



# The impact of a positive wealth shock on consumption: evidence from a housing reform in China

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## ABSTRACT

Housing property reform in China exerted an exogenous positive wealth shock to state employees who were renting state-owned housing when they were offered the opportunity to buy their homes at highly subsidised prices. Exploiting the national representative micro data set CHIP, we study the consumption response to this large-scale housing property reform. Propensity Score Matching (PSM) strategy is implemented to balance the covariates between a treatment group and a control group. We find that the positive wealth shock has led to an increase in household consumption for the treatment group. Our results provide new insights into consumer response to positive shocks associated with access to home equity and wealth transfer through housing.

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## KEYWORDS

Housing reform; household consumption; wealth shock; PSM; China

## I. Introduction

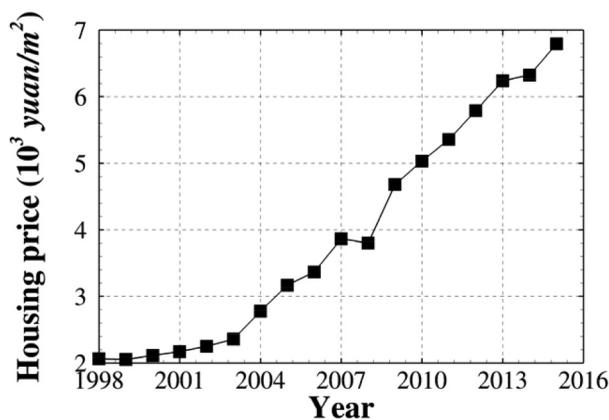
Housing represents a large proportion of household wealth in most countries. According to Iacoviello (2011), about one half of household net worth and almost two-thirds of the total wealth of the median household was stored in housing in the United States at the end of 2008. As a result, household wealth is very dependent on the level and changes of housing prices. A large body of literature has looked at the effects of housing prices on household consumption and savings (e.g. Skinner, 1989, Chen, Kuan, & Lin, 2007; Engelhardt, 1996; Iacoviello, 2004). While the important role of housing equity and leverage in real economy was also recently highlighted by Keys, Piskorski, Seru, and Yao (2014), few studies have measured the impact of housing wealth shock on household consumption or saving behaviours. The channels through which the effects might work have not been studied either.

The impact of a housing wealth shock on consumption and saving bears important implications for the role of housing in consumption smoothing. A small body of literature has investigated the consumption response to changes of home equity, especially following the happening of Global Financial Crisis (GFC) (e.g. Mian and Sufi, 2011, Agarwal & Qian, 2017). These studies have confirmed the role of housing for consumption smoothing. They found that consumption is positively related to the wealth shocks. These findings, however, are mainly based on experiences from developed countries.

In this paper, we use a unique housing property reform in China as a natural experiment to analyse how the subsidised purchase over the stock of state-owned housing affects household consumption decisions. The idea of exploiting the housing reform in China as a quasi-experiment to analyse its economic outcomes was applied by several studies, including the quasi-experimental analysis of the effects of housing reform on housing prices (Wang, 2011) and its labour market outcomes (Iyer, Meng, & Qian, 2009, Wang, 2012).

Implemented from 1994 onwards, the reform provided the sitting tenants of state housing, who worked at state-owned enterprises the opportunity to purchase their homes at highly discounted prices. This large-scale housing programme affected over 40% of urban households. This study focuses on the response of consumption to the positive wealth transfer from the government to sitting tenants, which is not well understood. The study focuses on the year 2002, when the housing reform has just completed. At that time housing prices remained mostly stable. They started to rise sharply afterwards (see Figure 1). This feature enables us to isolate the consumption response to the positive wealth shock from the response to increasing housing prices, whose forces are intertwined.

The consumption response to a housing wealth shock bears important economic implications. A large share of wealth for households is stored in housing. The housing program succeeded in turning China into a country of homeownership through encouraging private ownership of homes. China also has witnessed a major housing price increase after 2003. As a result, housing has become more and more unaffordable for the general public. Housing-price-to-income ratio, as the most widely used indicator for housing affordability, is 14 for a 31-square-meter living space (i.e. the average living space per person in urban areas of Beijing in 2013) in urban Beijing for the year 2013. Therefore, the findings in this chapter have broad policy implications. Specifically, a positive shock to household wealth, independent of value associated with the home equity has a positive causal effect on the increase of consumption. This effect is likely to be exerted through the channel of strengthening the role of privately owned homes as the consumption smoothing device. The paper also contributes to the vast literature on the impact of a wide variety of income/wealth shocks to consumption.



**Figure 1.** Housing price changes in urban China: 1998–2015.

Data source: 《China Statistics Yearbook 》 1999–2016.

A study most closely related to our work is by Gan, Yin, and Zang (2010), which examine the effect of the housing reform on household consumption of nine durables after the housing reform in urban China. Our study agrees with theirs in that households affected by the housing reform have a higher level consumption than those unaffected. However, our study improves upon theirs by exploiting the Propensity Score Matching (PSM) strategy to balance the covariates between a treatment group and a control group. Therefore, our study is expected to be less plagued by the endogeneity problem and more easily to establish causality.

The rest of the paper is organised as follows. The next section reviews the existing literature. Section III discusses the institutional background. Section IV describes the data and variables, and section V explains the identification and empirical Strategy. Section VI presents the results and section VII concludes.

## II. Literature review

This study is closely related to the body of literature investigating the saving and consumption response to wealth shocks. The body of literature on this subject is relatively small, largely because identifying wealth shocks that are exogenous and unanticipated is difficult (Agarwal & Qian, 2014). Based on the source of the unexpected shock, the relevant literature can be further divided into consumption response to non-housing wealth shock and consumption response to housing wealth shock.

### A. Research on consumption response to non-housing wealth shock

First, by combining weather data with income and consumption data for rural farm households in India, Wolpin (1982) estimated the permanent income elasticity of consumption. This is achieved through the computation of estimates of the basic parameter of Friedman's permanent income hypothesis. The results showed a larger income elasticity (ranging from 0.91 to 1.02) using rainfall data as an instrument, compared to estimates based on other conventional instruments.

Second, Agarwal and Qian (2014) studied the response of consumption and debt of over 180,000 consumers in Singapore to an unanticipated fiscal stimulus programme. They identified a control group using foreigners since they were not eligible for the dividend and applied a difference in difference estimator. They found that Singaporean consumers increased their consumption after the policy announcement. Moreover, more liquidity-constrained consumers showed a more pronounced positive effect.

In addition, Jappelli and Padula (2015) estimated the impact of an unanticipated reduction in lifetime resources arising from a reform to severance pay, on the consumption of employees in Italy. In 2000, Italy's traditional system of severance pay for public employees was replaced with a new system, which reduced severance pay for future generations of public employees. Using a difference in difference estimator, their results suggest that with each euro reduction in severance pay, average propensity to consume decreased by 3 cents, with a stronger response for younger employees and for households with both spouses employed in the public sector.

## ***B. Research on consumption response to housing wealth shock***

Several studies examine the effects of positive home equity shocks on consumption, meaning an increase in consumption caused by a rise in home equity. For example, Leth-Petersen (2010) exploited a credit market reform that enabled Danish house owners to use home equity as collateral for consumption loans and investigates whether this exogenous increase in access to credit affected total household expenditure and the level of household debt. They found that the aggregate effect of the reform was significant, but the magnitude of the response was small.

In addition, Mian and Sufi (2011) found that a significant increase in household debt in the US between 2002 and 2006 can be attributed to the increased borrowing capacity against the increase in home equity for existing homeowners. The results suggest a stronger home equity-based borrowing response for younger households and households with low credit scores. They report that a total of 1.25 USD trillion of household debt was added because of home equity-based borrowing between 2002 and 2008 and that borrowing against the increase in home equity was responsible for at least 39% of the increase in defaults from 2006 to 2008.

By contrast, existing studies also analysed the impact of negative shocks to housing net wealth on consumption decisions. For example, Mian, Rao, and Sufi (2013) investigated the dramatic decline in consumption following the 2006–2009 housing collapse in the US. Exploiting the large variations in geographical distribution of wealth losses across the country, they found the effect of housing wealth loss on consumption is statistically significant and large in magnitude. Their results also suggest that the aggregate effect of the housing wealth shocks is not only correlated with the total wealth losses but also with the distribution of these losses across the population. The average marginal propensity to consume (MPC) out of housing wealth is significantly higher for ZIP codes with poorer and more leveraged households. In addition, Agarwal and Qian (2017) studied the consumption response to a housing policy change in Singapore that led to a decrease in home equity access using consumer financial transaction of more than 56,000 consumers. A difference in difference estimator was used and they found a decline in consumption in response to the policy shock. Specifically, the negative shock to home equity access has led to a reduction of credit card spending by 9.4% monthly since the policy announcement. The reason for this negative response is that the decrease in home equity access diminishes the role of housing as a self-insurance mechanism for smoothing consumption.

In summary, while research has been conducted examining the relationship between (housing) wealth shock and household consumption decisions, such evidences are mainly from developed countries. Studies in this field from developing countries are largely absent, especially in transitional economies.

This study is the first attempt to examine how the wealth shock arising from the reform has affected aggregate consumption among urban Chinese households. The urban housing reform in China induced major wealth transfer from the state to the household, which provides an excellent quasi-experiment to investigate the consumption response to the wealth shock.

This study is of both theoretical and practical importance. First, this study investigates whether the evidence from the Chinese housing reform aligns with the theoretical

proposition indicated by the existing literature. Based on the literature review, the theory and evidence are in supportive of the proposition that wealth shocks have a positive impact upon consumption. We will test empirically whether the housing wealth shock arising from the housing reform in urban China has any impact on the household consumption decisions. Second, investigating how the housing wealth shock has affected household consumption can help understand the housing wealth effect in transitional economies. It also provides new insights into how privatisation of public assets can convert bureaucratic privilege into wealth inequality, and more importantly, how this wealth inequality was further translated into consumption inequality.

### **III. Background**

#### ***A. Socialist housing system***

After gaining control of the nation in 1949, the Communist Party implemented enormous socialist reforms nationwide. The government established public ownership over all new housing stocks and in the following decades launched a massive construction of public housing units which were allocated to state-owned employees by their work units (known as “danwei”). These residents only paid a small amount of rent (usually <1% of household disposable income) as the rents were subsidized by the government. As a result, urban China has experienced a severe housing crowding and housing shortage before 1985 (Bian & Logan, 1996). Moreover, a certain extent of housing inequality emerged between people with different political status and work units (Huang, 2003; Huang & Clark, 2002; Huang & Jiang, 2009). This inequality was mainly attributed to the unbalanced distribution of houses and difference in rent subsidies provided (Lee, 1988). Housing inequality also existed between and within work units, who were responsible for providing and distributing houses (Zhao and Bourassa, 2003) and housing units were allocated based on worker characteristics, such as job tenure, rank and social connections (Zhou and Logan, 2008).

#### ***B. Privatisation and commodification of public housing units***

In the last few decades, China’s housing market has seen an unprecedented commodification transition, as the housing system was transformed from welfare-oriented into market-oriented. This housing privatisation reform was officially implemented all over the nation in 1988, to gradually introduce market mechanisms in the housing market. In 1994, the state council of China outlined procedures for state employers to sell public housing units to sitting tenants at a subsidized price, in urban areas throughout the country (Wang, 2011). Because prices for state-owned housing units were far below market value, a large proportion of urban households in state-owned housing chose to purchase private property rights over their homes. At the same time, commodity housing (known as shang pin fang) developed by developers was sold at market prices, enabling individuals to establish to buy their own houses, particularly in small cities and towns. As a result, China has become a country with one of the highest private homeownership in the world (Wang, 2011). The rate of home ownership in urban China was 89.3% in 2010 compared to 66.9% in the United States for the same year. Housing now plays an equally

important role in shaping household lifetime wealth and the aggregate economy in China as it does in the United States.

In 1998 the provision of welfare housing officially ended. Since then, China has experienced an unprecedented housing boom with rapid appreciation of housing prices, particularly after 2004 when housing commodification and marketisation were accelerated. As a consequence of the massive housing reform, urban residents in China have enjoyed more access to decent housing and housing consumption has increased considerably.

The reform or post-reform era, however, has not seen housing inequality disappear (Li, 2000, Hiroshi, 2006). The benefits of the housing reform were not shared by all the Chinese people, as housing inequality was exacerbated during the marketisation process (Wang, 2003). Some urban households cannot afford a house, and others live in extremely crowding living environments.

## IV. Data and variables

### A. Data

The data used in our analysis are drawn from the Chinese Household Income Project (CHIP), an ongoing international collaborative project involving a team of international researchers and China's National Bureau of Statistics (NBS). The data collection aims to track the dynamics of income distribution of rural and urban households during market reform. CHIP has conducted household surveys in 1989, 1996, 2003, 2008 and 2013, named CHIP1988, CHIP1995, CHIP2002, CHIP2007 and CHIP2013, respectively. CHIP collected data in 10 provinces, namely, Shanxi, Liaoning, Jiangsu, Anhui, Henan, Hubei, Guangdong, Chongqing, Sichuan, Yunnan and Gansu. These provinces were chosen in the CHIP survey to represent the entire urban Chinese population (Yoko, 2008).

The CHIP contains data from the urban household surveys and the rural household surveys. Since 2002, in light of the increased importance of rural-to-urban migration, rural-to-urban migrant survey was added to the data set. Therefore, for CHIP2002, CHIP2007 and CHIP2013, survey consists of three parts: the Urban Household Survey, the Rural Household Survey and the Migrant Household Survey.

The data set offers several advantages. First, the data covers a large and representative sample of households in urban China. Second, the data contains information on a range of variables that are essential for this study, including: whether the residence is owned; value of mortgage, household income, household expenditure and financial assets of the household. The data also contain a rich set of demographic information, including age, gender, marital status, ethnicity, party membership, educational attainment, occupation, etc.

CHIP 2002 is particularly useful for this research for two reasons. First, as shown in [Figure 1](#), rapid increase in housing prices happened after the year 2002. CHIP2002 contains data gathered before this major housing boom, while CHIP2007 and CHIP2013 were both conducted when housing values were increasing dramatically (see [Figure 1](#)). Therefore, using CHIP2007 and CHIP2013 will increase the difficulty of distinguishing the effect of housing wealth shock (associated with the wealth transfer) from that of home value appreciation. Therefore, we use only CHIP2002 in order to tease

out the impact of housing windfalls from price appreciation on household consumption. Second, of all CHIP surveys, CHIP2002 is the first survey conducted after completion of the housing reform. In this study, we aim to evaluate the housing reform from the perspective of household consumption changes. CHIP1988 and CHIP1995 were conducted before the housing reform ended; therefore, they are not useful for our research purchase. Nevertheless, the readers should bear in mind that our results are limited to this cross-sectional analysis, wherein the observations are only for the year 2002.

We have compiled a comprehensive data set containing information on 5,102 households for 2002 but after executing the following sample restrictions. First, while CHIP2002 survey includes urban, rural and migrant households, we restrict our main test sample to urban households. This is because the housing reform was only implemented in urban areas. Rural and migrant households are not eligible for state housing and therefore they are excluded from our sample. Second, the sample is restricted to household heads aged between 25 and 65 in 2002. We omit individuals aged 66 and above because their consumption behaviour tends to be influenced by their retirement arrangements. Third, we excluded renters from our sample because it is difficult to compare the consumption behaviour between homeowners and renters.

## **B. Variables**

The key independent variable of interest is the “living in subsidised housing”. It is a binary variable constructed based on the answer of the survey question on home ownership types. The survey questionnaire covers six types of the home ownership: rented public housing, rented private housing, traditional private housing, privately owned housing obtained by purchasing public housing at subsidised prices, commodity housing bought from the housing market and others.

If the respondent chooses “privately owned housing obtained by purchasing public housing at subsidised prices” as the current home ownership, the variable “living in subsidised housing” is coded “1”. If the respondent chooses traditional private housing, or commodity housing bought from the housing market, it is coded as “0”. As can be seen, we did not include those who rented public or private housing in our database. This is because, as renters, their consumption behaviour is different from homeowners.

We separate the selected households into two groups; the treatment group comprising 3,809 households, and the control group consisting of 1,293 households. These two groups are divided on the basis of the response to the survey question on whether they were “living in subsidised housing”. Those responding in the affirmative were placed in the treatment group, while the rest placed in the control group. The control group included those who were renting, or having acquired a home without the subsidy.

The assurance of all relevant covariates is included in the control set is crucial. In practice, no formal guide for choosing the covariates exists. The idea is to compare subsidised residents with unsubsidised residents that are otherwise identical in terms of their life cycle characteristics, such as their family composition, demographical information of the household head, the permanent and current income level. Permanent income is approximated by level of education and gross income in 2002. Given this, we included a range of factors as our control variables. These variables are the age, age square term, gender, educational attainment, occupation and seniority of the household head and

household income. Besides, household size, dummies for pension and health status and province indicator are also included in the estimator. See Appendix 1 for summary statistics for these key independent variables.

## V. Identification and empirical strategy

### A. Ordinary least squares

To investigate the effect of the housing reform on the consumption of households living in subsidised housing purchased through the subsidised housing program during the housing reform in the 1990s, we start with a simple OLS model of the form given in [equation \(1\)](#) to show how OLS estimation will provide biased results.

$$Y_i = \beta_0 + \beta_1 D_i + \beta_2 X_i + \varepsilon_i \quad (1)$$

where  $Y_i$  is total consumptive expenditure for household  $i$  reported in 2002 following the housing reform.  $X_i$  is a vector of control variables, including age, age square, gender, health status, educational attainment, Chinese Communist Party (CCP) member, pension, occupation and seniority of the household head, as well as household income, household size and the located province.  $D_i$  is the binary variable “living in subsidised housing” as mentioned above: taking the value one if owner occupied household  $i$  was observed living in subsidised housing in 2002 and zero otherwise. The intercept is the average consumptive expenditure for households residing in non-subsidised housing.  $\beta_1$  measures the difference in the average consumption between households living in subsidised housing and those that are not, and this is the parameter of interest.

### B. Matching estimator

The parameters of [equation \(1\)](#) could be estimated by OLS under the assumption that  $\varepsilon_i$  is orthogonal to  $(X_i, D_i)$ . This would undoubtedly be the easiest way to capture the impact of the reform for the subsidised housing residents. However, OLS specification is biased and inconsistent because of the omitted variable bias and is sensitive to differences in the covariate distribution.

Identifying whether or not the housing reform in China influences household consumption raises an endogeneity issue: there might be confounding factors that affect both the likelihood of receiving the subsidised purchase and the household’s consumption decisions. To solve this methodological issue, an instrumental variable (IV) estimator or a propensity score matching (PSM) approach are often used by the existing literature. In the absence of the reliable instruments, we apply propensity score matching to identify the impact of the housing reform on household consumption. The PSM method offers the advantage of controlling for self-selection based on observed characteristics without imposing strong distributional assumptions (Jimenez-Soto & Brown, 2012).

We implement a propensity score matching (PSM) framework to study the impact of wealth shock emanating from the housing reform on household consumption behaviour. A matching estimator balances the covariates between the subsidised housing group and the non-subsidised housing group and estimates the mean effect of the reform. To estimate the average treatment effect, two groups are constructed: a treatment group

living in subsidised housing and a control group not living in subsidised housing. For this purpose, consider the following equation:

$$E[(Y_{1i} - Y_{0i})|D_i = 1, X_i] = E[Y_{1i}|D_i = 1, X_i] - E[Y_{0i}|D_i = 1, X_i] \quad (2)$$

where  $E()$  is the cross-sectional expectation operator, and  $(Y_{1i} - Y_{0i})$  is the difference between the total consumptive expenditure for a household with different subsidised housing status. Equation (2) measures the additional growth in  $Y_i$  for the treated group conditional on  $X$ , which signifies the average treatment effect on the treated, and this corresponds to  $\beta_1$  in equation (1).

Note that the last term on the right-hand side of equation (2) is unobserved. In other words, the change in  $Y$  for the households living in subsidised housing had they lived in unsubsidised housing is the true counterfactual. However, if households within subsidised residences had ended up there due solely to a random event conditional on  $X_i$ , e.g. a random positive consumption or wealth shock, it is reasonable to make the conditional independence assumption (CIA); namely,

$$\{Y_{0i}, Y_{1i}\} \perp D_i | X_i \quad (3)$$

where  $\perp$  indicates independences. Equation (3) assumes that conditional on  $X_i$ , whether living in subsidised housing is not systematically related to differences in the levels of consumptive expenditure. The CIA therefore implies that  $E[Y_{0i}|D_i = 1, X_i] = E[Y_{0i}|D_i = 0, X_i]$ . That is to say that the expected consumption for the subsidised residents had they lived in unsubsidised housing is the same as the expected consumption for those who are not affected by the housing reform but otherwise have similar characteristics.  $E[Y_{0i}|D_i = 0, X_i]$  has a sample counterpart if there is overlap in the distribution of  $X$  between the two groups in question. When implementing matching estimators, an issue is how to match on a multidimensional covariate vector. One way to tackle the problem of high dimension is to use the propensity score matching estimator, i.e. estimate  $E[D_i|X_i]$  by a parametric model and match on the estimated propensity score and calculate the effect of the treatment (Rosenbaum and Rubin, 1983).

To progress this analysis we draw on the PSM theorem which states that if potential outcomes are independent of treatment status conditional on a covariate vector  $X_i$ , then potential outcomes are also independent of treatment status conditional on a scalar function of covariates, the propensity score.

The working principle of direct PSM is the same as covariate matching except that we match on the propensity score rather than the covariates per se. The specific matching estimator applied here is the simplest possible. Propensity score matching uses the distance between estimated propensity scores to find similar individuals. For each household in the treatment group, a single match is found from the control group that minimises the difference in the propensity score. Specifically, we compute propensity scores based on propensity score regressions using a rich set of observable characteristics. The probit estimates are used to calculate the propensity score for all households in the sample. We then perform the nearest-neighbour matching based on the computed propensity scores. By using propensity score matching, we aim to construct a matched sample of subsidised housing residents and non-subsidised housing occupants that are observationally similar.

### **C. Limitations of using PSM**

Admittedly, the PSM estimator is not without its own faults, as it relies on a strong identifying assumption: CIA which states that, conditional on a set of observable characteristics  $X$ , the treatment status is independent of potential outcomes. This means that the validity of the PSM estimator relies on a strong identification assumption of selection on observables. Although we balance for the available observables that could affect the consumption decision of households, there are still some variables that we could not be included in our model. In other words, our analysis may still suffer from omitted variable bias. Therefore, the results should be interpreted with these limitations in mind.

The omitted variable bias in the study may be generated from two sources. First, there may be unobserved characteristics that are systematically different across the two groups, and these unobservables are omitted variable in our regression model. Second, although we have included all the relevant control variables which are available in our database, it is likely that some other covariates may be omitted. For example, financial profitability of the enterprises which owned the housing units before the reform was related to their employees' opportunity for subsidised purchase. If the enterprises were profitable SOEs, their employees were more likely to live in the subsidised housing units during the 1990s. Thus, variables on firm's characteristics are missing from our model. Therefore, our findings should be interpreted with caution.

## **VI. Empirical results**

This section presents an estimation of the average effect of the housing reform on households living in subsidised housing. First, results from estimating the propensity score are presented, followed with an assessment of the ability of the matching estimator to balance the covariates between the two groups. Finally, the main results for estimates of the average treatment effect on the treated are presented.

### **A. Estimating the propensity score and the balance check of the covariates**

Based on the propensity score theorem, we control for covariates that affect the probability of being treated. Therefore, the propensity score is calculated using a probit model giving the probability of living in subsidised housing as a function of the age, age square term, gender, marital status, educational attainment, occupation and seniority of the household head, household size, pension and household income.

The estimation results in [Table 1](#) demonstrate that the probability of living in subsidised housing is negatively associated with gender, household size, being a farmer or holding a professional job status. Household with higher education level is more likely to live in a house purchased through subsidised housing purchase program. In addition, household heads that are elder and CCP members are more likely to reside in subsidised housing. Finally, having a senior, middle or junior job title, and being a technician, section chief or section member increases the probability of living in subsidised residence. The coefficients on the geographical location dummy variables show that being located in all provinces covered by the survey except for Liaoning Province is positively correlated with the likelihood of subsidised housing residence.

**Table 1.** Probit estimates for subsidised housing residence.

Subsidised	Param.	SE
Gender	-0.3036***	0.0470
Age	0.1227***	0.0216
Age_square	-0.0012***	0.0002
Education	0.0470***	0.0079
CCP membership	-0.0127	0.0467
ln(household income)	0.3022***	0.0379
Household size	-0.1361***	0.0271
Pension	0.1608*	0.0907
Health	-0.0760*	0.0426
Occupation		
owner of private firm	0.4033	0.3620
Self-employed	-0.5253*	0.3134
Professional	-0.6042***	0.1174
Director of government agent, institution and enterprise	-0.0056	0.1283
Department director of government agent, institution and enterprise	0.3322**	0.1610
Clerical/office staff	-0.0272	0.1316
Skilled worker	0.0842	0.0972
Unskilled worker	0.2522***	0.0833
Salesclerk or service worker	0.1353	0.0994
Farmer	-0.2091**	0.1017
Seniority		
Senior title	0.2106*	0.1160
Middle title	0.3944**	0.1641
Junior title	0.2057	0.1264
Technician level	0.2846**	0.1322
Bureau chief level and above	0.3160	0.2187
Division chief level	0.0653	0.6916
Section chief level	1.2679***	0.2934
Section member	0.2701*	0.1387
Geographical location		
Shanxi Province	-0.0773	0.0874
Liaoning Province	0.3290***	0.0825
Jiangsu Province	0.2563***	0.0828
Anhui Province	0.7637***	0.0924
Henan Province	0.4337***	0.0873
Hubei Province	0.8951***	0.0873
Guangdong Province	0.3927***	0.0850
Chongqing Province	0.5877***	0.1045
Sichuan Province	0.7800***	0.0903
Yunnan Province	0.8642***	0.0882
Gansu Province	0.8689***	0.1000

Notes: The dependent variable takes the value 1 if the household lived in subsidised housing purchased through the housing reform.

\*\*\*Significant at the 1% level.

\*\* Significant at the 5% level.

\* Significant at the 10% level.

Note that it is not completely the household's decision to live in a subsidized housing or non-subsidized housing. For example, if the enterprises were profitable SOEs, their employees were more likely to live in the subsidized housing units during 1990s. As such, the aim of the Probit model results from Table 1 is just to show the correlation between certain individual characteristics and the probability to live in the subsidized housing. Readers should interpret these results with this notion in mind.

The purpose of the propensity score matching is to balance the covariates between the two groups. To validate the matching estimator, we check the common support for both the treated and the untreated groups. Figure 2 reveals a clear overlap of the distribution between the matched treated and control observations. Figure 3 plots the kernel densities of the estimated propensity scores for the two groups, and it shows that there is common support. In summary, these findings do not reject the hypothesis that the matched unsubsidized and subsidized households are comparable. We now turn to the analysis of the effect of the reform.

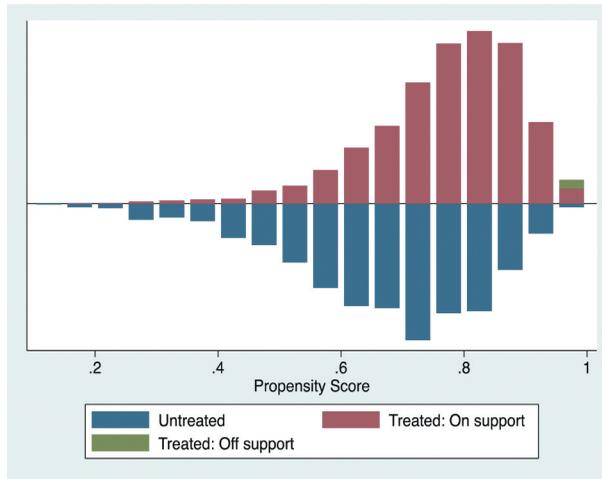


Figure 2. Propensity scores histogram by treatment status.

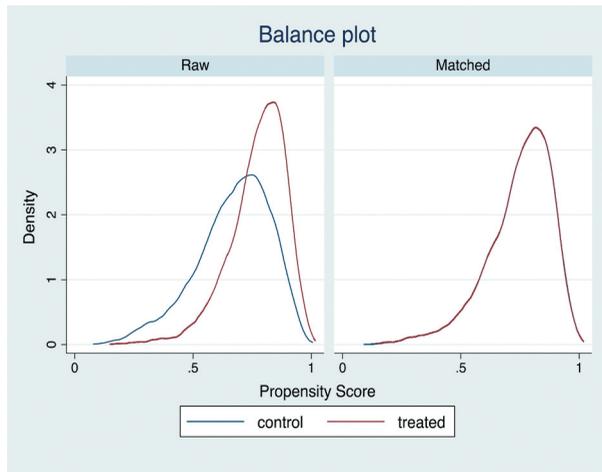


Figure 3. Kernel densities of propensity scores for the raw data and matched sample.

**B. Main results**

Estimates of the average treatment effect of the housing reform on household consumption are presented in Table 2. The results show that the privatisation of housing assets through subsidised purchase has a statistically significant positive effect on household consumption. The positive wealth shock leads to approximately 5% increase in the log term of household consumption for those who purchased public housing at subsidised prices.

**VII. Conclusion**

This study investigates the impact of a positive wealth shock on household consumption in China. The study is based on a unique housing reform in the 1990s in urban China that

**Table 2.** Treatment effect estimates from propensity score matching.

ln(consumption)	Param.	SE (AI robust)
ATE subsidised (1 vs 0)	0.0491**	0.0229

allowed sitting tenants in state-owned housing to buy their homes at highly subsidised prices. We use an extraordinary data set from the Chinese Household Income Project (CHIP) to identify the consumption response to the wealth shock arising from the large-scale housing reform. The effect of the reform is estimated using a propensity score matching estimator for two groups of households: households that were living in subsidised housing and others that were not. We find a positive consumption response to the positive wealth shock. The average treatment effect on the treated is 0.049 and is statistically significant. That is to say, living in subsidised housing leads to an around 5% increase in household consumptive expenditure.

Our studies, using aggregate consumption rather than just durables consumption, reached a qualitatively similar yet more comprehensive conclusion compared to those of Gan et al. (2010). Their results show that households benefited from the housing reform have a significantly higher level of durables consumption than those unaffected by the housing reform. Their results are limited to durable consumption. Our results show that in response to the positive wealth shock, compared to the non-beneficiaries, those who benefited from the housing reform would increase their total consumption expenditures.

Our results provide new insights into consumer response to positive shocks associated with access to home equity and wealth transfer through housing. This could be useful to policymakers in a sense that they can stimulate consumption and economic growth through similar ways of wealth transfer and relaxation of accessibility to home equity.

This study implies the consumption inequality resulted from the housing reform. My results show that housing reform has created new sources of housing and wealth inequality, which was mirrored by the inequality in consumption. These findings demonstrate that the housing reform has converted bureaucratic privilege under the old system into inequality in wealth and consumption. More detailed analysis on the inequality and distribution effects of this reform can be a fruitful avenue of future research.

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## Appendix A

### Appendix A1. Summary statistics for key variables.

Variable	Observations	Mean	Standard Deviation	Min	Max
Subsidised		0.7466	0.4350	0	1
Gender	5,102	0.6629	0.4728	0	1
Age	5,102	45.9716	8.9474	25	65
Education	5,102	11.0286	3.1525	0	23
CCP membership	5,102	0.3893	0.4876	0	1
ln(household income)	5,102	9.9332	0.5880	5.9661	12.3345
Household size	5,102	3.0382	0.7456	1	9
Pension	5,102	0.1541	0.3610	0	1
Health	5,102	0.6245	0.4843	0	1
Occupation					
owner of private firm	5,102	0.0047	0.0684	0	1
Self-employed	5,102	0.0035	0.0593	0	1
Professional	5,102	0.0274	0.1634	0	1
Director of government agent, institution and enterprise	5,102	0.1727	0.3780	0	1
Department director of government agent, institution and enterprise	5,102	0.0316	0.1748	0	1
Clerical/office staff	5,102	0.0855	0.2796	0	1
Skilled worker	5,102	0.1582	0.3649	0	1
Unskilled worker	5,102	0.1503	0.3574	0	1
Salesclerk or service worker	5,102	0.0635	0.2439	0	1
Farmer	5,102	0.0547	0.2274	0	1
Seniority					
Senior title	5,102	0.6294	0.4830	0	1
Middle title	5,102	0.0376	0.1903	0	1
Junior title	5,102	0.1264	0.3324	0	1
Technician level	5,102	0.0751	0.2635	0	1
Bureau chief level and above	5,102	0.0114	0.1060	0	1
Division chief level	5,102	0.0008	0.0280	0	1
Section chief level	5,102	0.0153	0.1227	0	1
Section member	5,102	0.0617	0.2407	0	1