Determinants of household's housing condition in Urban China: A study based on NBS panel data

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Abstract

With rapid economic growth and dramatic progress in the market–oriented reform on housing systems since the 1ate 1980s, the housing conditions in urban China have improved significantly. On the other hand, it is widely believed that the introduction of market mechanisms has led to the rise of housing inequality among urban households. Based on panel data of the NBS survey (2004-2007), this paper measures housing inequality among urban households in 162 cities, and examines the determinants of individual household's housing conditions in China. We find that in the period investigated, there exists a rising trend in housing inequality among urban households. However, the rise of inequality is not simply the result of the market–oriented reform. Our panel analysis demonstrates that although the income factors such as "Household Total Income" have dominant effects on the probability of owning a market-price (i.e., high price) house, the probability of owning a low-price house or renting a public house provided by the government is still significantly affected by some non-income factors, including the employment sectors of household members, and their Hukou (registered residence status). As a whole, both income/market and non-income/institution factors have effects on the probability of having a resident-owned house as well as on the house size. More interestingly, compared to Peking and Shanghai, the two most developed cities in China, the household housing conditions of the rest 160 cities included in the survey receive stronger influence from the old housing allocation system and Hukou system. It means that in the mid-2000s the rising housing inequality in urban China should be the result of a combined influence from ongoing market–oriented reforms and the persisting impact of some traditional systems.

Keywords: *Housing condition, inequality, urban China, determinants, panel data*

JEL: D6, R31

1. Introduction

During the socialist planned economy period (1950s - late 1970s), China's urban housing system was a government-funded and government-run welfare-oriented system. Due to extremely low government investment in housing construction, the housing shortage became the most serious problem in urban China. After 1978, with reforms to the economic system, China's urban housing system underwent a dramatic transition from an inefficient welfare-oriented system to a market-oriented one.

Housing system reform in China has taken two paths: privatization of public housing, and development of new private housing (Tang et al. 2006; Gao 2010). In 1992, China had established a nationwide real estate market. In 1998, the Chinese government announced the termination of old housing allocation system, under which urban housing was treated as a kind of public welfare. In 1999, the Ministry of Construction further clarified that all existing public housing should be sold to current qualified residents who are willing to purchase it. After 2000, when the privatization of existing public housing was almost completed, the production and distribution of new housing for urban residents began to be determined by the housing market. Housing system reforms over the past decades, particularly in the most recent two decades, have led to significant improvements in the housing conditions in urban China. The per capita floor space of urban households rose dramatically from 6.7 m^2 in 1978 to 30.1 m^2 in 2007, and 32.9 m^2 in 2012 (NBS, 2014).

On the other hand, there are high concerns that housing inequality amongst urban households has been rising in recent years. Regarding the causes of rising housing inequality, many researchers tend to believe that it is the result of China's ongoing market-oriented reform, which has been accompanied by a significant rise in income inequality. Meanwhile, other researchers stress that the overall housing distribution patterns of contemporary urban China have transformed from the old welfare–oriented housing system, under which some non-income factors such as the characteristics of household member occupations and Hukou (registered residence status) were important for gaining access to public housing at low cost. They argued that, although the welfare–oriented housing system was almost completely abolished around 2000, the previous public housing sold to users at very low prices remains to be the largest part of the total housing stock in urban China. Consequently, the old housing distribution system still has a large impact on the current housing distribution in urban China.

With increasing concerns about urban housing inequality from society and the government, more empirical studies based on qualified data are necessary to provide support for policy making. This paper, using panel survey data (2004-2007) from China's National Bureau of Statistics (NBS), attempts to answer the following questions:

(1) What is the trend of housing inequality in urban China in the mid-2000s?

(2) Which factors affect a household's probability of having a resident-owned house and renting a public house owned by the government?

(3) Which factors affect a household's house size (floor space)?

This paper is organized into 6 sections. Section 2 reviews previous studies. Section 3 introduces the data and approaches used in the paper. Section 4 measures housing inequality in urban China for the period 2004-2007. Section 5 examines the effects of household characteristics, including income factors and non-income factors, on a household's probability of owning various types of houses and renting a public house as well as on house floor space. Section 6 offers concluding remarks.

2. Review of previous studies

The quality of an empirical study largely depends on the quality of data. Unfortunately, researchers on China's housing issues always encounter the problem of poor housing data. In fact, until 2000, China had not conducted a nationwide housing survey. The Population Census in 2000 was the first time China collected information on the housing condition of all households in the country. Since 2000, the National Bureau of Statistics (NBS) has gradually increased the number of questions on housing in the annual sample household survey. However, the household level micro-data collected from these surveys have never been released to the public. As a result, there is only a small number of related empirical studies despite significant concerns about the issues pertaining to housing inequality, and these are mainly based on data from small-scale surveys conducted by academic institutions or the aggregated data of the NBS survey with very limited information. Despite the small volume of literature, previous studies have discussed two key questions: (1) how high is the level of housing inequality in urban China? And (2) what are the underlying factors of housing inequality?

Among the literature that focuses on question (1), Dai and Xue (2002, 2007) are earlier empirical studies, which measured the housing inequality of 13 Chinese cities, using the household level data from the *CASS (Chinese Academy of Social Sciences) 1999 Survey*. Their estimations show that the Gini coefficient of housing inequality in the 13 cities had reached a considerable level, ranging from 0.27 in Jinzhou, a mid-sized city in Liaonin province, to 0.42 in Beijing[1], the capital of China. More importantly, they indicated that the levels of housing inequality in the 13 cities were much higher than the income inequality in these cities. However, since the CASS survey stopped after 2002, it is impossible to use this survey data to examine the follow-up trend in the housing inequality.

The second question articulated above is another main topic of previous studies. Although it is widely believed that, as market-oriented reforms progress, income-related factors should become the key factors affecting each household's housing condition and housing inequality in urban China, most of the existing literature paints a different picture. Based on independent surveys in Shanghai, Tianjin and Beijing, several studies have stated that the old housing allocation system—under which non-income factors, such as household members' employment sectors, political/social position, and Hukou (registered residence status), are important for gaining access to better housing—still has a heavy impact on the current housing distribution in urban China (Logan etal.1999, Huang 2005，Huang and Jian 2009). Logan, Fang and Zhang (2010) used 2000 Census data to estimate the housing subsidies received by the remaining renters in the public sector and purchasers of public housing, based on private sector prices for housing of comparable quality and size. They also analyzed variations in the estimated discounts from market prices that these people received. Their findings demonstrate that the biggest winners in China's transition from socialist housing allocation are those who were favored in the previous system, based on factors such as residential status, education, and occupation.

Aside from the persisting influences of the old housing system, the impact of increasing migrant households in urban areas on housing inequality are also discussed in a few previous studies (Dai and Xue 2002, Huang 2005, Sato 2006). The results of these studies show that there is high inequality in housing conditions between urban and migrant households, and within migrant household groups. They argued that rapid migration to urban areas is becoming an important factor that is contributing to rising housing inequality.

The studies introduced above provide a few valuable viewpoints for examining the situation and causes of housing inequality in urban China in the initial ten years of housing system reform. However, there are two obvious shortcomings in these studies. First, the data used in almost all existing studies are from independent single-year surveys. Since the results for different years are not comparable with each other, it is difficult to use them to estimate trends in housing inequality and changes in the underlying factors. Secondly, since the cost of conducting surveys in urban China has been rising, most of the existing studies are based on data of small survey, which always has sampling bias. In order to better understand the trends and the underlying factors of housing inequality in urban China, it is necessary to use the unpublished household level microdata of NBS (National Bureau of Statistics) household survey, which includes large amount of samples and covers many years. Following Dai and Xue (2012), who made the first attempt to use NBS panel data for analyzing housing inequality, this study uses the same data, but conducts more detailed analysis.

3. Data and Methodology

3.1 Data

The data used in this paper, panel data for 2004-2007[2], were provided by the NBS of China for a joint research project organized by Nagoya University. Panel data, also called longitudinal data or cross-sectional time series data, are data where multiple cases (persons, households, firms, etc.) are observed at two or more time periods. There are two kinds of information in panel data: cross-sectional information that shows the differences between subjects, and time-series or same-subject information that shows the changes within subjects over time. Panel approaches allowe us to take advantage of these different types of information.

The NBS of China has been conducting annual sample household surveys in urban areas throughout China since the early 1980s. In recent years, dozens of survey items on housing have been added to the annual survey, making it a very important official source on the housing conditions of urban households in China. Among the more than 60,000 sample households included in the annual nationwide survey, one third of them are replaced by new ones every year, while a portion of them remain unchanged for several years. During the period of 2004 to 2007, about 5,000 households in 162 cities in the annual survey remained unchanged. A summary of basic information concerning

these 5,000 households, which are divided into "households in Peking and Shanghai" and "households in the other 160 cities" in this paper, is shown in Table 2. Meanwhile, the variables (survey items) listed in Table 2 are described in Table 1.

Table 1: Description of selected variables (survey items)

Variable	Description
Ncp	national capital (Peking = 1, other = 0)
Pcp	provincial capital (Yes = 1, No = 0)
Coast	coastal city (Yes = 1, No = 0)
Pop	household population (persons)
Hspace	house floor space (m^2)
Myhouse	household owned house (Yes = 1, No = 0)
Pub-renthouse	public rental house (Yes = 1, No = 0)
Pri-renthouse	private rental house (Yes = 1, No = 0)
Oldmyhouse	myhouse owned before 1989 (Yes = 1, No = 0)
Lpmyhouse	myhouse purchased at low price for the privatization of previous public house (Yes=1, No=0)
Mpmyhouse	myhouse purchased at high price from housing market (Yes = 1, No = 0)
Otherhouse	other unidentified houses (Yes = 1, No = 0)
Hvalue	estimated market value (price) of the house (Yuan)
GSOE	at least one member employed by the government or SOEs (Yes = 1, No = 0)
Tincome	total yearly household income (Yuan)
Rurban	resident with local urban Hukou (Yes=1, other =0)
Rrural	resident with local rural Hukou (Yes=1, other =0)
Murban	migrant with urban Hukou of other region (Yes=1, other =0)
Mrural	migrant with rural Hukou of other region (Yes=1, other =0)
Hminority	nationality of household head (minority =1, Han Chinese= 0)
Hsex	sex of household head (male=1, female =0)
Hage	age of household head (year)
Heduyear	household head's years of education received (Year)
Hgsoe	household head employed by the government or SOEs (Yes = 1, No = 0)

Source: NBS survey database.

Table 2　Basic information on households included in the NBS survey (2004-2007) :

Peking and Shanghai vs. Other cities

	Peking and Shanghai(Obs: 2500)				Other cities(Obs: 16910)			
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Pcp	0.33	0.47	0	1	0.12	0.32	0	1
Coast	1.00	0.00	1	1	0.50	0.50	0	1
Pop	2.98	0.69	1	6	2.93	0.84	1	10
Hspace	64.57	26.38	9	210	86.48	44.06	0	560
Myhouse	0.76	0.43	0	1	0.92	0.28	0	1
Pub-renthouse	0.23	0.42	0	1	0.07	0.25	0	1
Pri-renthouse	0.00	0.07	0	1	0.01	0.14	0	1
Oldmyhouse	0.03	0.16	0	1	0.18	0.41	0	1
Lpmyhouse	0.58	0.49	0	1	0.48	0.50	0	1
Mpmyhouse	0.15	0.35	0	1	0.25	0.43	0	1
Otherhouse	0.01	0.09	0	1	0.01	0.19	0	1
Hvalue	356,958	321,593	0	6,000,000	117,889	122,838	0	3,000,000
GSOE	0.69	0.46	0	1	0.57	0.49	0	1
Tincome	62,434	36,295	3,086	346,184	34,428	24,758	700	574,450
Rurban	0.981	0.14	0	1	0.978	0.15	0	1
Rrural	0.000	0.02	0	1	0.013	0.11	0	1
Murban	0.012	0.11	0	1	0.005	0.07	0	1
Mrural	0.007	0.08	0	1	0.004	0.06	0	1
Hminority	0.04	0.21	0	1	0.05	0.23	0	1
Hage	51.33	10.04	22	93	48.57	11.91	21	90
Hedu	11.37	2.90	0	19	11.14	3.25	0	19
Hgsoe	0.45	0.50	0	1	0.45	0.50	0	1

Source: NBS survey database

Note: After deleting a few household samples from the 5,000 households without qualified housing information or other important characteristics, the number of effective household samples for panel analysis (see Section 5) is 625 (2,500 observations) in "Peking and Shanghai," and 4,373 (19,610 observations) in " Other cities."

3.2 Methodology

Based on the NSB survey data, in Section 4 we use a few indicators to measure the Gini coefficient of housing inequality in urban China. After confirming the housing inequality situation and recent trends, in Section 5 we examine the effects of various household characteristics, including both income factors and non-income factors, on the housing condition of urban households.

In previous studies, analysis results are essentially based on non-panel data. Although it is possible to use ordinary multiple regression techniques on single-year survey data, the estimates of coefficients derived from regression may be subject to omitted variable bias—a problem that arises when there is some omitted variables that affect the dependent variable but cannot be controlled for. With panel data, however, it is possible to control for some types of omitted variables without observing them, by observing changes in the dependent variable and other independent variables over time. The model designed to use panel data to control for omitted variables that differ between cases but are constant over time is called the ***fixed effects model***, which is the main technique used to analyze panel data. Meanwhile the model designed to control for omitted variables that vary over time but are constant between cases is called the ***between effects model***. In addition, if it is believed that some omitted variables may be constant over time but vary between cases, and others may be fixed between cases but vary over time, then we can include both types by using the ***random effects model***.

As we know, location is usually a very important factor in people's housing consumption behavior, and it greatly affects housing price and housing demand. However, in most household surveys, including the NSB survey, the information on household locations is not sufficient enough for supporting analysis. Moreover, because the importance of a location is determined by many factors, such as its spatial position in the city, accessibility to public facilities (transportation systems, schools, parks, etc.) and shopping centers, the quality of surrounding environment, etc., it is not easy to include appropriate location variables in the model. However, with panel data, it is possible to use the ***fixed effects model*** to control for omitted variables that differ between cases but are constant over time, such as location. Then, we can use the changes in the other variables (household characteristics) over time to estimate the effects of these independent variables on the dependent variable (housing condition).

In this paper, we choose the 'probability of owning a house,' 'probability of renting a public house,' and 'household floor space' as dependent variables that represent housing conditions. Correspondingly, we use the following two models in our analysis.

(1) Fixed effects panel regression model
The fixed effects panel regression model is expressed as:

$$y_{it} = \alpha + \beta'X_{it} + u_{it}$$

$$i = 1, \ldots N ; \quad t = 1, \ldots T$$

Where i is the household dimension and t is the time dimension.
y_{it} : floor space of household i in year t;
X_{it} : characteristics of household i in year t (see Table 1 and   Table 2)

(2) Fixed effects logit model
The fixed effects logit model, which is also called the conditional logit model, can be expressed as:

$$\Pr(y_{it} = 1 \mid x_{it}) = F(\alpha_i + \beta'X_{it})$$

$$F(z) = \exp(z) \diagup (1 + \exp(z))$$

Where F is the cumulative logistic distribution, i (= 1, 2, . . . , n) is the household dimension and t (= 1, 2, . . . , T) is the time dimension. y_{it} is a dummy variable of the ownership / use of a certain type of house, with *YES=1* and *NO=0*. X_{it} stands for the characteristics of household i in year t. *Pr* is the probability of owning / renting a certain type of house. *B* is the matrix of coefficients *for X_i* (see Table 1 and Table 2).

Using this model with a full maximum-likelihood approach leads to difficulties, however. When Ti is fixed, the maximum likelihood estimates for αi and β are inconsistent. This difficulty can be circumvented by looking at the probability of yi = (y$_{i1}$, . . . , y $_{iTi}$) conditional on $\sum_{t=1}^{T_i} y_{it}$. This conditional probability does not involve αi, so it is never estimated when the resulting conditional likelihood is used (Hamerle and Ronning, 1995).

4. Recent trends in urban housing inequality

4.1 Indicators used for measuring housing inequality

Before the housing system reform, the shortage of housing supply was regarded as the most serious urban problem in China. After the housing system reform, while housing conditions in urban areas have improved significantly, housing inequality has come to be a notable social problem. Based on the household-level micro data of the CASS 1999 Survey, Dai and Xue (2002) stated that in 1999 the Gini coefficients of housing inequality were higher than the Gini coefficients of income inequality in most of the 13 cities. However, due to the lack of comparable multiple-year survey data on urban housing, there are no empirical studies examining the trend in the overall housing inequality in urban China.

Given the availability of NBS panel data for 2004-2007, it is possible to measure housing inequality and identify its trends during this four-year period. However, given the multi-dimensional differences of housing in terms of size, quality, and location, it is not easy to construct an appropriate housing indicator for measuring inequality. In Dai and Xue (2002), a quite complicated set of adjusted indicators based on the large volume of housing information obtained from the survey database were used [3]. In this paper, following Dai and Xue (2012), we use two types of indicators to measure housing inequality. The first type includes two unadjusted indicators, ***house floor space*** (***HSPACE $_{0it}$***) and ***per capita house floor space (PSPACE $_{0it}$)***, which are from (or simply calculated from) the original survey data. The second type includes two adjusted indicators: ***adjusted house floor space*** (***HSPACE$_{it}$***) and ***adjusted per capita house floor space*** (***PSPACE$_{it}$***). The latter indicators are adjusted from the former by using the housing price information from NBS survey database. The adjustment methods are as follows.

$HSPACE_{it} = HSPACE_{0it} \times$ *(unit price of floor space of household i / average unit price of floor space of all households surveyed in year t)*

$PSPACE_{it} = PSPACE_{0it} \times$ *(unit price of floor space of household i / average unit price of floor space of all households surveyed in year t)*

The data for unit price of floor space of household ***i*** and the average unit price of floor space in the above formula are from the original survey database. By making this adjustment, the quality and market value of housing can be taken into account.

Therefore, we believe that the second set of indicators is more suitable for comparing housing conditions among households in different locations of different cities. Because significant regional disparities are present within housing prices across different cities, the Gini coefficients measured using the adjusted indicators may be much higher than those measured using the unadjusted indicators. Thus, it is interesting to compare the results based on the two types of indicators, although they should be interpreted carefully.

4.2 Gini coefficients of housing inequality for 2004-2007

Table 3 shows the Gini coefficients for the two types of indicators (*house floor space* and *per capita house floor space, adjusted house floor space* and *adjusted per capita house floor space*) for 2004-2007 data. The Gini coefficient is calculated as follows.

$$Gini = \left(\frac{2}{\mu n^2} \sum_{k=1}^{n} k w_k \right) - \frac{n+1}{n}$$

Where, W_k, ranked in order from the lowest to the highest, stands for house floor space or per capita floor space of the k-th household, μ is the average value and n is the number of households.

From Table 3 we can ascertain the following:

(1) Regardless of the indicator used, the Gini coefficients show that there is an obvious rising trend in housing inequality in urban China.

(2) Although the Gini coefficients of the two unadjusted indicators (per capita house floor space and house floor space) do not seem to be very high, the Gini coefficients of the two adjusted indicators, per capita adjusted house floor space and adjusted house floor space—which take the house quality (market value) into account—are significantly higher. When inequality is measured using 'adjusted per capita house floor space', the Gini coefficient for 2007 reaches 0.486, rising from 0.466 in 2004, 0.479 in 2005, and 0.481 in 2006.

It should be noted that the results in Table 3 reflect trends in overall housing inequality in urban China, which is composed of 'same-city inequality' and 'inter-city inequality'. Since the household samples are taken from 162 cities of 24 provinces, which can be combined into several groups by income level or population size, 'inter-city (or city group) inequality' is no doubt an important component of overall

housing inequality. Thus, 'same-city (or city group) inequality' should be lower than the overall inequality shown in Table 3. For example, if we combine Shanghai and Beijing, the two highest income cities in China, as one group, our analysis shows that the Gini coefficient of adjusted house floor space and per capita adjusted floor space for the Shanghai-Beijing group rose from 0.292 and 0.293 respectively in 2004, to 0.297 and 0.320 in 2007.[4] This means that housing inequality in this city group rose significantly during the period of 2004-2007, but that the inequality level is lower than that of overall urban China.

However, since the proportion of migrant households without Hukou (registered residence status) in the city of residence to the total of households included in NBS panel data for 2004-2007 is only nearly 1%, the effect of migrant households on the rise of housing inequality in urban China is suggestively underestimated[5]. Therefore, in reality, both overall housing inequality in urban China and housing inequality in Shanghai and Beijing should be higher than the results of our estimates based on NBS panel data.

Table 3 Gini coefficients of housing inequality in recent urban China

	Per capita floor space				Adjusted per capita floor space			
	2004	2005	2006	2007	2004	2005	2006	2007
Gini coefficient	0.2660	0.2702	0.2729	0.2733	0.4656	0.4790	0.4812	0.4862
Number of samples	5,000	5,000	5,000	4,966	4,463	4,534	4,572	4,965
Mean (M^2)	28.8	30.0	30.6	31.8	27.9	29.3	29.7	29.0
Maxium	160.5	252.5	252.5	252.5	514.1	439.2	526.2	582.0
Minimum	2.6	2.6	2.3	2.4	0.4	0.4	0.4	0.5
	Floor space				Adjusted floor space			
	2004	2005	2006	2007	2004	2005	2006	2007
Gini coefficient	0.2417	0.2474	0.2481	0.2457	0.4342	0.4674	0.4714	0.4734
Number of samples	5,000	5,000	5,000	4,966	4,463	4,534	4,572	4,965
Mean (M^2)	80.9	83.8	84.7	86.1	78.3	81.5	82.3	78.1
Maxium	560.0	505.0	505.0	670.0	1,285.0	1,098.0	1,423.7	1,552.1
Minimum	12.0	12.0	12.0	8.0	1.3	1.1	1.1	1.9

Source: Dai and Xue (2012).

5. Determinants of urban household's housing condition

In a country with a market economy system, a household's housing condition is mainly determined by the household income. In contrast, in a country with a non-market system such as China in the planned economy period, other non-income household characteristics usually have a larger impact on housing condition. In this section, in order to examine the determinants of a household's housing condition and identify the underlying factors of rising housing inequality in urban China, we will analyze the impact of household characteristics, including both income factors and non-income factors, on individual household's housing condition.

5. 1 Determinants of a household's probability of having a resident-owned house and renting a public house

In the NBS survey, according to current house ownership (i.e., resident-owned or not) and the channel of house acquisition, all houses (including single-family houses and various types of attached or multi-user dwellings) in urban China are classified as one of the following six types.

(1) Public rental house: Low-rent public house owned by government (including all public organizations)

(2) Private rental house

(3) Low-price resident-owned house: Resident-owned house purchased at the 'housing system reform price' (very low price) during the privatization of public housing

(4) Market-price resident-owned house: Resident-owned house purchased at the market-price from the housing market

(5) Resident-owned house owned before the housing system reform of the late 1980s

(6) Other unidentified house

Types one and two are rental houses, while types three, four and five are resident-owned houses, i.e. *my house*. For 2004-2007, the average proportion of households who own *my house* in "Peking and Shanghai" and "Other cities" are as high as 76% and 92% respectively (Table 2). Within three *my house* types, the proportion of low-priced *my house* and market-price *my house* are the largest and second largest at 58% and 15% in "Peking and Shanghai," while 48% and 25% in "Other cities," respectively. Our concern is to identify the factors (i.e. the household characteristics) that affect the probability of owning various kinds of *my house* (*low-price my house*, *market-price my house*, and *all my house)* and renting a public house.

As mentioned in Section 3, we employ the Fixed Effects Logit Model in this paper to analyze the effects of household characteristics on the probability of owning various types of *my house* and renting a public house. The coefficients for independent variables, i.e., household characteristics, are estimated by STATA, using a conditional likelihood (Hamerle and Ronning, 1995).

Table 4 shows the estimation results for three cases in "Peking and Shanghai" and "Other cities," where the dependent variable is the probability of owning *low price my house, market-price my house*, and *all my house*, respectively. Table 5 shows the estimation results for the same three cases in "Other cities." Table 6 compares the estimation results for renting a public house in "Peking and Shanghai" and "Other cities."

Table 4   The effects of household characteristics on the probability of owning various types of *my house* in Peking and Shanghai (2004-2007)

	LPmyhouse			MPmyhouse			Myhouse		
	Coef.	t	P>t	Coef.	t	P>t	Coef.	t	P>t
Pcp	–	–	–	–	–	–	–	–	–
Coast	–	–	–	–	–	–	–	–	–
Pop	-0.010	-0.73	0.47	9.43E-05	0.01	0.99	-0.010	-1.03	0.30
Tincome	**0.000**	**-2.05**	**0.04**	**1.05E-06**	**6.11**	**0.00**	**0.000**	**1.79**	**0.07**
Rurban	0.003	0.02	0.99	-0.006	-0.05	0.96	-0.002	-0.01	0.99
Rrural	0.010	0.04	0.97	-0.020	-0.10	0.92	-0.007	-0.04	0.97
Murban	-0.021	-0.10	0.92	0.019	0.13	0.90	0.000	0.00	1.00
Minority	0.082	1.39	0.17	0.011	0.26	0.80	0.010	0.24	0.81
Hage	-	-	-	-0.002	-1.41	0.16	0.001	0.81	0.42
Heduyear	0.009	**2.08**	**0.04**	0.002	0.66	0.51	0.004	1.10	0.27
Hgsoe	0.033	**1.82**	**0.07**	0.003	0.22	0.82	-0.027	**-1.98**	**0.05**
_cons	0.513	2.74	0.01	0.142	0.93	0.35	0.698	4.67	0.00
Number of observations:				2500					
R^2	0.018			0.1100			0.018		

Source: Calculated by the author.

Table 5 The effects of household characteristics on the probability of owning various types of *my house* in Other Cities (2004 - 2007)

	LPmyhouse			MPmyhouse			Myhouse		
	Coef.	t	P>t	Coef.	t	P>t	Coef.	t	P>t
Pcp	-0.025	-0.23	0.82	0.027	0.27	0.79	0.001	0.020	0.99
Coast	-0.019	-0.52	0.61	-0.017	-0.48	0.63	-0.040	-1.72	0.09
Pop	-0.017	-3.53	0.00	0.005	1.10	0.27	0.015	5.00	0.00
Tincome	0.000	-3.12	0.00	0.000	9.84	0.00	0.000	6.86	0.00
Rurban	0.172	2.53	0.01	0.005	0.08	0.94	0.300	7.21	0.00
Rrural	0.037	0.50	0.62	0.073	1.04	0.30	0.227	4.98	0.00
Murban	-0.104	-1.18	0.24	0.062	0.75	0.45	-0.008	-0.15	0.88
Minority	-0.001	-0.06	0.95	0.013	0.57	0.57	0.031	2.13	0.03
Hage	0.006	15.29	0.00	-0.005	-13.58	0.00	0.002	6.53	0.00
Heduyear	0.002	1.64	0.10	0.009	6.04	0.00	0.005	5.25	0.00
Hgsoe	0.072	7.85	0.00	-0.024	-2.84	0.01	0.011	2.05	0.04
_cons	0.021	0.28	0.78	0.353	4.91	0.00	0.432	9.24	0.00
Number of observations:				16910					
R^2	0.0235			0.0404			0.0413		

Source: Calculated by the author.

Table 6   The effects of household characteristics on the probability of renting a public house (2004 - 2007): Peking and Shanghai vs. Other Cities

	Peking and Shangahi				Other cities		
	Coef.	t	P>t		Coef.	t	P>t
Pcp	–	–	–	Pcp	-0.005	-0.08	0.93
Coast	–	–	–	Coast	0.033	1.66	0.10
Pop	0.018	1.96	0.05	Pop	-0.009	-3.36	0.00
Tincome	0.000	-1.98	0.05	Tincome	0.000	-8.28	0.00
Rurban	0.002	0.02	0.99	Rurban	0.078	2.14	0.03
Rrural	0.008	0.04	0.97	Rrural	0.114	2.87	0.00
Murban	0.003	0.02	0.98	Murban	0.124	2.65	0.01
Minority	-0.012	-0.29	0.77	Minority	-0.022	-1.75	0.08
Hage	-0.001	-0.90	0.37	Hage	-0.001	-2.34	0.02
Heduyear	-0.004	-1.17	0.24	Heduyear	-0.004	-4.47	0.00
Hgsoe	0.034	2.60	0.01	Hgsoe	-0.001	-0.23	0.82
_cons	0.276	1.90	0.06	_cons	0.087	2.15	0.03
Number of observations: 2500				Number of observations: 16910			
R^2	0.016			R^2	0.0101		

Source: Calculated by the author.

From Tables 4-6, we can elucidate the following points:

(1) In Peking and Shanghai, GSOE (government official or staff of State Owned
Enterprises) and Heduyear (household head's education years) have significantly
positive effects on the probability of owning a *low-price my house,* while
household total income (Tincome) has a significantly negative effect. In contrast,
household total income has an outstandingly positive effect on the probability of
owning the Market-price *my house*. Consequently, household total income has a
positive effect on the probability of owning *(all) my house.* However, partly due to
its significantly positive effects on renting a public house (Table 6), GSOE has
negative effect on owning *my house* (Table 4).

(2) In "Other cities", some non-income variables including GSOE (government official
or staff of State Owned Enterprises), Hage (household head's age) and Rurban
(local urban HUKOU resident) have significantly positive effects on the probability
of owning a *low-price my house,* while household total income (Tincome) has a
negative effect. In contrast, household total income and household head's level of
education have outstandingly positive effects on the probability of owning the
market-price (high-price) *my house*. Consequently, both income factors (such as
household total income and household head's education years) and some
non-income factors including GSOE, Rurban & Rrural (local urban /rural Hukou
resident status), and Hage (household head's age) have positive effects on the
probability of owning *(all) my house.*

(3) On the probability of renting a public house, in Peking and Shanghai two
non-income factors including GSOE (government official or staff of State Owned
Enterprises) and Pop (household population) have significantly positive effects,
while household total income has negative effects. This indicates that some
low-income government officials or staff of State Owned Enterprises have a
significantly higher chance to rent cheap public housing in these two large cities,
where housing price have risen to an extremely high level. In contrast, in "Other
cities," Rurban & Rrural (local urban /rural Hukou resident status) and Murban
(migrant household with urban Hukou of other city) have positive effects, while
household total income, household head's level of education and a few other
non-income household characteristics have significantly negative effects on renting
a public house. This demonstrates that although cheap public rental housing is not as
attractive to local rich households and local government officials who usually have
higher social status than those in Peking and Shanghai, migrants from rural areas

who are the poorest group in these cities still have fewer chances to access public rental housing owned by the government.   .

(4) Compared to Peking and Shanghai, non-income factors generally have stronger effects on a household's probability of having a resident-owned house (*my house)* and renting a public house in "Other cities."

5.2 Determinants of a household's house size

As shown in Table 3, housing inequality measured by house floor space or per capita house floor space has been rising through the period from 2004 to 2007. Furthermore, if the market value is taken into account, it is found that real housing inequality in urban China has reached a considerably high level. In Section 5.1, we examined the effects of household characteristics on the probability of owning various *my house* and accessibility to the public rental house. In this section, using the same panel data from the NSB survey and the Panel Regression Model *(fixed effect model)*, we will examine the effects of household characteristics on house size (house floor space). Table 7 displays the estimation results for the effect of household characteristics on house floor space in "Peking and Shanghai" and "Other cities".

It can be found that in both groups, the total household income, household head's level of education, and a few non-income variables, including household head's age and household population have significantly positive effects on house floor space. In the case of "Peking and Shanghai," GSOE (government official and SOE staff) also has significantly positive effects, while in "Other cities," local Hukou status in the current city of residence has significantly positive effects, while coastal cities (with high housing prices) have negative effect on the house floor space. In addition, house type factor has the similar effects on house floor space in both groups, with market-price *my house* having positive effects, while low-price *my house* and public rental house have negative effects.

Table 7 The effects of income and other household characteristics on house floor space
(Dependent variable: Hspace = house floor space)

	Peking and Shanghai			Other cities		
	Coef.	t	P>t	Coef.	t	P>t
Pcp	-	-	-	-5.737	-0.68	0.50
Coast	-	-	-	-5.540	-1.87	0.06
Pop	1.487	2.72	0.01	5.313	13.89	0.00
PUBrenthouse	-9.954	-2.81	0.01	-27.033	-15.10	0.00
OLDmyhouse	-4.547	-1.21	0.23	14.455	11.47	0.00
LPmyhouse	-1.557	-0.45	0.66	-12.360	-8.75	0.00
MPmyhouse	11.654	3.24	0.00	5.418	3.78	0.00
Otherhouse	6.139	1.40	0.16	0.841	0.66	0.51
GSOE	-0.082	-0.10	0.92	1.475	1.61	0.11
Tincome	0.00003	2.92	0.00	0.000	16.51	0.00
Rurban	0.835	0.12	0.91	19.135	3.57	0.00
Rrural	0.298	0.03	0.98	19.052	3.24	0.00
Murban	-0.546	-0.07	0.95	0.518	0.07	0.94
Minority	-2.715	-1.12	0.26	2.716	1.47	0.14
Hage	0.123	1.92	0.06	0.952	7.94	0.00
Heduyear	0.788	4.23	0.00	0.279	8.49	0.00
Hgsoe	1.881	2.21	0.03	0.744	0.80	0.43
_cons	43.247	4.74	0.00	26.623	4.41	0.00
Number of observations: 2500						
R^2 : 0.383						

Source: Calculated by the author.

6. Conclusions

Using panel data (2004-2007) from China's NBS survey, this paper measured the level of housing inequality in urban China and examined the determinants of household housing conditions for the years of mid-2000s. The main findings can be summarized as follows:

(1) Housing inequality in urban China has risen to a considerably high level in mid-2000s. If inequality is measured using 'adjusted per capita house floor space', which takes a house's market value into account, the Gini coefficient of housing

inequality in urban China had reached 0.486 in 2007, rising from 0.466 in 2004, 0.479 in 2005, and 0.481 in 2006.

(2) Although China has abolished the old housing allocation system, which was controlled by various levels of government and various kinds of state-owned 'working units' (i.e., companies or institutes), and saw the housing market become the major supplier of urban housing after late 1990s, the effects of non-income factors (including household members' employment sectors and Hukou) on the condition of housing in urban households still remain strong. The results of our panel analysis show that these variables have significantly positive effects on the probability of owning a low-price *my house* or renting a cheap public rental house, as well as on the house size (floor space).

(3) With the dramatic transition of China's urban housing system from a planned system to a market–oriented one, household income has become an important determinant of housing conditions in urban China. Like in market economies, household income-related factors, including total household income and household head level of education, have significantly positive effects on the probability of having a *market-price resident-owned house* and *all resident-owned houses* as well as on the house size (house floor space).

(4) Compared to Peking and Shanghai, in "Other cities" non-income factors have stronger effects on a household's probability of having a resident-owned house (*my house)* and renting a public house, as well as on the house size (floor space)."

By comparing the effects of a household's income characteristics and non-income characteristics summarized above, we can conclude that rising housing inequality in urban China in the mid-2000s is a combined result of the increasing impact from ongoing market–oriented reform and the persisting impact of some traditional systems and institutions including the old housing allocation system and the Hukou (registered residence status) system. Particularly, compared to the effects of market–oriented reform on housing inequality, which is usually more transparent and relatively fair to all households, the old housing allocation system and the Hukou (registered residence status) system are favorable to only some residents, such as officials and urban registered residents, so that their effects on housing inequality are more detrimental. Thus, in order to alleviate rising housing inequality, the government at first should

continue to reform these institutions (old systems) that are lagging behind. Meanwhile, it is also necessary to adjust the highly uneven income distribution by reforming China's tax system, and to improve the governance of China's housing market—a market that lacks property tax and clearly favors high income households.

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(Notes)

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[1] The data used in Dai and Xue (2002) are from the CASS 1999 survey. For Beijing, 100 of the 760 sample households are migrant households without local Hukou.

[2] More recent and longer data are expected to be provided for the future studies.

[3] In Dai and Xue (2002), the original survey data of house floor space (H0) was adjusted to comparable floor space (H) as follows:

$$H = H0 \times (WA \times TA) \times (WB \times TB) \times (WC \times TC) \times (WD \times TD) \times (WE \times TE) \times (WF \times TF)$$

Where, WA , WB , WC,, WD , WE, WF are the weights of each item respectively, including toilet and bathroom, kitchen, location, gas supply, air conditioner, and house type, while TA , TB , TC , TD , TE , TF are adjustment coefficients determined by the condition of each item.

[4] The number of effective household samples in Beijing and Shanghai was 480 in 2004 and 620 in 2007. In 2004, there was no information on the market value of houses for many households.

[5] The share of migrant households without local Hukou to the total number of households in the city of residence was nearly 20% in the early 2000s (Dai and Xue, 2007). Furthermore, this share has been rising. In 2013, it has reached to nearly 40% in some large cities including Shanghai and Peking.