ISSN: 1648-715X / eISSN: 1648-9179

VILNIUS TECH
Vilnius Gediminas Technical University

INTERNATIONAL JOURNAL OF STRATEGIC PROPERTY MANAGEMENT

2024
Volume 28
Issue 5
Pages 334–348
https://doi.org/10.3846/ijspm.2024.22449

URBAN HOUSING PRICES AND CONSUMPTION STRUCTURE UPGRADING: DIFFERENT RELATIONSHIPS IN URBAN AND RURAL CHINA

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Article History:
- received 8 June 2024
- accepted 1 October 2024

Abstract. The dynamics of housing prices can play a pivotal role in shaping household behavior. Motivated by the limited research on the impact of housing prices on consumption structure upgrading in China, this paper presents a series of analyses that deploy panel data from 276 Chinese cities between 2005 and 2019 to scrutinize this impact. Firstly, fixed effect models were used to investigate the relationship between urban housing price and the consumption structure upgrading, and it was found that urban housing price has an inverted U-shaped effect on the consumption structure upgrading of Chinese urban residents, while it has an inhibitory effect on the consumption structure upgrading of Chinese rural residents. Then, we conducted multiple robustness tests, all of which corroborated the benchmark results' reliability. Finally, deeper than existing research, the mechanism of the impact of urban housing prices on the consumption structure upgrading was further explored and it was found that increasing urban housing prices can affect consumption structure upgrading by affecting residents' marginal propensity to consume in development and enjoyment. Our findings provide key alternatives for China's government to promote residents' consumption structure upgrading.

Keywords: housing prices, consumption structure upgrading, urban, rural, China.

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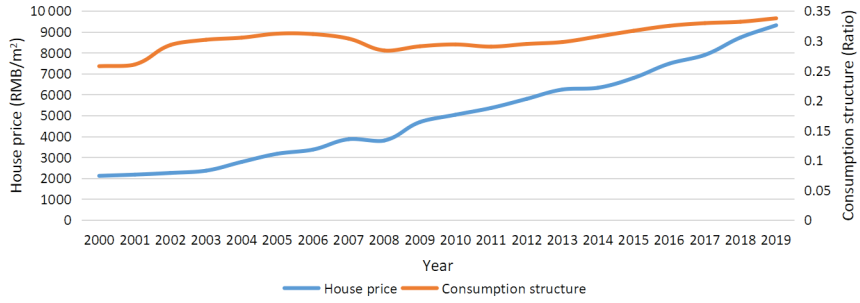
1. Introduction

The relationship between housing prices and consumption has been widely discussed in academia. In theory, housing prices mainly affect consumption through wealth effect, collateral effect, liquidity constraint effect and substitution effect (Atalay & Edwards, 2022; Attanasio et al., 2009; Dong et al., 2017; Kaplan et al., 2020; Leonard, 2010; Louise, 1995; Suari-Andreu, 2021). Empirically, a number of literature works have explored housing prices' influence on total consumption and achieved fruitful results (Chao et al., 2011; Duca et al., 2012; Liu, 2012; Yang et al., 2018). Although many studies have paid attention to the empirical relationship between housing prices and total consumption, the impact of housing prices on consumption structure has not attracted enough attention from researchers. Consumption structure is critical as a tool to measure citizens' living standards (Chai, 1992). Consumption includes survival consumption, development consumption and enjoyment consumption (Uhrich & Benkenstein, 2012). As such, promoting the evolution of consumption from survival-based to development-based and enjoyment-based is referred to as consumption structure upgrading (Wertenbroch, 2002), hereafter denoted as CSU in this paper. In other words, CSU is reflected in the higher proportion of development and enjoyment consumption in total consumption (Dai, 2019).

Figure 1 illustrates the trends in housing prices and consumption structure in China from 2000 to 2019. It can be observed that, in contrast to the rapidly escalating housing prices, CSU has been considerably weak. Specifically, since 2000, housing prices in China increased from slightly above 2000 RMB/m^2 to nearly 10000 RMB/m^2, representing a rise of almost 400%. In comparison, development consumption and enjoyment consumption, as a percentage of total consumption, only increased from 0.26 to 0.34, a growth of just 8%. This phenomenon inspires us to consider whether the increase in housing prices can hinder CSU in China. On the one hand, promoting CSU is the top priority of Chinese government, as this is the only way to improve the living standards of the Chinese people (Tang et al., 2020). On the other hand, significant new technological advancements may be challenging to achieve in the short term and are unlikely to serve as new drivers



Note: Consumption structure means the proportion of development and enjoyment consumption in total consumption.

Figure 1. House price and consumption structure from 2000 to 2019 in China (source: China National Bureau of Statistics, 2022)

of economic growth. The process of globalization faces potential reversals under the dual impact of trade frictions and the COVID-19 pandemic. These both necessitate that China places particular emphasis on domestic consumption. Consequently, during the 14th Five-Year Plan[1] period, China has been focusing on building a "dual circulation" system with the domestic cycle as the main body, where stimulating consumption and upgrading the consumption structure is the main focus of the domestic cycle (Hong & Lou, 2022). As such, examining the influence of housing prices on CSU in China carries high practical significance, whether from the perspective of key issues of people's livelihood or national strategy.

In China, land can be categorized based on ownership into state-owned land and collectively owned land. State-owned land refers to urban land, while collectively owned land primarily includes rural and suburban lands, except where specifically designated otherwise by law. Urban land can be transferred to developers for housing construction, and China's law does not prohibit multiple transactions of these houses. This ensures the liquidity of urban housing and facilitates the formation and development of the urban housing market in China. However, collectively owned land cannot be directly transferred to developers, and the sale of houses built by villagers on collectively owned land is subject to numerous legal restrictions. For instance, the sale of houses on collectively owned land typically requires both the seller and buyer to be villagers from the same village. These restrictions significantly limit the mobility of rural housing and the formation of a rural housing market in China. Moreover, the current trend in China is still urbanization rather than reverse urbanization (Liang et al., 2022). In other words, due to the significantly greater availability of employment opportunities and superior access to public resources such as education and healthcare in urban areas compared to rural areas, Chinese residents prefer migrating from rural to urban areas rather than the opposite. The above analysis rationalizes the study of housing prices in urban rather than rural areas. Therefore, this study focuses on urban housing price (hereafter denoted as UHP in this paper), exploring its impact on CSU in China. Additionally, given the differing urban housing ownership rates between urban and rural residents[2] in China, the influence of UHP on CSU could vary between these two groups. As such, it is imperative to separately explore this relationship among urban and rural residents in China.[3]

So far, as far as we know, only Dai (2019) has empirically tested whether housing prices affect the CSU of the Chinese population. Specifically, Dai's (2019) empirical examinations utilized data from the China Family Panel Studies in 2012 and 2014, and confirmed the negative relationship between higher house prices and the CSU of Chinese urban residents. However, the study of Dai (2019) has some limitations. First, Dai (2019) only focused on Chinese urban residents without examining Chinese rural residents. China's urbanization rate in 2020 was 64%, indicating that 36% of the population are rural residents, which means that rural residents in China still constitute a significant demographic group. It would be unreasonable for research to overlook such a large population. Second, Dai (2019) only examined the linear connection of housing prices with Chinese urban residents' CSU, while ignoring the potential nonlinear relationship between the two, which will be discussed in detail in the next section. Third, Dai (2019) only tested the direct path from housing prices to CSU, neglecting the mechanism of this relationship. As such, employing panel data spanning from 2005 to 2019, this study not only empirically examines the influence of increasing UHP on the CSU of both Chinese urban and

[1] The Five-Year Plan, officially termed the "Outline of the Five-Year Plan for National Economic and Social Development of the People's Republic of China," is a crucial component of China's national economic planning and falls under the category of long-term planning. It primarily involves the planning of major national construction projects, the distribution of productive forces, and the significant proportional relationships within the national economy, setting forth the objectives and directions for the long-term development of the national economy.

[2] Based on the type of household registration (*Hukou*), Chinese residents from each city can be classified into urban residents (those holding an urban *Hukou*) and rural residents (those holding a rural *Hukou*) (He et al., 2024).

[3] The influence of UHP on CSU among these two groups will be further discussed in Section 2.3.

rural citizens, but also considers the potential nonlinear relationship between the two. Additionally, the mechanism of the impact of UHP on CSU is further explored.

This work greatly improves the relevant research via the following marginal contributions. Firstly, different from the linear relationship found by existing research, this study found the effect of UHP on the CSU of Chinese urban residents to take the shape of an inverted U. Secondly, different from the existing research which ignores Chinese rural residents, this study investigates and confirms the significant inhibitory influence of UHP on the CSU of Chinese rural residents[4]. Finally, deeper than existing literature, this study confirms that the rise in UHP can affect CSU by affecting residents' marginal consumption propensity in development and enjoyment.

The rest of the paper is arranged in four segments. Section 2 provides a review of the relevant literature; Section 3 details the data and methods used; Section 4 reports and discusses the statistical findings; and Section 5 completes the paper with conclusions and relevant policy implications.

2. Literature review

2.1. Theoretical review

The effect of housing prices on consumption is mainly realized through four effects, namely wealth, collateral, liquidity constraint, and substitution. The wealth effect and collateral effect are mainly aimed at the families with housing, which believe that there is a positive correlation between housing prices and consumption. Specifically, the wealth effect holds the view that increasing housing prices cause the appreciation of the housing held by families. Being a crucial component of family assets, housing price appreciation augments family assets and then stimulates higher household consumption (Attanasio et al., 2009; Bostic et al., 2009; Calcagno et al., 2009; Dong et al., 2017; Kaplan et al., 2020). Similar to the wealth effect, the collateral effect is also based on the fact that the rise of housing prices will cause the appreciation of the housing held by families. As a kind of collateral, the appreciation of housing will release the borrowing constraints of families, which will enable residents to obtain more loans from banks for consumption (Attanasio et al., 2009; Iacoviello & Minetti, 2008; Kaplan et al., 2020; Suari-Andreu, 2021). The liquidity constraint effect and substitution effect are mainly for the families who rent temporarily and have a home purchase plan. The liquidity constraint effect holds that when housing prices rise, these families have to increase savings and reduce current consumption in order to pay higher housing prices (Atalay & Edwards, 2022; Louise, 1995). In other words, high housing prices crowd out household consumption. When housing prices escalate further and surpass the affordability of these families, however, the substitution effect will appear. Specifically, when housing prices rise dramatically, the home purchase plans of these families may be delayed or even cancelled. Accordingly, these families can use the funds originally planned for house purchase for consumption, that is, the further rise of housing prices may stimulate consumption (Dong et al., 2017; Louise, 1995). It must be emphasized that these effects do not act alone, but jointly connect housing prices to consumption (Attanasio et al., 2009).

2.2. Empirical review

Vast literature has empirically tested the impact of housing prices on total consumption. Some studies found that rising housing prices stimulated total consumption (Benjamin et al., 2004; Boone & Girouard, 2002; Campbell & Cocco, 2007; Chen et al., 2010). For example, by exploring the quarterly data during the period of 1952:1-2001:4 in the United States, Benjamin et al. (2004) estimated the consumption function of the United States and found that each dollar increase in housing wealth will lead to an increase in consumption of 8 cents. On the contrary, some studies found a negative correlation between housing prices and total consumption (Chao et al., 2011; Liu, 2012; Wong et al., 2015; Yang et al., 2018). For example, Yang et al. (2018) conducted an empirical study on the data from Urban Household Survey of 2002 to 2009 in China and revealed the significant inhibitory impact of house prices on total consumption. In addition, studies believed that housing price has a heterogenous influence on consumption across people of different ages (Attanasio et al., 2009; Vinson, 2021). For example, by exploring the data of household consumption expenditure from the UK's Family Expenditure Survey from 1978 to 2001, Attanasio et al. (2009) found that growing housing prices have the strongest stimulating effect on the consumption of young families, a weak stimulating effect on the consumption of middle-aged families, but no significant effect on the consumption of elderly families. In addition to focusing on total consumption, Dai (2019) also empirically tested the relationship between housing prices and the CSU of Chinese urban citizens. By exploring the 2012 and 2014 data of the China Family Panel Studies, Dai (2019) found that an increase in house prices can inhibit the CSU of Chinese urban residents.

Upon combing the literature, we find that most research has focused on how housing prices affect total consumption, while largely neglecting consumption structure. So far, as far as we know, only Dai (2019) has empirically investigated this relationship among the Chinese urban population. However, Dai (2019) did not pay attention to variations in the consumption structure of Chinese rural residents, and did not explore the mechanisms underlying the influence of UHP on CSU. As such, our study used the unbalanced panel data of 276 Chinese cities from 2005 to 2019 to empirically analyze the distinct influence of UHP on the CSU of the Chinese urban and rural population, and further explore the mechanism of this relationship.

[4] The inhibitory impact refers to the phenomenon where rising UHP leads to a downgrade in the consumption structure of Chinese rural residents, specifically by reducing the proportion of development and enjoyment consumption in total consumption.

2.3. Hypothesis development

2.3.1. The influence of UHP on the CSU of Chinese urban citizens

The urban housing ownership rate of Chinese urban residents ranks among the top in the world, and nearly 90% of Chinese urban households own urban housing (Huang et al., 2021). Almost all Chinese families apply for housing loans from commercial banks when buying houses (Fung et al., 2006). When UHP is relatively low, families take out a smaller loan, wherein the proportion of monthly mortgage in household income is lower and does not affect household consumption. When UHP rises, the wealth effect and collateral effect dominate in increasing total household consumption, which is usually accompanied by CSU (Yu et al., 2021). In line with these arguments, we propose HP1a.

However, when UHP further increases to the point that monthly house payments account for a large proportion of household income, the liquidity constraint effect emerges, forcing citizens to decrease their consumption to afford higher mortgage costs. With the reduction of total consumption, urban residents have to spend limited consumption funds more on necessities, which impedes their CSU. Based on the analysis, HP1b is proposed.

HP1a: The influence of UHP on the CSU of Chinese urban citizens is positive.

HP1b: The influence of UHP on the CSU of Chinese urban citizens is inverted U-shaped.

Simply put, UHP's effect on the CSU of Chinese urban citizens could be positive or inverted U-shaped, based on if UHP is high enough.

2.3.2. The influence of UHP on the CSU of Chinese rural citizens

In China, urban housing ownership rate among rural residents is low (Huang et al., 2021). As such, the wealth effect and collateral effect from UHP growth may not exist for rural residents. Likewise, if the vast majority of Chinese rural residents do not plan to move to urban areas to buy housing, the liquidity constraint effect and substitution effect should not exist as well. However, as previously mentioned, due to the greater availability of job opportunities and higher-quality public resources in urban areas compared to rural areas, rural residents in China are migrating to urban areas, which can be evidenced by the country's urbanization rate data[5]. Given the traditional cultural emphasis in China on the importance of owning individual housing, when rural residents move to urban areas, they intend to buy urban housing (Chin & Li, 2021). The rise of UHP in this scenario can produce the liquidity constraint effect, wherein Chinese rural residents reduce their consumption to pay higher UHP, and thus, downgrade their consumption structure. Based on the analysis, we propose HP2a.

However, when UHP further increases beyond the acceptable range, Chinese rural residents may delay or even cancel their house purchase plan in urban areas, causing the substitution effect where they use funds originally allocated for urban housing for consumption. Accordingly, their consumption structure will upgrade with higher total consumption. Based on the analysis, we propose HP2b.

HP2a: The influence of UHP on the CSU of Chinese rural citizens is negative.

HP2b: The influence of UHP on the CSU of Chinese rural citizens is U-shaped.

In a word, the influence of UHP on the CSU of Chinese rural citizens could be negative or U-shaped, depending on whether UHP is high enough.

3. Data and methodology

In this research, we employed the unbalanced panel data of 276 Chinese cities[6] between 2005 and 2019. It is important to note that due to the lockdown policy implemented

Table 1. Descriptive analysis results of full sample

Variable name	Measurement	Mean	Standard Deviation	Min	Max
Structure_urban	Ratio	0.30	0.05	0.17	0.41
Structure_rural	Ratio	0.28	0.07	0.10	0.45
UHP	RMB per square metre	4,462.25	3,510.05	471.03	55,797.00
Income_urban	RMB	22,436.76	10,593.76	4,987.00	73,848.51
Income_rural	RMB	12,297.08	5,547.32	1,513.00	37,413.00
Inflation	Percentage	1.23	0.17	1.00	1.68
Industry	Ratio	2.26	0.15	1.83	2.83
Interest	Percentage	5.78	0.79	4.75	7.26
Urbanization	Ratio	0.56	0.15	0.22	1.00
Children	Ratio	0.24	0.07	0.10	0.46
Old	Ratio	0.13	0.03	0.06	0.25

[5] China's urbanization rate rose from 36% in 2000 to 64% in 2020. Urbanization rate data can be obtained from the National Bureau of Statistics of China.

[6] The cities are listed in List A1 of the Appendix.

in China[7] starting from 2020, triggered by the COVID-19 pandemic, residents were significantly restricted from engaging in external consumption activities. This situation caused the consumption data post-2020 to be unrepresentative of the true consumption capacity of Chinese residents. Consequently, to ensure the accuracy and reliability of our analysis, the dataset used in this study does not include data from the year 2020 onwards. Table 1 reports the descriptive analysis results of all the research variables, which are explained subsequently.

3.1. Dependent variables

The aim of this study is to determine the influence of UHP on CSU in China. Consumption structure (*Structure*) is the explained variable of this study. As mentioned earlier, consumption includes survival consumption, development consumption and enjoyment consumption, in which the increase in the proportion of development and enjoyment consumption is an important embodiment of CSU. As such, we employ the percentage of development and enjoyment consumption in total consumption to measure the consumption structure of residents. In addition to publishing the data of per capita consumption expenditure of urban and rural residents, city statistical yearbooks also publish more detailed data such as the consumption expenditure of: food; clothing; residence; daily necessities and services; transportation and communication; education, culture and entertainment; and medical care. Referring to Cao et al. (2017), we define the consumption of transportation and communication, education, culture and entertainment, and medical care as development and enjoyment consumption. In order to examine whether there exists a different effect of UHP on the CSU between the urban and rural Chinese population, this study further divides consumption structure into urban residents' consumption structure (*Structure_urban*) and rural residents' consumption structure (*Structure_rural*), and investigates the possible influence of UHP on the CSU of the two types of residents separately.

3.2. Independent variable

UHP (*UHP*) is the core explanatory variable of this paper, and its proxy variable is the annual average price of urban housing at city level. The data of *UHP* can be obtained from China Real Estate Information Network, which is compiled by the State Information Center of China.

3.3. Control variables

According to Yu et al. (2021), total consumption and consumption structure tend to change in the same direction, that is, the increase of total consumption tends to lead to CSU, while the decrease of total consumption tends to cause the consumption structure downgrading. As such, this study selects the variables that may affect total consumption or consumption structure, such as per capita disposable income, inflation rate, industrial structure upgrading, interest rate, urbanization rate, dependency ratio of children and dependency ratio of the elderly, as control variables, incorporating them into the study framework to more closely describe the effect of UHP on CSU. The control variables are further discussed below.

Per capita disposable income (*Income*): Income is the most critical variable affecting household consumption decision-making, and there is a positive correlation between income and household consumption (Calcagno et al., 2009). Therefore, we take *Income* as a control variable and expect it to have a positive coefficient. Referring to Tang et al. (2022), per capita disposable income is used to measure the income level of regional residents. Notably, the variable called *Income* in this study includes the per capita disposable income of urban residents (*Income_urban*) and that of rural residents (*Income_rural*). The data of *Income_urban* and *Income_rural* can be acquired from city statistical yearbooks.

Inflation rate (*Inflation*): Inflation can encourage residents to increase savings and thus reduce consumption by triggering uncertainty and pessimistic expectations for the future (Katona, 1975). However, Howard (1978) believed that inflation may produce "flight of currency". Specifically, inflation devalues the currency held by residents, which makes residents reluctant to hold money and thus stimulates consumption. As such, *Inflation* is incorporated in our analysis, although its direction of action on consumption and consumption structure is uncertain. In this study, the Consumer Price Index based on 2005 is used to measure inflation rate. The data of *Inflation* is available from city statistical yearbooks.

Industrial structure upgrading (*Industry*): The upgrading of industrial structure enables the development of some high-level emerging industries, and more development and enjoyment goods are produced with the development of these industries, which promotes CSU (Yin, 2011). As such, *Industry* is incorporated in the model, and the coefficient is expected to be positive. Referring to Wang et al. (2015), we use Equation (1) to calculate and measure industrial structure upgrading, and larger value of *Industry* means more advanced industrial structure. In the Equation (1), y_i represents the proportion of the output value of the $i_{\text{-th}}$ industry in GDP. All the data required to calculate *Industry* can be obtained from the China Real Estate Information Network.

$$Industry = \sum_{i=1}^{3} y_i \times i. \tag{1}$$

Interest rate (*Interest*): According to Lehrer and Light (2018), the increase of interest rate may not only promote residents' consumption through wealth effect, but also inhibit residents' consumption through substitution effect.

[7] During the COVID-19 pandemic, China designated the detection points, residences, workplaces, activity sites, and surrounding areas of individuals who tested positive for the virus as lockdown zones. Residents within these lockdown zones were not permitted to leave their homes without a necessary reason (Zhang et al., 2021).

As such, *Interest* is included in the model, but the coefficient's sign is uncertain. In accordance with Zhou et al. (2018), this study uses the benchmark interest rate of one to three years bank loan to measure *Interest*. The data of *Interest* can be obtained from the official website of People's Bank of China.

Urbanization rate (*Urbanization*): Urbanization stimulates the supply of high-end service commodities by promoting the development of service industry, which is favorable for CSU (Cheng, 2013). At the same time, urbanization can promote the increase of national income through the accumulation of material, knowledge and human capital (Liang & Yang, 2019), so as to stimulate residents' consumption and CSU. Thus, we add *Urbanization* as a control variable and expect it to present a positive coefficient. *Urbanization* data comes from city statistical yearbooks.

Dependency ratio of children (*Children*): Since children are a non-labor force population, the greater dependency ratio of children means less labor supply, which can hamper economic growth and thus curb household consumption and CSU. In addition, when the income of a family is fixed, the more children need to be raised in the family, the per capita consumption expenditure of the family will be reduced. Accordingly, the family is likely to reduce development and enjoyment consumption and thus impede CSU. Supporting this, Ji and Shi (2020) conducted a series of empirical tests on the panel data of 31 provincial regions in China from 2005 to 2018 and found a negative correlation between dependency ratio of children and consumption in China. As such, *Children* is incorporated in the research, predicted to exhibit a negative coefficient. The data of *Children* is obtained from city statistical yearbooks.

Dependency ratio of the elderly (*Old*): Similar to children, the elderly are also non labor force population. As such, the dependency ratio of the elderly may have an inhibitory effect on CSU. However, different from children, some elderly people can receive pensions and had accumulated some wealth. The intergenerational transfer of these wealth can improve the purchasing power of families and thus promote household consumption and CSU (Torche & Spilerman, 2009). As such, *Old* is added to the model, but the coefficient sign is uncertain. The data of *Old* is obtained from city statistical yearbooks.

3.4. Empirical methodology

This study sought to examine the effect of UHP on CSU in China. In order to test whether UHP has a non-linear relationship (inverted U-shape or U-shape) with the CSU of Chinese urban residents and rural residents, the square term of *UHP* was integrated into the model. In addition, the variables of *UHP* and *Income* were transformed into logarithms to alleviate the heteroscedasticity problem, and *UHP* and *Income*, which involve price factors, were treated with *CPI* for de-inflation. Ultimately, we developed two panel data models as presented by Equations (2) and (3) for CSU of Chinese urban and rural residents. In both equations, *Z* denotes the control variables detailed above; μ_i and ν_t represent fixed effects of the city and year, respectively; ε_{it} represents the error term; and α_0, α_1, α_2 and β are the coefficients to be estimated.

$$Structure\_urban_{it} = \alpha_0 + \alpha_1 Ln(UHP_{it}) + \alpha_2 (Ln(UHP_{it}))^2 + \beta Z_{it} + \mu_i + \nu_t + \varepsilon_{it}; \quad (2)$$

$$Structure\_rural_{it} = \alpha_0 + \alpha_1 Ln(UHP_{it}) + \alpha_2 (Ln(UHP_{it}))^2 + \beta Z_{it} + \mu_i + \nu_t + \varepsilon_{it}. \quad (3)$$

According to Lind and Mehlum (2010), identifying a U-shaped effect solely using the significance of the squared term is unreliable, as convex and monotone effects may also incorrectly demonstrate a U-shape with an extreme value. They recommend that if the square term of *UHP* in Equations (2) and (3) obtains a significant coefficient, a U-test should be implemented to confirm the existence of a U-shaped relationship. If the relationship is rejected, the square term of *UHP* should be eliminated, and new models would be constructed as in Equations (4) and (5) for re-estimation. The variables in both equations carry the same connotations as above.

$$Structure\_urban_{it} = \alpha_0 + \alpha_1 Ln(UHP_{it}) + \beta Z_{it} + \mu_i + \nu_t + \varepsilon_{it}; \quad (4)$$

$$Structure\_rural_{it} = \alpha_0 + \alpha_1 Ln(UHP_{it}) + \beta Z_{it} + \mu_i + \nu_t + \varepsilon_{it}. \quad (5)$$

To test the robustness of the benchmark analysis, several tests are implemented. The first robustness check was the placebo test. As a result of overlooked limitations in the research design, the findings of the benchmark estimation on the influence of UHP on CSU may be a placebo (Ding et al., 2023b). As per their suggestion, we extracted the full sample's *UHP* data and randomly designated it among the samples before re-estimating Equations (2) or (4) and (3) or (5). If the effect of UHP on CSU is only a placebo, the results should be consistent with the benchmark regression.

The second robustness check was alternative dependent variable. In addition to the percentage of development and enjoyment consumption from total consumption, Engel's coefficient can also be used to measure residents' consumption structure (Wang & Yang, 2014). As such, we replaced the dependent variable with Engel's coefficient and estimated Equations (2) or (4) and (3) or (5) again. Different from the development and enjoyment consumption percentage, which reflects the advanced level of residents' consumption structure, Engel's coefficient measures the low level of residents' consumption structure. As such, if the benchmark estimation results are robust, after the variable replacement, the signs of the coefficients obtained by the core explanatory variable should be opposite to the benchmark estimation results. Engel's coefficient is derived by dividing food consumption by total consumption; this data is available from city statistical yearbooks.

Thirdly, although the fixed effect model represents a good static estimation process, it may get a biased estimation result due to ignoring the endogenous problem caused by dynamic panel deviation (Ding et al., 2023a).

As such, in order to alleviate the endogenous problem, referring to Arellano and Bond (1991), this study included an instrumental variable in the model, namely the lagged value of the dependent variable. Then, we applied system GMM analysis to dynamically estimate the UHP-CSU link. The system GMM models are presented as Equations (6) to (9). In the Equations (6) to (9), $Structure\_urban_{i,t-1}$ and $Structure\_rural_{i,t-1}$ are the lagged value of $Structure\_urban_{it}$ and $Structure\_rural_{it}$ respectively, and other variables have the same meaning as above. It should be noted that we will not dynamically estimate all the Equations (6) to (9), but only select two equations for dynamic estimation according to the benchmark estimation results.

$$Structure\_urban_{it} = \alpha_0 + \alpha_1 Structure\_urban_{i,t-1} + \alpha_2 Ln(UHP_{it}) + \alpha_3 (Ln(UHP_{it}))^2 + \beta Z_{it} + \varepsilon_{it}; \quad (6)$$

$$Structure\_rural_{it} = \alpha_0 + \alpha_1 Structure\_rural_{i,t-1} + \alpha_2 Ln(UHP_{it}) + \alpha_3 (Ln(UHP_{it}))^2 + \beta Z_{it} + \varepsilon_{it}; \quad (7)$$

$$Structure\_urban_{it} = \alpha_0 + \alpha_1 Structure\_urban_{i,t-1} + \alpha_2 Ln(UHP_{it}) + \beta Z_{it} + \varepsilon_{it}; \quad (8)$$

$$Structure\_rural_{it} = \alpha_0 + \alpha_1 Structure\_rural_{i,t-1} + \alpha_2 Ln(UHP_{it}) + \beta Z_{it} + \varepsilon_{it}. \quad (9)$$

Furthermore, although system GMM estimation can effectively alleviate the endogeneity caused by dynamic panel deviation, it is powerless to address the endogeneity caused by the interaction between UHP and consumption structure. Consequently, to further address the potential endogeneity in this study, corresponding with Antonakis et al. (2014), we used 2SLS (also known as instrumental-variable estimation) to analyze the UHP-CSU relationship. Specifically, we regarded *UHP* and its square term as endogenous variables, and selected land supply area (*Land*) and fiscal decentralization (*Fiscal*) as instrumental variables. As for the reason for selecting *Land* as one instrument variable, firstly, *Land* can be regarded as an exogenous variable, because China's land supply is strictly controlled by the governments (Liang et al., 2016). Secondly, land supply has a positive correlation with housing supply (Wang & Zhang, 2014). According to the theory of supply and demand, in the case of constant demand, more housing supply will bring downward pressure on housing prices. As such, more land supply can lower housing prices (Liang et al., 2016). As for the reasons of choosing *Fiscal* as the other instrumental variable, firstly, fiscal decentralization is that central government gives local governments certain autonomy in fiscal revenue and expenditure, which is an institutional arrangement. As such, fiscal decentralization is exogenous for housing market. Additionally, China's fiscal decentralization reform in the 1990s gave birth to the phenomenon of local governments pushing up land prices by virtue of their monopoly on land (Yuan et al., 2019). Land price as an important part of housing construction cost, higher land price will promote the rise of housing prices. Supporting this, Ouyang (2019) concluded that the expansion of fiscal decentralization promoted the rapid rise of China's housing prices. Following Jin and Zou (2005), this paper defines *Fiscal* as the percentage of per capita municipal fiscal expenditure from per capita national fiscal expenditure. The data of *Land* and the data required to calculate *Fiscal* comes from China Real Estate Information Network, city statistical yearbooks, and China statistical yearbooks.

4. Empirical results and discussion

4.1. Baseline regression results

First, this study applied the fixed effect model on Equations (2) and (3) (see Columns I to IV of Table 2 for results). The single columns leave out the control variables, whereas the double columns integrate them. The first and second columns reveal the impact of UHP on CSU for Chinese urban citizens, while Columns III and IV reveal the same for Chinese rural citizens. For all Columns I to IV, *UHP* recorded a significant positive coefficient whereas the square term of *UHP* recorded a significant negative coefficient. Therefore, UHP may have an inverted U-shaped influence on CSU for both urban and rural residents. Next, the U-test was performed to verify the inverted U-shaped effect. As presented in Table 3, where Columns I to IV correspond to Columns I to IV of Table 2, the extreme points of the first and second columns are both within the interval and demonstrate significance ($p < 0.01$). Simultaneously, one slope within the interval in every column is negative. As such, the inverted U-shaped influence was verified to exist for Chinese urban residents, verifying HP1b.

In addition, according to Table 3's second column, the extreme point[8] of the inverted U-shaped relationship is 8.297[9]. As of 2019, UHP in only 18 of the 276 cities involved in this study did not cross the extreme point[10]. In other words, the high UHP in most Chinese cities has already negatively affected the CSU of urban residents. However, the *p*-values greater than 0.1 in the third and fourth columns of Table 3 indicate that the U-test findings are not statistically significant. That means the effect of UHP on the CSU of Chinese rural residents is not inverted U-shaped. Subsequently, we used Equation (5) to re-estimate this relationship (see Columns V and VI of Table 2 for results; Column V does not include control variables and Column VI includes them). Based on both columns' results, regardless of the incorporation of the control variables, *UHP's* coefficient is negative and statistically significant, indicating that the rise of UHP can inhibit the CSU of Chinese rural residents. In other words, HP2a is verified.

[8] The extreme point refers to the UHP corresponding to the inflection point of this inverted U-shaped relationship.

[9] In the empirical analysis, the *UHP* data was incorporated as logarithms. As such, the real extreme point should be RMB 4011.82.

[10] The 18 cities are Hulunbeier, Baishan, Shizuishan, Xinzhou, Shuozhou, Yuncheng, Lvliang, Laibin, Zhangye, Fuxin, Shangluo, Qitaihe, Shuangyashan, Jixi, Hegang, Heihe, Suihua, Yichun1.

Table 2. The impact of UHP on CSU (Fixed Effect)

	Urban		Rural (Including UHP_squared)		Rural (Excluding UHP_squared)	
	I	II	III	IV	V	VI
UHP	0.603***	0.598***	0.621***	0.359***	–0.096***	–0.057***
	(10.63)	(8.74)	(7.23)	(4.37)	(–17.62)	(–4.23)
UHP_squared	–0.036***	–0.036***	–0.032***	–0.024***		
	(–10.50)	(–9.07)	(–6.13)	(–5.13)		
Income		–0.016		–0.041*		–0.058***
		(–0.86)		(–1.87)		(–2.62)
Inflation		–0.012		0.257***		0.287***
		(–0.28)		(4.87)		(5.33)
Industry		0.018		0.088**		0.059
		(0.48)		(1.99)		(1.31)
Interest		–0.008***		–0.017***		–0.016***
		(–4.10)		(–7.50)		(–6.86)
Urbanization		0.094*		0.178***		0.328***
		(1.78)		(2.81)		(5.70)
Children		0.034		0.162**		0.090
		(0.64)		(2.54)		(1.41)
Old		0.164**		0.340***		0.356***
		(2.25)		(3.88)		(3.95)
Constant	–2.208***	–2.056***	–2.671***	–1.193***	–0.498***	0.694***
	(–9.36)	(–6.24)	(–7.48)	(–3.02)	(–11.08)	(4.68)
R^2	0.212	0.302	0.464	0.702	0.418	0.684
city FE	YES	YES	YES	YES	YES	YES
year FE	YES	YES	YES	YES	YES	YES

Notes: T-statistics in parentheses; ***, **, and * denote statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$, respectively.

Table 3. U-test results

	I		II	
Extreme point	8.415		8.297	
	Lower bound	Upper bound	Lower bound	Upper bound
Interval	6.079	10.582	6.079	10.582
Slope	0.078	–0.125	0.070	–0.135
t-value	10.451	–9.496	4.858	–7.863
P > *t*	0.000	0.000	0.000	0.000
t-value	9.50		4.86	
P	0.000		0.000	
	III		IV	
Extreme point	9.804		7.341	
	Lower bound	Upper bound	Lower bound	Upper bound
Interval	6.079	10.582	6.079	10.582
Slope	0.157	–0.023	0.000	–0.138
t-value	13.926	–1.142	0.024	–6.725
P > *t*	0.000	0.127	0.490	0.000
t-value	1.14		0.02	
P	0.127		0.49	

Test: H_1: Inverse U-shape vs. H_0: Monotone or U-shape.

Almost all the estimated coefficient signs of the control variables with statistically significant coefficients meet the expectations. However, the negative coefficient obtained by *Income* in Column VI of Table 2 indicates that income has an inhibitory effect on the CSU of Chinese rural residents unexpectedly. In addition, for both urban and rural residents, the role of *Old* in promoting the CSU is the strongest among all the control variables, implying the key role of intergenerational wealth transfer in resident consumption (Torche & Spilerman, 2009).

4.2. Robustness checks

Several robustness checks were executed to affirm the reliability of the benchmark model analysis (see Table 4). The first and second columns of the table depict the placebo test outcomes, which indicate that the estimated coefficients of *UHP* and *UHP_squared* are all not statistically significant. Thus, the inverted U-shaped and inhibitory effects of UHP on the CSU of Chinese urban and rural residents, respectively, are not placebo effects, supporting the benchmark estimation's robustness. The third and fourth columns of Table 4 show the statistical outcomes after replacing the dependent variable with Engel's coefficient. According to the results, the signs of the estimation coefficients obtained by *UHP* and *UHP_squared* are opposite to the benchmark estimation results, which proves the robustness of the benchmark estimation results.

In order to alleviate potential endogenous problems caused by dynamic panel deviation, the system GMM estimation was implemented. Its results in the fifth and sixth columns show that the Sargan test in both columns are insignificant ($p > 0.10$), suggesting the effectiveness of the instrumental variable and rejecting any over-identification issues. For both columns, AR(1) is significant ($p < 0.01$)

Table 4. The impacts of UHP on CSU (Placebo test, Alternative dependent variable and System GMM)

	Placebo test		Alternative dependent variable		SYS-GMM	
	Urban	Rural	Urban	Rural	Urban	Rural
	I	II	III	IV	V	VI
Lagged dep. var					0.735***	0.759***
					(18.42)	(20.40)
UHP	0.014	0.000	–0.167**	0.044***	0.181***	–0.018***
	(0.31)	(0.04)	(–2.05)	(3.56)	(2.77)	(–3.82)
UHP_squared	–0.001		0.011**		–0.010**	
	(–0.32)		(2.32)		(–2.42)	
Income	–0.051***	–0.099***	–0.027	–0.018	0.017	0.011
	(–2.92)	(–4.87)	(–1.26)	(–0.86)	(1.26)	(1.03)
Inflation	0.037	0.303***	–0.071	–0.182***	0.061*	0.064**
	(0.77)	(5.51)	(–1.35)	(–3.95)	(1.71)	(2.08)
Industry	–0.031	0.038	–0.042	0.005	–0.048*	–0.032
	(–0.76)	(0.84)	(–0.95)	(0.13)	(–1.87)	(–1.45)
Interest	–0.006***	–0.015***	0.012***	0.014***	–0.005***	–0.005***
	(–2.89)	(–6.32)	(5.18)	(6.33)	(–12.19)	(–10.94)
Urbanization	0.321***	0.350***	–0.422***	–0.360***	0.080*	0.073
	(6.30)	(5.96)	(–6.72)	(–7.56)	(1.90)	(1.56)
Children	–0.069	0.101	0.116*	0.121**	0.008	0.009
	(–1.22)	(1.55)	(1.84)	(2.04)	(0.12)	(0.15)
Old	0.197**	0.398***	–0.267***	–0.268***	–0.029	–0.022
	(2.48)	(4.35)	(–3.07)	(–3.17)	(–0.43)	(–0.30)
Constant	0.654***	0.635***	1.625***	0.526***	0.778***	0.100*
	(2.84)	(4.20)	(4.15)	(4.12)	(3.06)	(1.66)
Sargan test					0.920	0.891
AR(1)					0.000	0.000
AR(2)					0.316	0.329
R^2	0.164	0.671	0.838	0.831		
city FE	YES	YES	YES	YES		
year FE	YES	YES	YES	YES		

Notes: T-statistics in parentheses; ***, **, and * denote statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$, respectively.

while AR(2) is insignificant ($p > 0.10$), establishing no autocorrelation of the error term and the reasonability of the dynamic panel data model. We also find the estimated coefficients of *UHP* and *UHP_squared* in the two columns to be statistically significant with similar signs to the benchmark estimation results. Thus, the inverted U-shaped and inhibitory effects of UHP on CSU were confirmed yet again. In addition, the lag values of the dependent variable in both columns reported significant positive coefficients ($p < 0.01$), implying that a city's advanced consumption structure in the past predicts the same in its future. Accordingly, Shiu et al. (2023) opined that consumption has inertia, whereby consumers' consumption decisions are affected by past consumption habits.

In order to further alleviate the endogeneity caused by the interaction between UHP and CSU, the instrumental-variable estimation was implemented (see Table 5 for results). Columns I and II report the estimated findings for urban residents, where Column I represents the first stage estimation results and Column II represents the second stage estimation results. In the first column, *Land* demonstrates a negative coefficient which is significant, indicating that more land supply can significantly suppress housing prices, while the significant and positive coefficient of *Fiscal* suggests that fiscal decentralization can significantly rise housing prices. The *F* statistic reported in Column I is 102.76, far more than 10, which indicates that the instrumental variables selected in this study are reasonable as they are not weak instrumental variables. According to Column II, the coefficients obtained by *UHP* and *UHP_squared* are both statistically significant and consistent with the benchmark estimation results, which once again confirms the inverted U-shaped relationship between UHP and the CSU of Chinese urban residents. The third and fourth columns report the estimations for rural residents. Similarly, the coefficient obtained by *Land* in Column III is significantly negative ($p < 0.01$), and the *F* statistic is 107.36 (far more than 10), indicating that the instrumental variable is not weak. Corresponding with the benchmark model, *UHP* in Column IV exhibits negative and significant coefficient, once again confirming that rising UHP can inhibit the CSU of Chinese rural citizens.

Table 5. The impact of UHP on CSU (2SLS)

	Urban		Rural	
	I	II	III	IV
Land	–0.071***		–0.069***	
	(–3.48)		(–2.81)	
Fiscal	0.633***			
	(3.49)			
UHP		2.092***		–0.126*
		(2.92)		(–1.91)
UHP_squared		–0.114***		
		(–2.87)		
Income	0.565***	–0.193**	0.399***	0.041
	(3.22)	(–2.50)	(4.23)	(0.67)
Inflation	–0.453***	0.130	–1.448***	0.127*
	(–4.61)	(1.49)	(–3.69)	(1.82)
Industry	0.267***	0.100	0.403***	–0.004
	(2.83)	(1.25)	(2.82)	(–0.08)
Interest	–0.138	–0.011**	0.019	–0.022***
	(–0.48)	(–2.23)	(1.28)	(–6.84)
Urbanization	0.689***	–0.025	1.157***	0.310***
	(6.68)	(–0.25)	(7.34)	(3.52)
Children	0.341*	–0.036	0.429*	–0.276***
	(1.94)	(–0.54)	(1.88)	(–5.48)
Old	–0.978*	0.094***	–0.863***	0.099
	(–1.79)	(2.88)	(–2.82)	(0.98)
R^2	0.877	0.476	0.875	0.627
city FE	YES	YES	YES	YES
year FE	YES	YES	YES	YES
F statistic	102.76		107.36	

Notes: T-statistics in parentheses; ***, **, and * denote statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$, respectively.

4.3. Mechanism analysis

In order to further explore how UHP affects CSU, this study investigated the mechanism of the effect through the viewpoint of the marginal propensity to consume (hereafter referred to as MPC). Referring to Lluch and Williams (1975), we used the ELES model to estimate MPC of urban and rural residents respectively for each year. The basic form of the ELES model is shown in Equation (10).

$$V_i = p_i r_i + b_i(X - \sum_{j=1}^{n} p_j r_j) i, j = 1,2,3,\cdots,n;\ i \neq j\ . \quad (10)$$

In Equation (10), V_i refers to the consumption expenditure of commodity i; X refers to the disposable income; p_i and p_j refer to the price of commodity i and j, respectively; r_i and r_j refer to the demand of commodity i and j, respectively; b_i is the parameter to be estimated, that is MPC. Substituting $p_i r_i - b_i \sum_{j=1}^{n} p_j r_j$ with k_i, then Equation (10) can be converted to Equation (11). Finally, the final form of ELES model is obtained by adding the stochastic disturbance team ε_i to Equation (11), as shown in Equation (12). The estimated value of b_i, i.e. MPC, can be obtained by OLS estimation of Equation (12). After obtaining the estimated value of MPC, we check whether UHP influences CSU by affecting MPC. The check is divided into two parts, urban sample check and rural sample check, respectively. Specifically, referring to Edwards and Lambert (2007), we set Equations (13) and (14) to check the mechanism for urban sample; referring to Baron and Kenny (1986), we set Equations (15) to (17) to check the mechanism for rural sample. In Equations (13) to (17), apart from MPC, other variables have the same meaning as above.

$$V_i = k_i + b_i X; \quad (11)$$

$$V_i = k_i + b_i X + \varepsilon_i\ ; \quad (12)$$

$$Structure\_urban_{it} = \theta_0 + \theta_1 Ln(UHP_{it}) + \theta_2 (Ln(UHP_{it}))^2 + \theta_3 MPC_{it} + \theta_4 Ln(UHP_{it}) * MPC_{it} + \beta Z_{it} + u_i + \nu_t + \varepsilon_{it}; \quad (13)$$

$$MPC_{it} = \lambda_0 + \lambda_1 Ln(UHP_{it}) + \lambda_2 (Ln(UHP_{it}))^2 + \beta Z_{it} + u_i + \nu_t + \varepsilon_{it}; \quad (14)$$

$$Structure\_rural_{it} = \alpha_0 + \alpha_1 Ln(UHP_{it}) + \beta Z_{it} + u_i + \nu_t + \varepsilon_{it}; \quad (15)$$

$$MPC_{it} = \gamma_0 + \gamma_1 Ln(UHP_{it}) + \beta Z_{it} + u_i + \nu_t + \varepsilon_{it}; \quad (16)$$

$$Structure\_rural_{it} = \delta_0 + \delta_1 Ln(UHP_{it}) + \delta_2 MPC_{it} + \beta Z_{it} + u_i + \nu_t + \varepsilon_{it}. \quad (17)$$

In Table 6, the first and second columns report the mechanism tests results for the urban sample, where Column I reports the estimated results of Equation (14), and Column II reports the estimated results of Equation (13). The results show that *UHP* obtained a statistically significant positive coefficient and *UHP_squared* obtained a statistically significant negative coefficient in both Columns I and II, which shows that there is an inverted U-shaped relationship between UHP and MPC, as well as between UHP and the CSU of urban citizens. In addition, the values of *MPC* and *UHP*MPC* in Column II are both significantly positive, which indicates that MPC promotes the CSU of urban residents, and UHP's inverted U-shaped relationship with the CSU of urban residents is affected by MPC. Columns III to V of Table 6 report the results of the mechanism tests for rural sample. The results show that the estimated coefficient of *UHP* in Column III is –0.057 and significant at 1% level; the estimated coefficient of *UHP* in Column IV is –0.07 and statistically significant; The estimated coefficient of *UHP* in Column V is –0.043 and significant at 1% level; the estimated coefficient of MPC in Column V is 0.204 and statistically significant. We can find that γ_1*δ_2 (–0.07*0.204) has the same sign as δ_1 (–0.043), which shows that UHP can indeed affect the CSU of rural residents by affecting MPC. In short, MPC is the intermediary mechanism between UHP and the CSU of Chinese residents.

To delve deeper into the impact of UHP on the MPC by category of consumption, we estimate the impact of UHP

Table 6. UHP, MPC, and CSU

	Urban		Rural		
	I	II	III	IV	V
	MPC	Structure	Structure	MPC	Structure
UHP	0.506***	1.091***	–0.057***	–0.070***	–0.043***
	(7.14)	(10.23)	(–4.23)	(–4.58)	(–3.18)
UHP_squared	–0.028***	–0.050***			
	(–6.73)	(–11.40)			
MPC		3.200***			0.204***
		(6.03)			(4.90)
*UHP*MPC*		0.400***			
		(6.35)			
Control variables	YES	YES	YES	YES	YES

Notes: *T*-statistics in parentheses; ***, **, and * denote statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$, respectively.

Table 7. The impacts of UHP on MPC (Left half of the inverted U-shape for urban sample)

	I	II	III	IV	V	VI	VII	VIII
UHP	0.109***	–0.127***	0.072***	–0.068***	0.002	0.052***	0.026***	–0.003
	(13.77)	(–12.08)	(15.67)	(-4.21)	(0.65)	(4.25)	(5.39)	(–0.54)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES

Notes: T-statistics in parentheses; ***, **, and * denote statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$, respectively.

Table 8. The impacts of UHP on MPC (Right half of the inverted U-shape for urban sample)

	I	II	III	IV	V	VI	VII	VIII
UHP	–0.098***	0.074***	–0.000	0.042***	0.020***	–0.080***	–0.098***	–0.009***
	(–9.51)	(19.24)	(–0.05)	(4.05)	(8.14)	(–14.19)	(–17.55)	(–3.46)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES

Notes: T-statistics in parentheses; ***, **, and * denote statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$, respectively.

Table 9. The impacts of UHP on MPC (Rural sample)

	I	II	III	IV	V	VI	VII	VIII
UHP	–0.070***	0.041***	–0.009***	0.021***	–0.004***	0.097	–0.052***	–0.011***
	(–4.58)	(26.18)	(–18.55)	(7.58)	(–11.37)	(0.31)	(–41.67)	(–16.38)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES

Notes: T-statistics in parentheses; ***, **, and * denote statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$, respectively.

on the overall MPC and the MPC of the seven categories of consumption[11], and the estimated results are shown in Table 7 to Table 9. In these tables, the dependent variables of Columns I to VIII are overall MPC, then the MPC of food, clothing, residence, daily necessities and services, transportation and communication, education, culture and entertainment, and medical care, respectively. Similarly, the estimation of the UHP-MPC relationship is classified into two categories, i.e., the urban sample and rural sample, respectively. In addition, considering that UHP's influence on the CSU of urban residents is inverted U-shaped, we take the extreme point of the inverted U-shaped relationship (8.297) as the boundary to estimate the left half and right half of the inverted U-shaped relationship, respectively. Table 7 shows the estimation results of the left half of the urban sample, which reveals that when UHP is lower than the extreme point, the growth of UHP can promote the CSU of urban residents by promoting urban residents' MPC in the development and enjoyment of transportation and communication; and education, culture and entertainment. Table 8 shows the results of the right half of the urban sample, which reveals that when UHP is higher than the extreme point, the rise of UHP can inhibit the CSU of urban residents by inhibiting urban residents' MPC in the development and enjoyment of transportation and communication; education, culture and entertainment; and medical care. Table 9 shows the estimated results of rural sample, which reveals that escalating UHP can hamper rural residents' CSU by inhibiting their MPC in the development and enjoyment of education, culture and entertainment; and medical care.

5. Conclusions

Using a fixed effect model, placebo analysis, dynamic system GMM analysis, and instrumental-variable estimation, this paper evaluates the influence of UHP on the CSU of the Chinese urban and rural population across 276 cities from 2005 to 2019. At the same time, per capita disposable income, inflation rate, industrial structure upgrading and other indicators that may affect residents' CSU were included in the model as control variables. The statistical findings demonstrate that UHP has an inverted U-shaped influence on the CSU of Chinese urban residents, but an inhibitory influence on the CSU of Chinese rural residents. In addition, this study explores the mechanism of the UHP-CSU relationship via MPC. Our findings validate that higher UHP can impact CSU by affecting the MPC in development and enjoyment.

This research's findings imply key alternatives for Chinese local governments to enhance residents' standard of living by upgrading their consumption structure. First, given the inverted U-shaped influence of UHP on the CSU of Chinese urban residents, local governments can enact policies tailored to their own housing prices. Specifically, in cities where UHP has yet to cross the extreme point, that is, where UHP has not yet had an inhibitory effect on the CSU of Chinese urban residents, the regulation of UHP does not seem to be very necessary for the time

[11] The city statistical yearbooks in China divide consumption into the following categories: food; clothing; residence; daily necessities and services; transportation and communication; education, culture and entertainment; and medical care.

being. However, for cities where UHP exceeds the extreme point, the authorities should mitigate the further escalation of UHP to alleviate the dilemma of urban citizens' CSU being restrained by high UHP. Secondly, considering the inhibitory influence of UHP on Chinese rural residents, the Chinese government should be committed to rural revitalization, improving the level of rural development and increasing rural employment opportunities, which can make rural residents willing to stay in rural areas, so that the consumption of rural residents will not be affected by UHP. Third, given that rising UHP can affect CSU by affecting MPC in development and enjoyment, Chinese local governments should strive to improve the level of public services related to development and enjoyment consumption, such as public transportation, education and medical treatment, so as to drive residents' development and enjoyment consumption and thus enhance residents' CSU.

Funding

This work was supported by the Jiangsu Education Department under the General Project of Philosophy and Social Science Research in Colleges and Universities of Jiangsu Province (2024SJYB1480), the Ministry of Higher Education of Malaysia under the Fundamental Research Grant Scheme (FRGS/1/2023/SS06/UPM/02/1), and Universiti Putra Malaysia under Grant Putra Initiative (GPSPE6303819).

Availability of data and materials

Available from the corresponding author upon request.

Code availability

Available from the corresponding author upon request.

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Appendix

List A1. The city list

Ankang, Anqing, Anshan, Anshun, Anyang, Baicheng, Baise, Baishan, Baiyin, Baoding, Baoji, Baoshan, Baotou, Bayanzhuoer, Bazhong, Beihai, Beijing, Bengbu, Benxi, Binzhou, Bozhou, Cangzhou, Changchun, Changde, Changsha, Changzhi, Changzhou, Chaoyang, Chaozhou, Chengde, Chengdu, Chenzhou, Chifeng, Chizhou, Chongqing, Chongzuo, Chuzhou, Dalian, Dandong, Daqing, Datong, Dazhou, Deyang, Dezhou, Dingxi, Dongguan, Dongying, Eerduosi, Ezhou, Fangchenggang, Foshan, Fushun, Fuxin, Fuyang, Fuzhou, Ganzhou, Guangan, Guangyuan, Guangzhou, Guigang, Guilin, Guiyang, Haerbin, Haikou, Handan, Hangzhou, Hanzhong, Hebi, Hechi, Hefei, Hegang, Heihe, Hengshui, Hengyang, Heyuan, Heze, Hezhou, Huaian, Huaibei, Huaihua, Huainan, Huang, Huanggang, Huangshan, Huhehaote, Huizhou, Huludao, Hulunbeier, Huzhou, Jiamusi, Jian, Jiangmen, Jiaozuo, Jiaxing, Jiayuguan, Jiazhuang, Jieyang, Jilin, Jinan, Jinchang, Jincheng, Jingdezhen, Jingmen, Jingzhou, Jinhua, Jining, Jinzhong, Jinzhou, Jiujiang, Jiuquan, Jixi, Kaifeng, Kunming, Laibin, Laiwu, Langfang, Lanzhou, Lianyungang, Liaocheng, Liaoyang, Liaoyuan, Lijiang, Lincang, Linfen, Linyi, Lishui, Liuan, Liupanshui, Liuzhou, Longnan, Loudi, Luohe, Luoyang, Luzhou, Lvliang, Maanshan, Maoming, Meishan, Meizhou, Mianyang, Mudanjiang, Nanchang, Nanchong, Nanjing, Nanning, Nantong, Nanyang, Neijiang, Ningbo, Ningde, Panjin, Panzhihua, Pingdingshan, Pingliang, Pingxiang, Putian, Puyang, Qingdao, Qingyang, Qingyuan, Qinhuangdao, Qinzhou, Qiqihaer, Qitaihe, Quanzhou, Qujing, Quzhou, Rizhao, Sanmenxia, Sanming, Sanya, Shanghai, Shangluo, Shangqiu, Shangrao, Shantou, Shanwei, Shaoguan, Shaoxing, Shaoyang, Shenyang, Shenzhen, Shuangyashan, Shuozhou, Simao, Siping, Songyuan, Suihua, Suining, Suizhou, Suqian, Suzhou1, Suzhou2, Taian, Taiyuan, Taizhou1, Taizhou2, Tangshan, Tianjin, Tianshui, Tieling, Tongchuan, Tonghua, Tongliao, Tongling, Weifang, Weihai, Weinan, Wenzhou, Wuhai, Wuhan, Wuhu, Wulanchabu, Wulumuqi, Wuwei, Wuxi, Wuzhou, Xiamen, Xian, Xiangtan, Xiangyang, Xianning, Xianyang, Xiaogan, Xingtai, Xining, Xinxiang, Xinyang, Xinyu, Xinzhou, Xuancheng, Xuchang, Xuzhou, Yaan, Yan, Yanan, Yancheng, Yangjiang, Yangquan, Yangzhou, Yantai, Yibin, Yichang, Yichun1, Yichun2, Yinchuan, Yingkou, Yingtan, Yiyang, Yongzhou, Yueyang, Yulin1, Yulin2, Yuncheng, Yuxi, Zaozhuang, Zhangjiajie, Zhangjiakou, Zhangye, Zhangzhou, Zhanjiang, Zhaoqing, Zhaotong, Zhengzhou, Zhenjiang, Zhongshan, Zhoukou, Zhoushan, Zhuhai, Zhumadian, Zhuzhou, Zibo, Zigong, Ziyang, Zuishan, Zunyi.