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Inequity in Housing Welfare: Assessing the Inter-City Performance of China's Housing Provident Fund Program

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Abstract: Accompanied by the monetisation of housing allocation, the Housing Provident Fund (HPF) has become an important part of China's housing security system. As of 2020, HPF has been implemented for almost 30 years, but limited effort has been made to examine its performance, especially from a spatial (regional) perspective. Taking 287 Chinese cities as a sample and using the "access–process–outcome" framework, this study explores the inter-city differences in the performance of HPF and their relevant influencing factors. The results show that (1) there is significant spatial heterogeneity in the performance of HPF in China; (2) from 2015 to 2020, regional variation in the process and outcome performance showed a convergence trend, but the access performance between cities tended to widen and diverge; (3) regression results show that process-relevant variables (i.e., the contribution rate and the capital utilization level) are positively associated with the loan beneficiary rate (the HPF outcome performance), whereas access-relevant attributes (i.e., the HPF participation rate) exert negative influences. The study contributes to revealing the spatial heterogeneity of China's HPF development. It highlights that more regionally oriented policy interventions are needed for policy makers and practitioners to optimize the development of HPF.

Keywords: Housing Provident Fund; housing security; housing inequality; spatial heterogeneity; China

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1. Introduction

Home ownership means wealth, stability, and success in the Chinese context, which symbolises a person's social status, and its value is recognised in the marriage market [1,2]. However, along with housing system reform, China's housing sector has rapidly transitioned from a welfare system to a highly commercialised market [3,4]. Though the growing market has significantly improved rates of homeownership, it has also intensified housing inequality for different family groups [5,6]. To help disadvantaged individuals to achieve homeownership, the Chinese government has built a housing security system comprising affordable housing, low-rent housing and the Housing Provident Fund (HPF) [7–9].

Among them, the HPF, established in 1990s, is the core of China's policy-related housing finance system [10,11]. After nearly 30 years, it has become the most beneficial housing security program in China [12]. However, with the development of real estate and financial markets, a series of problems concerning HPF have gradually arisen, of which the inequity issue has become the focus of the debate [8,13]. Considerable research has unveiled that there are significant inequalities in participation opportunities, deposit rules and loan use of the HPF among groups from different enterprises and cities [14,15]. Burell argued that the HPF had a tangible discriminatory impact on workers in the informal economy [16]. Wang and Murie noted that the HPF program mainly benefits high-income households and reinforces existing housing inequalities in China, due to rising housing prices [17].

Although scholars have achieved fruitful results in research on the development of China's HPF, several gaps remain. First, owing to data limitation, previous studies mainly

rely on descriptive analysis and have not provided sufficient quantitative evidence. In 2014, the Chinese central government began to require local HPF management centres to disclose information about fund operation. Consequently, the availability of data offers the possibility of further empirical or even quantitative analysis. Second, the HPF in China has been implemented for almost 30 years, but little effort has been made to examine its regional features, especially the nature of spatial equity. Additionally, analysis chiefly focuses on a single city or examines a few large cities, but it is unclear how HPF performs across multi-scale cities and regions. As Deng et al. pointed out, there is a need for research that examines cross-city variation in the HPF performance on a much larger scale [18]. Third, there is a lack of analyses of the factors influencing the HPF's performance. As housing commercialisation deepens and housing prices increase rapidly, the regional imbalance in housing welfare represented by the HPF could be further amplified. Thus, further attention is needed to identify the intricate local dynamics that shape the program's performance.

In this context, this paper takes 287 cities in China as a sample and intends to (1) evaluate the equity performance of the HPF by using the "access–process–outcome" research framework; (2) reveal the spatial heterogeneity of the HPF's performance across multi-scale cities and regions in the Chinese context; and (3) explore the influencing factors of the HPF's outcome performance based on analysis of panel data. Contrary to previous micro-analysis, this paper deepens understandings of China's HPF from a macro-regional perspective. Since equity is the key target of China's new round of HPF reform, our findings could provide important policy implications for the improvement of the program from a spatial perspective. In addition, examining the equity performance of the program from different dimensions may enrich the content of housing security and housing equality research.

The remainder of this article is organized as follows. Section 2 reviews the relevant research on this topic. The methodology and the data used in this study are introduced in Section 3. Sections 4 and 5 show the results of the empirical analysis. Section 6 is the discussion of findings and Section 7 concludes the study.

2. Literature Review

2.1. Housing Inequality and the Government-Designed Savings Program

Housing inequality is a key dimension of social inequality and has become a universal global phenomenon [19–21]. As a basic element of human survival, housing has both commodity and social security attributes. Owing to its market orientation, the wealth effect continues to expand, while the social security function gradually weakens, which consequently aggravates housing inequality and social stratification [22]. To remedy market failure, European and American countries mainly adopt market-oriented means, using policy tools such as tax preferences and interest rate subsidies to indirectly reduce the housing financing costs of disadvantaged groups [23]. Emerging economies such as Singapore, China, Mexico and Nigeria choose to establish collective saving programs to directly intervene in the housing loan market [24].

For instance, Singapore established the Central Provident Fund (CPF) by using citizens' future retirement savings to solve the current housing financing problem and achieve a high homeownership rate [25]. This social welfare system is often considered a model for solving the housing problem in Southeast Asia [26,27]. The long-term intervention of the state in the economy has encouraged Mexico to create a complex and diversified housing financial system dominated by public and quasi-public institutions, such as National Housing Fund for (Private Sector) Workers (INFONAVIT) [28,29]. Other similar programs include the National Housing Fund (NHF) in Nigeria, a semi-public fund (FGTS) in Brazil and the Filipino Development Housing Fund (PAG-IBIG) in the Philippines [28].

These programs, however, are criticized for their broader efficiency and equity issues [30,31]. For instance, unlike traditional welfarism that emphasises income transfer, Singapore's CPF over-relies on the privatisation of social security, causing insufficient social wealth redistribution and poor social compatibility [32]. In Mexico, INFONAVIT favours middle-income families, providing insufficient housing financing security for citizens work-

ing in the informal sector [33,34]. In addition, variations in local industrial structure and the number of formal employees led to significant regional differences in the number of issued INFONAVIT loans [35].

2.2. China's HPF Program and Its Inequity Controversy

Based on Singapore's experience, the HPF was developed by the Chinese government and promoted nationwide in 1990s [36,37]. The system is based on compulsory savings, which requires both enterprises and employees to pay HPF [16]. The deposit basis is the average monthly salary of the employee in the previous year, and the contribution rate varies across cities but in general ranges from 5% to 12% [13,36]. Meanwhile, there are two main ways to make personal use of the HPF: loans and withdrawals. All employees who have joined the HPF program can apply for a withdrawal or a loan [38]. In addition, the HPF management centre in each city is responsible for the management and operation of the local HPF program [18].

After almost three decades' development, China's HPF has become the largest policy-related housing finance program in the world. As of 2020, the number of contributors to the program has reached 153.28 million, and the accumulated fund scale has reached CNY 19,583.49 billion [39]. Although the scale of contributors is noticeable, the participation rate among urban workers is insufficient, accounting for only 33.13% in 2020 [39,40]. Due to the low participation rate and limited loan quota, China's housing financial system continues to be dominated by commercial mortgage loans, and the market share of HPF loans in 2020 was only 15.30% [39].

Similarly to other countries, the HPF in China also face challenges on equity grounds, especially in terms of participation opportunities [16,28]. For instance, the main body of contributors mainly consists of state agencies, government-sponsored institutions, and state-owned enterprises, whereas the vulnerable groups (e.g., low-income people) are highly excluded from the HPF [11]. The HPF target also excludes rural residents, which could widen the gap between the urban and rural areas [41,42]. Third, the HPF participation rate of major cities in China shows remarkable inter-city and regional variation, especially between cities with different development levels [18,38].

Deposit rule injustice is another prominent concern. The deposit of HPF is directly linked to individual income, and high-income groups can obtain more matched subsidies from their employers [13,18]. Empirical research shows that the deposit level of state-owned enterprises is significantly higher than that of foreign, private and individual enterprises, and use of the HPF as a tax shelter makes it an important mechanism for public enterprises to legally increase their salaries [41]. Existing studies have also noted that due to the decentralized management structure, the HPF cannot be circulated between cities, resulting in the coexistence of a "funds shortage" and "funds precipitation" [43].

2.3. Research Framework and Hypotheses

In this study, the justice theory is used as a starting point to examining the HPF equity performance. Rawls proposed in his book, *A Theory of Justice,* that "justice is the primary value of a social system" [44]. Rawls believes that socioeconomic inequality is reasonable only when all society members have fair opportunities and can compensate for vulnerable groups. Broadly viewed, justice is composed of multiple dimensions, such as starting point, opportunity, process and outcome justice [45,46]. The fairness of initial resources is the premise of opportunity equity, and opportunity and process fairness are the basis of the equity of outcome [46,47].

Equity is the original intent of the housing security system and the soul of the HPF [48]. However, differing institutional design could lead to significant differences in equity performance across cities. In China, the HPF's management is undertaken by local governments, forming a decentralised management structure [13,38]. Although the central government tends to emphasize the equity of this program, the localization of policy implementation weakens the ability of the central government to effectively stimulate or sanction local

government behaviours, causing differing performance of the HPF across cities [38,49]. In addition, local HPF management committees, as the only supervision authority, are not permanent bodies, and their functions have not been fully achieved. This disorder further produces variation in policy compliance among local governments [14].

Existing research has shown that the development of the HPF program is deeply rooted in local social and economic development. Any given local housing market situation, including house prices, the house price-to-income ratio and the housing marketization level, plays an important role in the coverage of HPF loan beneficiaries [18]. Then, the macroeconomic status also influences the deposit level of the HPF [50]. Furthermore, some man-made factors in the local HPF management centre, such as different management policies and efficiency, are identified as important aspects that shape the HPF's equity performance [10,38,51,52].

From a regional perspective, this paper adopts the three aspects of equity, namely, access–process–outcome, to establish the conceptual framework for exploring the HPF performance (Figure 1). Access performance refers to the equality of opportunities for individuals to participate in the program. Process performance evaluates the operation of the HPF from two aspects: deposit and use of funds. Outcome performance measures the loan benefit level of participants. We first explore the three types of performance from a spatial view. Thereafter, we discuss how the access and process performance exerts an influence on the outcome performance by controlling the relevant variables of local socioeconomic development and HPF administration.

Given that only employees who participate in the HPF program are eligible for subsidized loans, we expect a positive relationship between the access and outcome performance. The deposit level of HPF is tied to the maximum allowable loan and withdrawal of funds, which may affect the participants' ability to repay mortgages and their enthusiasm to apply for HPF loans [38]. In addition, enhancing the utilization level of HPF means less capital precipitation, which is conducive to supporting the role of the HPF loans in financing housing consumption [43]. Thus, our hypotheses are presented as follows:

Hypothesis 1. *The access performance is positively associated with the outcome performance.*

Hypothesis 2. *The process performance has positive effects on the outcome performance.*

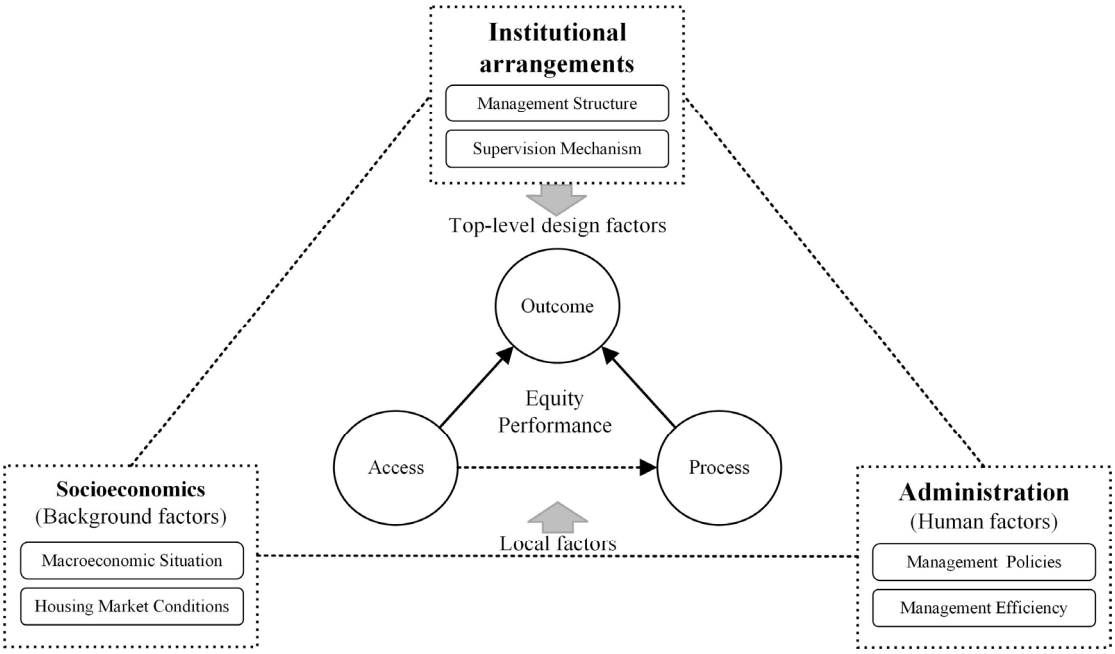

Figure 1. Conceptual framework.

3. Methodology

3.1. Indicators of the HPF Performance Evaluation

Access performance: Based on the existing literature [15], this paper selects the HPF participation rate of total urban employees as the measurement index. A higher participation rate means that more employees are included in the program, and the city has better access to the HPF. The specific formula is as follows:

$$PR = E_{hpf} / E_{total} \tag{1}$$

where PR is the HPF participation rate of the city in the reporting year; E_{hpf} is the total number of HPF participants; and E_{total} is the total urban employees.

Process performance: The deposit and use of HPF are used to assess the process performance [18,43]. The HPF is based on compulsory savings, requiring both enterprises and individuals to pay in the same proportion; thus, this paper selects the contribution rate of individuals as the measurement index. In addition, there are two main ways to make personal use of the HPF: loans and withdrawals, of which the low-interest loan is the key embodiment of the institutional advantages. Therefore, we select the loan-to-deposit ratio as the measurement index of the fund utilization level. A higher index value indicates that the HPF has been well utilized, and fewer funds have been sedimented. The specific formula is as follows:

$$CR = C_{hpf} / 2 / AS \tag{2}$$

where CR is the HPF contribution rate of the city in the reporting year; C_{hpf} is the average annual HPF contribution per participant; and AS is the average annual salary of employees of the city.

$$LDR = LB_{hpf} / DB_{hpf} \tag{3}$$

where LDR is the HPF loan-to-deposit ratio of the city in the reporting year; LB_{hpf} is the total outstanding balance of HPF loans; and DB_{hpf} is the total HPF deposits' balance after deducting the withdrawal.

Outcome performance: Low-interest housing loans are the greatest advantage of the HPF and the most important incentive for employees to participate in the program. Although since 2015, the HPF can be withdrawn to pay rent, it still has limited impact on housing consumption. In the year of 2020, for instance, the HPF supported 12.26 million people to withdraw 118.85 billion yuan for rental housing, accounting for 8.00% of the total participants and 4.53% of the total amount of savings, respectively. Therefore, based on previous research [18,38], the loan beneficiary rate is selected as the measurement index of outcome performance, which examines how many of participants have benefited from the HPF loans. The specific formula is as follows:

$$LBR = \lambda * L_{hpf} / E_{hpf} \tag{4}$$

where LBR is the HPF loan beneficiary rate of the city in the reporting year; L_{hpf} is the cumulative total number of issued HPF loans; E_{hpf} is the total number of HPF participants; and λ is the number of participants benefiting from a HPF loan in the city. Considering that HPF loans are issued by families, and the beneficiaries of a loan may be a family with one participant, double participants or other types. For instance, in Beijing among the participants benefiting from loans in 2020, 43.5% were families with single participants and 56.5% were double participants [1]. Then, the value of λ was 1.57 using the method of weighted average.

3.2. Spatial Agglomeration Analysis

Measuring the spatial agglomeration of the HPF performance is vital to understand its spatial characteristics. This study uses the spatial hotspot analysis (Getis-Ord G_i^*) to

detect the clustering pattern of the distribution of the HPF's performance [53]. The specific formula is as follows:

$$G_i^*(d) = \sum_{j=1}^{n} W_{ij}(d)x_j / \sum_{j=1}^{n} x_j \quad (5)$$

$$Z(G_i^*) = G_i^* - E(G_i^*) / \sqrt{Var(G_i^*)} \quad (6)$$

where i and j represent city i and city j. W_{ij} is the spatial adjacency matrix. x_j represents the HPF performance of city j. n is the number of cities. $Z(G_i^*)$ is the standardized value of $G_i^*(d)$. $E(G_i^*)$ is the mean of G_i^*, and $Var(G_i^*)$ is the variation coefficient of G_i^*. If $Z(G_i^*)$ is positive and significant, it means there is high-value spatial agglomeration. If $Z(G_i^*)$ is negative and significant, there is a low-value of spatial clustering. If $Z(G_i^*)$ is close to zero, there is no obvious spatial agglomeration.

3.3. Spatial Convergence Analysis

The variation coefficient and the Gini index are commonly used indicators to measure the degree of regional economic differences [54]. This paper adopts these two indexes to analyse the inter-city differences and dynamic variation in the HPF's performance. The variation coefficient is calculated as follows:

$$C_v = \frac{1}{\overline{x}} \sqrt{\frac{1}{n} \sum_{i=1}^{n} (x_i - \overline{x})^2} \quad (7)$$

where C_v is the coefficient variation. $\overline{x}$ is the average value. n, x_i are the same as those above. The Gini index is calculated as follows:

$$G = \frac{1}{2n^2\overline{x}} \sum_{i=1}^{n} \sum_{j=1}^{n} |x_i - x_j| \quad (8)$$

where G is the Gini index and n, x_i, $\overline{x}$ are the same as those above.

The variation coefficient and the Gini index may show the overall evolution of the spatial differences of the HPF's performance, but it cannot depict its specific spatial distribution pattern. Thus, we employ the kernel density function to estimate the distribution characteristics of HPF performance. As an important nonparametric estimation method, kernel density estimation is mainly used to estimate the probability density of random variables [55]. The specific formula is as follows:

$$f(x) = \frac{1}{nh} \sum_{i=1}^{n} K\left(\frac{x_i - \overline{x}}{h}\right) \quad (9)$$

where h is the bandwidth. n, x_i, $\overline{x}$ are the same as those above. $K(x)$ is the kernel function, and we adopt the commonly used Gaussian function for estimation.

3.4. Regression Model

Based on the data of 287 cities in China from 2015 to 2020, we apply the panel regression model to analyze the influencing factors of the outcome performance:

$$LBR_{it} = \beta_0 + \beta_1 PR_{it} + \beta_2 CR_{it} + \beta_3 LDR_{it} + \sum_{j=1}^{k} \beta_j X_{it} + \alpha_i + \mu_t + \varepsilon_{it}$$

where LBR_{it} is the explained variable. i is the city and t is the year. β_0 is the constant term. PR_{it}, CR_{it}, LDR_{it} are the key explanatory variables. X_{it} is the control variable. α_i is the city effect variable. μ_t is the time effect variable. ε_{it} is the random disturbance variable.

Key variables: The explained variable in this study is the loan beneficiary rate of the HPF. The key explanatory variable is the access and process performance of the HPF, which is characterised by three indicators: the participation rate, the contribution rate, and the loan-to-deposit ratio. These data were collected from The Housing Provident Fund Annual Report 2015–2020, provided by local HPF management centres.

Control variables: Based on Deng et al. [18], we selected control variables from two aspects: socioeconomic conditions and HPF administration. The house price is an important factor affecting property purchases, and may delay loan applications; the data on urban housing prices come from the China House Price Quotation Network (http://www.creprice.cn (accessed on 15 October 2021)), which is hosted by the China Real Estate Association. Income level is another key element influencing housing affordability for workers. We used the average annual salary of employees as the measurement index, and the data were from the China City Statistical Yearbooks 2016–2021. Housing loan interest rates may affect citizens' enthusiasm for loan application. We selected the commercial housing loan interest rate of more than five years as the measurement index, and the data were from the open data portal of the People's Bank of China.

Regarding man-made factors, the proportion of non-public sector contributors reveals the structure of local participants and the efforts of local governments. Then, the maximum loan amount may affect the attraction of HPF loans. The operational efficiency of local HPF management centres influences the convenience of loan applications. We select the management expense rate, namely the proportion of management cost expenditure in capital gains as the measurement index. These data were collected from The Housing Provident Fund Annual Report 2015–2020.

3.5. Descriptive Analysis

Table 1 shows the descriptive statistics for the variables from 2015 to 2020. The average value of the loan beneficiary rate is 41.484%, indicating relatively low benefit. The average values of participation rate, contribution rate and loan-to-deposit ratio are 31.235%, 9.989% and 81.729%, respectively. The figures reveal low access to HPF, low HPF contributions from individuals, and a relatively moderate-to-high level of HPF utilization. Except for the key variables, the descriptive statistics of socioeconomic and administration variables (treated as covariates) are also included in Table 1.

Table 1. Descriptive statistics for the variables from 2015 to 2020.

Variable	Mean	Median	Std. Dev	Expected Relationship
Dependent variable				
Loan beneficiary rate (LBR)	41.484	38.492	21.615	
Key explanatory variables				
Participation rate (PR)	31.235	29.065	11.340	Positive
Contribution rate (CR)	9.989	9.948	2.135	Positive
Loan-to-deposit ratio (LDR)	81.729	84.305	18.704	Positive
Socioeconomic variables				
Urban housing price (LnHP)	8.633	8.534	0.491	Negative
Average annual salary of employees (lnAS)	11.101	11.095	0.236	Positive
Loan interest rate_5over (LIR)	4.958	4.875	0.321	Negative
Administration control variables				
Proportion of non-public contributors (NPC)	28.108	23.470	19.134	Positive
HPF maximum loan amounts (LnML)	4.018	4.007	0.264	Positive
Management expense rate (MER)	15.418	13.619	8.228	Negative

Note: Non-public enterprises are enterprises other than state organs, public institutions and state-owned enterprises.

4. Spatial Equity Performance of HPF

4.1. Inter-City and Regional Heterogeneity

From 2015 to 2020 (Table 2), the participation rate showed a fluctuating growth, indicating that the access equity of the HPF in China has been consistently improving. Table 3 shows that eastern cities had the highest rate, with a mean of 35.86% in 2020, followed by the western and central cities, with rates of 33.92% and 29.27%, respectively. Moreover, HPF access in cities of different sizes shows great differences. In 2020, the HPF participation rate in the megacities, supercities, large cities, mid-sized cities and small cities was 52.67%, 42.95%, 35.54%, 30.98% and 30.31%, respectively, forming a typical reversed

pyramid structure, indicating that the access performance of larger cities is better. The participation rate showed the characteristic of spatial agglomeration. In Figure 2, cities with better access equity are concentrated in the Yangtze River Delta, Pearl River Delta and Bohai Ring Megalopolis, as well as the economically developed inland cities such as Urumqi and Karamay.

Table 2. The average of the HPF equity performance from 2015 to 2020 (%).

Indicators	2015	2016	2017	2018	2019	2020
Participation rate	30.67	30.75	30.72	31.17	31.51	32.59
Contribution rate	10.24	10.12	10.04	9.86	9.88	9.79
Loan-to-deposit ratio	74.38	82.75	83.79	83.36	83.12	82.98
Loan beneficiary rate	34.08	36.57	40.54	43.59	45.77	48.35

Table 3. The HPF performance of different cities in 2015, 2018 and 2020 (%).

Classification	Participation Rate		Contribution Rate		Loan-to-Deposit Ratio		Loan Beneficiary Rate	
	2015	2020	2015	2020	2015	2020	2015	2020
Overall mean	30.67	32.59	10.24	9.79	74.38	82.98	34.08	48.35
Region								
Eastern cities	31.91	35.86	9.72	8.88	83.07	88.00	32.34	41.33
Central cities	28.98	29.27	10.22	10.28	70.57	80.36	30.93	47.67
Western cities	32.00	33.92	11.03	10.23	68.56	80.40	42.54	60.07
Scale rank								
Megacities (>10 million)	46.13	52.67	7.42	6.70	80.44	83.68	21.01	24.54
Supercities (5–10 million)	39.66	42.95	8.97	8.25	92.00	88.76	27.38	32.37
Large cities (1–5 million)	33.86	35.54	9.64	9.06	81.68	87.76	28.82	39.09
Mid-sized cities (0.5–1 million)	28.39	30.98	10.32	10.20	74.73	83.67	32.24	47.41
Small cities (<0.5 million)	29.28	30.31	10.81	10.16	67.11	78.37	40.90	58.37

Note: The division of city hierarchical structure is defined by the permanent urban population in 2015, with reference to the standards published by the State Council.

The mean contribution rate showed a downward trend (Table 2), changing from 10.24% in 2015 to 9.79% in 2020. Table 3 shows that compared with eastern cities, central and western cities had a higher contribution rate. Then, middle-sized and small cities exhibited a higher contribution rate than larger-scale cities. Figure 2 reveals that provinces including Sichuan, Chongqing, Hubei, Hunan and Jiangxi were the hub of the hotspots. Then, the loan-to-deposit ratio showed a fluctuating increase from 74.38% in 2015 to 82.98% in 2020, indicating that utilization level of HPF loans in general has been improved. Eastern cities show better use of HPF loans, and the performance of small cities is far behind other cities. Figure 2 also shows that the hotspots were mainly distributed in eastern coastal and southern provinces. Note that the improvement in the loan-to-deposit ratio during the past five years is more pronounced for central and western cities, as well as mid-sized and small cities.

Table 2 shows that the loan beneficiary rate increased significantly from 34.08% in 2015 to 48.35% in 2020, meaning that the outcome performance and the housing security function of the HPF in China were significantly improved. In Table 3, the loan beneficiary rates of the eastern, central and western cities were 41.33%, 47.67% and 60.07% in 2020, respectively, and decreased from west to east. In Figure 2, the hotspots of loan beneficiary rate were concentrated in cities in the southwest, northwest and northeast regions. Then, cities with different scales also showed significant differences in outcome performance.

In 2020, the values in megacities, supercities, large cities, mid-sized cities and small cities were 24.54%, 32.37%, 39.09%, 47.41% and 58.37%, respectively, indicating that the outcome performance of small-scale cities is better.

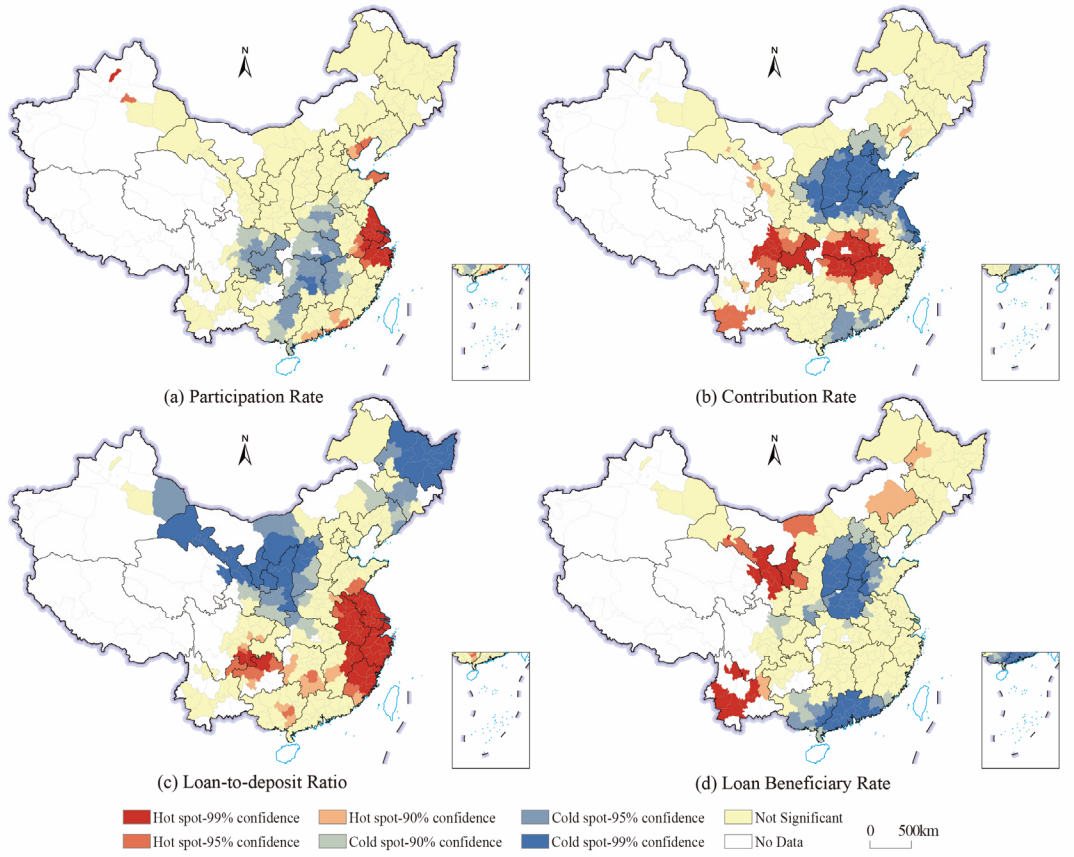

Figure 2. The hotspots map of the HPF equity performance from 2015 to 2020. Note: Based on the average value of cities from 2015 to 2020, the hotspots map was drawn using ArcGIS software.

4.2. Differentiated Spatial Convergence Trend

In Table 4, the variation coefficient and Gini index of the participation rate showed a general upward trend, meaning that differences in the HPF access between cities tended to widen. In Figure 3, there is a long tail on the right side of the curve, suggesting that the participation rate in a few cities is far ahead. In 2020, the peak of the curve increased significantly and moved to the right, but the lateral width decreased. These mean that cities with poor access performance have been improved, and the concentration trend of the distribution of the participation rate is strengthened.

Regarding process performance, the variation coefficient and Gini index of the contribution rate and the loan-to-deposit ratio showed a fluctuating downward tendency, indicating that the inter-city variation tends to converge. As shown in Figure 3, since 2015, the peak of the contribution rate curve has obviously shifted to the left, meaning that the contribution rate of cities has generally decreased. Moreover, the obvious long tail on the left side of the curve of the loan-to-deposit ratio showed that some cities still face the challenge of fund precipitation. In addition, for the two curves, the height of peaks increased obviously, suggesting that the concentration trend of the process performance was enhanced.

In terms of outcome performance (Table 4), the continuous decline of the variation coefficient and Gini index revealed that the intercity difference of loan beneficiary rate is narrowing. Compared with 2015, the horizontal distribution range of the loan benefit ratio curve in 2018 and 2020 was significantly narrowed, and the peak was significantly

increased and moved to the right (Figure 3). The findings indicate that the loan beneficiary rate of cities has been generally improved, and the spatial disparity has been alleviated. In addition, the long tail on the right side of the curve implies that the loan beneficiary rate of a few cities is far ahead of the rest.

Table 4. The variation coefficient and Gini index of the HPF equity performance from 2015 to 2020.

Year	Participation Rate		Contribution Rate		Loan-to-Deposit Ratio		Loan Beneficiary Rate	
	CV	G	CV	G	CV	G	CV	G
2015	0.352	0.195	0.229	0.128	0.253	0.141	0.590	0.301
2016	0.362	0.198	0.205	0.114	0.236	0.128	0.549	0.284
2017	0.360	0.198	0.243	0.138	0.223	0.120	0.525	0.269
2018	0.364	0.202	0.203	0.111	0.217	0.116	0.491	0.251
2019	0.368	0.203	0.199	0.109	0.213	0.113	0.470	0.241
2020	0.366	0.202	0.193	0.107	0.212	0.112	0.449	0.234

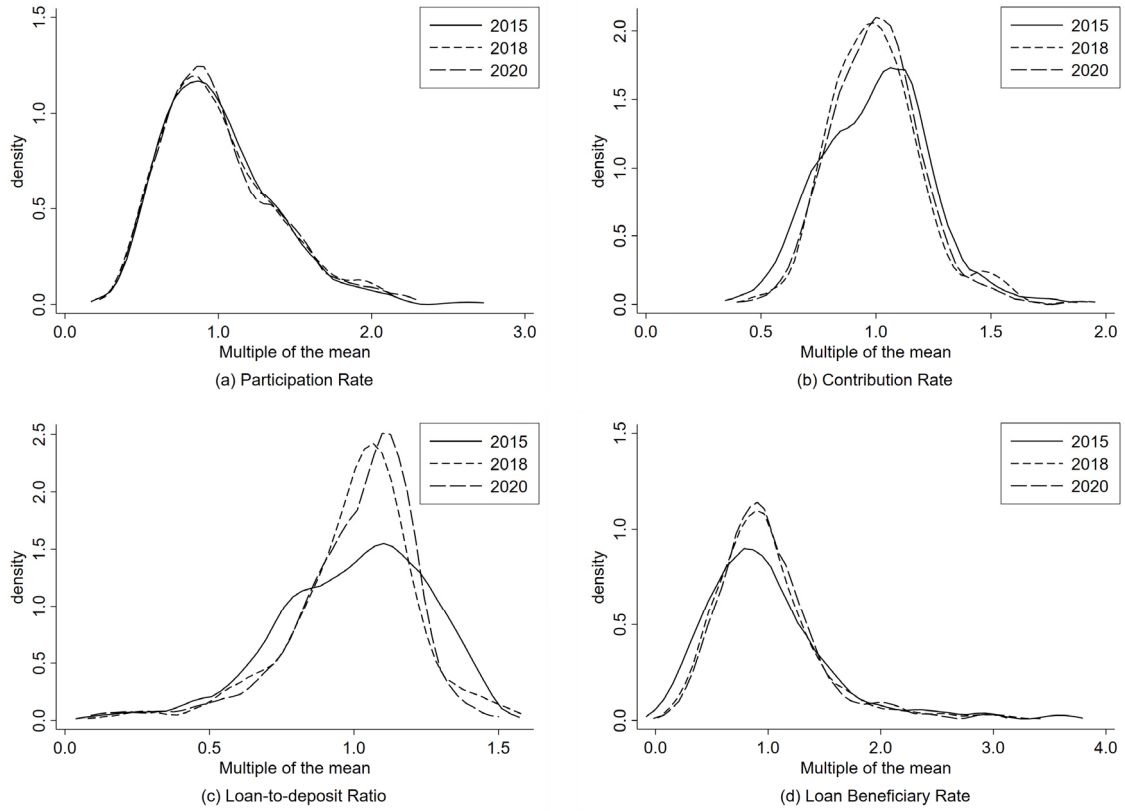

Figure 3. The kernel density curves of the HPF equity performance in 2015, 2018 and 2020. Note: To accomplish the dynamic comparability of time series, we adopt the mean value processing, that is, the value of each city is divided by the mean value of all cities in that year.

5. Regression Results

As shown in Table 5, we adopted a panel regression model to explore the factors influencing the outcome performance. First, we executed a collinearity diagnostic, and the result shows that the VIFs of all variables were less than 5, meaning that no relevant collinearity existed. Then, considering that heteroscedasticity may exist in the model, the robust standard error was used in the regression. In Table 6, we further classified 287 cities by region and scale, and explored the spatial differentiation characteristics of the impact of related factors on the loan beneficiary rate.

Table 5. Estimation results of the panel regression model.

Variables	Model 1		Model 2		Model 3		Model 4	
	Coef.	*p*	Coef.	*p*	Coef.	*p*	Coef.	*p*
PR	−0.296	0.000					−0.173	0.000
CR			1.874	0.000			1.673	0.000
LDR					0.151	0.000	0.151	0.000
lnHP	−3.377	0.001	−4.477	0.000	−4.519	0.000	−4.875	0.000
lnAS	0.319	0.890	18.303	0.000	−0.669	0.770	14.372	0.000
LIR	−17.157	0.000	−9.661	0.000	−16.470	0.000	−10.490	0.000
NPC	−0.099	0.000	−0.071	0.000	−0.149	0.000	−0.076	0.000
lnML	2.250	0.013	0.935	0.264	3.353	0.000	1.343	0.076
MER	−0.084	0.000	−0.062	0.001	−0.086	0.000	−0.041	0.014
Cons.	162.862	0.000	−89.467	0.006	155.921	0.000	−44.343	0.135
R^2	0.684		0.730		0.687		0.781	
LogL	−4568.456		−4433.489		−4560.415		−4254.370	
AIC	9160.913		8890.979		9144.83		8536.741	
BIC	9226.327		8956.394		9210.245		8613.058	
Obs	1722		1722		1722		1722	

Table 6. Grouped regression estimation results.

Variables	(1) Region				(2) Scale Rank			
	Eastern Cities		Central and Western Cities		Large Cities		Mid-Sized and Small Cities	
	Coef.	*p*	Coef.	*p*	Coef.	*p*	Coef.	*p*
PR	−0.086	0.004	−0.174	0.000	−0.083	0.029	−0.209	0.000
CR	2.434	0.000	1.483	0.000	1.565	0.000	1.641	0.000
LDR	0.084	0.000	0.175	0.000	0.143	0.000	0.145	0.000
lnHP	−8.581	0.000	−1.634	0.165	−4.932	0.001	−3.347	0.003
lnAS	15.315	0.000	15.264	0.000	8.953	0.049	15.279	0.000
LIR	−10.500	0.000	−9.537	0.000	−10.622	0.000	−10.483	0.000
NPC	−0.071	0.003	−0.060	0.008	−0.037	0.190	−0.094	0.000
lnML	0.847	0.491	0.765	0.406	0.522	0.692	1.346	0.139
MER	−0.028	0.380	−0.027	0.153	−0.114	0.009	−0.026	0.155
Cons.	−28.939	0.608	−82.227	0.019	12.535	0.841	−62.888	0.065
R^2	0.732		0.814		0.716		0.804	
LogL	−1354.088		−2820.746		−1180.633		−3035.106	
AIC	2736.176		5669.491		2389.266		6098.212	
BIC	2797.451		5739.96		2448.382		6169.681	
Obs	588		1134		504		1218	

Note: Megacities and supercities are included in the group of large cities;

Regression results of Model 1 show that the coefficient of the participation rate is significantly negative after controlling for related variables. In Model 2 and 3, the coefficient of the contribution rate and loan-to-deposit ratio are significantly positive. When variables of both the access and process performance are included, as shown in Model 4, the direction and significance of their effects on the loan beneficiary rate are unchanged. After comparing the values of R^2, Log*L*, AIC and BIC of different models, we found that Model 4 has a better explanatory power.

In Model 4, the participation rate is significantly and negatively correlated with the loan beneficiary rate, which is contrary to our expectation. Then, both the coefficient of the contribution rate and loan-to-deposit ratio have passed the significance test of 1% level, suggesting that the deposit level and the fund utilization level are significantly and positively related to the loan beneficiary rate. Regarding socioeconomic factors, the coefficients of urban housing prices and commercial loan interest rate are significantly

negative. Another significant variable is the average annual salary of employees, which is positively related to the loan beneficiary rate. In terms of administration variables, the proportions of non-public sector contributors and the management expenses rate are remarkably and negatively correlated with the dependent variables, but the coefficient of the maximum loan amount is significantly positive.

According to the results of grouped regression (Table 6), the variables of access and process performance have a robust effect on the outcome performance. There is no remarkable change in the direction and significance of their influence, but the intensity showed differences. Specifically, the absolute value of the participation rate in the central and western cities is larger than that in the eastern cities, whereas the rate in small and medium-sized cities is larger than that of big cities. In addition, there are prominent regional differences in contribution rate and loan-to-deposit ratio. In detail, the contribution rate in eastern cities has a stronger positive correlation with the loan beneficiary rate, whereas in central and western cities the influence of the loan-to-deposit ratio is much higher.

For socioeconomic factors, the loan beneficiary rate is more sensitive to the loan interest rate in eastern cities and larger cities. Urban housing prices, then, have a much stronger negative influence on the loan beneficiary rate in eastern cities and larger cities. The average annual salary of employees significantly influences the loan beneficiary rate, mainly in small and medium-sized cities. Regarding administration factors, the influence of the proportion of non-public sector contributors in small and medium-sized cities is more notable. Finally, the management expenses rate is negatively associated with the loan beneficiary rate in large cities, but the maximum loan amount failed the significance test.

6. Discussion

Based on the above analysis, we further discuss the spatial difference of the HPF performance and its driving mechanisms to deepen our current understanding of the HPF program in the Chinese context.

First, a multidimensional assessment of the access, process and outcome performance of HPF reveals that there exists significant spatial heterogeneity in the development of the system. Results show that from 2015 to 2020, the participation rate of eastern cities is significantly higher than that of central and western cities, and the larger the city, the better the access performance. This finding is in agreement with that of previous studies, that HPF access is tied to the financial capability of local governments and the local development level [16,18]. For eastern cities and larger cities, sufficient financial support means the program is well funded. Thus, local people are more capable of affording contributions to the HPF compared to cities in the western region [38].

As for process performance, central and western cities had a higher contribution rate, and middle-sized and small cities exhibited a higher contribution rate than larger-scale cities. As mentioned previously, the deposit level is linked to the regional economic structure and deposit behaviours of different enterprise types [41]. In general, the contribution rate of private enterprises is lower than that of state-owned enterprises [56]. Since eastern cities in China have a large proportion of private economies, the prosperity of the private economy may lead to a lower deposit rate, compared to western cities, which have a high rate of public sector employees [57]. In terms of fund utilization, the regional imbalance of loan use indicates that although the decentralized management of HPF reflects the flexibility of the program, it may also hinder the overall optimization of fund allocation efficiency [43].

Further, the loan beneficiary rate of eastern cities and large-scale cities is limited. This also confirms the study by Tang and Coulson [52]. They stated that HPF loan applicants in China are required to be able to afford mortgage down payments, which is an important means for financial institutions to manage credit risk. However, rocketing housing prices in the eastern cities have caused many low-and middle-income workers to be unable to afford the down payment and loan repayment in a short time, leading them to postpone applying for HPF loans [13,16,43,52]. As the deposit and loan amount of HPF are linked to income, the potential financing support provided by this program is often limited for low-

income groups, which discourages them from applying for HPF loans [38,57]. In addition, compared with soaring house prices in larger cities, the limited loan quota accounts for only a small part of the total housing purchase expenditure, which may further make HPF loans less attractive [10].

Second, the results reveal that the regional variation in process and outcome performance showed a convergence trend, but the access performance between cities tended to widen and diverge. Results show that from 2015 to 2019, cross-city variation in the participation rate continued to expand. This is in accordance with the statement by Yeung and Howes that under the localized management structure, local policies are prone to implementation deviation without effective incentives and restraint measures [58]. In 2020, affected by COVID-19 pandemic, a large number of private enterprises that were in trouble were allowed to postpone paying the HPF, which thus temporarily alleviated regional disparities [59].

Then, in 2016, the Ministry of Housing and Urban Development of China lowered the cap of the HPF contribution rate from 20% to 12% [60]. This to some extent alleviated the burden for the private sector, which may explain why cross-city variation in the contribution rate is narrowing. Since 2015, the government has made efforts to slash the mounting housing inventory, especially in middle-sized and small cities [61]. Favourable policies, including easing of HPF loan terms, have been pushed forward to encourage citizens to buy properties [62]. These policies may have promoted the fund utilization level and the loan beneficiary rate of lower-tiered cities. Moreover, since 2017, some cities have reduced the HPF loan restriction on local deposits, and allowed inter-provincial HPF loans for home purchase in cities across provinces [63]. Though the reforms are not uniform across China, they may further help to narrow the benefit cap between cities.

Third, although the influences of the access-relevant variables and process-relevant variables differed, they are revealed as significant for the development of the HPF program. By investigating the driving mechanisms of HPF performance, our research may provide an empirical foundation for improving the HPF system and a reference for promoting the healthy development of the real estate market. As for the participation rate, it is significantly negative associated with the loan beneficiary rate, which means that employees who newly participated in the system were less likely to obtain HPF loans. This confirms the results of the study by Deng et al., that the majority of deposits into the HPF are made by public sector work units and large private companies, and increasing participation rate means that more less well-to-do private firms will be included in the system [18]. However, faced with rocketing house prices, employees in private enterprises, especially those in small enterprises, are more likely to be excluded from the HPF loan market due to poor housing affordability [16,64]. After controlling for participation rate, the rate of the proportion of non-public sector contributors is significantly negative, which further confirmed the statement.

The existing literature shows that HPF loans are more available to middle- and high-income people, which contradicts the real demand among low-income families [13,57]. According to Chen, without substantial improvement in housing affordability, the HPF may be transformed into a deposit that occupies the disposable income of low-income groups [14]. They are not only excluded from the housing benefits brought by the HPF loans, but also have to bear the risk of depreciation of their HPF accounts [16,65]. Thus, the widening gap of opportunity equity (access to HPF) is worthy policy concerns, and local governments need to pay more attention to the benefits of different groups, especially vulnerable people.

As for the positive effects of process-relevant variables, process-relevant variables such as the contribution rate and the utilization level are significantly and positively correlated with the loan beneficiary rate. It is first understandable that increasing the contribution rate directly increases the amount of funds in personal HPF account, improves the repayment ability of participants, and stimulates their enthusiasm to apply for HPF loans [38]. In addition, improving the fund utilization level, according to Chen [43], means that more

HPF loans will be issued and more precipitated funds will be activated to support housing consumption, consequently improving the loan beneficiary rate. Moreover, according to Tang and Coulson [52], due to strict government constraints on using the funds, such as borrower qualifications, a maximum loan amount and a minimum down payment rate, the contribution of the HPF to housing speculation is limited. Therefore, improving the fund utilization level and the loan beneficiary rate will help to enhance overall housing welfare.

Note that although increasing the level of funds' deposit and utilization helps improve the benefit rate of the HPF, it still faces certain challenges. For economic reasons, local governments have no incentive to increase the contribution rate of the HPF, especially for non-public sectors [43]. Considering that private enterprises are important contributors to local jobs and taxes, local governments tend to ignore their low deposit behaviours [41]. In addition, compared with the steady growth of capital supply, the significant improvement of the utilization level of HPF has caused the problem of insufficient liquidity [14]. Thus, there is a need for local governments to handle the relationship between the efficient use of funds and liquidity risks [43].

7. Conclusions and Implications

Taking 287 cities in China from 2015 to 2020 as the sample, this paper explores the HPF's performance by using the access–process–outcome framework. On this foundation, we discuss the influencing factors of HPF outcome performance based on panel data analysis. We find that (1) there is significant spatial heterogeneity in the performance of the HPF in China; (2) from 2015 to 2020, the regional variation in the process and outcome performance showed a convergence trend, but the access performance between cities tended to widen and diverge; (3) regression results show that process-relevant variables (i.e., the contribution rate and the capital utilization level) are positively associated with the loan beneficiary rate (the HPF outcome performance), whereas the relationship of access-relevant attributes (i.e., the HPF participation rate) with the loan benefit level shows a negative trend. This study highlights that more regional-oriented policy interventions are needed for policy makers and practitioners to improve the effectiveness of the HPF program.

This study at least has the following policy implications. First, it is necessary to consistently improve the opportunity equity for participation in the HPF, and include more low- and middle-income groups into this scheme. Since private companies are often reluctant to pay the HPF, better institutions can be designed to encourage their deposit behaviour.

Second, while committed to improving the participation rate of the HPF, local governments still need to consider the housing benefits of vulnerable people. It is recommended that they reasonably formulate more flexible policies, such as interest subsidies and loan guarantees, to promote HPF loans in favour of low- and middle-income participants.

Third, for small and medium-sized cities, more generous terms for HPF use are recommended to reduce capital precipitation. For large-scale cities, local governments should be aware of the risk of liquidity shortage while maximizing capital supply. Policies, for instance, can be initiated to break obstacles to the flow of funds between cities, and promote optimal allocation of the HPF.

This article has certain limitations. Due to the availability of data, the research period is still limited, and the sample does not cover all cities in China. As information disclosure improves, a longer series of panel data can be added to follow-up research. This would help produce more systematical analyses of the spatial-temporal characteristics, the influence mechanisms and the relevant policy effects of the HPF program.

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Note

[1] http://gjj.beijing.gov.cn/web/zwgk61/gjjndbb/10960899/index.html (accessed on 5 February 2023).

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