

Local Government Debt Risks and Digital Economy: Experience from China

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Abstract. Advancing urban digital transformation is crucial for establishing a new development paradigm and securing a smooth shift to a new development model; it also provides an important strategy for local governments to cope with debt problems under increasing repayment pressures. This paper investigates the dual context in which local governments promote the digital economy, transform economic development models, and accumulate debt. Taking a local government agency perspective, it applies logical deduction and carries out empirical tests using nationwide prefecture-level city data from 2014 to 2023. The study finds that debt pressure positively affects the digital economy by driving local governments to intensify efforts to close fiscal gaps. Further mechanism tests reveal that debt repayment pressure heightens local governments' digitalization motivation, strengthens their corporate talent attraction initiatives, and advances the digital industry, thereby propelling the digital economy. This paper systematically examines new ways for local governments to resolve debt problems during the waning phase of the land-based fiscal model, and offers empirical evidence and policy suggestions to ease repayment pressure and enable a smooth transition to a new development model.

Keywords: Local government, Debt risks, Digital economy, New development model

1. Introduction

The digital economy has become a crucial power of economic growth and structural transformation. Existing studies show that digitalization can stimulate consumption, improve productivity, promote innovation, and support high-quality development [1-3]. Research also identifies technology, infrastructure, institutions, finance, and human capital as key determinants of digital economy development [4-8].

At the same time, local government debt has become an increasingly important policy issue in China. Existing literature mainly focuses on the evolution of local government debt, its relationship with land finance, and the associated fiscal and financial risks [9-11]. However, limited attention has been paid to whether rising debt pressure affects local governments' incentives to promote digital transformation.

Against the backdrop of declining land-finance revenues and growing debt burdens, local governments face increasing pressure to cultivate new sources of economic growth. The digital economy provides a potential pathway for economic restructuring and fiscal sustainability. As the

primary agents of local economic governance, Chinese local governments possess substantial policy tools and administrative capacity to promote digital development.

Based on a panel of over 280 Chinese prefecture-level cities from 2014 to 2023, this paper investigates the relationship between local government debt risk and digital economy development. The study offers several contributions to the existing literature. It first underscores the role of fiscal debt pressure as an important determinant of digital economic growth. Second, it investigates the mechanisms through which local governments promote digital transformation, including stronger digitalization intentions, the attraction of firms and talent, and the development of digital industries. Third, it investigates temporal and spatial heterogeneity in the relationship between debt risk and digital economy.

2. Theoretical hypothesis

2.1. Research hypothesis

Under China's fiscal decentralization system, local governments are responsible for both economic development and debt repayment. Rising debt risks increase fiscal pressure and strengthen local governments' incentives to cultivate new sources of economic growth. The digital economy offers local governments a possible way to lessen reliance on traditional land, such as finance revenues and support sustainable development, as a key driver of innovation, productivity, and structural change [12].

Consequently, when local governments have more debt pressure, they might be more willing to push ahead with digital transformation and support the growth of the digital economy.

Hypothesis 1: Debt risk can help the digital economy develop.

Local governments hold a lot of power in making policies work, handing out resources, and managing the economy [13, 14].

When debt risks go up, local governments have more reason to put digital transformation first. They want to do this so they can build new sources of growth and increase their fiscal income [15, 16]. By paying more attention to policies, carrying out digital governance reforms, and giving stronger support through regulations, local governments can build a better institutional environment for the digital economy to grow.

Hypothesis 2: Debt risk helps the digital economy develop, and it does this by making local governments more willing to pursue digitalization.

The digital economy needs a lot of money, technology, and trained workers; to support digital transformation, local governments often adopt favorable policies, make the business environment better, and attract companies and talent [17, 18]. Greater debt pressure may then push local governments to try harder to bring in firms, investment, and skilled people; this inflow of money and skilled workers gives an important base for the digital economy to grow.

Hypothesis 3: Debt risk helps the digital economy develop by attracting firms and talent.

Industrial upgrading can be directly influenced by local governments not only through the attraction of production factors but also by supporting the expansion of digital industries. Innovation capacity, productivity, and economic performance are improved by digital industries, while new sources of growth and fiscal revenue are generated [19, 20]. Consequently, greater emphasis may be placed by local governments facing higher debt risks on fostering digital industrial development and related innovation activities [21].

Hypothesis 4: Digital industry development is promoted by debt risk, and thereby digital economy growth is facilitated.

3. Research methodology

3.1. Empirical model

This paper examines the role of debt repayment pressure in promoting digital economy and constructs the following empirical model:

$$Dgt_{i,t} = \alpha + \beta_1 Dtr_{i,t} + \beta_j Controls_{i,t} + C_i + Y_t + \varepsilon_{i,t}$$

$Dgt_{i,t}$ is the dependent variable, represents digital level in i area in t year. $Dtr_{i,t}$ as dominating explaining variable, represents the debt risk of prefecture-level cities in t year. β_1 is the coefficient of interest. $Controls_{i,t}$ is the control variable selected at the city level. C_i is fixed effect of the city; Y_t is fixed effect of the year.

3.2. Variable construction and measurement

3.2.1. Measuring digital economy comprehensive index

With regard to the construction of the dependent variables, this paper draws on widely used indicators in the academic community and adopts the Comprehensive Digital Economy Index developed by Zhao Tao and others [22]. As the dependent variable, it measures a region's level of digital development.

3.2.2. Measuring local government's debt risk

Regarding the construction of the debt risk variable, this paper follows the approach of Chen Junhua, Liu Na, and others [23], using the annual debt-to-repayment capacity ratio of Chinese prefecture-level governments as the core explanatory variable to represent the debt risk of that prefecture-level city in a given year. In this context, local government debt includes not only the principal and interest on debt that the local government must repay in the current year, but also the principal and interest on implicit debt issued by urban investment and financing platforms.

3.2.3. Control variables

The control variables include per capita GDP, share of primary industry output (%), total retail sales of consumer goods (10,000 yuan), waste harmless treatment rate (%), green coverage rate (%), registered population at year-end (10,000 people), air quality, and degree of reliance on land-related fiscal revenue.

Table 1. Definition and descriptive statistics for variables

Variables	Definition	Obs	Mean	Std.	Min	Max
Digital	Comprehensive digital economy index	2949	0.055	0.079	0.00	0.94
Debtrk	Debt risk	3368	0.143	0.193	0.00	2.49
Pergdp	GDP per capita	3368	7.382	4.540	1.11	26.35
Prigdp	Share of the primary sector in regional GDP	3368	11.456	19.335	0.03	735.00

Table 1. (continued)

Rscg	Total retail sales of consumer goods	3368	2709.431	4051.345	0.02	18515.50
Htrate	Household waste Safe disposal rate	3368	97.392	8.071	5.49	100.00
Gcover	Green space coverage in built-up areas	3368	42.081	7.388	0.39	100.00
Popreg	Year-end registered population	3368	577.669	435.663	20.25	3416.00
Airqu	Air quality	3368	3.744	1.414	1.00	6.00
Delafi	Dependence on land revenue	3368	0.355	0.279	0.00	5.15

3.3. Data sources

The data in this article primarily come from the *Annual Statistical Yearbook of Cities*, the *Annual Statistical Yearbook of China*, the *Wind* Information database, and other statistical sources. After collection, the data samples were processed, and interpolation was performed for certain variables. Ultimately, the empirical study in this paper The study covers data from 336 prefecture-level cities nationwide between 2014 to 2023, thereby laying a solid and reliable data foundation for the sorts of regressions.

4. Empirical analysis

4.1. Baseline regression

In this section, this paper performs a benchmark regression analysis of debt risk and digitalization.

Table 2 reports the baseline regression results.

A benchmark regression analysis of debt risk and digitalization is conducted in this section. The baseline regression results are presented in Table 2.

The estimated coefficient of debt risk stabilizes as additional controls and fixed effects are introduced.

In the preferred specification that includes control variables and city and year fixed effects, debt risk exerts a significantly positive effect on digital economy development. The results suggest that local governments under increased debt pressure are more likely to promote digital transformation, supporting the main hypothesis of this paper.

Table 2. Benchmark regression results

Variables	(1) Digital	(2) Digital	(3) Digital	(4) Digital
Debtrk	-0.149*** (0.008)	-0.068*** (0.008)	0.014 (0.009)	0.034*** (0.010)
Control variables	No	Yes	No	Yes
Year Fixed Effects	No	No	Yes	Yes
City Fixed Effects	No	No	Yes	Yes
Sample Size	2949	2949	2949	2949
Adjusted R ²	0.2088	0.5868	0.4220	0.6986

Note: *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors are reported in parentheses. These notations apply to all following tables. Furthermore, detailed results for the control variables are omitted for brevity.

4.2. Robustness tests

4.2.1. Change the dependent variable

This paper tries to check if the earlier regression is reliable, so it replaces the dependent variable and the core explanatory variable. First, the comprehensive digital economy index is taken out and the reform of big data management institutions is used instead. This reform is meant to capture the digital governance efforts of local governments. The coefficient is still positive and significant, which suggests that the main results do not change much when the digital economy is measured in a different way.

4.2.2. Change the independent variable

Second, the fiscal debt-to-revenue ratio, an alternative indicator of local fiscal pressure, replaces the debt risk variable. The estimated coefficient remains positive and significant, according to the results. Overall, further proof is provided by the robustness tests that increased debt pressure encourages local governments to support digital economy growth.

4.3. Endogeneity tests

Three additional tests are conducted in this paper to address potential endogeneity concerns.

4.3.1. Incorporate the high-dimensional fixed effects

Province-by-year high-dimensional fixed effects are introduced so that unobservable regional and temporal variables can be accounted for. A positive and statistically significant coefficient of debt risk is maintained, indicating that the baseline findings are not driven by omitted regional or time-specific characteristics.

4.3.2. Reject the competitive hypothesis

The proportion of construction land area is further controlled for in this paper, so that the effect of debt risk can be distinguished from the influence of land development constraints. A positive and significant coefficient at the 1% level is retained for debt risk, indicating that the main findings are robust to alternative explanations.

4.3.3. Implement shift-share(IV) tool

To address possible reverse causality between debt risk and digital economy development, this paper employs provincial expenditures on agriculture, forestry, water, and healthcare as instrumental variables. The estimated coefficient remains positive and statistically significant, further corroborating the baseline results.

Overall, these endogeneity tests verify the robustness of the main conclusion that debt risk promotes digital economy development.

Table 3. Robustness test and endogeneity test

Variables	(1) Reform of the Big Data Management Agency	(2) Digital	(3) High-Dimensional Fixed Effects	(4) Rule out competing hypotheses	(5) Digital
Debtrk	0.145* (0.075)		0.041*** (0.011)	0.028*** (0.010)	3.046 (25.261)
Fiscal debt-to-revenue ratio		0.548*** (0.186)			
proportion of construction land area				-0.003 (0.003)	
Control variables	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
City Fixed Effects	Yes	Yes	Yes	Yes	Yes
Sample Size	2459	2881	2907	2455	2949
Adjusted R ²	0.7318	0.7240	0.7516	0.8228	-34.3027

5. Mechanism and heterogeneity analysis

5.1. Mechanism analysis

Building on the regression analysis in the previous section, this section examines the specific transmission mechanisms between debt risk and digital economy.

5.1.1. Strong digitalization intention

As the primary entities responsible for debt repayment and regional economic development, local governments may adjust policy priorities in response to fiscal pressure and policy incentives [24, 25]. Rising debt risks can therefore strengthen local governments' incentives to promote digital transformation. To capture local governments' digitalization intentions, this paper employs three indicators. First, following [13], the frequency of digital-related terms in government work reports is used to measure policy attention to digital development.

Second, the level of digital government and administrative digitalization is shown by fiscal transparency [26]. Third, the government's effort to support the digital economy is measured by the severity of market regulation penalties [27]. The regression results are in Table 4.

Table 4. Strong digitalization intention

Variables	(1) Digital Information	(2) Fiscal Transparency	(3) Severity of administrative penalties
Debtrk	0.038*** (0.009)	0.832 (2.754)	0.017*** (0.003)
Control variables	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
City Fixed Effects	Yes	Yes	Yes
Sample Size	2842	2922	3143
Adjusted R ²	0.0062	0.5379	0.7272

Debt risk seems to make local governments more interested in going digital. When fiscal strain becomes greater, policy tends to focus more on digital development, digital management gets better, and enforcement help grows stronger. This means that budget pressure pushes local authorities to speed up digital change.

5.1.2. Enterprise and talent recruitment

Rising debt risks make local governments more interested in the digital economy, and they also push governments to use different policy tools to bring in companies and skilled workers; businesses and skilled people, as main drivers of growth and innovation, provide the money, human resources, and tech support needed to go digital [28]. To check this idea, this paper uses the number of private firms and their fixed-asset investment to measure business inflows, and it also uses how people move and labor market resources to capture talent attraction and inflows, with the results shown in Table 5.

Table 5. Enterprise and talent recruitment

Variables	(1) Number of companies	(2) Fixed-asset investment by non-state-owned enterprises	(3) Abortion	(4) Labor Market Resources
Debtrk	8164.592*** (2786.652)	0.048*** (0.013)	279.752* ** (29.063)	0.089*** (0.029)
Control variables	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
City Fixed Effects	Yes	Yes	Yes	Yes
Sample Size	3286	3143	3143	3143
Adjusted R ²	0.5627	0.7047	0.9192	0.9608

That local governments, when facing fiscal pressure, tend to attract economic and human capital in order to support digital transformation is suggested by all coefficients being positive and significant at the 1% level.

5.1.3. Development of the digital industry

Besides attracting firms and talent, local governments may also advance the digital economy by fostering digital industry growth; industrial robot usage mirrors digital tech's application in the real economy, while innovation outcomes indicate the digital sector's performance [29, 30]. Accordingly, we gauge digital industry development by industrial robot usage and local innovation outcomes, with regression results shown in Table 6.

Table 6. Development of the digital industry

Variables	(1) Industrial Robot Penetration Rate	(2) Innovation Outputs
Debrk	169.551 (492.508)	1.048** (0.510)
Control variables	Yes	Yes
Year Fixed Effects	Yes	Yes
City Fixed Effects	Yes	Yes
Sample Size	1631	3143
Adjusted R ²	0.7962	0.5126

From Table 6, it can be seen that fiscal pressures push robot usage and new patent numbers up quite a bit. These same pressures make city officials get behind digital projects, and that speeds up growth driven by technology. Taking it all together, the result here is that borrowing risks help the digital world by way of government tech schemes. These schemes pull in firms and top talent, and at the same time they give a boost to digital industry development.

5.2. Heterogeneity test

In order to see if the effect of debt risk changes across different situations, this paper runs some analyses on temporal and spatial heterogeneity. The results from these analyses are put in Table 7.

5.2.1. Temporal Heterogeneity

Column (1) reports temporal heterogeneity results, where a significantly negative debt risk coefficient and a significantly positive interaction with the post-pandemic period imply a strengthened effect after the pandemic, likely because rising fiscal pressure and declining land finance revenues spurred digital transformation.

5.2.2. Spatial heterogeneity

Column (2) reports the results for spatial heterogeneity. Debt risk has a positive and significant coefficient, while its interaction with central-city status is negative and significant. This suggests that the effect is smaller in central cities than in non-central cities. Non-central cities are often under

tighter fiscal constraints and rely more on land revenue. So, higher debt risk tends to push digital transformation more strongly in these regions.

Table 7. Temporal and spatial heterogeneity

Variables	(1) Digital	(2) Digital
Debtsp	-0.070*** (0.023)	0.019** (0.008)
Post-pandemic	-0.086*** (0.003)	
Debt risk× Post-pandemic	0.111*** (0.021)	
Central city		0.108*** (0.005)
Debt risk × Central city		-0.368*** (0.024)
Control variables	Yes	Yes
Year Fixed Effects	No	Yes
City Fixed Effects	Yes	No
Sample Size	2949	2922
Adjusted R ²	0.6886	0.5170

6. Conclusion and discussion

By using panel data from prefecture-level cities in China over the years 2014 to 2023, this study tries to look at how local government debt risk influences the development of the digital economy. The findings show that fiscal pressure coming from debt repayment has a significant positive effect on the growth of the digital economy. After running a series of tests to deal with endogeneity and to check robustness, this conclusion still holds. Further evidence also indicates that when debt risk becomes higher, local governments tend to step up their digitalization strategies, work on attracting firms and talent, and give support to the digital industry. Through these efforts, they speed up digital transformation and build new growth drivers.

What these findings suggest is, the digital economy has become an important pathway, local governments use it to deal with budget pressure and to cut their reliance on land-based money; with economic restructuring and debt management going on, local governments should keep on building digital infrastructure, make the business climate better for digital industries, and strengthen policies for attracting talent; at the same time, policymakers should further improve debt management methods, set up lasting fiscal systems, so as not to rely too much on growth driven by debt; by putting debt control and digital shift together, local governments can better get long-term economic growth and keep fiscal health.

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