INTERNATIONAL REAL ESTATE REVIEW

2025 Vol. 28 No. 1: pp. 21 – 51

Urban Village Redevelopment and Local Housing Market in China

Xiaolong Liu*
University of Groningen, Groningen, The Netherlands,
Email: xiaolong.liu@rug.nl

Weidong Qu
Renmin University of China, Beijing, China, Email: quwd@ruc.edu.cn

Yiqi Huang
Shenzhen MSU-BIT University, Guangdong, China, Email: hyq@smbu.edu.cn

With rapid urbanization taking place in China in recent decades, urban village redevelopment is increasingly recognized as a viable strategy to promote efficient land use and urban revitalization, which entails externalities at the local level. This paper examines the external effects of urban village redevelopment on the local housing market over three project phases, i.e. before, during and after redevelopment. We apply a staggered difference-in-differences model to the housing transaction data of Zhengzhou city, and our results reveal the presence of a positive spillover from urban village redevelopment to the local housing market. Specifically, during the project development phase, urban village redevelopment brings about a housing price premium of 4.9% within the treatment area. After project completion, redevelopment further contributes 4.9% to the local house price premium. These results are robust to heterogeneity in terms of the redevelopment project scale as well as the economic well-being of the districts where the urban villages are located.

Keywords

Urban revitalization, Urban village redevelopment, Housing market, China

---

* Corresponding author

1. Introduction

Urban villages are a unique phenomenon in the urbanization process of China, which has been predominantly led by Chinese rural-to-urban migration (Zhang and Song, 2003). They emerged in the early stages of urbanization along the urban fringes on rural land to accommodate transient populations with low income, such as migrant workers and other job seekers. Over time, the urban frontiers expanded due to economic and population growth, so these villages were gradually included within the urban landscape but their land ownership was still retained within rural collectives, compared to the rest of the urban land owned by the state. Historically, urban villages have provided affordable low-cost shelter for numerous migrants. However, their negative externalities cannot be ignored. Given their marginalized social and spatial statuses, urban villages have been characterized by substandard living environments that contribute to issues related to public health and security (Lai et al., 2014; Lee et al., 2017). Hence, neighboring urban residents consider urban villages to be a disamenity (Song and Zenou, 2012), which intensifies the urban filtering process and results in high-income residents relocating to more prestigious neighborhoods rather than living in proximity to urban villages (Braid, 1986; Bond and Coulson, 1989).

From the perspective of space and land use, sub-optimal urban village land use and development due to the peculiar land ownership structures and immunity from planning control have led to inconsistency in terms of urban development with urban villages lagging far behind the rest of the urban areas (Liu et al., 2010; Zhu and Hu, 2009). Efficient use of urban village land is crucial to mitigate the increasing scarcity of urban construction land, owing to the rapid urbanization of China. To this end, urban village redevelopment by means of demolition and reconstruction is increasingly recognized as a viable strategy to revitalize urban villages in order to improve the overall quality of life of residents and promote optimal and sustainable land use within urban areas. In July 2023, the Chinese government proposed to actively promote the redevelopment of urban villages in megacities and supercities[1], accelerate the vitalization of various types of inefficient land, and guide the transformation of urban and rural developments from relying on increments to tapping stock. In reality, urban village redevelopment is a complex process and its success depends on collaboration among the key stakeholders, i.e. local governments with planning authority, the rural collectives who own the land, and developers with the financial means and professional expertise in urban development (Hao

[1]A megacity is defined as a city with a permanent urban population of 10 million or more, whereas a supercity is a city with a permanent urban population of over 5 million and under 10 million. According to the seventh population census of China, there are 7 megacities including Shanghai, Beijing, Shenzhen, Chongqing, Guangzhou, Chengdu and Tianjin, and 14 supercities including Wuhan, Dongguan, Xi'an, Hangzhou, Foshan, Nanjing, Shenyang, Qingdao, Jinan, Changsha, Harbin, Zhengzhou, Kunming and Dalian.

et al., 2011; Zhou, 2014). Therefore, studying the externalities of past urban village redevelopments is important for interpreting the behavior of stakeholders and promoting the implementation of policies.

From a social welfare perspective, urban village redevelopment will potentially enhance the living standards of urban villages and drive their development. However, the effects of redevelopment might not be exclusively contained within the urban villages themselves; rather, they may well reach beyond the scope of these villages. Hence, the external impact of redevelopment on the local housing market, among others, is essential in evaluating the overall welfare implications around redevelopment. It is perceivable that urban village redevelopment may impact the local housing market through both the supply and demand channels. Specifically, urban village redevelopment adds to the existing housing stock by increasing the supply of available construction land and floor-to-area ratio, which may consequently depress the local house prices (Ooi and Le, 2013). In the meantime, urban village redevelopment removes the "nuisance factor" in terms of public health and safety associated with existing urban villages and may also bring about desirable amenities and job opportunities to the community via the urban planning imposed in redevelopment (Brunes et al., 2020; Zheng et al., 2020). Moreover, middle to high-income residents may also be attracted to the neighborhoods around the redeveloped urban villages that have underwent urban gentrification. As a result, the redevelopment of urban villages is likely to contribute to a positive demand shock in the local housing market. Overall, the direction and magnitude of the external effect of urban village redevelopment on neighboring house prices remain undetermined at the theoretical level.

In this paper, we empirically examine the response of neighboring house prices to urban village redevelopment, which connects to the general literature on urban revitalization and its externalities on local housing markets. There is much evidence that points to the positive external effects associated with urban renewal (Ding, 2000; Zahirovich-Herbert and Gibler, 2014; Lee et al., 2017; vom Hofe et al., 2019; Liang et al., 2020), including subsidized housing (Schwartz et al., 2006), brownfield redevelopment (De Sousa et al., 2009; Woo and Lee, 2016), and redevelopment of industrial heritage sites (van Duijn et al., 2016), to name a few. In contrast, Lai et al. (2007) and Greenstone and Gallagher (2008) find no significant pricing impact on the local housing market with respect to comprehensive redevelopment plans and the clean-up of hazardous waste sites, respectively. In terms of the theme of urban village redevelopment, the existing literature primarily focuses on the process of redevelopment (Li and Li, 2011; Li et al., 2014; Zhang and Li, 2016) and sustainable land use (Lai et al., 2014; Liang et al., 2018; Liu and Wong, 2018), whereas empirical research on the redevelopment of urban villages and its external effect on local housing markets is relatively scarce. Among the few empirical studies on urban villages, Song and Zenou (2012) examine the house price gradient for an existing urban village, and document housing price discounts associated with properties that are in close proximity to the urban villages. Hence, the current paper contributes to the existing literature by adopting a dynamic approach to empirically investigate the externality surrounding urban village redevelopment, thus adding to a welfare evaluation related to urban village redevelopment.

Given that urban village redevelopment is a lengthy process, forward-looking market participants may foresee the expected impact of redevelopment on house prices and capitalize on this information before the completion of redevelopment projects. To accommodate a possible anticipation effect, we adopt a staggered difference-in-differences (DID) hedonic framework in our research design to make a causal inference with the magnitude and significance of the external effect during various phases of urban village redevelopment, i.e. after the commencement of the redevelopment process but before its completion, and after the completion of the redevelopment.

Our preliminary findings indicate that there is a positive external effect on neighboring house prices during and after redevelopment with an average treatment effect of 4.9% for both stages. These results are robust to heterogeneity in terms of the scale of redevelopment as well as the degree of economic well-being of districts where the urban villages are located.

The remainder of the paper is structured as follows. Section 2 reviews the literature. Section 3 elaborates on the empirical methodology. Section 4 introduces the data used in the analysis. Section 5 reports and discusses the empirical results. Section 6 concludes.

2. Literature Review

Urban villages have long been synonymous with poor quality of living. These villages are typically located in densely populated residential areas with poor public infrastructures and characterized by a lack of amenities, which cause problems such as congestion, environmental pollution, and safety (Liu and Liang, 1997; Zhang et al., 2003). As a corollary, urban villages are perceived negatively by urban residents, and houses that are in close proximity to these villages suffer from price discount. Song and Zenou (2012) study the pricing effect of urban villages on local housing sales. Using a sample with 940 housing units sold in 2008 in the Nanshan district of Shenzhen in China, they show a price discount of 156 RMB (22.46 USD)[2] for housing units that are one meter closer to the nearest urban village while controlling for other housing attributes.

---

[2] According to the historical exchange rate data released by the State Administration of Foreign Exchange, the average RMB:USD in 2008 was 100:694.51.

Since the land of urban villages is owned by rural collectives rather than the state, development within urban villages is purely initiated by the landowners. Thus, this development has immunity from the state-imposed urban planning controls. Previous studies attribute underdevelopment in urban villages to the absence of land use planning (Liu et al., 2010; Zhu and Hu, 2009). Lai et al. (2014) expand on earlier research by identifying that aside from the lack of planning control, property rights related institutional constraints (such as possible land expropriation by the state), inaccessibility to credit and absence of state regulations that concern collective land transactions, can also lead to sub-optimal development outcomes in urban villages.

In the process of urban village redevelopment which aims to realign development in urban villages with that of the rest of the urban area, the power struggle among key stakeholders can determine the prospects of redevelopment. Using a case study in Guangzhou, China, Liang et al. (2018) show how a coalition formed by developers and rural collectives defended the territory, which was earmarked for other development plans, by resisting an attempt by the local government to redevelop the urban village. In the same vein, Zhang and Li (2016) show that the traditional top-down planning approach may not necessarily work in the case of urban village redevelopment, especially with the presence of cross-pressuring by informed residents, the mass media, advocacy groups and local experts. In contrast, Li and Li (2011) and Li et al. (2014) provide evidence that local authorities can adopt a liberal attitude to embrace market forces and show commitment and support for the private sector, which contribute to the eventual success of the redevelopment.

Urban village redevelopment constitutes an important part of the urban revitalization process in China which includes re-planning and redesigning urban areas to promote land use efficiency and stimulate local economic development. Previous studies in the literature have attempted to quantify the external impact of urban revitalization projects on the housing market, and the results are mixed. Among others, Schwartz et al. (2006) explore the case of New York City, and find that subsidized housing projects exert significant and positive external impacts on house prices in a neighborhood, and the benefits seem to be due to the removal of the existing disamenity. Zahirovich-Herbert and Gibler (2014) examine the effect of new residential construction in built-up areas in Baton Rouge, Louisiana, USA, on neighboring house prices. Their results show that the price of existing houses is positively influenced by the new construction of larger homes, but depressed when new similar sized houses are constructed nearby. Aarland et al. (2017) investigate whether area-based intervention programs in troubled neighborhoods in Oslo, Norway, have succeeded in making these neighborhoods more attractive as proxied by house prices. Of the four city districts, significant house price appreciation is present in two districts, while in the other two districts, the pricing effect of intervention programs is either negative or insignificant. Lee et al. (2017) study the effect of announcements of urban renewal projects on house prices in local neighborhoods. Their results indicate that, before the announcement of urban renewal, house prices in areas that expect urban renewal are lower than those in other areas. However, after urban renewal projects are publicly announced, the expected positive spillover to the housing market is revealed to be the extent that houses in close proximity to the designated renewal projects enjoy a premium in comparison to those located further away. vom Hofe et al. (2019) estimate that housing policy intervention, to redevelop vacant residential structures by means of demolition and reconstruction, leads to the appreciation of neighboring house prices by as much as 14.1% after redevelopment. van Dujin et al. (2016) examine the Dutch industrial heritage redevelopment experience and provide evidence that negative externalities on local housing markets are associated with the period before redevelopment, and redevelopment brings about a positive external effect on the surrounding house prices upon completion of the projects. In the context of brownfield redevelopment, De Sousa et al. (2009) and Woo and Lee (2016) share similar findings that brownfield redevelopment contributes to local house price appreciation in the USA; that is, Milwaukee and Minneapolis, and Cuyahoga County, Ohio, respectively.

Contrary to the predominant findings that urban revitalization projects positively affect house prices, Lai et al. (2007) reject the hypothesis on the positive externalities of redevelopment projects in their research which measures the effect of comprehensive redevelopment initiatives on house prices in Hong Kong. Moreover, Greenstone and Gallagher (2008) report that clean-up of hazardous waste sites in the USA is associated with an economically small and statistically insignificant influence on residential property values.

Overall, the existing literature reveals that empirical research that evaluates the externalities of urban village redevelopment is scarce, and the direction and magnitude of the external effects of urban village redevelopment on neighboring house prices remain undetermined, especially in the context of developing economies such as China. Hence, this study bridges this knowledge gap and contributes to the literature on the externalities of urban revitalization. Another marginal contribution of this paper lies in adopting the staggered DID model to make a causal inference of the external effect during various phases of urban village redevelopment. Many studies have used the conventional DID method for analyzing the impact of the implementation of urban renewal on neighborhood housing prices (Ooi and Le, 2013; Lee et al., 2017). However, they have ignored that renewal of most redevelopment projects does not start on the same date. In the meantime, redevelopment is a lengthy process in which the spillover effects on neighborhood housing prices vary with time (Zheng et al., 2020). Fan et al. (2024) apply a dynamic DID framework to investigate the shock generated by redevelopment projects in Hong Kong and find positive externalities of urban redevelopment on local housing prices following the announcement of redevelopment, with diminishing magnitude as the redevelopment project proceeds. Their study is an important inspiration for this study. This paper adopts a staggered DID model to capture the average external effect of redevelopment projects with different starting dates, and identify the direction and extent of these externalities during various phases of urban village redevelopment.

3. Methodology

3.1 Treatment and Control Groups

The identification strategy of the DID model crucially depends on the specification of the treatment and control groups. By definition, the number of observations in the treatment group should be the same as that in the control group for all dimensions except for the treatment. Admittedly, *a priori*, it is challenging to define the extent that the external effect of an urban village can reach. In the literature, various distance ranges have been proposed for defining the treatment and control areas, which seem to be correlated with the population density. The defined treatment area is generally smaller in populated urban areas than rural areas. For instance, Schwartz et al. (2006) use 2000 feet as the criterion to differentiate the treatment and control areas in their study of the external effects of place-based subsidized housing. Ooi and Le (2013) use 500 meters as the treatment radius around an infill development. van Duijn et al. (2016) set the treatment area as being within 1000 meters of redeveloped industrial heritage sites. Lee et al. (2017) and Liang et al. (2020) define the area within an 800-meter range of urban renewal projects as the treatment area. In contrast, Dröes and Koster (2016) extend the boundaries of the treatment area to as far as 2000 meters from wind turbines located in rural areas. In view of previous studies in the literature, and given the urban density in China, we define the treatment area as being within 1000 meters from the boundaries of each urban village redevelopment project, and the control area is extended a further 1000 meters from the boundaries of the treatment area. Due to the geographic or economic heterogeneity of each redevelopment project, we also conduct a robustness check by using 500, 1000, 1500 and 2000 meters as the boundaries to mitigate this concern (see Table 6).

To establish the validity of the DID estimator that adopts the treatment and control areas defined as such, we examine the house price trends in both the treatment and control areas before and after the commencement of urban village redevelopment. If the common-trend assumption that underlies the DID framework holds, we would expect that, in the absence of urban village redevelopment, house price development in the treatment and control areas have parallel trends. The effect of urban village redevelopment, if it exists, would be reflected by the convergence or divergence of house price trends in the control and treatment areas after the launch of redevelopment. To this end, we follow Autor (2003) and estimate a dynamic model specified as follows,

$$\ln P_{ijt} = \alpha + \gamma_j + \lambda_t + \delta Z + \sum_{\tau=1}^{T'} \beta_{-\tau} D_{i,t-\tau} + \sum_{\tau=0}^{T} \beta_{\tau} D_{i,t+\tau} + \varepsilon_{ijt} \quad (1)$$

where $D_{i,t-\tau}$ assumes a value of one if housing transactions in the treatment area take place before the start of the urban village redevelopment, and T' denotes the maximum difference in the year between these housing transactions and the start of the urban village redevelopment. Similarly, $D_{i,t+\tau}$ takes the value of one for houses in the treatment area sold at the start of the urban village redevelopment, and T refers to the maximum lag in the year of these housing transactions relative to the start of the urban village redevelopment. The differences in housing price developments between the treatment and control areas before the start of urban village redevelopment are captured by coefficients $\beta_{-\tau}$. Hence, if both the treatment and control areas follow similar housing price trends before the start of redevelopment, $\beta_{-\tau}$ would be statistically insignificant. The effect of the redevelopment on the differences in housing price trends between the treatment and control areas are reflected by coefficients β_{τ}. γ_j represent the neighborhood fixed effects, which capture all the time-invariant characteristics of the community where property i is located, which might influence the outcome of interest. λ_t represents the year-by-quarter fixed effects, which control for shocks in a particular quarter that will be likely to affect all neighborhoods in a similar manner. δ is a vector of the corresponding coefficients to Z, a $(\mathrm{m} \times 1)$ vector composed by m control variables, such as housing size, floors and orientation.

3.2 Staggered DID Model

As the implementation date is different for each urban village redevelopment process (see Table 1), we conduct a staggered DID specification to make causal inference on the average impact of urban village redevelopment on local house prices. The model is specified as follows:

$$\begin{aligned}\ln P_{ijt} = \alpha + \gamma_j + \lambda_t + \delta Z + \beta_0 \mathrm{TREAT}_i + \beta_1 \mathrm{AFTER}_i \\ + \beta_{AFTER}(\mathrm{TREAT}_i \times \mathrm{AFTER}_i) + \varepsilon_{ijt}\end{aligned} \quad (2)$$

where the dependent variable $\ln P_{ijt}$ is the natural logarithm of the transaction price of property i in year t that is located in neighborhood j. TREAT_i is a binary dummy that equals 1 if property i is located in the treatment area with β_0 as its coefficients. AFTER_i is a dummy variable which takes a value of 1 if property i is sold after the completion of the urban village redevelopment. It can be seen that the average treatment effect is captured by β_{AFTER} which is the coefficient of the interaction term between TREAT_i and AFTER_i.

In some cases, the shock of the intervention does not occur at a specific point in time. Taking urban village redevelopment for example, the project period, i.e. from project commencement to completion, can be up to three years in general. Hence, in the process of urban village redevelopment, expectation plays a key role in the decision making of housing market participants, which reflects the intrinsic uncertainty that surrounds the outcome of redevelopment (van Duijn et al. 2016; Lee et al., 2017). To accommodate this anticipation effect, we modify the classic DID model by disentangling the various phases in a redevelopment project as follows:

$$\begin{aligned}\ln P_{ijt} = \alpha + \gamma_j + \lambda_t + \delta Z + \beta_0 \mathrm{TREAT}_i + \beta_1 \mathrm{BETWEEN}_i \\ + \beta_{BETWEEN}(\mathrm{TREAT}_i \times \mathrm{BETWEEN}_i) \\ + \beta_{AFTER}(\mathrm{TREAT}_i \times \mathrm{AFTER}_i) + \varepsilon_{ijt}\end{aligned} \quad (3)$$

where $\mathrm{BETWEEN}_i$ takes the value of 1 if property i is sold after project commencement but before project completion. $\beta_{BETWEEN}$, the coefficient of the interaction term $\mathrm{TREAT}_i \times \mathrm{BETWEEN}_i$, thus measures the treatment effect during the redevelopment phase. If there is anticipation in the housing market before the completion of redevelopment, its effect should be captured by $\beta_{BETWEEN}$.

Bertrand et al. (2004) highlight the serial correlation problem found within the DID setup which leads to underestimation of standard errors and higher rejection rates of the null hypothesis of no treatment effect. This is a relevant issue in this study since spatial and temporal correlations among housing transactions are inherent in property markets. Basu and Thibodeau (1998) argue that house prices are correlated across space because neighborhood properties have similar structural attributes and share location amenities. Temporal dependence among housing transactions arises because housing transactions that have taken place in the recent past, e.g. within a year, may contain information, such as market trends or changes in institutional settings, that is relevant to the pricing of the subject property (Liu, 2013). To address the issue of serial correlation among housing transactions, we estimate the DID model with standard errors clustered on both neighborhood and year.

4. Data

4.1 Urban Village Redevelopment in Zhengzhou City

This study examines urban village redevelopment cases in Zhengzhou, which is the capital city of Henan Province in China (see Figure 1). Zhengzhou is one of the 14 supercities in China as well as the economic hub of central China with a permanent population of 13 million in 2023 and covers an area of 7,446 square kilometers[3]. Zhengzhou is the pioneering city of urban village redevelopment

[3] Statistical Communiqué of Zhengzhou in 2023, https://tjj.zhengzhou.gov.cn/tjgb/8324080.jhtml

in China not only because it once had the largest number of urban villages in the country but also due to the fact that it started urban village redevelopment as early as 2003. After 10 years of modifications and steady increase, urban village redevelopment in Zhengzhou was fast tracked in 2013 as redevelopment plans were revealed for some key urban villages such as Lao Ya Chen village and Chen Zhai village. In the meantime, the municipal government started to take the lead in the redevelopment of urban villages, including the resettlement of urban villagers. In 2018, Zhengzhou became the first city in China without an urban village within its urban periphery. Therefore, Zhengzhou models an urban regeneration experience that can be extended to other cities in China within the rapid urbanization process of China.

Figure 1 Geographic Location of Zhengzhou City

Source: National Catalogue Service for Geographic Information (http://www.webmap.cn/)

Hence, in this study, we focus on urban village redevelopment projects that were initiated after 2013 and completed before 2018. According to the Zhengzhou Urban and Rural Construction Bureau, 24 urban village redevelopment projects were implemented during this period of time, and information about these projects have been made available such as the dates of start and completion, location, project size, etc.[4] Table 1 lists the details of these projects and the geographic location of these projects is illustrated in Figure 2.

Table 1 Details of Urban Village Redevelopment Projects

ID number	Urban village	Surface area (km^2)	Start date	End date
1	Liu Zhai	0.93	2013/9/1	2015/9/1
2	Gao Zhai	0.33	2015/3/1	2017/4/1
3	Tie San Guan Miao	0.26	2016/1/1	2017/1/1
4	Zhu Tun	0.14	2014/5/7	2017/12/14
5	Bei Wo Long Gang	0.20	2014/11/3	2016/11/12
6	Da Li – Xi Gang	0.78	2014/9/1	2016/9/1
7	Sun Zhuang	2.05	2015/4/1	2017/9/1
8	Yan Tong	0.82	2015/4/1	2017/12/1
9	Shi Li Pu	2.33	2015/1/1	2016/1/1
10	Nan Liu Zhuang	0.69	2015/6/1	2016/6/1
11	Lu Zhai	1.03	2014/12/1	2017/12/28
12	Liu Zhuang	2.17	2015/4/1	2017/6/14
13	Chen Zhai	1.30	2015/10/1	2017/10/1
14	Chang Zhai	0.19	2013/9/1	2015/9/1
15	Yang Jun Liu	0.05	2016/7/1	2017/12/1
16	Gao	3.69	2016/12/1	2017/10/26
17	Xiao He Zhuang	0.88	2013/8/1	2015/8/1
18	Yang Zhuang	0.81	2014/9/16	2017/9/1
19	Mu Ma	0.39	2015/12/26	2017/12/28
20	Gu Cheng	0.65	2016/5/1	2017/12/1
21	Jin Wa	0.89	2015/10/1	2017/12/1
22	Gong Zhuang	0.86	2014/8/22	2016/8/31
23	Su Tun	2.08	2015/4/2	2017/5/31
24	Mao Zhuang	0.43	2014/11/1	2016/11/1

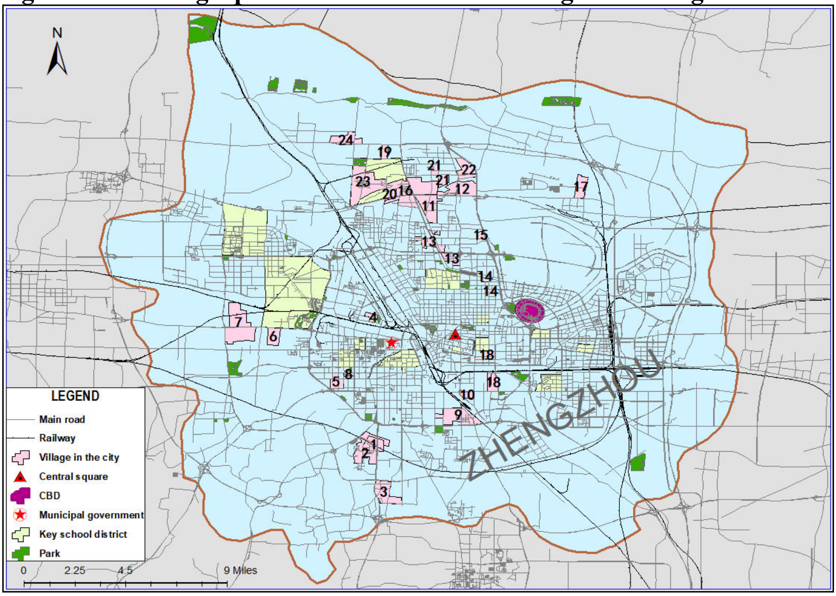
4.2 Housing Transaction Data

We obtain registered housing transaction data from the Local Taxation Bureau of the Henan Province, which include information on addresses, declared sales, appraisal and taxable values, size, floor to site and landscaping ratios, age, floor on which the property is located, type of property construction which ranges from low to high rise buildings, and direction that the property is facing, among

[4]The information on urban village redevelopment is obtained from the website of Zhengzhou Urban and Rural Construction Bureau (http://zzjsj.zhengzhou.gov.cn/)

others. It is worth noting that declared sales value may differ from appraisal value with taxable value being the maximum of the two values. This differentiation is motivated by the fact that, in property transactions in China, both property buyers and sellers may have the incentive to under-report declared sales value in order to partially evade property transaction tax payments.[5] Hence, in this study, the taxable value is taken as the fair market value for properties.

Figure 2 Geographic Location of Urban Villages in Zhengzhou



***Source*:** National Catalogue Service for Geographic Information (http://www.webmap.cn/) and Zhengzhou Urban and Rural Construction Bureau (http://zzjsj.zhengzhou.gov.cn/)

The original dataset consists of 369,190 housing transactions that span the period of April 2012 to April 2018. The data cleaning process involved first, the removal of repeated observations with identical information, then observations with transaction type recorded as "non-house sale" are removed. The data are further filtered on the basis of taxable value, sales date and property characteristics, and observations with missing or unreliable information are excluded. Finally, we removed observations with incorrect addresses. After data cleaning, there are 288,367 housing sales transactions in the work dataset. In order to allocate properties to the respective treatment and control areas for each redevelopment project, we use ArcGIS to establish a buffer zone 1000 meters around the boundaries of the urban village as the treatment area and extend a further 1000-meter buffer zone as the control area. All properties that

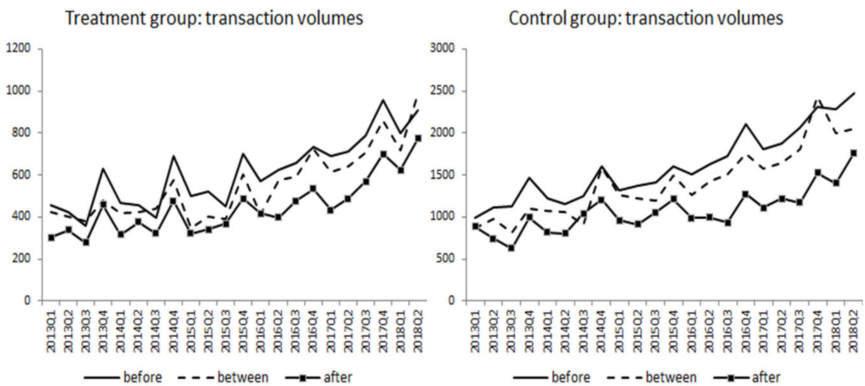
[5]See, for example, Dai and Xu (2018).

are located beyond the second buffer zone are removed from the work data. In addition, we single out urban village redevelopment cases if, in the treatment area, there are less than 100 observations in any of the three phases of redevelopment, i.e. before, during or after redevelopment. Table 2 provides information on the final selection of urban village redevelopment projects and the associated number of housing transactions that fall within the treatment and control areas of each project. Figure 3 presents the trend of the transaction volume during the redevelopment period. The figure shows that the sales volume in each stage is relatively constant and there is a certain seasonal trend in both the control and treatment groups.

Table 2 Final Selection of Urban Villages and Number of Housing Transactions

ID	Urban Village	Treatment group	Control group	Total
2	Gao Zhai	1994	6037	8031
4	Zhu Tun	3344	13,790	17,134
5	Bei Wo Long Gang	2925	1746	4671
8	Yan Tong	3335	7553	10,888
9	Shi Li Pu	1196	536	1732
10	Nan Liu Zhuang	782	711	1493
13	Chen Zhai	4444	17,249	21,693
14	Chang Zhai	7037	14,138	21,175
15	Yang Jun Liu	4730	4939	9669
20	Gu Cheng	5606	23,413	29,019
	Total	**35,393**	**90,112**	**125,505**

Figure 3 Transaction Volume before, during and after Redevelopment



Note*:* Transaction volume is aggregated on a quarterly basis

Table 3 shows the sample descriptive statistics. In view of the full sample, the average size of the properties is around 88 m^2. As for the property orientation, 75.5% of the properties are facing south and less than 10% are facing the other directions in their own respective categories. On average, properties are located on the 15^{th} floor in high-rise apartment buildings.

Table 3 Descriptive Statistics

	Full sample		Treatment group		Control group	
Panel A Continuous variable						
Variable	Mean	SD	Mean	SD	Mean	SD
lnP	13.38	0.57	13.40	0.53	13.38	0.59
Size (m^2)	88.25	41.92	90.28	40.89	87.45	42.29
Floor	15.92	10.63	14.69	9.93	16.40	10.81
Panel B Dummy variable						
Variable	Proportion in sample (%)		Proportion in sample (%)		Proportion in sample (%)	
Orientation						
South	75.12		77.99		73.99	
North	9.74		7.13		10.76	
East	6.68		6.66		6.84	
West	4.86		5.15		4.75	
Southeast	1.08		0.92		1.14	
Southwest	1.17		1.08		1.21	
Northeast	0.67		0.59		0.70	
Northwest	0.58		0.49		0.61	
N	125,505		35,393		90,112	

***Note**:* See Appendix A for definition of variables.

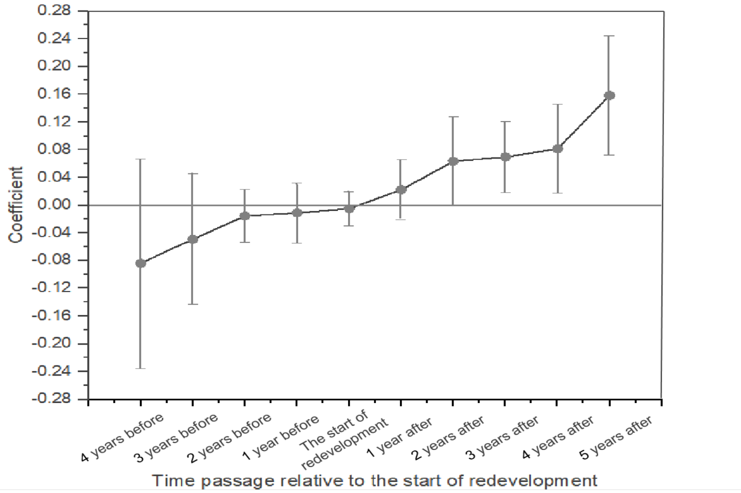
4.3 Parallel Trend Test

To examine the potential heterogeneity in terms of property characteristics among properties that fall within either the treatment or control area, we split the full sample into two subsamples, i.e. the treatment and control groups. When comparing property transactions in the treatment group with those in the control group, the sample statistics indicate that the properties within these two groups are quite comparable along all dimensions related to property characteristics. Furthermore, to check the validity of the common trend assumption, we estimate Equation (1) by using $T'= 4$ and $T= 5$.[6] Figure 4 plots the coefficient estimates that correspond to four years before the start of the redevelopment,

[6]Given the different starting dates of urban village redevelopment cases as presented in Table 1, T' is determined by the maximum lead in year of housing transactions relative to the start of redevelopment. Since the most recent starting year of urban village redevelopment cases was 2016, and earliest housing transactions took place in 2012, only four years can be traced back at the most before the start of the redevelopment, i.e. $T'= 4$. Similarly, for determining the maximum lag T, we use the redevelopment case with the earliest starting year, which is 2013, and the most recent housing transactions in 2018. Hence, the maximum lag in year for housing transactions after the start of redevelopment is five, i.e. $T= 5$.

the year of the start of the redevelopment, and five years after the start of the redevelopment.[7] It can be observed that, before the start of the redevelopment, coefficients $\beta_{-\tau}$ are not statistically different from zero, which indicate that housing price trends do not seem to differ between the control and treatment areas before the start of redevelopment.

Figure 4 Impact of Urban Village Redevelopment on Housing Price Trends between Control and Treatment Areas

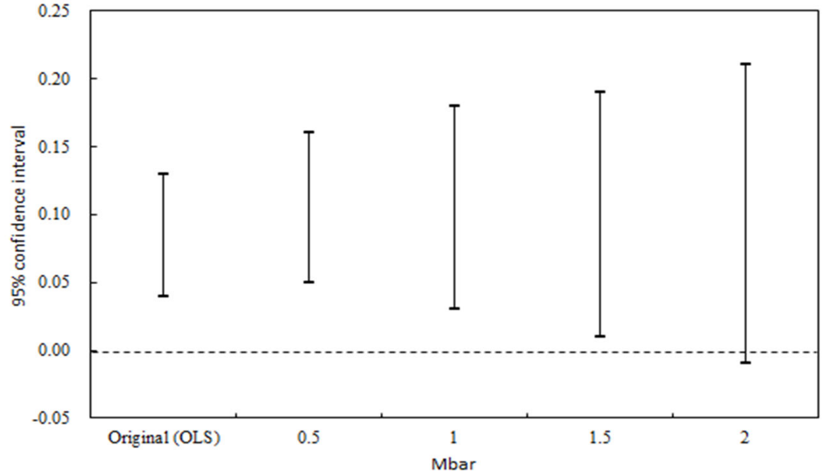


***Notes**:* The outcome variable is logarithm of housing transaction price. Dots correspond to coefficient estimates with vertical lines being 95% confidence bands.

However, the latest studies in the literature suggest that even if prices are not statistically significant before the price trends, this does not necessarily imply that the parallel trend assumption holds (Kahn-Lang and Lang, 2018; Roth, 2022). To this end, Rambachan and Roth (2023) propose an alternative approach for powerful inference in event-study designs where the parallel trends assumption does not hold. This sensitivity analysis consists of two parts: first, imposing the maximum deviation (Mbar) from the parallel trend; second, reporting confidence sets of the treatment effect that correspond to Mbar. A confidence set of the post-treatment point estimator that does not contain zero indicates that the treatment effect holds up to a certain deviation of the parallel trend assumption. We refer to Rambachan and Roth (2023) and set the deviations from the parallel trend assumption by 0.5, 1, 1.5 and 2, and obtain the confidence intervals for the average causal effect of all periods after treatment, as shown in the Figure 5. The results show that when Mbar=2, our robust confidence set now includes zero, which means that the treatment effect can be robust if we restrict the deviations of parallel trends to be no larger than twice the parallel trends at pre-treatment.

[7]For the complete estimation results, please see Appendix B.

Figure 5 Sensitivity Analysis for Parallel Trend Test



Notes: *Original* corresponds to the OLS confidence interval which is only valid if parallel trends hold exactly. The remaining vertical lines represent the confidence sets for the average treatment effect when the parallel trend deviates 0.5, 1, 1.5, and 2 times.

5. Empirical Results

In presenting the empirical results, we first report the main estimation results, by using the full sample, and the coefficients of variable of interest are estimated with various model specifications that differ in the scope of inclusion of the control variables. We then show the results of the robustness checks in terms of heterogeneity at the scale of redevelopment projects as well as the economic well-being of districts where urban villages are located.

5.1 Main Results

Our main empirical results are shown in Table 4. The dependent variable is housing transaction price in natural logarithm terms and variable coefficients are estimated while controlling for year and neighborhood fixed effects. The coefficients of the variables of interest $TREAT \times BETWEEN$ and $TREAT \times AFTER$ are significant with the expected sign. In general, there is a clear tendency that urban villages lead to property premiums after the completion of redevelopment in the treatment area relative to the control area. Interestingly, between the start and completion of redevelopment, the effect of redevelopment is already capitalized in property pricing within the treatment area, which reflects the presence of anticipation of the market participants.

Table 4 Main Estimation Results

Variable	Dependent variable: lnP	
	Coefficient	
TREAT	-0.061***	(0.021)
TREAT × BETWEEN	0.049***	(0.009)
TREAT × AFTER	0.049***	(0.019)
BETWEEN	0.012**	(0.006)
AFTER	0.014**	(0.007)
Floor	0.004***	(0.001)
North	-0.241***	(0.009)
East	-0.103***	(0.008)
West	-0.149***	(0.011)
Southeast	-0.011**	(0.005)
Southwest	-0.025***	(0.006)
Northeast	-0.135***	(0.014)
Northwest	-0.099***	(0.013)
Size	0.014***	(0.000)
Constant	12.735***	(0.018)
Year fixed effect	YES	
Neighborhood fixed effect	YES	
R^2	0.892	
Sample Size	125,505	

Notes: Results presented with use of full sample. Standard errors are reported in brackets. Standard errors are clustered on neighborhood and year. *, ** and *** correspond to significance levels of 10%, 5% and 1%, respectively.

In examining the magnitude of the coefficients, the coefficient of $TREAT \times BETWEEN$ implies that, during redevelopment, capitalization of expected gain from redevelopment leads to a premium of 4.9 percent in average house price in the treatment area in comparison to that in the control area. After redevelopment, houses around redeveloped urban villages are sold for 4.9 percent higher than similar houses located within the control area. With respect to other coefficient estimates of variables that relate to housing characteristics, we find that properties located on higher floors are associated with a pricing premium that is 1.1 percent for one additional floor higher. Such a premium might be attributed to good and unobstructed views, and quietness of living on higher floors. For property orientation, the coefficient estimates reveal pricing discounts applicable to properties that face directions other than south, which shows the desirability of south-facing properties which offer sufficient sunlight and brightness. In terms of the marginal pricing effect of property size, we find that one additional square meter contributes to the house price by 1.4 percent.

Overall, these results indicate that the welfare effect of urban village redevelopment is not contained within but goes beyond these villages in terms of capitalization in local house prices. Given the revealed positive external effect of urban village redevelopment on local house prices, it seems to suggest that the capitalization effect induced by the positive demand shock dominates that caused by the rising housing supply after urban village redevelopment. Compared with the findings in earlier studies, for example, Schwartz et al. (2006), van Duijn et al. (2016), Lee et al. (2017) and vom Hofe et al. (2019), the results in this study are consistent in that urban revitalization projects have a positive spillover to the local housing market. In particular, housing price capitalization before the completion of urban village redevelopment shows how expectations may play a role in the lengthy process related to urban revitalization projects, which feed into local house prices in a continuous fashion. It is interesting to note that, if perfect anticipation exists in such a way that there is no uncertainty or information asymmetry related to these redevelopment projects, we would expect full capitalization of the ex post effect of redevelopment to take place before the completion of the projects. Our findings suggest that home sellers and potential buyers factor in both the uncertainty and expected benefits of redevelopment in property transactions before the completion of a redevelopment project. Such an anticipation effect has also been well documented in studies such as Schwartz et al. (2006), van Duijn et al. (2016), and Lee et al. (2017).

5.2 Results of Further Checks

5.2.1 Robustness Checks

Recent advances in the econometric theory show that staggered DID designs are likely to be biased in the presence of treatment effect heterogeneity, and the premise for unbiased estimation is that the treatment effect remains constant over time (Baker et al., 2022; Goodman-Bacon, 2021). In this paper, we refer to Callaway and Sant'Anna (2021) to estimate group-time average treatment effects to obtain more robust results than the standard two-way fixed effects (TWFE) regressions. We divide the urban villages into four groups according to the year when the redevelopment was implemented, and then calculate the weighted average effect according to the sample size of each treatment group. As shown in Table 5, the estimated average treatment effect (ATT) is 5% during the redevelopment while it is 5.5% after completion, which are close to the baseline results (in Table 4), thus suggesting that heterogeneous treatment effects would not interfere with our main results.

In considering the geographic or economic heterogeneity of each redevelopment project, we use 500, 1000, 1500 and 2000 meters as the boundaries to redefine the treatment and control groups for robustness checks. Table 6 reports the results of the urban village redevelopment effect on neighborhood housing prices based on the four boundaries. Only when 1000 meters is used as the boundary are the treatment effects during and after the redevelopment remarkable at a significance level of 5%, which supports the robustness of our baseline results.

Table 5 Robustness Check: Group-time Average Treatment Effects

	Dependent variable: lnP			
	2013	2014	2015	2016
Variable	(1)	(2)	(3)	(4)
TREAT × BETWEEN	0.048*** (0.006)	0.051*** (0.005)	0.050*** (0.006)	0.051*** (0.004)
TREAT × AFTER	0.053*** (0.017)	0.061*** (0.019)	0.052*** (0.011)	0.056*** (0.013)
ATT: between	5.0%			
ATT: After	5.5%			
Year fixed effect	YES			
Neighborhood fixed effect	YES			
R^2	0.889	0.874	0.878	0.801
Sample Size	21,175	21,850	43,837	38,688

Notes: We divide the sample into groups according to the year of the implementation of urban village redevelopment. The treatment villages are Chang Zhai in Column (1), Zhu Tun and Bei Wo Long Gang in Column (2), Gao Zhai, Yan Tong, Shi Li Pu, Nan Liu Zhuang, and Chen Zhai in Column (3), and Yang Jun Liu and Gu Cheng in Column (4). The average treatment effect is weighted by the sample size for each treatment group. Standard errors are reported in brackets. Standard errors are clustered on neighborhood and year. *, ** and *** correspond to significance levels of 10%, 5% and 1%, respectively.

Table 6 Robustness Check: Redefining the Boundaries

	Dependent variable: lnP			
	500 m	1000 m	1500 m	2000 m
Variable	(1)	(2)	(3)	(4)
TREAT	-0.010* (0.006)	-0.061*** (0.021)	0.033 (0.021)	0.027 (0.024)
TREAT × BETWEEN	0.013 (0.017)	0.049*** (0.009)	0.033* (0.018)	0.027 (0.019)
TREAT × AFTER	0.023 (0.018)	0.049*** (0.019)	0.056* (0.033)	0.052* (0.027)
BETWEEN	0.005 (0.006)	0.012** (0.006)	0.010* (0.006)	0.007 (0.005)
AFTER	0.009 (0.007)	0.014** (0.007)	0.012* (0.007)	0.009 (0.006)
Constant	10.563*** (0.021)	12.735*** (0.018)	21.074*** (0.034)	32.852*** (0.042)
Control variables	YES			
Year fixed effect	YES			
Neighborhood fixed effect	YES			
R^2	0.887	0.892	0.894	0.871
Sample Size	125,505	125,505	125,505	125,505

Notes: Results presented with use of full sample. Standard errors are reported in brackets. Standard errors are clustered on neighborhood and year. *, ** and *** correspond to significance levels of 10%, 5% and 1%, respectively.

5.2.2 Scale of Redevelopment Projects

Among the selected urban redevelopment cases, heterogeneity exists in terms of the scale of the redevelopment. It is possible that the main results presented above are driven mostly by large scale redevelopment projects that involve large capital investments, while the external effect is negligible for small scale projects. Along these lines, we split the full sample into three subsamples on the basis of the surface area of the urban villages. Urban villages are classified as small-scale if they cover an area less than 0.5 square kilometers. Medium-scale villages are those with a surface area greater than 0.5 square kilometers but less than 1 square kilometer and villages with a surface area greater than 1 square kilometer are categorized as large-scale villages. Table 7 lists the details of the villages that fall under each of three categories and their associated number of housing sales.

Table 7 Classification of Urban Villages into Categories of Three Different Scales

Category	Urban village	Surface area (km^2)	Observations
Small-scale	Yang Jun Liu	0.047	9669
	Zhu Tun	0.143	17,134
	Chang Zhai	0.189	21,175
	Bei Wo Long Gang	0.202	4671
	Gao Zhai	0.333	8031
Medium-scale	Gu Cheng	0.647	29,019
	Nan Liu Zhuang	0.690	1493
	Yan Tong	0.817	10,888
Large-scale	Chen Zhai	1.297	21,693
	Shi Li Pu	2.333	1732

The results of the robustness checks by using the three subsamples are shown in Table 8. Examining the coefficients of the variables of interest, irrespective of the scale of the urban village redevelopment, it can be observed that the positive spillover of redevelopment is found over both the redevelopment phase and the period after the project completion. For small-scale villages, the housing price premium in the treatment area relative to that in the control area amounts to 4.9 percent during development and 5.8 percent after redevelopment. Similar results are found for middle-scale and large-scale villages, and, in terms of the magnitude of the coefficient estimates, they are quite comparable with that of the coefficient estimates for small-scale villages. In general, the results estimated with the use of subsamples, that differ in terms of redevelopment scale, are consistent with the main results, which implies that the main results are not driven by heterogeneity in the scale of redevelopment.

Table 8 Heterogeneity Check across Scale of Redevelopment

	Dependent variable: lnP		
	Small-scale villages	Middle-scale villages	Large-scale villages
Variable	(1)	(2)	(3)
TREAT	-0.052*	-0.049**	-0.039***
	(0.025)	(0.017)	(0.018)
TREAT × BETWEEN	0.049***	0.055***	0.052***
	(0.007)	(0.005)	(0.007)
TREAT × AFTER	0.058***	0.063***	0.053**
	(0.010)	(0.006)	(0.017)
BETWEEN	0.014**	0.012*	0.011**
	(0.006)	(0.007)	(0.005)
AFTER	0.016**	0.015**	0.013**
	(0.007)	(0.007)	(0.006)
Floor	0.005	0.000***	0.012
	(0.007)	(0.000)	(0.001)
North	-0.188***	-0.189***	-0.291***
	(0.009)	(0.010)	(0.006)
East	-0.069***	-0.078***	-0.083***
	(0.011)	(0.008)	(0.016)
West	-0.110***	-0.109***	-0.119***
	(0.016)	(0.009)	(0.007)
Southeast	-0.005	-0.024	0.005**
	(0.005)	(0.013)	(0.002)
Southwest	-0.032***	-0.027**	-0.043**
	(0.011)	(0.011)	(0.020)
Northeast	-0.137***	-0.076***	-0.165***
	(0.019)	(0.015)	(0.026)
Northwest	-0.082***	-0.133***	-0.091**
	(0.014)	(0.024)	(0.029)
Size	0.013***	0.014***	0.014***
	(0.000)	(0.000)	(0.000)
Constant	12.631***	12.408***	12.392***
	(0.036)	(0.198)	(0.035)
Year fixed effect	YES	YES	YES
Neighborhood fixed effect	YES	YES	YES
R^2	0.889	0.893	0.885
Sample Size	60,680	41,400	23,425

Notes: This table presents the results by using three subsamples with urban villages that differ in terms of their surface area. Standard errors are reported in brackets. Standard errors are clustered on neighborhood and year. *, ** and *** correspond to statistical significance levels of 10%, 5% and 1%, respectively.

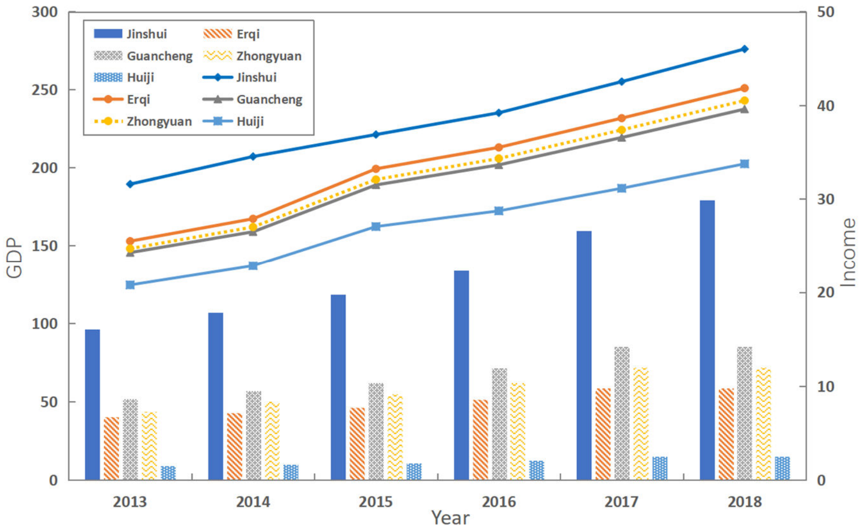
5.2.3 Economic Well-being of Districts where Urban Villages are Located

Among the redeveloped urban villages, heterogeneity is also found in the economic well-being of districts where urban villages are located. Some urban villages are located in districts with high rankings according to economic indicators such as gross domestic product (GDP) and disposable income, while other urban villages are situated in districts that are relatively less prosperous economically. As shown in Figure 6, a total of five districts, i.e. Jinshui, Zhongyuan, Guangcheng, Erqi and Huiji, have jurisdiction over urban villages in our sample. Among these districts, substantial differences are found in GDP and disposable income over the period of 2013 to 2018 with Jinshui taking the lead followed by Erqi, Guancheng and Zhongyuan which have a similar level of economic development, and Huiji being the least well-off among the five districts. It might be the case a priori that after redevelopment, poor districts might benefit more economically from redevelopment than rich districts. As redevelopment is typically associated with the provision of new infrastructures, the marginal economic impact of these new infrastructures might be higher on economically disadvantaged districts than that for other districts. For instance, adding a new road or renovating an existing road during redevelopment in poor districts, where high quality infrastructure is scarce, would yield a higher marginal value than in rich districts with existing higher quality infrastructures. Moreover, the redevelopment of urban villages in poor districts might convey a much stronger positive signal of the economic prospects in these districts than middle-income or rich districts, which further contributes to the local house price development. Hence, the main results are potentially subject to the heterogeneity in district economic status. To check if the main results hold across urban villages that are located in districts with different economic conditions, we divide the full sample on the basis of GDP and disposable income into three subsamples which correspond to urban villages located in rich, middle-income, and poor districts respectively. Table 9 shows the classification of urban villages based on the economic well-being of districts into which they fall.

Table 9 Classification of Urban Villages based on Economic Well-being of Districts

Category	District name	Urban village	Observations
Rich district	Jinshui	Yang Jun Liu	9669
		Chen Zhai	21,693
		Chang Zhai	21,175
Middle-income district	Zhongyuan	Zhu Tun	17,134
		Bei Wo Long Gang	4671
		Yan Tong	10,888
	Guancheng	Shi Li Pu	1732
		Nan Liu Zhuang	1493
	Erqi	Gao Zhai	8031
Poor district	Huiji	Gu Cheng	29,019

Figure 6 Temporal Development of GDP (CNY in billions; 1 CNY = 6.43 USD) and Per-capita Disposable Income of Urban Residents (CNY in thousands) across Districts



Notes: Bars denote GDP on left vertical axis and polylines denote income on right vertical axis. Data on GDP and disposable income taken from Henan Statistic Yearbook (2014-2019). According to the historical exchange rate data released by the State Administration of Foreign Exchange, the average RMB:USD from 2013 to 2018 was 1.00:6.43.

Table 10 reports the estimation results. In line with the main results, the expected benefit after redevelopment of urban villages located in rich, middle-income or poor districts is already capitalized in local house prices before the completion of the redevelopment. The external effect of redevelopment remains positive and statistically significant after project completion. With respect to the magnitude of the coefficient estimates for the variables of interest $TREAT \times BETWEEN$ and $TREAT \times AFTER$, as expected, substantial differences exist between the external effect of urban village redevelopment in poor districts and rich or middle-income districts. In poor districts, urban village redevelopment brings about much greater positive external effects than in middle-income or rich districts. In sum, while differences in terms of economic well-being across districts seem to drive the magnitude of the estimated treatment effect, the overall findings are consistent with the main results.

Table 10 Heterogeneity Check of Redevelopment Effect in Different Districts

	Dependent variable: lnP		
	Rich district	Middle-income district	Poor district
Variable	(1)	(2)	(3)
TREAT	-0.041*** (0.015)	-0.031*** (0.010)	-0.029*** (0.006)
TREAT × BETWEEN	0.053*** (0.007)	0.041*** (0.007)	0.125*** (0.006)
TREAT × AFTER	0.051*** (0.012)	0.064*** (0.008)	0.159*** (0.017)
BETWEEN	0.015** (0.007)	0.014** (0.007)	0.010 (0.007)
AFTER	0.017*** (0.008)	0.015** (0.007)	0.012* (0.007)
Floor	0.004 (0.010)	0.007*** (0.001)	0.007*** (0.002)
North	-0.205*** (0.017)	-0.203*** (0.011)	-0.176*** (0.012)
East	-0.090*** (0.012)	-0.058*** (0.010)	-0.077*** (0.010)
West	-0.127*** (0.015)	-0.078*** (0.013)	-0.108*** (0.011)
Southeast	-0.002 (0.003)	-0.002 (0.004)	-0.041*** (0.015)
Southwest	-0.026** (0.011)	-0.029** (0.013)	-0.031*** (0.011)
Northeast	-0.136*** (0.016)	-0.119*** (0.025)	-0.081*** (0.018)
Northwest	-0.085*** (0.017)	-0.082*** (0.017)	-0.149*** (0.026)
Size	0.013*** (0.000)	0.013*** (0.000)	0.014*** (0.000)
Cons	12.682*** (0.027)	12.564*** (0.036)	12.355*** (0.209)
Year fixed effect	YES	YES	YES
Neighborhood fixed effect	YES	YES	YES
R^2	0.886	0.890	0.895
Sample Size	52,537	43,949	29,019

Notes: This table presents the results by using three subsamples that are differentiated on the basis of the economic well-being of the districts where the urban villages are located. Standard errors are reported in brackets. Standard errors are clustered on neighborhood and year. *, ** and *** correspond to statistical significance levels of 10%, 5% and 1%, respectively.

6. Conclusion

This paper is set against the era of rapid urbanization in China during which many urban villages have gone through transformation and redevelopment to realize efficient land use and provide amenities, thus ultimately promoting a better quality of life for local residents and harmonious overall urban development. In this study, we focus on the welfare implications of urban village redevelopment by investigating its external effect on local house prices. Using a DID methodology, and housing transaction data from Zhengzhou city, we show the dynamics of the externality imposed by urban village redevelopment, over various project phases, on the local housing market. Specifically, upon the commencement of redevelopment, local house prices react positively with a premium of 5% on average, in comparison with the average housing sales price in the control area in anticipation of the expected benefits from the redevelopment. After project completion, urban village redevelopment further contributes to local house price premium by 5.5% on average. These results are robust to heterogeneity in terms of the redevelopment project scale as well as the economic prosperity of districts where urban villages are located. In general, the current results indicate the presence of positive spillover of urban village redevelopment on the local housing market.

The findings of this study provide important insights for the understanding of the externality imposed by urban renewal projects on housing markets. From the perspective of policy makers, it is important to consider the externalities of the redevelopment of urban villages in evaluating the overall cost and benefit that surround these redevelopment projects. Besides, the findings also clearly show relevance to the stakeholders in the housing market such as home sellers and buyers as well as property investors, which adds to the discussion on the Chinese housing price hikes in recent years.

Despite the revelation of a positive externality stimulated by urban village redevelopment in terms of housing price capitalization, we do recognize the complex and multi-dimensional nature of a welfare analysis related to redevelopment. For instance, while we focus on the housing market in this study, urban village redevelopment may also contribute to urban gentrification which may further change the urban demographic landscape. Some potential buyers in control areas might be attracted to the treatment areas, thus resulting in an overestimate of the price premium. Additionally, urban village redevelopment may cause displacement of low-income households which may add to the social cost in connection with redevelopment. Solving these problems requires more detailed data on household migration, which is difficult for us at the moment. We leave explorations along these lines to future research.

Acknowledgements

We thank the editor and anonymous reviewers for their valuable comments. This work was supported by the National Social Science Fund Project of China (NSSFC) [No. 18BJY223]. We would also like to acknowledge the financial support from the Key Project of Beijing Social Science Fund (Grant 23GLA005). The authors alone are responsible for any errors.

References

Aarland, K., Osland, L., and Gjestland, A. (2017). Do area-based intervention programs affect house prices? A quasi-experimental approach. *Journal of Housing Economics*, 163, 67-83. https://doi.org/10.1016/j.jhe.2017.05.002

Autor, D. (2003). Outsourcing at Will: The Contribution of Unjust Dismissal Doctrine to the Growth of Employment Outsourcing. *Journal of Labor Economics,* 21(1), 1-42. https://doi.org/10.1086/344122

Baker, A.C., Larcker, D.F., and Wang, C.C.Y. (2022) How Much Should We Trust Staggered Difference-in-differences Estimates? *Journal of Financial Economics,* 144(2), 370-395. https://doi.org/10.1016/j.jfineco.2022.01.004

Basu, A. and Thibodeau, T. (1998). Analysis of Spatial Autocorrelation in House Prices. *Journal of Real Estate Finance and Economics*, 17(1), 61–85. https://doi.org/10.1023/A:1007703229507

Bertrand, M., Duflo, E. and Mullainathan, S. (2004). How Much Should We Trust Differences-In-Differences Estimates? *Quarterly Journal of Economics,* 119(1), 249-275. https://doi.org/10.1162/003355304772839588

Bond, E. W. and Coulson, N. E. (1989). Externalities, filtering and neighborhood change. *Journal of Urban Economics*, 26(2), 231-249. https://doi.org/10.1016/0094-1190(89)90019-3

Braid, R. M. (1986). The comparative statistics of a filtering model of housing with two income groups, *Journal of Urban Economics,* 16, 437-448.

Brunes, F., Hermansson, C., Song, H. S., and Wilhelmsson, M. (2020). NIMBYs for the rich and YIMBYs for the poor: analyzing the property price effects of infill development. *Journal of European Real Estate Research*, 13(1), 55-81. http://dx.doi.org/10.1108/JERER-11-2019-0042

Callaway, B. and Sant'Anna, P.H.C. (2021). Difference-in-Differences with multiple time periods. *Journal of Econometrics,* 225(2), 200-230. https://doi.org/10.1016/j.jeconom.2020.12.001

Dai, Y. and Xu, Y. (2018). Regulations Enlarge Inequality: Evidence from Yin and Yang Contracts on Beijing's Housing Market. *Sustainability,* 14(20), 13346. http://dx.doi.org/10.3390/su142013346

De Sousa, C. A., Wu, C., and Westphal, L. M. (2009). Assessing the effect of publicly assisted brownfield redevelopment on surrounding property values. *Economic Development Quarterly*, 23(2), 95-110. https://doi.org/10.1177/0891242408328379

Ding, C., Simons, R. A., and Baku, E. (2000). The effect of residential investment on nearby property values: evidence from Cleveland, Ohio. *Journal of Real Estate Research*, 19(1), 23-48. https://doi.org/10.1080/10835547.2000.12091011

Dröes, M. and Koster, H. (2016). Renewable energy and negative externalities: The effect of wind turbines on house prices. *Journal of Urban Economics*, 96, 121-141. https://doi.org/10.1016/j.jue.2016.09.001

Fan, Y., Fu, Y., and Qian, Z. (2024). Time-varying and land use-induced spillover effects of urban redevelopment: Evidence from Hong Kong. *Cities,* 146, 104760. https://doi.org/10.1016/j.cities.2023.104760

Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics,* 225(2), 254-277. https://doi.org/10.1016/j.jeconom.2021.03.014

Greenstone, M. and Gallagher, J. (2008). Does Hazardous Waste Matter? Evidence from the Housing Market and Superfund Program. *Quarterly Journal of Economics*, 123(3), 951-1003. http://dx.doi.org/10.1162/qjec.2008.123.3.951

Hao, P., Sliuzas, R. and Geertman, S. (2011). The development and redevelopment of urban villages in Shenzhen. *Habitat International,* 35(2), 214-224. https://doi.org/10.1016/j.habitatint.2010.09.001

Kahn-Lang, A., and Lang, K. (2018). The Promise and Pitfalls of Differences-in-Differences: Reflections on 16 and Pregnant and Other Applications. J*ournal of Business & Economic Statistics*, 38(3), 1-14. http://dx.doi.org/10.1080/07350015.2018.1546591

Lai, L. W. C., Chau, K. W., Yiu, E. C. Y., Wong, K. S. K., Wong, W. S., and Chan, P. Y. L. (2007). Measuring and Interpreting the Effects of a Public-Sector-

Led Urban Renewal Project on Housing Prices—An Empirical Study of a Comprehensive Development Area Zone Developed upon 'Taking' in Hong Kong. *Environment and Planning B: Planning and Design*, 34(3), 524–538. http://dx.doi.org/10.1068/b31139

Lai, Y., Peng, Y., and Lin, Y. (2014). Industrial land development in urban villages in China: A property rights perspective. *Habitat International,* 41, 185-194. https://doi.org/10.1016/j.habitatint.2013.08.004

Lee, C., Liang, C., and Chen, C. (2017). The impact of urban renewal on neighborhood housing prices in Taipei: an application of the difference-in-difference method. *Journal of Housing and the Built Environment*, 32(3), 407-428. https://doi.org/10.1007/s10901-016-9518-1

Li, L. H., and Li, X. (2011). Redevelopment of urban villages in Shenzhen, China – An analysis of power relations and urban coalitions. *Habitat International*, 35(3), 426-434. https://doi.org/10.1016/j.habitatint.2010.12.001

Li, L. H., Lin, J., Li, X., and Wu, F. (2014). Redevelopment of urban village in China – A step towards an effective urban policy? A case study of Liede village in Guangzhou. *Habitat International*, 43, 299-308. https://doi.org/10.1016/j.habitatint.2014.03.009

Liang, C., Lee, C., and Yong, L. (2020). Impacts of urban renewal on neighborhood housing prices: Predicting response to psychological effects. *Journal of Housing and the Built Environment*, 35, 191-213. https://doi.org/10.1007/s10901-019-09673-z

Liang, X., Yuan, Q., Tan, X., and Li, Z. (2018). Territorialization of urban villages in China: The case of Guangzhou. *Habitat International,* 78, 41-50. https://doi.org/10.1016/j.habitatint.2018.05.009

Liu, R. and Wong, T. (2018). Urban village redevelopment in Beijing: The state-dominated formalization of informal housing. *Cities,* 72(A), 160-172. https://doi.org/10.1016/j.cities.2017.08.008

Liu, X. (2013). Spatial and temporal dependence in house price prediction. *Journal of Real Estate Finance and Economics,* 47(2), 341-369. https://doi.org/10.1007/s11146-011-9359-3

Liu, X. and Liang, W. (1997). Zhejiangcun: social and spatial implications of informal urbanization on the periphery of Beijing. *Cities*, 14(2), 95-108. https://doi.org/10.1016/S0264-2751(96)00047-9

Liu, Y., He, S., Wu, F., and Webster, C. (2010). Urban villages under China's rapid urbanization: unregulated assets and transitional neighborhoods. *Habitat International,* 34(2), 135-144. https://doi.org/10.1016/j.habitatint.2009.08.003

Ooi, J. and Le, T. (2013). The spillover effects of infill developments on local housing prices. *Regional Science and Urban Economics,* 43(6), 850-861. http://dx.doi.org/10.1016/j.regsciurbeco.2013.08.002

Rambachan, A., and Roth, J. (2023). A More Credible Approach to Parallel Trends. *The Review of Economic Studies,* 90(5), 2555-2591. https://doi.org/10.1093/restud/rdad018

Roth, J. (2022). Pretest with Caution: Event-Study Estimates after Testing for Parallel Trends. *American Economic Review: Insights,* 4(3): 305-22. DOI: 10.1257/aeri.20210236

Schwartz, A. E., Ellen, I. G., Voicu, I., and Schill, M. H. (2006). The external effects of place-based subsidized housing. *Regional Science and Urban Economics*, 36(6), 679-707. https://doi.org/10.1016/j.regsciurbeco.2006.04.002

Song, Y. and Zenou, Y. (2012). Urban villages and housing values in China. *Regional Science and Urban Economics,* 42(3), 495-505. https://doi.org/10.1016/j.regsciurbeco.2011.06.003

van Duijn, M., Rouwendal, J., and Boersema, R. (2016). Redevelopment of industrial heritage: Insights into external effects on house prices. *Regional Science and Urban Economics*, 57, 91-107. https://doi.org/10.1016/j.regsciurbeco.2016.02.001

vom Hofe, R., Parent, O., and Grabill, M. (2019). What to do with vacant and abandoned residential structures? The effects of teardowns and rehabilitations on nearby properties. *Journal of Regional Science,* 59(2), 228-249. https://doi.org/10.1111/jors.12413

Woo, A. and Lee, S. (2016). Illuminating the impacts of brownfield redevelopments on neighboring housing prices: Case of Cuyahoga County, Ohio in the US. *Environment and Planning A: Economy and Space*, 48(6), 1107-1132. https://doi.org/10.1177/0308518X16636380

Zahirovich-Herbert, V. and Gibler, K. M. (2014). The effect of new residential construction on housing prices, *Journal of Housing Economics* 26, 1-18. https://doi.org/10.1016/j.jhe.2014.06.003

Zhang, C. and Li, X. (2016). Urban redevelopment as multi-scalar planning and contestation: The case of Enning Road project in Guangzhou, China. *Habitat International*, 56, 157-165. https://doi.org/10.1016/j.habitatint.2016.05.008

Zhang, K. and Song, S. (2003). Rural-urban migration and urbanization in

China: Evidence from time-series and cross-section analyses. *China Economic Review*, 14(4), 386-400. https://doi.org/10.1016/j.chieco.2003.09.018

Zhang, L., Zhao, S. X. B., and Tian, J. P. (2003). Self-help in housing and Chengzhongcun in China's urbanization. *International Journal of Urban and Regional Research*, 27(4), 912-937. https://doi.org/10.1111/j.0309-1317.2003.00491.x

Zheng, X., Li, J. X., Zheng, L., and Lv, J. (2020). Multi-owned property, urban renewal and neighborhood property value externalities: Revisiting the Hong Kong case. *Cities,* 107, 102915. https://doi.org/10.1016/j.cities.2020.102915

Zhou, Z. (2014). Towards collaborative approach? Investigating the regeneration of urban village in Guangzhou, China. *Habitat International,* 44, 297-305. https://doi.org/10.1016/j.habitatint.2014.07.011

Zhu, J. and Hu, T. (2009). Disordered land-rent competition in China's urbanization: case study of Beiqijia Township, Beijing. *Environment and Planning A*, 41(7), 1629-1646. https://doi.org/10.1068/a41147

Appendix A Variable Definition

Variable	Definition
lnP	Transaction price in logarithm
Size	Gross floor area (m^2)
Floor	Floor number of property
Treat	Treat =1 if property falls within treatment area and 0 otherwise
Between	Between =1 if property falls within treatment area and is sold during the redevelopment of urban village, and 0 otherwise
After	After =1 if property falls within treatment area and is sold after the redevelopment of urban village, and 0 otherwise
Orientation	
South	South =1 if the property is facing south and 0 otherwise
North	North =1 if the property is facing north and 0 otherwise
East	East =1 if the property is facing east and 0 otherwise
West	West =1 if the property is facing west and 0 otherwise
Southeast	Southeast =1 if the property is facing southeast and 0 otherwise
Southwest	Southwest =1 if the property is facing southwest and 0 otherwise
Northeast	Northeast =1 if the property is facing northeast and 0 otherwise

Appendix B Estimation Results of the Yearly Difference on Housing Price Trends between the Treatment and Control Areas

	Coefficient	Standard Error
4 years prior to start of redevelopment	-0.084	0.062
3 years prior to start of redevelopment	-0.049	0.039
2 years prior to start of redevelopment	-0.015	0.016
1 year prior to start of redevelopment	-0.011	0.018
Start of redevelopment	-0.005	0.010
1 year after redevelopment	0.023	0.018
2 years after redevelopment	0.064**	0.026
3 years after redevelopment	0.070**	0.021
4 years after redevelopment	0.081***	0.026
5 years after redevelopment	0.159***	0.035
Floor	0.000	0.001
North	-0.129**	0.044
East	-0.052*	0.025
West	-0.080**	0.029
Southeast	-0.007*	0.003
Southwest	-0.019	0.031
Northeast	-0.026	0.036
Northwest	0.000	0.032
Size	0.006***	0.001
Cons	12.917***	0.079
Year fixed effect	YES	
Neighborhood fixed effect	YES	
R^2	0.863	
Sample size	125,505	

Notes: Estimation results of the difference in housing price trends between treatment and control areas relative to the start year of redevelopment. Standard errors are clustered on neighborhood and year. *, ** and *** correspond to statistical significance levels of 10%, 5% and 1% respectively.