

Research Article

The Impact of Borrowing Debt on the Efficiency Loss of Municipal Infrastructure Investment and Construction

Xiaojie Li , Hao Li, and Fei Qiu 

Zhejiang Wanli University, Ningbo 315100, Zhejiang, China

Correspondence should be addressed to Fei Qiu; qiufei@zwu.edu.cn

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Borrowing debt has impacted on the financing effect and governance effect of investment entities. Borrowing debt has become an important financing channel for the investment and construction of municipal infrastructure in China. In this paper, panel data from 2003 to 2018 in cities above the prefecture level in China are used to study the impact of borrowing debt on the efficiency loss of municipal infrastructure investment and construction. First, the results indicate that financing constraints have a greater impact than agency costs for the investment and construction of municipal infrastructure in China. Second, borrowing debt can effectively reduce the efficiency loss of municipal infrastructure investment and construction due to financing constraints. Third, the governance effect of borrowing debt is not very positive, but the rigid repayment of debt and interest to international banks will play some positive governance effects in the later stage.

1. Introduction

Since the 1990s, China has entered a stage of comprehensive and rapid urbanization development, the demand for municipal infrastructure has increased significantly, and debt financing has become an important financing channel for local governments in China to invest in municipal infrastructure. Chinese local governments act much like firms. Municipal infrastructure investment and construction are important means for local governments to perform government functions such as economic development and public services in China. However, in recent years, China's local governments have also generated and accumulated huge local government debts due to municipal infrastructure investment and construction, which have aroused widespread concern. The report of the 19th National Congress of the Communist Party of China pointed out that resolving local government debt risks is an important part of preventing major risks.

Substantial empirical evidence documents the strong influence of cash flow on some firms' investment spending which is inconsistent with both the Modigliani and Miller irrelevance theorem [1]. Two main explanations focus on

imperfect information. The first explanation, the pecking order hypothesis of Myers and Majluf, identifies the adverse selection problem that arises when firm insiders have better information than outsiders about the value of their firm [2]. An important implication of adverse selection is that firms with positive net present value investment opportunities will forgo profitable projects to avoid the excessive cost of external financing. The second explanation, the free cash flow hypothesis of Jensen, focuses on the agency issue. Jensen argues that managers can increase their wealth at the expense of shareholders by investing a firm's free cash flow in unprofitable investment opportunities rather than paying out those funds in the form of dividends, debt-financed share repurchases, and the like [3].

The aim of this research is to examine whether the impact of borrowing debt on the efficiency loss of municipal infrastructure investment and construction is because local governments waste free cash flow, or because they face excessive costs of external financing created by asymmetric information in China. Under the conditions of a market economy, debt financing is not only a financing tool but also a governance tool. The current rapid urbanization and comprehensive marketization determine that the investment

and construction of municipal infrastructure in China's local governments are facing both financing constraints and agency costs, both of which will lead to the loss of municipal infrastructure investment and construction efficiency. Among them, the problem of financing constraints leads to insufficient investment and construction, and the problem of agency cost leads to excessive investment and construction. First, based on the above definition of efficiency loss and based on the relevant panel data of cities and municipal districts above the prefecture level in China, in this paper we intend to use two-tier stochastic frontier methods to quantitatively measure the efficiency loss due to the financing constraints and the agency costs in the investment and construction of municipal infrastructure. Finally, on the quantitative measurement of efficiency loss, the impact of debt financing is further studied by using the double difference method. This effort is a marginal improvement over existing research.

2. Literature Review

2.1. The Impact of Local Government Borrowing Debt. In recent years, the borrowing debt problem of local governments in China has also been the main focus of attention by the academic community at home and abroad.

The first focus is to study the reasons for the formation of local government debt. The existing literature mainly explains from the perspective of local governments' pursuit of economic growth goals, financial resource reduction and expenditure expansion, and lack of strict relevant supporting institutional arrangements [4–9].

The second focus is to study the ways to obtain credit for local governments. The existing literature mainly draws from local governments and their officials through policy formulation, inspection interviews, and exercise of actual control [10–15].

The third focus is to study the role of local government debt. There are still some differences in the understanding of the role of local government debt on economic growth, mainly including three views positive, negative, and non-linear [16–21].

These research results have laid a good foundation for an in-depth study of the impact of debt financing on the efficiency of municipal infrastructure investment and construction.

2.2. The Relationship between Cash Flow and Investment. Considerable empirical evidence indicates that internally generated funds are the primary way firms finance investment expenditures. Fazzari et al. find that cash flow has a strong effect on investment spending in firms with low-dividend-payout policies [22]. Whited finds evidence of a strong relationship between cash flow and investment spending for firms facing debt financing constraints because of financial distress [23]. Fazzari and Petersen find that this same group of low-payout firms smooths fluctuations in cash flow with working capital to finance desired investment opportunities [24]. Himmelberg and Petersen in a study of

small research and development firms find that cash flow strongly influences both capital and R&D expenditures [25]. They argue that the asymmetric information effects associated with such firms make external financing expensive and forcing them to fund expenditures internally. In recent years, a large number of scholars have drawn a similar conclusion [26, 27].

Another explanation is that managers divert free cash flow to unprofitable investment spending. Devereux and Schiantarelli find that the impact of cash flow on investment spending is greater for larger firms [28]. Oliner and Rudebusch find that insider shareholdings and ownership structure do little to explain the influence that cash flow has on firm investment spending; firm age, exchange listing, and insider stock trading patterns exhibit a moderately stronger influence [29]. Harford suggests that cash-rich companies are more inclined to engage in acquisitions, but these irrational acquisitions tend to decrease the value of the company [30]. Faulkender and Wang proved that the marginal value of each \$1 increase in a company is less than \$1, and this loss can partly be attributed to agency costs, by directly calculating the value of cash held by a company [31]. They conclude that weak support exists for the free cash flow hypothesis.

To shed additional light on the relationship between cash flow and investment, we intend to use the two-tier stochastic frontier method to quantitatively measure the efficiency loss due to the financing constraints and the agency costs in the investment and construction of municipal infrastructure. On the quantitative measurement of efficiency loss, the impact of debt financing is further studied by using the double difference method.

3. Research Hypotheses

3.1. Assumptions about the Financing Effects of Borrowing Debt. Since the reform and opening up, with the continuous increase in the demand for municipal infrastructure investment and construction in China, the amount of debt financing has continued to grow, and it has become an important source of funds for local governments to invest in municipal infrastructure. Chenery and Strout argue that judging from the effects of the introduction of funds in the private sector, it is possible to directly expand the industry because of the capital brought in, which causes capital effect [32]. Rui Ji et al. argue that financial development has alleviated the fiscal gap caused by the mismatch between governmental power and financial power [33]. Guangyu Cao et al. believe that countries with lower initial financial endowments facing fierce interregional competition are more inclined to set up financing platforms to ease financing constraints [34].

Hypothesis 1. Borrowing debt can directly alleviate the financing constraints of local governments in China's municipal infrastructure investment and construction.

Borrowing debt to invest in the construction of municipal infrastructure not only promotes local economic development and brings about an increase in local

government revenue but also releases incremental information to induce loans from other lenders, thereby alleviating the financing constraints of local government investment and construction of municipal infrastructure in China. Yuan empirically examined the impact of private capital participation on urban infrastructure performance and found that the participation of domestic private capital significantly improved the performance of urban infrastructure, while the corresponding effect of international capital participation was not significant [35]. Fan et al. argue that borrowing debt is not only manifested as increasing GDP in the form of direct investment but also attracting industrial investment, which leverages the growth of local industries [36]. Shen et al. believe that bank credit provides incremental information to the bond market and increases the credit rating of the urban investment bonds issued by the financing platforms, and the urban investment bonds are issued on a larger scale and lower cost by the financing platforms [37].

Hypothesis 2. Borrowing debt can indirectly ease the financing constraints of local governments in China's municipal infrastructure investment and construction.

3.2. Assumptions about the Governance Effects of Borrowing Debt. Managers of debt-free or low-debt firms can easily reduce external shareholder value without harming their own interests, but managers of high-debt firms struggle to achieve this goal. Jensen argues that borrowing debt has a hard constraint on corporate due to reducing managers' use of free cash flow and can alleviate conflicts between the external shareholders and the internal managers [3]. Zhu and Wang believe that the market constraints generated by the pilot "self-issue self-repayment" of local government bonds can significantly reduce the risk premium of urban investment bonds [38]. The effect of the reduction of the risk premium on urban investment bonds is more pronounced in areas with high fiscal transparency and more balanced finances. Combined with the actual situation in China, with the deepening of the market-oriented reform of state-owned banks and the development of the bond market, the role of debt governance has been reflected.

Hypothesis 3. Borrowing debt can constrain the excessive investment and construction of municipal infrastructure by local governments in China.

The root cause of the problem of excessive investment in enterprises lies in the principal-agent relationship formed by the separation of ownership and management rights. Jensen believes that the most direct way for managers to make a profit is to expand the size of the business, and managers will try to use free cash flow investments to pursue the various benefits of the expansion of the business, even in projects with a negative net present value [3]. Zhou and Jia believe that when the company has sufficient free cash flow within the company, the company's managers artificially increase their own interests, which will produce excessive investment,

damage the interests of shareholders, and even cause serious economic consequences such as reducing the company's sales growth rate and increasing management expenses [39]. Peng and Lu believe that small- and medium-sized cities have low-labor productivity, fewer economic development opportunities, and lack of other means to stimulate economic growth, but land supply is relatively adequate, land prices are relatively low, and investment from new city construction is more likely to become a source of short-term economic growth [40]. In the same way, it can be speculated that when local government officials can mobilize more free cash flow, they will overinvest in municipal infrastructure without the necessary supervision, resulting in increased agency costs, which in turn will increase the efficiency loss of investment and construction.

Hypothesis 4. Borrowing debt could lead to excessive investment in municipal infrastructure by local governments in China.

4. Research Design

4.1. Empirical Models. Fazzari et al. find that cash flow has a strong effect on investment spending in firms with low-dividend-payout policies in Q models of investment. They argue that this result is consistent with the notion that low-payout firms are cash flow-constrained because of asymmetric information costs associated with external financing [22]. When considering both financing constraints and agency costs, we use the extended Q models of investment determined by (1) and (2) to describe the expenditure of municipal infrastructure investment and the construction of local government.

$$\ln inv_{it} = \alpha_0 + \alpha_1 \ln FQ_{it} + D_t + \varepsilon_{it}, \quad (1)$$

$$\varepsilon_{it} = v_{it} - \mu_{it} + \omega_{it}, \quad (2)$$

where i and t represent different cities and time series of years, respectively. The dependent variable inv is the construction investment expenditure of municipal infrastructure per unit of land. The independent variable FQ is the investment opportunity, and D is a dummy variable that reflects a fixed effect of time, where FQ can be estimated by the PVAR models from the panel data of the GDP and the general fiscal revenue of per unit land [41]. The stochastic disturbance term ε is made up of v , μ , and ω in (2), where v is a usual stochastic error term, $\mu \geq 0$ and $\omega \geq 0$ are, respectively, the efficiency loss caused by the insufficient investment due to the financing constraint and the excessive investment due to the agency cost of the local governments. In this paper, μ and ω will be estimated under the framework of the two-tier stochastic frontier method [42], which makes it possible to test (1) and (2) empirically.

In order to test the effect of domestic bond issuance, international bank loan, and domestic bank loan on the efficiency loss of local government municipal infrastructure investment, we set up the following model:

$$\begin{aligned}
\exp(-\mu_{it}) &= \beta_{10} + \beta_{11}DS_{it}, \quad \exp(-\omega_{it}) = \gamma_{10} + \gamma_{11}DS_{it}, \\
\exp(-\mu_{it}) &= \beta_{20} + \beta_{21}FS_{it}, \quad \exp(-\omega_{it}) = \gamma_{20} + \gamma_{21}FS_{it}, \\
\exp(-\mu_{it}) &= \beta_{30} + \beta_{31}BANK_{it}, \quad \exp(-\omega_{it}) = \gamma_{30} + \gamma_{31}BANK_{it},
\end{aligned} \tag{3}$$

where both DS and FS are dummy variables that indicate, respectively, whether the municipal infrastructure construction of the city is financed by domestic issuance of bonds and borrowing debt from international banks. $BANK$ is the proportion of domestic bank loan financing in the municipal infrastructure construction investment. This paper designs three schemes (see Table 1) to test the effect of variables DS and FS .

4.2. Data Sources. During 2003–2018, a large number of pilot reforms have been carried out in capital raising for municipal infrastructure construction by local governments in China. The pilot reform has the characteristics of quasi-natural experiments, which can reduce the endogenous problems in the estimation of measurement parameters. This paper uses panel data from 2003 to 2018 in 283 major cities in China. The original data of each variable are from the China Statistical Yearbook (2004–2019), the China Urban Construction Statistical Yearbook (2004–2019), and the China Urban Statistical Yearbook (2004–2019). The descriptive statistics of the main variables are shown in Table 2.

5. Empirical Analysis

5.1. Investment Efficiency. In this section, we use four methods, including the ordinary least squares method (OLS), maximum likelihood estimation method (MLE), and two-tier stochastic frontier method (TSFA) with controlling and not controlling time fixed effect, to estimate parameters in (1) and (2). The results of different methods are similar in Table 3, which illustrates the robustness of applying the q-theory model to study municipal infrastructure investment. The coefficient of FQ passes the test at a significant level of 1% and is positive, which conforms to expected result that the investment opportunities have a positive effect on investment expenditures. In particular, we find that the log-likelihood value of the TSFA with controlling time fixed effect is the largest among them, indicating a better estimation effect. Therefore, the following research is mainly based on the TSFA with a controlling time-fixed effect.

We also use variance to investigate the influence of financing constraints and agency costs on the efficiency of municipal infrastructure investment. As can be seen from Table 4, financing constraints have a greater impact on investment efficiency than agency costs due to $\sigma_{\mu} > \sigma_{\omega}$. The unexplainable total variance $\sigma_{\nu}^2 + \sigma_{\mu}^2 + \sigma_{\omega}^2$ of $\ln inv_{it}$ reaches 96.34%, of which 51.84% is caused by financing constraints and agency costs. The proportion of σ_{μ}^2 in $\sigma_{\mu}^2 + \sigma_{\omega}^2$ reaches 99.89%, far exceeding that of σ_{ω}^2 by 0.11%, which implies that financing constraints are in an absolute dominant position for agency costs in the total impact of information asymmetry factors. What above shows that the source of funds has

a decisive influence on the investment and construction expenditure of municipal infrastructure.

As can be seen from Table 5, the efficiency loss caused by financing constraints will make the average expenditure of municipal infrastructure investment and construction lower than the benchmark of 41.36%. However, the efficiency loss caused by the agency cost will make it 2.29% higher than the benchmark, and financing constraint has a greater impact on the efficiency of investment and construction. This also shows that financing constraints have a greater impact on the efficiency of investment than those in the agency cost.

From Figures 1 and 2, it can be seen that the distribution of efficiency loss caused by financing constraints and agency costs shows the characteristics of tailing to the right, which means that only a few cities are in an extreme situation of investment loss caused by financing constraint and agency cost.

We also can see that the investment efficiency loss of local governments in China caused by financing constraints generally presents an upward trend during the period from 2003 to 2018 in Figure 3. In particular, compared with the three major economic regions in China, we find that the efficiency loss caused by financing constraints has the following different characteristics:

- (i) In the eastern region, the efficiency loss keeps growing at a rapid rate, which implies a contradiction between the need for municipal infrastructure investment due to accelerated urbanization and the relatively limited financing channels
- (ii) In the central region, the efficiency loss shows a trend of falling first and then rising, which implies that although the financing channels of municipal infrastructure construction have been broadened, the acceleration of urbanization makes the existing financing channels become inadequate
- (iii) In the western region, the efficiency loss shows a trend of rising first and then falling, which implies that the pressure of municipal infrastructure investment caused by the acceleration of the urbanization process leads to the broadening of fundraising channels

It can be seen from Figure 4 that, during the period from 2003 to 2018, the efficiency loss of construction investment caused by agency costs of municipal infrastructure in local governments in China remained generally stable. Comparing the three major economic regions, we find the following:

- (i) In the eastern region, the efficiency loss caused by the agency cost decreased significantly, which should be attributed to the breakthrough and substantial

TABLE 1: The basic content of the empirical test scheme.

Schemes	Content	Purpose
Scheme 1	$DS_{it_k}, FS_{it_k} = \begin{cases} 1 & t = t_k \\ 0 & \text{others} \end{cases}$	Test direct effects
Scheme 2	$DS_{it_k}, FS_{it_k} = \begin{cases} 1 & t \geq t_k \\ 0 & \text{others} \end{cases}$	Test total effect
Scheme 3	$DS_{it_k}, FS_{it_k} = \begin{cases} 1 & t > t_k \\ 0 & \text{others} \end{cases}$	Test indirect effects

Here, t is the year and i is the city raising debt by domestic bond issuance or international bank loan.

TABLE 2: Descriptive statistics of the main variables.

Variable	Mean	Standard deviation	Minimum	p25	p50	p75	Maximum
$\ln inv$	4.170	1.710	-1.590	3.010	4.230	5.400	8.860
$\ln FQ$	6.360	1.430	0.990	5.420	6.490	7.410	10.44
BANK	0.200	0.240	0	0	0.0800	0.350	1
DS_1	0.100	0.310	0	0	0	0	1
DS_2	0.370	0.480	0	0	0	1	1
DS_3	0.260	0.440	0	0	0	1	1
FS_1	0.170	0.370	0	0	0	0	1
FS_2	0.600	0.490	0	0	1	1	1
FS_3	0.430	0.490	0	0	0	1	1

TABLE 3: Parameter estimates of infrastructure investment and construction efficiency model.

Dependent variable ($\ln inv$)	OLS	MLE	TSFA	
$\ln FQ$	0.968*** [93.680]	0.996*** [86.529]	0.982*** [105.266]	0.991*** [101.784]
Cons	-1.983*** [-29.444]	-2.077*** [-27.784]	-1.380*** [-6.591]	-1.218*** [-14.718]
Time-fixed effect	No control	No control	No control	Control
Adj- R^2	0.66			
Log-likelihood	-6400	-6600	-6228	-6172
LR (χ^2)	—	—	728	839
p value	—	—	0	0
N	4528	4528	4528	4528

Note. ***indicate that the levels of 1% are significant, and the value of t is in square brackets.

TABLE 4: The impact of financing constraints and agency costs on investment efficiency.

	Variable meaning	Symbol	Measurement
Causes of influence	Financing constraints	σ_μ	0.7063
	Agent cost	σ_ω	0.0234
	Random error effects	σ_y	0.6811
Variance decomposition	The total variance of the random term	$\sigma_y^2 + \sigma_\mu^2 + \sigma_\omega^2$	0.9634
	The proportion of financing constraints and agency costs	$(\sigma_\mu^2 + \sigma_\omega^2) / (\sigma_y^2 + \sigma_\mu^2 + \sigma_\omega^2)$	0.5184
	The proportion of financing constraints	$(\sigma_\mu^2 / \sigma_\mu^2 + \sigma_\omega^2)$	0.9989
	The proportion of agency costs	$(\sigma_\omega^2 / \sigma_\mu^2 + \sigma_\omega^2)$	0.0011

TABLE 5: Estimation of loss of efficiency in the infrastructure investment.

Causes of efficiency loss	Mean (%)	Standard deviation (%)	p25 (%)	p50 (%)	p75 (%)
Agency costs	2.290	0.0600	2.240	2.280	2.320
Financing constraints	41.36	17.78	27.83	36.79	50.76

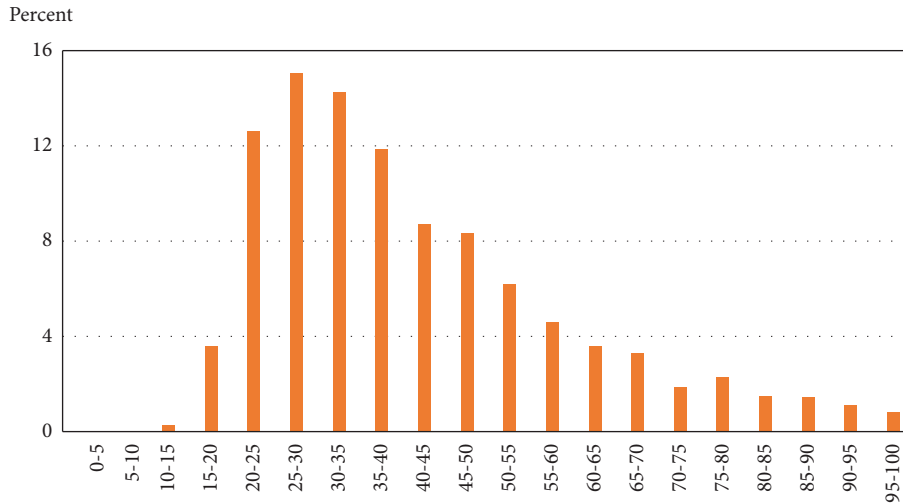


FIGURE 1: Loss of investment and construction efficiency caused by financing constraints.

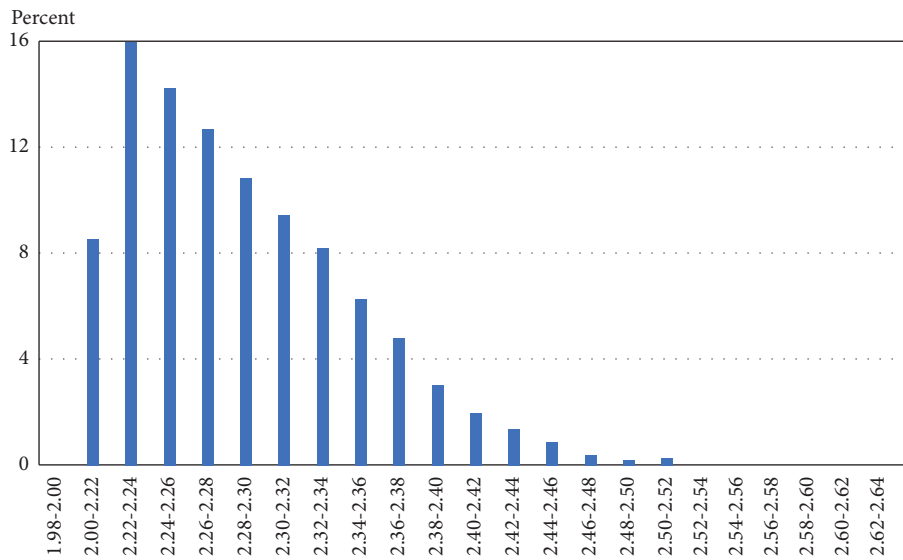


FIGURE 2: Loss of investment and construction efficiency caused by agency costs.

change in the institutional reform of municipal infrastructure.

- (ii) In the central and western regions, the efficiency loss caused by the agency cost has decreased significantly. Actually, the lag of institutional and mechanism reform leads to the growth of agency costs due to the increase in construction investment, which supports Hypothesis 4.

5.2. The Financing Effects of Borrowing Debt. Scheme 1 is used to examine the direct financing effect of domestic bond issuance, international bank borrowing, and domestic bank borrowing. Judging from the regression results of Table 6, the efficiency loss caused by financing constraints is significantly negatively correlated with borrowing debt financing. In other words, the cash flow brought by borrowing

debt such as domestic bond issuance, international bank borrowing, and domestic bank borrowing can directly reduce the efficiency loss caused by financing constraints, supporting Hypothesis 1.

This study uses Scheme 2 to examine the overall financing effect of borrowing debt such as domestic bond issuance and international bank borrowing. Judging from the regression results of Table 7, the efficiency loss caused by financing constraints is significantly negatively correlated with borrowing debt financings such as domestic bond issuance and international bank borrowing in the central region and western region. In other words, borrowing debt such as domestic bond issuance and international bank borrowing can generally reduce the efficiency loss caused by financing constraints in the central region and western region. But the efficiency loss caused by financing constraints is not significantly negatively correlated with

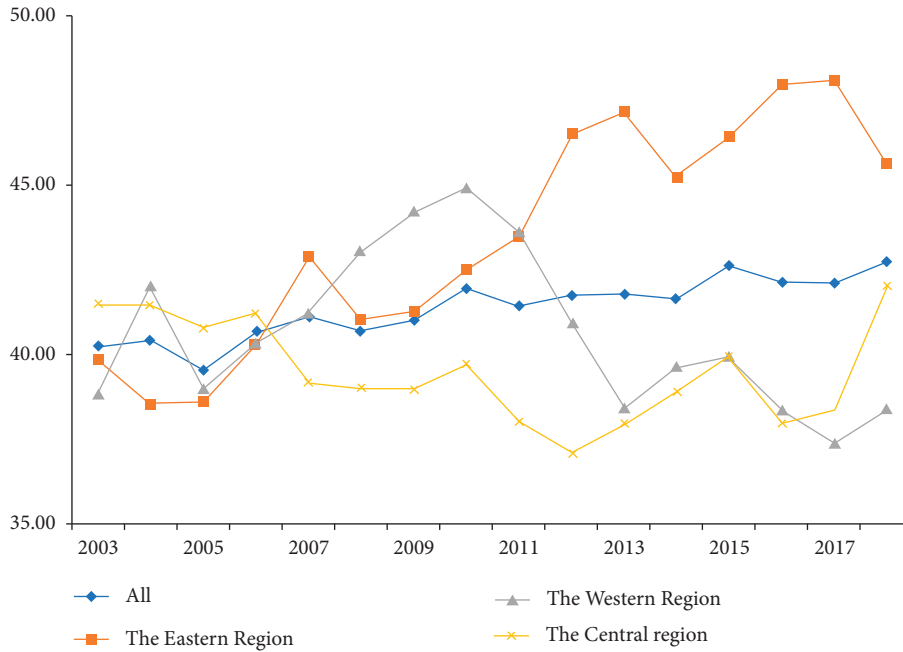


FIGURE 3: Comparison of efficiency loss of construction investment of different regions in China caused by financing constraints.

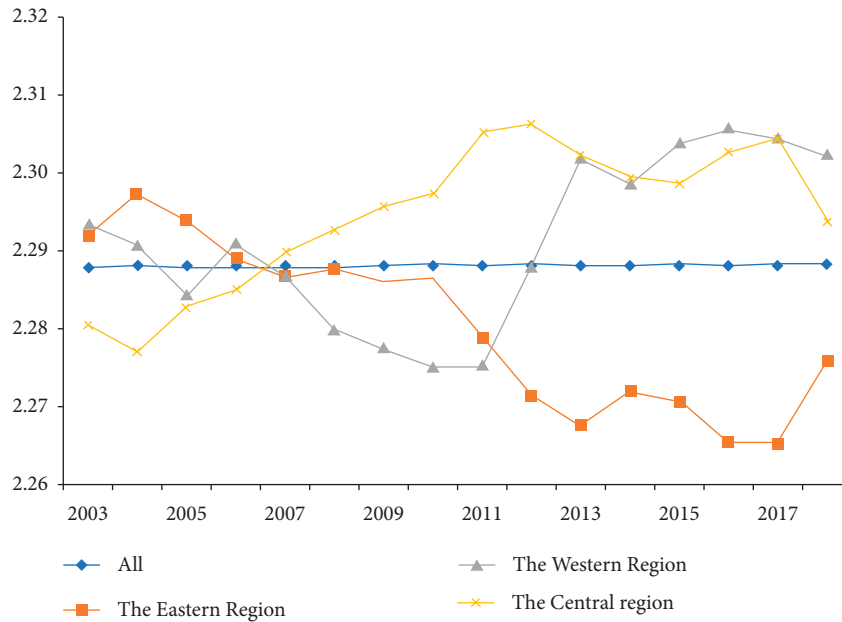


FIGURE 4: Comparison of efficiency loss of construction investment of different regions in China caused by the agency cost.

domestic bond issuance and is not significantly positively correlated with international bank borrowing in the eastern region. In other words, borrowing debt cannot effectively reduce the efficiency loss caused by financing constraints in the eastern region.

In this paper, Scheme 3 is used to examine the indirect financing effect of domestic bond issuance and international bank borrowing. Judging from the regression results of Table 8, the efficiency loss caused by financing constraints is

significantly negatively correlated with the financing of domestic bond issuance in the central region and western region and the efficiency loss caused by financing constraints is significantly positively correlated with the financing of domestic bond issuance in the eastern region, but the efficiency losses caused by financing constraints are positively related to international bank borrowings in the eastern region. There is a significant positive correlation in borrowing debt financing; that is, domestic bond financing can

TABLE 6: Direct financing effects of borrowing debt.

Variable	Domestic issuance of bonds				International bank borrowing				Domestic bank borrowing			
	All	Eastern	Central	Western	All	Eastern	Central	Western	All	Eastern	Central	Western
	-6.42*** [-7.46]	-4.24*** [-2.87]	-4.59*** [-3.42]	-11.97*** [-7.25]	-7.51*** [-10.72]	-7.96*** [-7.23]	-8.00*** [-7.41]	-6.44*** [-3.98]	-15.91*** [-14.70]	-23.44*** [-13.37]	-12.58*** [-7.29]	-11.71*** [-5.27]
Cons	42.0*** [151]	43.9*** [97]	40.0*** [94]	42.2*** [71]	42.6*** [149]	44.9*** [95]	40.8*** [94]	41.6*** [69]	44.5*** [133]	48.6*** [86]	41.6*** [85]	43.1*** [59]
Adj-R ²	0.13	0.08	0.16	0.18	0.22	0.27	0.30	0.15	0.42	0.60	0.42	0.27

Note. ***indicate that the levels of 1% are significant, and the value of t is in square brackets.

TABLE 7: Overall financing effects of borrowing debt.

	Domestic issuance of bonds				International bank borrowing			
	All	Eastern	Central	Western	All	Eastern	Central	Western
Variable	-4.197*** [-7.699]	-0.169 [-0.180]	-3.794*** [-4.464]	-10.323*** [-9.319]	-2.104*** [-3.913]	0.759 [0.815]	-5.456*** [-6.788]	-3.326*** [-2.944]
Cons	42.900*** [130.04]	43.525*** [83.46]	41.065*** [78.75]	44.785*** [63.85]	42.616*** [102.73]	42.954*** [55.75]	42.599*** [70.53]	42.246*** [53.91]
Adj-R ²	0.12	0.01	0.12	0.42	0.08	0.01	0.15	0.12

Note. *** indicate that the levels of 1% are significant, and the value of t is in square brackets.

TABLE 8: Indirect financing effects of borrowing debt.

	Domestic issuance of bonds				International bank borrowing			
	All	Eastern	Central	Western	All	Eastern	Central	Western
Variable	-1.94*** [-3.24]	1.94* [1.842]	-2.36*** [-2.71]	-5.76*** [-4.57]	2.19*** [4.10]	5.46*** [6.36]	-1.072 [-1.303]	-0.233 [-0.195]
Cons	41.87*** [136.20]	43.06*** [88.11]	40.24*** [83.10]	42.22*** [64.19]	40.43*** [115.80]	40.75*** [67.28]	39.95*** [76.47]	40.73*** [58.33]
Adj-R ²	0.08	0.01	0.09	0.16	0.09	0.21	0.00	0.01

Note. *, *** indicate that the levels of 10% and 1% are significant, respectively, and the value of t is in square brackets.

TABLE 9: Direct governance effects of borrowing debt.

	Domestic issuance of bonds				International bank borrowing				Domestic bank borrowing			
	All	Eastern	Central	Western	All	Eastern	Central	Western	All	Eastern	Central	Western
Variable	0.019*** [6.80]	0.005 [1.08]	0.016*** [3.27]	0.044*** [7.80]	0.021*** [8.80]	0.021*** [6.64]	0.023*** [5.52]	0.019*** [3.42]	0.047*** [12.96]	0.071*** [14.37]	0.030*** [4.63]	0.042*** [5.47]
Cons	2.29*** [2484]	2.28*** [1752]	2.29*** [1442]	2.29*** [1127]	2.285*** [2401]	2.276*** [1679]	2.291*** [1399]	2.288*** [1093]	2.279*** [2049]	2.265*** [1421]	2.290*** [1238]	2.282*** [910]
Adj-R ²	0.14	0.001	0.16	0.17	0.19	0.24	0.35	0.11	0.32	0.42	0.12	0.27

Note. *** indicate that the levels of 1% are significant, and the value of t is in square brackets.

indirectly reduce the efficiency loss caused by financing constraints, supporting Hypothesis 2; but international banks borrowing can increase the efficiency loss caused by financing constraints.

5.3. *The Governance Effects of Borrowing Debt.* This paper uses Scheme 1 to examine the direct governance effect of borrowing debt such as domestic bond issuance, international bank borrowing, and domestic bank borrowing. Judging from the regression results in Table 9, the efficiency loss caused by agency costs is significantly positively correlated with the financing of borrowing debt such as domestic bond issuance, international bank borrowing, and domestic bank borrowing. That is, borrowing debt to finance brings cash flow, increases free cash flow, and increases the efficiency loss caused by agency costs, supporting Hypothesis 4.

This paper uses Scheme 2 to examine the overall governance effect of borrowing debt such as domestic bond issuance and international bank borrowing. Judging from

the regression results of Table 10, the efficiency loss caused by agency costs is significantly positively correlated with the borrowing debt such as domestic bond issuance and international bank borrowing in the central region and western region. In other words, domestic bond issuance, international bank borrowing, and so on can bring cash flow, increase the efficiency loss caused by agency costs, and support Hypothesis 4.

In this paper, Scheme 3 is used to examine the indirect governance effect of borrowing debt. Judging from the regression results of Table 11, the efficiency loss caused by agency costs is significantly positively correlated with the domestic bond issuance in the central region and western region, but is significantly negatively correlated with the domestic bond issuance in the eastern region. The efficiency loss caused by agency costs is significantly negatively correlated with international bank borrowing in the eastern region, but is significantly positively correlated with international bank borrowing in the central region. That is, domestic bond issuance brings cash flow, increases free cash flow, and increases the efficiency loss caused by agency costs

TABLE 10: Overall governance effects of borrowing debt.

	Domestic issuance of bonds				International bank borrowing			
	All	Eastern	Central	Western	All	Eastern	Central	Western
Variable	0.015*** [8.044]	-0.004 [-1.599]	0.017*** [5.498]	0.037*** [9.753]	0.008*** [4.290]	-0.003 [-1.256]	0.021*** [6.824]	0.012*** [3.073]
Cons	2.283*** [2090.07]	2.828*** [1532.40]	2.288*** [1174.17]	2.276*** [945.57]	2.284*** [1661.65]	2.283*** [1036.66]	2.28*** [1008.62]	2.29*** [846.82]
Adj-R ²	0.13	0.01	0.17	0.43	0.09	0.01	0.15	0.12

Note. *** indicate that the levels of 1% are significant, and the value of t is in square brackets.

TABLE 11: Indirect governance effects of borrowing debt.

	Domestic issuance of bonds				International bank borrowing			
	All	Eastern	Central	Western	All	Eastern	Central	Western
Variable	0.008*** [4.065]	-0.008** [-4.573]	0.012*** [3.698]	0.020*** [4.608]	-0.004** [-2.326]	-0.016*** [-6.331]	0.008*** [2.702]	0.003 [0.733]
Cons	2.286*** [2246]	2.282*** [1636]	2.291*** [1265]	2.286*** [1009]	2.290*** [1977]	2.288*** [1321]	2.291*** [1172]	2.290*** [952]
Adj-R ²	0.09	0.07	0.10	0.20	0.07	0.21	0.04	0.00

Note. **, *** indicate that the levels of 5% and 1% are significant, respectively, and the value of t is in square brackets.

in the central region and western region, supporting Hypothesis 4. Rigid debt service constraints on international bank borrowing reduce free cash flow and reduce efficiency losses due to agency costs, supporting Hypothesis 3.

6. Conclusions and Policy Recommendations

6.1. Basic Conclusions. This work studies the impact of borrowing debt on the efficiency loss of municipal infrastructure investment and construction. The main conclusions are as follows: first, financing constraints have a greater impact on agency costs, and alleviating financing constraints can reduce the loss of municipal infrastructure investment and construction efficiency. Second, borrowing debt brings cash flow, which can directly reduce the efficiency loss caused by financing constraints, and borrowing debt such as domestic bond issuance and international bank borrowing has a significant indirect financing effect, but the rigid repayment to international bank borrowings will increase financing constraints in the later stage. Third, the governance effect of borrowing debt is not good, and the cash brought by borrowing debt increases free cash flow and increases the efficiency loss caused by agency costs, but the rigid repayment of international banks will play some governance effects in the later stage.

6.2. Policy Recommendations. Based on the above research conclusions, the policy enlightenments of this paper are as follows: first, improve the public service system, promote government procurement of services, promote the reform of the price mechanism, and accelerate the establishment of a stable, reliable, reasonable, open, and transparent compensation mechanism for municipal infrastructure investment and construction expenditure. Second,

increase efforts to revitalize state-owned assets, inject state-owned assets into local municipal infrastructure investment and construction enterprises in batches, increase financing collateral, reduce the asset-liability ratio of enterprises, improve the credit rating of enterprises, and improve the financing capacity of enterprises. Third, give full play to the role of policy-oriented financial institutions and increase the proportion of long-term direct financing such as asset securitization. Fourth, actively use new project financing models such as PPP to establish multilevel and multichannel financing channels to achieve better integration of state-owned capital and social capital. Fifth, adjust the existing urban development performance appraisal and evaluation system, incorporate more indicators reflecting the city's medium-term and long-term development performance into the official appraisal system, establish and improve the local government asset and liability monitoring and early warning system, pay attention to the continuity of municipal infrastructure planning, and reduce the short-sighted behavior of administrative measures.

6.3. Limitations. Although this work reached several significant results through scientific and empirical investigation, it nevertheless has major shortcomings. To begin, inadequate consideration of soft budget constraints faced by local governments will lead to the overestimation of investment efficiency losses of local governments in China. The impact of borrowing debt on local government's municipal infrastructure investment lacks typical case support. In the future study, the soft budget constraint of local governments needs further attention, and a single city may be chosen, and longitudinal data from the city are utilized to integrate qualitative and quantitative research.

Data Availability

The (DATA TYPE) data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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