Financial Liberalisation and House Prices: Evidence from China*

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Abstract

I investigate whether financial liberalisation can causally impact the Chinese real estate market, with the 2008 US financial crisis providing exogenous variation in credit supply. Using the cross-sectional variation in foreign banks' establishment and asset value, I document that cities with a higher level of financial openness have more volatile property price movements. I also show that the growth drops in the property price in 2008 are larger for cities with higher withdrawal or exit rates of overseas banks. The evidence suggests a credit supply channel. Further analyses show that the negative effect of financial liberalisation on the house price growth rate is more pronounced for more geographically constrained cities.

Keywords: Real Estate Market, House Prices, Financial Liberalisation, Foreign Banks, Credit Channel

JEL Classification: G21, G28, R21, R31:

1 Introduction

Since the 1990s, global investors have been seeking investment opportunities in emerging real estate markets. China, with the world's largest population of 1.3 billion, has conducted aggressive economic liberalisation and market reforms since 1978 and successfully positioned itself as the second largest economy in the world. One key milestone in China's market transformation is the commercialisation of its real estate market from 1998 to 2001. While the property sector is nascent with less than two decades' history, it is growing rapidly and attracting attention from international investors.

Figure 1 displays the average sale prices of houses in China from 2000 to 2014, as well as the Standard & Poor's Case-Shiller composite home price index for 10 major US metropolitan cities. China's property prices have maintained a strong and dazzling upward trend, displaying an 8% annual growth rate, from 2112 Yuan per square metre (Yuan/sq.m) in 2000 to 6793 Yuan/sq.m in 2014.[1] In comparison, US house prices only increased by 3.4% per year. Nevertheless, during the 2008 US financial crisis, China's real estate market experienced a downward price adjustment for the first time, with a negative real growth rate of 1.6%.

In the wake of the subprime financial crisis, there has been considerable debate over the role of foreign money in explaining the dramatic booms-busts pattern in real estate prices around the world.[2] Will this also be the story that applies to China's housing market in the 2000s?

My paper contributes to this important area of research by investigating the causal impact of financial liberalisation on China's real estate market. In particular, I use information on the establishment of foreign banks' branches and asset value as indicators of financial

[1] Yuan is the basic unit of the official currency of China, which is Renminbi (RMB).

[2] See, for example, "The role of overseas investors in the London new-build resident market," *British Politics and Policy at LSE*, 15 June 2017, "The real cause of the America's housing bubble was foreign money," *The Financial Times*, 2 October 2017, "Real estate goes global," *The New Yorker*, 26 May 2014.

liberalisation. I exploit the 2008 US financial crisis as an exogenous shock that negatively affected foreign banks' operations in China. In theory, such a negative funding shock increases the real cost of financial intermediation and reduces borrowers' access to credit for real estate investment (Favilukis, Kohn, Ludvigson, and Van Nieuwerburgh, 2012; Jack, Ludvigson, and Stijn, 2017). The cross-sectional variation in the exposure to this 'externally' identified shock is captured by the degrees of financial liberalisation across different cities. Indeed, I show that cities which are more financially liberalised have more volatile property price movements. In particular, I document that cities with a higher level of financial openness experienced worse property price growth drops during the Great Recession. Despite the limited market share of foreign banks in China, which represented only 2.38% of the country's total banking assets in 2007 (CBRC, 2008), the economic impact of foreign banks' presence on the real estate market is surprisingly large and significant. On average, a city that was at the 75^{th} percentile of the pre-crisis bank asset distribution suffered an additional 2.04% drop in the property price growth rate in 2008, compared to a city that is at the 25^{th} percentile of that distribution.[3] Arguably, it is not likely that such a negative shock to foreign banks was caused by deteriorating local economic conditions, given that the average GDP growth of China was 10.3% for the first 6 months of 2008. I also provide evidence that this identified effect is not biased by factors such as the city size.

I argue there are three reasons why foreign banks have such a significant impact on China's real estate market. First, due to regulation restrictions and limited financial liberalisation before 2006, foreign banks are the primary channel for cross-borderer transactions between overseas investors and domestic property sellers. Second, foreign banks actively take over and merge large real estate developers in order to directly participate in the local property market. Third, foreign banks are marginal lenders in China and provide foreign currency mortgage with competitive terms, especially for overseas investors and corporations. Furthermore, the

[3]It is 1.442% when using the establishment of foreign bank branches.

foreign currency mortgage rates are not controlled by the People's Bank of China (PBOC).[4]

Since China joined the World Trade Organization (WTO) in 2001, overseas individuals and corporations have been pouring investments into the mainland, thanks to rapid domestic economic growth and the steady revaluation of RMB. The total value of Foreign Direct Investment (FDI) rose by 20% in 2002 against 2001 and immediately made China the largest host for FDI inflows in the world. Owning to tight capital controls on cross-border portfolio flows, foreign investors are not allowed to trade RMB-denominated financial assets (i.e., stocks and bonds) in China by themselves.[5] On the other hand, the central government terminated the restrictions on foreign ownership of domestic real estate in 2001, promoting overseas investments in property development and real estate sales (Gong and So, 2003).[6] This made the real estate sector the second largest receipt industry for foreign investments, right behind the manufacturing sector. The average annual growth rate of FDI in the property market was 20% from 2000 to 2007.[7]

As a result, foreign investors have become an important part of China's property market over the years. According to the State Administration of Foreign Exchange office, overseas investments accounted for 15% of overall real estate investments in 2005.[8] This ratio is considerably high globally. It is larger, for example, than a share of 13% of overseas buyers in London's private housing market in 2017 (Scanlon, Whitehead, and Blanc, 2017).[9] According to the same authority, the proportion of overseas buyers is even higher in first-tier and

[4]The People's Bank of China is the nation's central bank.

[5]Since 2002, foreign investors were allowed to trade financial assets via the "qualified foreign institutional investors " (QFIIs), who are licensed foreign institutional investors licensed to invest in the RMB denominated capital market. The license certification organisation is the Chinese Securities Regulatory Committee (CSRC).

[6]Before 2001, there were two classes of property: one for local resident sales only, and one for 'overseas' sales with extra costs on the land for non-domestic usage. This differentiation was removed in 2001. This made all properties in China equally accessible to both local and foreign developers and buyers.

[7]See the *Foreign Investment in China Report* published by the Ministry of Commerce of the PRC (in Chinese): http://www.mofcom.gov.cn/article/zhengcejd/bq/200511/20051100776203.shtml

[8]See, for example, http://theory.people.com.cn/GB/49154/49155/4496324.html (in Chinese).

[9]Also see: http://blogs.lse.ac.uk/politicsandpolicy/what-is-the-role-of-overseas-investors-in-the-london-new-build-residential-market/.

capital cities, such as Shanghai, Beijing and Shenzhen. For example, the ratio of property transactions carried out by foreign individuals and institutions in Shanghai was 23.2% in 2004, increased dramatically from 8.3% in 2003.[10] The total amount of foreign money flowing into the real estate market in Shanghai alone exceeded 22.2 billion RMB for the first 11 months in 2004, an increase of 13.5% from the previous year. 15 billion RMB was invested in the development sector, constituting 12.8% of the city's total investment, while 7.2 billion RMB was used for direct property purchases, concentrating on high-end and luxury apartments and buildings (Zhang and Sun, 2006). As a result, various authorities share the concern that such massive foreign money can cause bubbles in China's real estate market in the mid 2000s (Tian and Gallagher, 2015).

There are two main channels for foreign individuals and institutions to invest in China's real estate market. First, they can directly purchase residential and commercial real estate properties, via either cross-border monetary transactions or mortgage loans. Second, overseas institutional investors often engage in real estate development activities by establishing sole-funded or sino-foreign property development companies and trusts through strategic actions such as takeovers, mergers and acquisitions of large local real estate developers.[11] In both channels, foreign banks play a crucial role in facilitating and accomplishing these transactions.

Firstly, foreign banks are the primary players in China's interbank foreign exchange market, accounting for almost half of participating banks.[12] They are essential for cross-border transactions between overseas investors and local corporations, for example, a UK investor purchased a property in Shanghai and made a direct monetary payment from London. Banks such as HSBC that have branches in China would charge this UK investor a lower service fee,

[10] See the report published by the Financial Market Department of PBOC (in Chinese): http://www.pbc.gov.cn/jinrongshichangsi/147160/index.html.

[11] See, for example, "Foreign Investment in Chinese Real Estate Market" *Sohu Finance*, 27 September 2005 (in Chinese), Xu and Chen (2012) and Wang, Wang, Cui, and Dong (2009).

[12] 179 of 366 banks in the interbank foreign exchange market are overseas banks, according to statistics released by SAFE in 2005.

and would provide faster and more efficient transaction services, in comparison to banks such as NatWest which has no branches in China.[13] Secondly, foreign banks have been aggressively taking over and acquiring local property developers, as well as establishing real estate trusts since 2003, including Morgan Stanley, Macquarie Group, Goldman Sachs, UBS, ING, Bank of America etc. (Huang, 2008). For example, Morgan Stanley purchased the Beijing Tower II office building from Chinese developer R&F Properties with 0.4 billion RMB in April 2005. Later in September, it acquired the Shanghai Jin Mao Tower with $900 million and the Shanghai Tomorrow Square of 3.2 billion RMB. In May 2006, Deutsche Bank spent 0.4 billion RMB on a 175-villa buy-to-let investment in Beijing. Thirdly, foreign banks provide competitive foreign currency mortgage loans to overseas investors in China. For example, in 2003, 15% of the purchases of the Beijing SOHO Resident Property were financed through mortgage loans issued by foreign banks, with a HK-based mortgage rate between 2.5% and 3% and a USD-based rate of 3%.[14] Meanwhile, the RMB mortgage rate provided by domestic banks was 5.76%, which later increased 8 times to 7.83% due to the tightening credit policy of the central bank (Xu and Chen, 2012). A survey conducted by Pwc in 2005 showed that mortgage loans became increasingly important for foreign banks' operations in China. They contribute to approximately 30% of overall business operations for banks such as the Bank of East Asia (Huang, 2008).

Based on the above reasoning, I argue that foreign banks are a crucial facility that channels foreign money into China's real estate market, either directly transferring and investing capital or providing credit loans. Figure 2 displays the geographic location of overseas banks across the mainland in 2006. They cluster in cities that are more economically and financially open in order to facilitate cross-border transactions. These (more economically openned) cities have greater demands for housing, warehouses or factories. To avoid the exchange risk, overseas investors and corporations opt for foreign currency mortgage loans

[13] This is based on the author's discussions with various commercial bank representatives in the UK.
[14] See http://bj.leju.com/n/2003-09-18/28615.html (in Chinese).

issued by foreign banks. The presence of overseas banks immediately represents a higher demand for buildings, office spaces and property investments, as well as large development projects. Ultimately, all of the above contribute to pushing up local property prices.

When the US financial crisis 2008 negatively affected the home country operations of various foreign investors and banks, the reversal of capital flows negatively affected the foreign funding of real estate investments in China. Cities with more foreign banks are expected to be more greatly exposed to this negative funding shock.[15] For instance, these cities are more financially liberalised with efficient and effective cross-border transaction facilities. As a result, the extraction of foreign money would be larger and faster in these locations. Moreover, direct withdrawal and exit decisions by various foreign banks during the crisis can be perceived as direct drops in foreign capital and credit (ABN AMRO, MUFG and CitiBank for example).

Figure 3 plots the time series of foreign investment in enterprises for real estate development from 2001 to 2014. Figure 4 plots the time series of such foreign investment in the real estate sector as a proportion of local GDP value.[16] In both figures, the red dashed line is the average value of foreign real estate investment (as the proportion of GDP in Figure 4) across cities that are more financially liberalised. That is, in these cities the number of foreign bank branches exceed the 75^{th} percentile of the variable's cross-sectional distribution in 2007.[17] The blue solid line is the average amount of foreign investment in the real estate

[15]It is not likely that such a negative shock to foreign banks was caused by deteriorating local economic conditions, given that the average GDP growth rate of China was as high as 10.6% in the first quarter of 2008. See section 5.3 for further discussion.

[16]The foreign investment refers to overseas funds received during the reference period, including foreign borrowings (loans from foreign governments and international financial institutions, export credit, commercial loans from foreign banks, issue of bonds and stock overseas), foreign direct investment and other foreign investments. It excludes capital in foreign exchanges owned and retained by enterprises, central and local governments. The data source is the National Bureau of Statistics of China.

[17]To clarify, I construct the cross-sectional distribution of the number of foreign bank branches in 2007. The cities in the top 25^{th} percentile of this distribution are considered as more financially liberalised. And the cities in the lower 25^{th} percentile of this distribution are considered as less or not at all financially liberalised. I then take the average value of foreign investment in real estate across the cities that are classified as more (or less) financially liberalised. The same steps apply when using the cross-sectional distribution of foreign banks' asset value in 2007.

(as the proportion of GDP in Figure 4) across cities with no establishment of foreign bank branches by the end of 2007 (i.e., below the 25^{th} percentile of the 2007's cross-sectional distribution).[18] It is clear that foreign investment in cities with overseas banks is much higher and more volatile over time. This is expected because foreign banks facilitate cross-border transactions. In particular, these cities experienced much stronger growth rates in overseas investment in real estate before 2008, but also larger drops during the financial crisis. Assuming that these foreign real estate investments were primarily channelled to China via foreign banks, cities with more overseas banks should experience larger growth drops in the local property market during the Great Recession.

Indeed, I show that cities which are more financially open have more volatile property price movements. The findings are statistically and economically significant across various rigorous econometric settings. In this sense, my paper is directly linked to the work by Favilukis, Kohn, Ludvigson, and Van Nieuwerburgh (2012); Jack, Ludvigson, and Stijn (2017). They argue for a causal impact of financial liberalisation on house prices in the US. In my paper, the process refers to the deregulation process of China's banking sector, in opening up its local currency business towards foreign financial institutions. The presence of foreign banks in China, as a result, makes it less costly for real estate market investment, either by facilitating foreign demand (Badarinza and Ramadorai, 2017) or providing additional credit to investors.

Furthermore, my paper contributes to the literature on the role of international banks as an important source of contagion during the periods of international capital reversal (Paravisini, Rappoport, Schnabl, and Wolfenzon, 2015; Cetorelli and Goldberg, 2011, 2012; Tripathy, 2016). I show that the presence of foreign banks in China exposes the host city to external shocks that affect the business of these international banks. Furthermore, my placebo tests show that foreign demand alone cannot adequately explain the house price

[18]For all the figures reported in this paper, I separate the cities based on the cross-sectional distribution of the 2007 establishment of foreign bank branches. For all figures, the same patterns hold when I separate the cities using the foreign bank's asset value as the indicator.

growth reversals. Nevertheless, I find that the growth drops in the property prices in 2008 were larger for cities with higher withdrawal or exit rates of overseas banks. The overall evidence suggests that this impact occurs via a credit supply channel. To a certain extent, this paper is related to studies on the causal impact of credit supply on real estate price (Mian and Sufi, 2009, 2011; Glaeser, Gottlieb, and Gyourko, 2013; Favara and Imbs, 2015).

This study also relates to the research on the geographic determinants of house prices (Saiz, 2010; Gyourko, Saiz, and Summers, 2008; Glaeser and Ward, 2009; Kiyotaki, Michaelides, and Nikolov, 2011; Mian and Sufi, 2014). I construct a land unavailability measure to capture the exogenously determined geographic constraints across different Chinese cities. I use them in a triple difference-in-difference regression. I show that cities that are more geographically constrained have more expensive property prices; and experienced a worse amplified negative effect of financial liberalisation on the local real estate market during the crisis.

Finally, my work contributes to the burgeoning literature on the determinants of China's real estate price (Glaeser, Huang, Ma, and Shleifer, 2017; Fang, Gu, Zhou, and Wei, 2016; Wu, Deng, and Liu, 2014; Deng, Gyourko, and Wu, 2014).[19] My study distinguishes from these papers in two aspects. First, I document a causal factor, namely financial liberalisation, and show it drives house price movements during the most recent financial crisis. Second, I investigate the role of foreign banks in China's real estate market and provide consistent evidence that the presence of overseas banking institutions indeed has a strong impact on the local property price growth. My findings have important implications for policy and regulation making. In particular, China is currently considering opening its capital account and committing to achieve complete liberalisation by 2020. This implies that foreign banks would play a significant role in facilitating cross-border portfolios and direct investments in the future. Given the findings in this paper, the government should consider a more rigorous paradigm on financial liberalisation, and prudential crisis management plans when facing

[19] Also see Wu, Feng, and Li (2015); Wang, Wang, Cui, and Dong (2009); Xu and Chen (2012); Mengkui (2008); Tian and Gallagher (2015); Chen, Liu, Xiong, and Zhou (2017)

severe international capital reversals.

The rest of this paper is organised as follows. Section 2 explains the identification strategy and presents the hypotheses. Section 3 describes the data and presents the summary statistics. Section 4 describes the empirical regression setting. Section 5 discusses the empirical findings discussion and explores numerous robustness checks and placebo tests. Section 6 considers the impact of land unavailability. Section 7 concludes.

2 Hypotheses Development

2.1 Financial Liberalisation

Recent studies show that financial liberalisation and international capital flows can partially explain the dramatic boom-bust pattern in US real estate prices (Favilukis, Kohn, Ludvigson, and Van Nieuwerburgh, 2012; Jack, Ludvigson, and Stijn, 2017). The term 'financial liberalisation' means an outward shift in the broad availability of credit, which can be caused by a relaxation of credit constraints and/or a decline in housing-related financial transactions costs. Both make it less costly to borrow against mortgage. Conversely, the reversal of financial liberalisation increases borrowing costs and might cause a housing bust.[20]

In this paper, I exploit the financial deregulation process conducted by China's central government in opening up its banking sector to foreign financial institutions. Since 2001 when the country joined the WTO, the public authority accelerated the pace of liberalisation in its banking industry, by gradually lifting geographical and customer restrictions on foreign banking institutions. In 2001, Shanghai, Shenzhen, Tianjin and Dalian were the only four cities allowing foreign banks to conduct RMB business. This was expanded to foreign banks located in Guangzhou, Zhuhai, Qingdao, Nanjing and Wuhan in 2002; Jinan, Fuzhou, Chengdu and Chongqing in 2003; Kunming, Beijing, Xiamen, Shenyang and Xi'an in 2004;

[20] A large group of literature shows that credit supply has a causal impact on real estate price movement, including Mian and Sufi (2009, 2010, 2014); Favara and Imbs (2015).

and Shantou, Ningbo, Harbin, Changchun, Lanzhou, Yinchuan, and Nanning in 2005. On 11 December 2006, China removed all geographical, customer and product restrictions on foreign banking institutions' operations, honouring its commitments to the WTO. This was accompanied by the removal of all non-prudential market access restrictions such as ownership and juristic form requirements. The complete deregulation of 2006 meant that foreign banks were granted full access to the Chinese market. As shown in Figure 2, we observe foreign banks tend to cluster in cities that are relatively financially liberalised by regulation.

Therefore, I collect information on the geographic distribution of foreign banks and use it to measure the cross-sectional variations in the levels of financial liberalisation across different cities. The detailed information includes the number of overseas bank branches and the total asset value for a particular city prior to the financial crisis.[21] For illustration, a higher number of overseas banks channels more foreign capital into the local real estate market at lower transaction costs, as well as providing local residents and corporations with additional access to credit. As a result, there is more capital available in the market for real estate investment, shifting the credit supply to the right (outward).[22] And such shift is larger for more financially opened cities. In turn, these cities enjoy larger price appreciation in the local property markets.

However, credit availability can also change in response to local demand shocks rather than supply, such as economic conditions and house price growths. For this reason, I identify the 2008 US financial crisis as an exogenous shock that negatively affected international banks' operations in mainland China. The differential levels of financial liberalisation capture the cross-sectional variations in the exposure to this negative shock on foreign banks. If financial liberalisation has a causal impact on real estate prices, cities that are more financially open should, in theory, experience worse property price depreciation during the Great

[21] As explained later, the foreign bank branch category includes incorporations, branches and sub-branches, in order to distinguish from the representative office category.

[22] That is, more foreign money makes it easier to invest in the real estate market, either by direct investment or by easier access to credit.

Recession.

H1: The real estate markets of cities that are more financially liberalised experience a larger price appreciation prior to the financial crisis and a more severe price depreciation during the Great Recession of 2008, that is, a more volatile real estate price movement.

When measuring the degree of financial liberalisation prior to the crisis, I use two indicators, namely, 1) the number of foreign bank branches; and 2) the total asset value of foreign banks for a individual city i by 2007. In particular, the branch category includes foreign bank incorporations, branches and sub-branches.

In legal terms, an incorporated foreign bank is considered to be an independent legal personal entity and it obeys regulations in China, whilst a branch or a sub-branch represents a subsidiary of the foreign bank overseas. The key difference in the business operation scope between the two is that an incorporation can issue credit cards, whilst the branch cannot.[23] The registration system was reformed in December 2006, when 11 international banks were immediately granted the right to transform main branches into legal incorporations.[24] This allows me to collect detailed information on the asset value of incorporated foreign banks and their branch locations by reviewing their annual reports. Both branch and incorporation of foreign banks can perform profitable business operations, such as issuing mortgage loans to local households and firms, and conducting direct investment and merger and acquisition activities.

There is a third legal format known as the representative office of overseas banks. By regulation, the representative office cannot operate direct banking services. They can only liaise between local investors and the parent banks in the home country. They also facilitate

[23]There is a lower bound in the RMB deposit amount that a foreign bank branch can intake, but no limits for the incorporations.

[24]See http://www.fdi.gov.cn/1800000121_23_71991_0_7.html

cross-border transactions, providing funding for international trade and business loans under the name of their parent banks. They cannot accept deposits from local residents or provide credit loans to them.

Therefore, in comparison to representative offices, foreign bank incorporations and branches provide capital for real estate investment directly (either invest themselves or transfer foreign money), and issue mortgage loans to borrowers. On the other side, the representative offices sever for foreign real estate investment demands from overseas investors. To distinguish from a pure foreign demand channel, I define the branch category, which includes foreign bank incorporations, branches and sub-branches. I use this branch indicator together with the foreign banks' asset value to measure the level of financial liberalisation across different cities.[25]

Figure 5 provides a preliminary illustration of my identification method. It plots the time series of the average real price of commercial property from 2001 to 2014 across cities with a high level of financial openness, which is the red dashed line, against the average real price across cities that are less financially liberalised, as shown in the blue solid line. As mentioned before, more financially opened cities are those that have foreign bank branch observations of year 2007 lie in the top 25 percentile of the variable's cross-sectional distribution (i.e., a value of 7). As a result, these cities were more sensitive to the financial crisis, in comparison to cities with no foreign branch involvement by 2007 (i.e., lie in the lower 25 percentile of the distribution, which is 0). Figure 5 shows a level difference in the average property real prices between the two groups of cities. In comparison to the average real price across with zero foreign bank branches, the series in more financially liberalised cities is much higher, but also more volatile, illustrating a stronger appreciation prior to the crisis but a worse depreciation during the global financial turmoil.

My identification strategy also captures the within group variation. Figure 6 plots the

[25]Another consideration is the limited data observations, if I separate the incorporations from the branches. The two should have differential economic impacts in the long run. But the limited time length between the regulation reform and the crisis makes it less of a concern.

time series of the real property prices for Shenzhen versus Beijing for the sample period. Both cities are first-tier cities with a strong economic performance. In comparison to Shenzhen, Beijing has the lowest foreign bank branches relative to the representative offices (see Table 4). As discussed earlier, foreign banks branches have an additional function as a direct credit supplier, in comparison to representative offices. In this sense, Shenzhen, who has the highest branch number against representative offices, is considered to be more exposed to financial crisis than Beijing, assuming that the underlying crisis propagation channel is a credit supply mechanism. As a result, Shenzhen's house price should illustrate a larger drop during the crisis, compared to the house price of Beijing. This is exactly what we observe in Figure 6. The differential property price movement between Beijing and Shenzhen, before and during the US financial crisis, supports my identification strategy and provides evidence for a credit supply channel.

2.2 Land Unavailability

As the most basic of all economic resources, land is fundamental to a country's economic development. Kiyotaki, Michaelides, and Nikolov (2011) show that land as an input to tangible asset production is more important than capital. This relative importance of land can intensify the impacts of labour productivity and interest rates on house prices. In most developing countries, land is not only the primary means of generating a livelihood, but also the main vehicle for investment, accumulating wealth, and transferring wealth between generations (Deinlnger and Binswanger, 1999). On the supply side of the property market, the price paid for acquiring the usage right to a piece of land serves as the primary cost for real estate developers and construction firms.

Land is the foundation for house construction. However, the supply of urban land is highly constrained by the regulations and geographical features of the location. The literature shows that the proportion of land that can be used for construction purposes has a direct impact on the elasticity of housing supply. Studies by Gyourko, Saiz, and Summers (2008) and

Glaeser and Ward (2009) find that regulations on land usage rights can partially explain the price variations in major US housing markets. Saiz (2010) collects satellite-generated data on the terrain elevation and presence of water areas in the US metropolitan areas to construct a precise measure of land unavailability. The measure captures the proportion of land that is not suitable for construction due to exogenous geographic features. The findings suggest that more geographically constrained cities display lower housing supply elasticities with respect to demand side shocks, and have more expensive housing prices.

Due to the limited data available on China's geography, a quasi-geographical constraint measure is constructed to capture land unavailability. Similar to Saiz (2010), this study focuses on the relative scarcity of land induced by predetermined geographic features such as oceans, lakes, mountains, and wetlands. In particular, the constrained land area is calculated as a sum of the following components: the area of afforested land, the area of wetlands and the area of agricultural land. The afforested land includes natural forest and man-made forest. The wetlands include natural wetlands such as coasts and seashores, rivers, lakes and marshland, as well as man-made wetlands. The land for agricultural usage is reported from the survey of 2008 and includes garden land, grazing land and pasture land. The unavailable/undeveloped land is the proportion of constrained land area over the administrative area of each city. More geographically constrained cities are expected to have more expensive house prices and lower house supply elasticities. Furthermore, the high supply inelasticity amplified the negative effect of credit contraction on the housing market during the US financial crisis.

H2: The property price of a more geographically constrained city is more expensive. Furthermore, such a city is more sensitive to negative funding shocks during crises. That is, cities that were more geographically constrained and more financially liberalised, suffered greater drops in property price growth during the US financial crisis.

3 Data and Summary Statistics

This section describes the dataset used in this paper, including information on Chinese house prices, the geographic distribution of foreign banks and other variables. It also explains the construction of other variable in detail and presents summary statistics.

3.1 Chinese House Prices

An ideal house price index should capture the accurate price variations of the same or comparable houses over time. Standard methodologies use either a hedonic price regression or the repeated sales method.[26] The nascent nature of China's property market means that there are relatively few repeated sales. Wu, Deng, and Liu (2014) adopt the hedonic regression method and construct the first multi-city constant-quality house price in China by using transaction data on newly-built homes. However, the issue with this method is that it requires detailed information on the implicit attributes of a transacted housing unit. Fang, Gu, Zhou, and Wei (2016) use a hybrid approach and construct house price indices for 120 large Chinese cities, based on detailed mortgage loan data.

Unfortunately, the information used in both aforementioned papers is private and not publicly available. Meanwhile, other available price indices for China have limited time series observations for the early 2000s.[27] In light of these considerations, I construct an average property price for 35 major cities using information published by the National Bureau of Statistics (NBS) of China.[28] As pointed out in Fang, Gu, Zhou, and Wei (2016), the

[26] The hedonic regression method regresses the house price on a series of variables which characterise the property unit, after controlling for the time effect. The second method is proposed and used by the Case and Shiller (1987)-repeated sale index. It does not require detailed house quality information, but assumes that such quality of housing remains constant over time.

[27] For example, the 70-city price indices started in 2006

[28] See http://data.stats.gov.cn/english/easyquery.htm?cn=E0105

NBS average price indices exhibit highly synchronised co-movement with their sophisticated hybrid price sequences. This ensures that my average price series can be used for measuring the fundamental fluctuations in the housing market.

The city-level average commercial property price is calculated by dividing its total transaction value by the total floor area of transacted areas in a given year for a given city.[29] The term 'commercial property' includes different property types such as residential buildings (i.e., affordable housing, villas and high-grade apartments), and non-residential commercial buildings (i.e., retail, office and business buildings). The average commercial property price is the transaction-value weighted average of the two categories. I then deflate the nominal value with the city's year-end Consumer Price Index (CPI) level to obtain the real price.[30] The data are collected from the China Real Estate Statistical Yearbooks.

Table 1 reports the summary statistics of the average transaction price of commercial property for 35 major Chinese cities except Lhasa, the Hong Kong Special Administration Region, the Macau Special Administration Region and Taiwan. The sample period is from 2000 to 2014. Columns 1 and 2 list the 35 cities and their respective provinces. There is at least one city in the sample for most provinces (except Tibet). For provinces such as Liaoning, Fujian, Zhejiang and Shandong, there are two cities, allowing for further analyses. These cities are scattered throughout the mainland, and demonstrate large cross-sectional variation. Together, they represent China's economic, geological, environmental and social diversity.

The summary statistics of the constructed average property price are reported in columns 3 to 6. The unit is Yuan per square metre. On average, first-tier cities, i.e., Beijing, Shanghai, Guangzhou and Shenzhen, are the group with the highest property prices. In particular, Shenzhen, as the first special economic zone established in 1980, has the highest average

[29] The formal term defined by the Chinese government is 'Commercialized Buildings'.

[30] In China, there is no city-wide or province-wide fixed based CPI. I obtain the year-end CPI of each city with previous year as base from the NBS and WIND China. City-level inflation rate is generated by the CPI minus 100.

property price of 11,042 Yuan/sq.m.[31] It is also the city with the highest volatile price movement, showing a standard deviation of 1,276. Furthermore, municipal cities near the south-east coast have higher and more volatile property prices, in comparison with capital cities in the inner regions of China. For example, Hangzhou and Xiamen have maximum property price observations of 11,805 and 11,398 Yuan/sq.m respectively. As shown in Figure 2, these cities host more foreign bank institutions and are considered to be more economically and financially open. In contrast, property prices for cities in the north-west region are much lower. Xining has the lowest real estate price of 2,048 Yuan/sq.m. It is the capital city of the Qinghai province, next to Tibet. Up to the time of writing, there is no single foreign bank in Xining.

Figure 7 plots the time series of average property prices for Shenzhen (red dashed line) versus Xining (blue solid line). Besides the significant difference in the average price level between the two, Shenzhen had a stronger boom and temporary bust pattern in its real estate market before and during the financial crisis of 2008. Nevertheless, there is much less price movement in Xining's property market.

3.2 The Foreign Bank Variable

To measure the level of financial liberalisation of each city, I collect data on the geographic distribution of foreign banks in China. Table 2 reports the list of incorporated overseas banks in the mainland, the city of each headquarter's location and the value equity capital at registration in billion RMB. Table 3 presents the list of branches of overseas banks (not necessarily incorporated at the time). The lists are constructed based on information from the China Banking Regulatory Commission's (CBRC) website and the Almanac of China's Finance and Banking for the years 2006 to 2008.

Table 4 reports the summary statistics of overseas banking institutions for each city in 2007. The total number of foreign banks is the sum of branches and representative offices,

[31] This is equivalent to 1,800 USD/sq.m at the 2014 year-end exchange rate of 0.163 USD per RMB.

wherein the branch category includes incorporation entities, branches, sub-branches. The second-to-last column reports the total asset value of foreign banks. In particular, only institutions under the branch category are entitled to list assets, not the representative offices. The data sources include the annual reports of incorporated foreign banks. As foreign banks have branches but no legal incorporations, annual reports of their holding company located in the homeland are used for relevant information. The accounting years covered are from 2006 to 2008. I cross-check the information with the entities listed in the almanac. I also report the year that the first branch was established in the last column.

By the end of 2007, foreign banks had established 547 operational institutions in China, including 309 branches (20 incorporations, 215 branches and 74 sub-branches) and 238 representative offices. The total amount of foreign banks' assets across the 35 cities was 1253.2 billion RMB.[32] Shanghai, Beijing, Shenzhen and Guangzhou are the four largest location hosts for foreign bank institutions. Shanghai alone had more than 200 overseas financial institutions established, accounting for more than half of the overall assets. 13 out of 35 cities had no foreign banks operating by the end of 2007. In terms of banks' home country origination, 167 institutions were set up by banks from Hong Kong, Macau, Taiwan and Singapore, 143 were from Asian countries such as South Korea, Japan and India, and 237 were from banks based in Europe and North America.

In order to determine whether the US financial crisis had affected foreign banks' operations in mainland China, I study the above-listed banks' strategic actions from January, 2007 to June, 2008.[33] First, I review the archive on the CBRC website and search for any filings regarding operations closure or capital (operational or equity) adjustments from foreign banks during the period. For example, Citibank filed for capital reduction across its branches at Shanghai, Beijing, Shenzhen, Guangzhou and Tianjin in 2007 by at least 25%

[32]This represents almost 100% total foreign banks' asset in China of 2007.

[33]The processing time of CBRC authorities is six months. This means that any public announcement issued before June 2008 can be still regarded as foreign banks' action in 2007

percent.[34] Second, I review the annual reports of the holding companies in their home countries for any 1) direct capital or asset transactions from Chinese subsidiaries to the home operation; 2) direct capital withdrawals from subsidiaries; and 3) any indication suggesting that the parent companies suffered from the financial crisis and stopped providing funding for overseas subsidiaries. For example, the Mitsubishi UFJ Financial Group 2008 annual report claims that MUFG failed to refinance impaired subordinated (mortgage-back) debt obligations with equally subordinated debt, which could reduce the holding firm's total regulatory capital and negatively affect its capital ratios. In the same report, MUFG further states that the Financial Services Agency could require the firm to take corrective actions including withdrawal from all international operations or suspensions of all or part of its business operations once its capital ratios fell below the required levels. Another direct example is the ABN AMRO Bank (China) Co.Ltd, which was only incorporated into China in the first month of 2007. However, due to the financial crisis, ABN AMRO was taken over by the Royal Bank of Scotland (RBS) in October 2007, forcing it to exit the mainland. [35]

I then count the number of foreign banks that satisfied the above conditions within each city. I divide that number by the total number of foreign banking institutions inside that city. I term this variable as '$CreditDrop_{i,2007}$' and use it for further analysis.

3.3 Land Constraint

As elaborated earlier in section 2, I construct a quasi-geographical constraint measure that is similar to the one used in Saiz (2010). I focus on the exogenously determined geographic conditions such as oceans, lakes, mountains, and wetlands. In particular, the constrained/unavailable land area is calculated as a sum of the following components: the area of afforested land, the area of wetlands, the area of water surface and the area of agricultural

[34] See http://www.cbrc.gov.cn/govView_02E9300BFBAD439EA23240E3643FCE0D.html (in Chinese).
[35] ABN AMRO Bank (China) Co.Ltd was liquidated. Now, ABN AMRO has only one branch in Shanghai.

land.[36] The afforested land includes natural forest and man-made forest. The wetlands include natural wetlands such as coasts and seashores, rivers, lakes and marshland, as well as man-made wetlands. The land for agricultural usage is reported from the survey of 2008 and includes garden land, grazing land and pasture land. All the data are collected from the China Land and Resources Statistical Yearbook. For the land information of a particular city, I collect the data from the statistic yearbooks of that city. The unavailable/undeveloped land is calculated as the proportion of constrained land area over the total administrative area of each city. I term such variable as '$LandUnava_i$'.

3.4 Other Variables

The study by Fang, Gu, Zhou, and Wei (2016) suggests that China's enormous house price appreciation is accompanied by an impressive growth in household incomes. The average annual real growth rate of households' disposable income was 9.0% from 2003 to 2013. The expectation of future income growth could partially explains the high demands for house and mortgage loans, even with a high mortgage down payment ratio. Nevertheless, another study by Glaeser, Huang, Ma, and Shleifer (2017) finds that household income cannot predict future real estate market movement, and claims that mortgage borrowers tend to have higher incomes in general. For robustness, I include the disposable income per capita of urban households. The data is collected from the China Statistic Yearbook for Regional Economy. The real disposable income per capita is calculated as the nominal disposable income per capita divided by the city-level CPI.

To control for local economic conditions, I calculate the real growth rate of GDP for each city. In addition, I include the real growth rate of the cost of buildings completed for real estate development for each city. It is used as a supply-side factor for construction costs.

[36] For a robustness check, I reconstruct the variable by removing the agricultural land. Local governments often purchase land from local farmers, converting the agricultural land to construction land.

The unit is Yuan/sq.m. The data source is the China Statistic Yearbook.

I calculate the 5-year real interest rate set by the central bank in order to consider the base rate for mortgage loan, which is the same rate across different cities.[37] As most foreign banks issue foreign currency mortgage loans, it is important to consider the value of RMB. I calculate the changes in the real exchange rate of the RMB against the USD. However, the nominal exchange rate was fixed in the early 2000s and was allowed to be semi-floating in 2005. Both the base rate and exchange rate variables lack cross-sectional variation and should reflect the fundamental structural changes in China's economy over time.

4 Empirical Framework

The main challenge in estimating the effect of changes in credit supply on property prices is that changes in the credit supply are highly endogenous. For example, the expectation of higher property price boosts the demand for real estate investment and mortgage loans. Because of the possibility of common shocks affecting both aggregate property price variation and credit supply, simple time series analysis does not allow us to derive precise inferences, or to attribute causality. Hence, estimations that are not based on a truly exogenous change in the credit supply will be biased. For this reason, I use the US financial crisis as an exogenous shock that negatively affected foreign banks' operations in China. I exploit a difference-in-difference specification to study the differential impacts of such a negative shock on the property price movements across different cities. The cross-sectional variations are linked to the degree of financial liberalisation of a specific city prior to the crisis. I regress the property growth rates in periods of crisis versus periods of non-crisis on a constructed treatment variable $Foreign\ Bank_{i,2007} * Crisis$. The crisis is a dummy of one for year 2008 and zero otherwise. As mentioned before, two measures are used for $Foreign\ Bank_{i,2007}$: a) the number of foreign bank branches and b) the asset value of foreign banks in city i by the

[37] Commercial banks of China do not enjoy complete freedom for setting the mortgage rates for their borrowers. They are allowed to tailor the mortgage loan by 20% and 30% around the base rate.

end of 2007.

Figure 8 plots the parallel trends in the average growth rates of property prices for cities in the treatment group versus the ones in the control group. Before the crisis, both groups had similar average growth trends in the local property market, especially for the years 2005 to 2008. The t-test of the difference in average property price growth rates between the treatment and control groups during the pre-treatment era is 0.036, which is not significantly different from zero.[38] Furthermore, the t-test on the difference in changes of growth rates across the two groups was 0.81 before the crisis, it was not significant either. The insignificant statistics of the pre-treatment period confirm the parallel trends assumption in applying a difference-in-difference setting (to the property price growth rates and to the changes in these growth rates).

During the crisis period of 2008, the average growth rate of the treatment group dropped by 136%, from 18.88% in 2007 to -0.08% in 2008. The growth rate decline in the control group was 58%, from 9.3% in 2007 to 3.9% in 2008. The cross-sectional difference between the two groups during the crisis period is statistically significant with a t-statistic of 3.47 with a P-value of 0.0019.

To gauge the unconditional impact of financial liberalisation, I first perform the difference-in-difference regression at a simple panel setting, without including any effects. The regression equation is given below.

$$\begin{aligned} \Delta ln\ house\ price_{i,t} &= \alpha_i Foreign\ Bank_{i,2007} + \delta_{2008} Crisis \\ &\quad + \beta Foreign\ Bank_{i,2007} * Crisis + \eta^k X^k_{i,t-1} + \psi + \epsilon_{i,t} \qquad (1) \\ Foreign\ Bank_{i,2007} &\in \{Branch\ Number_{i,2007}, Asset\ Value_{i,2007}\} \\ i \in \{1, ..., 35\}; &\quad t \in \{2001, ..., 2014\} \end{aligned}$$

The dependent variable of the equation (1) is the annual real growth rate of commercial

[38]The t-statistics are calculated with a 1-tail hypothesis, assuming two-group unequal variance type.

property prices for city i at year t. α_i captures the unconditional impact of foreign banks' presence on the local real estate market. δ_{2008} measures the time effect of the Great Recession. X^k are the control variables including the real growth rate of local GDP, income per capital and construction costs for city i at year $t-1$, as well as the real growth rate of the national mortgage base rate and the RMB exchange rate at year $t-1$. The coefficient β on the interaction term explains the changes in property prices of city i that are caused by the conditional impact of financial openness during the crisis. I also include the constant term ψ for the unconditional national-wide real estate market condition.

As shown in Figure 8, besides the vast difference in growth drop during the crisis, I also notice a significant difference in the trends of property growth levels between the treatment and control groups. One potential reason for this is the fact that cities with non-zero foreign bank indicators opened earlier towards the West, either endogenously or exogenously induced by government regulation. Hence, these cities illustrate higher levels of property growth. I, therefore, conduct the difference-in-difference specification with fixed effects. The regression setting is given in equation (2).

$$\Delta ln\ house\ price_{i,t} = \alpha_i + \delta_t + \beta Foreign\ Bank_{i,2007} * Crisis + \eta^k X^k_{i,t-1} + \epsilon_{i,t} \tag{2}$$
$$Foreign\ Bank_{i,2007} \in \{Branch\ Number_{i,2007}, Asset\ Value_{i,2007}\}$$
$$i \in \{1, ..., 35\}; \quad t \in \{2001, ..., 2014\}$$

α_i is the city dummy, controlling for all city-specific characteristics that are fixed over time. δ_t is the time dummy, controlling for all time-specific trend effects that are fixed across cities. All the other settings stay the same as equation (1). For all regressions conducted below, the standard errors are clustered at the city-level to produce heteroskedasticity-consistent estimations.

5 Empirical Findings

In this section, I describe the empirical findings from my estimation, beginning with a simple panel regression of equation (1).

5.1 Panel Regression

Table 5 show the estimates of coefficients from a simple panel regression specification to explain major Chinese cities' house prices. Columns 1 to 4 are the regression results when using the number of foreign bank branches in each city in 2007 as the indicator '$Foreign\ Bank_{i,2007}$', while columns 5 to 8 are the results when using the foreign banks' asset value in 2007. All standard errors are clustered at city level and are reported in the parentheses.

In the basic regression without any controls, column 1 (5) reports the estimates of α, δ and β. The presence of one additional foreign bank branch or an extra billion RMB bank assets positively contributes to a 0.03% house price appreciation with a significance level of 1%. Furthermore, it is not surprising that the crisis dummy negatively affects cross-sectional real estate price performance. Turning to the interaction term, β estimates have the correct negative signs. The economic scale of these coefficients are considerably large (i.e., -0.206 at 5% significance level when using the foreign bank branch number and -0.17 at 1% significance level when using the asset value in the regressions). This is, cities with 1 standard deviation increase in their levels of financial liberalisation, in terms of foreign branch establishments (bank assets), experienced larger declines in local property prices by 0.37 (0.24) standard deviation, during the crisis.

Moving ahead to columns 2-4 (6-8) of Table 5, I add control variables gradually, including the one-year lagged real growth rate of the local GDP, income per capita and construction costs for each city i. I also include the one-year lagged real growth rate of national base rate

or the RMB against the USD exchange rate separately.[39]

First, in all settings, the aforementioned unconditional effects of financial liberalisation on the local property price movement stay economically and statistically significant. The conditional negative impacts of foreign banks during the crisis interaction term also illustrate consistent robust significance, with a considerable economic impact on the local property market. The only case we observe a change in the sign or significance in the estimation is for the crisis variable when the base rate is included (columns 3 and 7). This is because, in 2008, the central bank reduced the base rate by 2% for the first time since 2000, responding to the US financial crisis. Overall, this simple difference-in-difference specification shows that a city with a higher exposure to foreign banks saw a greater volatility in the property price movement before and during the Great Recession.

Second, all control variables illustrate the correct signs with statistical significance. Better local economic conditions, in terms of higher real GDP growth and residential income, positively contribute to greater house price appreciation. As a supply-side factor, higher construction costs for real estate developers also increase property prices. Furthermore, a 1% increase in the base interest rate drives up borrowing costs and negatively affects the house price appreciation by 1.055%. The positive coefficient of exchange rate means that RMB appreciation correlates to positive real estate market performance. On average, the model has an adjust R-squared approximately of 10%.

5.2 Difference-in-Difference with Fixed Effects

As discussed in section 4, a simple difference-in-difference setting, such as the one used in section 5.1, fails to pick up the differential fixed trends between the financially liberalised group versus the non-liberalised group. Even if I argue that the government regulation 'exogenously' determined the geographic distribution of foreign banks prior to 2007, it is

[39]The base rate is the 5-year interest rate set by the Chinese central bank. The RMB exchange rate was fixed and set by the central bank. It was not until 2005 when the Chinese government set the nominal exchange of RMB as semi-floating.

still possible that the central government's choice of opening up a city is endogenously linked to the local funding needs. Hence, cities with more foreign banks can be endogenously different from the cities in the control group. To address this issue, I exploit the difference-in-difference specification with fixed effects to control for any changes in the property growths that resulted from city-specific trends in the local real estate markets.

Table 6 summarises the findings from equation (2). For both indicators of financial liberalisation (the number of foreign bank branches and the asset value), the results show a negative and significant estimate of β consistently across all 8 settings. The scales of β do not change much. One unit of foreign bank branches exposed the local property market of the financially liberalised city to an additional growth drop of 0.206% during the crisis, compared with the cities with no overseas bank establishment. Similarly, an extra billion RMB overseas bank assets negatively affected the local real estate price appreciation with a 0.17% drop in 2008.

In comparison to Table 5, I find that the causal impact of financial liberalisation is economically and statistically significant. It also illustrates persistent robustness in such a rigorous econometric setting. However, all of the control variables lost significance, confirming there is economically heteroskedasticity across Chinese cities. Nevertheless, the overall model goodness of fit improves with a higher adjusted R-square of 27%.

In summary, the empirical findings support the Hypothesis 1 that a more financial liberalised city experiences more volatile house price movement. In particular, such a city suffered a larger growth drop in the local real estate market during the Great Recession. On average, a city that was at the 75^{th} percentile of the pre-crisis bank asset distribution suffered an additional 2.04% drop in the property price growth rate in 2008, compared to a city that is at the 25^{th} percentile of that distribution.[40] The economic impact of foreign banks' presence on the real estate market is significantly important.

[40]It is 1.442% when using the establishment of foreign bank branches.

5.3 Robustness of the Results

A. Sub-Sample Regression: 2001-2009

The Great Recession started as the Sub-prime Mortgage Crisis in the US in late 2007 and it transformed into global turmoil right after the default of Lehman Brothers in September 2008. I set the crisis dummy to 1 for year 2008 only. This is reasonable in the sense that foreign banks are marginal lenders in the domestic real estate market. It might take time for the negative funding shock to propagate throughout these international banks' overseas operations and to generate reasonable impacts on the local economy. Such a temporary contraction of capital/credit in China, therefore, allows me to study the impact of credit supply on property prices. Furthermore, it is temporary given the fact that the Chinese government issued a 4 trillion economic stimulus plan in December 2008 with special focuses on the developments of real estate and construction sectors. Such a large amount of money immediately boosted the capital/credit supply for real estate investments.

However, since my data sample finishes in 2014, it is possible that the regressions pick up potential post-crisis events, which could drive the differential price movements cross-sectionally, for example, the national house purchase restriction orders issued by various local governments from 2010 to 2012. Cities with higher housing prices issued more constrained orders. Also these cities normally are more financially liberalised. Therefore, I perform sub-sample regressions of equation (2) with observations from 2001 to 2009 to omit such a concern.

Table 7 reports the estimation of β. Again, across all 8 regression settings, I observe a consistent negative impact of financial openness on the local house price growth in 2008. In comparison to the full-sample estimation in Table 6, the sub-sample coefficient β illustrates reinforced economical and statistical significances, with a larger negative scale of -0.237 when regressing with foreign bank branch and -0.209 when regressing with asset value.

B. The Endogeneity and Simultaneity Issues

Nevertheless, even controlling for the fixed effects, there are still potential endogeneity and simultaneity issues. That is, the property price and foreign bank credit can be jointly determined by an omitted factor. Bertrand, Duflo, and Mullainathan (2004) cast doubt on inferences drawn from difference-in-difference studies. They also recommend a variety of techniques to improve the inferences using such methods. To mitigate these concerns, I exploit three econometric techniques to ensure that my findings are robust.

First, I examine the 2008-2014 sub-sample period so that the cross-sectional distribution of foreign banks are considered as predetermined and as an exogenously fixed condition that varies across difference cities. That is, I consider the cross-sectional variations in the financial liberalisation as given, and only study the differential impacts on local property price growth during the crisis. By doing so, I overcome a potential simultaneity issue that local property prices and foreign bank locations were jointly caused by some omitted factors in another dimension during the pre-crisis period. The results are reported in Table 8. The estimation of β stays significantly negative across all 8 settings. The findings suggest that more financially liberalised cities are more sensitive to the exogenous negative shock in 2008 and illustrate larger house price growth drops.

Furthermore, the exchange rate of RMB was set to be semi-floating in 2005. As a result, the exchange rate variable started to show significant explanatory power in this sub-period sample. I also run same sub-sample regressions from the period 2007-2014 by using foreign bank observations at the end of 2006. The results stay consistently robust.

Second, I conduct a placebo test to address the endogenous issues that relate to the local economic conditions. In particular, I investigate the potential influence of city-size. Foreign banks opt for larger cities in order to gain a larger client-base and to serve a larger population. Meanwhile, due to a larger urban population and a higher level of local GDP, larger cities often have higher property prices, and hence higher demands for capital/credit to support investments. During the crisis, larger cities were expected to suffer more, either

due to the worsening local economic conditions or the transmission of the external crisis shock.

To capture such size-related local economic condition, I use the local real GDP growth level as a proxy. I continue with the difference-in-difference setting with fixed effects. The new specification is shown in equation (3).

$$\Delta ln\ house\ price_{i,t} = \alpha_i + \delta_t + \phi \Delta lnGDP_{i,2007} * Crisis + \gamma \Delta lnGDP_{i,t-1} + \epsilon_{i,t} \qquad (3)$$

The regression results are reported in Table 9. I report the regression results with the real GDP growth rates instead of the city-level GDP values for two reasons. First, I find that the GDP values are highly persistent over time. Second, in terms of coefficients' significances, the two variables give the exact same findings as illustrated in Table 9.

As shown in columns 1 and 2 in Table 9, the city size proxy variable is indeed statistically insignificant in terms of explaining the conditional house price movement during financial crisis. In columns 3-4 (5-6), I include the financial liberalisation treatment variable $Foreign\ Bank_{i,2007} * Crisis$. The results show a consistent negative and highly significant impact of financial liberalisation, whilst the local economic condition treatment variable $\Delta lnGDP_{i,2007} * Crisis$ stays insignificant. Interestingly, γ, the coefficient of local economic conditions, has a significant positive estimate, but only when the time fixed effects are not included (columns 1, 3 and 5).[41]

Third, I conduct another placebo test simulation using the randomisation inference testing method as suggested in Badarinza and Ramadorai (2017). In particular, I check whether the geographic distribution of foreign banks correctly captures the cross-sectional variations in exposure to the financial crisis. I construct a synthetic variable $Sim\ Foreign\ Bank_{\tilde{i},2007}$ by drawing (with replacement) from the set I for each city i. That is, I match the property price

[41] Alternatively, I conduct a similar placebo regression using the local import and export value over the local GDP level. This international trade variable measures the degree of economic openness for a particular city i at year 2007. I find similar results as in the Table 9. It suggests that the significant treatment effect is not biased by local economic condition such as the international trade.

growth in city i with the foreign bank exposure variable $Sim\ Foreign\ Bank_{\tilde{i},2007}$ from randomly selected other cities $\tilde{i} \neq i$. I then include the placebo variable $Sim\ Foreign\ Bank_{\tilde{i},2007}$ in the regression (2) and estimate the $\tilde{\beta}$. The specification is as below.

$$\Delta ln\ house\ price_{i,t} = \alpha_i + \delta_t + \tilde{\beta} Sim\ Foreign\ Bank_{\tilde{i},2007} * Crisis + \epsilon_{i,t} \tag{4}$$

$$Sim\ Foreign\ Bank_{\tilde{i},2007} \in \{Branch\ Number_{\tilde{i},2007}, Asset\ Value_{\tilde{i},2007}\}$$

$$\tilde{i} \in \{1, ..., 35\} \quad and \quad \tilde{i} \neq i, \quad t \in \{2001, ..., 2014\}$$

For each city i, I run 2,000 such regressions of equation (4) with random draws of $Sim\_ForeignBank_{\tilde{i},2007}$. I then plot the distribution of the 2,000 $\times$ 35 $\tilde{\beta}$ estimates and find that its mean (-0.189 for the foreign bank branch number indicator and -0.167 for the asset value indicator) is statistically no different from the estimation I reported in Table 6, providing reinforcement that my indicators for exposure to the financial crisis are sound.

5.4 The Credit Supply Channel

From the previous section, I find evidence that financial liberalisation can causally impact the local real estate market with statistically and economically significant. The findings are consistently robust across various econometric specifications. In the following content, I investigate the underlying channel.

Given the limited market share of foreign banks in China, it is hard to claim that the aforementioned significant financial liberalisation impact is caused by a contraction in the foreign credit supply without further supporting evidence. For example, it could also be caused by drops in the foreign demand for local real estate investment. I argue that this is less likely given the fact that the financial crisis shock is exogenous to China's local economy and the real estate performance. According to the 'safe-haven' effect as shown in Badarinza and Ramadorai (2017), investors should flee away from the US market and move towards assets that they perceive as being safe, such as the real estate investment in China. Said that,

the foreign demand for local property investment should have increased after the explosion of the crisis.

Assuming that the majority of overseas investments in China's real estate market are primarily channelled through foreign banks, the 'safe-haven' demand effect should yield an opposite effect of financial liberalisation on the local property price movement. That is, the financial liberalisation should have positively contributed to house price growth during and after the crisis, especially for global cities such as Shanghai and Shenzhen. Therefore, the negative temporary impact that I find is not a 'safe-haven' induced foreign demand story.[42]

Nevertheless, foreign demand can still drop, probably due to the fact that overseas investors themselves suffered during the financial crisis. As a result, they either withdrew their capital or stop investing in China's real estate market. Again assuming that a large proportion of such foreign investment flowed into China via overseas banks in the mainland; and hypothetically all of these were financed via foreign currency mortgage loans, a significant foreign demand drop would cause such mortgage rate to decrease during the crisis.

On the other hand, the evidence suggests an increasing mortgage rates during and after the financial crisis. In June 2008, Standard Chartered increased its 20 year USD mortgage loan rate from 3% to 3.25%, rising again to 4% in 2010.[43] The bank also increased service charges for personal and business credit applications. Moreover, for RMB mortgage loans, the Chinese central bank lowered the base rate in December 2008. While every domestic bank reduced their mortgage loan rates right after the introduction of the policy, foreign banks kept the same high RMB mortgage rate as before. It tend to suggest a credit supply channel instead of the foreign demand mechanism. Meanwhile, it was still possible that both foreign demand and foreign credit supply for the local property investment dropped simultaneously during the crisis. In this case, the increasing mortgage loan rates and service

[42]However, it is important to point out that such effect can still exist, especially in the long run and in international cities alike Shanghai. However, due to limited data and the 4-trillion stimulus plan after the crisis, I'm unable to make a definitive statement on the existence of the 'safe-haven' demand effect.

[43]See http://finance.sina.com.cn/leadership/mroll/20120111/175011179482.shtml.

fees indicate that the impact of the credit contrast outweighs the effect of the foreign demand side.

Before I move forward to presenting my empirical investigation of a credit channel, it is important to define the 'foreign credit supply' mechanism in this paper. It is not a narrow definition of credit supply for mortgage borrowing. It is a broad definition in terms of providing more foreign capital/credit for real estate investment in China, thanks to financial liberalisation. Such supply channels of foreign banks include 1) facilitating efficient cross-border transactions for real estate investment at lower transaction costs; 2) providing direct capital for real estate investment; 3) supplying credit for mortgage loans. All of these improve investors' access to capital/credit for property investment in China, shifting the credit supply outward. Conversely, the foreign credit constraints tightened during the crisis, which reduced borrowers and investors' access to capital/credit for property investment and caused the temporary price adjustment in 2008. Due to lack of detailed information, I cannot distinguish the proportional effect of foreign investment from the proportional effect of foreign credit on the local real estate market. The following section therefore discusses joint influence of foreign money (direct investment and credit).

To confirm the credit supply story, I employ another two empirical investigations. First, I conduct a placebo test of regression (2) by using the representative offices of foreign banks. As discussed in section 2, foreign banks' representative offices are not legally allowed to conduct credit service. I do not expect to observe any statistical significance unless the results in section 5 were caused by drops in the foreign demands only. Table 10 reports the findings, which show that the estimated effects are indeed insignificant.

Second, I use information on foreign banks' withdrawal or exit actions from the mainland prior to the explosion of the crisis. I argue that these withdrawal decisions, which originated from foreign banks' home countries, are direct results of the US financial crisis, and are independent of the local demand and economic conditions. Under this reasoning, I construct a variable $CreditDrop_{i,2007}$ as elaborated in section 3. The difference-in-difference setting is

listed in equation (5)

$$\Delta ln\ house\ price_{i,t} = \alpha_i + \delta_t + \beta CreditDrop_{i,2007} * Crisis + \eta^k X^k_{i,t-1} + \epsilon_{i,t} \quad (5)$$
$$i \in \{1, ..., 35\}; \quad t \in \{2001, ..., 2014\}$$

wherein the $CreditDrop_{i,2007}$ is the proportion of foreign banks that were forced to withdraw or exit the mainland due to the US financial crisis for city i during year 2007. The regression results are reported in Table 11. For simplicity, I only report the regression setting that includes the real growth rates of local GDP, income per capita, construction costs for city i in year $t-1$, plus the changes in the logarithm of real 5-year interest rate in year $t-1$ as a control variable.

Columns 1 to 2 are the results based on the full sample, and columns 3-4 (5-6) are the estimations based on the sub-sample from 2001-2009 (2008-2014). In general, I find that the estimate of β stays statistically significant and in general it has a similar economic significance, in comparison to the estimates when using the foreign banks' branches and asset value. 1 standard deviation increase in the foreign banks' credit drop ratio exposure the local real estate market growth by a 0.233 standard deviation drop. Table 12 reports the robustness test when testing the influence of the local economic condition.

6 Land Unavailability

The study by Saiz (2010) shows that the supply of land largely determines the housing supply elasticity. Furthermore, land price is often included in real estate prices as a cost (Kiyotaki, Michaelides, and Nikolov, 2011). To reinforce my findings, I conduct a trip difference-in-

difference regression with land unavailability.

$$\begin{aligned}\Delta ln\ house\ price_{i,t} =& \beta_i^1 ForeignBank_{i,2007} + \beta_i^2 LandUnava_i + \beta_{2008}^3 Crisis_t \\ &+ \beta^4 ForeignBank_{i,2007} * UandUnava_i \\ &+ \beta^5 ForeignBank_{i,2007} * Crisis + \beta^6 Crisis * LandUnava_i \\ &+ \beta^7 ForeignBank_{i,2007} * LandUnava_i * Crisis + \epsilon_{i,t}\end{aligned} \tag{6}$$

where the variable $LandUnava_i$ is the proportion of unavailable land for construction due to the exogenous geographic conditions of city i. Note that the coefficients β_i^1, β_i^2, β_{2008}^3 and β^4 are dropped when I regress the equation (6) with city and time fixed effects.

The regression statistics are reported in Table 13. Columns 1 (3) to 2 (4) are the results when regressed with the number of foreign bank branches (asset value). Columns 1 and 3 have the basic panel regression setting. Columns 2 and 4 include both city and time fixed effects. Again, standard errors are in the parentheses and clustered at city level to achieve heteroskedasticity-consistent estimations. I also conduct the triple difference-in-difference regression using the $CreditDrop_{i,2007}$ and report the estimates in Table 14.

The study by Saiz (2010) suggests that areas that have a larger portion of unavailable land (that cannot be used for construction and real estate purposes) exhibit higher housing supply inelasticity. The house prices in these areas are more expensive. In Tables 13 and 14, the coefficients of the unavailable land are positive. The findings are aligned with Saiz (2010), who finds that a more geographically constrained city experiences higher house prices. Moving towards the interaction term, first, the treatment effect $Foreign\ Bank_{i,2007} * Crisis$ stays significantly negative, confirming that the impact of financial liberalisation (credit supply) is robust. Secondly, the real estate market of a more geographically constrained city illustrates an additional growth drop by 5.6% during the crisis. This is because a higher inelasticity of the housing supply in more geographically constrained cities amplifies the influence of a negative supply shock.

The next hypothesis to investigate is whether the geographical constraint condition of a city, which is measured as the unavailable land, is expected to intensify the impact of credit supply shock on house prices. A city with less available land has lower housing supply elasticity, and hence is more sensitive to the supply shock than a city that is less geographically limited. Table 13 and 14 report a consistent and negative estimate for the triple interaction term with statistical significance of 1%. In summary, I provide evidence in confirming both the hypotheses 1 and 2 with statistical significance.

7 Conclusion

This paper studies the impact of financial liberalisation on the real estate market of China. The identification strategy comes from the US financial crisis. A city is considered to be more financially liberalised if it has more foreign bank branches or a higher value of foreign bank assets, and is hence more exposed to the negative funding shock. Indeed, I find that cities which are more financially open exhibit a more volatile price movement. Furthermore, these cities experienced worse property price depreciations during the financial crisis.

Furthermore, the evidence suggests a credit supply channel. I show that the aforementioned effect is no longer significant when I use the number of foreign banks' representative offices as an indicator of financial openness, which arguably represents the pure foreign demand channel. Nevertheless, I calculate the proportion of foreign banks that were forced to withdraw or exit the mainland in 2007 and use it as a direct measure of foreign credit drop. I find that cities with higher proportions of foreign credit drop experienced large declines in house price growth in 2008.

Finally, I exploit a triple difference-in-difference setting by considering exogenous geographic conditions. I find that more geographically constrained cities have higher house prices but also larger drops during the crisis. Furthermore, such geographical constraints further intensified the negative impact of foreign credit shock during the financial crisis.

Numerous robustness checks provide evidence that the findings are consistently significant.

My empirical results provide innovative insights into whether foreign banks and financial liberalisation have affected real estate price volatility in a particular setting China. This has been the subject of numerous policy debates given that the Chinese government promised a complete financial liberalisation of the nation's capital account by 2020. By then, the influence of foreign banks on China's economy should become crucially important.

Figure 1: Average House Price

This figure depicts average sale price of commodity property in China and the Standard & Poor's Case-Shiller composite home price index for 10 major US metropolitan cities from 2000 to 2014. All prices are standardised against the year-end price of 2000 as 100. The X-axis marks the beginning of each year. The time series are extracted from the National Bureau of Statistics of China and the Federal Reserve Bank of St. Louis. The vertical line marks the 2008 US financial crisis.

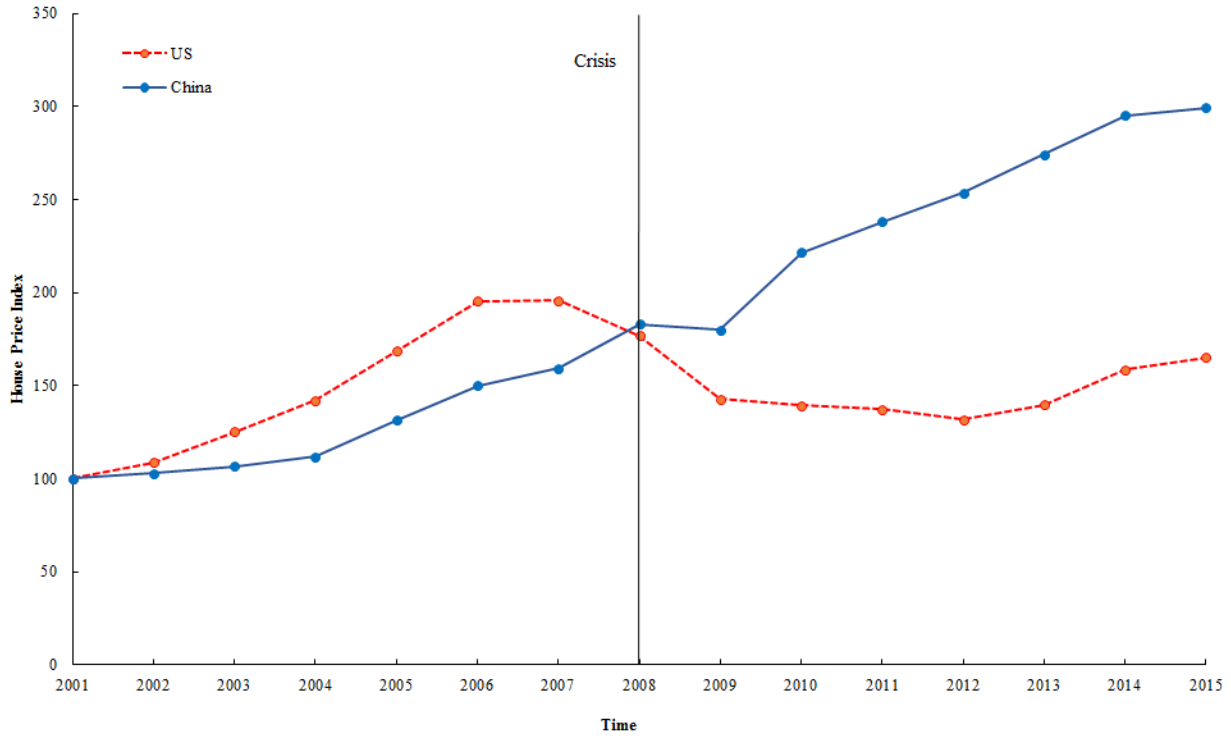

Figure 2: Location Distribution of Foreign Banking Institutions in China, 2006

This figure depicts the location distribution of foreign banks, including branches and representative offices, in China by the end of 2006. The source of figure is from He and Yeung (2011).

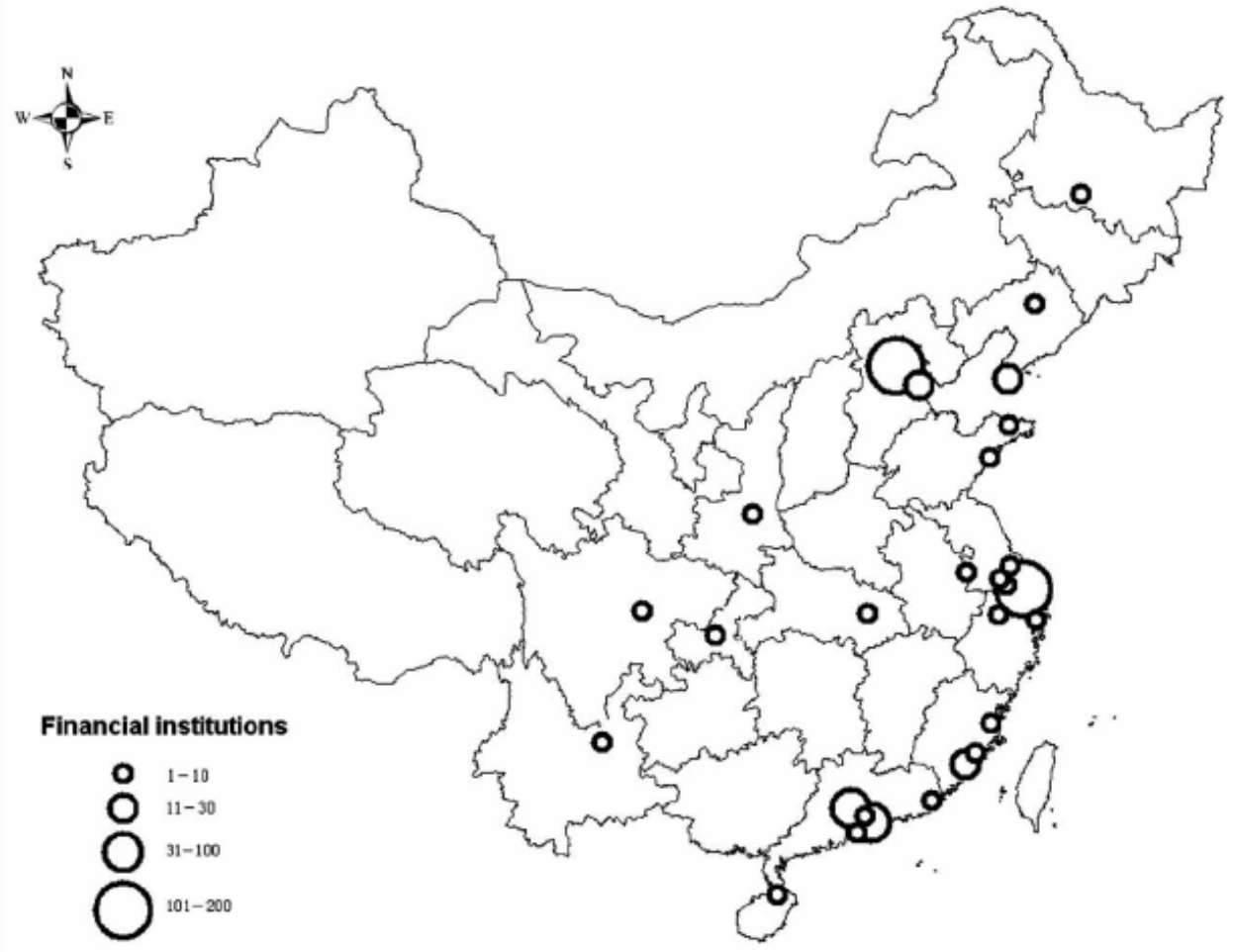

Figure 3: Foreign Investment in Enterprises for Real Estate Development

This figure depicts the time series of foreign investment in enterprises for the real estate market. The unit is billion RMB. The red dashed line is the average amount of foreign investment in real estate development enterprises across cities with a high level of financial liberalisation. That is, these cities have observations of foreign bank branch number in 2007 exceed the 75^{th} percentile of the variable's cross-section distribution. The blue solid line is the average investment amount across cities with a low level of financial liberalisation. These cities have no foreign bank branch by the end of 2007 (i.e., below the 25^{th} percentile of the 2007 cross-section distribution of foreign bank branches). The vertical line marks the 2008 US financial crisis. The data source is the National Bureau of Statistics of China.

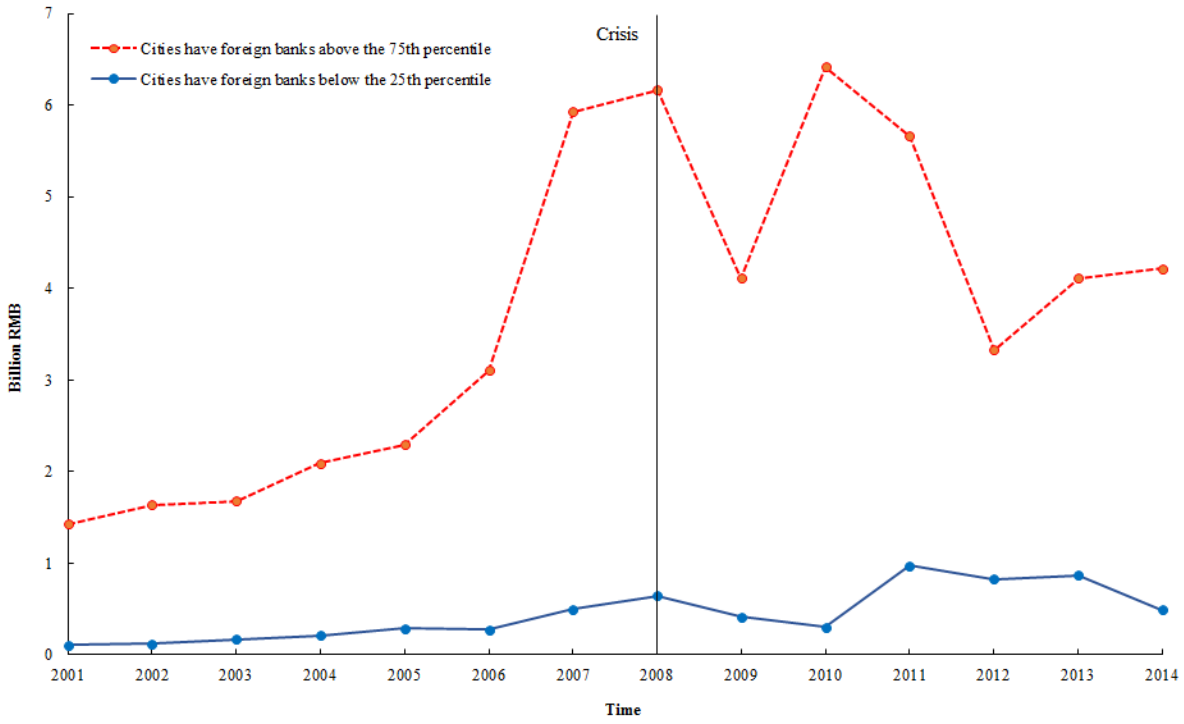

Figure 4: Foreign Investment in Enterprises for Real Estate Development over GDP

This figure depicts the time series of the ratio of foreign investment in enterprises for real estate market over the local GDP in percentage. The red dashed line is the average value across cities with high level of financial liberalisation. That is, these cities have observations of foreign bank branch number in 2007 exceed the 75^{th} percentile of the variable's cross-section distribution. The blue solid line is the average value across cities with low level of financial liberalisation. These cities have no foreign bank branch by the end of 2007 (i.e., below the 25^{th} percentile of the 2007's cross-section distribution of foreign bank branches). The vertical line marks the 2008 US financial crisis. The data source is the National Bureau of Statistics of China.

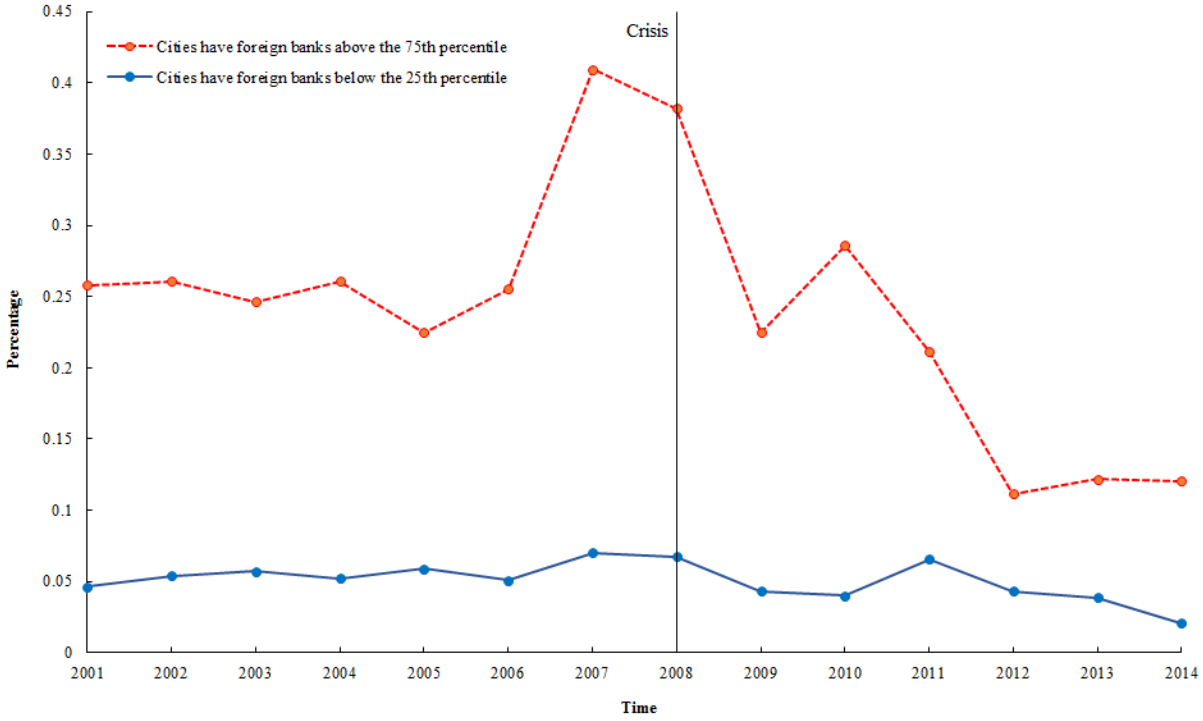

Figure 5: Average Commercial Property Price

This figure displays the time series of average real price of commercial property from 2001 to 2014. The unit is Yuan per square metre. The red dashed line is the average real property price across cities with high level of financial liberalisation. That is, these cities have observations of foreign bank branches in 2007 exceed the 75^{th} percentile of the variable's cross-section distribution. The blue solid is the average real property price across cities with low lever of financial liberalisation. These cities have no foreign bank branch by the end of 2007 (i.e., below the 25^{th} percentile of the 2007's cross-section distribution). The vertical line marks the 2008 US financial crisis. The data source is the National Bureau of Statistics of China.

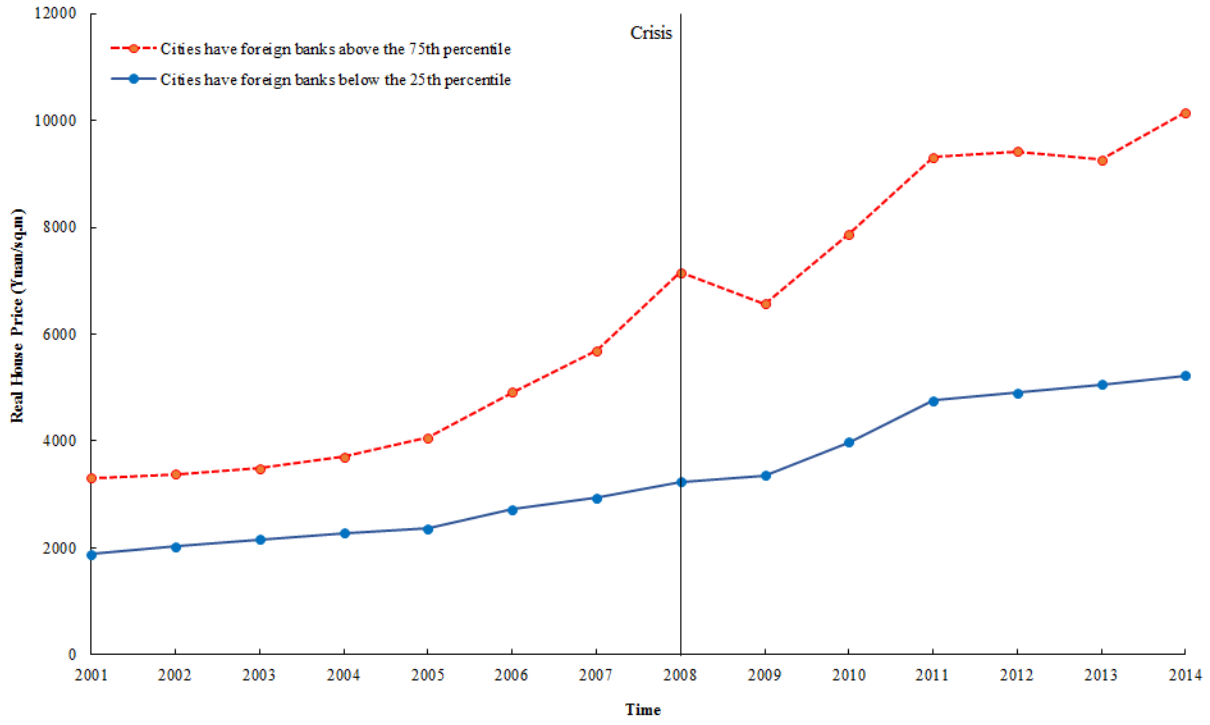

Figure 6: Cross-Sectional Average Commercial Property Price: Shenzhen vs. Beijing

This figure plots the real price of commercial property from 2001 to 2014. The unit is Yuan per square metre. The red solid line is the time series of Beijing. The blue dashed line is the one of Shenzhen. The vertical line marks the 2008 US financial crisis. The data source is the National Bureau of Statistics of China.

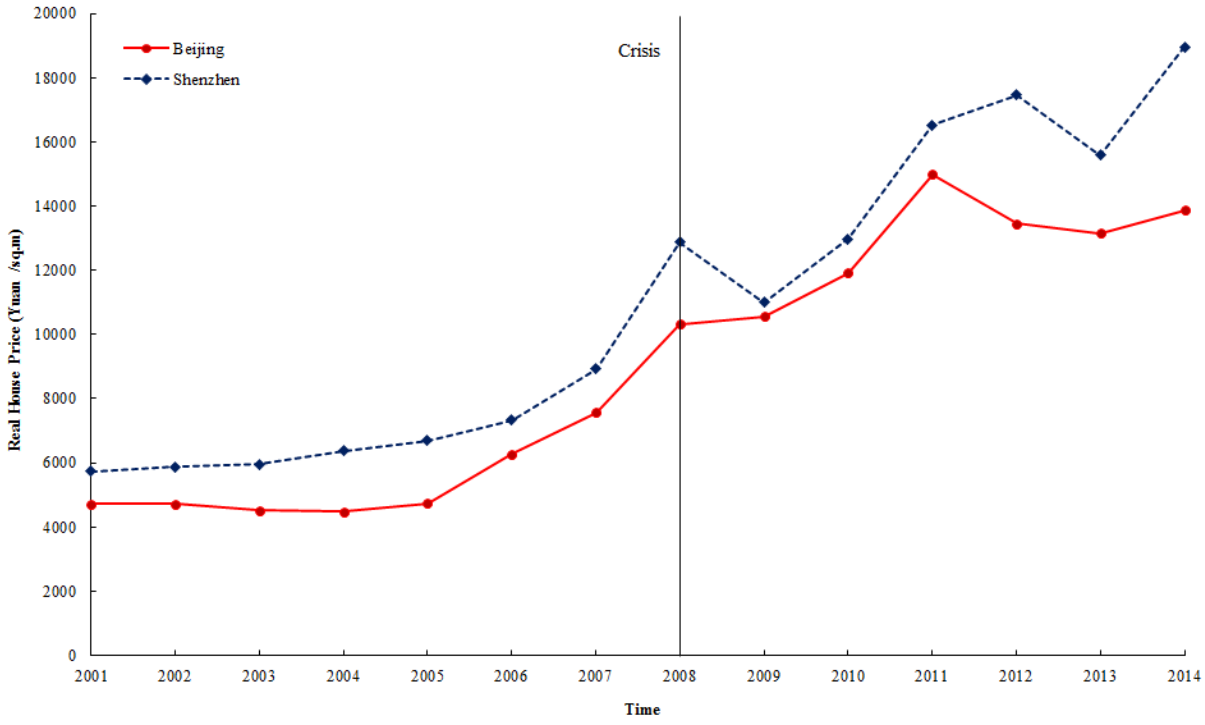

Figure 7: Cross-Sectional Average Commercial Property Price: Shenzhen vs. Xining

This figure plots the real price of commercial property from 2001 to 2014. The unit is Yuan per square metre. The red solid line is the time series of Shenzhen. The blue dashed line is the one of Xining. The vertical line marks the 2008 US financial crisis. The data source is the National Bureau of Statistics of China.

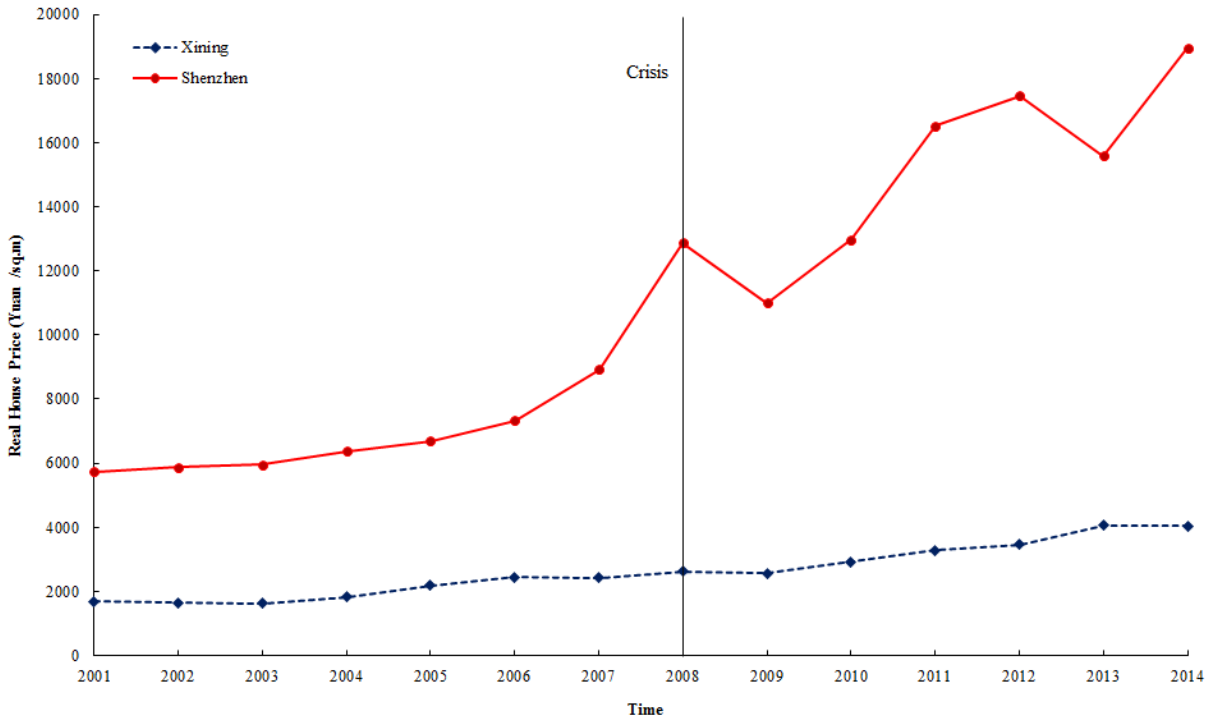

Figure 8: Parallel Trends in the Growth of Property Price

This figure displays the time series of real growth rate of property price from 2001 to 2014. The real growth rate is the changes in the natural logarithm of deflated property price. The red dashed line is the average real growth rate across cities with high level of financial liberalisation. That is, these cities have observations of foreign bank branches in 2007 exceed the 75^{th} percentile of the variable cross-section distribution. The blue solid is the average real growth rate across cities with low lever of financial liberalisation. These cities have no foreign bank branch by the end of 2007 (i.e., below the 25^{th} percentile of the 2007's cross-section distribution). The vertical line marks the 2008 US financial crisis.

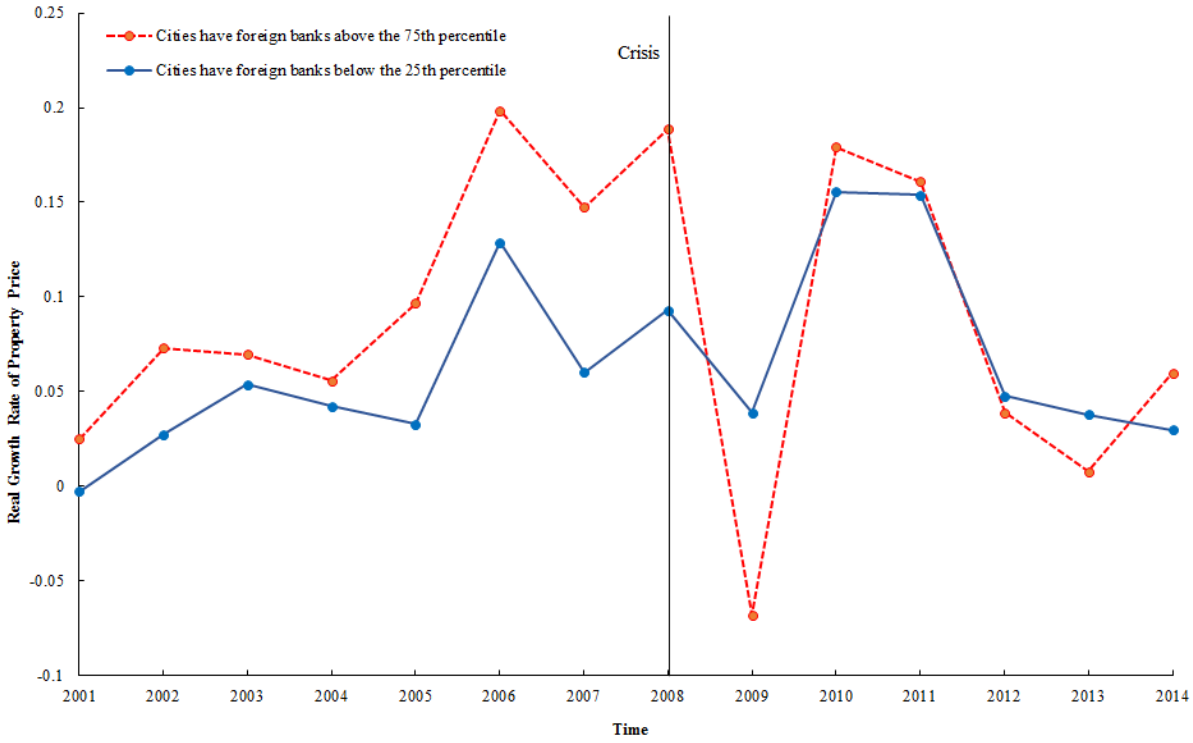

Table 1: Summary Statistics: Average Property Price

The table reports the summary statistics for the average real price of commercial property across 35 cities in mainland China. The unit is Yuan per square metre. The sample ranges from 2000 to 2014. The reported statistics are mean, standard deviation (Std), minimum (Min) and maximum (Max).

			Average Property Price			
	City	Province	Mean	Std	Min	Max
1	Beijing	Beijing	9049.86	1019.54	4484.64	14992.95
2	Tianjin	Tianjing	4609.20	471.58	2276.04	7009.14
3	Shijiazhuang	Hebei	2538.11	234.16	1491.82	4131.01
4	Taiyuan	Shaanxi	3438.72	341.94	1310.24	5603.77
5	Hohhot	Neimenggu	2395.88	238.25	1317.54	3947.00
6	Shenyang	Liaoning	3597.84	209.64	2729.91	4905.74
7	Dalian	Liaoning	4485.51	394.28	2362.07	6867.88
8	Changchun	Jilin	3094.87	261.59	1842.12	4804.15
9	Harbin	Heilongjiang	3212.89	238.84	1982.44	4665.63
10	Shanghai	Shanghai	7544.54	840.74	3371.43	12107.72
11	Nanjing	Jiangsu	5040.04	534.28	2823.92	8493.00
12	Hangzhou	Zhejiang	6814.77	831.79	2859.77	11805.39
13	Ningbo	Zhejiang	5460.23	689.36	1953.14	9376.14
14	Hefei	Anhui	3206.29	316.11	1733.27	5215.40
15	Fuzhou	Fujian	4739.87	638.48	2010.09	8670.66
16	Xiamen	Fujian	6002.54	708.29	2844.82	11398.93
17	Nanchang	Jiangxi	3063.30	334.97	1223.12	5336.03
18	Ji'nan	Shandong	3516.50	342.12	1782.48	5392.09
19	Qingdao	Shandong	3980.20	417.07	1807.65	6289.38
20	Zhengzhou	Henan	3148.93	308.28	1539.73	5357.43
21	Wuhan	Hubei	3601.30	371.48	1841.52	5627.15
22	Changsha	Hunan	2787.99	259.47	1705.47	4423.92
23	Guangzhou	Guangdong	7261.68	730.47	4293.50	11933.66
24	Shenzhen	Guangdong	11041.83	1275.75	5603.87	18951.78
25	Nanning	Guangxi	3213.18	257.33	1915.68	5080.94
26	Haikou	Hainan	3555.22	395.81	1830.11	6537.05
27	Chongqing	Chongqing	2580.68	268.04	1386.71	4268.28
28	Chengdu	Sichuan	3388.21	323.32	1829.64	5235.37
29	Guiyang	Guizhou	2564.17	226.73	1480.88	3958.68
30	Kunming	Yunnan	2955.96	200.13	1872.62	4501.16
31	Xi'an	Shanxi	3143.60	298.69	1211.66	4985.01
32	Lanzhou	Guansu	2689.67	228.79	1626.79	4364.09
33	Xining	Qinghai	2047.58	160.13	1348.74	3459.94
34	Yinchuan	Ningxia	2441.29	141.61	1598.78	3333.23
35	Urumqi	Xinjiang	2800.00	230.36	1763.86	4372.29

Table 2: List of Incorporated Foreign Banks

The following table reports the name list of incorporated foreign banks in mainland China by the end of 2007, the headquarters location and the value of equity capital when registered. The original documents are collected from the China Banking Regulatory Commission (CBRC) website.

	Incorporated Foreign Banks	Headquarters Location	Registered Capital (Billion RMB)
1	HSBC Bank (China) Company Limited	Shanghai	8.00
2	The Bank of East Asia (China) Limited	Shanghai	8.00
3	Nanyang Commercial Bank (China) , Limited	Shanghai	2.50
4	Hang Seng Bank (China) Limited	Shanghai	4.50
5	OCBC (China) Limited	Shanghai	3.50
6	Chinese Mercantile Bank	Shenzhen	0.72
7	Hana Bank (China) Company Limited	Beijing	2.00
8	Woori Bank (China) Limited	Beijing	2.40
9	United Overseas Bank (China) Limited	Shanghai	3.00
10	DBS Bank (China) Limited	Shanghai	4.00
11	Mizuho Bank (China) , Ltd.	Shanghai	4.00
12	Bank of Tokyo-Mitsubishi UFJ (China), Ltd.	Shanghai	6.50
13	Societe Generale (China) Limited	Beijing	4.00
14	Standard Chartered Bank (China) Limited	Shanghai	6.23
15	Morgan Stanley Bank International (China) Limited	Shanghai	6.00
16	Deutsche Bank (China) Co., Ltd.	Beijing	2.85
17	Citibank (China) Co., Ltd.	Shanghai	3.97
18	JPMorgan Chase Bank (China) Company Limited	Beijing	2.00
19	ABN AMRO Bank (China) Co.Ltd	Shanghai	4.00
20	Wing Hang Bank (China) Limited	Shenzhen	1.00

Table 3: List of Foreign Banks Branches

The following table reports the name list of foreign banks that establish branches, sub-branches and representative offices in mainland China. The list is consolidated by the author from various sources, including the Almanac of China's Finance and Banking, CBRC official documents, annual reports of foreign banks.

Chong Hing Bank Ltd	Raiffeisen Bank International AG
Chiyu Banking Coporation Ltd	KBC Bank N.V.
Public Bank (Hong Kong) Ltd	Coöperatieve Rabobank U.A.
Wing Lung Bank	ING Bank N.V.
Shanghai Commercial Bank Ltd	LUSO INTERNATIONAL BANKING LIMITED
Cathay United Bank Company	Barclays Bank PLC
Chang Hwa Commercial Bank	Natixis
Taiwan Cooperative Bank	Norddeutsche Landesbank Girozentrale
Land Bank of Taiwan Co., Ltd	Commerzbank AG
First Commercial Bank Co., Ltd.	UniCredit S.p.A.
Hua Nan Commercial Bank Ltd	Intesa Sanpaolo S.p.A.
CTBC Bank Co., Ltd.	Banca Monte dei Paschi di Siena S.p.A
Mega International Commercial Bank Co., Ltd.	Caixa Geral de Depositos, S.A.
Taiwan Business Bank, Ltd.	Banco Santander
Bank of Taiwan	Banco Bilbao Vizcaya Argentaria,
Banco Nacional Ultramarino, S.A	Credit Suisse AG
The Bank of Yokohama	Nordea Bank AB
Sumitomo Mitsui Trust Bank, Ltd	Skandinaviska Enskilda Banken AB
The Bank of Nagoya, Ltd	Swedbank
The Korea Development Bank	Svenska Handelsbanken AB (publ)
The Daegu Bank Ltd	VTB Bank(Public Joint-Stock Company)
The Busan Bank Co., Ltd	DNB Bank ASA
Malayan Banking Berhad	Bank of The Orient
CIMB Bank Berhad	Wells Fargo Bank, National Association
Krung Thai Bank Public Co., Ltd	Bank of America, National Association
State Bank of India	The Bank of New York Mellon
Bank of India	State Street Bank and Trust Company
ICICI Bank Limited	The Northern Trust Company
Bank of Baroda	The Bank of Nova Scotia
Canara Bank	The Royal Bank of Canada
Axis Bank Limited	Banco do Brasil S.A.
PT Bank Mandiri (Persero) Tbk	Commonwealth Bank of Australia
Habib Bank Limited	National Australia Bank Limited
National Bank of Kuwait S.A.K.P.	Westpac Banking Corporation
National Bank of Egypt	The Shoko Chukin Bank Ltd
Tai Fung Bank	Union National Bank PJSC

Table 4: Foreign Banks in China

The following table reports the total number of foreign banking institutions across 35 Chinese cities, including the number of branches* and representative offices. The branch* category includes foreign bank incorporation, branch and sub-branch. It also reports the total asset value of foreign banks by the end of 2007 for each city, and the year when the first branch was established.

	City	Number of Foreign Banks	Branches*	Representative Offices	Asset Value (100 Million RMB)	Year of First Branch
1	Beijing	124	40	84	1702	1993
2	Tianjin	22	18	4	338	1992
3	Shijiazhuang	0	0	0	0	-
4	Taiyuan	0	0	0	0	-
5	Hohhot	0	0	0	0	-
6	Shenyang	8	4	4	94.33	2004
7	Dalian	14	9	5	188.7	1993
8	Changchun	0	0	0	0	-
9	Harbin	1	0	1	0	-
10	Shanghai	203	104	99	7567	1990
11	Nanjing	5	4	1	69.27	1992
12	Hangzhou	7	5	2	55.63	2004
13	Ningbo	4	3	1	33.38	1993
14	Hefei	0	0	0	0	-
15	Fuzhou	7	5	2	120.7	1992
16	Xiamen	20	16	4	344.7	1986
17	Nanchang	0	0	0	0	-
18	Ji'nan	0	0	0	0	-
19	Qingdao	10	9	1	167.5	1992
20	Zhengzhou	0	0	0	0	-
21	Wuhan	6	3	3	27.4	1992
22	Changsha	1	0	1	0	-
23	Guangzhou	46	29	17	783.6	1992
24	Shenzhen	47	42	5	801.0	1981
25	Nanning	0	0	0	0	-
26	Haikou	1	1	0	5	1988
27	Chongqing	7	6	1	64.5	1997
28	Chengdu	9	7	2	76.2	1996
29	Guiyang	0	0	0	0	-
30	Kunming	2	1	1	3	1996
31	Xi'an	3	3	0	90.4	2000
32	Lanzhou	0	0	0	0	-
33	Xining	0	0	0	0	-
34	Yinchuan	0	0	0	0	-
35	Urumqi	0	0	0	0	-

Table 5: Panel Regression of Real House Price

The following table reports the panel regression results of annual real growth rate of commercial property prices across 35 Chinese cities from 2001 to 2014. Explanatory variables include foreign bank indicator of year 2007, crisis dummy of 1 for year 2008 and an interaction term between the two. Control variables include the real growth rates of local GDP, income per capita and construction costs at city level; and the real growth of 5-year interest base rate as well as the RMB against the USD exchange rate. Columns 1 to 4 are the regression results when using the number of foreign bank branches at each city by 2007 as variable '$ForeignBank_{i,2007}$', while columns 5 to 8 report the results when using the foreign banks' asset value. Standard errors are reported in the parentheses and are clustered at city level. *** stands for 1% significant level; ** stands for 5% significant level; * stands for 10% significant level.

	Regress with Foreign Bank Branch				Regress with Foreign Bank Asset Value			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign Bank$_{i,2007}$	0.031***	0.038***	0.037***	0.036***	0.030***	0.039***	0.036***	0.036***
	(0.010)	(0.010)	(0.011)	(0.011)	(0.007)	(0.007)	(0.008)	(0.007)
Crisis	-5.049**	-5.002**	2.722	-4.732**	-6.172***	-6.071***	1.605	-5.824***
	(2.010)	(2.096)	(2.550)	(2.081)	(2.214)	(2.266)	(2.553)	(2.257)
Foreign Bank$_{i,2007}\times$ Crisis	-0.206**	-0.178*	-0.183*	-0.184*	-0.170***	-0.1264**	-0.1320**	-0.1335**
	(0.087)	(0.097)	(0.098)	(0.098)	(0.050)	(0.059)	(0.059)	(0.060)
Δln GDP$_{i,t-1}$		0.242***	0.1577**	0.1425**		0.247***	0.163**	0.147**
		(0.071)	(0.067)	(0.067)		(0.072)	(0.067)	(0.067)
Δln Income$_{i,t-1}$		0.1184**	0.1317**	0.1222**		0.114*	0.127**	0.118**
		(0.058)	(0.058)	(0.056)		(0.059)	(0.059)	(0.057)
Δln Construction Cost$_{i,t-1}$		0.0976**	0.0943**	0.0916**		0.099**	0.095**	0.093**
		(0.043)	(0.042)	(0.043)		(0.044)	(0.043)	(0.044)
Δln Base Rate$_{t-1}$			-1.055***				-1.053***	
			(0.186)				(0.185)	
Δln Exchange Rate$_{t-1}$				0.141***				0.140***
				(0.032)				(0.031)
Constant	7.126***	2.487***	2.540***	1.6998*	7.274***	2.652***	2.704***	1.864**
	(0.354)	(0.897)	(0.924)	(0.884)	(0.353)	(0.892)	(0.914)	(0.875)
Observations	525	519	519	519	525	519	519	519
Adjusted R^2	0.050	0.083	0.112	0.143	0.046	0.078	0.107	0.138

Table 6: Difference-in-Difference Regression with Fixed Effects

The following table reports the difference-in-difference regression results of annual real growth rates of commercial property prices across 35 Chinese cities from 2001 to 2014. City and time fixed effects are both controlled in the regressions. Explanatory variables include foreign bank indicator of year 2007, crisis dummy of 1 for year 2008 and an interaction term between the two. Control variables include the real growth rates of local GDP, income per capita and construction costs at city level; and the real growth of 5-year interest base rate as well as the RMB against the USD exchange rate. Columns 1 to 4 are the regression results when using the number of foreign bank branches at each city by 2007 as variable '$ForeignBank_{i,2007}$', while columns 5 to 8 report the results when using the foreign banks' asset value. Standard errors are reported in the parentheses and are clustered at city level. *** stands for 1% significant level; ** stands for 5% significant level; * stands for 10% significant level.

	Regress with Foreign Bank Branch				Regress with Foreign Bank Asset Value			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign Bank$_{i,2007}$×Crisis	-0.206**	-0.199*	-0.199*	-0.199*	-0.170**	-0.155**	-0.155**	-0.155**
	(0.091)	(0.091)	(0.091)	(0.091)	(0.053)	(0.059)	(0.059)	(0.059)
City Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δln GDP$_{i,t-1}$		-0.027	-0.027	-0.027		-0.02	-0.02	-0.02
		(0.090)	(0.090)	(0.090)		(0.090)	(0.090)	(0.090)
Δln Income$_{i,t-1}$		0.101	0.101	0.101		0.098	0.098	0.098
		(0.066)	(0.066)	(0.066)		(0.067)	(0.067)	(0.067)
Δln Construction Cost$_{i,t-1}$		0.046	0.046	0.046		0.048	0.048	0.048
		(0.032)	(0.032)	(0.032)		(0.033)	(0.033)	(0.033)
Δln Base Rate$_{t-1}$			-0.732				-0.739	
			(1.809)				(1.810)	
Δln Exchange Rate$_{t-1}$				0.092				0.093
				(0.228)				(0.228)
Observations	525	519	519	519	525	519	519	519
Adjusted R^2	0.274	0.293	0.293	0.293	0.269	0.287	0.287	0.287

Table 7: Robustness Regression: Sub-Sample 2001 to 2009

The following table reports the difference-in-difference regression results of annual real growth rates of commercial property across 35 Chinese cities. The sample period is from 2001 to 2009. City and time fixed effects are both controlled in the regressions. Explanatory variables include foreign bank indicator of year 2007, crisis dummy of 1 for year 2008 and an interaction term between the two. Control variables include the real growth rates of local GDP, income per capita and construction costs at city level; and the real growth of 5-year interest base rate as well as the RMB against the USD exchange rate. Columns 1 to 4 are the regression results when using the number of foreign bank branches at each city by 2007 as variable '$ForeignBank_{i,2007}$', while columns 5 to 8 report the results when using the foreign banks' asset value. Standard errors are reported in the parentheses and are clustered at city level. *** stands for 1% significant level; ** stands for 5% significant level; * stands for 10% significant level.

	Regress with Foreign Bank Branch				Regress with Foreign Bank Asset Value			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign Bank$_{i,2007}$×Crisis	-0.237**	-0.233**	-0.233**	-0.233**	-0.209***	-0.198***	-0.198***	-0.198***
	(0.092)	(0.100)	(0.100)	(0.100)	(0.055)	(0.063)	(0.063)	(0.063)
City Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δln GDP$_{i,t-1}$		-0.139	-0.139	-0.139		-0.126	-0.126	-0.126
		(0.106)	(0.106)	(0.106)		(0.105)	(0.105)	(0.105)
Δln Income$_{i,t-1}$		-0.016	-0.016	-0.016		-0.022	-0.022	-0.022
		(0.075)	(0.075)	(0.075)		(0.076)	(0.076)	(0.076)
Δln Construction Cost$_{i,t-1}$		0.048	0.048	0.048		0.050	0.050	0.050
		(0.038)	(0.038)	(0.038)		(0.040)	(0.040)	(0.040)
Δln Base Rate$_{t-1}$			-16.311				-16.311***	
			(3.785)				(3.766)	
Δln Exchange Rate$_{t-1}$				-0.008				0.013
				(0.048)				(0.047)
Observations	350	347	347	347	350	347	347	347
Adjusted R^2	0.286	0.302	0.465	0.192	0.277	0.292	0.292	0.292

Table 8: Robustness Regression: Sub-Sample 2008 to 2014

The following table reports the difference-in-difference regression results of annual real growth rates of commercial property across 35 Chinese cities. The sample period is from 2008 to 2014. City and time fixed effects are both controlled in the regressions. Explanatory variables include foreign bank indicator of year 2007, crisis dummy of 1 for year 2008 and an interaction term between the two. Control variables include the real growth rates of local GDP, income per capita and construction costs at city level; and the real growth of 5-year interest base rate as well as the RMB against the USD exchange rate. Columns 1 to 4 are the regression results when using the number of foreign bank branches at each city by 2007 as variable '$ForeignBank_{i,2007}$', while columns 5 to 8 report the results when using the foreign banks' asset value. Standard errors are reported in the parentheses and are clustered at city level. *** stands for 1% significant level; ** stands for 5% significant level; * stands for 10% significant level.

	Regress with Foreign Bank Branch				Regress with Foreign Bank Asset Value			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign Bank$_{i,2007}$×Crisis	-0.212**	-0.212**	-0.212**	-0.212**	-0.172***	-0.167***	-0.167***	-0.167***
	(0.103)	(0.112)	(0.112)	(0.112)	(0.061)	(0.076)	(0.076)	(0.076)
City Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed-Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Δln GDP$_{i,t-1}$		-0.171	-0.171	-0.171		0.184	0.184	0.184
		(0.156)	(0.156)	(0.156)		(0.263)	(0.263)	(0.263)
Δln Income$_{i,t-1}$		0.209*	0.209*	0.209*		0.202*	0.202*	0.202*
		(0.119)	(0.119)	(0.119)		(0.117)	(0.117)	(0.117)
Δln Construction Cost$_{i,t-1}$		0.002	0.002	0.002		0.008	0.008	0.008
		(0.069)	(0.069)	(0.069)		(0.072)	(0.072)	(0.072)
Δln Base Rate$_{t-1}$			-0.917***				-0.914	
			(0.230)				(0.230)	
Δln Exchange Rate$_{t-1}$				0.210***				0.209****
				(0.053)				(0.053)
Observations	245	241	241	241	245	241	241	241
Adjusted R^2	0.338	0.366	0.366	0.366	0.329	0.356	0.356	0.356

Table 9: Placebo Regression: Effect of Local Economy

The following table reports the difference-in-difference regression results of annual real growth rates of commercial property prices across 35 Chinese cities from 2001 to 2014. Columns 1 and 2 include the real growth rate of local GDP, the crisis dummy of 1 for year 2008 and an interaction term between the two. Columns 3 to 6 include the interaction term between the '$ForeignBank_{i,2007}$' and the crisis. Columns 3(5) to 4(6) are the results when using the number of foreign bank branches (foreign banks' asset value) at each city by 2007. Columns 1, 3 and 5 include the city fixed effect. Columns 2, 4 and 6 include both city and time fixed effects. Standard errors are reported in the parentheses and are clustered at city level. *** stands for 1% significant level; ** stands for 5% significant level; * stands for 10% significant level.

			Regress with Foreign Bank Branch		Regress with Foreign Bank Asset Value	
	(1)	(2)	(3)	(4)	(5)	(6)
Δln GDP$_{i,t-1}$	0.324***	-0.055	0.326***	-0.052	0.326***	-0.052
	(0.087)	(0.093)	(0.088)	(0.093)	(0.087)	(0.093)
Crisis	-4.704		-2.031		-2.145	
	(8.078)		(7.536)		(8.473)	
Δln GDP$_{i,2007}\times$ Crisis	-0.168	0.160	-0.435	-0.102	-0.324	0.010
	(0.549)	(0.562)	(0.495)	(0.512)	(0.561)	(0.578)
Foreign Bank$_{i,2007}\times$Crisis			-0.218**	-0.215**	-0.180**	-0.172**
			(0.086)	(0.091)	(0.072)	(0.075)
City Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	No	Yes	No	Yes	No	Yes
Observations	525	525	525	525	525	525
Adjusted R^2	0.067	0.266	0.076	0.275	0.071	0.269

Table 10: Placebo Regression: Representative Office

The following table reports the difference-in-difference regression results of annual real growth rates of commercial property prices across 35 Chinese cities from 2001 to 2014. City and time fixed effects are both controlled in the regression. Explanatory variables include the number of foreign bank representative offices at each city of year 2007, the crisis dummy of 1 for year 2008 and an interaction term between the two. Control variables include real growth rate of local GDP, income per capita and construction costs at city level; and real growth of 5-year interest base rate as well as RMB against the USD exchange rate. Standard errors are reported in the parentheses and are clustered at the city level. Standard errors are reported in the parentheses and are clustered at city level. *** stands for 1% significant level; ** stands for 5% significant level; * stands for 10% significant level.

	(1)	(2)	(3)	(4)
Foreign Bank Office$_{i,2007}$×Crisis	-0.688	-0.625	-0.625	-0.199
	(0.054)	(0.047)	(0.047)	(0.091)
City Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
Δln GDP$_{i,t-1}$		-0.018	-0.018	-0.018
		(0.090)	(0.090)	(0.090)
Δln Income$_{i,t-1}$		0.098	0.098	0.098
		(0.067)	(0.067)	(0.067)
Δln Construction Cost$_{i,t-1}$		0.050	0.050	0.050
		(0.034)	(0.034)	(0.034)
Δln Base Rate$_{t-1}$			-0.752	
			(1.809)	
Δln Exchange Rate$_{t-1}$				0.095
				(0.228)
Observations	525	519	519	519
Adjusted R^2	0.191	0.206	0.206	0.206

Table 11: Regression with Credit Drop

The following table reports the difference-in-difference regressions results of annual real growth rates of commercial property prices across 35 Chinese cities. Explanatory variables include the '$CreditDrop_{i,2007}$' indicator, the crisis dummy of 1 for year 2008 and an interaction term between the two. Control variables include real growth rate of local GDP, income per capita and construction costs at city level; and the real growth rate of 5-year interest base rate. Columns 1, 3 and 5 include the city fixed effect. Columns 2, 4 and 6 include both city and time fixed effects. Columns 1 and 2 use the full sample observations from 2001 to 2014. Columns 3 and 4 use the sub-sample observations of 2001 to 2009, while columns 5 and 6 use the sub-sample observations of 2008 to 2014. Standard errors are reported in the parentheses and are clustered at city level. *** stands for 1% significant level; ** stands for 5% significant level; * stands for 10% significant level.

	2001-2014		2001 to 2009		2008 to 2014	
	(1)	(2)	(3)	(4)	(5)	(6)
Crisis	-5.446**		-6.764***		-5.884**	
	(2.500)		(2.508)		(2.727)	
$\text{CreditDrop}_{i,2007} \times \text{Crisis}$	-1.124*	-1.273*	-1.366**	-1.502**	-1.184	-1.389*
	(0.663)	(0.654)	(0.693)	(0.681)	(0.864)	(0.744)
City Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	No	Yes	No	Yes	No	Yes
$\Delta\ln \text{GDP}_{i,t-1}$	0.188**	-0.026	-0.011	-0.136	0.524**	0.170
	(0.086)	(0.092)	(0.116)	(0.110)	(0.240)	(0.266)
$\Delta\ln \text{Income}_{i,t-1}$	0.127**	0.098	-0.022	-0.021	0.250*	0.202*
	(0.058)	(0.067)	(0.072)	(0.075)	(0.132)	(0.118)
$\Delta\ln \text{Construction Cost}_{i,t-1}$	0.096**	0.049	0.103*	0.052	0.158*	0.017
	(0.046)	(0.033)	(0.055)	(0.040)	(0.083)	(0.068)
$\Delta\ln \text{Base Rate}_{t-1}$	-1.035***	-0.768	-0.748***	-16.210***	-0.695***	-0.922***
	(0.198)	(1.812)	(0.231)	(3.770)	(0.255)	(0.234)
Observations	519	519	347	347	241	241
Adjusted R^2	0.159	0.289	0.170	0.294	0.230	0.359

Table 12: Placebo Regression with Credit Drop: Effect of Local Economy

The following table reports the difference-in-difference regression results of annual real growth rates of commercial property prices across 35 Chinese cities from 2001 to 2014. The explanatory variables include the real growth rate of local GDP, the crisis dummy of 1 for year 2008 and an interaction between the two. It also includes the interaction between the '$CreditDrop_{i,2007}$' indicator and the crisis dummy. Column 1 includes city fixed effect. Column 2 includes both city and time fixed effects. Standard errors are reported in the parentheses and are clustered at city level. *** stands for 1% significant level; ** stands for 5% significant level; * stands for 10% significant level.

	(1)	(2)
Δln GDP$_{i,t-1}$	0.324***	-0.055
	(0.088)	(0.094)
Crisis	-1.254	
	(9.167)	
Δln GDP$_{i,2007}\times$ Crisis	-0.371	-0.042
	(0.594)	(0.610)
Credit Drop$_{i,2007}\times$Crisis	-0.418***	-1.377***
	(0.762)	(0.813)
City Fixed Effect	Yes	Yes
Time Fixed Effect	No	Yes
Observations	525	525
Adjusted R^2	0.072	0.271

Table 13: Regression with Land Constraint

The following table reports the triple difference-in-difference regression results of annual real growth rates of commercial property prices across 35 Chinese cities from 2001 to 2014. Explanatory variables include foreign bank indicator of year 2007, the proportion of unavailable land over a city's administrative area, the crisis dummy of 1 for year 2008, the interaction terms between each two, and the triple interaction term among the three. Columns 1 and 3 conduct the panel regression. Columns 2 and 4 include both the city and time fixed effects. Standard errors are reported in the parentheses and are clustered at the city level. Standard errors are reported in the parentheses and are clustered at city level. *** stands for 1% significant level; ** stands for 5% significant level; * stands for 10% significant level.

	Regress with Foreign Bank Branch		Regress with Foreign Bank Asset Value	
	(1)	(2)	(3)	(4)
Foreign Bank$_{i,2007}$	0.033***		0.096**	
	(0.009)		(0.045)	
LandUnava$_i$	0.293*		0.443*	
	(0.173)		(0.114)	
Crisis	-1.972		-2.534	
	(2.545)		(2.980)	
Foreign Bank$_{i,2007}$×LandUnava$_i$	-0.010*		-0.101	
	(0.006)		(0.064)	
Foreign Bank$_{i,2007}$×Crisis	-0.322***	-0.334***	-0.857***	-0.857***
	(0.053)	(0.055)	(0.201)	(0.208)
Crisis×LandUnava$_i$	-5.641**	-6.496**	-5.695*	-5.695*
	(2.682)	(2.759)	(3.095)	(3.192)
Foreign Bank$_{i,2007}$×Crisis×LandUnava$_i$	-0.250***	-0.270***	-1.055***	-1.055***
	(0.066)	(0.068)	(0.284)	(0.293)
City Fixed Effect	No	Yes	No	Yes
Time Fixed Effect	No	Yes	No	Yes
Constant	7.270***		6.970***	
	(0.603)		(0.515)	
Observations	525	525	525	525
Adjusted R^2	0.060	0.280	0.057	0.276

Table 14: Regression with Credit Drop: Land Constraint

The following table reports the triple difference-in-difference regression results of annual real growth rates of commercial property prices across 35 Chinese cities from 2001 to 2014. Explanatory variables include the $\text{CreditDrop}_{i,2007}$ indicator, the proportion of unavailable land over a city's administrative area, the crisis dummy of 1 for year 2008, the interaction terms between each two, and the triple interaction term among the three. Column 1 conducts the panel regression. Column 2 includes both city and time fixed effects. Standard errors are reported in the parentheses and are clustered at the city level. Standard errors are reported in the parentheses and are clustered at city level. *** stands for 1% significant level; ** stands for 5% significant level; * stands for 10% significant level.

	(1)	(2)
$\text{CreditDrop}_{i,2007}$	-0.224	
	(0.196)	
LandUnava_i	1.527**	
	(0.777)	
Crisis	-2.960	
	(3.805)	
$\text{CreditDrop}_{i,2007} \times \text{LandUnava}_i$	-0.145	
	(0.120)	
$\text{CreditDrop}_{i,2007} \times \text{Crisis}$	-1.746***	-1.746**
	(0.660)	(0.681)
$\text{Crisis} \times \text{LandUnava}_i$	-5.511	-5.511
	(4.128)	(4.258)
$\text{CreditDrop}_{i,2007} \times \text{Crisis*LandUnava}_i$	-1.527**	-1.527**
	(0.639)	(0.659)
City Fixed Effect	No	Yes
Time Fixed Effect	No	Yes
Constant	6.957***	
	(0.559)	
Observations	525	525
Adjusted R^2	0.055	0.274

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