Urban Housing Privatization and Household Saving in China

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Abstract

During the past three decades, the housing market in China has transformed from an employer-based public housing system to a private market. This transformation began with some pilot experiments in selected cities in the 1970s and ended with a radical reform in 1998, when the provision of public housing is completely prohibited. This paper studies how the 1998 reform and the resulting rapid housing price affected the saving behaviors of urban households. We find the reform raises urban household saving rates during the reform period(1998-2001). Furthermore, we find cities with more rapid privatization are associated with higher household saving rates during the reform period and higher housing prices after the reform period(post 2001). The higher housing prices impose a larger financial burden on urban households and encourage them to save even more after the reform period.

Keywords: China, Urban Housing Reform, Housing Price, Urban Household Saving

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1 Introduction

China's urban housing policies have experienced dramatic changes. Before 1978, the majority of urban residents used to live in public housing units provided by their state-owned employers. During the past three decades, along with the economic reforms in other sectors, the government has implemented various reforms attempting to transform this public housing system to a market-based system. This has involved a nationwide abolish of public housing provision starting in 1998. The 1998 reform not only strongly accelerated China's housing reform and led to rapid development in the housing market but also profoundly changed the household saving behaviors as buying a house is gradually becoming the major reason behind household saving since the reform. The linkages between the housing reform, the resulted housing market development, and household saving is particular important in understanding the high and rising household saving rate in China, the cause of which is still under heated debates (Meng, 2003; Modigliani and Cao, 2004; Wang and Wen, 2010; Chamon and Prasad, 2010; Wei and Zhang, 2011; Yang et al., 2012; Chamon et al., 2013; Liu et al., 2014). So far, while the housing market consequences of the reform is widely recognized (Chen, 1996, 1998; Wang and Murie, 1996, 2000; Man, 2011), there is remarkable lack of evidence that measures the effects of housing reform on households savings, despite its importance.

This paper seeks to fill this gap by studying how the 1998 reform affects households saving behaviors. The termination of public housing provision fundamentally changed the way how urban residents obtain housing services. Instead of passively waiting for the housing allocation from their employers, they now need to buy their own homes in the market. This change unleashed the long pent-up housing demand and is followed by a significant growth in housing consumption among urban households. According to the Urban Household Survey (Figure 1)[1], the owner-occupied home ownership rate was around 20 percent in the early 1990s, and it raised quickly after 1998 and reached 80 percent in 2002. The ratio keeps rising but much slowly afterward, reaching 90 percent after 2009, which is among the highest in the world.[2][3] Also, the average floor area per capita has increased from 13 square meters to 32 square meters during the period from 1992 to 2009 (Table 3).

[1]The UHS is a large household-level data set collected by the China's National Bureau of Statistics (NBS). It covers more than 230,000 households across 16 provinces for the period of 1992-2009.

[2]By comparison, the American home ownership rate was 65.1 percent according to the U.S. Census Bureau in 2010.

[3]Another reason why the home ownership rate is high in the UHS sample is that it includes only formal housing in urban areas; informal housing, such as temporary dwellings, villages in cities, construction site shelters that are often occupied by mobile low-income population or migrant workers, were not covered.

Immediate after the 1998 reform (1998-2001), without a mature mortgage market at that time,[4] the sudden rise of housing demand forced Chinese households to save a disproportionately large share of their earnings to purchase a home. This saving motive is strengthened after the reform period (2001-2009). Though rising housing demand triggered rapid growth in the Chinese real estate sector, the housing supply in China is relatively lagged because land supply is rigorously controlled by the government. The gap between the demand and supply pushes home prices to rise tremendously, which imposes a larger financial burden on urban households and encourage them to save even more. Indeed, from 2000 to 2010, house prices in China increased by about 161 percent (Figure 2). In the meantime, personal saving is still the most common way of how Chinese homebuyers finance their home. According to the UHS, Only 12.20 percent of households purchased their house with montages, and this number only increased to 26.56 percent in 2009. For homebuyers who finance with a mortgage, they faced large required down paymentsłtypically 30-40 percent, but in some major cities as high as 50 percent (Fang et al., 2015).

The housing market reform and development are accompanied by the dramatic increase in household saving rate. As showed in Figure 2, the aggregate saving rate in China increased from 38 percent in 1998 to 50 percent in 2009. In recent years, China's saving rate is not only higher than in developed countries, but also higher than in countries that are at a similar stage of development, such as Brazil and India, as well as those with a similar culture, such as Japan and South Korea(Table 1). The high and rising saving rate of China is puzzling as it cannot be explained by standard consumption-saving theories (Yang et al., 2012). Although housing has been mentioned as a potential factor that would affect household saving (Chamon and Prasad, 2010; Wei and Zhang, 2011), few papers have directly studied how and to what extent changes in housing market affect household saving.

The biggest challenge to identify the effect of changes in the housing market on household saving has been separating this effect from the effects of other economics changes which happened around the same period. We deal with this problem by adopting a difference-in-difference method, making using the fact that the housing reform carried unequal treatment among urban households. Our treatment group includes households who were state-employees and were on the waiting list of the public housing provided by their employers.[5] They were

[4]There was no (official) mortgage system during the pre-reform period.

[5]State-employees usually live in the staff dormitory where the living condition is poor (Chen, 1996, 1998).

the potential beneficiaries of the old public housing system, but the 1998 reform removed their benefits and forced them to save for housing. We consider two control groups. One includes state-employees who already lived in the public housing, the other includes households who were not state employees. Since these households no longer expected or were not expecting housing benefits from their employers, the effects of removing these benefits might be smaller or negligible for them. By comparing changes in the saving rates of otherwise similar households before and after the housing reform, our estimations show that the 1998 reform significantly increased household saving rate.

The positive effect of the housing reform on household saving is confirmed when we explore the city-level variation regarding the reform speed. This city-level variation is made possible because the Chinese government has adopted a decentralized approach in implementing the 1998 housing reform, which means the local governments has the right to terminating the provision of public housing with their pace(Huang, 2004; Wang et al., 2005). Cities that underwent more rapid housing reform experienced a greater increase in housing demand within the short time period, the increase in saving rates caused by the reform would larger in these cities. Measuring the speed of housing reform with the decrease in the proportion of public housing in that city , we find that cities with rapid housing reform were associated with a larger rise in household saving rates.

Apart from these short-term effects, city-level variations in terms of housing reform also render us a chance to explore the long-term effect of the 1998 reform on local housing prices and household saving rates. After control other city-level demand and supply side factors, we find that cities with rapid housing reform during 1998-2001 experience higher housing price rises after the reform (2001-2009). Facing the soaring housing prices, urban residents who want to purchase houses have to keep raising their saving rates. This issue is especially significant since the mortgage market in China is not well developed until very recently, and a large down payment is commonly required from financial institutions subject to government regulations. Using the city-level pace of reform as an instrumental variable for the housing price, we find that 1 percent rise in the local housing prices increase urban households saving rate by about 9.6 percent.

The rest of the paper is structured as follows. Section 2 reviews the literature. Section 3 documents the process of urban housing reforms in history and the development of the housing market in today's China. Section 4 outlines the potential mechanisms of how the reforms affect

households' savings. Sections 5 describes the UHS data. Sections 6-8 present empirical strategies and the results. We conclude with Section 9.

2 Literature Review

2.1 Housing Reform and Housing Prices in China

Most previous studies on China's urban housing reforms focus on the causes of the reform (Chen, 1996, 1998; Wang and Murie, 1996, 2000) and housing market consequences of the reform (Fu et al., 2000; Huang and Clark, 2002). The consequences beyond housing market, however, is relatively fewer studies. To our best knowledge, only two other papers have studied the effects of housing reform outside of the housing market, both of which focus on labor market outcomes. The first is (Wang, 2012) which studies the effect of housing reform on job mobility and entrepreneurship. The second is (Iyer et al., 2009) which examines the effects of city-specific timing of the reform on labor mobility. Both papers made use of the 1994 reform when households were entitled property rights by purchase the previous state-owned housing units in which they were living. Our paper is different from their papers from two perspectives. First, our paper emphasizes the effects of the 1998 reform when state employers were no longer allowed to provide public housing for their employees. Second, instead of labor mobility, we focus on the effects of the housing reform on household saving rates.

This paper is also related to a growing literature that studies the dynamics of housing prices in China. Most studies in this field are trying to find the fundamental reasons behind the growth of housing prices ((Wang and Zhang, 2014; Fang et al., 2015; Wu et al., 2015)). This paper contributes to the literature by linking the historical city-level variation in the pace of the housing reform with current housing prices.

2.2 Saving rates in China

About China's household consumption and savings, there are many explanations that have been put forth in the existing literature. The first is based on the life-cycle theory (Ando and Modigliani, 1963). The life cycle theory is widely found to be an important determinant of household consumption behavior. (Modigliani and Cao, 2004) argue that the rising share of the labor force in China's population has driven up the savings ratio. However, (Chamon and Prasad, 2010) find this explanation to be inconsistent with the profile of consumption and savings at the household level in China since older people save more than middle-aged people. They also found

that the savings ratios increased across all demographic groups during 1995-2005. Furthermore, (Kraay, 2000) finds that the life-cycle theory cannot explain the declining consumption ratio in aggregate-level data. The second explanation is based on liquidity constraints (Kuijs, 2005; Aziz and Cui, 2007). These researchers argue that the underdevelopment of China's financial market has forced households and companies to save more and has led to a lower consumption ratio. Nevertheless, the efficiency of China's financial markets is improving as time goes by, while the household consumption ratio is still declining. This suggests that the level of financial market development is, at most, a minor factor about China's household consumption. The third explanation is based on the precautionary savings theory (Meng, 2003; Blanchard and Giavazzi, 2006; Giles and Yoo, 2007; Chamon and Prasad, 2010; Liu et al., 2014), which argues that China's pension, health care, education, and housing system reforms have increased the uncertainty of household income and expenditure, and consequently, have increased household saving. We believe that precautionary saving is an important perspective for explaining China's low level of household consumption; however, recent social safety net reforms and the increasingly wide coverage of pensions and health care has not led to a significant rise in China's household consumption. Such a gap calls for further explorations of how the precautionary saving mechanism works with China's institutional background and on the effective policies targeting it.

Although housing has been mentioned as a potential factor that would affect household saving, few papers have directly studied the effect of the housing market on household saving. (Chamon and Prasad, 2010) find that the saving rate is higher for young and old households than for the middle-aged households. This finding is consistent with the story that young and old households are more likely to save for purchase a house (for themselves or their adult children). Our paper follows (Chamon and Prasad, 2010) and provides more detailed and solid evidence on the linkage between changes in housing market and household saving. Our explanation is also closely related with (Wei and Zhang, 2011) who argues that, as China experiences a rising sex ratio imbalance, the increased competition in the marriage market has encouraged Chinese people, especially parents with a son, to postpone consumption in favor of wealth accumulation to increase the competitiveness of their son. This argument emphasizes the important role of the privatized housing market in reshaping household living arrangements and in changing the whole society's attitude towards marriage. Both factors contribute to the growth in the household saving rate.

3 Institutional Background

3.1 China's Urban Housing Reform in History

Upon taking control in 1949, the Communist Party established a system that guaranteed jobs and houses for all urban workers. Under this system, the majority of urban residents were employed in state-owned enterprises and lived in state-owned housing units. These housing units were allocated, usually free or at a highly subsidized price, to state employees as in-kind compensation. Because the nominal rent collected did not even cover the cost of basic maintenance, there was little incentive for housing investment and improvement. As a result, China experienced continuously deteriorating urban living conditions and a widespread housing shortage under the old system.[6] For years, the majority of urban residents had to live in shared dormitories, which are usually small and lack necessary facilities, before moving into houses with better living conditions. This scheme of housing allocation not only largely depressed housing consumption and generated serious complaints from the public, but also caused a big financial burden for the central government.[7] In the late 1970s, these problems had become very serious and forced the government to reform the old system.

In the early stages of urban housing reforms (1979-1988), the government took a progressive approach. A series of reforms were implemented in certain selected cities. Those reforms included raising rents and promoting sales of public housing (Wang and Murie, 2000). In 1988, the central government began to develop nationwide housing reform. The initial attempt, however, were interrupted in 1989 by economic and political problems(Tiananmen Square protests). The actual national-level housing reform began in 1991, which allowed public housing units throughout the country to be sold to their current tenants. In 1994, the central government established a more comprehensive framework from both demand and supply sides, intending to facilitate the privatization of housing stocks. On the demand side, the 1994 reform provided two different arrangements for the purchase of public housing. Households could pay the market price and have full property rights, including the right to resell on the open market, or they could pay the subsidized price and have partial property rights in which restrictions on the resale of the house are imposed. To be more specific, houses with partial property rights have to wait five years for resale and have to share the profits from the sale with their work units. On the supply

[6] The per capita living space, for example, declined from 4.5 square meters in the early 1950s to 3.6 square meters in the late 1970s .

[7] As summarized in (Wang and Murie, 1999), state-owned housing had other problems including poor management and corruption with the distribution.

side, the construction of commodity houses and the development of the real estate industry were allowed and were gradually expanded.[8]

Clearly, the overall objective behind the 1994 reforms was to establish a functional housing market so that families could purchase housing directly from the market and so the government would be relieved from their housing responsibility. Unfortunately, this did not happen easily. Immediately after the 1994 reform, the country saw rapid growth in the professional housing development industry and an unprecedented housing construction boom. Instead of being sold to individual urban households, most of the housing units were purchased by work units, which then were resold at deeply discounted prices to their employees (Wang and Murie, 1996). Since many of the work units were state-owned and were not subject to hard budget constraints, their purchase behaviors significantly distorted the emerging housing market.

In 1998, to speed up the urban housing reform and to encourage the participation of individuals in the housing market, the central government decided to completely abolish[9] the public housing system. Work units were prohibited to build or provide housing units for their employees. Urban employees had either to buy the sitting public housing from their work units or to purchase commercial houses from the market. In the meantime, the government further increased the rents of public housing to make them less attractive and to set up a new housing finance system to help individuals obtain mortgages. The 1998 reform marked the turning point of China's housing reform. Shortly after it was implemented, China finally established the market mechanism in both housing production and housing consumption. By 2002,[10] this reform had been implemented in most cities and more than 80 percent of public housing had been sold to individuals (Wang and Murie, 2000). Since 2002, private market housing transactions have become more and more prevalent for Chinese households.

The housing reforms, especially reforms in the 1990s, have encouraged homeownership and have transformed China into a country with one of the highest rates of homeownership in the world. Figure 2 summarizes the year-over-year trend of different types of home ownership status between 1992 and 2009 based on the UHS. In 1992, approximately 85.4 percent of urban

[8]While the state owned all the land during this period, private-sector firms purchased land use rights for 70 years. Land use rights include the right to participate in secondary markets and to rent out the use of the land to others. The initial prices were set by public tender, auction, or negotiation. See (Lin and Ho, 2003)for more details on land use rights.

[9]Some SOEs offered monetary compensation to employees not living in public housing at the time of the reform to offset the associated loss for workers who were on the waiting list for public housing allocations. However, evidence suggests that this compensation was not universal and its effect was limited.

[10]After 2002, reforms in the housing sector have been focused on developing and regulating the housing loan market.

households in China were renting state-owned public housing; this proportion declines to 43.0 percent in 1998 and further to 5.9 percent in 2009. However, the proportion of households who live in owned houses[11] increases from 14.5 percent in 1992 to 57.0 percent in 1998 and further to 90.0 percent in 2009.

One important feature of this reform is that its implementation had a large geographic variation. This variation was allowed and encouraged by the central government, considering the large differences in both social and economic situations across different places.[12] To measure the pace of the 1998 reform at the city level, we calculate the decrease in the proportion of public housing among urban household between 1998 and 2002. The idea is that places with rapid reform should experience a larger decrease in public housing. Table 2 illustrates the variation of the pace of the 1998 reform at the province level. It shows that the proportion of private housing increase most rapidly in Guangdong and Shandong Provinces, which are both in China's coastal areas, while less rapidly in Shaanxi Province, which is located in hinterland China.

Around 1998, several other economic reforms were taking place in China. The most important one is the SOE reform, which led to a large-scale layoff of SOE employees. We are interested in learning the relationship between the two reforms at the city level. Particularly, if cities experienced rapid housing and SOE reforms at the same time, one should be concerned that the SOE reform may confound our major results (Liu et al., 2014). Table 2 illustrates the pace of the SOE reform at the province level, where the pace of the SOE reform is measured by the decline of the proportion of SOE employees in the city. It shows that Zhejiang and Sichuan Provinces has the most rapid SOE reform, while Gansu Province has the most moderate SOE reform. The correlation between the housing reform and the SOE reform is 0.067 at the city level and is only significant at 5 percent. These results indicate that though correlated, the 1998 housing reform and the SOE reform were carried out with considerable different paces at the local level.

3.2 Improved Living Conditions of Urban Households

Along with the housing privatization, the living conditions of the majority of households have also been dramatically improved. Our data provides comprehensive information on the living conditions of urban households, including the total floor area, the number of bedrooms, weather

[11] Owned houses included household with full property rights and those with partial property rights.

[12] Often, China's central government sets the guidelines and provides only very limited resources, and local governments are asked to pay for most of the costs involved in the reform.

a individual bathroom or kitchen is included in the house, types of water supply, heating system, and cooking fuel. This information makes it possible to describe the living conditions of urban households from three perspectives: unit size, unit structure, and facility in the unit. First, column(1) of Table 3 displays the increase of floor area by the ownership status over the years. It shows that the floor area has increased from 13 square meters in 1992 to 32 square meters in 2009.

Obviously, unit size is just one measure of housing quality. By looking at the various types of housing structures, we can divide housing stocks into the following categories: single family house, one-bedroom apartment, two-bedroom apartment, three-bedroom apartment, four-bedroom apartment and collective dormitory. Junior state employees normally lived in the collective dormitories in which they usually had to share the bathroom and kitchen with others for years before having the chance to move into apartments of better living conditions. Single-family houses were not common and were usually reserved for high-status employees. Columns (2)-(6) of Table 3 show the change of housing structures over the years. In 1992, 42.5 percent urban households lived in the collective dormitories; this proportion decreased to 25 percent in 1998 and further to 11 percent in 2009. Also in 1992, 57 percent of urban households lived in apartments; this proportion increased to 74 percent in 1998 and further to 86 percent in 2009.

Finally, we measure living conditions by facilities within the house: bathroom condition, water supply, heating system, and cooking fuel. Table 4 shows the improvement of housing conditions over the years. A larger value corresponds to better living conditions. For example, bathroom condition is coded as "no bathroom=1,""shared bathroom=2,""own bathroom without shower=3," and "own bathroom with shower=4."[13] It shows that only after 2002 did the average housing quality begin to improve. This largely reflects that housing stock of good condition is not available until 2002, when new construction began to appear in the market on a large scale. Table 5 reports the housing conditions by housing structure. It shows that the living conditions of apartments are much better than that of collective dormitories.

3.3 China's Housing Market Today

In addition to being a relatively young market, China's housing market today has three unique characteristics. First, the housing finance market is not mature. Individual mortgage lending by

[13]Water supply is coded as "river water=1,""shared running water=2," and "own running water=3"; heating system is coded as "no heating system=1,""stove and heated kang=2,""heater=3," and "air condition=4"; cooking fuel is coded as "no cooking fuel=1,""coal=2, and ""liquefied petroleum gas or pipeline gas=3."

formal banking institutions is less common and usually imposes stricter borrowing requirements. For example, the downpayments[14] and interest rates in China are typically higher than in other developed countries, such as the United States. In the meantime, the financial market doesn't provide products to refinance housing assets, which means housing are less liquid than those in developed countries. The imperfect mortgage market implies that China's households on average carry less debt and have to accumulate substantial wealth before purchasing houses.

Second, the development of the housing market was accompanied by a nationwide urbanization with rural migrants moving into urban areas, especially into the first- and second-tier cities. Between 1996 and 2005, the urban population increased by about 50 percent from 373 million to 562 million. The strong urbanization trend and the growth of the urban population contribute to a larger growth of housing demand in major cities.[15]

Those two factors have largely affected the demand side of the current housing market. On the supply side, China is also unique regarding the role of the government has played. Especially, different from U.S. cities where the housing supply is often determined by landscape and local land regulations (Saiz, 2010), the market response of housing supply in China is lagged because land is legally owned and controlled by the local government. Land sale revenues have contributed to a substantial fraction of local governments' fiscal budget (almost 50 percent in some cities). Under this "land finance" system, local governments have a strong incentive to push up land prices through limiting land supply. From 2002 to 2009, even though the rapid urbanization generated rapid growth of the housing demand, the areas of land supplied by governments increased relatively slow or even experienced a slight downturn in some years. The land fiscal dependence of local government has largely reduced the efficiency of land supply and is one of the main reasons behind the growing housing prices in certain cities.

4 Conceptual Theory and Hypothesis

The 1998 urban housing reform is likely to affect household saving behavior through three main channels in the short and long run. First, it changes the main method of how urban residents obtain housing. Because the financial responsibility of supporting the housing service have

[14]Banks usually require at least 30 percent down-payment qualifying for a mortgage. Because there is no mortgage insurance, applicants usually must pay the down-payment in full amount.

[15]Historically, the inter-province migration in China is largely regulated by the household registration system (hukou). Under this system, households must have official registration to live in a specific city and to have access to health, education and other public services. However, the restriction of this system has lessened in recent years. See (Garriga et al., 2014).

transferred from the state to the households, we should expect the overall household saving rates increase after the reform. In particular, for state-employees who are on the waiting list of the public housing, after the reform, they have to purchase houses from the private market instead of waiting for the assignment from their employers. Without a mature a mortgage market, this means that they have to sacrifice current consumption and save more for the future housing expenditures. On the other hand, for state-employees that already received public housing, they can continue to enjoy the housing benefit by staying in and purchasing these houses at prices lower than the market values. They are reluctant to save for housing unless they plan to own a second house in the future, which is less common in China. For non-state employees, no matter whether they are planning to buy a house, since they were not receiving the housing benefits before and after the reform, they are not affected by the housing reform unless from a general equilibrium effect.

Second, throughout the housing reform, the Chinese government adopted a decentralized approach in implementing the 1998 reform, which means the local governments can set up their timetable and implement the reform with their pace (Huang, 2004; Wang et al., 2005). The spatial heterogeneity renders us a chance to identify the effect of the reform on household savings at the city level. Because cities that underwent more rapid reform induce housing demand within a shorter period, they were expected to experience a more substantial increase in the households saving rates.

Apart from the immediate effects on household savings, the 1998 reform also has long-term effects on the development of private housing market. Given that the housing supply is limited by governments' rigorous control of land and the relatively lagged housing construction, the released housing demand caused by the housing reform were continually boosting the housing prices. Facing the soaring housing prices, urban residents who want to own a house have no choice but to save more. This is especially true considering that the mortgage market in China is still not well developed and a large down payment is commonly required from the financial institutions. According to (Fang et al., 2015), the price-to-income ratio is around 8-10 in the first to third-tier cities in recent years in China. This means households are paying eight times its annual disposable income to buy a home. If the household made a down payment of 40 percent with a modest mortgage rate of 6 percent, buying a house would require them to save 3.2 times the annual household income to make the down payment and another 45 percent of its annual income to service the mortgage loan. Since cities with rapid housing reform experience higher

housing prices, households living in these cities would have a larger financial burden and need to save more for housing.

To summarize, the potential effects of the 1998 reform are illustrated by the following four hypotheses. We test the four hypotheses in the later sections.

- Hypothesis 1: After 1998, The saving rates increase more for households living in public housing of poor condition than for households living in public houseling of good condition. The saving rates increase more for households with SOE employees than for households without SOE employees.
- Hypothesis 2: Between 1998 and 2002, more rapid housing reform is associated with higher household saving rates at the city level.
- Hypothesis 3: After 2002, the more rapid housing reform is associated with higher housing prices at the city level.
- Hypothesis 4: After 2002, household saving rates are higher in cities with higher housing prices.

5 Data

The data we use come from the Urban Household Survey (UHS) 1992-2009.[16] The survey is conducted annually by China's National Bureau of Statistics. With the purpose of monitoring income and expenditure changes for households whose registrations (Hukou) are located in urban areas, the UHS is the only household-level data set in China which goes back 20 years, and therefore covers the housing reform period. More importantly, the UHS provides detailed information on residential conditions, including property rights and living conditions. Those two features enable us to study the linkage between the dramatic changes in the housing market and rising household saving rates. Basic individual demographic and labor market variables are also available at the individual-level.[17]

The UHS samples households with urban household registration for every province in the nation. We use the data from 16 of the 31 provinces including Beijing, Shanxi, Liaoning,

[16]The UHS is based on a probabilistic sample and a stratified design, similar to that used in the Current Population Surveys (CPS) in the US.

[17]Because of its richness on household income and expenditure, the UHS have been widely used to analyze income inequality and household savings in China. See (Meng et al., 2005), (Chamon and Prasad, 2010; Song and Yang, 2010).

Heilongjiang, Shanghai, Jiangsu, Anhui, Jiangxi, Shandong, Henan, Hubei, Guangdong, Chongqing, Sichuanm Yunnan, and Gansu. The 16 provinces vary considerably in their geography and the levels of economic development, and thus, the data are roughly national representative. At the city level, the UHS covers about 110 cities, which include four first-tier cities- Beijing, Shanghai, Guangzhou, and Shenzhen, and about 20 second-tier cities, which are autonomous municipalities, provincial capitals, or vital industrial or commercial centers, and about 80 third-tier cities, which are important cities in their regions.

In 2002, the UHS underwent a major adjustment during which it added more samples and survey questions. For 1992-2001, we have about 8,000 households per year, and this number goes up to about 20,000 households for 2002-2009. Because the government started to abolish welfare housing in 1998 and the information on housing prices is only largely available after 2002, we study the short-term effect of the housing reform on household savings by using 1992-2001 data, and the long-term effect by combing 1992-2001 and 2002-2009 data. We exclude households whose household head were enrolled in school or retired, and we drop those with missing values for the key variables. Our final sample includes 230,924 households for 1992-2009.

We measure savings as the difference between disposable income and consumption expenditures. The measure of disposable income includes labor income, property income, transfers (both social and private, including gifts), and income from household sideline production. The consumption expenditure variable covers a broad range of categories[18]. Our data on housing prices come from the China Statistical Yearbook published by the National Bureau of Statistics (NBS). The NBS measures city-level housing prices by averaging the purchase prices of commercial housings in that city, which are collected from the business reports of real estate developers. Alternatively, households in the UHS reports the current value and total floor area of their houses, and we could construct city-level housing prices by averaging property values within a city. We use this alternative measurement of housing prices as a robustness check. All flow variables are expressed on an annual basis and, where relevant, nominal variables are deflated to 1995 value using the consumer price index (CPI). Our measurement of the housing prices is different from the commonly used NBS 70 city index and NBS average price index in the sense that it covers a relatively large set of cities, which are more suitable to answer our research question.[19]

[18]The consumption expenditure includes food, clothing and footwear, household appliances, goods and services, medical care and health, transportation and communications, recreational activities, education, and housing.

[19]Evidence shows that our housing price has a similar trend to the NBS 70 city index and NBS average price index.

A basic summary of statistics for the sampled households is reported in Table 5. Regarding household characteristics, the average household head is 43 years of age. Almost 72 percent of household heads are men and, on average, have 12 years of education. The average household size is three persons. About 88 percent of household has one member employed in SOE. On average, annual household income is 19,300 yuan and 20 percents are used as saving. About 72.8 percent households live in owned houses, 25.6 percent households rent public houses, and only 1.6 percent rent private houses. Table 6 also reports the city-level characteristics. During 1992-2009, the average city-level gross domestic product(GDP) per capita is 23,620 yuan. The average population density was 546 per square kilometers (about 35 dollars per square feet), and the urban population takes about 46.6 percent of the total population. Regarding the housing market, the average housing price is 2436 Yuan per square meters and the annual land supply at the city level is around 3.25 square kilometers every year.

In the following sections, we explore the effects of the 1998 housing reform from three perspectives. First, we estimate how the 1998 reform affects household saving rates during the reform period (1992-2001). Second, we explore the spatial variation of the pace of the 1998 reform at the city level, studying how the city-level household saving rates and housing prices are affected by the pace of housing reform. Finally, we study how higher housing prices, induced (instrumented) by a more rapid reform of the city, affect household saving rates after the reform period (2002-2009).

6 The 1998 Reform and the Household Saving: 1992-2001

The unequal treatment of the 1998 reform on household savings provides an opportunity to evaluate the causal impact of this reform through a difference-in-difference (DID) approach. This approach compares the household saving rates not only before and after the reform but also between treatment and control groups. We identify the treatment group as households with at least one SOE employee and that are on the waiting list for public housing. These households were most likely to be affected by the housing reform. The UHS provides no variables that directly define whether the households are on the waiting list. However, we can infer by checking the housing conditions. The idea is that housing conditions of households who are on the waiting list usually are poorer than those whose already received the public housing. These houses may lack necessary living facilities, like private bathroom or kitchen. As mentioned in the last section, households in the UHS report housing conditions from four dimensions: bathroom, water supply,

heating system and cooking fuel. So we define households as still on the waiting list of public housing if their housing conditions are reported as poor from at least two dimensions.[20]

We define two control groups. The first one includes households with at least one SOE employee and have already received the public housing from their employers (state-employed control group). Compared with households who were on the waiting list, these households were less likely to response to the housing reform because their housing demand was satisfied to some extent. This state-employed control group offers the advantage of absorbing other changes occurring in the state sector around the time of the housing reform, for example, changes in the wage structure or other in-kind compensations and lay-offs in the state sector. The second control group includes households that were working in the private sector (private-employed control group). Households in this group were not expecting the public housing, therefore, they should not be influenced by the abolition of the public housing.

Table 6 presents the summary statistics for the treatment and control groups before the 1998 housing reform. The treatment group is statistically similar to the control groups along with several dimensions, including age, year of education and family size. As expected, the treatment group is also different from the control groups along with a number of characteristics. For example, compared to the two control groups, households in the treatment group has relatively lower consumption and income.

To illustrate the potential effects of the 1998 reform on different groups of households, Figure 3 plots the saving rates of the treatment and control groups before and after the reform. It shows that the saving rates for all the three groups are relatively flat before the reform and they began to increase around 1998, and the trend of growth continues after 1998. Among the three groups, households in the treatment group experienced the largest growth in saving rates around and after 1998 comparing with the two control groups.

The baseline DID estimator is implemented as the ordinary least squares (OLS) regression with the following form:

$$S_i = \alpha_0 + \alpha_1 Treat_i * Post + \alpha_2 Post + \alpha_3 Treat_i + \alpha_4 X_i + \epsilon_i \tag{1}$$

where S_i is the household saving rate, *Treat* identifies the treatment group, and *Post* is a dummy

[20]We have used two alternative ways to define poor housing conditions and identify households who are on the waiting lists of public housing. The first one uses bathroom condition as the single criteria. The second one explores housing floor plan and defines households as on the waiting lists of public housing if they live in the collective dormitory. Using the two alternative definitions, we derive similar estimation results as using the baseline measurement.

variable that equals 1 for years after 1998. The vector of covariances, X_i includes age, education, gender, household size, the proportion of people who are participating in the labor market, and occupation dummies. The coefficient, α_1, is the estimated effect of housing reform. Throughout the paper, the standard errors are adjusted to allow for clustering at the city level to account for correlation in the city-level errors over time.

Table 7 summarizes the estimation results from equation (1) using a state-employed control group. We consider several different regression specifications. In column (1), we compare the saving rates of households before and after the reform. The positive coefficient indicates an increasing trend of household saving rates. In column (2), we add the treatment indicator *Treatment* and show that the growth of household saving rates in this group is larger than the other group. Column (3) reports the results for a preliminary DID estimation where we include the interaction term of *Treatment* and *Post*98. To control for unobserved city-level and macroeconomic factors that are affecting household savings, we include city and year dummies in column (4). We use this specification as the baseline model. To further control time-varying regional-level characteristics, we include the province-year dummies in column (5). Consistent with the first hypothesis, the estimates suggest that the reform significantly increases the saving rates for households in the treatment group relative to households in the state-employed control group. The saving rates of households on the waiting list increase by about 1.7 percent after the reform compared to households already received the housing benefits.

The accuracy of the DID estimate depends on the assumption that the composition of households of the different groups stays unchanged over time. This assumption might be violated if only households with limited financial resources stay live in houses of poor living condition after the reform. In this case, the DID estimations underestimate the effect of reform. To deal with this problem, we use data only one year before(1997) and after (1999) the reform and repeat the baseline DID regression in Table 8 column (1). The idea is that within a relatively short period, the number of households that have moved between treatment and control groups is small, and therefore, the composition of households of the different groups is relatively stable. As expected, the estimated effect of reform based on the 1997-1999 data is larger than these based on 1992-2001. Columns (2)-(3) provide three further robustness checks. Column (2) considers an alternative measurement of household saving rate, defined as log (per capita disposable income/per capita living expenditure) as in (Chamon and Prasad, 2010; Wei and Zhang, 2011). Column (3) mitigates the mega city effect by deleting the three big cities (Beijing, Shanghai,

and Guangzhou) from the estimation sample. The effects of housing reform are similar across different specifications.

Tables 9 and 10 report the estimation results from equation (1) using the private-employed control group. We consider a similar set of specifications as in Tables 7 and 8. The estimates suggest that the saving rates of households with SOE employees increase by about 2.4 percent more after the reform compared with households without SOE employees. These results are robust across different specifications which confirm our argument that the housing reform increases household saving rates. Although the treatment group differs from the control groups along with some characteristics, the two control groups also differ substantially from each other along those characteristics. Thus, the similarity in the coefficient estimates for the treatment group relative to the two control groups provides some robustness of the estimation results.

To further check the baseline results, we conduct two placebo checks. The first one is based on the event framework and includes lags and leads of the treatment year. Columns (2) and (4) of Table 11 report the results using the state-employed and private-employed control groups, respectively. These results show that leads are less significant, which confirm that the parallel trends assumption is not seriously violated in our case. On the other hand, we could pretend that the abolition of public housing was enacted in 1997 instead of 1998. The effects of a 1997 reform are not significant, which confirm that the raise of saving rates among the treatment group mainly comes from the 1998 reform.

7 Consequences of Cross-City Variation in Housing Reform

Although the abolition of public housing in 1998 was a nationwide reform, its implementation has large variations across cities as illustrated in Table 2. In this section, we evaluate the consequences of this cross-city variation in terms of the pace of the housing reform from two perspectives, as we study how the pace of housing privatization affects current household saving rates and future housing prices. In other words, we test the Hypothesis 2 and 3 in section 3. To measure the pace of housing reform, we calculate the decrease in the proportion of public housing among urban households between 1998 and 2001 at the city level. The idea is that cities with rapid reform should experience a larger decrease in the proportion of public housing.

7.1 The Housing Reform and the Household Saving: 1998-2001

Using the following regression model, we compare the household saving rates in cities with rapid or slow housing reform,

$$S_{ijt} = \beta_0 + \beta_1 Rapid_{jt} + \beta_2 SOERapid_{jt} + \beta_3 X_i + \epsilon_{ijt} \quad (2)$$

where S_{ij} is the saving rate of household i in city j, and $Rapid_j$ is a dummy variable indicating a rapid housing reform in city j, which is measured by whether the proportion of public housing is decreasing at a rate that is higher the national level in the same year. The vector of covariances X_i includes individual- and household- level variables such as age, education, gender, household size, the proportion of people participating in the labor market, and occupation dummies. City and year dummies are also included to control for the city- and macro- level characteristics.

The mid-1990s was a time of continued economic growth, during which the Chinese government introduced numerous policies to reform the socialist system. It is possible that cities with a rapid pace of housing reform are associated with a rapid SOE reform. To control for this alternative explanation, we include the pace of the SOE reform $SOERapid_j$ into the regression equation (2). The pace of the SOE reform is measured as the decline in the proportion of employees in the SOE sector. If a city experienced rapid SOE reform, the proportion of SOE employees in that city should decrease at a higher rate than that at the national level in the same year.

To further confirm our hypothesis about the relationship between the speed of housing reform and household saving, we repeat the DID estimations in the last section but replace the uniform reform year 1998 with the city-level pace of the reform. Columns (1) and (4) of Table 12 presents the DID regression results for the state- and private-employed control groups, respectively. These results suggest that saving rates for households in the treatment group grow more than for households in the two control groups. Columns (2) and (5) present the similar DID regressions for the pace of the SOE reform instead of the housing reform. The coefficients for the SOE reform are not significant. In columns (3) and (6), we take into consideration the pace of the housing reform and the pace of the SOE reform at the same time. The coefficients for the housing reform stay positive and significant while the coefficient for the SOE reform are not significant, which confirm our findings that the increase in household saving rates for the treatment group is more likely to be caused by the housing reform instead of the SOE reform.

7.2 The Housing Reform Pace and the Housing Prices: 2002-2009

The city-level housing reform, as a historical factor, not only has an immediate effect on local household saving rates but also has a persistent effect on the development of the housing market. First, cities with a larger proportion of households whose housing demand is depressed before the reform face a larger potential increase in the housing demand. After the reform, this demand is released more rapidly in cities with rapid reform. The rising demand leads to high housing prices if the housing supply is relatively inelastic. Figure 3 plots the correlation between the pace of the 1998 reform and the housing prices after the reform (2002-2009) at the city level. The figure shows that housing prices are higher in cities that experience rapid housing reform.

To test this hypothesis, we conduct the following city-level regression:

$$HP_j = \gamma_0 + \gamma_1 Reform_j + \gamma Z_j + \epsilon_j \tag{3}$$

where HP_j stand for the housing prices in city j during 2002-2009, and $Reform_j$ is the variable that measures the pace of housing reform with the change in the proportion of public housing among urban households between 1998 and 2001. Table 13 column (1) shows that housing prices are higher in cities with rapid housing reform. In column (2), we control demand side factors in the housing market including GDP per capita, population density, the proportion of urban population, sex ratio among population age 7 to 21. These variables control city-level housing demand from a comprehensive perspective. Especially the proportion of urban population controls the rising housing demand induced from rural-urban migration ((Garriga et al., 2014)), and the sex ratio among population age 7 to 21 control the competitive saving motive as in (Wei and Zhang, 2011). Consisting with the literature, all these demand side variables are significantly positively correlated with the housing prices in that city. In column (3), we control regional-level variations by including province dummies. In column (4), we further control supply-side factors by including the city-level land supply. The coefficient for land supply is positive but not significant. This probably is because the supply of land is endogenous, as local governments have a larger incentive to supply land in cities with higher housing prices. Among all these models, rapid housing reform is positively associated with higher housing price. These regressions link the historical characteristics around reform with the latter-day development of the housing market in the same city. This linkage highlights the far-reaching effects of the pace of the local reform around 1998 and validates an instrumental variable which we use in the next section.

8 The Housing Prices and the Household Saving Rates: 2002-2009

In this section, we study how the historical housing reform affects current household saving through its impacts on housing prices. We first directly estimate the effects of housing prices on household saving based on the pooled OLS. To deal with the potential endogeneity problem, we then use the housing reform variable as an instrument for the local housing prices.

8.1 OLS Results

We study the cross-sectional relationship between housing prices and household saving rates base on the following OLS model:

$$S_{ijt} = \tau_0 + \tau_1 HP_{jt} + \tau_2 X_{it} + \tau_3 D_j + \tau_4 D_t + \epsilon_{ijt} \tag{4}$$

where S_i is household saving rate; HP_{jt} is the housing price in city j in period t; and X_i includes individual controls, such as age, education, gender, occupation dummies, and household level characteristics, such as household size, home ownership status, living condition and unit area. Our coefficient of interest is τ_1, which represents the difference of household savings corresponding to different city-level housing prices.

We conduct the pooled OLS for the sample year 2002[21] to 2009. Column (1) of Table 14 shows the results of the baseline model. Household saving rates significantly increased by about 3.6 percent when the housing price increases by 1 percent. Columns (2)-(6) present the estimation results of different specifications. First, some city-level unobserved characteristics are likely to affect our cross-sectional results. Column (2) adds the interaction of province and year dummies to further control the unobserved characteristics that are time-varying. Columns (3) and column (4) use two alternative definitions of household saving rates. In column (3), housing expenditure is counted as both disposable income and expenditure. In column (4), we measure household savings rate by the formula 100∗(income-expenditure)/income as in (Wei and Zhang, 2011). To control for the potential measurement error of housing prices, we adopt two alternative measurements of housing prices in columns (5) and (6). The first one is the city-level housing prices calculated based on the UHS. The second alternative is the lagged city-level housing price. The effects of housing price are found to be positive and significant across the above specifications. In terms of the control variables, households owning a house have significantly

[21]The year 2002 is the first year when information on city-level housing prices becomes available.

higher saving rates, and households with poor living conditions or small unit spaces are also associated with higher saving rates.

8.2 Instrumental Variable Results

So far, our regression results suggest a strong correlation between the housing prices and the household saving rates. To interpret our results as causality, however, we have to deal with the following problems. On the one hand, the growth of household income can also cause the growth of housing price, which leads to a reverse causality. On the other hand, some unobservable factors that are relevant to the local market productivity can push up housing prices and household saving rates at the same time, which leads to an omitted variable problem.

We think the reverse causality problem is not severe for two reasons. First, housing prices are city-level variables, which is less likely to be affected by the saving rate of a single household. Second, if the household saving rate does affect housing prices by increasing housing demand, it can only affect the housing prices in the current or later years. In column (4) of Table 14, we use lagged housing prices instead of current housing prices and obtain similar regression results, which suggest that reverse causality would not seriously affect our main conclusion. For the omitted variable problem, we have controlled unobservable aggregate factors by adding city, year and province-year dummies. However, there are still some time-varying factors that are hard to be fully controlled. These factors could affect our regression results in an indefinite direction.

To solve the potential endogeneity problem, we use the pace of the housing reform between 1998 and 2001 as an instrumental variable for the housing prices in that city. As shown in Section 7.2, the pace of reform is a good predictor of the level of housing prices in that city, and it is less likely to affect current household saving rates other than through its effects on housing prices, given what we have controlled in the regressions. These features make it a good instrumental variable for the housing prices. Table 15 reports that the F-value for the first stage regression is 16.69, indicating that the pace of reform is not a weak instrumental variable. The coefficients for housing prices in the second stage are significant and positive, which further support our argument that higher housing prices raise household saving rates. One thing worth noticing here is that since the pace of housing reform is time-constant, it is not possible for us to control city dummies as we do in the OLS regressions. This explains why the OLS and IV coefficients in Table 16 is larger than those in Table 15.

9 Conclusion

Within a relatively short period, the 1998 housing reform have helped transform China's housing market from a public housing system to a private market. The sudden policy changes, however, have also profoundly changed China's economic structure. We find that the housing reform significantly raises urban household saving rates during and after the reform periods. This contributes to the rising saving rates at the macro level and the rising structural imbalance of the economy. To rebalance the economy structure, it is necessary to weaken the saving motive caused by the housing demand, in particular for low-income households. From this perspective, the government provided low-rent housing and affordable housing are essential complements to the commercial housing market.

More importantly, even though the market mechanism for housing consumption was established after the housing reform, the supply side of the housing is still far from competitive, mainly because housing supply is largely determined by the local government through the control of land supply. Restricted housing supply is one of the most important reasons behind high and rising housing price in big cities. To curb the rapid growth in housing prices and to enhance household consumption, it is necessary to bring in more market mechanisms into the land and housing supply process.

Table 1: Household Saving Rates of Different Counties (2011)

Country	U.S.	U.K.	Germany	Japan	South Korea	India	Brazil	China
Total Consumption as % of GDP	84	85	75	82	66	70	82	51
Household Consumption as % of GDP	68	65	56	61	51	59	62	37
Saving as % of GDP	16	15	25	18	34	30	18	49

Source: World Development Indicator (WDI).
Available at http://data.worldbank.org/indicator/NE.CON.TETC.ZS..

Table 2: The Pace of the 1998 Reform and the SOE Reform at Province Level: 1998-2002

	Housing Reform		SOE Reform	
	1997	1998-2001	1997	1998-2001
Beijing	0.88	-0.20	0.47	-0.03
Shanxi	0.69	-0.08	0.53	-0.08
Liaoning	0.68	-0.37	0.51	-0.06
Heilongjiang	0.53	-0.30	0.46	-0.09
Jiangsu	0.59	-0.23	0.53	-0.08
Zhejiang	0.38	-0.25	0.51	-0.19
Anhui	0.62	-0.23	0.56	-0.15
Jiangxi	0.71	-0.23	0.56	-0.09
Shandong	0.76	-0.40	0.60	-0.09
Henan	0.61	-0.10	0.51	-0.10
Hubei	0.83	-0.13	0.54	-0.04
Guangdong	0.80	-0.52	0.46	-0.06
Chongqing	0.76	-0.37	0.58	-0.11
Sichuan	0.55	-0.29	0.49	-0.14
Yunnan	0.37	-0.19	0.57	-0.08
Shaanxi	0.84	-0.00	0.50	-0.09
Gansu	0.81	-0.25	0.49	-0.04
Total	0.49	-0.28	0.44	-0.07

Note: The pace of the 1998 reform is measured by the decrease of the proportion of public housing among urban households between 1998 and 2001. The pace of the SOE reform is measured by the decline of population as SOE employees.
Source: Urban Housing Survey.

Table 3: Floor Area and Housing Structure over Time: 1992-2009

	Floor Area per capita(sqm)	Single Family House	One Bed	Two Beds	Three Beds	Four Beds	Collective Dormitories
1992	12.957	0.005	0.088	0.317	0.146	0.019	0.425
1993	13.288	0.004	0.081	0.342	0.158	0.018	0.396
1994	13.905	0.009	0.083	0.357	0.165	0.019	0.366
1995	14.302	0.007	0.090	0.389	0.172	0.022	0.319
1996	14.767	0.008	0.092	0.407	0.182	0.021	0.289
1997	15.613	0.011	0.087	0.412	0.194	0.021	0.275
1998	16.153	0.009	0.087	0.426	0.204	0.022	0.252
1999	16.897	0.010	0.082	0.436	0.213	0.022	0.237
2000	17.646	0.011	0.078	0.453	0.218	0.023	0.217
2001	18.203	0.012	0.080	0.462	0.217	0.021	0.208
2002	25.337	0.019	0.061	0.454	0.257	0.031	0.178
2003	26.851	0.024	0.061	0.457	0.260	0.030	0.167
2004	27.382	0.024	0.059	0.462	0.267	0.029	0.158
2005	29.256	0.020	0.059	0.477	0.281	0.031	0.132
2006	29.727	0.021	0.058	0.478	0.289	0.034	0.120
2007	29.751	0.022	0.051	0.485	0.293	0.032	0.117
2008	32.502	0.029	0.059	0.448	0.313	0.036	0.114
2009	32.368	0.030	0.056	0.446	0.319	0.037	0.111
Total	24.178	0.018	0.068	0.441	0.249	0.028	0.196
Obs.	230924						

Source: Urban Housing Survey.

Table 4: Housing Condition over Time: 1992-2009

	Bathroom	Water Supply	Cooking Fuel	Heating
1992	2.519	2.836	1.612	1.754
1993	2.632	2.856	1.663	1.808
1994	2.757	2.868	1.717	1.860
1995	2.864	2.888	1.753	1.909
1996	2.965	2.906	1.781	1.977
1997	3.023	2.891	1.818	2.014
1998	3.070	2.899	1.842	2.038
1999	3.110	2.912	1.855	2.081
2000	3.165	2.927	1.866	2.169
2001	3.188	2.932	1.868	2.211
2002	3.354	2.938	1.880	2.351
2003	3.399	2.942	1.888	2.397
2004	3.446	2.939	1.901	2.475
2005	3.523	2.945	1.917	2.636
2006	3.553	2.950	1.922	2.678
2007	3.697	2.982	1.933	2.752
2008	3.721	2.987	1.935	2.737
2009	3.728	2.988	1.934	2.751
Total	3.322	2.933	1.860	2.374
Observations	230924			

Note: A larger value corresponds with better living conditions. Bathroom condition is coded as no bathroom=1,shared bathroom=2,own bathroom without shower=3, and own bathroom with shower=4; water supply is coded as river water=1,shared running water=2, and own running water=3; heating system is coded as no heating system=1,stove and heated kang=2,heater=3, and air conditioning=4; cooking fuel is coded asno cooking fuel=1,coal=2, and liquefied petroleum gas and pipeline gas=3. Source: Urban Housing Survey.
Source: Urban Housing Survey.

Table 5: Summary of Statistics: 1992-2009

	Count	Mean	SD	Min	Max
Age	230924	43.07	8.15	20.00	64.00
Female	230924	0.29	0.45	0.00	1.00
Years of Education	230828	11.90	2.68	0.00	18.00
Household Size	230924	3.02	0.73	1.00	9.00
Household Consumption(RMB)	230924	14210	12364	1132	89098
Household Disposable Income(RMB)	230924	19300	17146	1380	109358
Household Saving	230924	0.20	0.25	-1.08	0.75
Ratio of Workers	230924	0.69	0.19	0.00	1.00
Work in SOE	230924	0.88	0.33	0.00	1.00
Housing Condition	207526	0.12	0.32	0.00	1.00
Homeowner	230924	0.73	0.45	0.00	1.00
Rent Public Housing	230924	0.26	0.44	0.00	1.00
Rent Private Housing	230924	0.02	0.13	0.00	1.00
GDP per Capita (RMB)	200031	23620	28983	1825	339864
Population Density(per sq km)	187595	546	382	4	4018
Sex Rato 7-11	230924	0.64	0.17	0.03	1.00
Prop. of Urban Population	198367	0.47	0.27	0.08	3.59
Land Supply (sq km)	68192	3.28	3.21	0.01	28.33
Housing Price (RMB per sqm)	133961	2436.	1933	448	11297
Observations	230924				

Source: Urban Housing Survey.

Table 6: Summary Statistics of the Treatment and Control Groups: 1992-2001

	Treatment Group	State-Employed Control Group	Private-Employed Control Group
Age	41.27	41.95	43.40
Female	0.24	0.31	0.43
Years of Education	11.11	11.82	10.30
Household Size	3.28	3.20	3.19
Household Consumption (RMB)	2923	4096	3911
Household Disposable Income(RMB)	3582	5076	4749
Household Saving	0.16	0.17	0.15
Ratio of Workers	0.67	0.69	0.70

Note: The treatment group is households still on the waiting list of public housing and with at least one member employed in SOE. Control group 1 is households with at least one member employed in a SOE, but living in houses of good condition. Control group 2 is households working in the private sector.
Source: Urban Housing Survey.

Table 7: Household Saving and 1998 Housing Reform (1992-2001)
DID: State-employed Control Group

	(1)	(2)	(3)	(4)	(5)
Post98*Treatment			0.016***	0.017***	0.010*
			(0.005)	(0.005)	(0.005)
Post 1998	0.006***	0.009***	0.007***	0.039***	0.082***
	(0.002)	(0.002)	(0.002)	(0.004)	(0.016)
Treatment		0.025***	0.021***	0.012***	0.016***
		(0.002)	(0.002)	(0.003)	(0.003)
Log(HH Income P.C.)	0.090***	0.095***	0.096***	0.160***	0.160***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Years of Education	-0.001*	-0.001	-0.001	-0.001**	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age	-0.000***	0.000***	0.000***	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ratio of Workers	0.108***	0.107***	0.107***	0.064***	0.063***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Household Size	0.048***	0.050***	0.050***	0.072***	0.072***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	-0.683***	0.691***	0.691***	1.241***	1.296***
	(0.016)	(0.030)	(0.030)	(0.031)	(0.036)
Occupation dummies	Yes	Yes	Yes	Yes	Yes
City dummies	No	No	No	Yes	Yes
Year dummies	No	No	No	Yes	Yes
Prov_Year dummies	No	No	No	No	Yes
Observations	64598	61154	61154	61154	61154
R^2	0.059	0.063	0.063	0.126	0.131

Note: Treatment group includes households with SOE employees who are on the waiting list of public housing. Stateemployed Control group includes households with SOE employees who already lived in public housing.
Standard errors in brackets.
* p<0.10, ** p<0.05, *** p<0.01.

Table 8: Robustness Check(1992-2001)
DID: State-employed Control Group

	1997-1999	Alte. SR	Allow HAC
Post98*Treatment	0.020**	0.025***	0.017***
	(0.006)	(0.006)	(0.005)
Post 1998	0.002	-0.044***	-0.033***
	(0.004)	(0.005)	(0.004)
Treatment	0.017***	0.014***	0.011***
	(0.004)	(0.003)	(0.003)
Log(HH Income P. C.)	0.160***	0.207***	0.155***
	(0.003)	(0.003)	(0.003)
Years of Education	-0.001*	-0.002**	-0.002***
	(0.001)	(0.001)	(0.000)
Age	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Ratio of Workers	0.079***	0.081***	0.067***
	(0.009)	(0.008)	(0.007)
Household Size	0.075***	0.093***	0.072***
	(0.002)	(0.002)	(0.002)
Constant	-1.261***	-1.617***	-1.276***
	(0.045)	(0.040)	(0.054)
Occupation dummies	Yes	Yes	Yes
City dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	31210	61154	54075
R^2	0.139	0.144	0.126

Note: Treatment group includes households with SOE employees who are on the waiting list of public housing. State-employed Control group includes households with SOE employees who already lived in public housing. Column (1) uses data of 1997-1999 instead of 1992-2002. Column (2) considers an alternative measurement of household saving rate which includes housing expenditure as both disposable income and consumption. Column (3) allows for serial correlation heteroscedasticity and autocorrelationconsistent asymptotic variance (HAC) by clustering standard errors within groups. Column (4) mitigates the mega city effect by deleting the three big cities (Beijing, Shanghai and Guangzhou) from the estimation sample.
Standard errors in brackets.
* p<0.10, ** p<0.05, *** p<0.01.

Table 9: Household Saving and 1998 Housing Reform
(1992-2001)
DID: Private-employed Control Group

	(1)	(2)	(3)	(4)	(5)
Post98*Treatment			0.026***	0.024***	0.015*
			(0.005)	(0.005)	(0.006)
Post 1998	0.009***	0.008**	0.005	0.048***	0.062*
	(0.003)	(0.003)	(0.004)	(0.006)	(0.028)
Treatment		0.044***	0.035***	0.020***	0.021***
		(0.003)	(0.003)	(0.004)	(0.004)
Log(HH Income P. C.)	0.092***	0.105***	0.106***	0.164***	0.164***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Years of Education	-0.001	-0.001	-0.001	-0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age	-0.000	-0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ratio of Workers	0.081***	0.082***	0.082***	0.051***	0.050***
	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)
Household Size	0.046***	0.050***	0.051***	0.069***	0.069***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	-0.682***	0.806***	0.808***	1.286***	1.279***
	(0.034)	(0.036)	(0.036)	(0.041)	(0.045)
Occupation dummies	Yes	Yes	Yes	Yes	Yes
City dummies	No	No	No	Yes	Yes
Year dummies	No	No	No	Yes	Yes
Prov_Year dummies	No	No	No	No	Yes
Observations	27085	26292	26292	26292	26292
R^2	0.066	0.075	0.076	0.136	0.144

Note: Treatment group includes households with SOE employees who are on the waiting list of public housing. Privateemployed Control group includes households with no SOE employees.
Standard errors in brackets.
* p<0.10, ** p<0.05, *** p<0.01.

Table 10: Robustness Check(1992-2001)
DID: Private-employed Control Group

	1997-1999	Alte. SR	Allow HAC
Post98*Treatment	0.021**	0.032***	0.024***
	(0.007)	(0.006)	(0.006)
Post 1998	-0.006	-0.054***	-0.044***
	(0.007)	(0.007)	(0.007)
Treatment	0.022***	0.024***	0.018***
	(0.005)	(0.004)	(0.004)
Log(HH Income P. C.)	0.168***	0.210***	0.158***
	(0.005)	(0.004)	(0.004)
Years of Education	-0.002*	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)
Age	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)
Ratio of Workers	0.075***	0.066***	0.058***
	(0.012)	(0.010)	(0.009)
Household Size	0.076***	0.089***	0.069***
	(0.003)	(0.003)	(0.002)
Constant	-1.366***	-1.669***	-1.181***
	(0.059)	(0.053)	(0.047)
Occupation dummies	Yes	Yes	Yes
City dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	12214	26292	23292
R^2	0.156	0.155	0.134

Note: Treatment group includes households with SOE employees who are on the waiting list of public housing. Private-employed Control group includes households with no SOE employees. Column (1) uses data of 1997-1999 instead of 1992-2002. Column (2) considers an alternative measurement of household saving rate which includes housing expenditure as both disposable income and consumption. Column (3) allows for serial correlation heteroscedasticity and autocorrelation-consistent asymptotic variance (HAC) by clustering standard errors within groups. Column (4) mitigates the mega city effect by deleting the three big cities (Beijing, Shanghai and Guangzhou) from the estimation sample.
Standard errors in brackets.
* p<0.10, ** p<0.05, *** p<0.01.

Table 11: Placebo Checks: 1992-2001

	State-employed Control Group		Private-employed Control Group	
	(1)	(2)	(3)	(4)
Post98*Treatment	0.017***		0.024***	
	(0.005)		(0.005)	
Post 1998	-0.039***		-0.048***	
	(0.004)		(0.006)	
Treatment	0.012***	0.012**	0.020***	0.021***
	(0.003)	(0.004)	(0.004)	(0.005)
Post 1997		-0.009		-0.039***
		(0.007)		(0.010)
Post97*Treatment		0.025**		0.022*
		(0.008)		(0.009)
Log(Household Income Per Capita)	0.160***	0.191***	0.164***	0.201***
	(0.002)	(0.005)	(0.004)	(0.007)
Years of Education	-0.001**	-0.000	-0.002***	-0.002*
	(0.000)	(0.001)	(0.001)	(0.001)
Age	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Ratio of Workers	0.064***	0.042***	0.051***	0.032*
	(0.006)	(0.011)	(0.009)	(0.015)
Household Size	0.072***	0.082***	0.069***	0.085***
	(0.002)	(0.003)	(0.002)	(0.004)
Constant	-1.241***	-1.521***	-1.286***	-1.601***
	(0.031)	(0.050)	(0.041)	(0.068)
Occupation dummies	Yes	Yes	Yes	Yes
City dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	61154	61154	26292	26292
R^2	0.126	0.061	0.136	0.073

Note: Treatment group includes households with SOE employees who are on the waiting list of public housing. State-employed Control group includes households with SOE employees who already lived in public housing. Private-employed Control group includes households with no SOE employees.
Standard errors in brackets.
* p<0.10, ** p<0.05, *** p<0.01.

Table 12: The Pace of Housing Reform and Household Saving (1998-2001): DID

	State-employed Control Group			Private-employed Control Group		
	(1)	(2)	(3)	(4)	(5)	(6)
Treat*Housing reform	0.026**		0.026**	0.029*		0.030*
	(0.009)		(0.009)	(0.012)		(0.012)
Treat*SOE reform		0.008	0.007		0.012	0.013
		(0.009)	(0.009)		(0.011)	(0.011)
Rapid Housing Reform	0.196***		0.200***	0.046		0.052
	(0.028)		(0.035)	(0.068)		(0.068)
Rapid SOE Reform		-0.009	-0.010		0.032	0.017
		(0.035)	(0.044)		(0.065)	(0.027)
Treatment	0.011	0.021**	0.008	0.014	0.027***	0.007
	(0.007)	(0.007)	(0.008)	(0.009)	(0.008)	(0.011)
Log(HH Income P. C.)	0.161***	0.161***	0.161***	0.165***	0.165***	0.165***
	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)
Years of Education	-0.001	-0.001	-0.001	-0.003**	-0.003**	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age	-0.001**	-0.001**	-0.001**	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ratio of Workers	0.081***	0.081***	0.081***	0.083***	0.082***	0.083***
	(0.010)	(0.010)	(0.010)	(0.014)	(0.014)	(0.014)
Household Size	0.079***	0.079***	0.079***	0.074***	0.074***	0.074***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Constant	-1.325***	-1.331***	-1.324***	-1.128***	-1.169***	-1.121***
	(0.075)	(0.068)	(0.075)	(0.090)	(0.063)	(0.090)
Occupation dummies	Yes	Yes	Yes	Yes	Yes	Yes
City dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22360	22360	22360	8775	8775	8775
R^2	0.142	0.142	0.142	0.164	0.164	0.164

Note: Treatment group includes households with SOE employees who are on the waiting list of public housing. State-employed Control group includes households with SOE employees who already lived in public housing. Private-employed Control group includes households with no SOE employees.
Standard errors in brackets.
* p<0.10, ** p<0.05, *** p<0.01.

Table 13: The Pace of Housing Reform and Housing Price(2002-2009)

	(1)	(2)	(3)	(4)
Rapid Housing Reform	1.180***	0.285***	0.382***	0.529***
	(0.098)	(0.074)	(0.081)	(0.113)
Log(GDP per Capita)		0.347***	0.264***	0.195***
		(0.031)	(0.033)	(0.042)
Log(Population Density)		0.110***	0.121***	0.152**
		(0.023)	(0.034)	(0.055)
Prop. of Urban Population		0.406***	0.378***	0.398***
		(0.069)	(0.059)	(0.069)
Sex Ratio 7-21		2.858***	4.500***	4.288***
		(0.525)	(0.703)	(0.871)
log(Land Supply)				0.018
				(0.017)
Constant	7.183***	3.440***	4.995***	4.602***
	(0.029)	(0.253)	(0.353)	(0.468)
Prov Dummies	No	No	Yes	Yes
Observations	576	490	490	219
R^2	0.141	0.739	0.810	0.775

Standard errors in brackets.
* p<0.10, ** p<0.05, *** p<0.01.

Table 14: Housing Price and Household Saving(2002-2009)
Pooled OLS

	(1)	(2)	(3)	(4)	(5)	(6)
log (Housing Price)	0.036***	0.014***	0.009***	0.046***		
	(0.007)	(0.004)	(0.003)	(0.009)		
log (Housing Price)UUHS)					0.016**	
					(0.005)	
log (Housing Price t-1)						0.036***
						(0.008)
Log(HH Income P. C.)	0.211***	0.211***	0.280***	0.288***	0.210***	0.211***
	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)
Homeowner	0.004	0.004	-0.029*	0.004	0.007	0.010
	(0.005)	(0.005)	(0.013)	(0.007)	(0.005)	(0.006)
Rent Public Housing	-0.018***	0.017**	-0.051***	0.024***	0.014**	-0.012*
	(0.005)	(0.005)	(0.013)	(0.006)	(0.005)	(0.006)
Partial Property Housing	-0.021***	0.020***	0.026***	0.028***	0.022***	0.024***
	(0.003)	(0.003)	(0.006)	(0.004)	(0.003)	(0.003)
Commercial Housing	-0.010***	0.010***	0.013	-0.015***	0.010***	0.012***
	(0.003)	(0.003)	(0.007)	(0.004)	(0.003)	(0.003)
Housing Condition	0.048***	0.046***	0.071***	0.059***	0.045***	0.044***
	(0.003)	(0.003)	(0.007)	(0.004)	(0.003)	(0.003)
Housing Area P. C.(sqm)	-0.000***	0.000***	0.001***	0.001***	0.001***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Years of Education	-0.005***	0.005***	0.004***	0.007***	0.005***	0.005***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Age	0.001***	0.001***	0.001***	0.002***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Household Size	0.044***	0.044***	0.055***	0.057***	0.044***	0.044***
	(0.001)	(0.001)	(0.003)	(0.002)	(0.001)	(0.001)
Ratio of Workers	0.044***	0.043***	0.027*	0.045***	0.044***	0.037***
	(0.005)	(0.005)	(0.011)	(0.006)	(0.004)	(0.005)
Constant	-2.192***	2.040***	2.532***	2.969***	2.015***	2.243***
	(0.064)	(0.079)	(0.138)	(0.080)	(0.044)	(0.076)
Occupation dummies	Yes	Yes	Yes	Yes	Yes	Yes
City Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Prov_Year Dummies	No	Yes	No	No	No	No
Observations	117270	117270	117270	117270	131340	101468
R^2	0.175	0.178	0.067	0.201	0.175	0.176

Note: Column (2) adds province-year dummies. Column (3) uses alternative definition of saving rate by adding housing expenditure into both disposable income and expenditure. Column (4) measures household savings rate by the formula $100x$(income-expenditure)/income as in Wei and Zhang [2011]. Column (5) uses hedonic housing prices calculated based on the UHS. Column (6) uses lagged housing price.
Standard errors in brackets.
* p<0.10, ** p<0.05, *** p<0.01.

Table 15: Housing Price and Household Saving(2002-2009)
Instrumental Variable Method

	OLS	IV	
		First Stage	Second Stage
log (Housing Price)	0.091***		0.096***
	(0.002)		(0.005)
Rapid Housing Reform		1.061***	
		(0.008)	
Log(Household Income Per Capita)	0.202***	0.507***	0.202***
	(0.002)	(0.004)	(0.003)
Homeowner	0.016**	0.015	0.011
	(0.005)	(0.013)	(0.007)
Rent Public Housing	-0.022***	0.137***	-0.020**
	(0.005)	(0.013)	(0.006)
Partial Property Housing	-0.030***	-0.076***	-0.029***
	(0.003)	(0.006)	(0.004)
Commercial Housing	-0.021***	-0.077***	-0.014***
	(0.003)	(0.006)	(0.004)
Housing Condition	0.050***	-0.141***	0.056***
	(0.003)	(0.006)	(0.004)
Housing Area Per Capita(sqm)	-0.000***	-0.007***	-0.000**
	(0.000)	(0.000)	(0.000)
Years of Education	-0.005***	-0.012***	-0.005***
	(0.000)	(0.001)	(0.000)
Age	0.001***	0.005***	0.001***
	(0.000)	(0.000)	(0.000)
Household Size	0.044***	0.009**	0.048***
	(0.001)	(0.003)	(0.002)
Ratio of Workers	0.055***	-0.360***	0.053***
	(0.004)	(0.009)	(0.006)
Constant	-1.036***	2.910***	-1.020***
	(0.016)	(0.034)	(0.025)
Occupation dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	117270	75965	75965
R^2	0.146	0.487	0.145
F		16.69	

Standard errors in brackets.
* p<0.10, ** p<0.05, *** p<0.01.

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Figure 1: The Trend of Home Ownership Status: 1992-2009

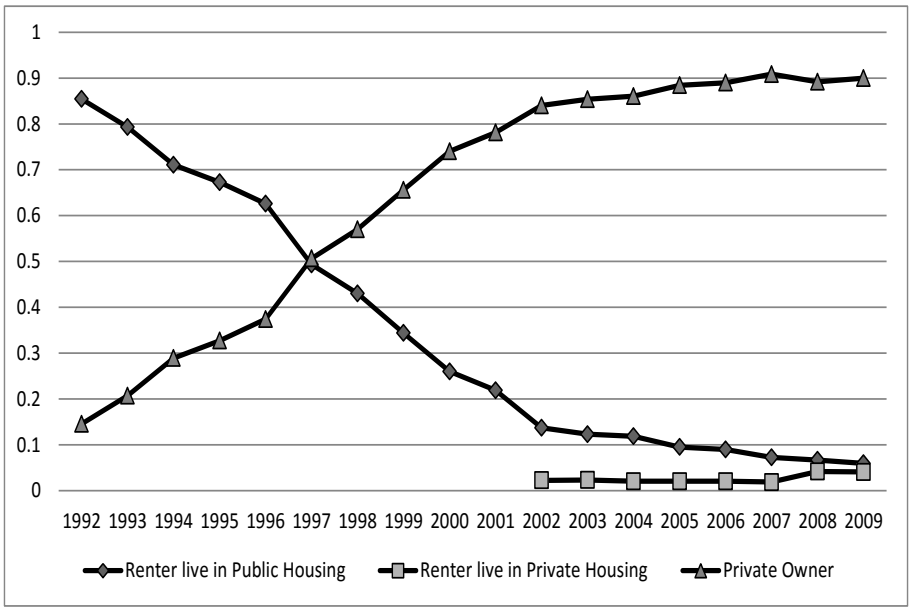
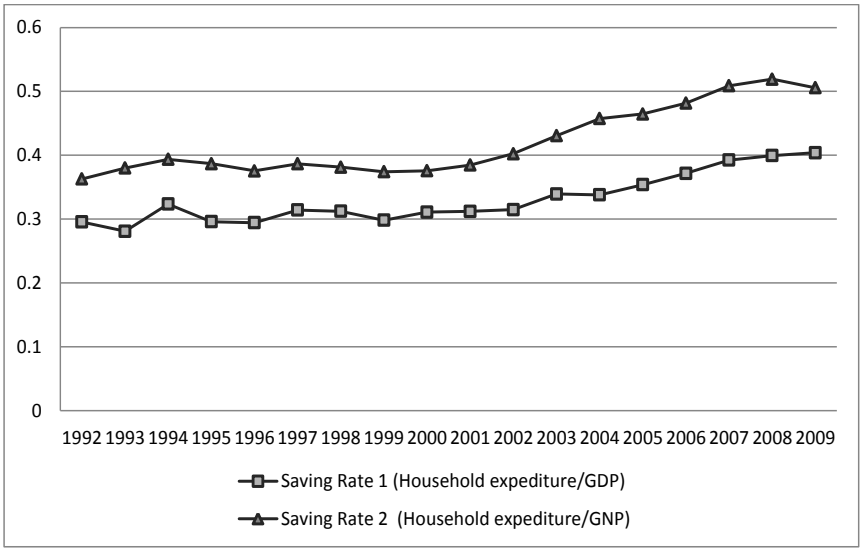
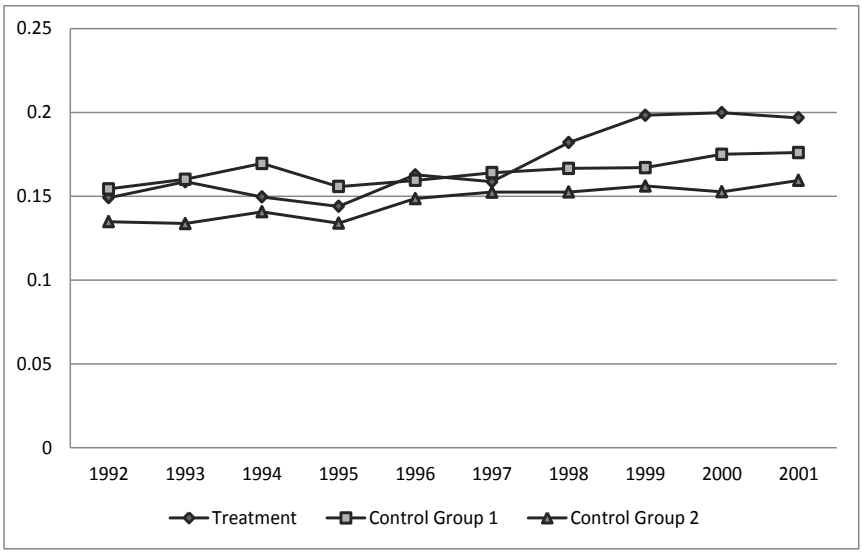


Figure 2: Household Saving Rate: 1992-2009



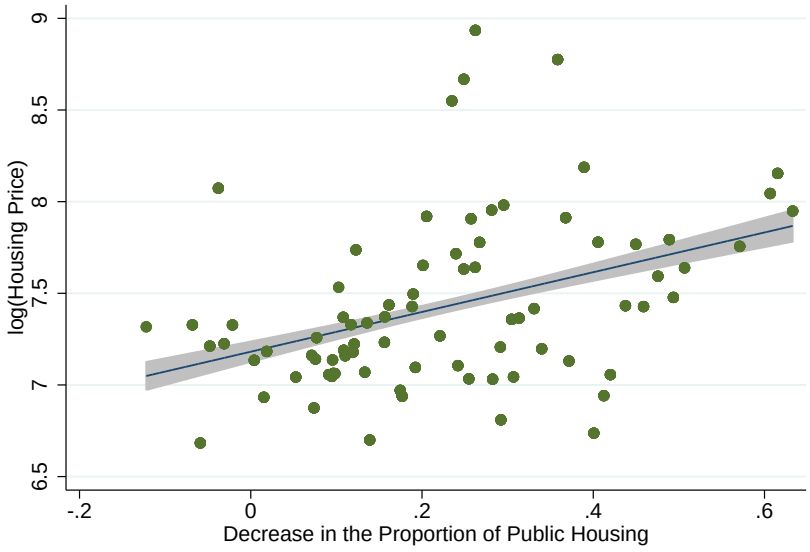
Source: National Bureau of Statistics of China

Figure 3: Household Saving Rates for Treatment and Control Groups: 1992-2001



Source: Urban Household Survey

Figure 4: Housing Reform and Housing Price: 2002-2009



Source: Urban Household Survey

10 Appendix

10.1 Alternative Definitions of Poor Condition Houses

In this section, we consider three alternative definitions of poor condition houses. Definition 1 defines poor condition houses as houses lacking at least two basic facilities among the four (bathroom, heater, cooking fuel, and water.) Definition 2 defines poor condition houses as collective dormitories. Definition 3 defines poor condition houses as houses without a bathroom. Table A1 presents the time trend of housing stocks with poor living conditions by the three definitions, which are quite consistent. Table A2 reports their correlations of different definitions of poor living conditions and indicate strong correlations between different definitions.

Table A1: Alternative Definitions of Poor Condition Houses

	Def 1	Def 2	Def 3
1992	0.345	0.425	0.437
1993	0.296	0.396	0.392
1994	0.250	0.366	0.350
1995	0.223	0.319	0.310
1996	0.195	0.289	0.271
1997	0.162	0.275	0.234
1998	0.146	0.252	0.212
1999	0.135	0.237	0.197
2000	0.115	0.217	0.176
2001	0.112	0.208	0.166
2002	0.096	0.178	0.137
2003	0.094	0.167	0.128
2004	0.083	0.158	0.118
2005	0.061	0.132	0.091
2006	0.055	0.120	0.083
2007	0.042	0.117	0.063
2008	0.048	0.114	0.055
2009	0.049	0.111	0.053
Total	0.118	0.196	0.158
Observations	230924		

Source: Urban Housing Survey.

Table A2: Correlations of Different Definitions of Poor Living Conditions

	Def 1	Def 2	Def 3
Def 1	1		
Def 2	0.508***	1	
Def 3	0.601***	0.785***	1

Source: Urban Housing Survey.