Research article

Analysis of the equalization effect of basic public services in new-type urbanization—A case study of county regions in Guizhou, China

Yuzhu Meng [a], Zhenlong Hao [a], Shu Shang [b],*

[a] School of Applied Economics, Guizhou University of Finance and Economics, Guiyang, Guizhou, 550025, China
[b] School of Economics and Management, Dalian University of Technology, Dalian, Liaoning, 116024, China

A B S T R A C T

The equalization of basic public services and the advancement of new-type urbanization are pivotal concerns within the framework of regional economic theory and national developmental strategies. Nonetheless, China's current landscape of basic public service equalization falls short of desired levels, while the aspiration for high-quality development embedded in new-type urbanization initiatives remains largely aspirational, lacking robust implementation frameworks, particularly in the underdeveloped western counties. Drawing upon an empirical econometric analysis, this study delves into the intricate relationship between new-type urbanization and basic public service equalization, focusing on 88 counties in Guizhou Province, spanning the years 2011–2022. Our findings underscore that new-type urbanization in Guizhou's counties holds significant potential to elevate the standards of basic public service equalization. This positive influence manifests through multifaceted dimensions of urbanization, encompassing economic, demographic, social, and ecological aspects. From a heterogeneity lens, the study reveals that the catalyzing effect of new-type urbanization is notably more pronounced in central Guizhou urban agglomerations compared to their non-central counterparts. Additionally, regions endowed with a robust economic foundation exhibit a significantly greater enhancement in basic public service equalization than those with weaker economic underpinnings. Notably, the implementation of new-type urbanization pilot policies has proven effective, substantially boosting the level of basic public service equalization within the designated pilot areas.This research contributes to the theoretical underpinnings of regional economics by expanding the scope of understanding on how new-type urbanization can foster basic public service equalization. Furthermore, it offers a practical roadmap for Guizhou's counties to harness the transformative power of new-type urbanization strategies, thereby enhancing the accessibility and quality of essential public services across the region.

1. The question raised

The report of the 20th National Congress points out that the main goal for the next five years is "significantly improving the level of equalization of basic public services "(EBPS). Currently, the primary contradiction in our society is between the people's growing needs

---

for a better life and the inadequate and unbalanced development. Although the level of EBPS in different regions has been significantly improved, there are still large gaps.

China has experienced the fastest and most extensive urbanization process in the world [1], but emphasizing the development of general urbanization process can no longer meet the needs of today's society [2]. Therefore, the development of New-type urbanization should not only pay attention to the economy and development scale, but also pay attention to the development of public services and other aspects [3].However, what is the effect of the EBPS in the context of New-type urbanization? Although there is a solid foundation for previous research on both topics, involving the construction of indicator systems [4,5] and the analysis of coupling coordination degrees [6], a definitive conclusion has not yet been reached. Currently, Adopting an econometric study, Yang et al. used 31 provinces in China to explore the impact of social organization participation and government management on the EBPS [7]; Among them, empirical evidence at the county level involves studies such as Pan M Z et al. [8]., who selected a total of 81 counties from 28 provinces in China as samples to analyze the allocation of rural public service resources in the context of county urbanization.

In the "14th Five-Year Plan" New-type urbanization Development Planning of Guizhou Province, the Guizhou Provincial Government proposed a new path to improve the level of EBPS through the construction of New-type urbanization. Therefore, this paper takes Guizhou counties as examples, analyzes the effects of this policy and forms typical experiences, aiming to provide references for other counties in western China and developing countries of the world, which has certain practical values.

Regarding the new proposal of the Guizhou government to enhance the effect of the EBPS in New-type urbanization, there is still a lack of empirical evidence from quantitative analysis at the county level. Important questions remain to be answered, such as its effectiveness, the mechanism of implementation, its heterogeneity in different urban agglomerations and regions with different economic foundations, and how to further enhance its effectiveness and promote it to other western regions.

The marginal contributions of this paper are as follows: Firstly, it broadens the connotation of New-type urbanization by proposing a mechanism for New-type urbanization to promote the EBPS from four dimensions: economic urbanization, population urbanization, social urbanization, and ecological urbanization. This enriches the theoretical periphery of regional economics and has certain theoretical significance. Secondly, taking Guizhou's counties as sample objects, this paper verifies the proposal of the Guizhou Provincial Government on the effect of New-type urbanization in promoting the EBPS. Compared with other studies, such as those based on provincial panel data [9] and municipal panel data [10], this paper adopts a more microscopic sample of county-level data. By employing econometric research methods, it distinguishes the heterogeneous effects across different urban agglomerations and regions with varying economic foundations. While focusing on Guizhou's counties, this paper serves as a typical example to illustrate the story of the western region, aiming to provide reference value for other western provinces and contribute Guizhou wisdom to the country's strategy for developing the western region and promoting county-level economic development, thus possessing practical value. Thirdly, this paper enriches the research on the pilot policies of New-type urbanization. Although existing literature has evaluated these policies from multiple perspectives, few have measured them from the perspective of EBPS. This paper strives to expand the effects of the pilot policy of new urbanisation with the goal of promoting the equalization of basic public services, and it shows that through the development of new urbanisation in Guizhou counties in China, not only does it promote the transfer of the rural population to the towns, but it also focuses on achieving the equalization of basic public services in the process of urbanisation. This development model provides counties in other countries, especially in developing countries, with new ideas on how to balance social equity and economic development in the urbanisation process.

2. Literature review and theoretical basis

2.1. Equalization of basic public services

The study of the equalization of public services originated abroad and has not yet formed a systematic and comprehensive framework. This research can be traced back to Adam Smith (1776), who argued that due to market imperfections, it is the state's duty to ensure fair provision of public services. He also introduced the concepts of public service and fairness in its provision [11]. Paul A. Samuelson's "The Pure Theory of Public Expenditure" further laid the foundation for subsequent studies on basic public services [12]. Academic research on the EBPS mainly focuses on aspects such as connotation, measurement, regional differences, and influencing factors.

Firstly, regarding the connotation of basic public service equalization: Arthur Cecil Pigou introduced "equalization" into economics by proposing the concept of "income equalization." He suggested that higher and more evenly distributed national income leads to higher levels of public service equalization and improved social welfare [13]. Buchanan proposed fiscal balance theory in 1950, asserting that all residents within a country have an equal right to enjoy government-provided basic public services [14]. This paper argues that the equalization of basic public services is an important social policy objective, which refers to fair and accessible access for all citizens to roughly equal basic public services, such as education, health care and infrastructure.

Second, the measurement of EBPS. Most scholars consider factors such as environmental protection, culture, sports, employment, healthcare, education, and infrastructure simultaneously [7,15]. For instance, Moullin evaluated the performance level of public service provision in health and social security from six dimensions: efficiency, fairness, social recognition among others [16]. Some scholars focus on specific aspects of basic public services such as healthcare [17], public health [18], and government satisfaction with public services [19].

Third, an analysis of the factors influencing the EBPS. Existing research has confirmed that fiscal expenditure, citizen demand [20], population levels, economic development, fiscal decentralization, transfer payment systems, openness to external markets, and marketization can all impact the EBPS [15,21]. However, different influencing factors have varying degrees of impact on this

equalization. In summary, there is a solid foundation of research on the equalization of basic public services, but there is a lack of research on western China, especially in the counties of Guizhou.

2.2. Existing research on new-type urbanization

Existing research primarily examines new-type urbanization from the perspectives of its connotation, level measurement, and influencing factors. Firstly, regarding connotation: The essence of new-type urbanization is to achieve human-centered urbanization by adhering to a people-oriented approach, driven by emerging industrialization, guided by principles of comprehensive coordination, aiming to enhance the quality and level of urbanization comprehensively. This includes achieving goals such as coordinated urban-rural development, resource-efficient utilization, ecological livability, and social harmony. Secondly, concerning measurement: Most scholars conduct comprehensive evaluations based on aspects like population urbanization, social urbanization, environmental urbanization, industrial integration with cities [22,23]. Thirdly considering influencing factors: Existing studies have confirmed that elements such as industrial structure optimization, infrastructure improvement levels of human capital accumulation foreign direct investment digital economy advancements environmental conditions land transfer directly impact the level of new-type Urbanisation [24–26]. Existing literature provides extensive foundational research on the equalization of public services within the context of the two types of new-type urbanization. However, a more thorough and detailed analysis of the specific mechanisms underlying the effects of basic public service equalization is still needed.

2.3. Research on the equalization effect of basic public services in new-type urbanization

The research on the effects of public service equalization in New-type urbanization has yet to reach a definitive conclusion. One perspective is the promotion theory. For instance, Cheng Kaiming and Liu Shucheng examined the impact of urbanization on basic public service equalization from a more micro-level perspective. By analyzing data from prefecture-level cities between 2003 and 2020, they concluded that urbanization exerts both direct and indirect significant positive effects on the EBPS, benefiting not only local but also surrounding areas [27] The second perspective is the suppression theory. Scholars analyzed inter-provincial panel data from 2010 to 2020 using a comprehensive evaluation model and entropy method for score construction. Their study revealed that trends in urbanization scores are inversely proportional to levels of basic public service scores [9].

The third aspect is the theory of uncertainty. Urbanization has led to a significant concentration of population in cities, providing a foundation for the expansion of public service scale and regional coverage. As urbanization accelerates, the capacity for urban public services continues to improve, offering citizens higher quality, more convenient, and efficient public services. However, rapid urbanization leads to the rapid growth of urban public service demand, but the supply capacity lags behind, resulting in the contradiction between supply and demand of public services, and the public service system with household registration as the barrier is difficult to meet the needs of migrants, accelerating the social and economic fragmentation of the city. It can be said that the rapid development of urbanization presents both opportunities and significant challenges to the basic public service system's development. By focusing on population mobility during urbanization as a research subject, this study examines how such mobility impacts the EBPS and finds that population inflow affects different-sized cities' levels of basic public services differently: it primarily manifests as "congestion effects" in megacities but shows more prominently as "scale effects" in other cities. Consequently, competitive hypothesis 1 is derived from these observations [28].

Competitive hypothesis 1a: New-type urbanization has the effect of improving the EBPS.

Competitive hypothesis 1b: New-type urbanization has the effect of inhibiting the EBPS.

2.4. Mechanism discussion on the promotion the equalization of basic public services in new-type urbanization

Economic urbanization means the concentration and expansion of economic activities in cities, which helps to raise the overall economic output and provides the Government with more financial resources to invest in basic public services; and demographic urbanization leads to the expansion of the size of the urban population and the concomitant increase in demand for public services. In order to meet these demands, the government needs to increase investment in public services and improve its service supply capacity, thereby promoting the equalization of public services. Social urbanization requires the establishment of a sound social security system covering both urban and rural areas, including pension insurance, medical insurance and unemployment insurance. Eco-urbanization emphasizes focusing on ecological environmental protection and restoration in the process of urbanization. By strengthening urban greening, improving air quality and combating water pollution, it can provide residents with a more livable living environment and improve their quality of life.

Therefore, this paper analyzes the mechanism for enhancing the EBPS in New-type urbanization from four dimensions.

2.4.1. Economic urbanization

The economic dimension of New-type urbanization, as the primary driving force behind urbanization, mainly refers to the increase in total economic output and the shift towards a non-agricultural economic structure. As urban economies grow and expand, this growth can generate more fiscal revenue that can be invested in essential infrastructure projects such as roads, bridges, water supply systems, and electricity grids. Investments in healthcare infrastructure receive financial support; foundational education construction gains additional fiscal backing; continuous economic growth provides necessary material resources for educational investments, further stimulating an expansion in educational investment scales which subsequently promotes overall economic growth. Regional

economic development, in turn, acts to promote all aspects of city building.

2.4.2. Population urbanization

Population urbanization refers to the continuous process of rural population migrating to urban areas, which also encompasses the expansion of urban density and scale. As populations concentrate in cities and urban areas expand, that they have access to educational and healthcare resources while providing a substantial labor force for urban development. The concentration of population and industries facilitates the pooling of capital and labor resources, forming a "labor reservoir." Consequently, these individuals become key contributors to social construction within cities; their efforts are evident in infrastructure projects essential for basic public service provision. Population urbanization generates additional employment opportunities that attract rural laborers into cities, influencing sustainable economic development through factors such as industrial structure adjustments and technological innovation [29]. Thus, people gain greater capacity and opportunity to access basic public services, further promoting their equal distribution.

2.4.3. Social urbanization

The social aspect of New-type urbanization emphasizes social development and the advancement of social civilization. Education, healthcare, and infrastructure construction are critical issues in the process of societal urbanization. Social security, as an important system closely related to all residents, can enhance people's welfare and promote social development. Taylor posits that urbanization facilitates a viable path for achieving coordinated economic, social, and environmental development [30]; it acts as a driving force that brings about significant capital and talent agglomeration effects while fostering innovation and restructuring in social governance mechanisms. The diverse array of socio-cultural activities within cities will draw greater attention to the construction and operation of public cultural facilities, allowing people to enjoy more cultural entertainment activities and spiritual enrichment. Therefore, societal urbanization is essentially the process through which equal access to basic public services is realized.

2.4.4. Ecological urbanization

Ecological urbanization is to take the concept of ecological civilization as the main theme and integrate its construction into the whole process of urbanization construction, which is the direction of future urbanization development. The white paper "China's Green Development in the New Era" states that "green is a symbol of life and nature's primary color; a good ecological environment is fundamental to a better life and shared aspiration." Advancing ecological urbanization can first provide city residents with improved living environments and enhanced quality of life through better air and water quality. Second, it advocates for resource conservation, recycling, and low-carbon development; scientific planning and management can achieve rational allocation and efficient use of resources. Thirdly, it encourages the growth of green industries such as clean energy and environmental technology. The expansion of these industries not only creates employment opportunities but also generates additional fiscal revenue for cities to improve basic public services while promoting environmental protection and ecological balance to offer better living conditions for people.

Hence, we propose Research Hypothesis 2.

Hypothesis 2. The enhancement effect of EBPS in the context of new-type urbanization is manifested through mechanisms such as economic urbanization, population urbanization, social urbanization, and ecological urbanization.

2.4.5. New-type urbanization promotes heterogeneity in the EBPS

Due to the differences in regional geographic location and economic base, the impact of new-type urbanization on the EBPS is bound to be different.

Firstly, from the perspective of regional location analysis, areas with more favorable regional conditions exhibit more pronounced economies of scale in production factors and characteristics of industrial agglomeration. This is conducive to enhancing residents' income levels and social welfare. Industrial agglomeration generates substantial fiscal revenue, which in turn contributes to urban public services and infrastructure construction, thereby improving the equalization level of basic public services within cities. Conversely, cities with less advantageous geographical locations may not be able to effectively attract aggregation elements in the short term, potentially leading to a lack of impetus for promoting the EBPS.

Secondly, regions with higher levels of economic development possess more production factors to invest in the provision of public services during urbanization processes. Additionally, their infrastructure construction is relatively well-developed. Conversely, regions with lower levels of economic development often face constraints related to economic growth objectives, leading to a resource allocation that favors sectors with higher returns on investment. Consequently, the quality of public service provision in these areas may be inferior compared to regions with higher economic levels. Based on this analysis, we propose Research Hypothesis 3.

Hypothesis 3. The impact of New-type urbanization on the EBPS will be heterogeneous due to the differences in geographical location and economic foundation.

2.4.6. Pilot policies for new-type urbanization and EBPS

The pilot policy of New-type urbanization accelerates the reform of the household registration system, speeds up the urbanization of agricultural migrants, enhances the equalization level of basic public services, narrows the gap in urbanization rates between cities, and achieves high-quality economic development. Essentially, this is an important manifestation of policies aimed at promoting high-quality urbanization. The "National New-type urbanization Plan (2014–2020)" proposed that "urbanization must enter a new stage of transformation focusing on quality improvement." Since then, urbanization has entered a new phase emphasizing quality enhancement. Scholars have extensively studied various aspects such as city innovation [31], regional development imbalance [32], and also

explored impacts on resource-related areas like green energy efficiency and carbon emissions under these pilot policies [33,34]. However, there is limited research on how these pilot policies affect the EBPS. Therefore, this paper attempts to study the impact effects of New-type urbanization pilot policies on basic public service equalization to enrich relevant theories and provide practical evidence for policy formulation.

3. Research design

3.1. Model setting

The theoretical mechanism of this paper shows that the New-type urbanization will improve the level of equality of regional basic public services, and its measurement model can be expressed by the following formula:

$$C_{it} = \beta_0 + \beta_1 U_{it} + \sum_{j=2}^{5} \beta_j X_{it} + \lambda_t + \mu_i + \epsilon_{it} \tag{1}$$

C_{it} represents the EBPS in County i in year t, and U_{it} represents the new-type urbanization in county i in year t. β_0 is the constant term, β_1 is the regression coefficient of the core explanatory variable, β_j is the regression coefficient of the control variable, λ represents the time effect, μ represents the individual effect, and ϵ is the random error term. X_{it} represents the control variable of county i in year t. In this paper, per capita fiscal expenditure (fiscal), year-end loan balance (finance), capital stock (capital) and industrial structure upgrading (advance) are selected as control variables.

3.2. Variable measurement and processing

3.2.1. Explained variable: EBPS(C)

Leveraging the "National Basic Public Service Standards (2023 Edition)" and basic public service equalization indicators constructed by various scholars [7,35], this study comprehensively considers data availability and representativeness. It selects indicators representing the EBPS from six subsystems: public safety, primary education, healthcare, public culture, social security and employment, and infrastructure. Using panel data from counties in Guizhou Province spanning 2011 to 2022 as the foundational dataset, this paper employs the entropy method to measure the EBPS (Table 1).

3.2.2. Core explanatory variables: new-type urbanization (U)

Based on the theoretical mechanism of this paper, and fully considering the connotation and extension of New-type urbanization, and drawing on the practice of some scholars to construct New-type urbanization indicators [22,36,37], fully considering the availability, scientificity and integrity of data, this paper selects indicators representing the development level of New-type urbanization from the four dimensions of economy, population, society and ecology, constructs the evaluation index system of New-type urbanization, and uses the entropy method to measure its score (Table 2).

Table 1
Index system of EBPS.

Target layer	Primary index	Secondary index	Index interpretation	Index unit	Index property
EBPS	Public security	Crown case	Number of criminal cases filed per 10,000 people	piece	–
		Child mortality rate	Under-five mortality rate	‰	–
	Elementary education	Primary school	Primary teacher-student ratio	%	+
		Junior high school	Junior high school teacher-student ratio	%	+
		Senior high school	High school teacher-student ratio	%	+
	Health and medical community	Health institution	Number of health facilities per 10,000 people	Unit	+
		Health technician	Number of health technicians per 10,000 people	Unit	+
	Public culture	Library collection	Total library collections per 10,000 people	Book	+
		Cultural institutions	Number of cultural institutions per million people	Unit	+
	Social security employment	Endowment insurance	Number of endowment insurance participants	Ten thousand people	+
		Medical insurance	Number of health insurance enrollees	Ten thousand people	+
		Unemployment rate	Urban registered unemployment rate	%	–
	Infrastructure	Highroad	Main highway density	km/km2	+
		Tap water penetration rate	Raw data	%	+
		Gas penetration rate	Raw data	%	+

3.2.3. Control variable

Per capita fiscal expenditure (*fiscal*) serves as a metric for assessing the impact of fiscal capacity. The year-end loan balance of financial institutions (*finance*) is used to measure the influence of financial institution development on the EBPS. Capital stock (*capital*), calculated using the perpetual inventory method with a depreciation rate of 9.6 %, is employed to control for its effect on the EBPS. Industrial structure upgrading (*advance*) is represented by the ratio of value added in the tertiary industry to that in the secondary industry; if this ratio exceeds 1, it indicates that industrial structure is increasingly oriented towards "economic service," signifying an advancement towards higher levels of industrial sophistication.

The dimensions and units of the variables involved in this study differ. To ensure the accuracy and reliability of the empirical results, a min-max normalization process was applied to all variables except for the level of EBPS and new-type urbanization (mapping all data to a range between 0 and 1). The formula is as follows:

$$X_{scaled} = \frac{X - X_{min}}{X_{max} - X_{min}} \tag{2}$$

In Equation (2), X_{scaled} represents the newly obtained result of the variable, X denotes the initial value of the variable, X_{min} signifies the minimum value of the variable, and X_{max} indicates the minimum value of the variable.

3.3. Data sources and study area

This paper is based on panel data from Guizhou's counties spanning the years 2011–2022, encompassing 88 counties (districts and county-level cities) within Guizhou Province. The primary sources of the data include the "China County Statistical Yearbook," "Guizhou Statistical Yearbook," "Guiyang Statistical Yearbook," as well as statistical bureaus and statistical bulletins from various municipalities and counties in Guizhou Province. Guizhou is located in the southwest of China, with a total area of 176,000 km^2, high in the northwest and low in the southeast, forming a unique geomorphological pattern of "eight mountains, one water, one field". The specific location in China is shown in Fig. 1.

4. Empirical analysis

4.1. Baseline model estimate results

This paper employs fixed effects regression based on Hausman test results to evaluate the impact of new-type urbanization construction on the EBPS; the estimation results are presented in Table 3. Columns (1) through (5) in Table 3 show regression outcomes with sequential inclusion of county-level control variables. The findings indicate that under different sets of control variables, new-type urbanization construction consistently exerts a significant positive effect on the equalization level of basic public services. This demonstrates that new-type urbanization can markedly enhance service equality by optimizing resource allocation across towns

Table 2
New-type urbanization index system.

| Target layer	Primary index	Secondary index	Index interpretation	Index unit	Index property
New-type urbanization	Economic urbanization	Economic level	Per capital gross regional product	Yuan	+
		Financial revenue	Local fiscal revenue per capita	Yuan	+
		Industrial structure	The proportion of the added value of the tertiary industry in gdp	%	+
		Foreign investment	At the end of the year, there are foreign-invested enterprises	Unit	+
		Community consumption	Total retail sales of consumer goods	Ten thousand yuan	+
	Population urbanization	Population density	Urban population density	Person/km^2	+
		Population size	Number of rural employees	Thousands of people	+
		Population quality	Number of vocational trainees	Thousands of people	+
		Demographic potential	Every ten thousand people have the number of students in school	People	+
	Social urbanization	Level of employment	The number of new urban employment	Thousands of people	+
		Savings level	Per capita savings balance of urban and rural residents	Yuan/person	+
	Ecological urbanization	PM2.5	The annual average concentration of pm2.5	μg/m^3	–
		Percentage of forest cover	Raw data	%	+
		Sewage treatment rate	Raw data	%	+
		Domestic waste	Raw data	%	+
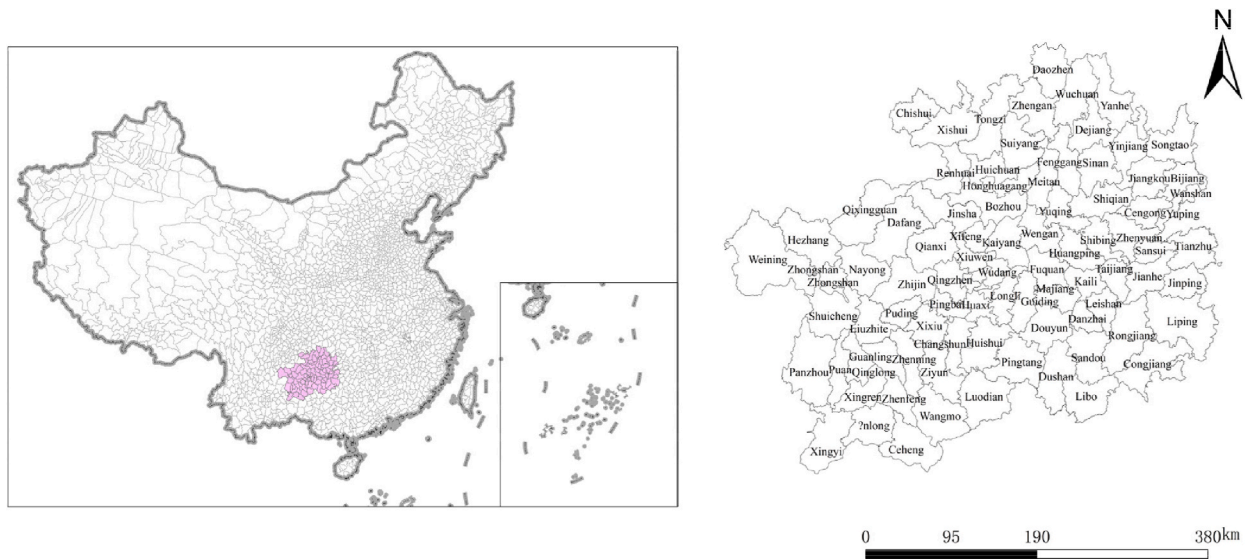
Fig. 1. Study area.

and rural areas. Through improved city planning and management, it is possible to make basic public services more widespread and equitable, mitigating issues related to excessive resource concentration. Additionally, this approach will further refine social security systems and infrastructure development while promoting regional transportation accessibility improvements—ultimately elevating residents' living standards and fostering service equality. In summary, these findings validate competitive hypothesis 1a.

4.2. Endogeneity test

The primary causes of endogeneity can be attributed to three main factors: measurement error, omitted explanatory variables, and mutual causality. Measurement error refers to discrepancies between the values of explanatory variables used in the model and the actual data. Omitted explanatory variables occur when it is generally impossible to identify all variables that influence the dependent variable. Mutual causality denotes a bidirectional influence between explanatory and dependent variables. While measurement errors are typically unavoidable, employing panel two-way fixed effects for baseline regression can partially mitigate endogeneity caused by omitted variables. Therefore, in econometric models, the bidirectional causality between new-type urbanization and EBPS emerges as a principal source of endogeneity. On one hand, the development of new-type urbanization inevitably leads to improvements in public service levels such as healthcare, education, and infrastructure; on the other hand, enhancements in the equalization level of basic public services attract more socio-economic production factors that drive further new-type urbanization efforts.

This study adopts the approach of Nunn and Qian [38], selecting geographic location and topographical features as exogenous instrumental variables. There are two main reasons for this choice: firstly, greater terrain undulation indicates poor land conditions, which negatively impacts the development of new-type urbanization; conversely, less undulation has a positive effect, thus satisfying the relevance criterion. Secondly, terrain undulation does not directly influence the EBPS, thereby meeting the exogeneity requirement. Drawing on Feng et al.'s [39] method for measuring terrain undulation, this research uses the reciprocal of terrain undulation in interaction with new-type urbanization levels as an instrumental variable. Additionally, considering that current period random

Table 3
Results of baseline regression estimation.

Variable	(1)	(2)	(3)	(4)	(5)
u	0.155*** (2.952)	0.156*** (2.904)	0.149*** (2.745)	0.152*** (2.775)	0.189*** (3.572)
fiscal		−0.002 (−0.095)	−0.001 (−0.030)	−0.001 (−0.029)	−0.003 (−0.143)
finance			−0.018 (−0.939)	−0.019 (−0.982)	−0.017 (−0.955)
capital				0.004 (0.442)	0.001 (0.154)
advance					−0.172*** (−8.614)
Constant	0.268*** (49.724)	0.269*** (49.517)	0.270*** (48.377)	0.269*** (43.374)	0.278*** (45.820)
Year FE	Y	Y	Y	Y	Y
County territory FE	Y	Y	Y	Y	Y
N	1056	1056	1056	1056	1056
adj. R^2	0.633	0.632	0.632	0.632	0.658

Note: **, *, and * denote statistical significance at the 0.01, 0.05, and 0.1 levels, respectively (t-values are provided in parentheses). The table below will not elaborate further on this notation.

disturbances may correlate with instrumental variables, we use lagged data from one period prior as our instrumental variable.

By examining the under-identification test and weak IV test in column (1) of Table 4, it can be concluded that the instrumental variables selected in this study exhibit strong explanatory power for the endogenous variables (core explanatory variables), are identifiable, and do not suffer from weak instrument issues [40]. Columns (2) to (4) present results using two-stage least squares method as well as generalized method of moments models under heteroskedasticity and homoskedasticity assumptions. The findings indicate that new-type urbanization construction significantly promotes the equalization level of basic public services at a 1 % significance level. Moreover, the estimated coefficient for new-type urbanization is considerably larger than that obtained from baseline regression results, suggesting that failing to account for potential endogeneity issues may lead to an underestimation of the baseline regression estimates.

4.3. Robustness test

4.3.1. Replace the core explanatory variable

Urbanization refers to the process by which rural populations are transformed into urban populations, a historical stage that is inevitably experienced during the industrialization processes of countries worldwide. Meanwhile, at the same time, the urbanization rate can reflect the level of new-type urbanization construction to a certain extent. Drawing on Zhang et al.'s method of replacing explanatory variables for robustness testing [41], the urbanization rate can partially reflect the level of new-type urbanization construction. In this paper, we incorporate the urbanization rate as a proxy variable for new city urbanization construction into our baseline model for regression analysis; results are presented in column (1) of Table 5. At this juncture, the coefficient indicating the impact of the urbanization rate on basic public service equalization is significantly positive at the 1 % level, consistent with our baseline conclusions.

4.3.2. Intertemporal shortening (2011–2020)

This study spans the period from 2011 to 2022. To eliminate the inhibitory effect of the COVID-19 pandemic at the end of 2020 on the development of equalization in basic public services, this paper designates 2020 as the terminal year for its research window. The baseline model is re-estimated using samples from 2011 to 2020, and the results are presented in column (2) of Table 5. At this juncture, it is evident that new-type urbanization has a significantly positive impact on the EBPS at a significance level of 1 %, thereby affirming the stability of our conclusions.

4.3.3. 1 % bilateral indent and generate county and time interaction terms

Drawing on Shang and Feng for robustness testing by excluding outliers [42], this paper performs 1 % bilateral shrinkage of all variables that are not 0 to 1. The regression results are shown in Column (3) of Table 5. In order to further control the influence of uncontrollable factors from the county level, the interaction term between county and time is generated, and the regression results are shown in Table 5 column (4). Both results verify the robustness of the benchmark regression.

4.4. Addition of control variables

Considering that the omitted variables may cause some errors in the estimation results, this paper takes the whole society fixed asset investment (INVEST) as a new control variable (normalized and bucketed with other variables), and the results are shown in column (5) of Table 5. It shows that the promotion effect of new-type urbanization on the EBPS is significantly positive at the 1 % level, reaffirming the stability of the conclusion.

4.5. Mediation effect analysis

Based on theoretical analysis and research hypotheses, this paper will further examine the mechanisms of mediating variables from four aspects of new-type urbanization: economic, demographic, social, and ecological. A bidirectional fixed effects model will be employed for regression analysis. Given that new-type urbanization encompasses dimensions such as economic urbanization, population urbanization, social urbanization, and ecological urbanization, an improvement in the level of new-type urbanization is expected to induce corresponding changes within its subsystems. The model is constructed as follows:

$$C_{it} = \beta_0 + \beta_1 economic_{it} + \sum_{j=2}^{5} \beta_j X_{it} + \lambda_t + \mu_i + \epsilon_{it} \tag{2a}$$

$$C_{it} = \beta_0 + \beta_1 pop_{it} + \sum_{j=2}^{5} \beta_j X_{it} + \lambda_t + \mu_i + \epsilon_{it} \tag{3}$$

$$C_{it} = \beta_0 + \beta_1 social_{it} + \sum_{j=2}^{5} \beta_j X_{it} + \lambda_t + \mu_i + \epsilon_{it} \tag{4}$$

Table 4
Endogeneity test.

Variable	New-type urbanization	Equal access to basic public services		
	The first stage	The second stage		
	OLS	2SLS	Heteroscedasticity is assumed to be GMM	Homoscedasticity assumes GMM
	(1)	(2)	(3)	(4)
IV	1.260*** (31.69)			
u		0.978*** (12.098)	0.773*** (10.701)	0.773*** (14.622)
fiscal	0.007 (0.67)	−0.041 (−1.603)	−0.100*** (−4.056)	−0.100*** (−4.114)
finance	−0.024*** (−2.95)	0.157*** (7.828)	0.074*** (6.095)	0.074*** (4.957)
capital	0.003 (0.56)	0.033*** (2.868)	0.053*** (4.701)	0.053*** (4.707)
advance	0.016* (1.87)	0.049* (1.777)	−0.033* (−1.946)	−0.033* (−1.813)
Year FE	Y	Y	Y	Y
County territory FE	Y	Y	Y	Y
N	1056	1056	1056	1056
Underrecognition test (Kleibergen-Paap rk LM statistic) <p-value>	27.463 <0.000>			
Weak IV test(Kleibergen-Paap rk Wald F statistic)	119.736 [16.38]			

Table 5
Robustness test.

Variable	(1)	(2)	(3)	(4)	(5)
rate	0.200*** (11.627)				
u		0.693*** (6.155)	0.153*** (2.839)	0.139*** (2.607)	0.203*** (3.83)
fiscal	0.029 (1.223)	−0.060** (−2.562)	−0.002 (−0.085)	−0.002 (−0.090)	−0.007 (−0.31)
finance	0.153*** (8.040)	−0.020 (−0.925)	−0.015 (−0.839)	−0.008 (−0.461)	−0.030 (−1.62)
capital	0.013 (1.121)	0.006 (0.577)	0.011 (1.181)	0.000 (0.039)	0.002 (0.26)
advance	0.123*** (6.773)	−0.199*** (−7.944)	−0.172*** (−7.993)	−0.163*** (−8.235)	−0.232*** (−8.17)
invest					0.073*** (2.94)
Constant	0.240*** (43.754)	0.247*** (29.370)	0.279*** (46.088)	6.520*** (5.578)	0.279*** (46.07)
Year FE*County territory FE				−0.000*** (−5.341)	
Year FE	Y	Y	Y	Y	Y
County territory FE	Y	Y	Y	Y	Y
N	1056	880	1056	1056	1056
adj. R²	0.487	0.672	0.659	0.668	0.661

$$C_{it} = \beta_0 + \beta_1 environment_{it} + \sum_{j=2}^{5} \beta_j X_{it} + \lambda_t + \mu_i + \epsilon_{it} \tag{5}$$

In equations (2)–(5), $economic_{it}$、pop_{it}、$social_{it}$ and $environment_{it}$ respectively represent the levels of economic urbanization, population urbanization, social urbanization, and ecological urbanization for county i during period t. The remaining indicators are consistent with those in equation (1) and will not be elaborated upon further. For the regression results concerning the impact of various mediating variables on the EBPS, please refer to Table 6.

Table 6 indicates that economic urbanization and population urbanization have a significantly positive impact on the EBPS, while social urbanization has a significantly negative impact. Ecological urbanization shows a positive but not significant effect on the EBPS. The potential reasons for these results are as follows: Firstly, economic and population urbanizations typically accompany the development of urban economies, which implies more resources and funds can be allocated to infrastructure construction. Economic growth can attract investment and resources, driving the construction and improvement of infrastructure such as roads, bridges, water supply systems, electricity grids, communication networks, etc. The enhancement of these infrastructures can increase both the coverage and quality of basic public services, enabling more residents to benefit from them. Secondly, the lack of promotive effects from social urbanization suggests that county-level development in Guizhou is not fully integrated; regions with early socio-economic advancements tend to attract elements necessary for further socio-economic development from neighboring or even distant areas. This leads to resource depletion in less developed regions negatively impacting their ability to achieve equalized basic public services. Thirdly, although ecological urbanization emphasizes environmental protection and sustainable development due to limited resources

Table 6
Results of mechanism test.

Variable	(1)	(2)	(3)	(4)
economic	0.052* (1.701)			
pop		0.245*** (4.695)		
social			−0.093*** (−3.711)	
environment				0.033 (0.988)
fiscal	0.004 (0.177)	0.010 (0.483)	0.021 (0.967)	0.013 (0.586)
finance	−0.023 (−1.260)	−0.016 (−0.861)	−0.033* (−1.826)	−0.026 (−1.416)
capital	−0.001 (−0.066)	−0.000 (−0.034)	−0.005 (−0.531)	−0.003 (−0.296)
advance	−0.170*** (−8.428)	−0.171*** (−8.616)	−0.177*** (−8.805)	−0.168*** (−8.338)
Constant	0.288*** (56.567)	0.278*** (49.877)	0.308*** (45.080)	0.279*** (21.600)
Year FE	Y	Y	Y	Y
County territory FE	Y	Y	Y	Y
N	1056	1056	1056	1056
adj. R^2	0.655	0.662	0.659	0.654

in Guizhou province it may result in insufficient investments in basic public service sectors especially in remote areas where restrictions related to ecological conservation constrain infrastructure building and provision of public services thus failing to show significant promotive effects on service equalization.

In summary, hypothesis 2 is validated. The enhancement effect of the EBPS in New-type urbanization primarily operates through these four aspects. Its economic consequences are inevitably related to the current stage of economic development and other factors, which may result in varying impacts. This also represents a new challenge and opportunity for Guizhou to "pioneer new paths, create new situations, seize new opportunities, and achieve new accomplishments."

4.6. Heterogeneity analysis

4.6.1. Regional heterogeneity

There are certain gaps in the economic base and resource endowments of different regions. In order to explore the differences in the internal regions of Guizhou and the implementation effect of policy-oriented regions, according to the implementation of the "Central Guizhou Urban Agglomeration Development Plan" issued in March 2017 [Central Guizhou Urban Agglomeration Areas: all regions of Guiyang City; honghuagang District, Huichuan District, Bozhou District, Suiyang County and Renhuai City of Zunyi City; bijie City, Qixingguan District, Dafang County, Qianxi County, Jinsha County, Zhijin County; xixiu District, Pingba District, Puding County and Zhenning County in Anshun City; duyun City, Fuquan City, Guiding County, Weng'an County, Changshun County, Longli County, Huishui County in Qiannan Prefecture and Kaili City and Majiang County in Qiandongnan Prefecture, a total of 33. The remaining counties (districts, county-level cities) in Guizhou belong to the non-central Guizhou urban agglomeration.] clearly put forward the "to accelerate the construction of a nuclear, a circle, four belts, five hearts, multi-point spatial structure to promote the formation of the core leading circle to promote the five hearts to support the development of collaborative linkage pattern."

Furthermore, the county of Guizhou is divided into the region belonging to the urban agglomeration in central Guizhou and the region not belonging to the urban agglomeration in central Guizhou, in order to better provide different suggestions for different regions. Therefore, this paper examines the regional heterogeneity of the impact of New-type urbanization on the equalization level of basic public services based on two distinct regions. The entire sample is divided into the Qianzhong Urban Agglomeration and non-Qianzhong Urban Agglomerations for grouped regression analysis, with results presented in columns (1) and (2) of Table 7. The regression coefficient for New-type urbanization in the Qianzhong Urban Agglomeration is significantly positive at the 1 % level, whereas it is positive but not significant and smaller in magnitude for non-Qianzhong Urban Agglomerations. This indicates that the promotion effect of New-type urbanization has different impacts on these two regions. One possible reason lies in policy orientation; as a leading force in Guizhou's development, Qianzhong Urban Agglomeration may benefit from more favorable policies compared to non-Qianzhong areas. Additionally, since Qianzhong includes more developed cities such as Guiyang and Zunyi, it serves as an economic hub for Guizhou, facilitating economic exchanges and coordinated development with surrounding areas.

4.6.2. Heterogeneity of economic development

To investigate whether there is heterogeneity in the impact of Guizhou's county-level economic foundation on the EBPS in New-type urbanization construction, counties will be divided into high and low economic foundation regions based on the median annual GDP (counties in 2011 are classified according to their 2011 GDP, counties in 2012 according to their 2012 GDP, and so forth up to counties in 2022). Using a baseline model for regrouped regression analysis, as shown in columns (3) and (4) of Table 7. It can be observed that the promotion effect of New-type urbanization on the EBPS is more significant and stronger in regions with a higher economic foundation compared to those with a lower economic foundation. As the economic base continues to improve, these regions' overall economy also expands, leading to a resource siphoning effect greater than that seen in areas with weaker economic foundations. Consequently, not only can they provide financial support for New-type urbanization construction, but governments can also gather more resources to support infrastructure development as well as medical care and education services. This ultimately fosters better development towards equalizing basic public services.

To sum up, regions such as Qianzhong Urban Agglomeration may be more likely to attract investment, talents and other resources

Table 7
Heterogeneity analysis.

Variable	Regional heterogeneity		Heterogeneity of economic development	
	(1)Central guizhou urban agglomeration	(2)Non-central Guizhou city cluster	(3)High value area	(4)Low-value area
u	0.361*** (4.127)	0.087 (1.268)	0.201** (2.516)	0.108 (1.371)
fiscal	−0.008 (−0.307)	−0.016 (−0.411)	−0.010 (−0.306)	0.002 (0.062)
finance	0.032 (1.331)	−0.026 (−0.960)	−0.003 (−0.093)	−0.018 (−0.672)
capital	0.009 (0.727)	0.002 (0.158)	0.002 (0.138)	0.006 (0.432)
advance	−0.153*** (−7.207)	−0.160*** (−4.255)	−0.160*** (−5.714)	−0.188*** (−5.780)
Constant	0.278*** (31.211)	0.272*** (32.769)	0.271*** (29.865)	0.289*** (32.376)
Year FE	Yes	Yes	Yes	Yes
County territory FE	Yes	Yes	Yes	Yes
N	396	660	528	528
adj. R^2	0.663	0.665	0.612	0.615

due to their policy tilts, geographical location and other advantages, thus accelerating the process of new-type urbanization, and thus raising the level of EBPS more quickly. Regions with better economic fundamentals have more abundant fiscal revenues and more funds to invest in public services, and at the same time, regions with good economic fundamentals are more likely to attract the clustering of high-quality public service resources. However, how to promote the development of non-urban clusters and less economically developed regions is also a key concern.

5. Further analysis: the impact of new-type urbanization pilot policies on the EBPS

5.1. Model setting and regression results

This section aims to investigate whether the pilot policy of New-type urbanization effectively promotes the EBPS by employing a difference-in-differences (DID) model. The fundamental principle of the DID method is to identify the treatment effect of a policy through dual differences in individual and time series induced by external policy interventions. This study designates counties, districts within cities at the prefecture level in Guizhou that were included in three batches of New-type urbanization pilots from 2014 to 2016 as the treatment group, while other regions in Guizhou not included in these pilots serve as the control group.[1] Given that the implementation times for these three batches differ, we refer to Beck et al. [43] and construct a multi-period difference-in-differences model as follows:

$$coordinate_{it} = \beta_0 + \beta_1 did_{it} + \sum_{j=2}^{5} \beta_j X_{it} + \lambda_t + \mu_i + \epsilon_{it} \qquad (6)$$

where: did_{it} is the DID estimator of this paper. If both "region i is the pilot region" and "time t is the current period and after the policy implementation" are met, the value is 1; otherwise, it is 0. The remaining variables are interpreted in the same formula (1). In the follow-up analysis, focus on the estimated coefficient β_1 of did_{it}. If β_1 is positive and significant, it indicates that the pilot policy can indeed promote the equal development of basic public services. The regression results of the impact of the New-type urbanization pilot policy on the equalization development of basic public services are shown in Table 8.

Table 8 columns (1) and (2) present the regression results without and with control variables, respectively. The results indicate that after implementing the New-type urbanization pilot policy, the level of equalization in basic public services in these regions has significantly improved. Taking column (2) as an example, following the implementation of the New-type urbanization pilot policy, there was a significant increase of 0.016 in the equalization level of basic public services, which corresponds to 4.43 % of the mean value for county-level basic public service equalization across the full sample.[2] Several reasons may account for this: First, post-implementation acceleration in household registration system reform and enhancement in free flow capacity provide labor force and economic foundation for equitable development in basic public services. Second, regions under pilot policies emphasize scientific planning and effective management more rigorously—focusing on holistic regional planning and construction coordination—thereby ensuring better support for equitable development through rational layout planning and enhanced governance capabilities. Thirdly, as policy testing grounds, pilot areas enjoy more autonomy in terms of system innovation and resource allocation, and are able to respond more quickly to market demand and optimize the supply of public services, thereby effectively raising the level of EBPS. At the same

---

[1] In 2014, the pilot regions included Anshun City (comprising two districts, three autonomous counties, and one county) and Duyun City (a county-level city). In 2015, the pilot regions expanded to include Meitan County; Gui'an New Area (encompassing Huaxi District and Qingzhen City of Guiyang City as well as Pingba District and Xixiu District of Anshun City—both previously designated as pilot areas in 2014); Zunyi County (now renamed Bozhou District); and Yuping County (an autonomous county). By 2016, the pilot regions further extended to Panzhou County (now renamed Panzhou City), Xingyi City (a county-level city), Kaili City (a county-level city), Dushan County, and Sandu County (an autonomous county).

[2] The percentage is derived by dividing the coefficient of DID by the mean value of the full sample, resulting in 0.016 ÷ 0.361 × 100 % = 4.43 %.

Table 8
DID estimation results.

Variable	(1)	(2)
did	0.096*** (10.209)	0.016** (2.031)
fiscal		0.048* (1.946)
finance		0.202*** (10.132)
capital		0.025** (2.104)
advance		0.203*** (11.308)
Constant	0.355*** (155.264)	0.272*** (53.670)
Year FE	Yes	Yes
County territory FE	Yes	Yes
N	1056	1056
adj. R^2	0.015	0.418

time, the clear guidance and incentive mechanism of the policy has also stimulated the enthusiasm of local governments and all sectors of society to participate in the construction of new-type urbanization and basic public services.

5.2. Parallel trend test

The validity of the Difference-in-Differences (DID) method hinges on the parallel trends assumption between the treatment and control groups. Given that the pilot regions for the New-type urbanization policy discussed in this paper do not share a uniform implementation timeline, it is infeasible to designate a single critical point in time. Consequently, we employ a multi-period DID approach to test for parallel trends, as follows:

$$coordinate_{it} = \alpha + \sum_{k=-3}^{k \geq 4, k \neq 1} \beta_k did_{it}^k + t\beta X_{it} + \lambda_t + \mu_i + \epsilon_{it} \tag{7}$$

In Equation (7), k represents the number of years since the implementation of the new-type urbanization pilot policy in a given region during year t. For instance, $k = -1$ indicates one year prior to the policy implementation in the pilot region, while $k \geq 4$ denotes four or more years post-policy implementation. The term is an interaction between temporal dummy variables and policy treatment variables; other variable definitions are omitted for brevity.

Fig. 2 illustrates the estimated values of parameter β_k within a 90 % confidence interval. It is evident that prior to the implementation of the pilot policy, the estimated values do not significantly reject the null hypothesis, indicating no substantial difference in the level of EBPS between treatment and control regions before policy implementation. This satisfies the parallel trend assumption required for a multi-period difference-in-differences model. From a dynamic effect perspective, during the initial period of policy implementation, the coefficient reflecting the impact of New-type urbanization pilot policies on basic public service equalization is significantly positive, and this promoting effect tends to strengthen over time.

5.3. Placebo test

To further eliminate the interference of omitted variables and demonstrate the robustness of the empirical results, this paper employs a method involving random selection of regions and years as pilot areas and policy implementation periods for an indirect placebo test. The study conducts 500 iterations of random experiments, reporting the probability distribution of the coefficients related to the New-type urbanization pilot policy in Fig. 3. As shown in Fig. 3, most coefficients from these random experiments are centered around zero, which significantly differs from the results presented in Equation (6). This indicates that improvements in basic public service equalization are indeed attributable to the New-type urbanization pilot policy rather than being influenced by other uncontrolled regional characteristics.

6. Conclusion and suggestion

This paper uses panel data from 88 counties (districts or county-level cities) in Guizhou Province between 2011 and 2022 as its research sample. By employing a bidirectional fixed-effects model, it investigates how new-type urbanization affects basic public service equalization. Furthermore, it explores whether pilot policies for new-type urbanization effectively promote levels of basic public service equalization to consolidate baseline regression results. The conclusions are as follows:

Firstly, the development of new-type urbanization significantly promotes the EBPS. This conclusion remains robust after a series of endogenous and robustness tests. From this perspective, local governments' efforts to enhance new-type urbanization are highly beneficial as such development facilitates the flow of socio-economic factors, thereby expanding economic scale and better promoting regional equalization in basic public services. The equalizing effect of basic public services through new-type urbanization is primarily achieved via advancements in economic urbanization, population urbanization, social urbanization, and ecological urbanization. Secondly, the impact effect of new-type urbanization on the level of basic public service equalization may vary according to different regions and economic foundations. In terms of regional differences, the promotion effect in central Guizhou city clusters is significantly
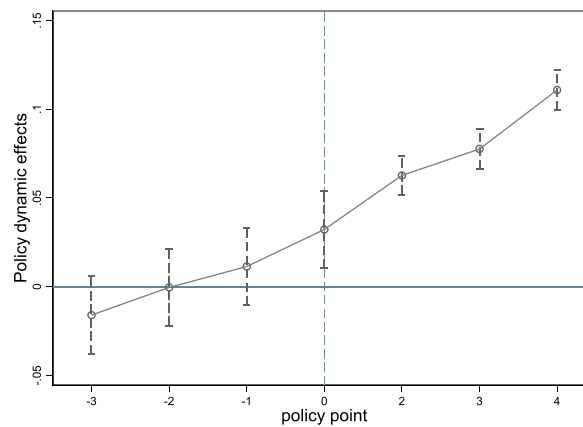
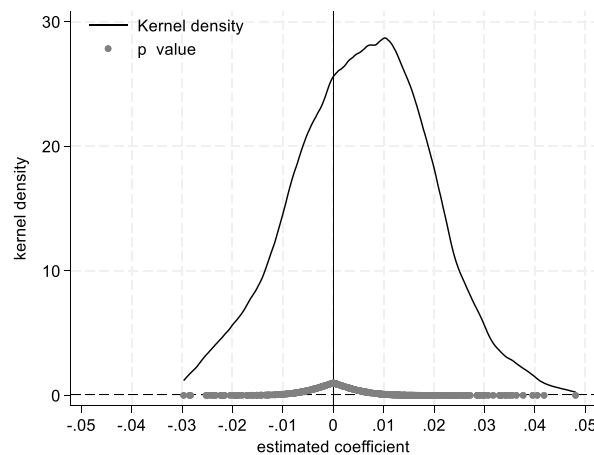**Fig. 2.** Results of parallel trend hypothesis testing.

Fig. 3. Placebo test results.

greater than that in non-central Guizhou city clusters; regarding economic foundation differences, areas with higher economic foundations experience a more pronounced promotion effect compared to those with lower economic foundations. Thirdly, pilot policies for new-type urbanization can effectively promote regional levels of basic public service equalizations; this conclusion remains robust even after parallel trend tests and placebo tests.

Based on the above conclusions, this paper puts forward the following policy recommendations.

First, we should give full play to the effect of promoting EBPS through the new-type urbanization in Guizhou. We must unswervingly follow the people-oriented path of new-type urbanization and be vigilant against the practice of traditional urbanization under the name of new-type urbanization.(1) Economic development serves as an essential foundation for the EBPS. We should strive to develop the real economy in every possible way, strengthen and expand economic capacity, and solidify the foundation for public service provision.(2) Rational policies and measures should be formulated to guide orderly population mobility, avoiding both excessive concentration and excessive dispersion, thereby providing a stable demographic base for the equalization of public services. (3) A comprehensive social security system covering both urban and rural areas should be established and improved, realizing the integration of social security systems between urban and rural areas.(4) We should advocate a green, low-carbon, and environmentally friendly lifestyle, raising residents' environmental awareness and motivation. Additionally, we should strengthen the guidance and promotion of green consumption and green travel, fostering harmony between humans and nature.

Secondly, to achieve equitable development of basic public services, differentiated development strategies should be implemented for regions with varying economic foundations. The Qianzhong urban agglomeration and non-Qianzhong urban areas can be viewed through the "center-periphery" model, where the Qianzhong urban agglomeration is surrounded by non-Qianzhong areas. As such, the Qianzhong region acts as an "engine" for Guizhou's socio-economic development and must steadfastly continue implementing New-type urbanization strategies under policy guidance to sustain its leading role in driving economic growth throughout Guizhou and fostering regional development. Meanwhile, counties within non-Qianzhong urban areas should actively promote population urbanization by encouraging investors and enterprises to expand their investments and establish businesses in these regions. This would create more employment opportunities, reduce income disparities between regions, and enhance residents' overall well-being.

Additionally, economically disadvantaged areas should leverage their unique resource endowments to uncover developmental potential, thereby addressing issues related to insufficient economic growth drivers. This approach aims to forge a novel path toward new-type urbanization with Guizhou characteristics while promoting equitable access to basic public services across all regions.

Thirdly, it is essential to summarize and disseminate the experiences from Guizhou's pilot projects on new-type urbanization at the county level. Gradually extending these insights across the western regions of China could eventually provide a model for implementing similar policies in underdeveloped areas nationwide. Accelerating household registration system reforms and dismantling labor market barriers are crucial steps toward fostering regional integration. While enhancing the quality of new-type urbanization, attention must be paid to diverse population needs, including those relocated for poverty alleviation, migrant workers, and rural left-behind populations, thereby promoting high-quality human-centered urbanization. In advancing county-level new-type urbanization, emphasis should be placed on coordinated rural-urban development through measures such as strengthening rural infrastructure and improving living conditions for farmers. This approach aims to stimulate rural economic growth by developing diversified mountain-specific agricultural economies and narrowing the urban-rural gap, ultimately achieving equitable access to basic public services across regions.

Research limitations and future research direction of this paper. Limitations of the study:(1) Limitations of data collection and statistics: the region of Guizhou may not be comprehensive enough for the construction of new-type urbanization indicators and indicators of EBPS due to various reasons, such as geography and economy, as there may be difficulties in data collection, especially in remote and underdeveloped areas. Missing or incomplete data may affect the accuracy and comprehensiveness of the study. (2) Guizhou has a complex topography and large differences in development between regions, and there are significant differences in the new-type urbanization process and the level of EBPS in different regions. However, the existing research may be too general, and although inter-regional differences are considered, the pertinence and operability of the proposed policy recommendations may be slightly insufficient. Future research directions: (1) Improve the construction of indicators and strengthen data statistics: new-type urbanization and EBPS include all aspects of the social economy, and the construction of its indicators needs to be scientific and reasonable; and in terms of data collection, it should be more accurate and improve the data collection system to ensure the accuracy and completeness of the data. (2) Deepen the research on regional differences: Conduct more detailed research on regional differences in Guizhou, analyze the differences in the new-type urbanization process and the level of EBPS in different regions and the reasons for them. Based on the regional differences, more targeted policy recommendations will be put forward. With a view to contributing to the development of similar regions in the world.

CRediT authorship contribution statement

Yuzhu Meng: Writing – original draft, Supervision, Funding acquisition, Conceptualization. **Zhenlong Hao:** Writing – review & editing, Writing – original draft, Validation, Formal analysis, Data curation, Conceptualization. **Shu Shang:** Writing – review & editing, Methodology, Data curation.

Funding statement

Data availability statement

Data available within the article or its supplementary materials.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] W. Zheng, P.P. Walsh, Economic growth, urbanization and energy consumption — a provincial level analysis of China, Energy Econ. 80 (2019) 153–162.
[2] M. Marinelli, How to Build a 'Beautiful China' in the Anthropocene. The political discourse and the intellectual debate on ecological civilization, J. Chin. Polit. Sci. 23 (2018) 365–386.
[3] B. Tahmasbi, M.H. Mansourianfar, H. Haghshenas, I. Kim, Multimodal accessibility-based equity assessment of urban public facilities distribution, Sustain. Cities Soc. 49 (2019) 101633.
[4] C. Zhao, B. Wang, How does new-type urbanization affect air pollution? Empirical evidence based on spatial spillover effect and spatial Durbin model, Environ. Int. 165 (2022) 107304.
[5] T. Li, Y. Zhao, X. Kong, Spatio-temporal characteristics and influencing factors of basic public service levels in the yangtze river delta region, China, Land 11 (2022) 1477.
[6] Z. Zhang, J. Gong, H. Ma, J. Zhang, The spatial and temporal evolution and influencing factors of the coupling and coordinated development of basic public services, urbanization, and tourism in China, Sustainability 15 (2023) 11753.
[7] G. Yang, Y. Xue, Y. Ma, Social organization participation, government governance and the EBPS: evidence from China, Int. J. Environ. Res. Publ. Health 16 (2019) 2996.

[8] M. Pan, Y. Huang, Y. Qin, X. Li, W. Lang, Problems and strategies of allocating public service resources in rural areas in the context of county urbanization, Int. J. Environ. Res. Publ. Health 19 (2022) 14596.

[9] Z.W. Zhang, J. Gong, H.Q. Ma, J.Y. Zhang, The spatial and temporal evolution and influencing factors of the coupling and coordinated development of basic public services, urbanization, and tourism in China, Sustainability 15 (2023).

[10] K. Cheng, S. Liu, Does urbanization promote the urban–rural EBPS? Evidence from prefectural cities in China, Appl. Econ. 56 (2024) 3445–3459.

[11] A. Smith, An Inquiry into the Nature and Causes of the Wealth of Nations, University of Chicago Press, 1977.

[12] P.A. Samuelson, The pure theory of public expenditure, Rev. Econ. Stat. 36 (1954) 387–389.

[13] A.C. Pigou, The Economics of Welfare, Macmillan, London, 1920.

[14] J.M. Buchanan, An economic theory of clubs, Economica 32 (1965) 1–14.

[15] Z. Qichun, T. Xuebing, M. Raluca Georgiana Popescua, Dynamic evaluation and determinants of China'S inter, regional EBPS, Economic research-Ekonomska istraživanja 26 (2013) 49–68.

[16] M. Moullin, Delivering Excellence in Health and Social Care, 2002.

[17] L. Guo, Y. Bao, S. Li, J. Ma, W. Sun, Quality analysis and policy recommendations on the utilization of community basic public health services in urban and suburban Shanghai from 2009 to 2014, Environ. Sci. Pollut. Control Ser. 25 (2018) 28206–28215.

[18] F. Longo, K. Claxton, J. Lomas, S. Martin, Does public long-term care expenditure improve care-related quality of life of service users in England? Health Econ. 30 (2021) 2561–2581.

[19] Y.-Y. Liu, Y. Wang, T.R. Walsh, L.-X. Yi, R. Zhang, J. Spencer, Y. Doi, G. Tian, B. Dong, X. Huang, L.-F. Yu, D. Gu, H. Ren, X. Chen, L. Lv, D. He, H. Zhou, Z. Liang, J.-H. Liu, J. Shen, Emergence of plasmid-mediated colistin resistance mechanism MCR-1 in animals and human beings in China: a microbiological and molecular biological study, Lancet Infect. Dis. 16 (2016) 161–168.

[20] D.F. Bradford, R.A. Malt, W.E. Oates, The rising cost of local public services: some evidence and reflections, Natl. Tax J. 22 (1969) 185–202.

[21] X. Wang, Research on the influence of China's transfer payment system on the EBPS, World Journal of Advanced Research and Reviews 13 (2022) 55–62.

[22] B. Lin, J. Zhu, Impact of China's new-type urbanization on energy intensity: a city-level analysis, Energy Econ. 99 (2021) 105292.

[23] Z. Wang, Y. Sun, B. Wang, How does the new-type urbanisation affect CO2 emissions in China? An empirical analysis from the perspective of technological progress, Energy Econ. 80 (2019) 917–927.

[24] L. Chen, C. Zhong, C. Li, Research on the impact of the digital economy on China's new-type urbanization: based on spatial and mediation models, Sustainability 14 (2022) 14843.

[25] H. Wu, Z. Gai, Y. Guo, Y. Li, Y. Hao, Z.-N. Lu, Does environmental pollution inhibit urbanization in China? A new perspective through residents' medical and health costs, Environ. Res. 182 (2020) 109128.

[26] M. Zhang, S. Tan, Y. Zhang, J. He, Q. Ni, Does land transfer promote the development of new-type urbanization? New evidence from urban agglomerations in the middle reaches of the Yangtze River, Ecol. Indicat. 136 (2022) 108705.

[27] K. Cheng, S. Liu, Does urbanization promote the urban–rural EBPS? Evidence from prefectural cities in China, Appl. Econ. (2023) 1–15.

[28] F. Lan, C. Wang, W.Z. Sun, et al., Crowding effect or scale effect: the impact of population inflow on the level of basic public services, Journal of East China Normal University (Philosophy and Social Sciences Edition) 54 (2022) 127–142+175 (in Chinese).

[29] S. Cao, N. Yu, Y. Wu, Z. Wang, J. Mi, The educational level of rural labor, population urbanization, and sustainable economic growth in China, Sustainability 12 (2020) 4860.

[30] R.W. Taylor, Urbanization, local government, and planning for sustainability, in: M.P. Weinstein, R.E. Turner (Eds.), Sustainability Science: the Emerging Paradigm and the Urban Environment, Springer New York, New York, NY, 2012, pp. 293–313.

[31] S Li, Y Wang, H Dincer, S Yuksel, D Yu, The Effects of New Urbanization Pilot City Policies on Urban Innovation: Evidence from China, Sustainability 15 (14) (2023) 11352. https://doi.org/10.3390/su151411352.

[32] B. Liao, L. Li, C.H. Tian, How does the pilot policies of new-type urbanization improve uneven development? Econ. Anal. Pol. 82 (2024) 86–103.

[33] Y. Feng, H. Yuan, Y. Liu, S. Zhang, Does new-type urbanization policy promote green energy efficiency? Evidence from a quasi-natural experiment in China, Energy Econ. 124 (2023) 106752.

[34] X. Yang, Z. Jia, Z. Yang, How new-type urbanization pilots reduce carbon emissions: a technology progress paths perspective, J. Clean. Prod. 401 (2023) 136663.

[35] J. Liu, P.J. Sun, Analysis of the equalization effects and mechanisms of basic public services in shrinking cities of the three northeastern provinces, Hum. Geogr. 38 (3) (2023) 128–137+181 (in Chinese).

[36] B.B. Yu, Ecological effects of new-type urbanization in China, Renew. Sustain. Energy Rev. 135 (2021).

[37] N. Cao, N. Luo, Y. Peng, J. Liu, K. Zhang, P. Sun, Evaluation of urbanization development dynamics based on quadrilateral diamond structure model: evidence from chongqing, China, in the New Era, J. Urban Plann. Dev. 149 (2023) 04023030.

[38] N. Nunn, N. Qian, US food aid and civil conflict, Am. Econ. Rev. 104 (2014) 1630–1666.

[39] Z.M. Feng, D. Zhang, Y.Z. Yang, Topographic relief by county and its correlation with population distribution and economic development in China, Journal of Social Sciences, Jilin University 51 (1) (2011) 146–151+160 (in Chinese).

[40] J.H. Stock, M. Yogo, Testing for weak instruments in linear IV regression, in: D.W.K. Andrews, J.H. Stock (Eds.), Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg, Cambridge University Press, Cambridge, 2005, pp. 80–108.

[41] M. Zhang, S. Tan, E. Chen, J. Li, Spatio-temporal characteristics and influencing factors of land disputes in China: do socio-economic factors matter? Ecol. Indicat. 160 (2024) 111938.

[42] S. Shang, L. Feng, The effect of digitalization on urban green total factor productivity: empirical evidence from China, Environ Dev Sustain (2024). https://doi.org/10.1007/s10668-024-05013-6.

[43] T. Beck, R. Levine, A. Levkov, Big Bad Banks? The winners and losers from bank deregulation in the United States, J. Finance 65 (2010) 1637–1667.