Who is Paying for Healthcare and School Enrollment? — A Study Based on County-Level Panel Data in China from 2000 to 2023

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Abstract. This paper proposes a simple unit fiscal burden(UFB) framework to track sector-specific cost dynamics in local public services. Using county-level panel data in China from 2000–2023, we construct UFB measures for healthcare and primary education as sectoral public expenditure per unit of service capacity (hospital beds and primary-school enrollment), expressed in logs. We document a persistent divergence in which expenditure grows much faster than capacity, implying sustained increases in unit burdens. Fixed-effects regressions show that both fiscal capacity (per-capita budget revenue) and fiscal pressure (the expenditure-to-revenue ratio) are positively and significantly associated with UFB in both sectors. Moreover, the association between fiscal capacity and UFB is stronger in high-pressure counties, consistent with tighter budget constraints amplifying cost intensity rather than facilitating proportional capacity expansion. The proposed indicators provide a practical tool for monitoring fiscal risk and service-cost inflation at the local level.

Keywords: County Public Finance, Fiscal Pressure, Healthcare, Compulsory Education, Unit Fiscal Burden

1 Introduction

1.1 Research Background

County governments are key providers of healthcare and compulsory education in China[1][2]. Although county spending on these services has increased markedly, physical service capacity (hospital beds and primary school seats) does not always expand proportionally[3][4]. This mismatch implies rising unit costs and potentially higher fiscal burdens per unit of capacity, driven by rigid operating costs, standards upgrades, and demographic change[5]. In 2006, the educational fiscal reform altered the process whereby county-level educational expenditures were incorporated into the budget and subsequently monitored[6].To measure this phenomenon consistently across counties and years, we define the Unit Fiscal Burden (UFB) as fiscal expendi-

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ture per bed/seat for healthcare and primary education, and use county panel data (2000–2023) to test how fiscal capacity and fiscal pressure relate to UFB in fixed-effects models.

1.2 Research Questions

To quantify the fiscal cost of providing public-service capacity, we define the Unit Fiscal Burden (UFB) as fiscal expenditure per unit of service capacity. Specifically, for healthcare, $UFB_{it}^{H} = Exp_{it}^{H}/Beds_{it}$ (fiscal healthcare expenditure per hospital bed). For primary education, $UFB_{it}^{P} = Exp_{it}^{P}/StuP_{it}$(fiscal education expenditure per primary-school student). In the empirical analysis, we use log-transformed measures (e.g., ln UFB_{it}^{s}) so that coefficients can be interpreted as elasticities.

Building on this measurement framework, we examine how fiscal capacity and fiscal pressure are associated with changes in UFB. This leads to three research questions:

Stylized facts (2000–2023). Did rising county fiscal expenditure mainly translate into expanded capacity (beds/seats), or into higher unit fiscal burden (UFB)? How do these patterns differ between healthcare and primary education?

Baseline associations. Conditional on county fixed effects and common shocks[7][8], how is fiscal capacity (per capita available fiscal resources) associated with ln UFB_{it}^{s}? How is fiscal pressure (budget constraint intensity given expenditure responsibilities) associated with ln UFB_{it}^{s}?

Heterogeneity (pressure × population growth). Does the association between fiscal capacity/pressure and UFB vary systematically with local population growth and the level of fiscal pressure? In particular, are estimated elasticities larger in high-pressure counties and/or in counties with weaker population growth.

2 Methodology

The core question of this paper is who pays healthcare beds and school enrollment. To make this question empirically testable, the study conceptualizes the payment for public services as the “Unit Fiscal Burden” (UFB), which is defined as the ratio of fiscal expenditure (numerator) to quantitative output (denominator). If fiscal expansion leads primarily to a proportional increase in output, the UFB may remain stable or even decline. Conversely, if fiscal expenditure grows faster than quantitative output, the UFB will rise.

2.1 Data Sources and Sample Construction

2.1.1 Samples and Timeframe.

This study utilizes annual panel data at the county level in China, covering the years 2000 to 2023. The research unit is the county-level administrative region (including counties, county-level cities, autonomous counties, and administrative units at the same level), forming a long panel at the "county-year" level. To ensure compara-

bility, the sample construction follows three principles: First, the main body is the county-level units that can be continuously observed in most years, minimizing structural discontinuities caused by administrative reorganization; second, unified statistical calibers and measurement units are adopted for fiscal and public service variables, and core variables are logarithmically transformed to obtain elastic interpretation; third, extreme values and abnormal fluctuations are processed reproducibly, and alternative processing methods are used in the robustness section to test the sensitivity of conclusions.

2.1.2 Data Sources.

County fiscal variables (general public budget revenue and expenditure, and sectoral spending on education and health) are collected from the County-level Finance Statistics sections of the China County Statistical Yearbook (various years) and the corresponding provincial statistical yearbooks. Healthcare capacity (hospital beds) and education output (primary-school enrollment) are obtained from the Health and Education sections of the same yearbooks. Population and basic socio-economic controls (resident population, GDP per capita, urbanization, age structure when available) are taken from the county statistical yearbooks and matched by county identifier and year.

2.1.3 Variables.

To ensure comparability, this paper establishes a consistent input-output framework for analysing both healthcare and primary school public services at the county level:

Healthcare Expenditure: Fiscal Expenditure on Healthcare(Exp^H);

Healthcare Output: Number of Healthcare Beds (Beds);

Education Expenditure: Fiscal Expenditure on Education (Exp^E);

Education Output Measure: Primary School Enrollment (Stu^P);

Fiscal Capacity, defined as per capita fiscal revenue (Rev/Pop);

Fiscal Pressure: The mismatch between expenditure responsibilities and fiscal resources.(Exp/Rev).

2.1.4 Outlier Treatment and Sample Consistency.

County-level fiscal and service variables are right-skewed and potentially affected by reporting outliers. To reduce the influence of extreme observations, we apply an annual 1st–99th percentile trimming rule to the log-transformed core variables (ln expenditure, ln beds/enrollment, ln revpc, ln pressure). Observations outside this range are dropped in the baseline sample. As a robustness check, we replace trimming-and-drop with annual winsorization at the 1st–99th percentiles and re-estimate all models. We drop county-year observations with non-positive values in variables that enter logarithms (expenditure, beds/enrollment, revenue, and pressure) before log transformation, which primarily arise from zero entries or reporting gaps in the raw yearbooks.

2.2 Variable Measurement and Definitions

2.2.1 Dependent Variable: Unit Fiscal Burden (UFB).

(1) **Healthcare Unit Fiscal Burden (Bed-Based Measure)**

$$UFB_{it}^{H} = \frac{Exp_{it}^{H}}{Beds_{it}}, \ln UFB_{it}^{H} = \ln\left(\frac{Exp_{it}^{H}}{Beds_{it}}\right)$$

Where i indexes counties and t denotes years. This indicator measures the fiscal expenditure intensity per hospital bed in a given county-year. An increase in ln(UFBh) implies that fiscal healthcare spending grew faster than the number of beds, indicating a higher unit cost per bed.

(2) **Primary Education Unit Fiscal Burden (Student-Enrollment-Based Measure)**

$$UFB_{it}^{P} = \frac{Exp_{it}^{E}}{Stu_{it}^{P}}, \ln UFB_{it}^{P} = \ln\left(\frac{Exp_{it}^{E}}{Stu_{it}^{P}}\right)$$

This indicator measures the fiscal expenditure intensity per primary school student in a given county-year. An increase in ln(UFBp) implies that fiscal education spending grew faster than the number of student places, indicating a higher unit cost per student.

Note: The key variables—fiscal expenditure, the number of beds, and student enrollment—all exhibit right-skewed distributions. Taking the logarithm of these variables serves two main purposes: first, it allows the regression coefficients to be interpreted directly as elasticities (i.e., percentage changes); second, it mitigates the influence of extreme values.

2.2.2 Fiscal Capacity.

This paper measures county-level fiscal capacity using per capita fiscal revenue:

$$Revpc_{it} = \frac{Rev_{it}}{Pop_{it}}, \ln\ Revpc_{it} = \ln\left(\frac{Rev_{it}}{Pop_{it}}\right)$$

Rev_{it} denotes budgetary revenue at the county level (or other fiscal indicators of equivalent scope), and Pop_{it} represents the resident population. An improvement in fiscal capacity implies greater available resources within the county, which could allow for enhanced protection levels and service quality in public provision.

Therefore, the relationship between fiscal capacity and the Unit Fiscal Burden is not predetermined. It may manifest in two divergent patterns: fiscal expansion could dilute the unit burden by increasing the quantity of beds and student places; conversely, it could raise the unit burden by channeling resources into quality enhancement and higher service standards.

2.2.3 Fiscal Pressure.

In this study, fiscal pressure is operationalized as the intensity of revenue and expenditure constraints:

$$Pressure_{it} = \frac{Exp_{it}^{Total}}{Rev_{it}}, \ln\ Pressure_{it} = \ln\left(\frac{Exp_{it}^{Total}}{Rev_{it}}\right)$$

Here,Exp_{it}^{Total} denotes total general public budget expenditure (or public expenditure of a comparable scope). A higher value of this indicator reflects a heavier expenditure responsibility and, consequently, a tighter budget constraint.

Fiscal pressure may elevate the Unit Fiscal Burden through multiple channels, including the rigidity of existing expenditures, rising operation and maintenance costs, and increased outlays for project management and regulatory compliance. Consequently, fiscal pressure serves as the key explanatory variable in this paper for determining who ultimately bears the cost.

2.2.4 Control Variables.

To isolate the effect of fiscal capacity and pressure from confounding factors such as population demand, economic structure, and long-term heterogeneity, we include a vector of control variables, X_{it}. This vector strives to encompass, where data permit, the following factors (among others):

$\ln\ Pop_{it}$: Population Size (Base for Public Service Demand);

$\ln\ GDPpc_{it}$: Per Capita Economic Output (Fiscal Capacity & Factor Cost Basis);

$Urban_{it}$: Urbanization Rate (Service Concentration & Cost Structure);

Age_{it}: Population Structure (Particularly Sensitive to Healthcare Demand).

2.3 Baseline Model Specification

2.3.1 Baseline Model.

In order to test whether the fiscal capacity is significantly positively related to the fiscal burden of the unit, a baseline model is set:

$$\ln\ UFB_{it}^{s} = \beta_0 + \beta_1 \ln\ Revpc_{it} + \gamma' X_{it} + \mu_i + \lambda_{pt} + \varepsilon_{it}, s \in \{H, P\}$$

$s = H$ as Healthcare, $s = P$ as Primary school;

$\mu_i$denotes the county fixed effect, which captures all time-invariant heterogeneity across counties;

λ_{pt}represents province-by-year fixed effects, absorbing annual shocks and policy changes common to all counties within a province;

ε_{it} is the idiosyncratic error term.

The coefficient $\beta_1$captures the conditional correlation between changes in fiscal capacity and changes in the Unit Fiscal Burden, based on within-county variation over time and purged of province-by-year common shocks.

2.3.2 Extended Model.

To test whether fiscal pressure significantly elevates the Unit Fiscal Burden and to assess the magnitude of this effect, we estimate an extended model:

$$\ln UFB_{it}^{s} = \alpha_0 + \alpha_1 \ln Revpc_{it} + \alpha_2 \ln Pressure_{it} + \gamma' X_{it} + \mu_i + \lambda_{pt} + \varepsilon_{it}$$

A positive and statistically significant coefficient $\alpha_2 > 0$ indicates that higher fiscal pressure is associated with an increase in the Unit Fiscal Burden. This suggests that in counties facing a heavier expenditure burden relative to their fiscal resources, additional fiscal outlays are more likely to translate into higher unit costs (e.g., for maintenance, quality, or standards) rather than into an expansion of service quantity.

2.3.3 Amplification Effect Model.

To test for the amplifying role of fiscal pressure, we introduce an interaction term:

$$\ln UFB_{it}^{P} = \theta_0 + \theta_1 \ln Revpc_{it} + \theta_2 HighPressure_{it} + \theta_3 (\ln Revpc_{it} \times HighPressure_{it}) + \mu_i + \lambda_{pt} + \varepsilon_{it}$$

Here, $HighPressure_{it}$ is a dummy variable that equals 1 if a county's fiscal pressure exceeds the annual median in year t , and 0 otherwise. A positive and statistically significant estimate $\theta_3 > 0$, indicates that the relationship between fiscal capacity and the Unit Fiscal Burden is stronger (i.e., the slope is steeper) in high-pressure counties. This implies that the intensity of cost absorption—or "who pays"—is more pronounced in environments with tighter fiscal constraints.

2.4 Heterogeneity Analysis: Population Growth, Student Enrollment Growth, and Fiscal Pressure

Given the stronger demographic link in education, the heterogeneity analysis focuses on the primary-school sector.

The core of heterogeneity analysis is the examination of a verifiable mechanism judgment: when population or school-age population growth is sluggish, the expansion of public service quantity is more difficult to occur, and newly added fiscal funds are more likely to precipitate into the unit input intensity of the existing system, thereby forming higher UFB. Based on this, this paper groups the samples according to the annual median of population growth rate and student enrollment growth rate, and repeatedly estimates the extended model within each group to compare the differences in fiscal capacity and fiscal pressure coefficients under the scenarios of "high growth (incremental expansion is more likely)" and "low growth (stock adjustment is more likely)". At the same time, this paper also groups fiscal pressure according to the annual median, in order to form a stable relative comparison in each year and avoid threshold drift caused by changes in the macro environment, which would make the groups incomparable. In addition, to reduce dependence on a single cutoff, we also verify that the heterogeneity patterns are qualitatively similar when (i) using alternative cutoffs such as terciles/quartiles, and (ii) replacing discrete splits with continuous

interaction terms between fiscal variables and demographic growth measures. These checks support that the heterogeneity results are not driven by an arbitrary grouping rule.

2.5 Robustness and Diagnostic Tests

2.5.1 Robustness to Outlier Treatment.

Baseline uses annual trimming-and-drop (1st–99th percentiles) for the log-transformed core variables as described in Section 2.1.4. Robustness re-estimates all models using annual winsorization at the 1st–99th percentiles (without dropping observations), and the main inferences are unchanged.

2.5.2 Lagged Variables Test: To Mitigate Simultaneity.

Fiscal capacity and fiscal pressure exhibit strong inertia and may reflect forward-looking budget planning. To mitigate the influence of contemporaneous shocks and simultaneity bias, we employ a one-period lag for all fiscal variables in our main specification:

$$\ln\ UFB_{it}^{S} = \delta_0 + \delta_1 L.\ln\ Revpc_{it} + \delta_2 L.\ln\ Pressure_{it} + \mu_i + \lambda_{pt} + \varepsilon_{it}$$

2.6 Inference and Standard Errors

All regressions employ standard errors clustered at the county level to account for serial correlation and heteroscedasticity in the panel data. The model includes county fixed effects and province-by-year fixed effects to control for time-invariant county heterogeneity and annual shocks common to all counties within a province, respectively.

3 Results

3.1 Stylized Facts

Using the UFB definitions in Section 2.2, Figure 1 plots median indices (2000=100) of expenditure and capacity measures from 2000–2023.

3.1.1 The Long-term Mismatch Between Expenditure and Output.

Figure 1 (median index of expenditure and outputs, base year 2000 = 100) shows the trends in the median indices of fiscal expenditure and quantity from 2000 to 2023. Overall, a clear divergence is evident: the fiscal expenditure index rose rapidly, while the growth in the indices for the number of beds and the number of primary school students was markedly slower, remaining almost stagnant.

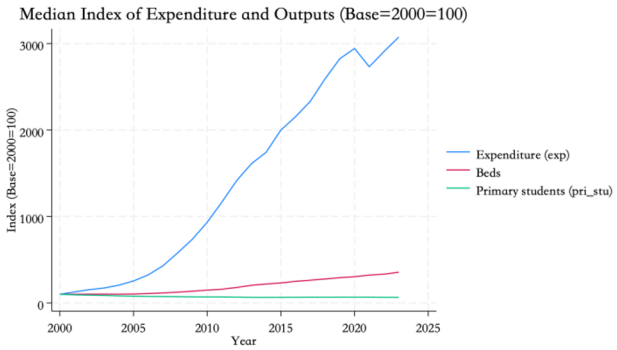

Fig. 1. Median Index of Expenditure and Outputs (Base Year 2000 = 100)

This implies that, in the long run, fiscal expansion has not translated into proportional growth in the quantity of public services. Instead, it has resulted in a structural imbalance: rapid expansion on the expenditure side versus slow adjustment on the quantity side. This imbalance is a direct driver of the sustained increase in unit fiscal burden.

3.1.2 Descriptive Statistics.

Table 1 reports the descriptive statistics for the sample after applying year-by-year truncation (1%–99%). This county-year panel dataset spans the period from 2000 to 2023 and contains approximately 49,200 observations.

The fiscal pressure defined as the expenditure-to-revenue ratio (exp/rev) and fiscal capacity as per capita fiscal revenue. The unit financial burden (UFB) index, measured as expenditure per bed and expenditure per student (exp/beds, exp/pri_stu), is also a ratio. Therefore, its regression coefficients should be interpreted in relative (logarithmic) terms, not in absolute monetary units.

Table 1. Descriptive Statistics (Trimmed 1%--99% within year)

	Count	Mean	SD	Min	Max
ln_ufb_med	49100	4.73	0.94	-8.51	9.65
ln_ufb_pri	49146	1.46	1.44	-11.16	7.67
ln_rev_pc	49067	-2.53	1.33	-11.33	3.68
ln_pressure	49066	1.38	0.82	-11.73	8.49
towns	48363	12.36	8.42	0.00	153.00
Observations	49200				

3.2 Results

3.2.1 Regression Specification.

Table 2 presents the main regression results. The dependent variables are the log-transformed unit fiscal burdens for healthcare (ln (UFB_{med})) and primary education

(ln (UFB_{pri})). The core explanatory variables are the log of fiscal capacity (ln $Revpc$) and fiscal pressure (ln $Pressure$). All models include county and province-by-year fixed effects with county-clustered standard errors.

Table 2. Fiscal Environment and Unit Fiscal Burden (Log Specification; Trimmed Sample)

	ln(UFB_med)	ln(UFB_med) with ln(pressure)	ln(UFB_pri)	ln(UFB_pri) with ln(pressure)
ln_rev_pc	0.158***	0.831***	0.184***	0.912***
	(0.010)	(0.020)	(0.010)	(0.018)
towns	0.007***	0.007***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
ln_pressure		0.860***		0.930***
		(0.020)		(0.016)
_cons	5.047***	5.561***	1.957***	2.512***
	(0.026)	(0.029)	(0.027)	(0.029)
Observations	48130	48130	48175	48175
Adj. R-squared	0.906	0.938	0.969	0.985

3.2.2 Specification with Fiscal Capacity Only: Fiscal Capacity is Positively and Significantly Associated with the Unit Fiscal Burden.

When fiscal pressure is excluded from the model, fiscal capacity shows a positive and significant correlation with the unit fiscal burden.

This indicates that, even after controlling for county fixed effects and province-by-year interaction effects, a stable positive correlation persists between per capita fiscal revenue growth and the increase in unit fiscal burden.

3.2.3 Inclusion of Fiscal Pressure: The Pressure Variable is Significantly Positive with A Larger Coefficient, and It Significantly Amplifies the Coefficient on Fiscal Capacity.

After further adding the fiscal pressure ln $Pressure$, two key changes occurred.

First, there is a highly consistent and significant positive correlation between fiscal pressure and unit burden.

Second, the fiscal capacity coefficient has been significantly enlarged.

This set of results yields a clear interpretation. First, fiscal capacity is intrinsically linked to rising unit fiscal burdens. Second, fiscal pressure not only correlates positively with the unit burden but also significantly amplifies the effect of fiscal capacity.

The positive coefficient on ln(pressure) suggests that tighter budget constraints are associated with higher spending intensity per unit of capacity. A natural mechanism is cost rigidity: when a county faces a high expenditure-to-revenue ratio, a larger share of spending is pre-committed to wages, compliance, and operating costs, so incremental resources are more likely to raise unit operating intensity rather than finance proportional expansion of beds/seats.

The increase in the ln(rev_pc) coefficient after controlling for ln(pressure) is consistent with an intensity channel: conditional on fiscal stress, additional fiscal capacity relaxes short-run liquidity constraints but may still be absorbed by upgrading standards, staffing, and maintenance in existing facilities. This channel should be stronger where demographic expansion is weak (i.e., limited demand-side growth makes capacity expansion less likely), which matches the heterogeneity logic in Section 2.4

3.3 Robustness Checks

Using winsor(1,99) and lagged fiscal variables, ln_rev_pc and ln_pressure remain positive and statistically significant in both sectors, with magnitudes comparable to the baseline.

3.4 Heterogeneity Analysis

3.4.1 Heterogeneity in Population Growth vs. Student Cohort Changes (Primary School Sector).

Table 3. Heterogeneity by Demographic Change (Education Unit Fiscal Burden)

	Low Pop Growth	High Pop Growth	Low Student Growth	High Student Growth
ln_rev_pc	0.961***	0.828***	0.908***	0.899***
	(0.019)	(0.036)	(0.030)	(0.024)
ln_pressure	0.967***	0.855***	0.924***	0.906***
	(0.016)	(0.033)	(0.026)	(0.021)
towns	-0.001**	-0.004***	0.000	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
_cons	2.644***	2.309***	2.527***	2.523***
	(0.028)	(0.055)	(0.050)	(0.029)
Observations	30545.000	15359.000	22990.000	22970.000
Adj. R-squared	0.985	0.981	0.984	0.986

Table 3 shows that, across all ranges of population and student cohort size, fiscal capacity and pressure remain significantly and positively associated with the primary school unit burden. However, considerable heterogeneity exists in the magnitude of coefficients between groups: Numerically, the fiscal capacity coefficient is markedly larger in areas with low population growth (0.961) than in high-growth areas (0.828). This indicates a stronger link between fiscal changes and unit burdens in regions with weaker demographic expansion, where the public service supply system is more inclined toward stock adjustment. This finding aligns with the reality in population-outflow regions: the education supply system requires constant adjustment and reorganization. When steady growth in service quantity is difficult to achieve, new fiscal funds are more likely to be absorbed as higher input per existing unit, rather than diluting the unit burden through quantitative expansion.

Fiscal capacity and fiscal pressure remain positively associated with education UFB across demographic environments. The estimated elasticities tend to be larger in counties with weaker population or student-cohort growth, consistent with a "stock adjustment" mechanism: when capacity expansion is sluggish, additional fiscal resources are more likely to show up as higher spending intensity per existing student rather than dilution through quantity growth. This pattern aligns with consolidation and reorganization pressures in population-outflow regions.

3.4.2 Heterogeneity in Fiscal Pressure.

Table 4 presents results from an analysis that splits the sample by the annual median of fiscal pressure (into low- and high-pressure groups) and from a model incorporating an interaction term with this pressure measure.

Table 4. Fiscal Pressure Heterogeneity (Education Unit Fiscal Burden)

Variable	(1) Interaction model
ln_rev_pc	0.890*** (0.018)
ln_pressure	0.932*** (0.016)
towns	-0.003*** (0.001)
1.high_pressure	0.101*** (0.014)
1.high_pressure × ln_rev_pc	0.042*** (0.005)
_cons	2.467*** (0.029)
Observations	48,175
Adj. R-squared	0.985
p-value (slope diff)	0.000

The interaction term is positive and significant, indicating a steeper capacity–UFB elasticity in high-pressure counties. The slope-difference test (p=0.000) confirms that fiscal pressure amplifies how fiscal capacity translates into higher spending intensity per student.

4 Conclusion

This study addresses a core question: Not whether fiscal expenditure will increase, but who ultimately bears the burden when fiscal expansion occurs alongside sluggish growth in public service quantity. To answer this, we operationalize the fiscal burden by constructing a unit fiscal burden index (expenditure per bed and per primary student) and analyze its systematic response to variations in fiscal capacity and fiscal pressure.

Conclusion 1: The burden of beds and student places stems not from quantity expansion, but from rising unit costs.

The trend decomposition reveals a prolonged divergence: while the county fiscal expenditure index has risen sharply, the growth in the number of hospital beds and primary school student placements has been markedly slower. This has driven a sus-

tained increase in the unit fiscal burden index. The implication is clear: fiscal expansion has not primarily translated into a commensurate expansion of service quantity (beds/student places), but rather into an upward shift in investment intensity per unit.

Conclusion 2: The greater the fiscal pressure, the higher the unit burden. Fiscal pressure is strongly and positively associated with UFB in both sectors, indicating that tighter budget constraints coincide with higher spending intensity per unit of capacity.

Conclusion 3: The burden for primary school placements is not only heavier but also more concentrated in regions with weaker population growth. This indicates that a declining or stagnating school-age population does not yield fiscal savings; instead, it readily precipitates a "unit burden trap."

Conclusion 4: Fiscal pressure amplifies the effect of fiscal capacity on the unit fiscal burden. This implies a critical dynamic: The greater the fiscal pressure, the more readily an improvement in fiscal capacity translates into a rising unit burden. Consequently, fiscal pressure is not merely a contextual background variable; it is a multiplier and a core determinant of who ultimately bears the cost of public service provision.

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