consumption and investment as observed in the data.³

In this article, we draw some policy implications relying on a model that allows for macroeconomic booms and busts driven by expectations on the supply of houses. In particular, we evaluate the performance of macro-prudential and monetary policy in terms of macroeconomic stabilization. We postulate that, apart from inflation and output stabilization, the policy maker also aims at dampening 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 Creditto-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 interest rate delivers a better outcome in terms of both macroeconomic and financial stabilization.

The goal of this article is to provide insight into the role of monetary and macro-prudential policy in leaning against boom-bust cycles. This article relies on recent research by Lambertini, Mendicino and Punzi (2011) that evaluates monetary and macro-prudential policy in terms of both macroeconomic stabilization and welfare. Differently from Lambertini, Mendicino and Punzi (2011) we 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 organized as follows. Section 2 presents the model. Section 3 illustrates boom-bust cycles as generated by expectations on housing market developments. Section 4 explores the effectiveness of stabilization policy in the presence of boom-bust cycles.

1. Model

In this section we briefly describe the model economy. The framework follows lacoviello 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 has been introduced in macro models by Kiyotaki and Moore (1997).

Borrowers maximize the utility function:

$$U_{t} = E_{t} \sum_{t=0}^{\infty} \beta^{'t} \left| \mathbf{T}_{c}^{'} \ln \left(c_{t}^{'} - \varepsilon^{'} c_{t-1}^{'} \right) + j \ln h_{t}^{'} - \frac{\tau}{1 + \eta^{'}} \left(\left(n_{c,t}^{'} \right)^{1 + \xi^{'}} + \left(n_{h,t}^{'} \right)^{1 + \xi^{'}} \right)^{\frac{1 + \eta^{'}}{1 + \xi^{'}}} \right|^{1 + \xi^{'}}$$

subject to the budget constraint:

$$c_{t}^{'} + q_{t} \Big[h_{t}^{'} - \Big(1 - \delta_{h} \Big) h_{t-1}^{'} \Big] - b_{t}^{'} \leq \frac{u_{c,t}^{'} n_{c,t}^{'}}{X_{wc,t}^{'}} + \frac{u_{h,t}^{'} n_{h,t}^{'}}{X_{wh,t}^{'}} - \frac{R_{t-1} b_{t-1}^{'}}{\pi_{t}}.$$

Except for the gross nominal interest rate, R , all the variables are expressed in real terms; π_t is gross

³ For stylized facts during periods of booms in house prices see Lambertini, Mendicino and Punzi (2010), Kannan, Rabanal and Scott (2009), Ahearne, A.G., J. Ammer, B.M. Doyle, L.S. Kole and R.F. Martin, (2005) and Borio and Lowe (2002).

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 the preference for housing with respect to consumption and leisure. The degree of habit persistence in consumption is measured by ε' . Borrowers are allowed to collateralize the value of their homes:

$$b_{t}^{'} \leq m E_{t} \frac{q_{t+1} \pi_{t+1} h_{t}^{'}}{R_{t}}$$

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

$$Y_t = \left(n_{c,t}^{\alpha} + n_{c,t}^{'1-\alpha}\right)^{1-\mu_c} \left(z_{c,t}k_{c,t-1}\right)^{\mu_c}.$$

$$IH_{t} = \left(n_{h,t}^{\alpha} + n_{h,t}^{'1-\alpha}\right)^{1-\mu_{h-\mu_{b}-\mu_{l}}} \left(z_{h,t}k_{h,t-1}\right)^{\mu_{h}} k_{b}^{\mu_{b}} l_{t-1}^{\mu_{l}},$$

The housing sector also uses land, l and an intermediate input, k_{i} , 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 back 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 lacoviello and Neri (2010)

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

where rr is the steady state real interest rate and GDP is defined as the sum of consumption and investment at steady state prices.

2. Introducing Boom-Bust Cycle into the Model

Fluctuations in the housing market are mainly generated by shocks to the demand and supply of houses. According to lacoviello and Neri (2010) half of the volatility of housing investment and housing prices is explained by housing demand and housing supply shocks, with equal importance. However,

housing market shocks lead to an increase in housing prices, but, cannot generate neither hump-shaped dynamics, nor the co-movement in consumption, investment and GDP observed during periods of booms in housing prices.

Lambertini, Mendicino and Punzi (2010) show that expectations of future macroeconomic developments can generate boom-bust cycles in housing and credit. In the following we report the dynamics of the model in response to expectations of future shocks to housing demand and supply.⁴ Chart 1 shows the model response to expectations of a negative supply shock, *i.e.* lower productivity in the housing sector. In particular, agents expect that at time T=4 a negative shock to housing productivity hits the economy. We illustrate the case in which the expectations turns out be wrong and at time T=4 there are no changes in productivity.⁵

Expectations of lower future in housing supply generate expectations of rising house prices. As a result, 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 an increased housing demand, current housing prices and housing investment rise. Moreover, agents increase their current labor supply in order to smooth the negative future effect of the shock on future labor income. When news about changes in future housing supply spread, 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 in 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 of capital used in the housing sector, current business investment slightly increases. As a result, GDP rises. As shown in chart 1 4-period anticipated negative housing supply shock 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 realizes. If expectations do not realize there is a dramatic drop in both quantities and prices. Thus, expectations of a negative housing supply shock that do not realize generate a housing market boom-bust cycle.

Expectations of future increases in housing demand generate booming dynamics in housing prices and investment but fail in accounting for co-movement between residential and non-residential investment. Due to an expected shift in preference for housing relative to consumption, firms in the consumption sector reduce their stock of capital. As a result, business investment falls. Because of the reduction in business investment during the boom phase, news about a future increase in housing demand fail to generate boom-bust dynamics consistent with the data. In the data business investment starts increasing on average six periods before the peak in housing prices. Expectations related to future housing demand make business investment decline throughout the boom phase. The behavior of business investment is independent of the time horizon of the expected increase in housing demand. See Lambertini, Mendicino and Punzi (2010) for further discussion on the sources of booms and busts in the housing market.

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 lacoviello and Neri (2009), such that, j_t and $A_{h,t}$ equal 0.0416 and 0.0193, respectively.

⁵ We introduce expectations of future macroeconomic developments to 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 change n quarters in advance, $\varepsilon_{z,t-n}$. So that, $u_{z,t} = \varepsilon_{z,t-n}$ 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 $u_{z,t} = 0$.





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3. Macroeconomic and Financial Stabilization

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. The model's parameters are set according to the estimated mean values presented by lacoviello and Neri (2010) for the US economy.

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

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

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

First, we investigate the effectiveness of macro-prudential 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 the indicator of financial imbalances. Thus,

$$m_t = \nu_m m_{t-1} + \left(1 - \nu_m\right) m + \left(1 - \nu_m\right) \nu_x \left(b_t - b_{t-1},\right)$$

Table 1

Loan-to-Value rule (LTV)	$k_{_b}\!\!=\!\!1,k_{_\pi}\!=\!\!k_{_y}\!\!=\!\!0$	$k_{b} = 0, \ k_{\pi} = k_{y} = 1$	$k_{_{b}}\!\!=\!k_{_{\pi}}\!=\!k_{_{y}}\!\!=\!\!1$				
<i>v_b</i> = -136.865	1.21371e-007						
Interest rate rule (R)							
$r_{\pi} = 37.6331, r_{y} = 38.2875$		1.5121e-006					
r_{π} = 16.9345, r_{y} = 12.7969 (r_{R} = 0)		1.42644e-006					
r_{π} = 10.7144, r_{y} = 1.73584	0.00580687						
r_{π} = 1.85184, r_{y} = -0.333143, r_{b} = 2.71008	0.00022085						
Using both rules (R & LTV)							
$v_b = -165.406, r_y = 969.023, r_y = 971.556$			1.50494e-006				
$v_{\scriptscriptstyle b}$ = -10.2081, $r_{\scriptscriptstyle y}$ = 4.02385, $r_{\scriptscriptstyle y}$ = 2.36347, $r_{\scriptscriptstyle b}$ = -0.932216			2.47229e-005				

Table 2

OPTIMAL STABILIZATION POLICY VOLATILITY				
Benchmark (estimates interest-rate rule)	b/GDP	q	π	GDP
$r_{\pi} =$ 1.40444, $r_{y} =$ 0.51261, $r_{R} =$ 0.59913	0.1471	0.2346	0.0010	0.0208
Loan-to-Value (LTV)				
v _b = -136.865	0.0361	0.2349	0.0007	0.0207
Interest rate rule (R)				
r_{π} = 37.6331, r_{y} =38.2875 (r_{R} = 0.59913)	0.1323	0.2344	0.0009	0.0185
r_{π} =1.85184, r_{y} = -0.333143, r_{b} =2.71008	0.0518	0.2342	0.0038	0.0253
Using both rules (R & LTV)				
$v_{_b}$ = -165.406, $r_{_\pi}$ = 969.023, $r_{_y}$ = 971.556	0.0320	0.2348	0.0008	0.0187
$v_{\scriptscriptstyle b}$ = -10.2081, $r_{\scriptscriptstyle \pi}$ = 4.02385, $r_{\scriptscriptstyle y}$ = 2.36347, $r_{\scriptscriptstyle b}$ = -0.932216	0.0715	0.2346	0.0014	0.0190



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

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 stabilizes credit aggregates without increasing the volatility of inflation and GDP. Table 2 shows the unconditional standard deviation of few key variables in the model. Chart 2 shows the behaviour of the LTV ratio and the debt to GDP ratio in response to an expected housing supply shock, under the counter-cyclical LTV policy. As a result the LTV ratio declines during the boom and increases during the bust. The optimal countercyclical LTV policy implies that under a 1.9 per cent expected housing supply shock, the LTV ratio (m in terms of our model) drops by 0.75 per cent. See chart 2.

Second, we investigate how, in the absence of an active macro-prudential policy $(m_t = m)$, monetary policy can reduce macroeconomic fluctuations and affect the magnitude of boom-bust cycles driven by expectations of a future reduction in the housing supply. Regarding, monetary policy, we consider alternative interest rate rules in which the central bank also reacts to changes in household debt

$$R_t = R_{t-1}^{r_R} \pi_t^{(1-r_R)r_\pi} \bigg(\frac{GDP_t}{GDP_{t-1}} \bigg)^{(1-r_R)r_Y} \bigg(\frac{b_t}{b_{t-1}} \bigg)^{(1-r_R)r_b}$$

Under a passive macro-prudential policy, an interest-rate response to credit growth yields sizable gains in terms of financial stabilization. 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 stabilization. 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 the credit-to-GDP ratio. It also reduces fluctuations in GDP and inflation.

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

4. Conclusion

Housing market fluctuations characterized by booms and busts in housing prices and credit are a central issue in policy discussions. In the aftermath of the recent financial crisis high importance has been given to the implementation of a policy that could reduce the severity of boom-bust cycles in the provision of credit and their spillovers to the macroeconomy.

In macroeconomic models it is particularly difficult to generate booms and busts in house prices and other macroeconomic variables. Expectations of future productivity shocks in the housing production sector can lead to rising dynamics in house prices followed by a sharp reversal. We show that in the presence of expectation driven boom-bust cycles, the use of the LTV ratio as a macro-prudential tool improves upon interest-rate rules that respond to financial variables in terms of both macroeconomic and financial stabilization.

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