International Journal for Housing Science and Its Applications
Publish August 10, 2025. Volume 46, Issue 4 Pages 7407-7420

https://doi.org/10.70517/ijhsa464641

Analysis of the Mechanism of Housing Policy's Impact on the Housing Preferences of College Student Entrepreneurs

Yuanyuan Yang[1] and Zhanjun Wei[2,*]
[1] Enrollment and Employment Office, Xinyang Normal University, Xinyang, Henan, 464000, China
[2] Business School, Xinyang Normal University, Xinyang, Henan, 464000, China
Corresponding authors: (e-mail: pdsxingzhe@126.com).

Abstract This paper uses housing policies from January 2019 to August 2024 as keywords to conduct content searches on the housing preference choices of college student entrepreneurs at the national, provincial, and municipal levels. After text mining using ROSTCM software, a quantitative evaluation was conducted using the Policy Index Model (PMC). Subsequently, propensity score matching and a multi-period double difference model were employed to calculate and match the impact of housing policy on the housing preferences of college student entrepreneurs, analyze the heterogeneity among different types of housing, and investigate the effects of housing policy implementation on the housing preferences of college student entrepreneurs. The results indicate that migration duration, migration scope, and the type of destination city all significantly influence the housing preference choices of college student entrepreneurs. The government primarily relies on environmental policy tools to exert indirect influence, while supply-side and demand-side tools have limited direct supply and incentive effects. The evaluation grades of the nine policies fall within the range of good to acceptable, with PMC scores ranging from 4.000 to 7.294. Under different housing policies, the impact on the housing preference choices of college student entrepreneurs is related to the number of properties owned by their families and their urban-rural distribution. For example, college students from families with two or three properties exhibit higher or lower preference choices under different housing policies compared to those from families with one property, and this effect exhibits heterogeneity across regions and urban-rural areas.

Index Terms Policy Model Index, Propensity Score Matching, Multi-Period Double Difference Model, Housing Preference Choices

I. Introduction

Housing is a fundamental material necessity for human survival and development, and a good living environment provides a sense of security [1]. As urbanization continues to advance, the rate of increase in housing prices far exceeds the growth rate of ordinary people's incomes, particularly for university graduates entering the workforce, who face the dual challenges of low incomes and high housing costs [2], [3]. For college students entering society for the first time, the dual pressures of rapidly rising housing prices and limited wealth accumulation mean that housing issues not only affect their lives in the first few years after graduation but also impact their career trajectories [4]-[7]. While contributing to urban economic development, this group of entrepreneurial college students urgently needs to address housing issues.

Given the current socio-economic development landscape in China, influenced by market economic conditions and competitive pressures, most college students who start businesses have low incomes upon entering society and cannot afford to purchase housing, forcing them to rent within their income range [8], [9]. When choosing rental housing, college students who start businesses prioritize locations near their workplaces due to job requirements. However, due to financial constraints, they also consider income levels when selecting areas and living environments [10]-[12]. Generally speaking, the larger the city, the more urgent the housing situation for college students becomes, and the poorer their living conditions tend to be [13]. In first-tier cities, the entrepreneurial college student population faces the reality of high employment pressure, high consumption, and low income, resulting in greater restrictions on their housing choices [14], [15]. To address these issues, the government has implemented various policies to ensure the income stability of low-income groups, with housing security policies being one of them [16], [17].

For college student entrepreneurs, housing issues in cities are the greatest pressure they face. Literature [18] points out that the housing affordability of college graduates is closely related to their wage growth in the labor market, and that college students from different levels of universities have different housing affordability at different

stages. Based on this, several policy recommendations are proposed to alleviate the housing pressure faced by college graduates in their early career stages. Literature [19] takes graduates in the Ghana region as the survey population, studying their perceptions of rental models involving advance rent payments and the distribution of demographic characteristics, thereby providing guidance for policymakers to formulate scientific housing policies. Literature [20] analyzes the factors influencing young people's willingness to rent and their satisfaction with housing, indicating that housing knowledge, housing challenges, and housing policies significantly impact their housing choices. This provides important references for policymakers to implement housing education programs, promote the development of affordable housing, and advance housing policy reforms. Literature [21] examined the housing choice strategies of Chinese graduates during the transition from students to employed individuals, finding that geographical location and budgetary conditions are common selection criteria for graduates, while housing vulnerability caused by economic instability also influences their housing choice strategies as an external factor. Literature [22] argues that urban housing prices exert a dual influence on university graduates' willingness to work and live in a city, with housing costs at the workplace becoming a key consideration. Based on this, it urgently proposes recommendations related to stabilizing housing prices and implementing inclusive housing policies. The above studies elucidate the current housing situation and housing satisfaction of university graduates. It is generally believed that housing security policies can alleviate talent loss in cities, but there is limited understanding of the mechanisms through which policies influence university students' housing choices, necessitating further research to propose targeted policy recommendations.

This study analyzed national, provincial, and municipal housing policies using text mining and quantitative evaluation methods, compiling 74 housing policy documents after screening. Using text mining results, a PMC model for housing policies was constructed, and this model was used to conduct a quantitative evaluation of the policies. Subsequently, propensity score matching and a multi-period double difference model were employed to process the matching of housing samples, and their propensity scores were calculated. Finally, based on dynamic monitoring data of college student entrepreneurs in Guangdong Province, a PSM-DID regression model was used to explore the impact of housing policies on the housing preference choices of college student entrepreneurs.

II. Construction of a multi-period difference-in-differences model based on college students' housing preference choices

II. A. Data and Methods

II. A. 1) Data Sources and Screening

Using the keyword “housing for college student entrepreneurs,” we set the search period from January 2019 to August 2024 and found a total of 127 policy documents. After screening, we finally selected 74 policy documents.

II. A. 2) Research subjects

In the ROSTCM software, 74 policies were imported for text mining. After removing meaningless words, the high-frequency words in the relevant policies were summarized to construct a social network diagram. Based on the high-frequency word list and social network diagram, the variables and parameters for this paper were determined. Two people were responsible for screening the comprehensive content of each policy, and the research subjects were finally determined.

II. A. 3) Research Tools and Methods

The PMC Index Model [23] is a widely recognized tool for evaluating public policies internationally. It assesses the consistency of policies while reflecting their quality during the quantitative evaluation process. The PMC Index employs a multi-dimensional analysis of policies from multiple perspectives, specifically including: variable identification and parameter setting, construction of a multi-input-output table, calculation of the PMC Index, and plotting of the PMC curve diagram.

(1) Variable Classification and Parameter Setting

Convert the policy text into a suitable format, filter out keywords irrelevant to the study, and use keyword extraction and semantic network analysis. Utilize the NetDraw tool in the ROSTCM software to draw a social network diagram of housing choices among college student entrepreneurs. Based on the social network diagram and existing research findings, construct a PMC model for housing preference among college student entrepreneurs.

(2) PMC Index Calculation

First, assign values (0 or 1) to the secondary variables based on the PMC index calculation method and derive scores from the input-output matrix. Extract $X8$ and $X9$ and conduct a heterogeneity analysis on them. Then, calculate the scores for the seven primary variables $X1 \sim X7$ using formula (3). The ratio of the total score of the secondary variables to the number of secondary variables becomes the score for the primary variables. Finally, the PMC score for housing policy is calculated using Formula (4), with a score range of 0 to 10.00 points. Using the

concavity index, the optimal policy path is explored, calculated using Formula (5), with a score range of 0 to 10.00 points. The PMC index model in this paper is as follows:

$$X \sim N[0, \quad 1] \tag{1}$$

$$X \sim \{X_{\mathrm{R}} : [0,1]\} \tag{2}$$

$$X_i = \sum_{j=1}^{n} \frac{X_{ij}}{n(X_{ij})} \tag{3}$$

$$PMC = \sum_{j-1}^{m} X_i = \sum_{j=1}^{m} \left(\sum_{j=1}^{n} \frac{X_{ij}}{n(X_{ij})} \right) \tag{4}$$

$$\text{Policy depression Index} = 10 - PMC \tag{5}$$

X_R denotes integer; where i denotes a primary variable, j denotes a secondary variable, X_{ij} denotes a specific secondary variable, m denotes the number of primary variables, and n or $n(X_{ij})$ denotes the number of secondary variables under a specific primary variable. According to Estrada's evaluation criteria, policies are specifically categorized into four levels: 8.00–10.00 is considered perfect, 6.00–7.99 is excellent, 4.00–5.99 is acceptable, and 0–3.99 is poor. The four-trap index is divided into four levels: 6.01–10.00 is unacceptable, 4.01–6.00 is acceptable, 2.01–4.00 is moderately concave, and 1.00–2.00 is slightly concave.

(3) PMC Surface Diagram Construction

The PMC surface diagram is composed of a 3×3 matrix formed by the specific values of the first-level variables of the PMC index. Through the surface diagram, the strengths and weaknesses of policies can be visually and three-dimensionally observed, thereby optimizing policy measures. The PMC surface diagram calculation formula is as follows:

$$PMC \text{ Surface} = \begin{bmatrix} X_1 & X_2 & X_3 \\ X_4 & X_5 & X_6 \\ X_7 & X_8 & X_9 \end{bmatrix} \tag{6}$$

II. B. Research Design

II. B. 1) Propensity Score Matching

The core explanatory variable and the dependent variable in this study may have a causal relationship, meaning that housing policies may influence the housing preferences of college student entrepreneurs. Based on this, this study employs propensity score matching (PSM) to match the sample. The treatment group is defined as college student entrepreneurs who have implemented housing policies and their housing preferences, while the control group is defined as those who have not implemented housing policies. By calculating the propensity scores using PSM, the study identifies the most similar control group observations to the experimental group for matching, i.e., housing units with the most similar characteristics in terms of covariates to the experimental group's housing preference, thereby simulating a “quasi-natural experiment” to test the net effect of the housing policy before and after implementation. The study constructs the following model to predict the probability of the housing policy affecting the housing preference of college student entrepreneurs:

$$logit(treated_i = 1) = \beta_0 + \beta_1 control + \xi_i \tag{7}$$

Among them, $treated_i$ is the policy dummy variable; control is the control variable.

II. B. 2) Construction of a multi-period double difference model

This paper constructs a multi-period difference-in-differences (DID) model [24], with the following specific procedures: First, the treatment group and control group are divided based on the implementation status of the housing policy; then, the difference in the impact of the policy implementation on the cost efficiency of the two groups is examined: the control group has a value of 0 before implementation and α_2 after implementation, with a net effect of α_2; the experimental group has a value of α_1 before implementation and $\alpha_1 + \alpha_2 + \alpha_3$ after implementation, with a net effect of $\alpha_2 + \alpha_3$. Therefore, the difference in net effects between the experimental and control groups before and after policy implementation is α_3, representing the net impact of the housing policy. Due

to the significant heterogeneity among different types of housing, this study sets different policy shock points for different types of housing across years. A multi-period DID model is constructed as follows:

$$y_{it} = \alpha_0 + \alpha_1 treat_i + \alpha_2 time_{it} + \alpha_3 did_{it} + \alpha_4 X_{it} + \varepsilon_{it} \tag{8}$$

In this context, i and t represent individual housing units and years, respectively; the explained variable y_{it} denotes the cost efficiency of housing unit i in year t; $treat_i$ is the individual housing unit's i whether the housing policy was implemented, with a value of 1 if implemented (public disclosure of housing-related indicators) and 0 otherwise; $time_{it}$ is a time dummy variable, with a value of 1 for the year of the housing policy shock and subsequent years, and 0 for previous years. did_{it} is the net policy effect, which is the product term of $treat_i$ and $time_{it}$; X_{it} is a set of control variables; ε_{it} is the disturbance term. The coefficient α_3 of the net effect of housing policy did_{it} is numerically equal to the difference between the net effects of the experimental group and the control group before and after the implementation of the policy. If α_3 is positive, it indicates that the housing policy improves cost efficiency in housing operations; conversely, if α_3 is negative, it indicates that it reduces cost efficiency.

Based on the model in equation (8), this paper adds a product term of did and the non-performing loan ratio (NPL), with the specific model specification as follows:

$$y_{it} = \alpha_0 + \alpha_1 treat_i + \alpha_2 time_{it} + \alpha_3 did_{it} + \alpha_4 X_{it} + \alpha_5 did_{it} \times NPL_{it} + \varepsilon_{it} \tag{9}$$

This paper uses the asset liquidity ratio (LIQ), i.e., the ratio of liquid assets to liquid liabilities, as a proxy variable for reputation. Based on the model in equation (8), the product term of did and LIQ is added. The specific model setting is as follows:

$$y_{it} = \alpha_0 + \alpha_1 treat_i + \alpha_2 time_{it} + \alpha_3 did_{it} + \alpha_4 X_{it} + \alpha_5 did_{it} \times liq_{it} + \varepsilon_{it} \tag{10}$$

II. C. Variable Definition and Model Setting

This paper takes the housing choices of college student entrepreneurs in Guangdong Province as an example to analyze the factors influencing their preferences. The data is sourced from the National College Student Entrepreneurship Dynamic Monitoring Survey conducted by the former National Health and Family Planning Commission in 2024. The survey targets college student entrepreneurs who have resided in the survey area for more than one month and are not registered residents of the district (county, city). The survey employed a combination of stratified, multi-stage, proportional PPS sampling and regional random sampling methods to understand the survival and development status of college student entrepreneurs, ensuring the data's high reliability and representativeness. This study selected college student entrepreneurs in Guangdong Province as the research subjects. After data screening and removal of outliers, the sample size was determined to be 8,262.

(1) Dependent variable

The dependent variable in this study is “housing preference of college student entrepreneurs.” Based on the question “What type of housing do you currently live in?” in the questionnaire, the dependent variable “housing preference” was treated as a multi-category variable and divided into three major categories: first, owner-occupied housing, including self-purchased housing and self-built housing; second, rented housing, including privately rented housing and government-provided public rental housing; third, free housing, including renting employer-provided housing, borrowing housing, or living at the workplace, i.e., samples with no actual housing expenses. Due to its low proportion and unclear definition, the original questionnaire's “other informal housing” category was excluded in this study. The housing conditions of college student entrepreneurs in Guangdong Province are shown in Table 1. Statistical analysis reveals that rental housing is the primary method used by college student entrepreneurs to address housing issues, accounting for 72.87% of cases, but government-provided public rental housing accounts for only 0.61%. The proportion of college student entrepreneurs owning owner-occupied housing is 11%, with purchased housing accounting for 9.3% and self-built housing accounting for 1.71%. Free housing accounts for 16.13%.

Table 1: The housing condition of migrant people in Guangdong province

Dependent variable	Housing form	For short	Quantity (household/set)	Proportion (%)
Property owned property	Buying commercial housing	X1	663	8.02
	Self-purchasing affordable housing	X2	6	0.07
	Private housing	X3	99	1.20
	self-building	X4	141	1.71
Rental housing	Private house - full rent	X5	4899	59.30
	Private housing - co-rent	X6	1071	12.96
	The government provides public rental	X7	50	0.61
Free housing	Unit/employer room	X8	1270	15.37
	Borrow house	X9	39	0.47
	Employment site	X10	24	0.29
Tot			8262	100

(2) Independent variables

This paper uses variables such as the scope of migration, migration patterns, time of migration, and the grade of the destination city to measure the impact of housing policies on population migration to cities. Drawing on existing research and based on the characteristics of the sample, this paper selects migration time, migration scope, and destination city type as factors to measure the impact of housing policies. The specific definitions are as follows:

Mobility duration for college graduate entrepreneurs under housing policies: This refers to the most recent mobility period during which the individual worked and lived in the destination city for more than one month. This variable is treated as a continuous variable by subtracting the current mobility year from the survey year.

Mobility scope for college graduate entrepreneurs under housing policies: This variable is treated as a binary variable based on whether the mobility involved interprovincial or intraprovincial movement.

Type of city of destination for college graduate entrepreneurs under housing policies: Based on the evaluation criteria of the “2024 City Commercial Appeal Ranking” released by the New First-Tier Cities Research Institute, and considering the characteristics of the sample data, the 21 cities in the province are categorized as follows: First-tier cities, including Guangzhou, Shenzhen, and Dongguan; Second-tier cities, including Foshan, Zhuhai, Zhongshan, and Huizhou; third- and fourth-tier cities, including Shantou, Jieyang, Zhanjiang, Qingyuan, Chaozhou, Zhaoqing, Meizhou, Jiangmen, Shaoguan, Shanwei, Maoming, Yangjiang, Heyuan, and Yunfu, etc.

(3) Control variables

Based on the 2024 dynamic monitoring data of the college student entrepreneurship group and drawing on existing literature, this paper controls for several variables that may influence the housing choices of the college student entrepreneurship group, including: “age, household registration status, marital status, educational attainment, housing expenditure ratio, employment status type, and whether a temporary residence permit has been obtained” (six variables).

The variable definitions and descriptive statistical results are shown in Table 2. The results indicate that the means and standard errors of all variables align with actual conditions and are suitable for subsequent analysis.

Table 2: Definition of variables and its descriptive statistics

Variable type	Variable name	Variable definition	Mean	SD
Dependent variable	The preference for housing selection of college students' entrepreneurial groups	Property ownership housing = 1, rental housing = 2, free housing = 3	2.005	0.342
Independent variable	The flow time of college entrepreneurs in housing policy	Survey year - this current year	4.98	0.209
	The flow range of college students' entrepreneurship group under the housing policy	The flow of trans-provincial flow is 1and the province flows	0.733	0.671
	The migration of college students into cities under housing policy	Flow into the third four lines of the city = 1, flow into the second-tier cities=2, flow into the first-tier cities = 3	0.939	0.301
Control variable	Age	Year of survey - year of birth	33.03	8.466
	The nature of the hukou	Non-agricultural account = 1, agricultural household = 0	0.151	0.476
	Marital status	Married = 1, unmarried = 0	0.761	0.416
	Degree of education	I didn't go to school=1,Primary school = 2,Junior high school=3,	3.543	1.054

		High school/secondary school =4,College specialist = 5,Undergraduate degree in college=6,Graduate student = 7		
	Housing expenditure	Monthly housing expenditure/monthly expenditure	0.151	0.102
	Type of employment status	The laborer who has no fixed employer is 1,Employee of a fixed employer=2,The self-employed worker = 3, Employer = 4	2.318	0.652
	Whether to apply for temporary residence certificate	It's the = 1, whether it's = 0	0.707	0.443

III. The Impact of Housing Policies on the Housing Preferences of College Student Entrepreneurs

III. A. Quantitative evaluation of affordable rental housing policies

III. A. 1) Method Selection and Data Sources

The criteria for selecting representative policies are as follows: 1) The time span should cover as many research years as possible; 2) The issuing departments of policies at the same level should be as diverse as possible; 3) The policies should be comprehensive, directive, or of significant importance. Based on the above criteria, a total of 12 specific policies were selected, including 3 national-level policies (A1, A2, A3), 3 policies issued by Guangdong Province (B1, B2, B3), and 3 policies issued by Guangzhou City (C1, C2, C3).

III. A. 2) PMC Index Calculation and Consistency Evaluation

This paper sets 9 evaluation policies and 10 secondary indicators as main variables and sub-variables, respectively. To ensure balance among all variables, this paper assigns binary values (0, 1) to all sub-variables. Specifically, if the analyzed policy involves the content covered by the sub-variable, the parameter is set to 1; otherwise, it is set to 0. Therefore, the sub-variables follow a two-point distribution of 0 and 1, denoted as N[0, 1].

Calculating the values of each primary variable: This value is equal to the sum of all sub-variables divided by the number of sub-variables included in that primary variable, as shown in Formula (13).

PMC Index Measurement: Substitute the calculated values of each primary variable into Formula (14) and calculate the PMC Index based on the final total score of all primary variables. That is:

$$X_j \sim N[0,1] \tag{11}$$

$$X = \{XR[0v1]\} \tag{12}$$

$$X_i = X_i\left(\sum_{i=1}^{\pi(x_{ij})}\frac{X_{ij}}{T(X_{ij})}\right) i = 1,2,3,4,\cdots,n \tag{13}$$

$$\begin{aligned} PMC &= \sum_{i=1}^{n}\left(X_i\left[\sum_{j=1}^{T(X_{ij})}\frac{X_{ij}}{T(X_{ij})}\right]\right) \\ &= \left[X_1\left(\sum_{a=1}^{5}\frac{X_{1a}}{5}\right)+X_2\left(\sum_{b=1}^{6}\frac{X_{2b}}{6}\right)+X_3\left(\sum_{c=1}^{5}\frac{X_{3c}}{5}\right)\right. \\ &\quad +X_4\left(\sum_{d=1}^{4}\frac{X_{4d}}{4}\right)+X_5\left(\sum_{c=1}^{3}\frac{X_{5c}}{3}\right)+X_6\left(\sum_{f=1}^{3}\frac{X_{6f}}{3}\right) \\ &\quad \left.+X_7\left(\sum_{g=1}^{3}\frac{X_{7g}}{3}\right)+X_8\left(\sum_{h=1}^{3}\frac{X_{8h}}{3}\right)+X_9\left(\sum_{k=1}^{3}\frac{X_{9k}}{3}\right)\right] \end{aligned} \tag{14}$$

Among them, X_j is a subvariable, X represents the set of subvariables, XR represents any variable in the set X, X_i is a main variable, and X_{ij} represents the value of the j th subvariable under the i th main variable. $T(X_{ij})$ denotes the number of subvariables under the i th main variable, and n denotes the number of main variables, with $n=9$ in this study.

Through the above steps, the PMC indices for the nine specific policies are obtained. A higher PMC index indicates a higher policy level and a broader scope of policy content. Conversely, a lower PMC index indicates a

relatively lower policy level with significant room for improvement. Based on existing research findings, a PMC index between 0 and 3.99 indicates low consistency, between 4 and 5.99 indicates acceptable consistency, between 6 and 7.99 indicates good consistency, and between 8 and 9.00 indicates complete consistency. Additionally, the concavity index of policy evaluation can be used to analyze the weaknesses of each policy by calculating the degree of difference between the evaluated policy and the "perfect policy." The results of the PMC index calculations for the nine specific policies are shown in Table 3. The results indicate that the PMC scores for the nine policies range from 4.000 to 7.294, with evaluation levels falling within the good and acceptable ranges. This suggests that the indicators selected in this study are suitable for use in the subsequent analysis.

Table 3: The PMC index results of 9 specific policies

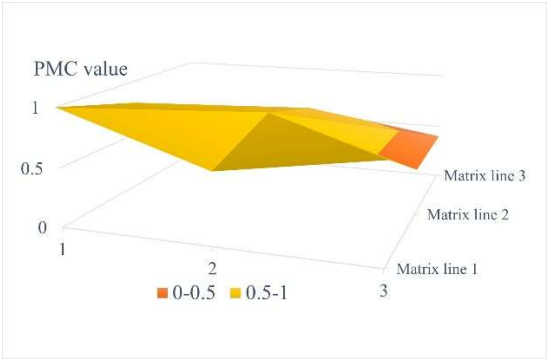
Policy number	A1	A2	A3	B1	B2	B3	C1	C2	C3
X1	0.998	0.598	0.804	0.8	0.798	0.397	0.399	0.596	0.399
X2	0.833	0.667	0.78	1.000	0.67	0.827	0.598	0.599	0.807
X3	0.801	0.603	0.556	0.8	0.802	0.599	0.499	0.499	0.502
X4	0.999	0.997	0.746	1.000	0.999	0.498	0.499	0.502	0.001
X5	1.000	0.671	0.355	0.999	0.997	1.000	0.071	0.333	0.33
X6	1.000	0.669	0.97	0.669	0.671	0.329	0.673	1.000	0.668
X7	0.329	0.332	0.319	0.332	0.329	0.335	0.33	0.329	0.33
X8	0.329	0.331	0.33	0.328	0.328	0.33	0.33	0.33	0.329
X9	1.000	0.602	0.597	0.698	0.648	0.298	0.499	0.501	0.499
X10	1.000	0.67	0.971	0.998	0.671	0.671	0.666	0.668	1.000
PMC index	7.294	5.54	5.954	6.931	6.269	4.989	4.000	4.857	4.363
Sag index	1.711	3.463	3.015	2.07	2.73	4.01	5.001	4.139	4.641
Ranking	1	5	4	2	3	6	9	7	8
Evaluation grade	Good	Acceptability	Acceptability	Good	Good	Acceptability	Acceptability	Acceptability	Acceptability

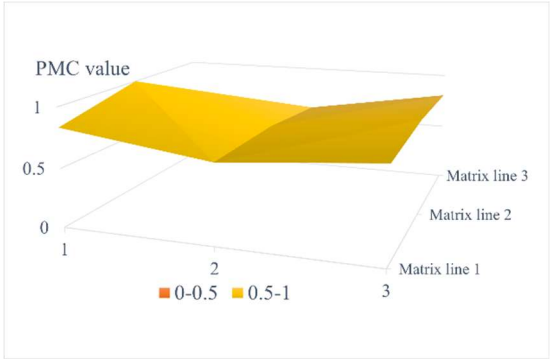
III. A. 3) Drawing PMC surface diagrams and analyzing results

In order to more intuitively reflect the advantages and disadvantages of a policy in various aspects, this paper constructs a 3×3 matrix based on the PMC results of nine policies and uses it to draw a three-dimensional surface diagram. The PMC calculation formula is as follows:

$$PMC = \begin{pmatrix} x_1 & x_4 & x_7 \\ x_2 & x_5 & x_8 \\ x_3 & x_6 & x_9 \end{pmatrix} \tag{15}$$

The PMC surface plots for the 9 affordable rental housing policies are shown in Figure 1, with the 3D surface plots for housing policies 1–9 arranged from left to right and top to bottom. The results indicate that under different affordable rental housing policies, there are significant differences in the housing preferences of the college student entrepreneurship group. For example, under the first 1-6 and 9th policies, the PMC values of the affordable rental housing policies are above 0.9, while under the 7th and 8th policies, the PMC values fluctuate around 0.3.





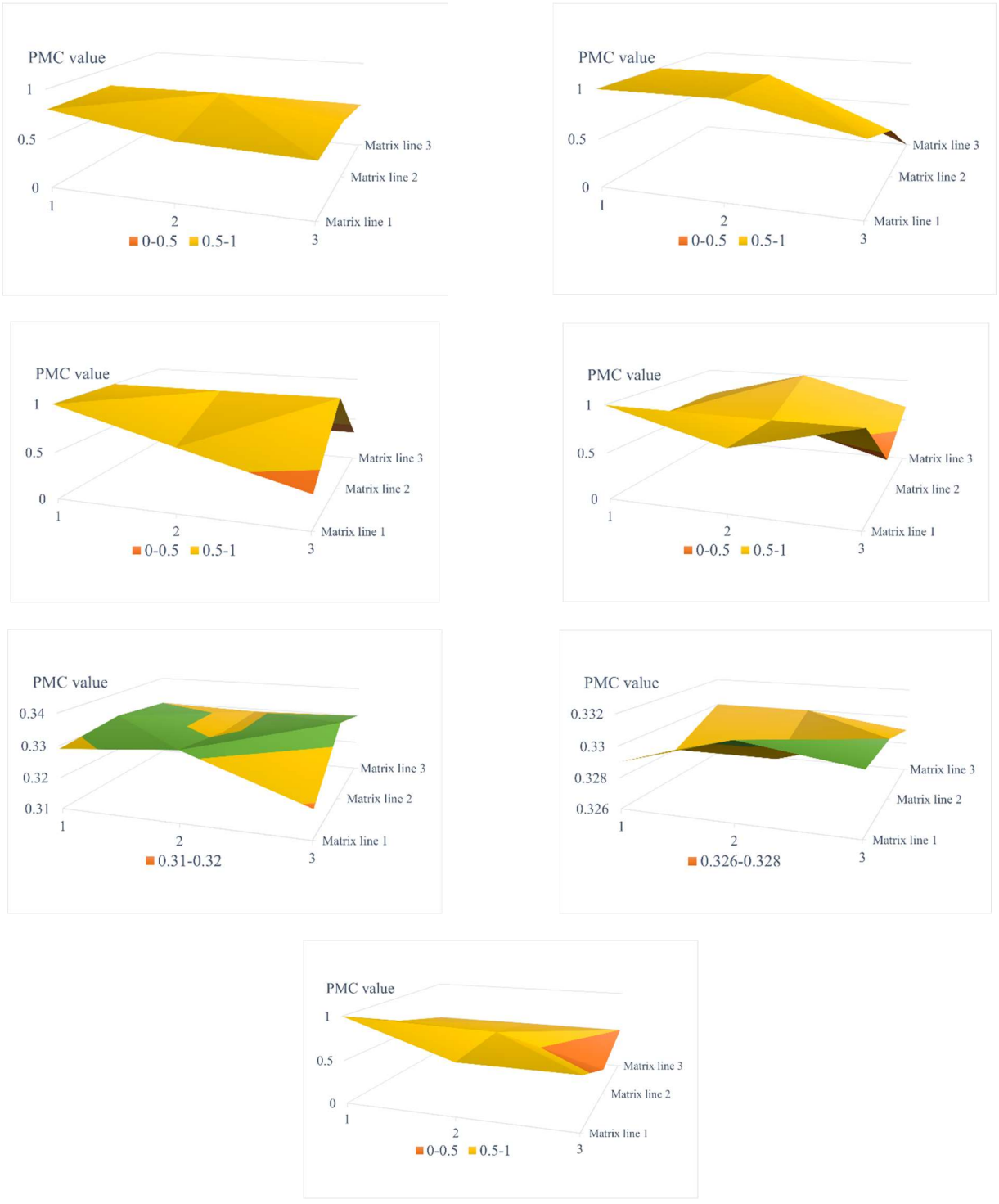


Figure 1: The PMC surface diagram of nine guaranteed rental housing policies

Additionally, to further explore the comparative situation across different policy levels and gain a deeper understanding of the shortcomings and deficiencies of each policy, we compiled a summary table of the average PMC scores for different policy levels based on the PMC score results and Estrada's evaluation criteria for each main variable. The average PMC evaluation results for different policy levels are shown in Table 4. Based on the PMC index results of the nine policies, combined with the presentation of surface plots and radar charts, it was found that the average PMC score for these nine affordable housing support policies was 5.7081, indicating that the policies as a whole are within an acceptable range of consistency. Due to factors such as the frequent use of

self-purchased affordable housing tools, the rich content of the “renting private housing - shared housing” theme, and the comprehensive coverage of the target population, which resulted in higher main variable scores, the evaluation grade for this policy is “good.” However, government-provided public rental housing and employer-provided housing have unique characteristics in single-policy analysis, resulting in lower scores for these two main variables.

The average PMC score for national-level affordable rental housing policies is 6.2701, with a rating of “good.” The three national-level policies are ranked from highest to lowest as A1 > A3 > A2. Policy A1, as a comprehensive guiding policy, has the highest single-item score due to its comprehensive coverage. Policy A2, as an investment-specific policy, lacks comprehensiveness in content, resulting in the lowest PMC index. Guangdong Province's policy evaluation grade is good (PMC average of 6.0573), with the three provincial policies ranked as follows: B1 > B2 > B3. Guangdong's provincial policies primarily utilize environmental and demand-oriented policy tools, with a focus on economic support and land support. Guangzhou's policy has a PMC average of 5.2594, with an evaluation grade of acceptable. The three policies are ranked as follows: C3 > C2 > C1. Guangzhou's municipal policies primarily utilize self-purchased affordable housing tools, placing greater emphasis on administrative and economic support, while the emphasis on land support is somewhat insufficient.

Table 4: The PMC mean evaluation results of different policy levels

Policy hierarchy	National level		Guangdong province		Guangzhou		General assessment	
	PMC mean	Master variable rating	PMC mean	Master variable rating	PMC mean	Master variable rating	PMC mean	Master variable rating
X1	0.7995	Good	0.6714	Acceptability	0.6254	Acceptability	0.6788	0.7984
X2	0.7783	Good	0.8303	Good	0.7704	Good	0.7932	0.7778
X3	0.6662	Acceptability	0.7271	Good	0.6152	Acceptability	0.6607	0.6696
X4	0.9209	Excellence	0.801	Good	0.5211	Acceptability	0.6493	0.9198
X5	0.6704	Acceptability	0.9994	Excellence	0.4958	Discontent	0.6685	0.6685
X6	0.8899	Good	0.5618	Acceptability	0.8397	Good	0.7817	0.8835
X7	0.3322	Discontent	0.3294	Discontent	0.3326	Discontent	0.3312	0.3295
X8	0.3341	Discontent	0.3319	Discontent	0.332	Discontent	0.3242	0.3344
X9	0.8976	Good	0.7779	Good	0.8381	Good	0.8402	0.894
X10	0.8884	Good	0.5659	Acceptability	0.8317	Good	0.7843	0.8887
PMC index	6.2701	—	6.0573	—	5.2594	—	5.7081	—
Policy rating	Good		Good		Acceptability		Acceptability	

III. B. Empirical regression results and analysis

This paper randomly divides some cities in Guangdong Province into treatment groups and control groups. The treatment groups include Guangzhou, Foshan, Zhongshan, Shantou, Jieyang, Zhanjiang, Qingyuan, Chaozhou, Zhaoqing, and other regions. The control groups include Shenzhen, Zhuhai, Huizhou, Meizhou, Jiangmen, Shaoguan, Shanwei, Maoming, Yangjiang, and other regions.

III. B. 1) Parallel Trend Analysis

A critical prerequisite assumption for the use of the double difference method is that the treatment group and control group must exhibit identical trends in the explanatory variable prior to the experiment, meaning they should share the same “time effect” trend. This requires satisfying two types of assumptions: homogeneity and randomness. Only then can the impact of policy implementation on the two groups be assessed. If systematic differences exist between the treatment group and control group, this will significantly skew the assessment results. The average trend of housing rental price indices is shown in Figure 2. It can be observed that prior to September 2020, the price indices of both city groups were in a phase of rapid growth. After the policy was implemented, the trends between the treatment group and the control group began to show significant differences, particularly in the later stages, where the control group experienced a more pronounced decline, while the treatment group showed a gradual decline. Therefore, it can be concluded that the treatment group and control group in this model meet the parallel trend requirement, passing the parallel trend test. This indicates that the results of using the difference-in-differences method to assess the impact of the rent-purchase policy on housing rental prices are reliable.

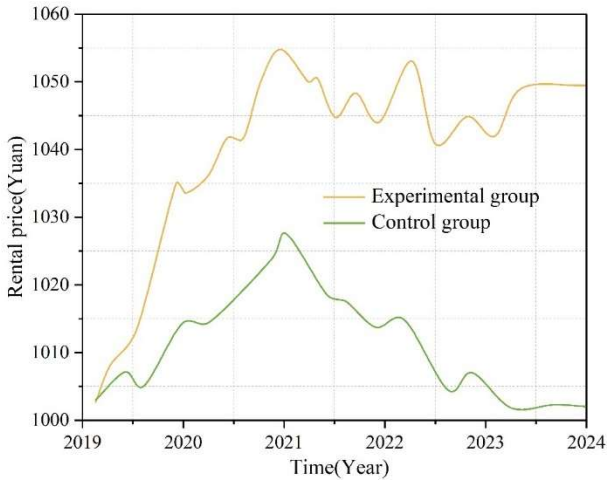


Figure 2: The trend of the average of housing rental index

III. B. 2) PSM Propensity Score Matching

Based on the previous summary of factors influencing housing rental prices and considering the feasibility of data acquisition, this paper ultimately selected the following three matching variables: the Consumer Price Index (CPI) for urban residents, per capita disposable income of urban residents (in ten thousand yuan), the new housing price index (HP) for each city, and a dummy variable (dt) set to 1 after policy implementation and 0 before. Using the psmatch program with a 1:1 nearest neighbor matching method, 17 observation samples were ultimately removed, and the differences in control variables significantly decreased after matching.

The propensity score matching results are shown in Figure 3. In the figure, values above 0 represent the treatment group of cities piloting the rent-purchase policy, while values below 0 represent the control group of cities without such policies. The lines above and below 0 have a large common intersection. Most of the observed values fall within the common range, indicating that the matching results are relatively ideal.

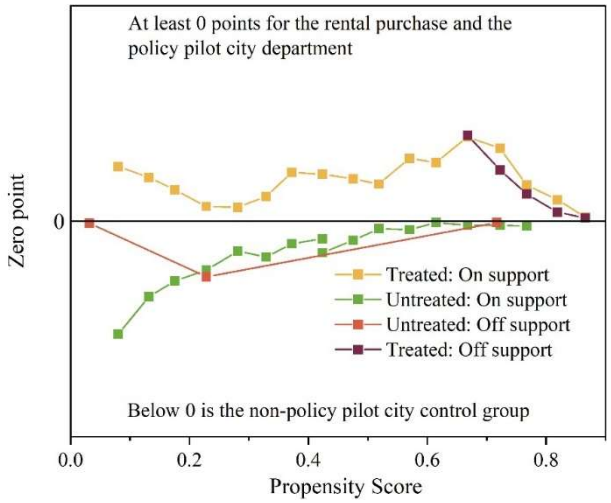


Figure 3: The matching results of the inclined score sample

The results of the post-propensity score matching variable difference analysis are shown in Table 5. The deviations in the urban consumer price index (CPI), per capita disposable income, and new housing price index decreased by 98.4008%, 83.2548%, and 84.6649%, respectively, and the post-matching means were found to have no significant differences. The above data indicate that after optimizing the empirical sample using PSM propensity score matching, there were no significant differences between the treatment group and the control group in the three control variables, and the standardized deviations were significantly reduced. The PSM matching effect was relatively ideal, enabling further quantitative analysis using the difference-in-differences method, thereby ensuring the reliability of the research conclusions.

Table 5: The results of the differential analysis of the variable score match

Variable	Unmatched	Mean		Bias (%)	Reduct |bias| (%)	t	p>|t|	V(T)/ V(C)
	Matched	Processing group	Control group					
Cpi	U	136.05	119.55	108.146	—	21.171	0.0000	1.0959
	M	135.24	135.73	-1.645	98.4008	-0.27	0.7862	0.8707
Income	U	3.0638	3.1264	63.315	—	12.907	0.0000	1.7506
	M	3.1959	3.0242	10.513	83.2548	1.813	0.0685	1.9528
hp	U	101.86	103.03	22.572	—	4.356	0.0000	0.9836
	M	102.25	102.68	3.708	84.6649	0.566	0.5674	1.0283

* p < 0.1, ** p < 0.05, *** p < 0.01

III. B. 3) Double Difference DID Results

To avoid the influence of variables that cannot be observed in different cities, a fixed individual effects model regression was adopted after conducting F-tests and Hausman tests. The summary results of the policy effect test for the rent-purchase policy are shown in Table 6. The results show that the DID regression coefficient is 17.0066 and is significant at the 1% level, indicating that the housing rental price index in the treatment group cities increased by 17.0066 units under the impact of the rent-purchase policy, suggesting that the rent-purchase policy moderately increased the overall housing rental price level in the short term. The regression coefficient for the time effect after policy implementation is -3.0894, which is significant at the 5% level, indicating that the time trend after implementation led to a decrease of 3.0894 units in the housing rental price index.

Regarding the regression results for control variables, the regression coefficient for per capita disposable income of urban residents is 3.3586, which is significant at the 1% level. That is, for every 10,000 yuan increase in disposable income, the housing rental price index increases significantly by 3.3586 units, indicating a positive correlation between the two. As the economy develops, residents' living standards also improve, with more people having greater disposable income and higher housing requirements. Under the encouragement of the “rent-purchase combination” policy, the housing rental market has developed in a more diversified, professionalized, and high-end direction, with rental levels also increasing. The regression coefficient for the new residential sales price index (hp) is -3.7652, which is significant at the 1% level, indicating that the trend in housing sales prices has actually suppressed rental prices.

Table 6: The rental purchase and the policy effect test summary results

Variable	Coefficient	Significance	Standard deviation
Did	17.0066	***	1.9009
Dt	-3.0894	**	1.4706
Cpi	-0.0865		0.1123
Income	3.3586	***	0.1726
Hp	-3.7652	***	0.3204
-cons	1403.0103	***	53.0147
R2	0.1102	—	—

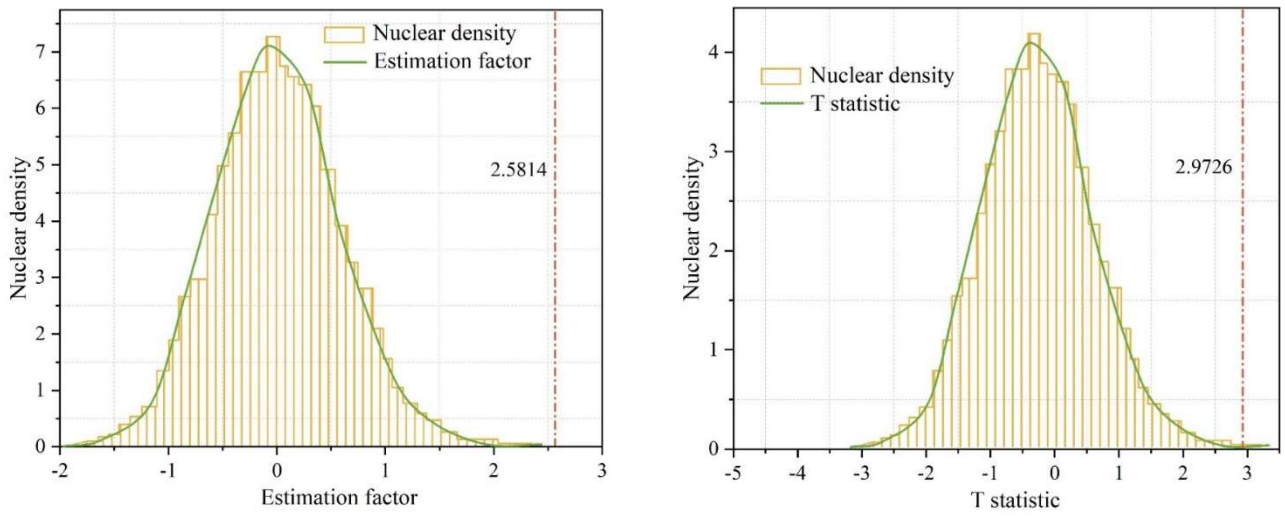
* p < 0.1, ** p < 0.05, *** p < 0.01

III. B. 4) Placebo testing

To test whether the empirical results were due to certain random factors, including unobservable omitted variables, this paper randomly generated an intervention group from the sample and conducted a placebo test. The specific steps are as follows:

A computer randomly generates an intervention group from the entire sample, with the remainder serving as the control group. Regression analysis is then performed to obtain the corresponding estimated values. This study uses Monte Carlo simulation to repeat the above steps 10,000 times and plots the kernel density distributions of the estimated coefficients and their T-statistics. The placebo test results are shown in Figure 4, where (a) and (b) represent the test results for the estimated coefficients and T-statistics, respectively. From the estimated coefficients, the estimated coefficients obtained from random simulation are concentrated around 0 and follow a normal distribution. Meanwhile, the vertical dashed line on the right indicates that the actual estimated coefficient of the model in this paper is 2.5814, which is completely independent of the distribution of the estimated coefficients obtained from random simulation. This means that the estimated coefficients obtained from random simulation are all smaller than those obtained from real data, which is consistent with the expectations of the placebo test.

From the perspective of the T-statistic, the T-statistics of the regression coefficients obtained from random simulations are also concentrated around 0 and follow a normal distribution, with most falling between [-2, 2], failing to pass the significance test. The vertical dashed line on the right indicates that the T-statistic of the actual estimated coefficient of the model in this paper is 2.9726, which is largely independent of the distribution of the T-statistics of the estimated coefficients obtained from random simulations, consistent with the expectations of the placebo test. This indicates that the empirical results of this paper are not due to random or accidental factors, and the positive impact of home purchases on household financial assets is highly robust.



(a)Estimation factor (b)T statistic

Figure 4: Placebo test results

III. C. Empirical Analysis of Housing Preferences

III. C. 1) Spatial heterogeneity analysis

To examine the regional heterogeneity of housing policy and the number of family-owned properties on college students' housing preferences, the sample was divided into two groups based on whether they were from first-tier cities. The coefficients for the number of properties and college students' housing preferences were compared. The regression results for the number of properties on college students' housing preferences are shown in Table 7. First, examining the spatial heterogeneity of family-owned property numbers and housing policies reveals: For college student entrepreneurs from first-tier city families, there is no significant difference in housing preference between students from families owning two properties and those from families owning one property. There are two possible reasons: First, for college student entrepreneurs from first-tier city families, owning one or two properties has little impact on their housing preferences; Second, there is an impact, but it is offset by the “wealth effect” and “crowding-out effect,” so it appears to have no effect. This paper leans toward the latter reason, as there is a significant negative correlation between the housing preference of college student entrepreneurs from households owning three properties and those from households owning one property, indicating that the number of properties does influence the housing preference of college student entrepreneurs.

For college students from families with three properties, the “crowding-out effect” plays a dominant role. Therefore, we can draw the following conclusion: for college students, when they own two properties, the “wealth effect” is stronger in non-first-tier cities; For college students from families with three properties, the “crowding-out effect” is stronger when choosing housing in first-tier cities during their entrepreneurial process. A possible explanation for this result is that first-tier cities have relatively well-developed public infrastructure, high and unstable housing prices, and significant housing price fluctuations, resulting in greater housing risks for college students and a stronger “crowding-out effect.” In non-first-tier cities, housing price fluctuations are smaller, so the “wealth effect” is more prominent.

Table 7: The return of the number of real estate to housing selection preferences

Explained variable	The preference for housing selection of college students' entrepreneurial groups	A first-tier urban family		The non-first-tier urban family	
		Regression coefficient	Error	Regression coefficient	Error
Core interpretation variable	A college student with a two-suite family	0.0549	0.0732	0.0921***	0.0329
	College students with three-suite family	-0.3285*	0.1263	-0.1044	0.0701
	Whether the variable is controlled	Yes		Yes	
	Pseudo R2	0.1461		0.2753	

III. C. 2) Analysis of urban-rural heterogeneity

To investigate the differences in housing preferences between urban and rural areas among college students engaged in entrepreneurship, the sample was divided into two groups based on urban and rural locations. The regression results for the number of properties owned and housing preferences among college students engaged in entrepreneurship are shown in Table 8. It can be observed that, for college students from rural families engaged in entrepreneurship, there is no significant difference in housing preferences regardless of the number of properties owned. The reason may be: compared to rural housing, urban properties appreciate in value more quickly, resulting in a more pronounced “wealth effect”; simultaneously, urban housing prices fluctuate more sharply, exposing college students from urban entrepreneurial families to greater housing risks, thereby highlighting the “crowding-out effect.” From another perspective, due to environmental factors, college students from rural families generally have lower preferences for housing choices when starting businesses, and properties in rural areas are difficult to appreciate in value, so there is no significant housing preference. Therefore, housing policies do not show obvious preferences for housing choices among college students starting businesses in urban and rural areas.

Table 8: The return of the number of real estate to housing selection preferences

Explained variable	The preference for housing selection of college students' entrepreneurial groups	Country		Town	
		Regression coefficient	Error	Regression coefficient	Error
Core interpretation variable	A college student with a two-suite family	0.0237	0.0897	0.0809**	0.0336
	College students with three-suite family	0.0988	0.206	-0.1867***	0.0691
	Whether the variable is controlled	Yes		Yes	
	Pseudo R2	0.1542		0.2035	

IV. Conclusion

This paper employs propensity score matching and a multi-period difference-in-differences model to conduct an empirical analysis of the impact of different housing policies on college students' housing preferences.

(1) College students who have been mobile within the province for a longer period of time are more likely to own their own housing. College students who have moved across provinces to third- and fourth-tier cities are more inclined to choose free housing, while those in first- and second-tier cities prefer to rent housing.

(2) Policy themes are evenly distributed across land, economic, and administrative support. The focus of policy implementation is on external environments and relevant institutions, rather than tenants and individual landlords. The average PMC value for the nine policies is 5.36288, which falls within an acceptable range.

(3) The implementation of the rent-purchase housing policy has increased the average housing rental price index in pilot cities by 17.0066 units, indicating that the rent-purchase policy has moderately raised the overall price level of housing rentals in the short term.

(4) The “crowding-out effect” on housing preferences among college student entrepreneurs in first-tier families is more pronounced, while the “wealth effect” is more pronounced in non-first-tier families. Additionally, the “crowding-out effect” on the proportion of real estate holdings among college student entrepreneurs in first-tier families is greater than in non-first-tier families.

Therefore, it is recommended to optimize the rental housing supply system, improve the household registration system and housing security system, implement policies tailored to specific cities, promote a differentiated housing provident fund system, and achieve equitable access to public services.

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