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Are there significant linkages between two series of housing prices, money supply and short-term international capital? – Evidence from China

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A B S T R A C T

This paper studies the relationship between two series of the money supply (M2), short-term international capital flows and housing prices by employing a continuous wavelet method. This method can enable us to examine the relation in both time and frequency domains in detail. We use data from China for empirical analysis. Although the relations are not stable, several main findings are observed. First, M2 affects short-term international capital flows mainly in the long term. The upward momentum of M2 has led foreign investors to be optimistic about China's economy, thus attracting inflows of capital. However, capital flows have little effect on the M2 due to the effectiveness of sterilization. Second, housing prices and M2 move synchronously before 2008. After 2008, housing prices are caused by M2 due to the excessive currency from the government's monetary and fiscal policies. Furthermore, M2 affects housing prices significantly in the long term. Additionally, after eliminating the influence of the M2, we find that a strong relationship exists between short-term international capital flows and housing prices in the short term, which means that this influence is mainly through a direct effect. These findings provide implications for the government to formulate monetary policy and regulate the housing market and capital flows.

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1. Introduction

Short-term international capital flows have surged significantly over the last three decades [1]. In particular, emerging markets such as Asia have attracted large amounts of capital inflows due to their promising growth prospects [2]. A modest international capital inflow can promote the economic growth of a country. However, a soar in capital inflows causes rises in the money supply, and it has an inflationary effect on the domestic economy. The authorities may resort to sterilization operations to counter the adverse effects on the domestic macroeconomic situation. If the sterilized intervention is not complete, then capital inflows will lead to monetary base increase, thereby increase money supply. In addition, foreign capital flows have exerted a more momentous role in shaping regional housing markets [3]. The influx of large-scale speculative funds has sharply increased the asset prices, fueled speculative bubbles and seriously affected the economics and finance [4]. On the other hand, since the housing market is short of flexibility, excess monetary liquidity easily appears in the housing market, which increases housing prices and leads to the formation of the housing bubble [5].

Most literatures only study the relationship between two series of capital flow, money supply and housing prices, and mainly from the time domain. However, there are few studies put the three variables together in terms of time and frequency domains. Economic variables are usually presented in the form of a time series, and the relationships between them may vary with both time and frequency. In this paper, the continuous wavelet method is used to explore the time- and frequency-varying relationship between two series of them and apply it to the data from China, which provides a new perspective for the research in this field.

China is a transitional country, and its economic structure and policy preferences continue to change over time. In 2001, China joined the World Trade Organization (WTO). Then, it launched the qualified foreign institutional investors (QFII) system and abolished the restrictions on foreign investments entering the domestic

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housing market in 2002. In addition, the fixed exchange rate was ended, and a managed floating exchange rate system was implemented in 2005. These reforms have attracted capital flows into China. The fear is that such inflows could create bubbles in asset markets, including stocks and housing. It flowed out of China due to the financial crisis during 2007–2008. Further, in 2014, the Chinese economy faced downward pressure, the short-term international capital flowed out of China sharply. Additionally, M2 growth slowed to 12.2% in 2014. Also housing activity began to weaken in early 2014, and there was a slowdown in domestic housing prices and trading volume [6]. Moreover, since 2001, monetary policy has undergone several changes in expansion and contraction to regulate the housing market [7,8]. Excessive money supply caused too much money to chase too few assets, thereby increasing the speculative demand for housing and raising its price [9]. Under the continued changing economic environment, this paper attempts to explore the dynamic links between two of these variables.

The main contribution of our work is the method used is different from the previous work on this research. We use a continuous wavelet method which enables us to detect dynamic relation between time series. This method can be used to observe both time and frequency variation information in a highly intuitive way by extending a time series into a time–frequency domain. This property makes it superior to traditional time series or frequency domain methods which cannot consider both of time and frequency, and those methods would therefore provide a limited understanding of the nexus between series. Therefore, it allows us to observe different periodic associations and possible structural changes [10]. Thus, we resort continuous wavelet method to offer insights into the nexus between two series of M2, short-term international capital flows, and housing prices in China.

The paper is arranged as follows. The literature review is presented in Section 2. In Section 3, the theory of housing prices, the money supply and short-term international capital flows is discussed, and Section 4 introduces the wavelet analysis method. The data and empirical results are exhibited in Section 5, and finally, Section 6 gives a conclusion.

2. Literature review

In the following, we review the literature that addresses the relationships between the money supply and capital flows, between the money supply and housing prices, and between capital flows and housing prices.

The examination of the nexus between the money supply and capital flows focuses on sterilization in economies with inflexible exchange rate regimes. Moreno [11] finds that Korea tends to sterilize shocks to foreign assets more adequately than Taiwan and achieves a far smaller change in its money supply. Khushk et al. [12] confirm that by changing its domestic assets, the central bank partially sterilized the impact of foreign net assets on the domestic monetary base. In studying the relationship between the money supply and housing prices, some studies have shown that an excessive money supply leads to excess liquidity, which results in housing prices rising. Congdon [13] argues that housing prices are strongly influenced by the money supply and that an increase in the money supply will lead to too much money chasing relatively few assets. However, Dreger and Wolters [14] suggest that the linkage between liquidity and asset prices is fragile and far from being obvious.

Many studies have investigated the relationship between capital flows and housing prices, but the empirical results are not conclusive. On the one hand, some evidence suggests that the two series have a stable relationship. Reinhart and Reinhart [15] assert that a soar in capital inflows is related to the rise of housing prices in developed economies over a longer term period. Yiu and Sahminan [16] find that portfolio inflows have a positive influence on housing prices in Singapore and Indonesia. However, Favilukis et al. [17] consider that capital flows play a small effect in driving housing prices.

For China, some studies find that international capital has different effects on the money supply (or sterilization) in different periods. Chung et al. [18] show that the monetary authorities have sterilized almost the entire impact of international capital inflows. Since March 2008, the policy of monetary sterilization has been seriously challenged due to the Federal short-term interest rates being near to zero in the U.S. Su et al. [19] consider that foreign exchange reserves' growth pressures the money supply. However, in general, sterilization is effective, but it was not in a few months during 2006–2007. Some studies about the effects of the money supply on housing prices in China find that the money supply affects housing prices prominently. Tsai [9] determines that excess monetary liquidity caused by too much money supply significantly influences the housing market in China. However, Luo [20] finds that a single monetary policy could not affect housing prices significantly. Dai and Yin [21] demonstrate that in the downturn period, M2 promotes the recovery of the housing market. However, in the vigorous period, the effect of monetary policy on the market is relatively weak.

A considerable number of studies identify a positive nexus between housing prices and short-term capital flows in China. Guo and Huang [22] reveal that speculative capital inflows increase housing prices. Su et al. [23] find bidirectional causal relations between the series. However, Tan and Lin [24] find that speculative capital cannot directly affect housing prices prominently.

Previous studies usually use time-domain methods (static or time-varying methods) to analyze the linkage. However, these methods usually lose information in the frequency domain. The other method is to use the frequency-domain method (Fourier transform) to study the linkage, but the time domain information is lost in this method. That is, it cannot capture time-varying features. Wavelet analysis considers both the frequency and time domains, and it can analyze how the relationship varies at various frequencies and how it changes over time [8]. Thus, in this paper, we attempt to revisit the nexus between two series of housing prices, the money supply and short-term capital flows in China by employing continuous wavelet analysis.

3. Housing prices, money supply and capital flows

In this section, we describe the theory explaining the relationships between two series of money supply, capital flows and housing prices.

3.1. Money supply and capital flows

In an open economy, the money supply can be written as [25]

$$M_S = kM_B \tag{1}$$

where k is the money multiplier, M_S is the money supply, and M_B is the money base, which equals the net domestic and foreign assets (NDA, NFA). Generally, the foreign exchange reserves (R) is the main part of the foreign assets.

Under a fixed exchange rate regime, the exchange rate e is a constant and NFA equals R times the exchange rate [26]:

$$M_S = k(NDA + NFA) = k(NDA + e \times R) \tag{2}$$

Changes in the foreign exchange reserves mainly come from the capital account balance and the current account balance, with the former reflecting the international capital net inflow. When the

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