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Mismatches between the Supply and Demand of Public Rental Housing in Chinese Cities

Ying Cao [1], Daichun Yi [1], Youqin Huang [2,*] and Yang Zhu [3]

1 Research Institute of Economics and Management, Southwestern University of Finance and Economics, Chengdu 610074, China; caoying_swufe@163.com (Y.C.); daichunyi@chfs.cn (D.Y.)

2 Department of Geography and Planning, University at Albany, State University of New York, Albany, NY 12222, USA

3 School of Information Science and Technology, Southwest Jiaotong University, Chengdu 611756, China; zhuyang@swjtu.edu.cn

* Correspondence: yhuang@albany.edu

Abstract: While many countries have witnessed the retreat of the state from social housing under neoliberalism, the Chinese government has taken the opposite trajectory, significantly expanding its involvement in public rental housing (PRH) over the past decade through substantial investments. However, the effectiveness of the PRH program has come under scrutiny due to its inability to meet the demand for housing units while grappling with a substantial vacancy rate. This study aims to unravel this paradox by utilizing a unique city-level database that encompasses information on public rental housing stock, land supply, waiting time, and allocation practices. The data suggest that there is a structural mismatch between supply and demand for PRH in China, with both high and low vacancy rates in different cities, and even high vacancy and high allocation rates co-existing in one city. The results of estimating the OLS regression model of PRH supply and demand indicate that the actual supply fails to align with the policy objectives and the actual housing demand. Rather, they are more a result of the power relationship between the central and local governments, and cities with high fiscal autonomy provide fewer PRH. Furthermore, local governments fail to set eligibility criteria in response to housing supply, demand, and allocation, further exacerbating the mismatch. This paper provides policy recommendations that aim to enhance the sustainability and effectiveness of the PRH program, contributing to more equitable urban development.

Keywords: affordable housing; social housing; public rental housing; demand-supply matching; sustainability; housing; China

1. Introduction

The provision of affordable and sustainable housing for low-income populations remains a pressing challenge worldwide, compelling governments to explore effective strategies [1]. In Europe, social housing has historically served as a crucial pillar of social welfare policy and affordable housing provision, particularly in the post-war reconstruction era [2]. However, the decline in welfare capitalism and the rise of neoliberalism have led to the privatization and demolition of existing social housing units, as well as a reduction in or cessation of new housing provisions across countries, resulting in a narrower reach to the impoverished population [3,4]. The Global Financial Crisis (GFC) in 2008 further strained governments' capacity to provide social housing, exacerbating housing shortages for the poor and intensifying residualization within the social housing sector. Additionally, the limited provision of social housing has shifted from traditional supply-side in-kind provision to demand-side monetary subsidies, increasingly relying on market mechanisms for housing provision [4,5]. Contrasting these global trends, China has undertaken a notable expansion of its social housing program since 2010, with a focus on in-kind housing provision. The public rental housing (PRH) initiative, a significant component of China's

affordable housing development, is primarily administered by municipal and county governments, with 16.12 million units built between 2010 and 2018, accommodating 37+ million occupants [6]. PRH has undoubtedly played a crucial role in alleviating housing challenges faced by low- and middle-income households in urban China.

However, the impact of PRH goes far beyond providing shelter to the demand group. Research based on survey data indicates that PRH tenants experience an increase in consumer income elasticity and labor supply, and notable improvements in mental health [7–9]. In addition, similar to many European and other countries, to address the housing problems of large numbers of rural-to-urban migrants [10,11], PRH is often built not as a new neighborhood, but rather in the form of integration into existing communities or in commercial housing complexes [1,12], which significantly increases the degree of social integration of the migrant population compared to other forms of housing [13]. Yet, despite the significance of PRH, the existing literature lacks comprehensive nationwide studies due to limited data availability. Although the overall level of PRH supply in China is substantial, a mismatch between supply and demand is inevitable, similar to other countries experiencing supply constraints. Evidence for this mismatch includes extensive waiting times for PRH units in certain cities due to overwhelming demand, and the existence of massive vacant PRH units resulting from factors such as remote location and insufficient supporting infrastructure [14–17]. The severity of the supply–demand mismatch in social housing is underscored by the report by CNAO [18] stating that 23.92 million units of affordable housing remained vacant for over a year in 2017. However, our understanding of the matching of supply and demand for PRH at the city level and the underlying mechanisms driving the mismatch remains limited. This study aims to address this knowledge gap by examining city-level supply and demand matching in China from a nationwide perspective.

The provision of social housing holds significant importance in ensuring social stability. To effectively meet the housing needs of vulnerable populations, governments must navigate the complex task of rationalizing land and housing planning to achieve a balanced supply–demand equilibrium, while optimizing financial support policies [19]. While estimating the demand for social housing presents its own set of challenges, the provision of sufficient housing remains a persistent obstacle for governments, regardless of whether the providers are government- or market-based, with supply shortages being a prevalent issue [20,21]. The lack of funding, particularly in the post-GFC era characterized by austerity measures, emerges as a key contributing factor to this challenge. However, in China, remarkable political will and substantial investments in social housing in recent years suggest that the supply–demand mismatch cannot be solely attributed to funding constraints. Therefore, an in-depth examination of the supply logic underpinning this mismatch becomes imperative. This paper aims to investigate the underlying reasons for this supply–demand mismatch, encompassing aspects such as quantity and quality of supply, taking a case study of PRH in China and exploring measures for enhancing the alignment between supply and demand.

Utilizing a unique nationwide database of urban PRH, this study investigates the matching of PRH supply to demand, and analyzes the implementation of eligibility criteria that may regulate the degree of matching between supply and demand. Compared to the existing literature, which focuses on theoretical analysis or empirical analysis of specific cities or projects, this study takes a more macroscopic view of the matching of supply and demand of PRH in China. Moreover, this study highlights the policy factors contributing to the supply–demand mismatches in PRH, permeating every stage of the process—from planning and construction to allocation. Considering China's ongoing rapid urbanization, an examination of PRH development, its supply–demand mismatch, and strategies for reducing this mismatch not only provides valuable insights for the evolution of China's social housing system but also serves as a reference for other countries in the Global South who are currently undergoing or anticipating a similar stage of urbanization and housing development. By investigating the complexities of PRH provision and mismatches, this study contributes to the broader discourse on housing policy and planning, ultimately

informing evidence-based interventions. This is conducive to improving the sustainability of affordable housing projects, which on one hand can improve the efficient use of funds, enhance cost-effectiveness, and in the long run reduce the environmental footprint associated with construction. On the other hand, it can also support social equity and contribute to increased social well-being.

The remainder of this paper is organized as follows. Section 2 reviews the literature on social housing in the West and China and introduces the PRH program in China. Section 3 lays out the conceptual framework to understand mismatches in PRH and present hypotheses. After introducing the dataset and key variables in Section 4, Section 5 presents the empirical findings, followed by discussion and conclusions in Section 6.

2. Literature Review and the Research Context

2.1. Social Housing in OECD Countries

While defined differently across countries, social housing is generally defined as rental housing provided at sub-market prices and allocated administratively according to specific rules [22]. In Europe, social housing accounts for about 6% of the total housing stock, but the level varies significantly across countries, ranging from less than 5% in Norway and Germany to 34% in the Netherlands [1]. The scale of social housing has declined significantly since the 1980s. Countries that were universalist (providing social housing to a wide range of populations) gradually became more targeted [23], with a reduction in social housing supply. The privatization of existing social housing, such as the Right to Buy program in the U.K., has led to a significant decline in stock [24]. In addition, social housing has gradually shifted from in-kind provision to monetary subsidies, relying increasingly on the private sector for housing provision, often in mixed-tenure and mixed-income development. Only about 11% of social rental housing in the U.S. is public housing, while the rest are various types of rental subsidies to households, developers, and landlords [5].

However, the demand for social housing remains strong, especially since the 2008 GFC as most countries witnessed an increase in the poor population and a lack of purchasing power [1,25,26]. Fiscal austerity has made it difficult for countries to sustainably grant more subsidies or supply new social housing, which has inevitably resulted in an undersupply of social housing [1,23,27]. This lack of supply can be directly reflected in the waiting time on the one hand [1,28], and in the results of the estimation or forecasting model constructed by using demand indicators such as affordability and purchasing power, on the other hand [19,29–31].

In addition to the supply shortage, the "quality" of social housing is also a problem. The first problem is social segregation caused by the concentration of social housing and the narrowing of eligibility criteria. While such a concentration can be beneficial to some extent, for instance, in social networks [32], it can be problematic with a reduction in local economic, educational, and social opportunities, which further exacerbates racial segregation and poverty concentration [33–35]. In a trend towards more targeted eligibility criteria, there is an increasing concentration of low-income households and residualization in social housing, potentially creating "social and economic ghettos by policy design" [3]. Not surprisingly, race and immigrant issues are often interwoven in this problem in social housing [36–38]. The second problem is poor housing quality, including poor safety, poor thermal and acoustic insulation, and high energy consumption, which leads to high vacancies, reduces tenant satisfaction, and causes social problems [1,39]. Renovating existing social housing stock has been a priority in recent years in the context of a changing climate and energy crisis, and about 40% of total spending in social housing will be devoted to renovating and maintaining existing stock in Europe and 60% for new construction [1].

In-kind housing provision has been largely replaced by monetary subsidies in many countries to mitigate these problems and facilitate social inclusion [3]. In the U.S., programs such as the Housing Choice Vouchers Program, Low-income Housing Tax Credit, and Project-based Rental Assistance now all surpass the scale of in-kind public housing [5]. Planning tools have also been utilized such as the strategy of "inclusionary housing" and

"mixed-tenure/mixed-income" housing development, which require private developers to incorporate social housing as part of market-driven developments [40,41]. While local governments still provide most social housing in Europe, private and for-profit organizations play a more significant role in the U.S. [1]. Yet, the impact of these new trends in social housing on low-income households is mixed in both the U.S. and U.K. (e.g., [5,42–45]).

2.2. Social Housing in China

In China, subsidized rental housing dominated the housing stock during the socialist era. However, with the deepening of the reform of the urban housing system, China's housing system was reshaped in the process of housing commercialization. To form a comprehensive housing supply system, in 1998, the central government proposed that the lowest-income households rent Cheap Rental Housing (CRH) provided by the government or enterprises, low- and middle-income households purchase Economic and Comfortable Housing (ECH), and other households purchase or rent market-priced commercial housing. However, the implementation of the system has not gone smoothly. The institutional construction of CRH lagged, with national-level management measures not introduced until 2007, and supply targets first specified in 2008. In the absence of targets and guidelines for action, coupled with insufficient financial support from higher levels of government, local governments and enterprises lacked incentives to construct CRH, resulting in a persistent shortage of supply. Over the decade since the establishment of the system, the central government issued several documents emphasizing the need to increase the supply of CRH to address the housing difficulties of the target groups. At the same time, the escalating housing prices and scarcity of rental housing have resulted in an increasing prevalence of "sandwiched" households in certain cities, i.e., households who could not afford to purchase housing on the market and did not qualify for CRH. Therefore, in 2010, PRH was introduced for urban low- and middle-income households with housing difficulties, new employees, and specific migrant workers, and it was merged with CRH in 2014 [46].

During the 12th Five-Year Plan period (2010–2015), PRH entered a phase of rapid development as a key method to ensure rental housing security and an important supplement to the real estate market. As the focus of affordable housing efforts subsequently shifted from PRH to shantytown renovation and urban renewal, the focus of PRH efforts shifted from new construction to regular operation [47]. By 2018, including CRH, the PRH stock stood at 16.12 million units [6], accommodating about 5.2% (based on 2020 Census data, the number of urban households is 31.04 million and the calculation assumes that one household lives in each PRH unit and the PRH vacancy rate is zero) of urban households. Using China Household Finance Survey (CHFS) 2019 data, we estimate that about 3.5% of urban households meet the income and residential access eligibility for PRH in their city but still do not occupy PRH, suggesting that latent demand remains. However, the literature has investigated the supply and demand for PRH in specific cities through surveys; demand measures based on factors such as population growth, income, and living space; and demand measures based on access eligibility (the data are at the prefectural level, with the income requirement being the per-capita income limit, and the housing requirement being the per-capita living space limit and the non-ownership of housing in the place of residence), and it has found a general gap between supply and demand in large cities, but among them, large cities in the Northeast and the Northwest have a larger supply than demand, which represents the existence of structural supply–demand matching problems at the city level [48–51].

The implementation of the policy follows a localized approach, i.e., the provincial government takes on the overall responsibility in the region, and municipal and county governments are responsible for the specific work, including target setting and decomposition, fund, land supply, and subsequent supervision and management [52–54]. As required by the central government, municipal governments should set targets considering local economic and social development, housing affordability, land conditions, financial

capacity, etc. [55]. However, targets are still described as "state-assigned" [56] or "province-assigned" [57] in government reports, making it challenging to intuitively understand the process of target setting. However, it was learned through interviews with government officials at each level that there may be some negotiation between upper and lower levels of government in finalizing housing targets. Once supply targets have been set, municipalities are responsible for the supply of land and most of the financing of PRH construction, with state-owned companies or other enterprises participating in construction and enjoying tax incentives and financial support.

With the development of PRH, research on the operation of the system has gradually emerged. First, since the construction of affordable housing requires local governments to invest a large amount of funds and resources, governments made trade-offs between benefits and burdens when setting targets, leading to final results that deviate from the policy goal of housing security [58]. However, some cities have also used it as a tool for urban development to realize socio-spatial transformation and win in the intercity rivalry for human capital [47]. Second, because of the high construction targets and heavy workload in the early stages of the system's development and local governments' conservative attitude towards land supply, some PRH programs were poorly sited and had inadequate infrastructure facilities [14–17], making it difficult to form an effective supply. Third, the allocation of PRH embodies many problems, including the lack of rationality in assessing eligibility such as income, assets, and living space [59,60]. The most common critique is that local urban residents and migrants have different eligibility criteria, especially in large cities such as Beijing and Chongqing, which makes it harder for migrants to access PRH [15,61]. Although the central government has encouraged the provision of PRH in the form of inclusionary housing (peijian) (local governments require developers to build some PRH units (usually about 5-10% of all units) in their commercial housing development) to avoid slums and residential segregation, as large-scale public housing programs have often experienced in other countries [21,34,62], different eligibility criteria for locals and migrants may exacerbate social tensions.

3. Conceptual Framework and Hypotheses

The analytical framework of this paper is shown in Figure 1. According to the theory of governmental decision making and the theory of housing demand, the supply and demand of PRH is affected by many aspects, while the measurement of matching supply and demand can be carried out in the quantitative and qualitative dimensions, and the eligibility criterion is that it can be regulated from the quantitative level. We focus on in-kind housing provision because it accounts for the majority of the total PRH provision and requires more planning by the government to match the supply and demand. We highlight and scrutinize three key factors that shape the supply of PRH in China, considering its unique institutional context and housing system.

First, the setting of PRH targets before construction plays a crucial role. In theory, local governments should consider local socioeconomic conditions and establish construction targets for PRH based on the principle of meeting basic housing needs. However, accurately estimating the demand for PRH proves challenging for local governments, particularly in cities with changing demand due to rapid economic and population growth. Further complicating the matter, upper-level governments may exert political pressure on local governments to increase their housing targets. Nonetheless, fiscal decision making in China has witnessed significant decentralization in recent decades [63], allowing local governments to negotiate with upper-level counterparts to determine their construction targets. A critical factor influencing these negotiations is fiscal autonomy. Municipal governments are the main financiers for the construction of PRH, with very limited transfer payments from the central and provincial governments [52,53]. Cities with higher levels of fiscal autonomy exert greater independence from transfer expenditures provided by upper-level governments [52,64], granting them more leverage in the negotiation process. Consequently, cities with greater fiscal autonomy may set lower construction targets for

PRH than the actual demand requires. Conversely, cities with limited fiscal autonomy find themselves at a disadvantage and are compelled to establish targets higher than the actual demand to meet the overall objectives of upper-level governments. This highlights how local governments' fiscal autonomy and political power shape target-setting decisions for PRH, potentially resulting in significant deviations from the actual housing needs. Thus, we hypothesize that

H1a. *Cities with higher levels of fiscal autonomy are more likely to set lower development targets for PRH and provide less PRH.*
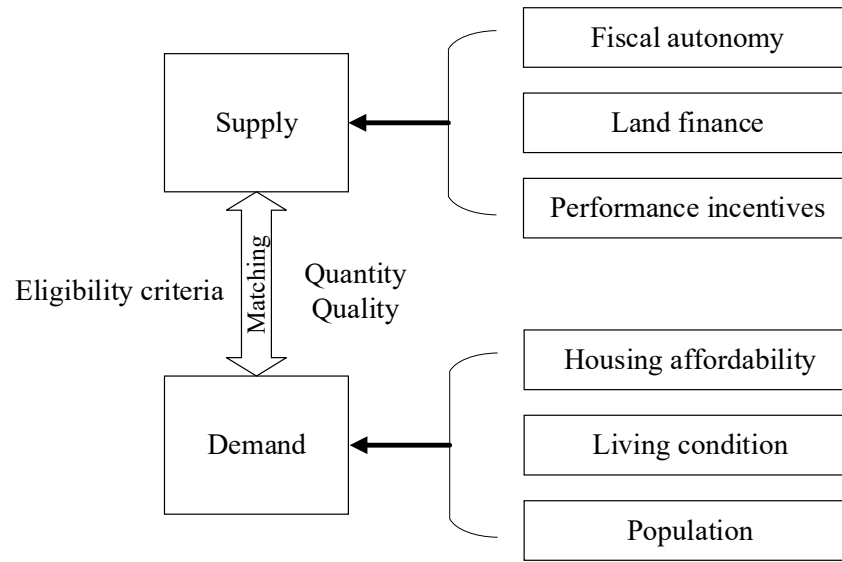

Figure 1. Analytical framework for supply and demand of public rental housing.

Second, the supply of PRH is also constrained by local public finance. Since the 1994 Tax Reform, local governments have had to shoulder more expenditures on public services and welfare benefits while receiving less tax revenue [65]. As urban land can only be leased to users by local governments, land leasing and related taxes have become an increasingly important part of local government revenues [66]. To maximize fiscal revenue, local governments prefer to allocate the limited residential land supply for commercial housing to obtain more land leasing revenue and real estate taxes than for PRH, as land for PRH is usually free or subsidized, and related taxes are often waived [67]. Therefore, there is a strong financial incentive for local governments to provide less land for PRH, or land with lower land leasing revenue potential for PRH construction. This explains why some PRH projects are located in more remote areas with poor infrastructure and transportation [14,15]. This results in a reduction in supply to some extent, but probably more of a reduction in effective supply in "quality". We hypothesize that

H1b. *Cities with a heavier reliance on land finance are more likely to supply less PRH.*

Third, the performance evaluation and incentive system for government officials can shape the supply of PRH. Chinese officials are evaluated based on their performance in meeting a set of social, economic, and political targets under the Target Responsibility System [63]. Traditionally, economic targets are "hard targets" and more important, while social targets are "soft targets" and often ignored by local governments [52]. However, since 2010, to ensure local governments fulfill the construction targets of PRH, MOHURD has required lower-level governments to sign an "affordable housing work target and responsibility contract", and whether local governments complete their PRH targets has been included in their performance evaluation. Naturally, local officials must ensure that the PRH targets are accomplished. In addition, since the construction of PRH is a

Livelihood Project (minshen gongcheng), exceeding the target can shed a positive light on local governments and potentially lead to officials' promotion. Consequently, local governments may initially set lower targets and subsequently strive to meet or surpass them. In essence, the supply of PRH may be more influenced by political motivations and performance incentives than actual housing needs. As the new performance evaluation and incentive system started in 2010 and is the same across cities, it is impossible to test its effect on PRH supply during the post-2010 period. Longitudinal data on another social housing program that experienced both the old and new incentive system are needed to test its effect on supply.

Housing demand refers to the type and number of dwellings that households choose to occupy based on preference and ability to pay [68]. Therefore, based on the policy objectives of targeting low- and middle-income households with housing difficulties, the overall demand for PRH is affected by three main factors. The primary factor is housing affordability, often measured by house-price-to-income ratio. As the ratio rises, an increasing number of households are unable to purchase/rent housing through the market that matches their preferences and affordability, and they have to rent housing on the market with a smaller size and poorer facilities or apply for PRH. In other words, the demand for PRH will increase with the rise in the housing-price-to-income ratio. The second factor is housing conditions. Given the same ability to pay, households generally prefer to live in housing with better conditions. Since PRH is relatively uniform across cities in terms of unit size and amenities bounded by government policies, residents have relatively less demand for PRH when overall housing conditions in the city are better. Third, population size matters as well and, in general, the population in need of PRH increases as the total population increases. China is amid rapid urbanization with massive rural-to-urban migration. While often excluded from subsidized housing, migrants are qualified for PRH and they are often the ones really in need of PRH [69]. However, migrants are usually only mentioned and not prioritized in PRH-related policies, even in cities where migrants make up a higher proportion of the population and have more serious housing problems. Thus, we propose the following hypotheses:

H2a: *Cities with lower housing affordability and thus larger demand may not provide more PRH.*

H2b: *Cities with poorer housing conditions and thus larger demand may not provide more PRH.*

H2c: *Cities with a high proportion of migrants may not provide more PRH.*

With local governments' unwillingness to supply sufficient PRH and the rising demand due to low affordability and poor housing conditions, the gap and mismatch between supply and demand are large. In addition to the "quantity" of PRH, other factors further contribute to this mismatch. For example, some PRHs are reserved for specific groups of people. PRH is often used by municipal governments as "talent housing" to attract college graduates and other talents and to facilitate economic upgrading [60,61]. Some enterprise-owned PRHs are for their employees only, and PRHs built in development zones and parks are allocated exclusively to employees working there [70]. These practices artificially cut off the process of matching supply and demand, resulting in many vacant units on the one hand and long waiting lists on the other hand. Furthermore, the central government has a specific standard for living space per capita for PRH, and the local government needs to build PRH in different unit sizes and types to solve the housing problems of different types of households. However, this is not an easy task for local governments to gauge needed units of different sizes and types, which further contributes to the supply–demand mismatch.

In the present stage, the direct trading of PRH units to regulate the degree of matching of supply and demand lacks top-level policy support, while the appropriate adjustment of eligibility criteria in due course can serve as a more convenient tool. In China, local governments set specific eligibility criteria, and theoretically, they should consider factors

such as local economic and social conditions, the housing market, and the level of matching of supply and demand for PRH. In other words, the level of eligibility criteria can effectively reflect the accessibility of PRH in a city, and it can be adjusted to improve the degree of supply–demand matching. Unfortunately, it is not the norm for local governments to adjust eligibility criteria in China, let alone make real-time adjustments based on matching supply and demand. For example, in Beijing, PRH eligibility criteria were first set up in 2011 and have not been changed since. Thus, we hypothesize that

H3. *Eligibility criteria do not change with the supply and allocation of PRH.*

4. Data and Variables

We construct a dataset from multiple sources, including PRH statistics, city statistical yearbooks, the China Land and Resources Statistical Yearbook 2012–2018, and the China Population Census Yearbook 2020. PRH statistics are prefecture-level city data reported by provincial governments and contain information on PRH stock, number of allocations, number of people on the waiting list and average waiting time, and living space and income access conditions for each city as of 2020. This dataset contains data for a total of 232 prefecture-level cities, which are distributed in all three regions and across city tiers. (Among 232 cities, 79, 98, and 55 cities are located in the Eastern, Central, and Western regions, respectively. Chinese cities are usually classified using a tier system, with the first-tier cities being the largest and the most developed, and the fourth- and fifth-tier cities being smaller cities. According to "2020 City Business Attractiveness Ranking", first-tier cities include Beijing, Shanghai, Guangzhou, and Shenzhen. Second-tier cities include 45 cities such as Chengdu, Chongqing, Hangzhou, Wuhan, Xi'an, Tianjin, and Suzhou. Among the 232 cities in our dataset, there are 4, 28, 53, and 147 first-tier, second-tier, third-tier, and fourth-tier cities, respectively.)

To test hypotheses H1a, H1b, H2a, H2b, and H2c, the outcome variable we use is the stock of PRH at the city level. The data are cross-sectional, and they are taken in logarithmic form (simplified as "ln (PRH)") due to the large differences in the values of the variables across cities.

We also collected relevant policy documents and eligibility criteria for PRH in 153 prefectural-level cities from 2010 to 2020. Due to the persisting Household Registration (hukou) System, eligibility criteria are usually different for urban residents with local permanent hukou (locals, hereafter) and migrants without local permanent hukou (migrants, hereafter). The eligibility criteria for locals mainly include requirements on income, assets, and housing conditions, while those for migrants include these three requirements and additional requirements depending on the city, which may include a temporary residence permit, labor contract, education, years of graduation, payment for social security, or a housing provident fund. Therefore, they must be analyzed separately.

To make eligibility criteria comparable between cities, we construct an indicator for each specific requirement, as shown in Table 1. The income requirement for both local and migrant applicants is measured by the ratio of the annual per-capita income limit of the applicant's household to the local urban per-capita disposable income. The larger the value, the more lenient the income requirement set by the local government. For housing conditions, most cities require that the existing living area per capita for applicants should be lower than a threshold, which is generally 15 m^2. If the local government does not allow the applicant to own a home, the indicator is assigned a value of 0; otherwise, the indicator is assigned the value of the restriction on the living area per capita of the applicant's household (m^2). For the other requirements, similarly, "0" is assigned if there are restrictions or requirements, and "1" is assigned if there are no restrictions or requirements.

Table 1. Evaluation indicators on eligibility criterion of PRH programs.

Groups	Categories	Indicators	Scale
Locals	Income Requirement	The ratio of household per-capita annual income limit to local urban disposable income per capita	numerical
	Current Housing Conditions	living area per-capita limits no homeownership (=0)	numerical
	Additional restrictions	hukou status of applicants (required = 0)	binary
		hukou status of family members (required = 0)	binary
		total household assets limits (required = 0)	binary
		no vehicle ownership (required = 0)	binary
Migrants	Income Requirement	The ratio of household per-capita annual income limit to local urban disposable income per capita	numerical
	Current Housing Conditions	living area per-capita limits no homeownership (=0)	numerical
	Additional restrictions	residence permit (required = 0)	binary
		stable employment (required = 0)	binary
		degree of education (required = 0)	binary
		years since graduation (required = 0)	binary
		participation with social security insurance/housing provident fund (required = 0)	binary

Note: Indicator hukou status of applicants indicates whether the applicant's hukou status is required to be non-rural. Indicator hukou status of family members indicates whether there is a requirement for family members to have a local hukou. Indicator stable employment indicates whether or not a labor contract is required.

Principal Component Analysis (PCA) is used to calculate PRH eligibility criteria indices. We first standardize the data to eliminate the influence of dimensionality and extract the principal components of the eligibility criteria for locals and migrants using an eigenvalue >1 and a variance contribution rate >85%. Then, we calculate the principal component coefficient matrix using the variance maximization rotation to obtain the principal component loading matrix and combine it with their corresponding eigenvalues to obtain the principal component coefficient matrix. Finally, we use the variance contribution of each principal component as the weight and calculate the weighted sum as the PRH eligibility criteria index of each city. The index can be positive and negative, and a larger index means the eligibility criteria for PRH are more lenient and it is easier to access PRH. The eligibility criteria indexes for locals and migrants are the outcome variables for OLS regressions to test hypothesis H3.

There are three sets of explanatory variables measured to test the hypothesis on PRH supply by 2020. First, fiscal autonomy and land finance are used to measure the impact of local government financial performance on PRH supply, thus testing hypotheses H1a and H1b, respectively. Since the government's fiscal performance has influenced the supply of PRH throughout and cities are more synchronized in the implementation of PRH policies, we define fiscal autonomy as the ratio of cumulative fiscal revenues to fiscal expenditures over the 2010–2020 period. Land finance measures the extent of municipal governments' dependence on land-related revenue [71], and is expressed as the ratio of cumulative land leasing revenue to cumulative fiscal revenue over a period of time. Similarly, the variable Land finance uses cumulative data for the periods of 2010–2020.

Second, to test hypotheses H2a and H2b, variables housing affordability and housing conditions are introduced. The housing-price-to-income ratio measures housing affordability, thus the need for PRH. It is defined as the ratio of the average housing price to the per-capita disposable income of urban households, where housing price is obtained by dividing the total sales of commercial residential units by sold floor areas. In addition,

housing conditions are measured using floor space per capita and the homeownership rate in each city. Both variables are calculated from 2020 China Census data, and we only use data from the urban household segment.

Third, additional control variables are included. Cumulative residential land supply is used to further control the impact of land supply on PRH supply. We take it in the logarithmic form, denoted as land supply. We also include the variables GDP per capita, number of urban households, and proportion of migrants (proportion of non-household residents in cities to total urban resident population) to control for city-level effects.

Finally, to test Hypothesis 3 on eligibility criteria, PRH supply, PRH allocation rate as of 2020 (proportion of allocated PRH to stock at the time point), housing affordability, and housing conditions are included to test if eligibility criteria vary depending on PRH supply, demand, and allocation. Table 2 lists the descriptive statistics for all regression variables. Due to data limitations, the qualitative mismatch in PRH will be studied through descriptive analysis and a case study.

Table 2. Descriptive statistics for all variables.

Variable	Definition	Mean	Std. Dev.	Min	Max
Outcome variables					
Ln (PRH)	Ln (number of PRH units)	9.517	1.112	6.468	13.210
Eligibility criteria index for locals	Eligibility criteria index for locals	0.022	0.443	−1.421	0.671
Eligibility criteria index for migrants	Eligibility criteria index for migrants	−0.0004	0.458	−0.813	1.052
Explanatory variables					
Land finance	The ratio of land leasing revenue to fiscal revenue	0.351	0.121	0.089	0.877
Fiscal autonomy	The ratio of fiscal revenues to fiscal expenditures	0.434	0.201	0.081	0.914
Housing-price-to-income ratio	The ratio of the average housing price to the per-capita disposable income	7.564	3.518	2.737	34.584
Floor space per capita	Floor space per capita	0.840	0.102	0.237	0.981
Homeownership rate	Proportion of households living in owned housing (including self-built)	10.838	0.485	9.599	12.223
Ln (households)	Ln (number of households)	33.331	5.739	21.030	46.750
Proportion of migrants	Proportion of non-household residents in cities to total urban resident population	1.007	0.273	0.709	3.372
Ln (GDP per capita)	Ln (GDP per capita)	0.840	0.102	0.237	0.981
Land supply	Ln (residential land supply)	10.838	0.485	9.599	12.223
Allocation rate	Proportion of allocated PRH to stock at the time point	0.918	0.100	0.420	1.000

Note: Since PRH is part of the Chinese affordable housing system in urban areas, the variables housing-price-to-income ratio, floor space per capita, homeownership rate, ln (Households), and proportion of migrants all use urban level data. Since the government's fiscal performance has influenced the supply of PRH throughout and cities are more synchronized in the implementation of PRH policies, when calculating the variables land finance and fiscal autonomy, we use the 2010–2020 data to obtain the average level.

5. Findings

5.1. The Supply–Demand Mismatch

Waiting time and allocation rate are two important indicators of supply–demand matching and the efficiency of allocation. An unusually long waiting list and low allocation rate indicate the supply–demand mismatch. MOHURD requires local governments to formulate a reasonable rental allocation program and accomplish the rental allocation work in a timely manner, and the waiting period is generally no more than five years. According to the data reported by cities, the average waiting time is 2.75 years. However, there are large variations between cities (Figure 2). Although more than 30% of cities have a waiting

time of 1–2 years, about one-quarter of cities have a waiting time of 5+ years and another 32% of cities have 3–4 years of waiting time.
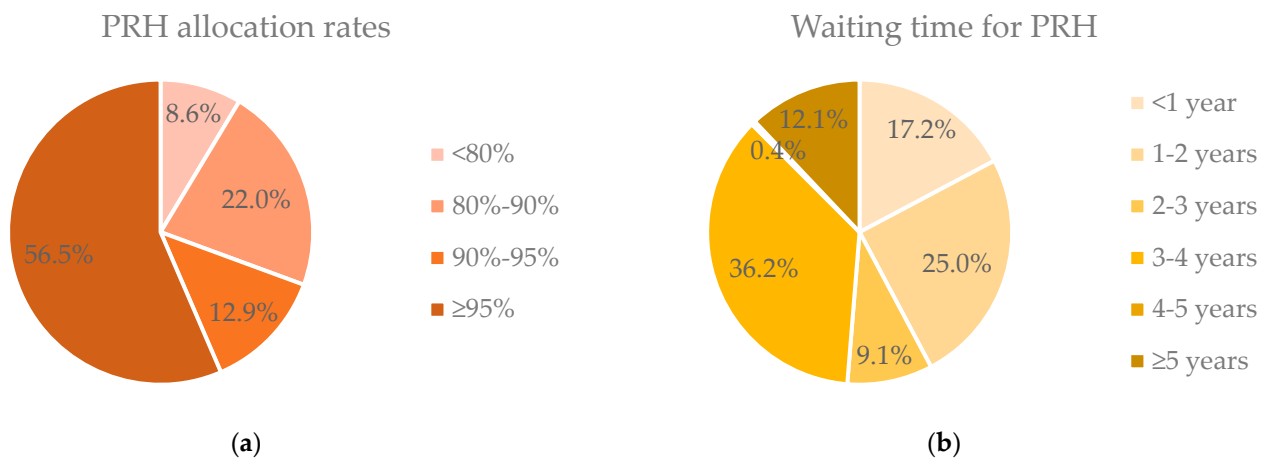
PRH allocation rates

(**a**)

Waiting time for PRH

(**b**)

Figure 2. (**a**) PRH allocation rates in prefecture-level cities; (**b**) waiting time for PRH in prefecture-level cities. Note: (**a**) the allocation rate is the proportion of allocated PRH to the total PRH stock as of the end of 2020; (**b**) waiting time is the average waiting time for PRH applicants as estimated by local governments as of the end of 2020.

The average allocation rate is 92.10%, slightly higher than the 90% required by MO-HURD [72]. However, regional variations are also large. Nearly half of the cities have an allocation rate of 95%+, while 10% of cities have an allocation rate of less than 80%, and the lowest allocation rate is only 41.99%. Some PRHs are built for specific populations, and cities with more such PRHs tend to have lower allocation rates. For example, nationwide, the allocation rate of enterprise-built PRH is 89%, lower than the 97% rate of government-invested PRH. In Shanghai, 64.6% of the PRHs are built by enterprises, which has an allocation rate of 83%. In other words, different types of PRH may have contributed to the variations in the allocation rate, which itself is an indicator of mismatch.

Based on allocation rate and waiting time, cities can be classified into four types (Table 3): The first one is "oversupply" cities, with lower-than-average waiting times and an allocation rate below 90% due to a large amount of vacant PRH but relatively low demand. The second type is "ideal matching" when the waiting time is relatively short and the allocation rate is higher than 90%. In other words, PRH reasonably meets the needs of households with housing difficulties but without an excessive waste of resources. The third type is "'low-quality' supply" when the waiting time is above average yet the allocation rate is low. The existing PRH supply does not match household demand, resulting in long waiting times and a high vacancy rate. The last type is "undersupply", where the allocation rate is high but cities lack sufficient housing for allocation, and the waiting time is long.

Table 3. Typology of supply–demand matching of PRH.

		Allocation Rate	
		Low (<90%)	High (≥90%)
Waiting time	Below average	Oversupply (12.77%)	Ideal matching (31.06%)
	Above average	"Low-quality" supply (16.6%)	Undersupply (39.57%)

Not surprisingly, Table 3 shows that only 31.06% of cities have "ideal matching" and about 70% of cities have various types of mismatches. Beijing, for example, is a typical "'low-quality' supply" city, with a waiting time of 3 years for PRH and a below-average

allocation rate of only 85.5%. Compared to other cities (Table 4), first- and second-tier cities with the highest proportion of "low-quality" supply include Guangzhou, Changsha, and Kunming. However, the proportion of "ideal matching" cities (including Chengdu and Wuhan) in first- and second-tier cities is below the level of other city tiers, and most cities are quantitatively unmatched, including "oversupply" cities such as Shenzhen and Dalian, and "undersupply" cities such as Xi'an and Wuhan.

Table 4. Typology of supply–demand matching of PRH by city tier.

Cities	Oversupply	Ideal Matching	"Low-Quality" Supply	Undersupply
First- and second-tier	17.1%	22.9%	20.0%	40.0%
Third-tier	15.8%	26.3%	12.3%	45.6%
Fourth- and fifth-tier	10.5%	35.0%	17.5%	37.1%

Overall, there is a significant supply–demand mismatch in PRH. However, because the reasons for the mismatch between supply and demand in the form of "'low-quality' supply" are multifaceted, we cannot analyze them with specific data or a unified logical framework at present. This bizarre situation is due to three main reasons, the first being that the supply and demand matching relationship varies among different districts. An oversupply and undersupply of PRH projects co-exist. The location, infrastructure, related facilities, and quality of housing in PRH projects all play a role in demand. The second is the low allocation rate of PRH with targeted allocation. Some of the dormitories built by enterprises for themselves are managed as PRH but allocated only for employees. The share of this type of PRH varies in each city, with Shanghai exhibiting the highest share (64.6%) and a lower-than-average allocation rate of 87%. Therefore, we study the matching relationship between supply and demand only at the quantity level, and we focus only on the situation at the overall national level rather than at the level of specific cities.

To test H1a-b and H2a-c, we construct two OLS Regression Models 1 and 2, respectively. Regression Model 1 contains demand-related variables and control variables, while regression Model 2 adds supply-related variables to it. Regression Model 2 is set up in the following form:

$$
\begin{aligned}
ln(PRH)_i = \alpha + \quad & \beta_1 Land\ finance_i + \beta_2 Fiscal\ autonomy_i \\
& + \beta_3 Housing\ price\ to\ income\ ratio_i + \beta_4 Floor\ space\ per\ capita_i \\
& + \beta_5 Homeownership\ rate_i + \beta_6 HProportion\ of\ migrants_i + X_i \\
& + \varepsilon,
\end{aligned}
\tag{1}
$$

where the main variables are defined as above. X_i includes a range of city-level control variables, including ln (households), ln (GDP per capita), and land supply. ε is a disturbance. α and β are coefficients to be estimated in the model.

Table 5 presents the regression results for Model 1 and Model 2. First, fiscal autonomy has a significant negative effect on the supply of PRH, i.e., for every 0.1 increase in fiscal autonomy, the supply of PRH decreases by 13.15% on average. This means that cities with higher fiscal autonomy have less PRH supply, providing strong evidence for H1a. This demonstrates local governments' defiance of the central government's call for PRH supply when they are relatively autonomous fiscally. Surprisingly, land finance is not significant, in contrast to the conventional wisdom that local governments are unwilling to provide land for PRH due to their reliance on land revenue. In other words, hypothesis H1b is not supported. However, this cannot rule out the possibility that PRHs supplied by local governments, which are more reliant on land revenue, can match the demand, as these PRHs may be built in more remote areas with lower land values. Second, the coefficient on the housing-price-to-income ratio is negative but not significant. This suggests that in cities with more severe housing affordability problems and thus higher demand, the supply of

PRH is not different, supporting hypothesis H2a. Similarly, floor space per capita has a positive effect on PRH supply (significant in Model 1 and not significant in Model 2). These findings imply that local governments may have ignored housing and economic conditions when supplying PRH. This contradicts the original policy goal of developing PRH to solve the housing problem of urban families. Fortunately, the higher the homeownership rate, the lower the supply of PRH. As the homeownership rate increases by each 0.1, the supply of PRH decreases by 27.38 and 21.99 in Models 1 and 2, respectively. This implies that in cities with higher rates of homeownership and thus a smaller demand for PRH, the supply of PRH is smaller. Third, the proportion of migrants does not significantly affect the supply of PRH, which is consistent with hypothesis H2c and suggests that the supply does not take into account the large number of migrants.

Table 5. OLS Regression results on PRH supply.

	Ln (PRH)	
	(Model 1)	**(Model 2)**
Land finance		0.715
		(0.574)
Fiscal autonomy		−1.315 **
		(0.586)
Housing-price-to-income ratio	−0.025	−0.032
	(0.026)	(0.020)
Floor space per capita	0.024 **	0.011
	(0.012)	(0.013)
Homeownership rate	−2.738 ***	−2.199 ***
	(0.984)	(0.785)
Ln (households)	0.617 ***	0.720 ***
	(0.131)	(0.151)
Proportion of migrants	−0.168	0.077
	(0.396)	(0.382)
Ln (GDP per capita)	0.377 **	0.866 ***
	(0.182)	(0.239)
Land supply	0.114	0.019
	(0.150)	(0.150)
Constant	3.716 *	−1.405
	(2.043)	(2.620)
N	232	232
R^2	0.407	0.436

Note: Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Please note that as part of the housing market, the supply of PRH may have a reverse effect on housing prices, housing space per capita, and homeownership rates. However, we believe this effect is extremely limited in China due to the relatively small scale of PRH (with only 2.93% of the population living in PRH).

5.2. Mitigating the Mismatch—Eligibility Criteria

The most intuitive way to mitigate the mismatch is to adjust the supply, but for the time being, there are still restrictions at the policy level on the sale of oversupplied housing stock and the conversion of sheltered housing types. Cities with excess demand are not supported by new housing stock, due to challenging fiscal pressures. In addition, adjusting the rent price of PRH is challenging, and most cities have largely refrained from adjusting rent prices due to the social risks that price increases may create. Adjusting the eligibility criteria, therefore, appears to be one of the most operational means of mitigating the mismatch.

Tightening the eligibility criteria when the supply is small would reduce the number of applicants on the waiting list. When there is a surplus of supply, relaxing eligibility criteria

can expand coverage and reduce vacancies. However, neither the central government nor local governments have required the frequency and trigger conditions for the adjustment of eligibility criteria. In reality, few cities adjust eligibility criteria, while rents and subsidy levels are often adjusted based on market rental standards. Even in Beijing, where the market is very active, eligibility criteria for PRH in Beijing have not been updated since the first policy released in 2011. From 2011 to 2020, Beijing's total public rental housing construction floor area exceeded 1.59 million square meters (calculated from the Beijing Statistical Yearbook). Therefore, it is safe to conclude that eligibility criteria are decoupled from PRH units supplied and allocated in the city.

According to Table 6, eligibility criteria are different for locals and migrants. The average index is 0.027 for locals and −0.01 for migrants, meaning it is much easier for locals to access PRH than migrants. However, there are significant differences across city tires. The difference in eligibility criteria between locals and migrants exists in all cities but is the largest among the first-tier cities. Furthermore, for locals, it is increasingly easier to access PRH as cities become larger, and it is the easiest in first-tier cities (with the largest eligibility criteria indices), while for migrants, it is harder to access PRH in larger cities, which tend to be their main destinations. Interestingly, in the smallest cities (4th tier+), migrants are more likely to access PRH than locals, probably because locals are mostly homeowners. For example, the eligibility criteria indices for migrants of Shenzhen, Hangzhou, and Guangzhou are −0.813, −0.730, and −0.510, respectively, which are at a more stringent level compared to other cities, while their eligibility criteria indices for locals are 0.602, −0.172, and 0.281, which are at a relatively lenient level. While the two indexes are not directly comparable, due to different compositions, it is fair to conclude that there is a lack of fairness in eligibility criteria, especially in the largest first-tier cities, which deviates from the central government's policy objective of solving the housing problems of new citizens such as migrants.

Table 6. Eligibility criteria indices for locals and migrants by city tier.

City Level	Eligibility Criteria Indices for Locals	Eligibility Criteria Indices for Migrants
First-tier	0.336	−0.215
Second-tier	0.006	−0.060
Third-tier	−0.033	−0.071
Fourth- and fifth-tier	−0.006	0.061
Total	0.022	−0.0004

We conduct a simple OLS regression on eligibility criteria indices for locals and migrants (Table 7). The estimated regression models are of the following form:

$$
\begin{aligned}
\textit{Eligibility criteria indices}_i \\
= \alpha + \beta_1 Ln\,(PRH)_i + \beta_2 \textit{Allocation rate}_i \\
+ \beta_3 \textit{Housing price to income ratio}_i + \beta_4 \textit{Floor space per capita}_i \\
+ \beta_5 \textit{Homeownership rate}_i + X_i + \varepsilon,
\end{aligned}
\tag{2}
$$

where the main variables are defined as above. X_i includes a range of city-level control variables, including ln (households), proportion of migrants, and ln (GDP per capita). ε is a disturbance. α and β are coefficients to be estimated in the model.

Table 7. Regression results on eligibility criteria.

	Eligibility Criteria Indices for Locals	Eligibility Criteria Indices for Migrants
	(Model 3)	(Model 4)
Ln (PRH)	0.106 **	0.097 *
	(0.049)	(0.052)
Allocation rate	−0.156	−0.297
	(0.188)	(0.219)
Housing-price-to-income ratio	−0.014	0.008
	(0.010)	(0.021)
Floor space per capita	−0.006	0.005
	(0.006)	(0.009)
Homeownership rate	−1.867 ***	−0.449
	(0.440)	(0.741)
Ln (households)	0.003	−0.151 **
	(0.077)	(0.075)
Proportion of migrants	−0.296 *	−0.259
	(0.165)	(0.203)
Ln (GDP per capita)	−0.267 ***	−0.061
	(0.112)	(0.108)
Constant	4.194 ***	1.064
	(1.112)	(1.171)
N	128	128
R^2	0.168	0.074

Note: Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

First, the extremely low goodness of fit of the regression of Model 4 implies that eligibility criteria for migrants are almost independent of PRH supply, allocation rate, and actual PRH demand. Second, the PRH supply is significantly positive for locals' and migrants' eligibility criteria, as the eligibility criteria indices for locals and migrants increase by 10.6% and 9.7%, respectively, for each unit increase in the supply of PRH, which represents a loosening of eligibility criteria. However, the allocation rate and GDP per capita are not significant, which means the allocation rate and economic conditions do not affect eligibility criteria for locals and migrants. In addition, the relationship between the number of households and the proportion of migrants is quite different for the two eligibility criteria indices. In Model 4, the coefficient on the number of households is significantly negative, while the coefficient on the proportion of migrants is also negative but not significant. This suggests that the eligibility criteria indices for migrants tighten relatively when the total population increases, but do not change significantly when the proportion of migrants alone increases. In contrast, in Model 3, the total number of households does not significantly affect the eligibility criteria index for locals, but the index decreases significantly by 2.96% when the proportion of migrants increases by 0.1. This may be interpreted as tightening access conditions for locals in response to increased demand for PRH from migrants.

6. Discussion and Conclusions

In China, where the government has strengthened its role in social housing, there are many problems in social housing. This study analyzes the mismatches in the supply–demand of PRH and its causes. Several interesting findings can be summarized. First, the supply of PRH is not based on the actual housing demand and there is a mismatch in the quantity of supply and demand of PRH. Cities with more crowded housing conditions and lower housing affordability, thus more demand, do not necessarily have more supply of PRH. On the contrary, cities with lower housing affordability have a smaller supply of PRH. These results indicate the failure of PRH supply to achieve its policy goal of meeting the basic housing needs of urban low- and middle-income households. In comparison, homeownership is considered properly in PRH supply. Cities with higher

rates of homeownership provide less PRH, which is what should be given the smaller demand for subsidized rental housing. Meanwhile, the supply of PRH is significantly associated with the degree of local fiscal autonomy. While more residential land supply leads to more supply of PRH, a high fiscal autonomy leads to a smaller supply of PRH, which shows that fiscally more autonomous cities are not motivated to provide more PRH regardless of the demand. However, affordable housing is an important component of government-provided public goods and requires adequate public functions rather than full marketization. While market-based operations are common internationally [1], at least in China, this may lead to further exacerbation of the mismatch between supply and demand.

Second, in addition to the mismatch in the quantity of PRH supply, there is a mismatch in the quality of PRH, as about 16.6% of cities have low allocation rates (or high vacancies) and long waiting times simultaneously. This lack of effective supply is related to the "low quality" of PRH such as remote locations and inappropriate dwelling types. This is partly because local governments tend to provide land for PRH in more remote areas with poor infrastructure to mitigate the impact on land leasing revenue and such PRH is less attractive to residents. In addition, local governments have not designed proper housing units according to the actual demand, such as supplying one-person units, while the demand groups are two-person households. This indicates that local governments lack adequate research on demand when planning for the development of PRH, as well as adequate evaluation and supervision during the construction process.

Third, local governments rarely adjust eligibility criteria based on actual supply and demand, or local economic conditions. Moreover, local governments usually have different eligibility criteria for locals and migrants, with the former being almost independent of PRH stock and allocation, and the latter being more restrictive in cities with a smaller PRH stock. In addition, cities with a large number of migrants such as the first-tier cities have adopted stricter eligibility criteria for migrants compared to other cities, defeating the purpose of PRH to improve the housing conditions of new urban residents.

Compared to the existing literature, the contribution of this paper is threefold. First, this study utilizes national city-level data on PRH stock, allocation, and eligibility criteria, filling a gap in the existing literature that only focuses on some cities or programs [14–17]. Since the existing literature usually does not have access to data on PRH stock, it can only study PRH through data such as land grants and planned construction numbers. This study, on the other hand, provides a national perspective on the supply–demand match of PRH and helps to develop top-level policy design from a macro-perspective. Second, this study investigates the supply–demand matching situation through the perspective of policy implementation, which is different from the related literature [48–51] that utilizes survey data to directly estimate the absolute gap between supply and demand in cities. On the one hand, we are more interested in guiding actual policies through the research results. In particular, as we are now in the stage of concentrated construction of new affordable rental housing, the government's involvement and influence in the construction of PRH, as well as the demand that should be considered in the development of affordable housing, should be paid attention to. On the other hand, given the lack of basic information about the housing stock, including size, location, rent, etc., and the absence of a national demand survey on PRH at the prefecture-level city level, constructing an accurate matching decision model is unrealistic. This is one of the limitations of our study. However, in subsequent studies, we will also consider further research on the structural PRH supply–demand matching problem using other methods or categorizing cities. Another limitation of this paper is the lack of further research on the "quality" of PRH. Because the causes of this mismatch are multifaceted, we are unable to analyze them with specific data or a uniform logical framework, but we will conduct case studies of specific cities based on more detailed data in subsequent studies. Third, this study takes eligibility criteria as an entry point and proposes a solution to regulate the degree of matching between supply and demand from the demand side. There is little research on this in the literature, partly because of the difficulties in data collection and indexation due to the different eligibility criteria in each

city. Another reason may be the lack of attention to the setting and adjustment of eligibility criteria by city governments compared to the management of PRH stock.

This study has significant implications for policy formulation and practical implementation within the PRH sector. Given that the large-scale construction of PRH is no longer in line with the existing policy orientation, the rational allocation of PRH, utilization of vacant stock, and not only focusing on in-kind support are the key points that should be considered by the local governments at this point. Firstly, local governments should promptly adjust eligibility criteria, thereby ensuring a more effective supply–demand matching in PRH allocation. In cities characterized by a substantial number of vacant PRH units, local authorities should consider converting these units into alternative forms of affordable housing or lowering eligibility requirements accordingly. By reducing vacant PRH and maintaining a reasonable level of physical supply, local governments can improve their ability to cater to diverse social groups facing housing difficulties. Secondly, vacant PRH can be merged into affordable rental housing to be provided to a wider group of people. Affordable rental housing has slightly lower rents than the market proposed by the central government in 2021. It has lower eligibility criteria than PRH and therefore can increase the efficiency of vacant PRH utilization. Thirdly, given the reluctance of local governments to develop new PRH and the presence of an undersupply of in-kind PRH in over 39% of cities, local governments are recommended to significantly expand currently small-scale monetary subsidy programs. This would not only offer households more housing options but also mitigate mismatches pertaining to both the quantity and quality of PRH by incorporating market mechanisms into the allocation process. Lastly, the central government should regulate the quality of the supply rather than the mere quantity. Therefore, the establishment of a comprehensive and real-time evaluation system is proposed, encompassing aspects such as the matching of supply and demand, eligibility criteria, allocation processes, and the satisfaction levels of target groups within each city. This scientific evaluation framework would facilitate a more efficient supply and allocation of housing resources, ensuring that the needs of individuals and communities are effectively met.

By identifying the underlying causes of mismatches, this study not only enhances our understanding of PRH in China but also offers valuable insights for other nations seeking to improve their own affordable rental housing programs, particularly within the challenging context of the post-pandemic era. Despite possible limitations in the capacity for massive investment, the findings presented here underscore the importance of implementing targeted adjustments and measures to mitigate mismatches and enhance the efficiency of existing social housing initiatives. This paper contributes to the ongoing discourse on social housing and the complex role of local governments' housing conditions and markets, and provides a valuable reference for policymakers and practitioners alike, with particular attention to the appropriateness of policymakers' involvement in the development process and the need to consider the development of more flexible and changeable policy regimes.

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