# MONETARY POLICY EXPECTATIONS AND BOOM-BUST CYCLES IN THE HOUSING MARKET\*

Caterina Mendicino\*\*

# 1. INTRODUCTION

Boom-bust cycles in asset prices and economic activity have been a central issue in policy and academic debates. Particular attention has been given to the behavior of housing prices and housing investment. In the following we document that over the last three decades housing prices boom-bust cycles in the US are characterized by cyclical dynamics in GDP, consumption, investment and housing investment. We also suggest a mechanism for modelling housing-market boom-bust cycles in accordance with the empirical pattern. Our explanation builds on a news shock mechanism, where public signals of future fundamentals cause business cycle fluctuations through changes in household expectations, and boom-bust cycles emerge when public signals are not realized *ex-post*.

This article relate to two recent strands of the business cycle literature: the first on expectation-driven cycles and the second on housing market fluctuations. Beautry and Portier (2004, 2006) first documented that stock prices movements anticipate future growth in total factor productivity and that such dynamics are accompanied by a macroeconomic boom. Since their seminal contribution, a growing strand of the business cycle literature investigated the role of changes in expectations or news about the future state of the economy as a source of business cycle fluctuations. Changes in expectations may be proved to be an important mechanism in creating business cycle fluctuations, if they generate pro-cyclical movements in consumption, hours and investment. In fact it is a well established empirical fact that consumption, hours and investment strongly commove with output at business cycle frequencies. However, as pointed out by Beautry and Portier (2004) the standard real business cycle framework is unable to explain expectation driven business-cycles. In fact, the wealth effect generated by expectations of higher productivity in the future leads consumption and labor to move in opposite directions. As a result, output and investment fall. Thus, standard models fail in generating macroeconomic booms driven by changes in expectations. Several authors investigate under which assumptions expectation-driven business cycles can arise in a simple neoclassical setting. Most of the papers propose alternative assumptions in preferences and/or production. Another limitation of the real business cycle framework is the inability to generate an increase in the price of capital together with the rise in consumption, hours and investment. Christiano, Ilut, Motto, and Rostagno (2007) document the importance of sticky wages and an inflation-targeting monetary policy to generate a contemporaneous boom-bust cycles in output and asset prices in response to news that do not realize.

\*\* Economics and Research Department, Banco de Portugal.

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The literature related to housing price dynamics and financial frictions at the household level has expanded considerably in the last couple of years. Since Kiyotaki and Moore (1997), the use of models with collateral constraints and discount factor heterogeneity has been widely used in the business cycle literature. Building on such a framework, lacoviello (2005) first documented the relevance of nominal debt contracts and collateral constraints tied to housing values in matching the positive response of spending to a housing price shock. He also replicated the sluggish response of real spending to an inflation shock. Campell and Hercowitz (2005) showed that collateralized household debt had a role in explaining the decline in the volatility of output, consumption, and hours worked. More recently, lacoviello and Neri (2009) present an estimated model that is successful in explaining both the trends and short run fluctuations in real housing prices and investment over the last four decades in the US. According to their findings the volatility of housing investment and housing prices is explained between 15 and 20 percent by monetary factors.

We extend lacoviello and Neri (2009) model by including expectations of future monetary policy developments. We show that changes in expectations about the future policy rate and the inflation target can generate boom-bust cycles in housing prices and aggregate quantities such as GDP, consumption, hours and investment.

The goal of this article is to provide insight into the role of monetary policy expectations in the formation of boom-bust cycles in the housing market. The article is a summary of the recent research of Lambertini, Mendicino and Punzi (2009). The article is organized as follows. Section 2 studies the cyclical behavior of housing prices and housing investment in the US during the last three decades. Section 3 describes the model. Section 4 investigates the occurrence of boom-bust cycles as a consequence of expectations on the future policy rate. Section 5 analyzes the effect of the degree of credit friction for the boom-bust cycle formation and section 6 concludes.

### 2. EMPIRICAL FACTS

In the following we investigate macroeconomic dynamics during periods of housing prices boom-bust cycles in the US. Chart 1 shows real house prices in the United States over the period 1965:1 to 2009:2.<sup>1</sup> Real house prices display a number of boom-bust episodes, namely periods of faster-than trend growth followed by periods characterized by falling prices. We identify four peaks in real house prices in the United States: 1973:3; 1979:4; 1989:2; 2006:2. The vertical lines in Chart 1 indicate the peak dates.<sup>2</sup> Interestingly, real house prices peaks are followed by recessions. The grey shaded areas in Chart 1 indicate recession dates according to the National Bureau of Economic Research.

We are interested in characterizing the behavior of a number of macroeconomic variables during boom-bust episodes. We consider the following variables: real house prices; real GDP *per capita*; real private consumption; real private residential fixed investment; real private nonresidential fixed invest-

<sup>(1)</sup> Real house prices are the Census Bureau House Price Index, which measures the price of new one-family houses sold including the value of the land lot, divided by the implicit price deflator for the non-farm business sector.

<sup>(2)</sup> We define a peak as the centered maximum in real house prices in a twenty-one-quarters window, excluding end points.



Note: The vertical line indicates the 4 peaks.

ment; hours in the construction sector; hours in the consumption-good sector; the short-term interest rate, CPI inflation and real wages as deviation from the trend.

We consider the average behavior of these series over the four peak episodes. We transform the variables in deviations from the trend calculated with the Hodrick-Prescott filter. Then we calculate the average behavior over the 22-period window around the four housing-peak episodes. Chart 2 shows that

AVERAGE BEHAVIOR OF MAIN DETRENDED MACROECONOMIC VARIABLES AROUND HOUSE PRICES

### Chart 2



Sources: Federal Reserve Fund – Saint Louis (FRED2), Bureau of Labour Statistics (BLS) and Bureau Economics Analysis (BEA), Census Bureau. Notes: The vertical axes measures deviations from the trend, while on the horizontal axes are quarters. The vertical line indicates the peak in housing prices. housing boom-bust episodes are accompanied by below- or above-trend behavior of some variables. In fact, real house prices, real GDP, private consumption and investment, both residential and nonresidential, fall below trend at the end of the bust phase. Moreover, real GDP, private consumption, real private residential and nonresidential fixed investment commove with real house prices in a bellshaped dynamics. For a more detailed analysis on this topic see Lambertini, Mendicino and Punzi (2009). Different hypothesis could be consistent with the empirical facts presented in this section. In the article we present one of the possible sources of boom-bust cycle formation.

# 3. THE MODEL

In this section we describe the model economy. We consider an economy populated by households, producers of final goods for consumption and investment purposes, a continuum of retailers and a central bank. The framework follows lacoviello and Neri (2009). See Chart 3 for an illustration of the model.

### Chart 3



**Households**. The economy is populated by two types of households: the Saver and the Borrower. They both work in the production of consumption goods,  $n'_{c,t}$ , and housing,  $n'_{h,t}$ , consume,  $c'_t$ , and accumulate housing,  $n'_t$ . They differ in their discount factor, ( $\beta$  and  $\beta'$ ). 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 modeling feature has been introduced in macro models by Kiyotaki and Moore (1997) and extended by lacoviello (2005) to a business cycle framework with housing investment.

The borrower maximizes the utility function:

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

subject to the budget constraint:

$$c_{t}' + q_{t} \left[ h_{t}' - (1 - \delta_{h}) h_{t-1}' \right] - b_{t}'$$

$$\leq \frac{w_{c,t}' n_{c,t}'}{X_{wc,t}'} + \frac{w_{h,t}' n_{h,t}'}{X_{wh,t}'} - \frac{R_{t-1} b_{t-1}'}{\pi_{t}}$$

We allow borrowers to collateralize the value of their homes.

$$b_{t} \leq mE_{t} \frac{q_{t+1}\pi_{t+1}h_{t}}{R_{t}}.$$
 (1)

Except for the gross nominal interest rate, *R*, all the variables are expressed in real terms;  $\pi_t$  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  $\delta_h$  and *j* determines the relative weight in utility on housing services. Limits on borrowing are introduced through the assumption that households cannot borrow more than a fraction of the next-period value of the housing stock. See equation 1. The fraction *m*, referred to as the equity requirement or loan-to-value ratio, should not exceed one and is treated as exogenous to the model. It can be interpreted as the creditor's overall judicial costs in case of debtor default and represents the economy's degree of access to the credit market. The borrowing constraint is consistent with standard lending criteria used in the mortgage and consumer loan markets.

The **Savers** choose how much to consume, to work and their house holding facing a similar problem. However, they also invest in capital and receive the profits of the firms.

**Firms**. Final good producing firms produce non-durable goods (Y) and new houses (IH). Both sectors face Cobb-Douglas production functions. The housing sector uses capital, k, land, l, and labor supplied by the savers, n and the borrowers, n', as inputs of production.

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

The non-housing sector produces consumption and business capital using labor and capital.

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

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. Monopolistic competition occurs at the retail level, leading to the following forward-looking Philips curve:

$$\ln \pi_t - \iota_{\pi} \ln \pi_{t-1} = \beta \left( E_t \ln \pi_{t+1} - \iota_{\pi} \ln \pi_t \right) - \in_{\pi} \ln \left( X_t / X \right)$$

where  $\in_{\pi} = \frac{(1-\theta)(1-\beta\theta_{\pi})}{\theta_{\pi}}$ , and  $X_t$  represents the price markup.

Households set wages in a monopolistic way. Wages can be adjusted subject to a Calvo scheme with a given probability every period. Housing prices are assumed to be flexible.

**Monetary Authority**. We assume that the central bank follows a Taylor-type rule as estimated by lacoviello and Neri (2009)

$$R_{t} = R_{t-1}^{r_{R}} \pi_{t}^{(1-r_{R})r_{\pi}} \left(\frac{GDP_{t}}{GDP_{t-1}}\right)^{(1-r_{R})r_{y}} rr^{(1-r_{R})} \frac{u_{R,t}}{S_{t}}$$
(2)

where *rr* is the steady state real interest rate and  $u_{R,t}$  is an *i.i.d.* monetary policy shock. The central bank's target is assumed to be time varying and subject to an AR(1) shock,  $S_t$ 

$$S_t = (1 - \rho_s) S_{t-1} + u_{s,t}.$$
 (3)

GDP is defined as the sum of consumption and investment at constant prices. Thus

$$GDP_t = C_t + IK_t + qIH_t$$
,

where q is real housing prices at the steady state.

# 4. MONETARY POLICY AND BOOM-BUST CYCLES IN THE HOUSING MARKET

In order to introduce expectations of future monetary policy developments we assume that the error term of the shocks is given by an unanticipated component,  $\varepsilon_{z,t}$  and the anticipated change *n* quarters in advance,  $\varepsilon_{z,t-n}$ ,

$$u_{z,t} = \varepsilon_{z,t} + \varepsilon_{z,t-n},$$

where  $\varepsilon_{z,t}$  is a *i.i.d.* and  $Z = \{R, s\}$ . Thus, for instance,  $\varepsilon_{R,t}$  represents a current shock to the policy rate. Instead  $\varepsilon_{R,t-n}$  is the anticipation at time *t* of a change in the policy rate at time t + n.

### 4.1. Expectations on future expansionary monetary policy

In order to develop intuition on the dynamics of the model, we first present the response to a current unexpected decline in the interest rate – *i.e.* a negative shock to the policy rule ( $\varepsilon_{R,t} < 0$ ). A decline in the policy rate induces agents to increase their current expenditures. Aggregate demand rises. Borrowers significantly increase their level of indebtedness and housing investment. Housing prices rise and the subsequent collateral effect induces a sizable increase in borrowers' consumption. See Chart 4.

In the following we study the role of expectations of a future reduction in the policy rate in driving business cycle fluctuations in the housing market. Chart 5 reports the effect of an anticipated future decline of the nominal policy rate ( $\varepsilon_{R,t-4} < 0$ ). Chart 6 illustrates the case in which the expected fall in the policy rate turns out to be wrong and at time t = 4 there is no reduction in the policy rate. Expectations of a reduction of the policy rate generate a macroeconomic boom that turns into a bust if agents' expectations are not realized *ex-post*. The intuition is as follows. Signals of lower policy rates generate ex-

### Chart 4



#### Source: Author's calculations.

Note: The vertical axes measure deviations from the steady state, while on the horizontal axes are quarters.

# RESPONSES OF THE MODEL ECONOMY TO A 4 PERIOD AHEAD ANTICIPATED NEGATIVE MONETARY POLICY SHOCK



### Monetary Policy: Anticipated

Source: Author's calculations. Note: The vertical axes measure deviations from the steady state, while on the horizontal axes are quarters

pectations of a decline in the future real interest rate. Thus, borrowers anticipate this effect and increase their current consumption. Demand pressures rise current inflation. The current *ex-post* real rate declines reducing the debt services. The anticipation of an expansionary monetary policy also creates expectations of higher future housing prices that further induce borrowers to increase their current demand for housing and thus indebtedness. Due to limits to credit, impatient households increase their labour supply in order to raise internal funds for housing investments. Lenders face a reduction in their current and expected interest income. Thus, for this group of agents, consumption increases by less, current housing investment declines and their labor supply significantly increases.

Due to the presence of capital adjustment costs, firms are willing to start adjusting the stock of capital already at the time in which news about a future reduction in the policy rate spreads. For the increase in investment to be coupled with an increase in hours, wages rise in both sectors. The increase in business and housing investment makes GDP increase already at the time of the signal. As a result of the current increase in inflation and the rise in GDP, the policy rate increases at the time of the anticipation of the shock, and declines only at the time of occurrence of the shock.

In the case of an anticipated shock aggregate variables keep booming and then slowly decline. The

RESPONSES OF THE MODEL ECONOMY TO A 4 PERIOD AHEAD ANTICIPATED NEGATIVE MONETARY POLICY SHOCK THAT DOES NOT OCCUR

### Monetary Policy: Not Realized



Source: Author's calculations. Note: The vertical axes measure deviations from the steady state, while on the horizontal axes are quarters.

peak response in output corresponds to the time in which expectations are realized. In contrast, if expectations do not realize there is a dramatic drop in both quantities and prices below their initial level. Thus, expectations of looser monetary policy that do not realize generate a macroeconomic boom-bust cycle.

### 4.2. Expectations of a shift in the central bank's inflation target

Chart 7 documents the effect of expectations of a temporary but persistent upward deviation from the central bank's inflation target. The anticipation of a higher target for inflation means higher long run expected inflation. Since prices are sticky, firms that can change prices in the current period already adjust their price upwards. Thus, expectations of higher inflation in the future increase inflation already in the current period. Expectations of a future reduction of the realized real rate coupled with a current reduction in the rate induces an increase in household indebtedness and, thus, higher consumption and housing spending. Housing prices and housing investment increase. Due to adjustment cost in capital, firms start adjusting the stock of capital already at the time in which news spreads. Real wages and

# RESPONSES OF THE MODEL ECONOMY TO A 4 PERIOD AHEAD ANTICIPATED TEMPORARY INCREASE IN THE INFLATION TARGETING



### Central Bank's Inflation Target Shock

Source: Author's calculations.

Note: The vertical axes measure deviations from the steady state.

hours worked rise. The economy experience a macroeconomic boom. After the shock is realized all variables slowly return to their initial levels. Chart 7 also displays the behavior of the model economy when news on future central bank's target do not realize (the target doesn't increase in period 4). As expected at time t=5 quantities and prices drastically drop. Compared to the previous case, expectations of a temporary upward shift in the inflation target generate a less sizable boom but a more pronounced bust.

## 5. CONCLUSION

In this article, we show that expectations on the conduct of monetary policy can be a source of fluctuations in the housing market. In fact, expectations of either a future reduction in the policy rate or a temporary increase in the central bank's inflation target that are not fulfilled can generate macroeconomic boom-bust cycle dynamics. Our results imply that good communication on monetary policy is essential for reducing the occurrence of expectation-driven cycles. However, as shown by Lambertini, Mendicino and Punzi (2009) monetary policy is one of the mechanisms that can generate boom-bust cycles in the housing market. In fact also expectations about the future state of productivity, investment cost, housing supply and inflation can generate housing-market cycles in accordance with the empirical findings. Empirical work to test the different sources of boom-bust cycle formations is left to future research.

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