Proceedings of ICFTBA 2026 Symposium: Digital Government, Finance, Accountability, and Sustainable Economic Development
DOI: 10.54254/2754-1169/2026.AB39197

A Review of Research on the Relationship Between Low Interest Rates, Financial Innovation, and Real Estate Bubbles

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Abstract. After the burst of the Internet bubble in 2000, the Federal Reserve reduced the federal funds rate to 1 % and maintained it for several years. At the same time, financial liberalization and asset securitization were spread around the world. Many economies accumulated real estate bubbles and eventually triggered a serious financial crisis. This paper is mainly based on literature review and supplemented by case comparison. Firstly, it combs the theoretical path of low interest rate and financial innovation affecting the real estate market, and then compares the two types of empirical research that support and question the "low interest rate fueling bubble". Then, taking the US subprime mortgage crisis as an example, it compares the macro indicators and cross-border capital flows during the bubble expansion period and the burst period, and summarizes the regulatory responses of various countries. The analysis shows that loose monetary policy is only a background condition for the formation of bubbles, not a sufficient condition; in the stage of crisis escalation, the lack of supervision and the role of cross-border capital flows are more critical. Incorporating these two opposing views into the analytical framework will help regulators better identify asset bubbles and coordinate monetary policy with macro-prudential tools.

Keywords: low interest rates, financial innovation, real estate bubble, subprime mortgage crisis, macro-prudential supervision

1. Introduction

Since the beginning of the 21 st century, major economies have maintained low interest rates for a long time, financial derivatives innovation has accelerated, and real estate bubbles have repeatedly formed and burst, causing significant losses to the real economy and household wealth. This paper chooses the U.S. subprime mortgage crisis as a case. There are two reasons: First, after 2001, the United States experienced low interest rates, subprime loan expansion and asset securitization surge at the same time. The three are highly coincident in time and space, which is convenient for examining the relationship between each other. Second, the US housing and credit data is complete, the previous research is rich, and both sides of the dispute have sufficient evidence for comparative analysis. Around the relationship between these three, the literature is roughly divided into two

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factions. Taylor's side believes that the Fed's policy interest rate from 2002 to 2005 deviates significantly from the reasonable range implied by the Taylor rule, and loose money is the key to pushing up house prices. Bernanke's side believes that the bubble is more due to lax financial supervision and large inflows of international capital, and monetary policy itself is not the main cause. The purpose of this paper is to connect the three clues of low interest rates, financial innovation and real estate bubble, and test how many facts can be explained by the arguments of both sides.

Most of the existing studies only focus on monetary policy, rarely put low interest rates, financial innovation and regulatory loopholes into the same framework, and do not systematically discuss why the two views are different and under what conditions they are established. This is the entry point of this paper. The full text is divided into three levels: theory, empirical controversy and regulatory experience. Section 2 shows how low interest rates and financial innovation affect the real estate market. Section 3 compares the empirical results of the two factions and explains the sources of differences. Section 4 compares the macro performance in the bubble cycle with the regulatory measures of various countries. Section 5 gives conclusions. Comparing the two views in a unified framework can provide a basis for regulators to identify asset bubbles and coordinate monetary easing and macro-prudential tools.

2. Theoretical foundations of the impact of low-interest rate policies and financial innovation on the real estate market

2.1. The background, implementation path, and market impact of the low- interest rate policy in the United States after 2001

After the burst of the Internet bubble in 2000, the US economic growth slowed down and the risk of deflation rose. In order to cope with this situation, the Federal Reserve has cut interest rates continuously since 2001, reducing the federal funds rate from 6.5 % in January 2001 to 1 % in June 2003 and maintaining it until 2004. According to Taylor's calculation, the real interest rate in 2002-2005 was significantly lower than the level implied by Taylor's rule, and the monetary policy environment was quite loose.

The loose environment is mainly transmitted to real estate through two channels. First, the interest rate channel : the decline in the benchmark interest rate leads to a decline in the mortgage interest rate, a reduction in the cost of housing financing, and an increase in housing demand. The second is the credit channel : the liquidity of the banking system is abundant, the willingness to lend is enhanced, and the supply of mortgage loans continues to expand. The two channels are combined to lower financing costs and increase household purchasing power while injecting more credit into the housing market, driving demand and house prices higher at the same time. This transmission chain is the basis of Taylor 's argument. However, the actual effect of low interest rates is still controversial, which directly leads to the inconsistency of the empirical conclusions.

2.2. The amplified transmission effect of financial innovation on real estate credit under financial liberalization

Since the 1980s, countries have gradually relaxed credit controls and lowered the threshold for cross-border capital flows; at the same time, the regulatory environment has become more relaxed, and financial innovation has expanded. At this time, real estate-related financial products have emerged: subprime mortgages, mortgage-backed securities (MBS), secured debt certificates (CDO)

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and credit default swaps (CDS). The role of these tools can be summarized as bypassing constraints. Through the "circular" structure, MBS avoids the three requirements of capital adequacy ratio, deposit level and risk retention, so that credit breaks through the limits of bank balance sheet; through 'repackaging', CDO reduces the restriction of asset quality on supply, and the supply of security assets and institutional financing no longer depends on the quality of underlying assets. The CDS cuts off the link between physical assets and capital constraints, so that nominal credit is no longer dependent on real economic activities to expand; the ' short-term loan, long-term loan' model bypasses the constraints of capital and maturity and pushes the leverage ratio to an unprecedented high level. Together, these mechanisms have relaxed the restrictions on real estate credit in terms of scale, capital, risk and leverage, and credit has poured into the housing market on a scale that is decoupled from income levels. The cycle of borrowing and refinancing was repeated, and the bubble continued to expand until it collapsed in 2006. They have one thing in common: the credit risk originally borne by the bank's balance sheet is systematically packaged and transferred to the capital market. This amplification mechanism is the hotbed of foam.

Empirical research supports this judgment. Keys et al. found that securitization weakens the enthusiasm of banks to prudently screen borrowers, resulting in lower loan standards [1]; mian and Sufi's calculations show that the expansion of credit supply has pushed up house prices in high-risk areas [2]; dell'Ariccia et al observed that the faster the credit growth in the region, the more obvious the decline in loan standards [3]; rajan has previously warned that financial development may accumulate hidden risks through profit-seeking behavior [4]. These interrelated changes have laid the foundation for the formation of housing price bubbles.

3. Empirical disagreements on the relationship between low interest rates and the real estate bubble

3.1. Theoretical and empirical basis for the argument that low interest rates fuel housing price bubbles

Supporting Theories: There are three theoretical paths to support the study of "low interest rates fueling asset bubbles". The interest rate channel theory holds that low interest rates depress the discount rate and financing costs, and asset prices are naturally pushed up. The Taylor rule deviation theory points out that real interest rates continued to be lower than the implied level of the Taylor rule in 2002-2005, and loose money boosted the bubble [5]. The theory of irrational exuberance and psychological contagion focuses on investor behavior: irrational expectations and 'this time different' mentality keep house prices out of fundamentals [6-8].

On the empirical side, Taylor uses the Taylor rule to measure the Fed's policy, and believes that policy deviation is the key to the formation of the bubble [5]; case and Shiller combined survey data and price data to identify the irrational components in house prices [6]; Reinhart and Rogoff look back at hundreds of years of financial history and find that credit booms almost always precede financial crises [8].

The data is also accurate. From January 2000 to July 2006, the Case-Shiller housing price index rose by about 84.6 %; the federal funds rate remained at a low level of 1% -6.5%; the amount of mortgage loans also increased significantly. Housing prices and interest rates are highly synchronized in time, but the synchronization can only reflect the correlation; to determine whether there is a causal relationship, a more detailed study design is needed.

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3.2. Opposing views and empirical evidence on low interest rates as the core cause of non-real estate bubbles

Opposition point of view: the argument from the opposite side is also persuasive. They believe that monetary policy is not the main cause. It is pointed out that loose monetary policy is only a necessary background for the formation of bubbles, rather than a sufficient condition; the real culprits are lax financial regulation and global capital inflows [9]. At the same time, from the perspective of 'past history', it is pointed out that the credit boom that emerged before the crisis is common in financial history, so it is unfair to blame all the blame on interest rates [8]. Relevant literature and empirical evidence: Bernanke's comparative study of countries with rising house prices shows that low interest rates do not trigger bubbles in all cases; cross-border capital flows and global savings glut have shown a stronger influence in explaining asset price volatility [9]. Mian and Sufi's micro-level data also show that the main driver of house price rises and defaults is the expansion of credit supply, rather than the interest rate level itself [2]. The difference between the two schools is that the difference between the two schools is fundamentally due to the difference in research design: one side focuses on the interest rate level, while the other side emphasizes the credit supply and regulatory intensity; data sources are also different-time series analysis, cross-country panel data and micro-level loan samples each highlight different aspects; there are also significant differences in recognition strategies. These differences explain why there are conflicting conclusions, and also show that the relationship between low interest rates and asset bubbles is not a simple linear causal relationship.

4. Macroeconomic characteristics and international regulatory lessons in the real estate bubble cycle

4.1. A comparative analysis of macroeconomic conditions and cross-border capital flows before and after the formation and collapse of bubbles

In the bubble expansion stage, the total amount of credit expanded rapidly, housing prices continued to rise, household leverage ratio gradually increased, and a large influx of foreign capital, financial institutions actively borrowed, and the market sentiment was generally optimistic. In the break-up stage, the above process is completely reversed: housing prices fall, loan default rates rise sharply, credit supply tightens suddenly, cross-border capital flees on a large scale, financial institutions fall into a vicious circle of deleveraging and liquidity tension, and the crisis spreads rapidly along the leverage chain [10]. The U.S. subprime mortgage crisis can see this process clearly. Put the 2003-2006 expansion phase and the 2007-2009 rupture phase together, the direction of changes in housing prices, credit, securitization issuance and leverage.

In the expansion stage, credit growth and asset prices form a positive feedback. Low interest rates led to the rapid expansion of housing mortgage loans. The average annual growth rate of residential credit in 2003-2006 was more than 10 %. The proportion of innovative products such as subprime loans continues to rise, and the US housing price index has risen by about 32 %. Over the same period, foreign capital significantly increased its holdings of mortgage-backed securities and other real estate-related instruments. In the context of global savings glut, most foreign investors from East Asian economies and oil producing countries almost doubled their holdings of US institutional bonds and MBS between 2003 and 2007. Continued capital inflows depress long-term interest rates and provide low-cost financing for credit expansion. In the break-up phase, the Case-Shiller national index fell by more than 20 % from its peak in mid-2006. The proportion of sub-prime loans overdue

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for more than 60 days climbed from less than 15 % in 2006 to more than 40 % at the end of 2008. Cross-border capital has shifted from the original continuous inflow to outflow, and foreign investors have quickly withdrawn real estate-related securities. The assets of financial institutions shrank sharply, Bear Stearns was acquired, Lehman Brothers went bankrupt, and eventually evolved into a systematic financial crisis. This conduction process is consistent with Brunnermeier's flow spiral theory.

4.2. An overview of regulatory policies across countries aimed at preventing real estate bubbles caused by loose interest rates and financial innovation

In terms of monetary policy, the Fed gradually raised interest rates in 2004-2006 to curb market overheating; some countries use forward guidance to stabilize expectations and prevent interest rates from staying low for a long time. In terms of credit supervision, most countries have tightened the loan-to-value ratio (LTV) and the loan-to-income ratio (LTI), increased the down payment ratio, and strengthened the loan review standards. The United States has strengthened mortgage review and information disclosure through the 'Dodd-Frank Act'. In terms of macro-prudential, counter-cyclical capital buffers and stress tests are used to smooth the credit cycle. The Volcker rule directly limits banks' proprietary trading and separates derivatives risk from credit risk.

The comparison of the United States, Britain, the West and Ireland shows that monetary tightening, credit constraints and macro-prudential tools have their own advantages and disadvantages in curbing asset bubbles and preventing systemic risks. The difference mainly comes from the policy mix rather than a single tool. Under the environment of 'loose regulation + low external interest rate', Spain and Ireland experienced an average annual credit growth of more than 20 %, house prices rose by 190%-300%, and house prices fell by 35%-50 % after the bubble burst; Canada implemented preventive measures such as compulsory insurance and stress tests. There was no bank bailout in 2008, and house prices fell by only about 9%.

These results point to the same point: it is not a tool that works, but whether the credit control mechanism exists and whether it is launched at the right time. This set of experience has a direct reference to China. China insists that 'houses are used for living, not for speculation', introduces the 'three red lines' of real estate financing, and continues to improve the macro-prudential assessment framework. In essence, it is to combine the lessons of the crisis with the actual situation of the country.

5. Conclusion

This paper takes the period of low interest rates in the United States after 2001 as the observation window, and re-examines the relationship between low interest rates, financial innovation and real estate bubbles. It can be summarized as three points: low interest rates create a relaxed credit environment, which is an important background for the formation of bubbles; financial innovation further exacerbates the accumulation of housing price bubbles and the accumulation of systemic risks by weakening loan review and credit expansion; monetary policy easing itself is not the key to the formation of bubbles. In the stage of crisis escalation, the lack of supervision and the role of cross-border capital flows are more critical. The superposition of these three will promote the expansion and rupture of the bubble. This study has obvious limitations: as a summary analysis, it mainly relies on second-hand literature and does not use the original micro-loan data for empirical testing; the case only covers the subprime mortgage crisis in the United States, so this conclusion needs to be further verified when it is extended to other countries; in addition, different views have

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not been quantitatively verified. Subsequent research can combine big data with artificial intelligence learning to improve bubble identification and early warning systems, and extend the comparison to emerging economies to test the actual effects of their real estate financial innovation and macroprudential policies.

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