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The impact of fiscal decentralization on the composition of public expenditure in Chinese prefecture-level cities: Does fiscal transparency matter?

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ABSTRACT

This research examines how fiscal decentralization influences the composition of public spending in Chinese prefecture-level cities, with a focus on the moderating role of fiscal transparency. We analyzed data from 283 Chinese cities from 2013 to 2022 using a special statistical model that accounts for changes over time and other factors. The findings indicate that fiscal decentralization negatively affects the share of public expenditure allocated to science and technology, education, and social security and employment. However, as fiscal transparency increases, these negative effects diminish, with the impact on science and technology spending becoming significantly positive at higher levels of transparency. In contrast, the marginal effects on healthcare expenditure are initially positive but insignificant, and they become significantly negative once transparency exceeds a certain threshold. These results underscore the critical moderating role of fiscal transparency in local governments' expenditure decisions in response to fiscal decentralization. The findings offer valuable insights for policymakers on how enhancing fiscal transparency can mitigate the negative impacts of fiscal decentralization and promote more efficient public expenditure allocation.

Contribution/ Originality: This study provides a new analysis of the connections between fiscal decentralization, transparency, and the composition of public spending within a single model, evaluating the moderating effect of fiscal transparency. This comprehensive approach to examining how these factors interact within the governmental framework presents a distinct contribution to the current body of research.

1. INTRODUCTION

The expansion of government size, including the growth of government expenditure, has been a central topic in public economics (Asngar, Nkoa, & Younda, 2024; Makreshanska-Mladenovska & Petrevski, 2019; Sirait, 2017). However, relatively less attention has been paid to the composition of government expenditure (Kappeler & Välilä, 2008; Siwińska-Gorzelak, Bukowska, & Wójcik, 2020) despite its importance. Given that public resources are limited, governments must make careful decisions regarding their allocation. Typically, governments face a challenging trade-off between promoting economic growth and enhancing social welfare (Rodrik, 1996). From a functional perspective, public expenditures on science and technology directly contribute to technological progress, which in turn drives economic growth. While growth also increases social welfare, its benefits are less immediate and tangible for citizens. In contrast, increasing public expenditures on social welfare programs, such as education, social security,

employment, and healthcare, improves citizens' well-being but provides a slower and more delayed contribution to economic growth.

Fiscal decentralization is recognized as a crucial determinant of the composition of public expenditure (Del Granado, Martinez-Vazquez, & McNab, 2018). However, empirical research examining this relationship remains relatively scarce. Existing studies have predominantly focused on the effects of fiscal decentralization on the economic classification of public expenditure, such as the division between recurrent and capital expenditures (Alegre, 2010; Kappeler & Välilä, 2008), with results that contradict expectations. Additionally, relatively little attention has been given to its influence on the functional composition of public expenditure, particularly in sectors such as education, healthcare, social security, and technology. Only a few studies, such as Del Granado et al. (2018), have explored this aspect. Furthermore, these studies have focused on the national level, with only a few, such as Alegre (2010) and Ghozali and Khoirunurrofik (2020), examining the relationship at the subnational level. While fiscal decentralization enhances the decision-making autonomy of local governments, enabling them to tailor public expenditure to local needs (Oates, 1972), this process is still influenced by the institutional environment, such as fiscal transparency. Fiscal transparency strengthens accountability by mitigating information asymmetry, reducing the potential for rent-seeking behavior among local governments (Alt & Lassen, 2006), and may therefore moderate the relationship between fiscal decentralization and the composition of public expenditure. Nevertheless, this issue remains insufficiently addressed in the existing literature.

Since the 1990s, China has advanced fiscal decentralization through a series of fiscal reforms, with local governments gradually assuming primary responsibility for providing public goods and services (Zhang, 2016). Data on fiscal expenditure show that the annual average level of fiscal decentralization at the provincial level has remained around 80% (National Bureau of Statistics of China, 2023). Furthermore, over the past two decades, China has established a relatively comprehensive fiscal information system, including the implementation of the Regulations on Government Information Disclosure in 2008 (State Council of the People's Republic of China, 2007), which has significantly enhanced fiscal transparency. According to the Chinese Prefecture-Level Fiscal Transparency Reports (Tsinghua University, 2023), the average fiscal transparency score for prefecture-level cities increased from 18 points in 2012 to 56 points in 2022 on a 100-point scale.

As China continues to advance fiscal decentralization, local governments have gained greater autonomy in public expenditure decisions. However, existing studies primarily focus on the impact of fiscal decentralization on the composition of public expenditure at the national level, with limited research on how it reshapes expenditure composition at the local level. Moreover, most studies focus on the economic classification of public expenditure rather than its functional composition, which directly reflects how government spending serves socio-economic objectives and allocates resources across sectors. Meanwhile, China's institutional reforms, particularly improvements in fiscal transparency, have significantly enhanced oversight of local government finances. Despite this, the role of fiscal transparency remains underexplored in shaping local governments' expenditure decisions under fiscal decentralization. Thus, the research questions of this study are: (1) How does fiscal decentralization affect the functional composition of public expenditure in China's prefecture-level cities? (2) What is the moderating role of fiscal transparency in this relationship?

This study examines the impact of fiscal decentralization and fiscal transparency on the composition of public expenditure at the prefecture level in China. This study specifically looks at how fiscal decentralization affects how money is spent in Chinese prefecture-level cities and how fiscal transparency influences this effect. This study uses data from 283 Chinese prefecture-level cities between 2013 and 2022 and applies a special statistical method called a dynamic panel model with two-way fixed effects, using Difference and System Generalized Method of Moments (GMM) to analyze the data. Model selection criteria will guide the choice of the optimal specification, and marginal effect analysis will illustrate the moderating role of fiscal transparency. This study makes three key contributions to the literature. First, it shifts the focus from the national level to prefecture-level cities, systematically analyzing how

fiscal decentralization affects expenditure composition. Second, it introduces fiscal transparency as a moderating institutional factor and develops a theoretical framework to examine its influence. Third, it adopts a rigorous model selection approach to enhance estimation robustness.

This study offers significant theoretical and practical insights. Theoretically, it advances our understanding of how fiscal decentralization shapes the composition of public expenditure at the prefecture level, filling a gap in existing research, which has mostly focused on national or provincial levels. By introducing fiscal transparency as a moderating factor, it broadens the framework for analyzing the impact of fiscal decentralization on public expenditure and highlights the role of transparency in resource allocation. Practically, the findings provide valuable policy recommendations for improving fiscal management and refining public expenditure composition. They guide governments in designing more targeted decentralization reforms and in adjusting expenditure across different sectors. The study also highlights how being open about finances helps local governments manage money better, showing proof that sharing financial information leads to better use of resources and better results from policies. Finally, it explores how fiscal transparency influences expenditure decisions under fiscal decentralization, providing policymakers with key insights on balancing decentralization with oversight in fiscal reforms.

This paper is organized as follows. Section 2 reviews the relevant theoretical and empirical literature, from which a theoretical framework is developed and research hypotheses are formulated. Section 3 outlines the research methodology, including sample selection, variable and data sources, model construction, and estimation and selection methods. Section 4 presents the empirical results and discussion, starting with the regression results, followed by a marginal effect analysis and discussion. The final section concludes with a summary and policy recommendations.

2. LITERATURE REVIEW

2.1. Fiscal Decentralization and the Composition of Public Expenditure

Theories of fiscal decentralization have evolved in two distinct phases, each exploring its impact on public spending patterns. Early perspectives, influenced by Tiebout (1956), emphasized the efficiency gains achieved when local governments respond to citizen preferences and compete across jurisdictions. Musgrave (1959) went into more detail about the different roles of government at different levels. He said that central governments are better at redistribution, price stabilization, and employment monitoring. On the other hand, local governments are better at allocating resources because they are closer to the people. Building on these ideas, Oates (1972) asserted that decentralization enables local governments to leverage their informational advantage regarding citizen preferences, allowing them to tailor public goods and services to local needs, thereby increasing demand and overall satisfaction.

The second generation of fiscal decentralization theories shifted focus to how decentralization can limit government expansion. The "Leviathan hypothesis," notably introduced by Brennan and Buchanan (1980), depicted governments as entities striving to maximize their revenue and influence. Niskanen (2017) argued that central governments often exploit their monopolistic position through high taxes or deficits, with little accountability from taxpayers. By fostering competition among local governments, decentralization helps curb these tendencies, promoting more controlled approaches to spending and taxation. Although the two generations of fiscal decentralization theory have different focal points, both agree that decentralization impacts public spending, but neither provides an explanation for how it alters the composition of that expenditure.

Within the framework of second-generation fiscal decentralization theory, Keen and Marchand (1997) examined how fiscal competition affects the structure of public expenditure at the subnational level. They categorize public expenditure into two types based on their economic characteristics: investment-type expenditure and consumption-type expenditure. Investment-type expenditure includes infrastructure, industrial park development, and other projects that promote long-term economic growth and productivity. In contrast, consumption-type expenditure focuses on local public goods, which primarily address current social needs. Their analysis suggests that, in a context where labor is immobile but capital is mobile, uncoordinated fiscal competition incentivizes local governments to

overinvest in productive public inputs to reduce firms' production costs and attract capital inflows while neglecting the provision of local public goods. While tax competition may reduce overall public expenditure by limiting fiscal revenue, it also shifts the composition of expenditure, prioritizing productive public investment over consumptive public goods. This results in imbalanced public service provision and a distortion in the allocation of fiscal resources.

Del Granado, Martinez-Vazquez, and McNab (2005) and Del Granado et al. (2018) proposed a theoretical framework to illustrate the impact of fiscal decentralization on the composition of public expenditure. They built upon Panizza (1999) median-voter model and linked the composition of national and subnational public expenditure to individual utility. Assuming that individuals are evenly distributed and that the utility of public goods decreases with distance from the provider region, their model employs a distance-sensitive utility function. According to their results, fiscal decentralization increases the demand for public goods that resemble private commodities. Alegre (2010) made two important modifications to this framework: first, he assumed that utility from public capital expenditure is homogeneous across individuals, while utility from public current expenditure is distance-dependent; second, he allowed both levels of government to allocate budgets more flexibly between these two categories of public goods. The findings indicate that fiscal decentralization alters the composition of public expenditure by decreasing the supply of goods with homogeneous utility and increasing the supply of goods with heterogeneous utility.

There remains a scarcity of empirical research on the impact of fiscal decentralization on the composition of public expenditure. Most existing studies have empirically tested the theoretical framework proposed by Keen and Marchand (1997). Rodríguez-Pose and Krøijer (2009) found that in Germany, India, Mexico, Spain, and the United States, fiscal decentralization is associated with a relative increase in recurrent expenditure, often at the expense of capital investment. Similarly, Alegre (2010) observed that, at the regional level in Spain, fiscal decentralization tends to raise the share of recurrent expenditures in public budgets. Examining capital expenditure in European countries, Kappeler and Välilä (2008) concluded that fiscal decentralization promotes productive public investment, particularly in infrastructure, while reducing the relative share of less productive expenditures, such as recreational facilities. Ghozali and Khoirunurrofik (2020) found that in Indonesia, fiscal decentralization increased capital spending on traditional infrastructure, enhancing the country's comparative advantage in international trade, but simultaneously reduced investment in human capital infrastructure. Additionally, Del Granado et al. (2018), using panel data from 42 countries, tested their own theoretical model based on the median-voter framework. They found that expenditure decentralization has a positive, significant, and robust impact on the share of education spending in the consolidated government budget, while also exerting a similarly positive effect on the proportion of health expenditures.

While existing studies provide valuable insights into the relationship between fiscal decentralization and the composition of public expenditure, they have certain limitations. First, the theoretical model developed by Keen and Marchand (1997) within the framework of second-generation fiscal federalism focuses on the impact of fiscal decentralization on the composition of public expenditure categorized by economic attributes. However, this study aims to examine how fiscal decentralization influences the composition of public expenditure from a functional perspective. Since each functionally classified category of public expenditure includes both recurrent and capital expenditures, the theoretical framework proposed by Keen and Marchand (1997) is not fully applicable to this study. Second, there is a discrepancy between empirical findings and theoretical expectations. Most empirical studies, at both national and regional levels, suggest that the share of recurrent expenditures increases with fiscal decentralization, while the share of capital expenditures declines. This observation contradicts the theoretical expectation that local governments, to attract mobile capital, would increase the share of capital expenditures and reduce recurrent expenditures. Third, while Del Granado et al. (2018) discuss how public spending is organized, their model looks at the big picture and assumes that local governments only provide one type of public good. As a result, their framework does not account for how local governments alter the composition of public expenditure following decentralization.

Keen and Marchand (1997) categorized public expenditure based on economic attributes, but we can adapt their theoretical framework for this study with some adjustments. They suggest that fiscal decentralization intensifies tax competition among local governments, encouraging them to allocate more resources to investment projects while reducing the share of consumption-related expenditures. When public expenditure is classified by function, local governments are likely to increase productive expenditures and decrease welfare-related expenditures in response to tax competition. This approach aligns with the goal of boosting investment expenditures to enhance economic output, which in turn generates higher fiscal revenues. Even without tax competition, fiscal decentralization may still lead to a higher proportion of productive expenditures. According to the Leviathan hypothesis, governments seek to maximize revenue. When granted more fiscal authority, they may be incentivized to allocate funds toward productive expenditures to increase economic output and, ultimately, revenue. Based on this reasoning, we propose the following hypothesis:

H_1: Fiscal decentralization positively impacts the shares of productive public expenditures.

H_2: Fiscal decentralization negatively influences the shares of welfare-related public expenditures.

2.2. Fiscal Transparency as a Moderator in their Relationship

The failure of empirical studies to validate Keen and Marchand (1997) theory can be attributed to their neglect of institutional factors. In their framework, the imbalance in public expenditure composition caused by fiscal competition assumes the absence of intervention. However, they have implemented various institutional mechanisms, such as fiscal transparency, have been implemented to mitigate the potential negative effects of fiscal decentralization. As a result, the divergence between theoretical expectations and empirical findings may stem from the omission of institutional influences. Fiscal transparency, a crucial institutional mechanism, refers to the openness and accessibility of government fiscal information, enabling citizens to monitor and understand public financial activities (Kopits & Craig, 1998). Due to a lack of professional expertise, citizens often delegate the management of public affairs to politicians, thereby establishing a principal-agent relationship (Jensen & Meckling, 1976). While citizens prioritize maximizing social welfare, governments, according to bureaucratic behavior theory (Niskanen, 2017), typically seek to maximize revenue. Moreover, governments possess a significant information advantage in public affairs, allowing them to exploit information asymmetry to pursue their interests. One common solution to address this issue is improving information disclosure, which helps reduce agency costs (Healy & Palepu, 2001). Fiscal transparency serves as an institutional mechanism that strengthens accountability by mitigating information asymmetry between governments and citizens, thereby constraining governments' self-interested behavior (Alt & Lassen, 2006).

Using new institutional theory with the extended Keen framework helps clarify how fiscal transparency affects the link between fiscal decentralization and how local governments spend their money. Fiscal decentralization, by shifting fiscal responsibilities to lower levels of government, increases local governments' involvement in regional economic development (Brennan & Buchanan, 1980; Oates, 1972). Whether driven by fiscal competition or self-interest, local governments may adjust the composition of public expenditure, often increasing productive expenditures, such as those in science and technology, to boost fiscal revenue and alleviate fiscal pressure through economic growth. However, such adjustments may deviate from citizens' goals of maximizing social welfare. Fiscal transparency acts as a constraint on these adjustments by strengthening accountability mechanisms. To maintain legitimacy and avoid public scrutiny, local governments must align their fiscal decisions with citizens' preferences (Bellver & Kaufmann, 2005). In this way, fiscal transparency moderates the impact of fiscal decentralization on the composition of public expenditure at the local government level.

Some research examines the impact of democratic institutions, but there are few empirical studies explicitly investigating the moderating role of fiscal transparency in the relationship between fiscal decentralization and the composition of public expenditure. Mulligan, Gil, and Sala-i-Martin (2004) and Mulligan, Gil, and Sala-i-Martin (2010) explored whether democracy affects the composition of public expenditure. Their 2004 study found that

democracy has little effect on the amount spent on social security. When they expanded their sample to 142 countries in 2010, they found no significant relationship between democracy and social welfare or pension spending. Similarly, Profeta, Puglisi, and Scabrosetti (2013) found no significant relationship between democracy and the amount or composition of public expenditures, except for defense spending, in a study covering Asia, Latin America, and new EU members from 1990 to 2005. However, Kotera and Okada (2017), using instrumental variable estimates with data from 125 countries between 1972 and 2010, reported that democracy affects the prioritization of various expenditures but has no clear effect on the total amount of public spending. Specifically, democracy reduces war expenditures while significantly increasing healthcare and education spending. Overall, the results of these studies are divergent, suggesting that institutions may influence the composition of public expenditure indirectly, such as by fostering a more orderly environment. Based on this reasoning, we propose the following hypothesis:

H_3: Fiscal transparency constrains the impact of fiscal decentralization on the composition of public expenditure.

Figure 1 shows the research plan for the expected link between fiscal decentralization and how public spending is divided, highlighting the important role of fiscal transparency.

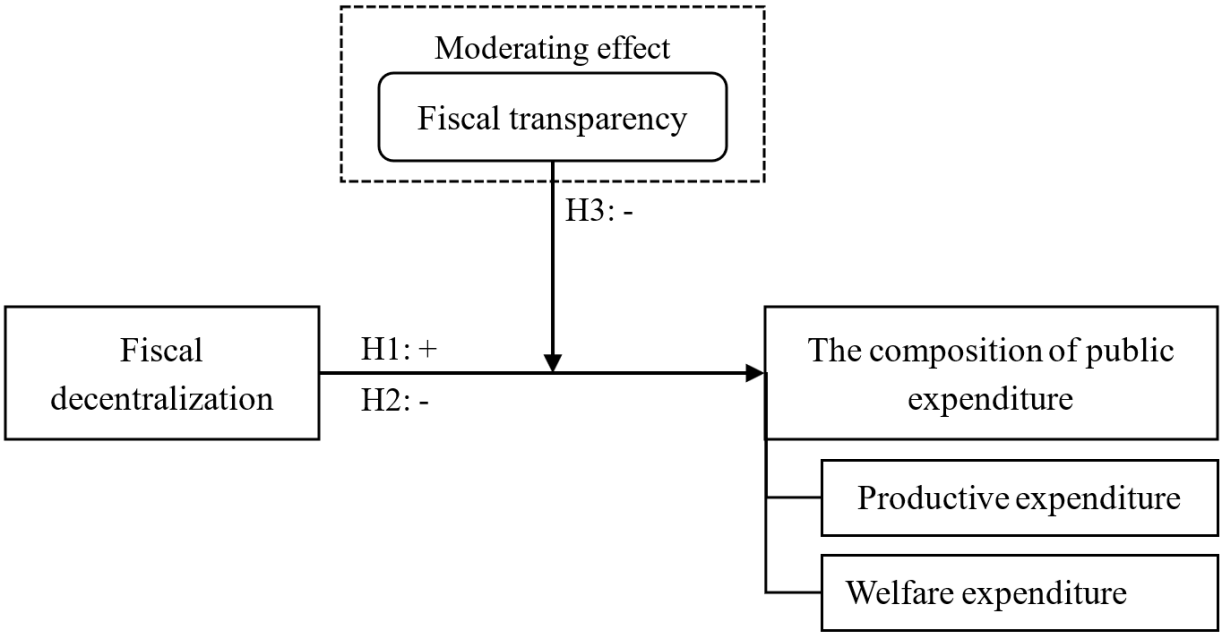

Figure 1. Research framework.

3. RESEARCH DESIGN

3.1. Sample Selection

This study uses panel data from 283 prefecture-level cities in China, covering the period from 2013 to 2022. China was chosen as the sample for two main reasons. First, while developed countries such as the United States have implemented fiscal decentralization policies for over forty years, fiscal decentralization in China began relatively recently. Second, China has made significant progress in enhancing fiscal transparency over the past two decades, offering a unique opportunity to examine its moderating role in the relationship between fiscal decentralization and the composition of public expenditure. Additionally, China's large number of prefecture-level cities is advantageous for this study. With a total of 293 prefecture-level cities, the sample of 283 cities meets the statistical analysis requirements. The cities of Sansha, Danzhou, Shigatse, Chamdo, Nyingchi, Shannan, Nagqu, Turpan, Hami, and Pu'er were excluded because of missing data. Although fiscal transparency data at the prefecture level became available starting in 2012, the study excludes data from that year to ensure greater accuracy and avoid potential inconsistencies. Therefore, the sample period begins in 2013. Fiscal transparency data are sourced from the Chinese Prefecture-level Fiscal Transparency Reports (2014-2023), published by the Tsinghua University Research Center for Public

Economics, Finance, and Governance (https://www.sppm.tsinghua.edu.cn/xycbw/yjbg.htm). Other data used in this study are obtained from various statistical yearbooks and government reports, available through the China Economic Information Network (CEInet) Statistics Database (https://ceidata.cei.cn/).

3.2. Variable Definition

Dependent Variables: In this study, the composition of public expenditure (EC) is categorized into two main types: productive expenditure and welfare expenditure, based on government functions. Productive expenditure refers to spending that directly fosters economic growth, such as expenditure on science and technology (SE). In contrast, welfare expenditure focuses on enhancing social welfare, including spending on education (ED), social security and employment (SE), and healthcare (HC). While public expenditure covers a wide range of categories, this study narrows its focus to these four types due to data availability. The composition of public expenditure is measured by the share of each category in general public budget expenditure across Chinese prefecture-level cities. Similar indicators have been employed in empirical studies, such as those by Kotera and Okada (2017) and Pan and Liu (2012). Data for these expenditure categories are sourced from the China City Statistical Yearbooks and the Statistical Yearbooks of the respective prefecture-level cities.

Independent Variable: Fiscal decentralization (FD) is measured by the ratio of per capita general public budget expenditure in prefecture-level cities to that in their respective provincial governments. This approach, commonly used in empirical studies, relies on total government expenditure as a metric for fiscal decentralization (Asngar et al., 2024; Choudhury & Sahu, 2023; Makreshanska-Mladenovska & Petrevski, 2019). To control for variations in the number of prefecture-level cities across provinces, per capita measures are applied, based on the methodology of Zhang (2016) and Zhang, Zhu, and Hou (2016). Data on population and general public budget expenditures at the provincial level are obtained from the China Provincial Statistical Yearbooks, while the local-level data is sourced from the China City Statistical Yearbooks.

Fiscal transparency (FT) is measured using a special index for cities, created by Tsinghua University, which is adjusted to fix any unevenness in the data. Based on the International Monetary Fund (2007) and adapted to the Chinese context, this index has become a widely used tool in empirical studies on fiscal transparency, including works by Li and Yang (2024) and Sun and Andrews (2020). Tsinghua University has been publishing the Chinese Prefecture-level Fiscal Transparency Reports for over a decade, ensuring the data's credibility, consistency, and high quality, making it a reliable source for assessing fiscal transparency at the prefecture level. Typically published before September, these reports mirror the fiscal transparency levels of the previous year. To maintain consistency across years with differing scoring criteria, the index scores are normalized to a 0-100 scale, where 0 represents the lowest level of transparency and 100 represents the highest.

Table 1. Variable and data source.

Category	Variables	Definition	Data source
Dependent variables	Composition-science and technology (ST)	The share of government expenditure allocated to science and technology in prefecture-level cities (%).	China city statistical yearbooks
	Composition-education (ED)	The share of government expenditure allocated to education in prefecture-level cities (%).	China city statistical yearbooks
	Composition-social security and employment (SE)	The share of government expenditure allocated to social security and employment in prefecture-level cities (%).	Statistical yearbooks of respective prefecture-level cities
	Composition-health care (HC)	The share of government expenditure allocated to health care in prefecture-level cities (%).	Statistical yearbooks of respective prefecture-level cities

Category	Variables	Definition	Data source
Independent variable	Fiscal decentralization (FD)	The degree of fiscal decentralization, measured as the ratio of per capita public budget expenditure in prefecture-level cities to that in their superior provinces (%).	China city statistical yearbook, China provincial statistical yearbooks
Moderator	Fiscal transparency (FT)	The fiscal transparency index of Chinese prefecture-level cities, measured on a scale from 0 to 100, where higher values indicate better fiscal transparency (Log-transformed).	Tsinghua university https://www.sppm.tsinghua.edu.cn/xycbw/yjbg.htm
Control variables	Vertical balance (VB)	The proportion of general public budget revenue to expenditure in prefecture-level cities (%).	China city statistical yearbook
	Population size (PS)	The number of residents in prefecture-level cities, in millions (Log-transformed).	Statistical yearbooks of respective prefecture-level cities
	Economic development (ED)	Real gross domestic product (GDP) per capita, calculated using the GDP growth index, with 2011 as the base year, in thousands (Log-transformed).	Statistical yearbooks of respective prefecture-level cities

Note: All the yearbook data is collected from the CEInet statistics database (https://ceidata.cei.cn/).

Control Variables: This study introduces three control variables: vertical balance, economic development, and population size. Rodden (2003) found that the form of decentralization influences local government public expenditure and emphasized the importance of controlling for its effects. While few empirical studies on fiscal decentralization and the composition of public expenditure directly control for this factor, other studies on decentralization's effects, such as those by Baldissera, Dall'Asta, Vesco, Scarpin, and Fiirst (2023) and Makreshanska-Mladenovska and Petrevski (2019), have incorporated it. Therefore, we include the vertical fiscal balance (VB) variable, which looks at the ratio of total public budget income to spending in prefecture-level cities, using the method from Eyraud and Lusinyan (2011). Data on general public budget revenue in prefecture-level cities are sourced from the China City Statistical Yearbooks.

Population size (PS) is measured by the total number of residents in prefecture-level cities, and a logarithmic transformation is applied. Keefer, Scartascini, and Vlaicu (2020) and Endrikat (2017) suggested that larger populations might lead to economies of scale, potentially influencing the composition of public expenditure. However, Kotera and Okada (2017) noted that the impact of population size on expenditure composition remains uncertain due to the heterogeneity of citizens' preferences for public goods and services. Empirical studies such as those by Del Granado et al. (2018) and Ghozali and Khoirunurrofik (2020) also included this variable to control for population size's effects on public expenditure composition. The former found a negative effect on education and health expenditures, while the latter found a positive effect on human capital resources and a negative effect on traditional infrastructure expenditure.

Economic development (ED) is measured by real GDP per capita, which is also log-transformed, following the methodologies of Endrikat (2017), Kotera and Okada (2017), and Cordis (2014). Real GDP is calculated using the GDP growth index from the Statistical Yearbooks of the respective prefecture-level cities, using 2011 as the base year. According to Wagner (1893), rising income levels increase the demand for public goods relative to private goods, thereby influencing the composition of public expenditure. While Del Granado et al. (2018) found no significant impact of economic development on the composition of health and education expenditures, Ghozali and Khoirunurrofik (2020) confirmed a negative influence on capital expenditure. An overview of the variables and their corresponding data sources is presented in Table 1, and descriptive statistics are provided in Table 2.

3.3. Model Construction

We follow the model construction approach of Del Granado et al. (2018), who empirically examine the impact of fiscal decentralization on the composition of public expenditure by using a dynamic panel model with two-way fixed effects.

To explore the moderating role of fiscal transparency, we extend their model by incorporating fiscal transparency and its interaction term with fiscal decentralization. The initial model is specified as follows:

$$EC_{it} = \alpha + \beta_1 EC_{it-1} + \beta_2 FD_{it} + \beta_3 FT_{it} + \beta_4 (FD_{it} \times FT_{it}) + \theta X + \mu_i + \omega_t + \varepsilon_{it} \quad (1)$$

Where, EC represents the composition of public expenditure, FD stands for fiscal decentralization, FT refers to fiscal transparency, and X includes control factors such as vertical balance (VB), population size (PS), and economic development (ED). β and θ denote the coefficients of the variables and α is the constant term. Individual fixed effects are denoted by μ_i, time-period fixed effects by ω_t, and the error term is denoted by ε_{it}.

The dynamic panel model introduced by Arellano and Bond (1991) provides a robust framework for analyzing the changing composition of public expenditure, effectively addressing endogeneity issues. To account for both entity-specific and time-specific variations, we employ a two-way fixed effects model. The inclusion of the interaction term allows us to assess the moderating role of fiscal transparency in the relationship between fiscal decentralization and public expenditure composition.

Importantly, the coefficient for fiscal decentralization does not directly represent its total effect on expenditure composition. To capture this overall impact, we derive the partial derivatives of fiscal decentralization with respect to the composition of public expenditure, as shown in Equation 2.

This approach highlights the crucial role of fiscal transparency in shaping the effects of decentralization. Additionally, we apply Equation 3 to estimate the standard errors of these marginal effects, following the methodology outlined by Brambor, Clark, and Golder (2006).

$$\frac{\partial EC_{it}}{\partial FD_{it}} = \beta_2 + \beta_4 FT_{it} \quad (2)$$

$$\hat{\sigma}_{\frac{\partial EC_{it}}{\partial FD_{it}}} = \sqrt{Var(\beta_2) + (FT_{it})^2 Var(\beta_4) + 2(FT_{it}) Cov(\beta_2, \beta_4)} \quad (3)$$

3.4. Estimation Approach

Following the approach of Del Granado et al. (2018), this study employs both the Difference and System GMM estimation techniques developed by Arellano and Bover (1995) and Blundell and Bond (1998) to estimate the coefficients.

These methods address endogeneity concerns by using lagged endogenous variables as instruments. Such techniques have been successfully applied in studies like Bamba, Combes, and Minea (2020), which examine the factors influencing the composition of public expenditure. The System GMM offers an advantage over the Difference GMM by reducing the issue of weak instruments.

In this study, we apply the orthogonal deviation transformation to minimize information loss and use a two-step estimation procedure to improve accuracy. To correct for potential underestimation, we employ Windmeijer-corrected standard errors (Windmeijer, 2005). Diagnostic tests, including the Arellano-Bond test for residual autocorrelation (Arellano & Bond, 1991), are performed to ensure the absence of autocorrelation.

We also conduct the Hansen (1982) test to confirm the validity of the instruments, examining their exogeneity and relevance. These rigorous diagnostic procedures ensure the robustness and reliability of the estimation results.

Table 2. Descriptive statistics.

Variables	Obs.	Mean	Std. dev.	Min.	Max.
Composition-science and technology	2,830	0.018	0.018	0.001	0.207
Composition-education	2,830	0.173	0.038	0.036	0.304
Composition-social security and employment	2,360	0.141	0.046	0.023	0.443
Composition-health care	2,120	0.099	0.024	0.034	0.209
Fiscal decentralization	2,830	0.854	0.238	0.376	2.494
Fiscal transparency	2,830	49.352	17.627	2.770	92.150
Vertical balance	2,830	0.433	0.214	0.056	1.107
Population size	2,830	4.304	2.920	0.256	21.268
Economic development	2,830	57.392	32.489	8.502	250.633

3.5. Model Selection

Kiviet (2020) suggests that introducing lagged terms can enhance forecasting accuracy and help address issues related to serial correlation. However, the challenge lies in selecting the appropriate lagged terms to retain. To tackle this, Kiviet proposes a model selection framework for GMM estimation in Stata, though it lacks an objective criterion. To resolve this, Kripfganz (2019) introduces the Model and Moment Selection Criteria (MMSC), based on the work of Andrews and Lu (2001), which align with established criteria such as the Hannan-Quinn Information Criterion (HQIC), Bayesian Information Criterion (BIC), and Akaike Information Criterion (AIC). This procedure creates a systematic approach for model selection. Following their framework, we proceed with the following steps to identify the most appropriate model: We follow these steps to find the best model: add past values to the initial model, use the difference GMM estimator to calculate them, and apply MMSC and significance tests to find the best lag length for each variable; test different combinations of variables with the difference GMM method, choosing the best one based on MMSC; remove any terms that are not significant and re-calculate the model using the difference GMM estimator; and finally, use the system GMM method to estimate the model and compare the results to find the best fit. Additionally, we use Chi-squared tests to check if the two-way fixed effects model is valid by testing if all time dummy variables are equal to zero. Additionally, chi-squared tests are employed to verify the validity of the two-way fixed effects model by testing the hypothesis that all time dummy variables are equal to zero.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Main Regression Results

The estimation results presented in Table 3 highlight the effects of fiscal decentralization and transparency on public expenditure in science and technology, as well as education. The results of the Arellano-Bond test indicate that the p-values for first-order autocorrelation are below 10% in all models, while those for second-order autocorrelation exceed 20%. This finding suggests that we can reject the null hypothesis of first-order autocorrelation but cannot reject the null hypothesis of second-order autocorrelation. Additionally, the Hansen J test p-values are above 20% in all cases, implying that we cannot reject the validity of the instruments used in the estimation. These diagnostic tests provide strong evidence supporting the reliability of the GMM estimation.

For science and technology expenditures, Models (1) and (3) present the estimation results using the difference GMM approach, with Model (3) incorporating the interaction term. Model (5) presents results based on the system GMM approach. The Chi-squared tests for all three models indicate that we cannot reject the null hypothesis that all time dummy variables are equal to zero. Therefore, the models with individual fixed effects present their estimation results on the right side. In all models, the dependent variable shows significantly positive coefficients for the first- and third-order lagged terms. The second-order lagged terms are only significant in Models (2) and (3), despite the fact that they are also positive. Moreover, all lagged term coefficients are less than 1, suggesting that science and technology expenditures follow a dynamic pattern where changes in expenditures induce positive but diminishing effects in subsequent periods.

The model selection results show that Models (3) to (6), which include the interaction terms, have lower MMSC values than Models (1) and (2), indicating that it's important to include the interaction between fiscal decentralization and fiscal transparency. In Models (1) and (2), both fiscal decentralization and transparency have positive coefficients, but in Models (3) to (6), these coefficients become negative and statistically significant. In Models (1) and (2), both fiscal decentralization and transparency exhibit positive coefficients; however, in Models (3) to (6), these coefficients turn negative and become statistically significant. The interaction terms are significantly positive at the 5% level or lower, with coefficients ranging from 0.015 to 0.03. The evidence suggests that both fiscal decentralization and fiscal transparency have a negative impact on science and technology expenditures when the other variable is held at zero. However, as fiscal transparency increases, the negative effect of fiscal decentralization is mitigated. For the control variables, even though vertical balance, population size, and economic development have positive values in Models (4) and (6), we cannot rule out the possibility that their effects are actually zero.

Models (7)–(9) present the estimation results for education expenditure. Models (7) and (8) are estimated using the difference GMM approach, with Model (8) including the interaction term, while Model (9) uses the system GMM approach. The results from choosing models show that the Chi-squared tests reject the idea that all time dummy variables are the same in all three models, which means that two-way fixed effects models are better than those with individual fixed effects. Furthermore, the model selection criteria values in Model (8) are smaller than those in Model (7), justifying the inclusion of the interaction term. Finally, the estimation results in Model (8), using the system GMM approach, and show no significant differences compared to Model (7).

Unlike science and technology expenditures, the first- and second-order lagged terms for education expenditure are significantly positive across all three models, while the third-order term is significantly negative. The size of these coefficients gets smaller as the lag length increases, which means that changes in education spending have lasting but weaker effects in the next two periods, followed by a small increase in the third period. The current values for both fiscal decentralization and transparency are strongly negative at the 1% level in all three models, and their values get smaller when the interaction term is added in Models (8) and (9). The lagged terms for fiscal decentralization are significantly positive across all models, with similar coefficients. The interaction terms in Models (8) and (9) are both significantly positive. These results suggest that both fiscal decentralization and transparency negatively affect education expenditure when the other variable is held at zero and that the negative effect of decentralization diminishes as transparency increases. In terms of control variables, vertical balance, population size, and economic development are generally insignificant, with the exception of population size in Model (9), where the coefficient is significantly positive at the 10% level. The result implies that an increase in population size contributes to a higher share of education in public expenditure.

Table 3. Estimation of public expenditure composition: science and technology expenditure and education expenditure.

Explanatory variables	Science and technology						Education		
	Difference GMM				System GMM		Difference GMM		System GMM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable $_{it-1}$	0.605***	0.465***	0.630***	0.408***	0.604***	0.441***	0.425***	0.482***	0.517***
	(3.82)	(3.50)	(3.33)	(2.68)	(3.68)	(3.51)	(6.09)	(6.70)	(8.96)
Dependent variable $_{it-2}$	0.103	0.111**	0.119*	0.0723	0.0719	0.0635	0.117***	0.112***	0.107***
	(1.53)	(2.25)	(1.73)	(1.44)	(1.08)	(1.23)	(4.65)	(3.87)	(3.95)
Dependent variable $_{it-3}$	0.0869**	0.0892***	0.0958**	0.0689**	0.0709*	0.0640**	-0.0503*	-0.0479*	-0.0495*
	(2.07)	(2.60)	(2.16)	(2.01)	(1.88)	(2.18)	(-1.82)	(-1.66)	(-1.74)
Fiscal decentralization	0.00887	0.0132	-0.0874***	-0.0566*	-0.0483*	-0.0935**	-0.139***	-0.241***	-0.241***
	(0.67)	(1.22)	(-2.67)	(-1.78)	(-1.81)	(-2.33)	(-7.78)	(-5.69)	(-5.64)
Fiscal decentralization $_{it-1}$							0.0897***	0.0984***	0.105***
							(4.10)	(5.03)	(8.30)
Fiscal transparency	0.00409	0.00371**	-0.0226***	-0.0146*	-0.0137*	-0.0213**	-0.0105***	-0.0359***	-0.0371***
	(1.25)	(2.29)	(-2.76)	(-1.96)	(-1.82)	(-2.52)	(-2.66)	(-3.76)	(-4.09)
Fiscal decentralization * transparency			0.0269***	0.0192**	0.0179**	0.0281***		0.0277***	0.0293***
			(2.89)	(2.06)	(2.44)	(2.79)		(2.82)	(3.00)
Vertical balance	0.0115	0.00744	0.0246*	0.0155**	0.0178	0.0165*	-0.0118	-0.00304	0.0208
	(0.50)	(0.84)	(1.80)	(2.13)	(0.94)	(1.93)	(-0.46)	(-0.11)	(1.24)
Population size	0.0136	0.0107	0.0282	0.0314***	0.0162	0.0281*	0.00298	0.00775	0.0114*
	(0.74)	(0.86)	(1.64)	(2.74)	(1.14)	(1.80)	(0.14)	(0.41)	(1.95)
Economic development	0.0248	0.00322	0.0309*	0.00972***	0.00761	0.00807**	0.00864	0.0113	-0.00650
	(1.36)	(0.86)	(1.79)	(2.90)	(0.60)	(1.99)	(0.28)	(0.39)	(-0.84)
Observations	1981	1981	1981	1981	1981	1981	1981	1981	1981
Time effects	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes
AR1 test	-3.419	-3.319	-5.179	-3.430	-3.912	-3.501	-6.294	-6.619	-7.296
	0.001	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000
AR2 test	-0.821	-1.265	-1.003	-1.007	-0.491	-0.681	-0.893	-0.376	-0.321
	0.412	0.206	0.316	0.314	0.624	0.496	0.372	0.707	0.748
Hansen J test	24.401	20.041	27.121	33.479	28.032	20.622	41.105	36.320	33.352
	0.382	0.639	0.827	0.542	0.620	0.661	0.379	0.846	0.966
Chi-squared test	4.390		7.500		2.590		92.040	110.990	149.140
	0.624		0.277		0.858		0.000	0.000	0.000
MMSC-AIC	-21.599	-25.959	-42.879	-36.521	-33.968	-27.378	-36.895	-55.680	-66.648
MMSC-BIC	-105.445	-109.804	-170.470	-164.111	-146.977	-114.869	-179.067	-223.371	-248.920
MMSC-HQIC	-56.015	-60.374	-95.250	-88.892	-80.353	-63.290	-95.251	-124.511	-141.463

Note: Parentheses indicate t-statistics, and significance levels are denoted as follows: *p < 0.01, **p < 0.05, and *p < 0.1. Diagnostic test results are presented in two rows: test statistics in the first row and p-values in the second row. All models control for individual fixed effects. Model selection criteria are categorized as MMSC-AIC, MMSC-BIC, and MMSC-HQIC. For the Chi-squared tests, the null hypothesis states that the coefficients of all time dummy variables are equal to zero.

Table 4 presents the estimation results for social security and employment expenditures, as well as health care expenditures. The diagnostic tests confirm the validity of the GMM estimations across all models. Specifically, the Arellano-Bond tests reject the null hypothesis of no first-order autocorrelation while failing to reject the null hypothesis of no second-order autocorrelation. Furthermore, the Hansen J tests show that we cannot reject the null hypothesis of valid instruments. For social security and employment expenditures, Columns (2) to (7) present estimation results from models with individual or two-way fixed effects, as chi-squared tests fail to reject the null hypothesis that all time dummy variables are equal to zero. Models (3) and (4), which include the interaction term, show lower model selection criteria values than Models (1) and (2), indicating that adding the interaction term makes the model work better. We estimate Models (5) and (6) using the system GMM approach, which mirrors the structure of Models (3) and (4) estimated with the difference GMM approach. The coefficients across these models are consistent, with no substantial differences observed.

Social security and employment expenditure exhibit similar dynamics, where the current share is positively influenced by its share in the previous period. In Models (1) and (2), fiscal decentralization and its lagged term are both statistically insignificant, with a negative coefficient for the current term and a positive coefficient for the lagged term. Transparency, on the other hand, shows a negative effect but achieves statistical significance only in Model (2). In contrast, Models (3) to (6) demonstrate notable improvements in the significance of these coefficients, with all reaching the 5% significance level or below. Furthermore, the interaction terms between fiscal decentralization and transparency are significantly positive across these models. These results suggest that consistent with the patterns observed in the previous two categories of expenditures, social security and employment expenditure are negatively affected by fiscal decentralization when transparency is zero. However, the negative effect of decentralization is mitigated as fiscal transparency improves. Regarding the control variables, the results indicate that changes in population size positively influence social security and employment expenditure in the subsequent period but exert a negative impact in the period thereafter.

Models (7) to (9) present the estimation results for health care expenditure. The Chi-squared tests reject the null hypothesis that all time dummy variables are equal to zero, indicating that two-way fixed effects models are appropriate. Model (8) has lower MMSC values compared to Model (7), suggesting that including the interaction term improves the model. In Model (9), the system GMM approach does not yield better estimations than the difference GMM approach used in Model (8). The estimation results indicate that health care expenditure is significantly positively affected by its change in the previous period. In Model (7), fiscal decentralization, its lagged term, and fiscal transparency are all negative and statistically insignificant. However, in Model (8), these variables become statistically significant at the 5% level or below, with the current terms of fiscal decentralization and fiscal transparency turning positive and the interaction term significantly negative. These findings differ from those for the other three categories of public expenditure. Specifically, when fiscal transparency is zero, fiscal decentralization positively affects the share of health care expenditure, but this positive effect diminishes as fiscal transparency increases. In terms of the control variables, vertical balance and population size are both significantly negative, while economic development is insignificant. The evidence suggests that increases in vertical balance or population size both reduce the share of health care expenditure.

Overall, across all models, the coefficient of the first-order lag of the dependent variable is significantly positive. This evidence indicates that past public expenditure composition in prefecture-level cities positively influences the current expenditure composition, with coefficients ranging from 0 to 1. These coefficients all fluctuate within a reasonable range, reflecting the stability of these categories in public expenditure. The past impact of social security and employment spending has a higher value, indicating that this area shows more stability and consistency in how public money is spent. In terms of fiscal decentralization, transparency, and their interaction term, all variables are statistically significant in the models for each category of expenditure. For health care expenditure, both fiscal decentralization and fiscal transparency have negative coefficients, while their interaction term shows a positive

coefficient. In contrast, for science and technology expenditure, education expenditure, and social security and employment expenditure, the coefficients for these variables exhibit opposite signs. These results suggest that, overall, fiscal decentralization has positive effects on science and technology expenditure, education expenditure, and social security and employment expenditure, but these effects are negatively moderated by fiscal transparency. Conversely, fiscal transparency positively moderates the negative impact of fiscal decentralization on health care expenditure. Additionally, enhancing vertical balance, the proportion of own-sourced revenue in expenditure, decreases the share of healthcare expenditure. An increase in population size reduces the share of healthcare expenditure but raises the share of education expenditure in public expenditure. It also decreases the share of social security and employment expenditure in the following period, with a slight reduction in the subsequent period. These results are consistent across different models, reinforcing the robustness of the analysis.

Table 4. Estimation of public expenditure composition: social security and employment expenditure and health care expenditure.

Explanatory variable	Social security and employment						Health care		
	Difference GMM				System GMM		Difference GMM		System GMM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable $_{it-1}$	0.867***	0.741***	0.745***	0.702***	0.705***	0.750***	0.482***	0.424***	0.399***
	(9.70)	(6.43)	(6.96)	(7.27)	(6.04)	(7.07)	(5.22)	(4.77)	(4.25)
Fiscal decentralization	-0.0401	-0.00876	-0.291***	-0.333***	-0.299***	-0.336***	-0.0243	0.107**	0.0521
	(-1.10)	(-0.17)	(-3.34)	(-3.68)	(-2.69)	(-2.84)	(-1.18)	(2.15)	(0.91)
Fiscal decentralization $_{it-1}$	0.0503	0.0776	0.149***	0.161***	0.166***	0.142***	-0.0227	-0.0575***	-0.0414**
	(1.40)	(1.52)	(3.48)	(4.80)	(3.26)	(3.35)	(-1.01)	(-2.77)	(-2.16)
Fiscal transparency	-0.0166	-0.0177***	-0.0605***	-0.0722***	-0.0605**	-0.0786***	-0.00570	0.0300***	0.0159
	(-1.55)	(-3.07)	(-2.66)	(-3.52)	(-2.28)	(-2.81)	(-1.42)	(2.69)	(1.13)
Fiscal decentralization * transparency			0.0549***	0.0632***	0.0579**	0.0700**		-0.0342***	-0.0203
			(2.70)	(2.97)	(2.18)	(2.37)		(-2.88)	(-1.42)
Vertical balance	0.0226	0.0637**	0.00103	0.0626**	0.0226	0.0550*	-0.0706*	-0.0918***	-0.0891**
	(0.24)	(2.02)	(0.02)	(2.27)	(0.28)	(1.78)	(-1.72)	(-3.02)	(-2.38)
Vertical balance $_{it-1}$	-0.0210	0.0267	0.115**	0.0650***	0.151***	0.0411			
	(-0.35)	(0.97)	(2.47)	(2.70)	(3.41)	(1.57)			
Population size	-0.0207	0.112	0.00666	0.0108	0.0442	0.0198	-0.0335*	-0.0350**	-0.0360**
	(-0.20)	(0.98)	(0.06)	(0.13)	(0.31)	(0.20)	(-1.74)	(-2.24)	(-2.27)
Population size $_{it-1}$	0.314***	0.209	0.344***	0.366***	0.343**	0.316***			
	(2.72)	(1.41)	(3.23)	(3.24)	(2.39)	(2.65)			
Population size $_{it-2}$	-0.174***	-0.195***	-0.214***	-0.229***	-0.246***	-0.214***			
	(-3.74)	(-3.89)	(-4.14)	(-4.62)	(-3.82)	(-4.77)			
Economic development	0.182***	0.0375***	0.0574	0.0469***	-0.0215	0.0398***	0.00590	0.0254	0.00682
	(3.65)	(3.18)	(1.13)	(4.38)	(-0.43)	(3.49)	(0.20)	(1.12)	(0.39)
Observations	1888	1888	1888	1888	1888	1888	1908	1908	1908
Time effects	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes
AR1 test	-6.491	-5.065	-6.362	-6.078	-5.464	-5.900	-5.175	-5.087	-5.146
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR2 test	-0.560	0.065	0.131	0.327	0.017	0.295	0.965	0.468	0.513
	0.576	0.948	0.896	0.744	0.986	0.768	0.335	0.640	0.608
Hansen J test	5.052	10.039	25.668	23.178	27.771	17.552	32.205	43.546	35.265
	0.929	0.613	0.643	0.768	0.633	0.617	0.225	0.364	0.456
Chi-squared test	14.000		5.750		7.040		78.300	84.320	103.310
	0.051		0.569		0.424		0.000	0.000	0.000
MMSC-AIC	-16.948	-13.961	-32.332	-34.822	-34.229	-22.448	-21.796	-38.454	-34.736
MMSC-BIC	-55.050	-55.527	-132.783	-135.274	-141.608	-91.725	-112.423	-176.074	-152.216
MMSC-HQIC	-32.681	-31.124	-73.809	-76.300	-78.567	-51.053	-59.332	-95.453	-83.393

Note: Parentheses indicate t-statistics, and significance levels are denoted as follows: *p < 0.01, **p < 0.05, and *p < 0.1.

4.2. Marginal Effect Analysis

The estimation results do not clearly indicate whether fiscal decentralization significantly influences the composition of public expenditure when fiscal transparency exceeds zero. To address this uncertainty, a marginal effects analysis is conducted. Figure 2 shows four smaller graphs, each for a different spending category, to demonstrate how fiscal decentralization affects the way public money is spent. In the figure, the x-axis represents fiscal transparency (log-transformed), while the left y-axis shows the marginal impacts of fiscal decentralization. The figure also includes a histogram of fiscal transparency, where the right y-axis displays the proportion of observations. The marginal impacts of decentralization are depicted by the slashed solid line, with the two dotted lines indicating the 95% confidence intervals. The horizontal solid line represents the point where the marginal impact of fiscal decentralization equals zero. Figure 2, groups the four categories of public expenditure into two distinct patterns. The first group consists of sub graphs (a), (b), and (c), where the solid lines go up to the right, indicating that as fiscal transparency improves, there is a positive connection between fiscal decentralization and how public spending is organized. The second group, represented by sub graph (d), shows a downward slope to the right, indicating a negative relationship between fiscal decentralization and expenditure composition as fiscal transparency increases.

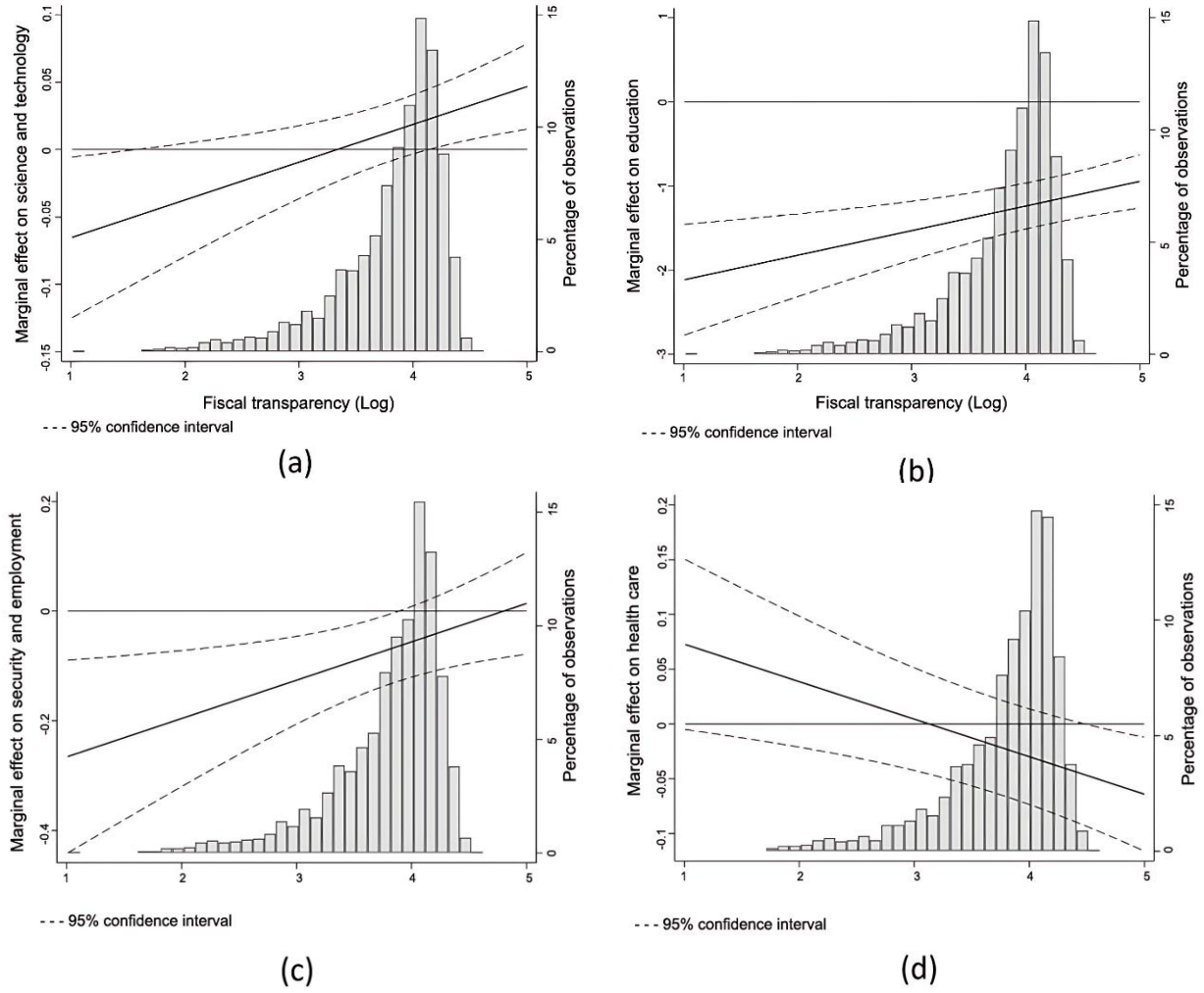

Figure 2. Marginal effect of decentralization on the composition of public expenditure.

There are further distinctions within the first group. In subgraph (a), the horizontal solid line intersects both the upper and lower dashed lines, with the intersections falling within the observed range of fiscal transparency. This pattern indicates that fiscal decentralization initially has a significantly negative impact on science and technology expenditure. However, as fiscal transparency increases, the marginal effect rises, becoming statistically insignificant

at first and eventually turning significantly positive once fiscal transparency exceeds the right intersection. For education expenditure, shown in subgraph (b), both dashed lines lie entirely below the horizontal solid line. This finding suggests that, within the observed range of fiscal transparency, fiscal decentralization consistently negatively impacts education expenditure, with the negative effect diminishing as fiscal transparency increases. In subgraph (c), the horizontal solid line intersects the upper dashed line at approximately 3.9 on the x-axis but does not intersect the lower dashed line. This result indicates that the impact of fiscal decentralization on social security and employment expenditure is initially negative, but the negative effect diminishes as fiscal transparency increases. Once fiscal transparency exceeds this threshold, the marginal effect becomes statistically insignificant and remains so for the rest of the range. In contrast, for health care expenditure (the second group, subgraph d), the horizontal solid line intersects only the upper dashed line. This finding suggests that while the impact of fiscal decentralization on health care expenditure is initially positive but insignificant, the marginal effect decreases as fiscal transparency increases. Beyond the threshold, the effect turns significantly negative.

4.3. Discussion

This study investigates the impacts of fiscal decentralization and fiscal transparency on the composition of public expenditure in Chinese prefecture-level cities, with a particular focus on the moderating role of fiscal transparency. Extending Keen and Marchand's theory and incorporating new institutional theory, we propose a framework to examine these relationships, leading to the following hypotheses: Fiscal decentralization positively influences productive expenditure but negatively impacts welfare expenditure, and fiscal transparency constrains the impact of fiscal decentralization on the composition of public expenditure. Based on econometric analysis of data from 283 Chinese prefecture-level cities spanning 2012 to 2022, we find that fiscal decentralization harms public expenditure in science and technology, education, and social security and employment, while positively impacting health care expenditure. Furthermore, fiscal transparency is shown to positively moderate the impact of fiscal decentralization on public expenditure in science and technology, education, and social security and employment, but negatively moderates the effect on health care expenditure.

Our results diverge from the predictions of the extended Keen and Marchand theory. Initially, we hypothesized that local governments, when delegated more fiscal authority, might increase public expenditure in science and technology to mitigate the pressures of tax competition. This, in turn, was expected to boost economic growth, thereby increasing government revenue, while leading to a reduction in the other three categories of expenditure. However, the results reveal a negative effect on science and technology expenditure, suggesting that fiscal decentralization negatively impacts productive expenditure, and thus, we reject the first hypothesis. Additionally, while fiscal decentralization shows a negative effect on education expenditure and social security and employment expenditure, it has a positive impact on health care expenditure, which contradicts the second hypothesis. Although both hypotheses are rejected, the findings confirm that fiscal decentralization significantly influences the composition of public expenditure in Chinese prefecture-level cities.

Conversely, our findings are consistent with new institutional theory. Local governments, when granted more fiscal authority, may increase science and technology expenditure to stimulate economic growth, which in turn improves revenue to address tax competition. Fiscal transparency, by reducing information asymmetry, helps constrain government behavior through enhanced accountability mechanisms. Our results show that as fiscal transparency increases, the negative effects of fiscal decentralization on public expenditure in science and technology, education, and social security and employment diminish. At the same time, the impact on health care expenditure shifts from insignificantly positive at first to significantly negative. While we didn't find proof that fiscal transparency reduces the positive impact of fiscal decentralization on spending for science and technology, our results indicate that fiscal transparency helps limit the changes local governments make to their public spending as fiscal decentralization grows. This finding supports the third hypothesis.

Due to differences in the classification of public expenditure, this study adopts a functional perspective to categorize public spending, whereas other studies, such as those by Alegre (2010), Ghozali and Khoirunurrofik (2020), and Kappeler and Välilä (2008), focus on public spending and investment. As a result, direct comparisons between the findings may not be straightforward. Additionally, although Del Granado et al. (2018) found that fiscal decentralization increases public expenditure in education and healthcare, our results differ, showing a negative impact on education expenditure and no significant effect on healthcare expenditure. However, this comparison is debatable, as their study examines national-level expenditure composition, while our study focuses on the composition of public expenditure at the prefecture level.

This study confirms the impacts of fiscal decentralization on the composition of public expenditure in Chinese prefecture-level cities, although it does not align with the initial expectations regarding how the composition would be adjusted. If we assume that governments want to make as much money as possible, the results suggest that spending more on healthcare leads to more economic growth for prefecture-level cities than spending on science and technology, which helps them compete better. However, we lean toward the view that this assumption is flawed. Economic growth theory suggests that technological advancement is the primary driver of economic growth. Therefore, we argue that local governments in China may not prioritize economic growth over social welfare improvements. Instead, they may seek to achieve prominent political gains through improvements in healthcare, possibly linked to the "New Healthcare Reform" launched in 2009. This comprehensive policy aimed to address the challenges of expensive, inaccessible healthcare for both urban and rural residents while promoting fairness and accessibility within the healthcare system. On the other hand, the moderating role of fiscal transparency, as supported by new institutional theory, is robust. When local governments, driven by political considerations, subjectively adjust the composition of public expenditure, fiscal transparency effectively constrains these adjustments, reinforcing accountability and governance.

5. CONCLUSION

Fiscal decentralization is a fundamental element of modern governance systems. While extensive research has explored its impact on government size, fewer studies have investigated its influence on the composition of public expenditure. However, how local governments allocate public resources is equally crucial, as it determines the balance between economic development and social welfare. Keen and Marchand (1997) say that when local governments have more control over taxes, it encourages them to spend more on investments, while Del Granado et al. (2018) look at how decentralization changes how money is spent by the government at the national level using a special method. Despite these contributions, their theories do not fully address the effects of fiscal decentralization and fiscal transparency on the functional composition of public expenditure in Chinese prefecture-level cities. This study introduces a comprehensive framework, informed by decentralization theories and new institutional theory, where fiscal transparency moderates local governments' self-serving behaviors.

Using data from 283 Chinese prefecture-level cities spanning 2013 to 2022, we investigate the moderating role of fiscal transparency in the relationship between fiscal decentralization and the composition of public expenditure. The findings from our analysis show that fiscal decentralization leads to a significant decrease in the amount of public spending on science and technology, education, and social security and employment, but these negative effects lessen when fiscal transparency is higher. These negative effects diminish as fiscal transparency increases. At high levels of fiscal transparency, the effects diverge: fiscal decentralization positively impacts science and technology expenditure, continues to affect education expenditure negatively, and becomes statistically insignificant for social security and employment expenditure. For health care expenditure, the impact of fiscal decentralization is insignificant; however, as fiscal transparency rises, the marginal effects decrease, turning significantly negative once openness exceeds a certain threshold. A systematic model selection process confirms the robustness of these findings.

Our findings build on the ideas of fiscal decentralization by showing how it affects how local governments spend money, especially regarding their roles. This study challenges the assumption in second-generation decentralization theory that local governments primarily seek to maximize revenue. Instead, we demonstrate that local governments adjust public expenditure to prioritize social welfare when granted greater fiscal authority, rather than focusing exclusively on economic growth. Moreover, this study offers a more profound understanding of fiscal transparency. While fiscal transparency is usually seen as a way to help governments work better by making information clearer for citizens, our research shows that it also plays an important role in how fiscal decentralization affects the way public money is spent, shaping how resources are distributed.

Based on these findings, several policy recommendations can be made. First, we should maintain fiscal decentralization at a moderate level. It is essential to assess its effects on public expenditure composition to prevent inefficiencies in resource allocation that may arise from imbalances in expenditure composition. If decentralization leads to such imbalances, reconsidering its degree may be necessary. Second, as fiscal decentralization can drive changes in the composition of local public expenditures, establishing effective monitoring mechanisms is critical. These mechanisms should enable timely identification of any imbalances in public expenditure allocation, facilitating corrective actions when needed. Lastly, enhancing fiscal transparency is crucial for improving the efficiency of public resource allocation. Central governments should actively promote greater transparency at the local level, ensuring comprehensive information disclosure and fostering citizen engagement. Additionally, incentive and evaluation systems should be introduced to encourage local governments to improve fiscal transparency, thereby enhancing the efficiency of fiscal management.

This study has several limitations. Although it focuses on the functional composition of public expenditure, we were unable to examine additional categories due to data constraints at the local level. Expanding the scope of categories would provide a more comprehensive understanding of the adjustments local governments make to public expenditure under fiscal decentralization. Moreover, this study uses Chinese prefecture-level cities as the sample, and given the significant differences between China's fiscal system and those in developed countries, the generalizability of our findings to other countries remains uncertain. Future research could tackle these issues by looking at different types of public spending, comparing how fiscal transparency affects developing and developed countries, or examining how other institutional factors impact the link between fiscal decentralization and public spending choices.

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