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What Determinants China's Mortgage Credit Boom

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Abstract

In this paper we investigate the relationship between housing prices and mortgage lending in China. We analyze a sample of 28 Chinese domestic commercial banks during the period between 2003 and 2009. Our results suggest that the urbanization process in China contributes substantively to the mortgage credit boom. We find a distinct behavior of the economic housing market, in which the housing price and mortgage credits affect each other adversely. The monetary policy has a greater impact on the mortgage lending than banks' characteristics. Raising bank reserves is a relatively effective instrument to control the mortgage credit boom. Our findings have important policy implications and account for the existing monetary policies which are implemented in China.

JEL classification numbers: D120; G20; G180
Keywords: mortgage; housing price; bank credit; urbanization

1 Introduction

Over the past decade, both the mortgage market and property sector have experienced a dynamic change. The current financial crisis, which starts from 2008 and makes the whole banking industry suffer, is largely attributed to the meltdown of US subprime mortgage market. The rapid growth of housing prices and mortgage credits has been extensively documented across many countries. (Miles and Pillonca 2008; Wolswijk 2006) Meanwhile, China, as one of the largest emerging markets, has witnessed the soaring property price and mortgage credit boom in domestic market. (Liang and Cao 2007) Figure 1 illustrates the movements of mortgage loans and property prices in mainland China respectively. In an international context, it is a stylized fact that the amount of bank lending is strong correlated to the property price. Many empirical studies have highlighted a strong correlation between bank lending and property prices. (Hofmann 2003; Gerlach and Peng2005; Fitzpatrick and McQuinn 2007; Davis and Zhu 2010) China provides a representative figure of emerging property market which experienced the mortgage boom

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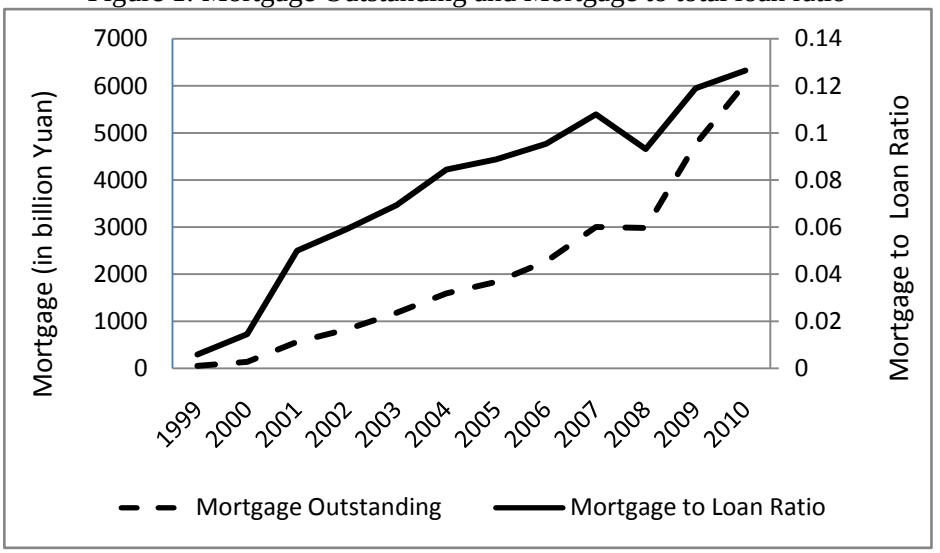
and soaring property prices during the past decades. At the same time, China also experienced a tremendous reform in both banking and house financing sectors.

Figure 1: Mortgage Outstanding and Mortgage to total loan ratio



The development of Chinese commercial mortgage market began to accelerate in 1998, when People's Bank of China authorizes all domestic commercial banks to issue household mortgage loans. From then on, the Chinese government has embarked upon an effort to introduce market-oriented mechanisms into property financing system. All these measures have promoted and contributed to the housing reform in mainland China. (Zhang 2000) The market competition is then brought about into the house financing market. Although the marketized housing mortgage was first introduced in 1998, the outstanding mortgage loans soared from 51 billion Yuan in 1999 to 6060 billion Yuan at the end of 2010. The mortgage to loan ratio for all financial institutions increased from 0.59% in 1999 to 12.65% at the end of 2010. During this period, the property prices increase with the volume of outstanding mortgage loans except for 2008, when the influence of financial crisis spread to China. On the other hand, the real estate bubble receives more and more attention from practitioners. The rapid increase in property prices may bring about the real estate speculation.[3] As a fund-intensive industry, the property sector relies heavily upon the financial - especially the banking - sector. Once the real estate price falls, the property industry suffers recession, which breaks the fund chain. As a result, the bank lending in real estate sector is exposure to high default risk.[4] In this paper we investigate the relationship between the outstanding mortgage loans and housing prices in China. In addition, we test the real effects of bank's characteristics and monetary policies as well. The Chinese mortgage market is featured in two aspects. First, a uniform

[3]A speculator can purchase a house with bank loans and then use this house as mortgage to finance another property. The repeated mortgage will fuel the housing bubble and cause the inflationary boom of property market.

[4]In 2008, when the influence of financial crisis spread to China, the housing prices fall in some major cities. As a result, some mortgagors default on the mortgage payment, in that the market value of their houses become lower than total mortgage loans.

and adjustable mortgage rate is set by the People's Bank of China, which is the central bank, for all mortgagers.[5] Once a new mortgage rate is announced, it applies to all types of mortgages, including existing ones. Second, there has been not yet mature secondary mortgage market in China. Until now only two Mortgage-Backed Securities (MBS) have been issued.[6] Consequently, Chinese mortgage holders have limited alternative way to invest their mortgage products. They are sensitive to the change of mortgage rate. (Deng et al. 2009)

The paper is organized as follows. Section 2 reviews the literature on the relationship between mortgage lending and property prices and highlights the major contributions of our work. Section 3 describes the data, methodology and variables employed in the estimation. The granger causality test and empirical results are presented in section 4. Section 5 concludes this paper.

2 Literature Review

Various models and empirical frameworks have been proposed to explain the close relationship between bank lending and property price movements. It is supported by the cross-country evidence (Tsatsaronis and Zhu 2004; Égert and Mihaljek 2007; Lacoviello and Minetti 2008; Goodhart and Hofmann 2008; Davis and Zhu2010) and the indications of individual countries, such as the USA (Capozza et al. 2002), Spain (Gimeno and Martinez-Carrascal 2006), Ireland (Fitzpatrick and McQuinn 2007), and China (Liang and Cao 2007). Hofmann (2003) and Basurto et al. (2006) suggest a bi-directional causality between housing prices and bank credits. However, Goodhart and Hofmann (2004), Gerlach and Peng(2005) find the change of property prices have a significant impact on bank lending, but no vice versa. By contrast, Liang and Cao (2007) investigate the case of China and suggest a unidirectional causality from bank lending, income and interest rate to property prices. It differs from the conventional empirical evidence of developed economies. Although the empirical analyses above involve the standard "bubble busters", such as the income and interest rate, they are rather ad hoc and hard to explain the real effect in theory. There are two alternative models in the literature to interpret the housing prices systematically. The first one is the inverted demand model, which includes the per capita housing supply and an index of credit conditioning as additional explanatory variables. (Muellbauer and Murphy 1997; Meen 2002) This model is more appropriate to those countries, in which the housing supply rockets up considerably. The alternative one is the house price-to-rent model. It assumes the house rent-to-price ratio depends only on the user costs and investigates the arbitrage between occupied and rental houses. (Ayuso and Restoy 2006) This model is more appropriate to those countries, in which housing rent is fully market-oriented, such as the U.S.

In terms of the bank-level analysis, Davis and Zhu (2009) use a sample of 904 banks of 17 countries during the period 1989-2002 and find strong correlation between bank credits and commercial property prices in those countries which suffered a bank crisis.

[5]Since 2005, commercial banks can set individual rate, which cannot be lower than 90 percent of the rate set by the People's Bank of China.

[6]According to the report by the People's Bank of China, only China Construction Bank (CCB) are authorized to issue MBS in the domestic inter-bank Bond Market, amounting to ¥3.018 billion and ¥ 4.16 billion respectively.

The previous research that investigates the Chinese case using a bank level data is rare. Our paper supplements the existing literature in twofold. First, a unique bank-level mortgage loan data, instead of the bank lending, is employed in our paper. We aim to sweep out the influence of other kind of commercial loans on the estimation. Next, we include the urbanization and monetary policy measures to capture the effects of socio-demographic change and regulatory constraints respectively.

3 Methodology

We aim to investigate what determined banks' mortgage credits. In addition, the central bank can carry out different monetary policies to intervene with the property and mortgage markets indirectly. We also test the real effects of the interest rate instrument and required reserve ratio on both mortgage and property markets. We propose an empirical framework to estimate the movements of mortgage lending as follows:

$$Mortgage_{it} = \beta_0 + \beta_1 Pop_{it} + \beta_2 Interest\ Rate_{it} + \beta_3 Inflation_{it} + \beta_4 NIM_{i,t-1} + \beta_5 LTD_{i,t-1} + \beta_6 RR_{it-1} + \beta_7 HousePrices_{it} + \varepsilon_{it}$$

The index of urbanization is Pop, which is proxied by the percentage of urban population to the total population. It also refers to the effect of internal migration and socio-demographic change. Inflation and House Prices are macroeconomic factors which have potential impact on the mortgage market. NIM, LTD represents the Net Interest Margins and Loan to Deposit ratio respectively, which reflect the characteristics of individual banks. We use the Interest Rate and Required Reserves, which are denoted as RR, as measures of monetary policy constraints. Previous research also indicates that House price

4 Data Description

Compared with developed countries, Chinese mortgage market has a relative short history and therefore limited data available. In this paper, an unbalanced panel of annual mortgage loans of Commercial Banks is employed. Our sample consists of all State-Owned-Banks (SOBs), Joint-Stock-Banks (JSBs) and major City-Commercial-Banks (CCBs). The sum of mortgage credits covers more than 80% of total mortgage outstanding. It makes our sample highly representative. Fixed effect model is more appropriate to control for the heterogeneity of individual banks. Next we carefully select explanatory variables for the empirical analysis so as to ensure our estimation is robust to omitted variables. The macro data which is collected from the People's Bank of China and National Bureau of Statistics of China. Mortgage loans, bank specific variables and house prices are collected from ALMANAC OF CHINA'S FINANCE AND BANKING, which is the official annual publication of People's Bank of China. The variables are described as follows, and the Summary statistics are shown in Table 1.

Table 1: Summary statistics of variables

Variable	Mean	Std. Dev	Min	Max
Income(log)	9.58	0.32	8.60	10.27
Interest (log)	1.65	0.25	0.44	2.14
Population(log)	9.12	1.59	6.81	11.04
Mortgage(log)	10.13	2.17	4.59	13.68
Loan Deposit Ratio(%)	65.73	7.77	46.72	86.31
NIM(%)	2.68	0.52	1.05	4.29
Condominium price(log)	8.31	0.37	7.63	9.53
Residential price(log)	8.26	0.38	7.53	9.49
High grade price(log)	8.91	0.32	8.06	10.00
Economical price(log)	7.58	0.27	6.94	8.38

4.1 Dependent Variables

We are more interested in the movements of both mortgage loans and housing prices within a given year. Therefore the change of mortgage loans and housing prices are employed as dependent variables. In addition, log transformations of both variables are employed.

4.2 Macroeconomic Factors

Although the GDP is a popular variable to assess the macroeconomic situation (Liang and Cao 2007, Davis and Zhu 2010), a large body of literature employs the disposable income as an alternative. McQuinn and O'Reilly (2007), Hill and Gan (2008) established the relationship between the income and house prices from both theoretical and empirical sides. We use the national average deposable income for SOBs and JSBs, given their nationwide business line; and local average disposable income for CCBs, considering their local market focus. In addition, urban disposable income is log transformed in order to avoid heteroscedasticity problem.

Urbanization is an important factor of our interests that may drive the movement of mortgage credits. Over the past decade, China has experienced a dramatic process of industrialization and urbanization. And Comparing with industrialization, China's urbanization has developed more rapidly. (Zheng et al. 2007). More and more new internal immigrants moved from the countryside to cities. We use the percentage of urban population to the total population as the measure of urbanization process. Taking into account more potential home buyers, as the effect of socio-demographic change, a positive impact of urbanization on mortgage loans is expected.

4.3 Bank specific variables

The interest rate, which is an indicator of monetary policy, is another widely accepted variable to estimate housing prices.7 A declining interest rate environment contributes to the increasing demand for real estate and housing investment. (Greenand Shoven1986; Kearl1979; Tsatsaronis and Zhu 2004;). In order to capture the heterogeneity among banks, we employ the interest margin of individual bank, which is more influenced by the interest rate policy, to proxy this variable. It is calculated as the ratio of the interest revenues over total interest bearing assets. In terms of Chinese housing market, Liang and Cao (2007) suggest that the property price movements have no sensitivity to the change of the real interest rate. We reinvestigate to what extend the raising interest rate can affect the mortgage credits and property prices.

The required reserves are the deposits of commercial banks in the form of reserves at the central bank. Over the past decade, along with the soaring property prices and mortgage credit boom, the central bank has raised the required reserve ratio several times, from 6% in 1999 to over 20% in 2011. It is regarded as another frequently used monetary policy other than the interest rate in China. We explore whether the change of banks' required reserves has an impact on the movements of property prices and mortgage loans. And we will compare the real effects of rising interest rate and required reserve ratio.

Loan_to_asset ratio is an important measure of balance sheet risk of individual banks. Since the bank cannot grant credit at all costs, they need to conduct credit audit and monitoring effectively in order to maintain low levels of non-performing loans and increase margins. (Abreu and Mendes 2001) In spite of a positive relationship between Loan to deposit ratio and bank profitability, a high loan to deposit ratio is a warning sign of banks' loan risk and then discourage the credit expansion. In order to reduce simultaneity, one period lagged Loan_to_asset ratio is used to capture the real effects of banks' risk taking behavior. NIM is referred to as the net yield on interest-earning assets and an indicator of profitability of a bank's lending activities.8 In addition, NIM is also a proxy of bank performance and profitability for Chinese banking sector. (Matthews 2009) We would like to test the favor of individual banks on mortgage profits.

4.4 Property Prices as Explanatory Variables

The growth of four different property prices is employed in the empirical framework. They are condominium price, the average real estate price and an indicator of the whole property market; residential price, the indicator of solo residential market; high_grade houses price, a measure of luxury and high-end real estate market; and economic houses price, the price of affordable houses for low-and-medium income households. Crone and Voith(1992) compare five popular methods to estimate the housing price. They suggest that the mean sales price is least affected by the sample size and more accurate than other estimating methods. We investigate the impacts of different price measures on the change of mortgage loans separately. The same as disposable income and mortgage outstanding,

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[7]Hofmann (2003) concludes that real interest rate is more closely associated with property prices than with bank lending. Wolswijk (2006) and Égertand Mihaljek (2007) find the negative effect of interest rate on housing prices.

[8] Hanweck and Ryu (2005) capture NIM dynamics in response to unanticipated credit, and find negative relationship between NIM and expected credit loss.

property prices are converted to logarithm form in order to avoid heteroscedasticity problem.

5 Results

5.1 Panel Granger Causality Test

Table 2 reports the results of Granger causality between Property Price and Mortgage loans, with Fixed Effect, Arellano-Bond one-step and two-step system GMM estimators. In spite of the short-run (first-order lagged price) negative effects, we find positive and significant impacts of property prices on the mortgage lending in a long run (proxied by the second-order lagged price) and vice versa. Through Sargan and Arellano-Bond tests, the estimation cannot reject the non-over-identifying and non second-order autocorrelation hypothesis. The rejection of $\beta 1+\beta 2=0$ confirms the evidence of long run effects for both estimations. In general, the results above provide some evidence that the mortgage lending and property prices have long-run positive impacts on each other. In the next part, we will investigate the determinants of mortgage lending and property prices, while taking into account other control variables.

Table 2: Granger Causality estimation of Property Price to Mortgage lending

	Mortgage		
	Fixed Effect method	Arellano-Bond one-step GMM	Arellano-Bond two-step GMM
Mortgage (-1)	0.3918***	0.3215***	0.2425***
	(3.20)	(3.10)	(2.66)
Mortgage (-2)	0.1326	0.1804**	0.2036***
	(1.26)	(2.59)	(3.88)
Condominium (-1)	-1.0347***	-1.0062***	-0.8153***
	(-3.65)	(-4.33)	(-6.11)
Condominium (-2)	1.5454***	1.5589***	1.5717***
	(7.18)	(8.83)	(15.71)
Observations	81	53	53
Wald Chi2 (*p*-value)	N/A	0.00	0.00
Sargan test (*p*-value)	N/A	0.07	0.99
AR(1) (*p*-value)	N/A	N/A	0.05
AR(2) (*p*-value)	N/A	N/A	0.23
Test of $\beta_1+\beta_2=0$ (*p*-value)	0.01	0.00	0.00

Note: The condominium price is employed as the representative of average property price. AR(1) and AR(2) are first- and second-order autocorrelation tests. They are only applied to the two-step GMM estimation. The "long-run effect" is tested under the null hypothesis that $\beta_1+\beta_2=0$. Standard errors are reported in Parenthesis, * p<0.10, ** p<0.05, *** p<0.01. Constant terms are not shown in the table.

The determinants of mortgage loan are illustrated in table 3. Our results so far suggest that the volume of outstanding mortgage loans increases with housing prices expect for the economic housing market. This finding is not surprising and in line with most recent

evidence of developed countries. However, we find the elasticity of condominium (and residential) price to mortgage credits is around 1.7, which is much higher than that of other countries.[9] It reflects a higher dependence of property market on the mortgage loans in China. The condominium and residential prices illustrate a similar impact on the mortgage lending. It is simply because after the housing reformation in 1998, there is no work unit is allowed to provide welfare houses to employees. As a result, the fully market-oriented residential houses contribute to the majority of condominium supply in housing market, and their prices also follows similar movements. On the other hand, we find a contrary result for the economical house price, which has a negative impact on mortgage movements. Since the economic houses focus on the market of low & medium income households and internal migrants, the increasing price will weaken the affordability of some potential buyers and vice versa. The fallen price is favored by more potential buyers, most of whom need to rely on the mortgage loans to finance their house occupation.

Table 3: The determinants of Mortgage lending

	(1) mortgage	(2) mortgage	(3) mortgage	(4) mortgage
Condominium	1.728***	-	-	-
price	(4.94)	-	-	-
Residencial	-	1.817***	-	-
price	-	(5.76)	-	-
High_grade	-	-	0.542**	-
price	-	-	(2.04)	-
Economical	-	-	-	-20.12**
price	-	-	-	(-2.14)
Urbanization	4.613**	4.085**	6.306***	41.22**
	(2.47)	(2.27)	(3.18)	(2.30)
Intere rate	0.441**	0.488***	0.226	0.485
	(2.29)	(2.65)	(1.10)	(0.73)
CPI	-1.335	-1.308	-2.625*	-20.60**
	(-0.97)	(-0.99)	(-1.78)	(-2.12)
NIM	0.176	0.237	-0.0139	1.239
	(1.13)	(1.58)	(-0.09)	(1.57)
Loan_To_Deposit	0.0895	0.0579	0.0691	-0.241
ratio	(0.31)	(0.21)	(0.22)	(-0.24)
Required Reserves	-0.245*	-0.303**	0.0385	1.118*
	(-1.81)	(-2.33)	(0.28)	(1.96)
N	78	78	78	73

Note: *t* statistics in parentheses: * p<0.10, ** p<0.05, *** p<0.01

[9]The impact of housing price on mortgage credits is tested to be 0.5 for Ireland, 0.62 for Spain and 0.75 for European Area. (Fitzpatrick and McQuinn 2007; CarboValverde and Francisco Rodriguez 2010; Annett 2005)

6 Conclusions

We use a bank level mortgage data and panel data approach to gain insight in the factors which determine the growth of mortgage lending and housing prices. We first investigate the relationship between mortgage and property prices using Granger Causality test. A positive long-run relationship between these two variables is found within the Granger causality framework. Then we use Two-Stage Least Squared/Instrumental Variable approach to investigate the determinants of mortgage lending and property prices, while taking into account other control variables. The results suggest a close relationship between housing prices and mortgage credits. We document a positive impact of urbanization on the growth of mortgage lending. In terms of monetary policy, we find negative effects of required reserves on the change of mortgage credits and the interest rate on property prices, but not vice versa. Our findings have important policy implications and account for the existing monetary policies which are implemented in China. The policymaker should raise the bank reserve to control the mortgage credit boom and imply the interest rates to temper property prices.

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