

Unbalanced Educational Resources under Urban Expansion: Based on the Allocation Characteristics of Educational Resources in Primary and Secondary Schools and Their Testing

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Abstract:

The factual analysis of the allocation characteristics of educational resources in primary and secondary schools shows that the allocation of educational resources in various jurisdictions of the city is obviously unbalanced in terms of human and financial resources. This paper finds that urban expansion in recent years is one of the important reasons leading to the unbalanced development of educational resources, and urban expansion has a significant impact on the unbalanced development of educational resources. Local governments, motivated by political promotion, have limited investment in education in newly-built urban areas, and the structural problems of educational resources allocation in old and new urban areas have not been effectively improved. Superimposed on the initial hierarchical system of school layout in basic education in China, "choosing schools by housing" is an inevitable choice. Housing prices bind educational resources, strengthen the imbalance of educational resources, reduce urban efficiency and hinder the realization of educational equity. We should establish and improve the guarantee mechanism of educational resources investment in newly-built urban areas, implement the enrollment policy of "large school districts" and explore the sharing mechanism of high-quality teachers' resources.

Keywords: *Urban expansion, Unbalanced educational resources, School district, Promotion incentive, Teacher-student ratio, Education spending.*

I. INTRODUCTION

Due to the priority of efficiency, China implements the policy of "key schools", which makes the enrollment opportunities among basic education groups unfair. After the 1980s, the layout adjustment of basic education schools followed the principle of "facilitating students to enter nearby schools" and abolished the "key schools" system. However, the "key schools" exist in name only, or continue to exist

under other names. In order to obtain limited high-quality educational resources, the purchase of "school district housing" has become an inevitable choice for parents to send their children to good schools. The policy of "nearby enrollment" has resulted in the phenomenon of "choosing schools by housing", forming homogeneous crowd gathering and "group division" of social classes [1], and strengthening the "pro-wealth" of educational resources [2].

There are two representative views on the causes and formation mechanism of unbalanced educational resources in academic circles. One is the Maximally Maintained Inequality Hypothesis (MMI Hypothesis), which holds that with the development of industrialization, the supply capacity of educational resources will increase and education will tend to be more equal [3]. However, the objective facts of educational development in many countries deviate from this hypothesis [4-6]. Another representative view is Lucas's "Effective Maintenance of Inequality Hypothesis" (EMI Hypothesis). According to this view, educational inequality includes the difference both in quantity and quality. Children of elite class have more social resources and are more likely to obtain high-quality educational opportunities. Increasing or reaching saturation of educational opportunities does not help eliminate its imbalance [7]. The empirical research results of many literatures support EMI hypothesis: the expansion of education scale has not led to a significant decline in educational inequality as expected. Educational differences within cities are becoming more and more hidden, and the social mobility of ordinary members of society to elite status has become increasingly difficult [8], and the educational "gap" between different groups has deepened as a result of the "growth differentiation" of family income [9].

Since the reform and opening up, China has experienced a rapid urbanization. The number of cities has increased from 226 in 1981 to 679 in 2019, and the built-up area has grown at an average annual rate of 4.88%. However, in the process of urban expansion, due to limited financial resources, investment in education cannot be "realized" into economic growth in the short term. Local officials are more inclined to allocate more resources to public goods with high visibility, "emphasizing infrastructure investment, neglecting science, education, culture and health" [10]. Although the scale of supporting construction of public services has expanded, the basic education resources in new urban areas have not kept up with the population growth rate. High-quality educational resources are highly concentrated in space, and the gap in resource allocation between urban areas continues to increase [11]. The imbalanced distribution of urban education resources leads to the increasing pursuit of "school district housing" by parents. The capitalization of education intensifies the market exclusion of the socially disadvantaged, and "school district housing" has gradually become synonymous with rich areas. Urban basic education is faced with more serious problem of unequal educational opportunities.

In the process of urban expansion, the role of education in social mobility should be enhanced accordingly. The allocation of educational resources deviates from the optimal state. On the micro level, it will cause the utility loss of residents' enjoyment of education, and on the macro level, it will reduce urban efficiency, which will hinder the realization of education equity. Does urban expansion significantly lead to unequal allocation of educational resources? What is its generation logic? What should be done to promote education equity in the process of urbanization and what is more effective? Few literature can give

sufficient empirical and strong evidence, which based on the basic characteristics of urban development in China. Therefore, it is of practical significance to objectively describe the characteristics and facts of the allocation of educational resources within cities in China during the process of urban expansion, and to scientifically and quantitatively study whether urban expansion leads to the balanced allocation of educational resources, so as to realize the balanced development of high-quality education in China and improve the social equity security system.

The possible contribution of this paper lies in: First, under the background of accelerating urbanization in China, this paper focuses on the unbalanced allocation of educational resources within cities in China, and by selecting the capital cities and 4 municipalities directly under the central government (Beijing, Shanghai, Tianjin and Chongqing), manual query administrative education resource data within the jurisdiction of the cities, to examine the influence of urban expansion on the imbalance of educational resources allocation within the cities. Second, based on the characteristic fact that the allocation of educational resources in China's cities is unbalanced, combined with the results of empirical analysis, from the local government level and the formation of the system of educational resources distribution in China, this paper further discusses the generative logic of why urban expansion leads to the balanced allocation of educational resources in urban areas, and points out its possible negative effects, which can provide strong evidence for formulating win-win policies to achieve rapid and healthy urban development and balanced regional development of education.

The rest of this paper is arranged as follows: The second part is characteristic facts. The third part is the model and data description. The fourth part is demonstration and analysis, and the fifth part makes further analysis based on reality. The last part is the conclusion of this paper and puts forward specific policy suggestions.

II. CHARACTERISTIC FACTS

2.1 The Basic Fact of Balanced Allocation of Educational Resources in China

Obtaining high-quality education in the early stage has a cumulative advantage effect, which has a decisive impact on the path diversion of follow-up education. Therefore, in order to describe the fact of unbalanced educational resources in China, this paper only focuses on the unbalanced allocation of resources in compulsory education, that is, primary and secondary schools. Teachers are "soft power" in the allocation of educational resources, so the teacher-student ratio of primary and secondary schools is selected to measure the manpower allocation of educational resources. The allocation of educational resources also has a great relationship with the financial resources of the jurisdiction, so the education expenditure in the general public budget is selected to measure the financial allocation of educational resources. The Gini coefficient, the ratio of 90% percentile and 10% percentile (p90/p10), the ratio of 75% percentile and 25% percentile (p75/p25) and so on are mainly selected to describe the disequilibrium. The calculation results are directly realized by the stata software.

Measuring the disequilibrium degree of education allocation among cities in China (Table I), the results show that the gini coefficient of education expenditure rises in the fluctuation, from 0.331 in 2010 to 0.295 in 2013, and then rebound to 0.333 in 2019; p90/p10 reaches a high of 5.496 and low of 3.689, and the dispersion degree of education expenditure among cities is high, which is related to the regional gap of economic development level in the eastern, central and western regions. The p75/p25 measurement index excludes the influence of the extreme value of 50% samples and measures the unit difference of the middle 50% samples. Its value is also above 1.5, reaching a high of 2.124, which also shows the characteristic of rebounding after falling back.

Compared with the dispersion degree of education expenditure, the dispersion degree of primary school teacher-student ratio and middle school teacher-student ratio is generally lower than education expenditure in the same period. The setting of "threshold" has promoted the qualification of running conditions of compulsory education schools. The unequal allocation of teacher resources in primary school is higher than that in middle schools.

TABLE I. Measurement on the disequilibrium of educational resources in provincial capitals and municipalities directly under the Central Government from 2010 to 2019

Year	Expenditure on education			Primary school teacher-student ratio (1 for pupil)			Teacher-student ratio in secondary schools (1 for student)		
	Gini coefficient	p75/p25	p90/p10	Gini coefficient	p75/p25	p90/p10	Gini coefficient	p75/p25	p90/p10
2010	0.331	1.737	4.327	0.150	1.193	3.501	0.086	1.247	1.497
2011	0.301	1.588	4.492	0.117	1.488	1.705	0.087	1.213	1.506
2012	0.322	1.849	5.496	0.110	1.311	1.914	0.086	1.222	1.465
2013	0.295	1.619	3.847	0.123	1.370	2.033	0.092	1.228	1.584
2014	0.299	1.589	3.912	0.149	1.422	2.566	0.105	1.299	1.612
2015	0.305	1.527	4.327	0.141	1.481	1.962	0.137	1.316	1.751
2016	0.325	1.992	4.315	0.126	1.389	1.848	0.112	1.255	1.579
2017	0.338	2.124	4.186	0.099	1.424	1.486	0.109	1.249	1.521
2018	0.316	1.696	3.689	0.086	1.326	1.467	0.112	1.248	1.506
2019	0.333	1.874	3.783	0.074	1.265	1.425	0.098	1.243	1.423

Note: There are 30 provincial capitals and municipalities directly under the Central Government in the table, excluding Hong Kong, Macao and Taiwan; Lhasa is also excluded due to lack of data; The variable values of education expenditure and teacher-student ratio are collected according to the statistical yearbooks of each city; p90/p10 and p75/p25 represent percentile ratios, respectively.

2.2 The Basic Characteristics of Unbalanced Allocation of Educational Resources within Cities

Since 2010, all provincial capitals in China have been expanding. In order to describe the factual characteristics of unbalanced allocation of educational resources in cities, this paper focuses on Xi 'an, Chengdu and Jinan, and Hangzhou is selected as the representative of the new first-tier cities. The above-mentioned cities are located in the east, middle and west of China respectively. The scale of the cities includes megacities, Type I and Type II big cities, etc. They are well representative and can comprehensively present the basic fact of unbalanced allocation of educational resources within cities. Limited by space, only Gini coefficient and p90/p10 are sorted out, and the measurement results are shown

in Table II.

As shown in Table II, due to the city's own economic development level, the dispersion degree of education expenditure in the cities' districts is lower than that between the cities over the years. But the Gini coefficient of education expenditure in each city basically shows a slight fluctuation upward trend. Compared with 2010, the gap in education expenditure has not dropped in recent years. Among them, Xi'an and Hangzhou show higher imbalance. Xi'an builds the city by developing development zone, which is a typical method of urban development. Its built-up area has expanded from 326.53 square kilometers in 2010 to 700.69 square kilometers in 2019, with a growth rate of about 115%, having 11 administrative districts. Due to the rapid growth of built-up areas, Gaoling District and Huyi District in the outer suburbs lag behind the old city in terms of economic development level and supply of supporting public goods. The difference in education expenditure between jurisdictions is obvious, with the p90/p10 ratio of education expenditure in some years reaching more than 3 times. The dispersion degree of teacher-student ratio is relatively smaller than that of education expenditure, which is related to Xi'an's implementation of the "Large School District Management System" in 2012 and the "Famous School Plus" project in 2017. However, around 2014, when Xi Xian New Area and Gaoling District were established, the measurement index of educational resources allocation imbalance showed a large increase. As a new first-tier city, Hangzhou is expanding rapidly. Compared with 2010, the built-up area of Hangzhou increased by 235.87 square kilometers in 2019, with an average annual growth rate of 5.15%. In addition, the population of Hangzhou was also increasing significantly. In 2019, the total resident population reached 10.36 million, with increase of 5.65%. Since the "Thirteenth Five-Year Plan", although the supply of compulsory education resources in Hangzhou has been increasing, the financial allocation gap of education expenditure among jurisdictions has shown certain differences, with p90/p10 peaking at 3.597.

Judging from the dispersion degree of teacher-student ratio in primary schools, in the same period, the Gini coefficient in each city is generally higher than that between cities, and the difference degree of teacher allocation within cities is higher than that between cities. Although the p90/p10 value has dropped year by year, it is basically about 1.5 times, and the balanced development level of compulsory education within cities needs to be further improved.

TABLE II. Measurement of unbalanced allocation of educational resources in representative cities

City	Variable	Measure index	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Xi'an	Education Expenditure	Gini coefficient	0.117	0.187	0.178	0.198	0.191	0.208	0.212	0.201	0.246	0.222
		p90/p10	2.100	3.063	2.878	3.489	3.233	2.873	2.928	2.391	2.697	2.662
	Teacher-student ratio	Gini coefficient	0.150	0.117	0.110	0.123	0.149	0.141	0.126	0.099	0.086	0.074
		p90/p10	2.501	1.705	1.914	2.033	2.566	1.962	1.848	1.486	1.467	1.425
Chengdu	Education Expenditure	Gini coefficient	0.142	0.145	0.273	0.165	0.134	0.227	0.244	0.225	0.147	0.147
		p90/p10	2.660	2.624	2.680	2.974	2.202	3.429	2.617	2.368	1.894	1.740
	Teacher-student ratio	Gini coefficient	0.068	0.091	0.102	0.088	0.134	0.097	0.109	0.053	0.064	0.055
		p90/p10	1.422	1.773	1.806	1.714	2.368	1.748	1.509	1.208	1.415	1.153
Jinan	Education	Gini coefficient	0.142	0.155	0.160	0.168	0.169	0.166	0.177	0.153	0.156	0.228

	Expenditure	P90/P10	2.018	2.043	2.031	2.102	2.070	2.142	2.339	2.051	2.125	3.363
	Teacher-student ratio	Gini coefficient	0.028	0.093	0.135	0.030	0.049	0.072	0.067	0.080	0.053	0.044
		p90/p10	1.187	1.697	2.140	1.194	1.300	1.534	1.469	1.486	1.408	1.251
Hangzhou	Education Expenditure	Gini coefficient	0.215	0.204	0.177	0.200	0.213	0.186	0.219	0.233	0.239	0.260
		p90/p10	2.866	3.083	2.460	2.816	3.149	2.989	3.597	3.131	3.137	3.173
	Teacher-student ratio	Gini coefficient	0.140	0.117	0.079	0.084	0.091	0.072	0.062	0.115	0.083	0.063
		p90/p10	2.216	1.954	1.556	1.502	1.520	1.416	1.690	1.687	1.483	1.405

Note: The teacher-student ratio in the table refers to the teacher-student ratio in primary schools (1 for students); The variable values of education expenditure and teacher-student ratio are collected according to the statistical yearbooks of each city and the statistical bulletins of each jurisdiction.

In order to depict the layout characteristics of educational resources in the process of urban expansion, this paper further captures the point data of the latitude and longitude of primary and secondary schools in Xi'an, Chengdu, Jinan and Hangzhou (different campuses of the same school are counted separately) by Google Earth and Baidu map. Relying on GIS technology, the layout of campuses in each district is visualized to get a glimpse of the spatial layout characteristics of urban educational resources. Judging from the distribution of primary and secondary schools in each cities, the spatial layout of primary and secondary schools shows a balance. With the expansion of the urban area, the agglomeration form of urban core area has not been moderately dispersed, and the "core-edge" distribution characteristics are obvious. Due to space constraints, Figure 1 only shows the spatial distribution of primary and secondary schools in Hangzhou and Jinan.

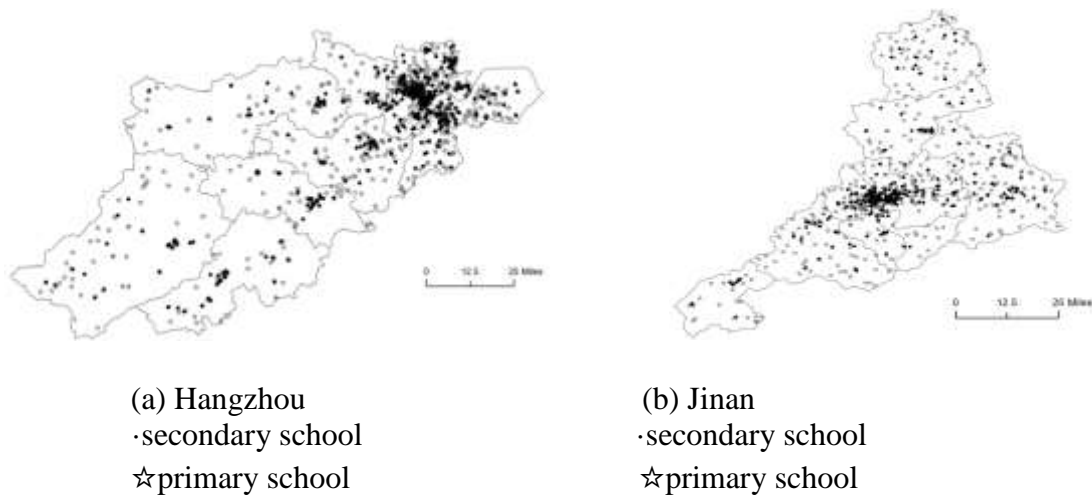


Figure 1: Spatial distribution of primary and secondary schools in Hangzhou and Jinan in 2019

According to the factual characteristics of various aspects, in the process of urban expansion, the allocation of urban educational resources does continue to show imbalance. However, this paper constructs a model for further test and analysis whether urban expansion significantly leads to the imbalance of educational resources.

III. MODEL AND DATA

3.1 Construction of Measurement Model

In order to investigate the relationship between urban expansion and the imbalance of educational resources, this paper sets the following model:

$$disequilibrium_{i,t} = \beta_0 + \beta_1 \times urban\ expand_{i,t} + controls_{i,t} + \varpi_i + \lambda_t + \mu_{i,t} \quad (1)$$

$disequilibrium_{i,t}$ is the explained variable, reflecting the imbalance of educational resources, namely, the Mcloone index of the teacher-student ratio of primary schools in the t year of the i city. $Urbanexpand_{i,t}$ is the index of urban expansion, that is, the speed of urban expansion in the t year of the i city. ϖ_i represents individual fixation effect, λ_t represents time fixation effect and $\mu_{i,t}$ represents random interference term. As a control variable, $controls_{i,t}$ represents a series of variables that affect the imbalance of educational resources.

3.2 Definition of Core Indicators

The unbalance of educational resources (*disequilibrium*). The imbalance of educational resources defined in this paper mainly refers to the measurement of the imbalance of compulsory education, and the measurement index is Mcloone index. Mcloone index measures the difference of 50% observation units below the median. It is the ratio of the sum of data below the median to the sum of these data at the median level. It can measure the gap between weak educational resources and the middle level educational resources, and depict the unbalanced degree of regional educational resources [12]. The value range of Mcloone index ranges from 0 to 1. If the value is close to 0, the difference between the regions below the median and the median is greater, that means the degree of disequilibrium is increased. Generally, 0.95 is considered ideal. As mentioned above, teachers are the "soft power" of compulsory education resource allocation, and after years of construction and development, the gap in hardware of compulsory education schools in cities has been small, and when parents choose a school, they mainly focus on teacher resources. Therefore, this paper calculates Mcloone index based on the teacher-student ratio data of primary schools in cities to measure the imbalance of urban education resource allocation. According to the annual administrative divisions of each city, we manually consult the statistical yearbooks of various cities, the statistical yearbooks of urban education and the bulletins of national economic and social development of various jurisdictions over the years, etc., and summarize the data of the number of primary school students and full-time primary school teachers in various jurisdictions of various cities from 2011 to 2019, among which Lhasa is not included in the observation unit due to the lack of data.

Urban expansion (*urbanexpand*). The urban expansion defined in this paper is measured by the growth rate of built-up areas. Built-up areas refer to areas where municipal public facilities and public facilities are basically available and centralized. The statistical indicator reflects the internal structure of urban land, correspond well to various social and economic indicators, which has been widely used. The area data of built-up areas in cities from 2011 to 2019 comes from the Statistical Yearbook of Urban Construction.

Control variables (*controls*). In order to control the influence of urban characteristics on the distribution of educational resources, a group of urban variables are selected, mainly including: (1) *Inhouse*. Drawing lessons from the international common measurement index, the average selling price of residential commercial housing/GDP Per Capita is used to measure the pressure of residents on buying houses, and the logarithm is taken. The higher the ratio, the lower the purchasing power of residents. (2) The proportion of employees in the tertiary industry (*employ*). Measuring the development of service industry in provincial capitals during urbanization. (3) Education expenditure (*Inedu*), measured by the ratio of urban education expenditure to the general public budget expenditure of the city. As the variable to be explained in this paper is teacher/student ratio, while the educational resources also involve financial and material resources, so it is controlled. (4) Population density (*Indensity*), expressed by the number of permanent residents per square kilometer and taken as logarithm. Large population density can reflect the scale effect of public goods and service supply and has a greater impact on the balanced development of public services. (5) Industrial structure (*industrial*), measured by the proportion of added value of secondary and tertiary industries in GDP. All the data mentioned above come from the statistical yearbooks of cities or bulletins of national economic and social development. The descriptive statistical results of variables are shown in Table III.

TABLE III. Descriptive statistics of variables

Variable Name	Variable interpretation	Sample size	Mean value	Standard deviation	Minimum value	Maximum value
<i>disequilibrium</i>	Mloone index of teacher-student ratio in primary schools (%)	270	89.0066	6.4625	65.0964	99.7553
<i>urbanexpand</i>	Growth rate of built-up area (%)	270	5.3765	7.4109	-11.2209	47.4873
<i>Inhouse</i>	The average selling price of residential commercial housing/GDP per capita takes logarithm	270	-11.4258	0.3155	-12.4297	-10.6049
<i>employ</i>	Proportion of Employees in Tertiary Industry (%)	270	55.2185	9.1037	37.2000	83.1000
<i>Inedu</i>	The proportion of education expenditure is logarithmic	270	2.7476	0.1643	2.2586	3.1591
<i>Indensity</i>	The number of permanent residents per square kilometer is taken as logarithm	270	8.2381	0.6635	6.4567	9.6195
<i>industrial</i>	Proportion of added value of secondary and tertiary industries in GDP (%)	270	95.8852	2.9545	82.3000	99.7000

IV. DEMONSTRATION AND ANALYSIS

4.1 Basic Estimation Results

The empirical results in column (1) of Table IV show that the estimation coefficient is significantly negative at a significant level of 10%. By continuously controlling other influencing factors and controlling the urban individual effect and time effect, the estimation results are shown in columns (2)-(6) of Table IV, and the empirical results are consistent. The estimation results in Table IV show that, based on the fact of the allocation of educational resources in China, urban expansion has significantly expanded the imbalance of educational resources, and this influence is still significant when a series of characteristic variables of the city are controlled.

TABLE IV. Basic estimation results of equation (1)

<i>disequilibrium</i>	(1)	(2)	(3)	(4)	(5)	(6)
<i>urbanexpand</i>	-0.2275* (0.1197)	-0.2501** (0.1175)	-0.2921*** (0.1165)	-0.2963** (0.1167)	-0.2909** (0.1168)	-0.2919** (0.1167)
<i>lnhouse</i>		-9.5686*** (2.7589)	-6.2194** (2.9344)	-5.3147* (3.1281)	-5.539* (3.1350)	-5.2903* (3.1389)
<i>employ</i>			-0.3099*** (0.1024)	-0.3261*** (0.1043)	-0.3318*** (0.1044)	-0.3515*** (0.1056)
<i>lnedu</i>				-4.6646 (5.5650)	-3.8368 (5.6205)	-2.8322 (5.6765)
<i>Indensity</i>					-1.3671 (1.3115)	-1.2569 (1.3135)
<i>industrial</i>						0.3629 (0.2996)
Constant term	88.2521*** (1.0943)	-20.9557 (31.5062)	34.6545 (36.067)	58.7193 (46.1146)	65.4313 (46.5546)	30.9034 (54.5559)
Individual effect	Control	Control	Control	Control	Control	Control
Time effect	Control	Control	Control	Control	Control	Control
<i>F</i>	3.62*	7.90***	8.48***	6.53***	5.44***	4.79***
<i>R</i> ²	0.0133	0.0558	0.0873	0.0897	0.0934	0.0984

Note: The standard deviation is in parentheses, and ***, ** and * indicate 1%, 5% and 10% significance levels respectively. The same below.

The control variable *lnhouse* has a significant negative impact on the unbalanced degree of educational resources. This effect is consistent with the introduction of other control variables, which indicates that with the increasing of the ratio of house price to income, the *Mcloone* index continues to decline, that is, the unbalanced distribution of educational resources is increasing. Although the control variable *lnedu* did not pass the significance test, the regression coefficients were all negative. Combined with the previous characteristic fact analysis, it can be seen that with the expansion of the city, the unequal distribution of financial resources within the city leads to the decline of the *Mcloone index* due to the slight rise of educational expenditure within the city. The regression coefficients of the control variable *employee* are consistently significantly negative, namely, this variable leads to the decline of *Mcloone index*. This shows that the proportion of employees in the tertiary industry has increased and the urban industrial system is developed and can provide sufficient employment opportunities for the inflow population. However, the floating population is more concentrated in the newly-built urban areas, which makes a greater gap between the supply and demand of educational resources in the new urban areas, and aggravates the unbalanced allocation of educational resources among various jurisdictions of the city. The regression coefficient of *Indensity* is consistently negative, indicating that with the increase of urban population density, *Mcloone index* decreases and the increase of urban population density does not alleviate the imbalance of educational resources. The control variable *Industrial* has a positive impact on *Mcloone index*, which shows that the optimization of urban industrial structure promotes the quality and efficiency of economic development, improves the economic level, relieves the financial pressure of educational resources to a certain extent, and improves the imbalance of educational resources allocation.

4.2 Robustness Test

Replace the explained variable. In order to test the robustness of the regression results, the Mloone index of teacher-student ratio in middle school is used to replace the Mloone index of teacher-student ratio in primary school, and other control variables and model structure remain unchanged for regression. The empirical results show that the urbanexpand coefficient is significantly negative at 5% significance level. After controlling other influencing factors, individual effect and time effect, columns (2)-(6) of Table V still maintain a high degree of consistency. Among them, at the significance level of 5% or 1%, the estimation coefficient of the control variable Lnhouse is also consistently significantly negative.

Table V. Robustness test results of substituted explained variables

<i>disequilibrium</i>	(1)	(2)	(3)	(4)	(5)	(6)
<i>urbanexpand</i>	-0.2499** (0.1176)	-0.2716** (0.1155)	-0.2901** (0.1162)	-0.2915** (0.1165)	-0.2880** (0.1167)	-0.2886** (0.1168)
<i>lnhouse</i>		-9.2552*** (2.7133)	-7.7836*** (2.9254)	-7.4757** (3.1221)	-7.6237** (3.1327)	-7.4724** (3.1421)
<i>employ</i>			-0.1362 (0.1021)	-0.1417 (0.1041)	-0.1455 (0.1043)	-0.1574 (0.1057)
<i>lnedu</i>				-1.5877 (5.5544)	-1.0414 (5.6163)	-0.4303 (5.6721)
<i>lndensity</i>					-0.9022 (1.3105)	-0.8352 (1.3148)
<i>industrial</i>						0.2207 (0.2999)
Constant term	88.0235*** (1.3407)	-78.6888*** (44.1208)	-23.2562 (44.5155)	-31.8294 (60.9214)	-33.0748 (62.0893)	-26.9856 (65.0926)
Individual effect	Control	Control	Control	Control	Control	Control
Time effect	Control	Control	Control	Control	Control	Control
<i>F</i>	4.78**	9.68***	9.63***	4.54***	7.67***	6.39***
<i>R</i> ²	0.0210	0.0802	0.1491	0.1491	0.0659	0.1495

Eliminate extreme values of samples. Since 2011, the built-up areas of Beijing, Shanghai, Hohhot and Taiyuan have remained basically unchanged. Therefore, excluding these sample data, other variables and model structure remain unchanged. The estimation results are shown in Table VI. The regression coefficients of urbanexpand in Table VI are consistently significantly negative. The columns (2)-(6) still maintain a high degree of consistency by gradually controlling other influencing factors and controlling urban individual effects and time effects. The estimation results show that the empirical results are robust after overcoming the influence of sample extremes.

Table VI. Robustness test results of excluding some samples

<i>disequilibrium</i>	(1)	(2)	(3)	(4)	(5)	(6)
<i>urbanexpand</i>	-0.3369** (0.1542)	-0.3222** (0.1498)	-0.3724** (0.1449)	-0.3689** (0.1462)	-0.3694** (0.1467)	-0.3669** (0.1472)
<i>lnhouse</i>		-14.5574*** (3.8509)	-12.1666*** (3.7556)	-12.5705*** (4.2409)	-12.5934*** (4.2556)	-12.9859*** (4.4390)
<i>employ</i>			-0.5105*** (0.1209)	-0.5090*** (0.1214)	-0.5099*** (0.1219)	-0.5080*** (0.1223)
<i>lnedu</i>				-1.3971 (6.7607)	-1.2741 (6.8666)	-1.2171 (6.8831)
<i>Indensity</i>					0.1663 (1.5043)	0.1775 (1.5077)
<i>industrial</i>						-0.1112 (0.3494)
Constant term	88.0235*** (1.3407)	-78.6888*** (44.1208)	-23.2562 (44.5155)	-31.8294 (60.9214)	-33.0748 (62.0893)	-26.9856 (65.0926)
Individual effect	Control	Control	Control	Control	Control	Control
Time effect	Control	Control	Control	Control	Control	Control
<i>F</i>	4.78**	9.68***	9.63***	4.54***	7.67***	6.39***
<i>R</i> ²	0.0210	0.0802	0.1491	0.1491	0.0659	0.1495

Endogeneity problem. Although some control variables are added to the benchmark regression model (1), and time factors and individual factors are controlled, there are inevitably missing variables, resulting in endogenous problems. In the test of endogenous explanatory variables, the traditional Hausmann test is not valid under heteroscedasticity, so the heteroscedasticity robust DWH test is adopted, and its P value is 0.0798. Under the significance level of 10%, urbanexpand can be considered as an endogenous explanatory variable. Considering that the per capita road area will increase in the process of urban expansion, and the per capita road area can not directly affect the allocation of educational resources to meet the exogenous conditions. Therefore, the per capita road area of the city is selected as the tool variable. The estimated results are shown in Table VII. According to Table VII, it is found that the estimation results of instrumental variables are consistent with the benchmark regression results, and the influence of core explanatory variables is significantly negative and the degree of influence is strengthened. The estimation results provide another evidence for the robustness of the empirical results.

Table VII. GMM regression results of instrumental variables

<i>disequilibrium</i>	(1)	(2)	(3)	(4)	(5)	(6)
<i>urbanexpand</i>	-3.1887** (1.4676)	-2.8877** (1.2947)	-1.5152* (0.7747)	-1.6675* (0.9078)	-1.8352* (1.0167)	-1.8041* (0.9897)
<i>lnhouse</i>		-12.0871** (5.4392)	-4.1321 (3.3035)	-3.0016 (3.6495)	-3.1488 (3.8318)	-3.0281 (3.7858)
<i>employ</i>			-0.4111***	-0.4751***	-0.4988***	-0.5129***

			(0.1167)	(0.1478)	(0.1579)	(0.1584)
<i>lnedu</i>				-8.1916 (7.3056)	-8.4632 (7.9551)	-7.7945 (7.7786)
<i>Indensity</i>					-0.4046 (1.4766)	-0.2799 (1.4873)
<i>industrial</i>						0.2388 (0.2797)
Constant term	104.2794*** (7.1976)	-35.5059 (59.6750)	71.2390* (36.6967)	110.8737** (55.4318)	115.4561** (57.6309)	91.6833 (63.0666)
Individual effect	Control	Control	Control	Control	Control	Control
Time effect	Control	Control	Control	Control	Control	Control
Wald chi2	4.72**	6.76**	12.68***	11.65**	14.21**	14.93**

V. FURTHER ANALYZE IN COMBINATION WITH REALITY

Since the reform and opening up, the agglomeration effect and scale effect of urbanization have played an irreplaceable role in China's economic growth. During the "14th Five-Year Plan" period, to build a new development pattern, it is still necessary to adhere to the urbanization as the carrier and grasp for structural adjustment. Therefore, it is urgent to solve the problems and contradictions accumulated in the middle and early stages of rapid urbanization development, alleviate the negative effects caused by urban expansion, improve the quality of urbanization and realize education equity. The empirical part of this paper has fully verified the significant impact of urban expansion on the imbalance of educational resources. Why does urban expansion lead to the imbalance of educational resources? Only by clarifying the logic behind it and its adverse consequences can policies and measures be targeted and effective. Combined with China's reality, this paper further interprets the generating logic and adverse consequences of unbalanced allocation of educational resources.

First, under the promotion incentive, the local government has limited investment in education in newly-built urban areas during the "city-building movement", and the structural problems in the allocation of educational resources in new and old urban areas have not been effectively improved. Promotion tournament is the common result of economic decentralization and political centralization. Economic decentralization is reflected in the fact that local governments can influence local economic development, while political centralization is reflected in the fact that the central government can guide local governments to implement behaviors conducive to economic growth through promotion incentives [13]. Under economic decentralization, local governments are forced by financial pressure to look for resources other than formal finance. Because urban expansion can not only bring industrial tax, but also increase land transfer income, local government officials have a strong motivation to promote urban expansion. The continuous "city-building movement" has significantly promoted the expansion of urban built-up areas in China, which is manifested as "land urbanization" in the middle and early stages of urbanization. Under political centralization, due to the low weight of public goods such as education, medical care and environmental protection in performance evaluation, local officials will naturally tend to allocate more resources to public goods with high visibility [10]. The structural contradiction between the old city (which

were originally rich in educational resources) and the newly-built city is prominent.

Second, the hierarchical system of the initial layout of basic education schools leads to the objective fact that educational resources are unbalanced, and then the policy of "entering schools nearby" forms the phenomenon of "choosing schools by housing". Housing prices bind educational resources, which strengthen the imbalance of educational resources. In the early days of the founding of China, based on the priority of efficiency, the state set up a number of key primary and secondary schools. These "key schools" have high-level teachers and abundant education funds. With the continuous improving hardware of compulsory education schools in China, students and parents are eager to chase famous teachers, so buying "school district houses" has become an inevitable choice for parents. Families with good social and economic resources have greater advantages in buying houses. Family resources can be converted into educational opportunities for children more easily and efficiently than ever before [14]. Families with similar family capital gather in living space, famous schools, famous teachers and "Niu Wa" achieve each other, forming Matthew effect, and education inequality is transmitted between generations. The speculation of school district housing not only worsens the demands of people's livelihood, but also violates the equalization of compulsory education. The empirical results of this paper also show that the control variable housing price-income ratio has a significant impact on the imbalance of educational resources, and the regression coefficient reflects that the higher the housing price-income ratio is, the higher the imbalance of educational resources allocation is.

Based on the above analysis, it can be seen that under the urban expansion, promotion incentives have not effectively improved the structural problems of educational resources allocation in old and new urban areas. And superimposing the current education system, it forces residents to "choose schools by housing" and chase "school district housing". Housing prices kidnap educational resources, and the two push each other up. The high price of "school district housing" doubles the burden of family education and increases the living pressure of urban residents, especially ordinary working class. "School district housing" forms the "grouping" and solidification of social classes, which also leads to the anxiety of family education in urban middle class. In order to keep children from losing at the starting line, "chicken baby" has become a hot word in current education, and the chaos of off-campus training is also contributing to the spread of educational anxiety. The Heavy burden of education and class solidification are not conducive to the stability and expansion of the middle class, and then may become obstacles to common prosperity. The educational ecology under the urban expansion needs systematic governance, and the efficiency and fairness of education should go hand in hand.

VI. CONCLUSIONS

The results show that the allocation of educational resources in Chinese cities presents the basic facts of unbalanced human and financial allocation. That controlling the urban characteristic variables one by one, the speed of urban expansion has a significant negative impact on the imbalance of educational resources. With the increase of urban expansion speed, the Mloone index decreases significantly, indicating that the imbalance of educational resources allocation in urban areas increases, and the empirical

results are robust. The logic of unbalanced educational resources caused by urban expansion lies in: In the process of urban expansion, for the promotion incentives, local governments lack the motivation to invest in education in the short term, resulting in the mismatch of educational resources allocation space. However, the initial school layout of basic education in China formed a hierarchical system, and the later policy of "entering the school nearby" formed the phenomenon of "choosing schools by housing". Housing prices bundled educational resources, which strengthened the imbalance of resources and led to unfair education. Based on this study, the following suggestions are put forward: Firstly, increase the supply of educational resources, establish and improve the guarantee mechanism of educational resources investment, and achieve a win-win situation between the rapid and healthy development of cities and the balanced development of education. Secondly, strengthen the implementation of the "large school districts" enrollment policy of "multi-school division", and implement relatively nearby enrollment. Thirdly, improve the effectiveness of collectivization, and expand the inter-school diffusion and derivation of high-quality educational resources.

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