

Local Government Debt, Sectoral Linkage and Resource Allocation Efficiency

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Increasing the efficiency of resource allocation is the basis and guarantee for boosting high-quality economic development. Based on the panel data of Chinese industrial enterprises and cities from 2008 to 2013, this paper studies the influence of infrastructure construction demand shocks represented by local government debt expansion on the efficiency of sectoral resource allocation from the perspective of sectoral linkage. According to the empirical findings, local government debt significantly reduces the resource allocation efficiency of manufacturing sector that is highly related to infrastructure construction. This conclusion is still tenable after the robustness test using the simulated local government debt as an instrumental variable. Further mechanism tests show that there are two reasons for the decline of the efficiency of resource allocation in manufacturing sector that is highly related to infrastructure construction. First, more product demands and investments brought by the expansion of local government debt flow to less productive enterprises in the sector. Second, resource misallocation reduces the probability of high-productivity enterprises entering the market and low-productivity enterprises exiting the market, and the effect is more prominent in cities with high dependence on state-owned enterprises and high pressure on officials to be promoted. According to this study, the performance management of local government debt should be further strengthened, and particular attention should be paid to the influence of local government debt on enterprise investment and financing crowding out and resource misallocation.

Keywords: local government debt, infrastructure construction, sectoral linkage, resource misallocation

1. Introduction

In recent years, local government debt has played a great role in maintaining stable growth, improving people's livelihood, and strengthening weak links in the

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context of declining economic growth and increasing pressure on fiscal revenue and expenditure. Although the overall government debt ratio is not high in China, there are still high pressure and risks of debt repayment in some regions. How to prevent and defuse local government debt risks in high-quality economic development has become an important issue concerned by the whole society. For now, the key to achieving high-quality economic development lies in optimizing the allocation of resources to improve the total factor productivity. Many scholars believe that there is a certain threshold value for the influence of local government debt on macroeconomic growth, and excessive debt stock can crowd out the productive investment of the government and private sector, which may lead to the decline of resource allocation efficiency and accumulation of debt repayment risks (Traum and Yang, 2015). Recent studies were carried out at the micro level starting from the allocation of credit resources, and found that in the segmented regional credit market, the increasing financing demand of local governments not only occupies the credit resources of private enterprises, reduces their enthusiasm for investment and R&D input (Huang *et al.*, 2020; Fan *et al.*, 2022), but also strengthens the incentive of leverage manipulation and greatly increases the possibility of debt default (Rao *et al.*, 2022). However, existing literature mainly focuses on the direct influence of local government debt financing on corporate investment and financing, but rarely studies the possible spillover effect that may be generated based on sectoral linkage on the basis of the investment of government debt funds.

According to the National Audit Office's audit reports on local government debt in 2010 and 2013, more than 60% of local government debt was used for municipal investment, transportation, and other fields of infrastructure. In addition to directly increasing economic output, infrastructure investment has a strong spillover effect. It can influence the development of other sectors through the input-output relationship. Especially, during the international financial crisis, the infrastructure construction by local government debt financing created a huge demand for products from the upstream manufacturing sector (e.g., steel, cement, non-ferrous metals, etc.). The demand spillover effect brought by such sectoral linkage may also affect the resource allocation of manufacturing sector. Specifically, on the one hand, positive external demand shocks will enhance the expected profit level of the manufacturing sector which is highly related to infrastructure construction, so that low-productivity enterprises in the sector which are on the verge of going out of business can continue to survive, resulting in a dynamic loss of resource allocation efficiency in the sector. On the other hand, as high-productivity enterprises tend to have optimal production scale, while low-productivity enterprises have excess production capacity, the increase in external demand caused by the expansion of local government debt is more likely to be utilized by low-productivity enterprises, which enables such enterprises to rapidly expand their production capacity and occupy a higher market share, thus inhibiting the improvement of the efficiency of resource allocation in the sector.

Based on the panel data of industrial enterprises and cities in China from 2008 to 2013, this paper studies the influence and mechanism of the spillover of demand for infrastructure products represented by the expansion of local government debt on the resource allocation efficiency of manufacturing sector. It takes the dispersion degree of enterprise total factor productivity (TFP) at the city-sector level as the index of sectoral resource allocation efficiency, and uses the complete consumption coefficient in the input-output table of China in 2007 to measure the linkage between different manufacturing and infrastructure sectors. The empirical study of this paper shows that the expansion of local government debt significantly reduces the efficiency of resource allocation in manufacturing sector that is highly related to infrastructure construction, and it mainly affects the efficiency of sectoral resource allocation through two channels: resource allocation among enterprises and enterprise entry and exit. Further studies show that the resource misallocation effect has obvious regional heterogeneity, and the negative influence of local government debt on sectoral resource allocation efficiency is more prominent in cities with high dependence on state-owned enterprises and high pressure on officials to be promoted.

The marginal contributions of this paper are as follows. First, it expands the research perspective of microeconomic effect of local government debt. Existing literature mainly focuses on the direct influence of local government debt on corporate investment and financing (Liang *et al.*, 2017; Wu *et al.*, 2022). From the perspective of sectoral linkage, this paper analyzes the possible spillover effect of local government debt expansion and its influencing mechanism, providing a reference for a comprehensive assessment of the economic effect of local government debt. Second, it complements the literature in the area of resource misallocation. Although there are more and more studies on the causes of resource misallocation in China, there is less systematic analysis of the role of local government debt in it. The study of this paper makes up for this deficiency, and shows that the rapid expansion of local government debt will reduce the efficiency of sectoral resource allocation, and provides new ideas for further improving resource allocation to promote high-quality economic development. Third, the relatively exogenous sectoral linkage index and the synthetic instrumental variable of local government debt in this paper can better alleviate the endogenous problems such as measurement error and reverse causation in the empirical study, so as to accurately identify the potential causal mechanism.

2. Research Hypotheses

As an important countercyclical policy tool, local government debt has played a decisive role in coping with the international financial crisis. By borrowing large amounts of debt for infrastructure construction, governments at all levels made up for the deficiency of effective demand from the private sector in the short term, reversed

the decline in economic growth, and rapidly improved the infrastructure conditions such as roads and electricity in many places. However, the incentive policy relying on demand expansion did not end with the end of the international financial crisis. In the fierce competitions for regional economic growth, local governments allocated land, funds, and other resources to the field of infrastructure, and relied on debt investment to drive economic growth. It should not be ignored that while the scale of local government debt expands, the return on debt investment declines year by year. This means that not only debt investment projects themselves cannot achieve expected returns, but also that resource allocation favoring infrastructure may crowd out production factors needed for the development of other sectors in terms of supply and price, resulting in a serious mismatch between supply and demand. In addition to directly affecting the resource allocation, the expenditure of government debt on infrastructure will undoubtedly stimulate the demand for manufacturing products that are highly related to it, and intensify the investment and capacity expansion of enterprises. This could easily lead to severe overcapacity after policy incentives are reduced and market demand becomes saturated. Theoretically, the expansion of local government debt may affect the efficiency of sectoral resource allocation from the two aspects of intensive margin and extensive margin.

First, in terms of intensive margin, accompanied by the expansion of local government debt, large-scale infrastructure investment may lead to a surge in demand for manufacturing products which are highly related to infrastructure construction, such as steel, cement, and non-ferrous metals. In a fully competitive market, such asymmetric external demand shock is more inclined to benefit enterprises with higher productivity in the sector, hence such enterprises can occupy a larger market share and improve the overall efficiency of resource allocation in the sector. However, in reality, it is often difficult for high-productivity enterprises to seize market opportunities brought about by the expansion of local government debt in time, because such enterprises usually have optimal production scale, and there is a mismatch between low idle capacity and expanding market demand (Wu *et al.*, 2020). Moreover, sectors which are highly related to infrastructure mostly need a certain amount of fixed investment. In the financial system dominated by indirect financing in China, the lack of explicit and implicit guarantees makes financing constraints even more severe for high-productivity enterprises, especially most private enterprises (Hsieh and Song, 2015). This means that in the face of growing market demand, such enterprises can hardly expand their capacity by external financing to increase their market share. In contrast, less productive state-owned enterprises generally have lower production capacity and financing requirements.¹ Therefore, they can occupy more production resources, so as

¹ For example, the research of Shen and Chen (2017) based on the data of Chinese industrial enterprises from 2011 to 2013 found that, averagely the capacity utilization rate of state-owned enterprises was significantly lower than that of private and foreign-funded enterprises.

to occupy a dominant position in capturing external product requirements to achieve the expansion of production scale. In view of this, this paper holds that the expansion of local government debt may make more resources flow to low-productivity enterprises and state-owned enterprises, thus leading to the increase of industrial TFP dispersion.

Second, in terms of extensive margin, the increasing product demand can improve the expected profit level of manufacturing sector, reduce the critical productivity of enterprises entering and exiting the market, and affect the productivity distribution of the sector. In ideal circumstances, the market demand created by the expansion of local government debt may push high-productivity enterprises into sectors which are highly related to infrastructure. But, as mentioned above, certain fixed costs are often required to enter these sectors, while high-productivity enterprises, especially most private enterprises, are subject to relatively severe financing constraints, which means that external demand is more likely to attract low-productivity enterprises into the sectors. Meanwhile, low-productivity firms can continue to survive and not be eliminated by the market because of the growing demand for products. In the context of imperfect market exit mechanism, local government intervention further increases the difficulty of their exit from the market. As a result, not only the existence of a large number of low-productivity enterprises may squeeze the living space of high-productivity enterprises, but also the difficulty of clearing these enterprises and the entry barrier of high-productivity enterprises may undoubtedly affect the normal operation of the market mechanism of survival of the fittest, resulting in the misallocation of sectoral resources and the loss of dynamic efficiency.

Based on the above analysis, this paper proposes the following three hypotheses to be tested:

Hypothesis 1: The expansion of local government debt will reduce the efficiency of resource allocation in manufacturing sector that is highly related to infrastructure.

Hypothesis 2: The increasing product demand brought about by the expansion of local government debt makes more resources flow to low-productivity enterprises with idle production capacity, thus reducing the efficiency of resource allocation in sectors which are highly related to infrastructure.

Hypothesis 3: The expected profit rate increase and capital misallocation caused by the expansion of local government debt will distort the entry and exit of heterogeneous enterprises, thus resulting in the dynamic loss of resource allocation efficiency in sectors which are highly related to infrastructure.

3. Empirical Strategy and Data Explanation

3.1. Model Setup

Based on the above analysis, this paper examines the influence of local government

debt expansion on the efficiency of resource allocation in manufacturing sector from the perspective of sectoral linkage. The empirical model is set as follows:

$$y_{cst} = \alpha + \beta debt_{ct} + \gamma debt_{ct} \times link_s + \rho X + \delta_{st} + \eta_c + \varepsilon_{cst} \quad (1)$$

Wherein, c , s and t refer to city, sector, and year respectively. The dependent variable y_{cst} represents the TFP dispersion of enterprises in the sector s in city c in year t . In this paper, the core independent variable is $debt_{ct} \times link_s$, that is, the interaction term of local government debt level at the city level $debt_{ct}$ and sectoral linkage $link_s$. The estimated coefficient γ is the focus of this paper, which is used to measure the differential influence of local government debt expansion on the TFP dispersion of different sectors that are related to infrastructure. X refers to other control variables, including urban economic development level, urbanization level, urban land transfer level, urban housing price, average employment by city and sector, proportion of fixed assets by city and sector, market concentration rate by city and sector, proportion of foreign-funded enterprises by city and sector. δ_{st} is the sector-year interactive fixed effect. η_c is the city fixed effect. ε_{cst} is the error term. In addition, this paper clusters the standard errors at the city-sector level.

3.2. Variable Selection

3.2.1. Efficiency of Sectoral Resource Allocation

Referring to the practice of Qing and Liu (2021), this paper adopts the three-digit standard deviation of TFP of enterprises in the sector to measure the efficiency of sectoral resource allocation. According to the logic behind this index, if there is no distortion in the market, market competition will make the TFP distribution of enterprises in the same sector tend to be consistent, that is, the TFP dispersion should be zero. Therefore, the higher the efficiency of sectoral resource allocation is, the lower the dispersion of TFP will be. According to the general practice, this paper uses the OP method and LP method respectively to estimate the enterprise TFP, and determines the standard deviation of the enterprise TFP in the sector on that basis to measure the dispersion.

3.2.2. Local Government Debt Level

As mentioned above, before 2015, local governments mainly relied on financing platform companies for debt financing. In view of the availability of data, existing literature mainly represents the debt level of local governments based on the bonds issued by financing platform companies and relevant financial data disclosed by Wind Terminal. According to Huang *et al.* (2020), this paper uses the ratio of total interest-

bearing debt of financing platform companies at the city level to GDP to measure the level of local government debt.

3.2.3. Sectoral Linkage

As local government debt funds are mainly invested in infrastructure sector, mainly municipal construction and transportation construction, large-scale infrastructure investment will undoubtedly stimulate the demand for products from manufacturing sector that is highly related to infrastructure. Viewed from the input-output relationship, if the unit output of the infrastructure sector consumes more products of a certain manufacturing sector, the linkage between the two sectors is closer. Based on this logic, this paper uses the complete consumption coefficient in the input-output table of China for 135 sectors in 2007 to measure the sectoral linkage by building 0–1 dummy variables. In calculating this index, the first priority is to determine which industries belong to the infrastructure sector. According to the industry classification of fixed asset investment in the *China Statistical Yearbook* and the *Statistical Yearbook of the Chinese Investment in Fixed Assets*, the statistical categories of infrastructure investment include: (1) Production and supply of electricity, heat, gas and water; (2) Transportation, warehousing and postal services; (3) Information transmission, software and information technology services; (4) Management of water conservancy, environment and public facilities. Huang *et al.* (2020) believed that the infrastructure sector directly affected by local government debt funds are mainly (1), (2), (4) and the construction industry. Based on their practice, this paper combines the four sectors in the input-output table in 2007, recalculates the combined complete consumption coefficient, and defines the sector with the coefficient values greater than the median as the sector highly related to infrastructure, namely, $link_s=1$, and the sector with the coefficient values lower than the median as the sector less related to infrastructure, namely, $link_s=0$.

3.3. Data Source and Explanation

The empirical analysis of this paper mainly uses three levels of data sets. First, the data at the enterprise level come from the database of Chinese industrial enterprises above designated size from 2008 to 2013. According to the practice of Brandt *et al.* (2012), this paper combines the data of different years based on the identification information such as legal person code, unifies the sectoral and regional codes, retains the manufacturing enterprises with two-digit codes of 13–42, and deletes the samples not conforming to the accounting standards and the samples in 2010. In addition, for missing indexes such as added value and intermediate input in the database of industrial enterprises, this paper matches the data of Chinese industrial enterprises in the sample period with the national tax survey data from 2008 to 2013 and the economic census data in 2008 to

supplement the missing information of key variables such as legal person code, added value, employment, and employee compensation payable. For the indexes which are still missing, this paper calculates and supplements them according to the method proposed by Kou and Liu (2019), establishes the price indexes of products and intermediate goods of different sectors, and deflates the total output value, added value and intermediate input.

Second, the raw data of sectoral linkage come from the input-output table of 135 sectors compiled by the National Bureau of Statistics in 2007. Compared with the input-output table in 2002, the sectoral division in the input-output table in 2007 is more detailed and basically consistent with the three-digit sectoral division in the database of Chinese industrial enterprises. Considering that the input-output table of the subsector is only published every five years, using the input-output table of 2007 to calculate the index can better measure the linkage between each manufacturing sector and the infrastructure sector within the research range on the premise of ensuring the predetermined variables.

Third, the raw data of urban government debt come from the new financing platform debt database between 2006 and 2018 built by Cao *et al.* (2019), and other city-level economic and social variables come from the EPS database. Based on uniform sectoral and regional codes, this paper combines the data at the above three levels and obtains 46883 city-sector-year observations for 287 cities. Besides, this paper also deletes the samples with fewer than five enterprises in the city-sector group, and winsorizes continuous variables by about 1% to alleviate the interference of outliers.

Table 1 shows descriptive statistics of main variables before dataset matching.

Table 1. Descriptive Statistics of Main Variables

Name	Definition	Sample size	Mean	Standard deviation	Minimum	Maximum
<i>tfpsd_op</i>	TFP standard deviation by city and sector (OP method)	46883	0.955	0.273	0.012	7.227
<i>tfpsd_lp</i>	TFP standard deviation by city and sector (LP method)	46883	0.969	0.274	0.000	2.729
<i>link</i>	Sectoral linkage (0–1 dummy variables)	167	0.495	0.501	0.000	1.000
<i>debt</i>	Total interest-bearing debt of financing platform companies / GDP	1435	0.088	0.141	0.000	0.816
<i>debt_pre</i>	Simulated value of local government debt level / GDP	1435	0.093	0.148	0.000	1.071
<i>lnpgdp</i>	Logarithm of real GDP per capita	1435	10.285	0.654	4.595	12.189
<i>lnurban</i>	Logarithm of the ratio of permanent population to built-up area	1435	5.753	0.897	1.597	7.869
<i>landre</i>	Ratio of land transfer income to GDP	1435	0.045	0.036	0.000	0.315
<i>lnhp</i>	Logarithm of the ratio of urban commercial housing sales to commercial housing sales area	1435	8.158	0.472	6.804	10.102

Name	Definition	Sample size	Mean	Standard deviation	Minimum	Maximum
<i>lnemp</i>	Logarithm of average employment of enterprises by city and sector	46883	4.172	0.818	1.731	7.943
<i>asset</i>	Ratio of fixed assets to total assets by city and sector	46883	0.262	1.108	0.001	0.650
<i>hhi</i>	Herfindahl-Hirschman Index by city and sector	46883	0.267	0.181	0.005	0.998
<i>foreign</i>	Proportion of foreign-funded enterprises by city and sector	46883	0.189	0.221	0.000	0.896

4. Analysis of Empirical Results

4.1. Benchmark Regression Results

Table 2 shows the regression results of Model (1). *tfpsd_op* and *tfpsd_lp* are the standard deviation of sectoral TFP calculated by OP and LP methods respectively. The estimated coefficient of the interaction term $debt \times link$ is the focus of this paper. Columns (1) and (4) only show the city fixed effect and sector-year fixed effect; Columns (2) and (5) include the control variables at the city level; Columns (3) and (6) further include the control variables at the city-sector level. It is clear that the estimated coefficient of $debt \times link$ is significantly positive at the level of 1%. This means that the higher the level of government debt in a city, the lower the efficiency of resource allocation in manufacturing sector that is closely related to infrastructure construction. On the contrary, the estimated coefficient of *debt* is negative in all models, but it is not significant. To some extent, this means that the findings of this paper are not caused by the decline of resource allocation efficiency in manufacturing sector that has little relation with infrastructure. Taken together, Hypothesis 1 has been preliminarily confirmed. Namely, the expansion of local government debt significantly reduces the efficiency of resource allocation in manufacturing sector that is highly related to infrastructure, compared to sector with little relation with infrastructure.

Table 2. Benchmark Regression Results

Variable	<i>tfpsd_op</i>			<i>tfpsd_lp</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>debt</i>	-0.096 (0.186)	-0.091 (0.189)	-0.088 (0.188)	-0.086 (0.065)	-0.077 (0.066)	-0.095 (0.065)
<i>debt</i> × <i>link</i>	0.124*** (0.027)	0.125*** (0.024)	0.122*** (0.028)	0.130*** (0.034)	0.132*** (0.035)	0.118*** (0.035)

Variable	<i>tfpsd_op</i>			<i>tfpsd_lp</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>lnpgdp</i>		−0.044** (0.022)	−0.042* (0.023)		−0.016 (0.011)	−0.012** (0.006)
<i>lnurban</i>		−0.031*** (0.011)	−0.032*** (0.011)		−0.008** (0.004)	−0.011*** (0.003)
<i>landre</i>		0.179 (0.342)	0.174 (0.345)		0.152* (0.089)	0.146 (0.094)
<i>lnhp</i>		0.091 (0.102)	0.093 (0.102)		0.003 (0.024)	0.001 (0.022)
<i>lnemp</i>			0.028* (0.016)			0.022* (0.012)
<i>asset</i>			0.045* (0.026)			0.053*** (0.015)
<i>hhi</i>			0.014** (0.007)			0.018*** (0.005)
<i>foreign</i>			−0.047** (0.021)			−0.095*** (0.015)
City fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Sector-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observation	45860	45860	45860	45860	45860	45860
R ²	0.402	0.414	0.458	0.281	0.287	0.375

Note: What is indicated in brackets is the clustering robust standard error at the city-sector level. ***, ** and * represent the significance at 1%, 5% and 10% respectively. Unless otherwise specified, the same applies below.

4.2. Robustness Test

4.2.1. Remeasurement of Local Government Debt

Considering that the total interest-bearing debt of financing platform companies may cover the liabilities of market-oriented business, Columns (1) and (2) of Table 3 respectively represent the debt level of local governments with the proportion of the

balance of urban investment bonds of financing platform companies in GDP and the degree of debt dependency.¹ The estimation results show that the basic conclusion is robust.

4.2.2. Remeasurement of Sectoral Linkage

First, in order to distinguish the sectoral linkage, Columns (3) and (4) of Table 3 show the estimated results after reclassifying sectors with high and low relation to infrastructure based on the tertiles and quartiles respectively. Second, the sensitivity of the conclusions in this paper to the statistical scope of the infrastructure sector may cause concern. For this reason, Column (5) of Table 3 excludes the construction sector, namely, limits the statistical scope of the infrastructure sector to the three industries of (1), (2) and (4), and recalculates the sectoral linkage index, and Column (6) further limits the statistical scope of the infrastructure sector to (1) and (2), that is, infrastructure in the narrow sense (Wu *et al.*, 2021). It can be seen that the benchmark conclusion is still valid after different sectoral linkage indexes are used for estimation.

4.2.3. Remeasurement of Sectoral Resource Allocation Efficiency

First, Column (7) of Table 3 uses the difference between the 90% quantile and the 10% quantile of TFP ($tfp90_op$) of enterprises in the sector to measure the TFP dispersion of the sector. Second, considering that there are relatively few enterprises in the three-digit sector in some cities, Column (8) of Table 3 provides the infrastructure linkage and resource allocation efficiency in the two-digit sector in the city. It can be seen from the estimation of Model (1) by using the above two different sectoral resource allocation efficiency indexes that the estimated coefficient of $debt \times link$ is still significantly positive.

4.2.4. Check of Omitted Variables

First, Column (9) of Table 3 further incorporates two more stringent sets of fixed effects, *i.e.*, city-year interactive fixed effect and city-sector interactive fixed effect. Second, Column (10) of Table 3 calculates the proportion of zombie enterprises in the sector and in the city, so as to control the possible influence of zombie enterprises on the conclusions of this paper. It can be seen that the benchmark conclusions are still robust whether it includes the interactive fixed effect or controls the proportion of zombie enterprises.

4.2.5. Deleting the Samples of Large Cities

Considering the incomparability of large cities and small cities in debt usage, Column

¹ Debt dependency = New local government debt / (General public budget expenditure of the year + New local government debt of the year).

(11) of Table 3 excludes the municipalities directly under the central government, sub-provincial cities, and provincial capitals, and regresses Model (1) again. It is not difficult to find that the conclusion of this paper is still significantly tenable.

4.2.6. Using Different Clustering Standard Errors

This paper clusters the standard errors at the city-year level. Column (12) of Table 3 shows the regression results. It is clear that though the standard error of the estimated coefficient $debt \times link$ increases, it is still significantly positive at the level of 1%.

Table 3. Results of Robustness Test

Panel A						
Variable	(1) Balance of urban investment bonds / GDP	(2) Debt dependency	(3) Tertile sectoral linkage	(4) Quartile sectoral linkage	(5) Excluding construction sector	(6) Infrastructure in the narrow sense
<i>debt</i>	−0.095 (0.147)	−0.018 (0.069)	−0.128 (0.153)	−0.094 (0.125)	−0.084 (0.171)	−0.096 (0.175)
<i>debt</i> × <i>link</i>	0.128*** (0.031)	0.147** (0.072)	0.227*** (0.033)	0.167*** (0.045)	0.115*** (0.030)	0.143*** (0.035)
Observation	45006	46082	30287	22037	45860	45860
R ²	0.459	0.415	0.467	0.449	0.452	0.455
Panel B						
Variable	(7) <i>tfp90_op</i>	(8) Two-digit sectoral measurement	(9) Interactive fixed effect	(10) Controlling the influence of zombie enterprises	(11) Deleting large cities	(12) City-year clustering standard errors
<i>debt</i>	−0.059 (0.082)	−0.033 (0.061)	—	−0.067 (0.113)	−0.092 (0.141)	−0.088 (0.247)
<i>debt</i> × <i>link</i>	0.106*** (0.037)	0.145*** (0.036)	0.116** (0.055)	0.126*** (0.041)	0.169*** (0.056)	0.122*** (0.043)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	No	Yes	Yes	Yes
Sector-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observation	45860	20679	43936	45860	31848	45860
R ²	0.384	0.426	0.745	0.412	0.473	0.458

Note: Except for Column (7), the dependent variable in all columns is *tfpsd_op*; Column (9) also controls the city-year and city-sector fixed effects.

4.3. Instrumental Variable Estimation

In order to alleviate endogenous problems, based on the practice of Dahl and Lochner (2012), the simulated value of local government debt level $debt_pre$ is established to identify causal connections. Specifically, the synthetic instrumental variable of local government debt is built, using the interaction term of the debt ratio $debt_{c0}$ of each city in the base period and the annual growth rate $debtgr_{pt}$ of the absolute scale of local government debt at the provincial level. The two years before the start of the sample (namely, 2006 and 2007) are taken as the base period for estimation. For cities with the debt data of 0 during this period, the year in which the first period is not 0 is taken as the base period. It is not difficult to find that actually this method avoids the endogenous problems caused by the fact that the real level of local government debt may be related to the degree of resource misallocation at the city-sector level and other missing factors through exogenous changes in the predicted value of local government debt level, and can better meet the exogeneity and correlation requirements of instrumental variables.

Columns (1) to (6) of Table 4 show the estimated results of instrumental variables. Columns (1) and (2) show the estimated results of the first phase. It can be seen that the influence of instrumental variables on endogenous variables is statistically significant, and the F statistics of the weak identification in the first phase are all greater than 10, which means that the instrumental variables selected in this paper are not weak. Columns (3) to (6) show the estimated results of the second phase. It is clear that whether the standard deviation of TFP of enterprises in the sector or the difference between the 90% quantile and the 10% quantile is taken as the dependent variable, the estimated coefficient of $debt \times link$ is significantly positive at the level of 5% at least. This once again proves that the conclusion that the expansion of local government debt aggravates the sectoral resource misallocation is robust.

Table 4. Results of Instrumental Variable Estimation

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	$debt$	$debt \times link$	$tfpsd_op$	$tfpsd_lp$	$tfp90_op$	$tfp90_lp$
$debt_pre$	0.799*** (0.061)	0.101*** (0.035)				
$debt_pre \times link$	0.005 (0.007)	0.824*** (0.059)				
$debt \times link$			0.174** (0.081)	0.181*** (0.047)	0.132** (0.061)	0.137** (0.063)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Sector-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
F value in the first phase	137.515	210.386	—	—	—	—
Observation	45860	45860	45860	45860	45860	45860

5. Mechanism Analysis and Heterogeneity Test

5.1. Mechanism Analysis

In order to verify Hypothesis 2 and Hypothesis 3, first, this part uses enterprise-level data to explore the influence of local government debt on the factor use and market share of enterprises with different initial productivity levels, so as to examine whether local government debt inhibits the flow of production resources such as capital and labor to high-productivity enterprises; second, it examines the influence of local government debt on the entry and exit of heterogeneous enterprises in different sectors, and then examines whether local government debt causes the dynamic loss of resource allocation efficiency in the sector.

5.1.1. Resource Allocation among Enterprises

This paper calculates the three-year average TFP of enterprises at the city-sector level from 2005 to 2007, and defines the enterprises with TFP of less than the median as low-productivity enterprises, namely, $tfp_l=1$, and those with TFP of more than the median as high-productivity enterprises, namely, $tfp_l=0$. Then, it examines the differential influence of local government debt expansion on enterprises with different productivity levels in the manufacturing sector through the cross-product term of tfp_l and $debt \times link$. The estimates are shown in Table 5, where the dependent variables in Columns (1) and (2) represent the change of capital, and the dependent variables in Columns (3) and (4) represent the change of labor, expressed by the logarithm of capital increment and labor increment respectively. It is not difficult to find that the estimated coefficient of $debt \times link \times tfp_l$ is significantly positive in Column (1), but it fails to pass the 10% significance test in Column (3). This suggests that, relatively speaking, low-productivity enterprises invested more funds, but they did not increase the labor force significantly, which is consistent with the findings of Cong *et al.* (2019), probably because of redundant personnel in low-productivity enterprises in the sector, especially state-owned enterprises, and no obvious need for extra labor force. Therefore, according to the above analysis, the external demand shock brought by local government debt mainly causes the capital misallocation in the manufacturing sector highly related to infrastructure.

Table 5. Influence of Local Government Debt on Resource Allocation among Enterprises

Variable	Capital change		Labor change		Market share change	
	(1)	(2)	(3)	(4)	(5)	(6)
$debt \times link$	-0.667*** (0.123)	-0.338** (0.165)	0.031 (0.047)	0.028 (0.021)	-0.019** (0.009)	-0.011* (0.006)
$debt \times link \times tfp_l$	0.836** (0.378)		0.442 (0.379)		0.044*** (0.016)	

Variable	Capital change		Labor change		Market share change	
	(1)	(2)	(3)	(4)	(5)	(6)
$debt \times link \times soe$		0.647*** (0.216)		0.283 (0.204)		0.063** (0.030)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Enterprise fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Sector $\times$ year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1188735	1188735	326165	326165	1188735	1188735
R ²	0.372	0.368	0.351	0.355	0.320	0.324

Next, this paper further examines whether such sectoral resource misallocation leads to an increase in the market share of low-productivity enterprises. If capital misallocation does not significantly lead to an increase in the market share, it means that resource misallocation at the sector level is not serious. Therefore, Columns (5) and (6) of Table 5 show the results of the mechanism test with the change of market share as the dependent variable. Market share *marks* is measured by the ratio of business sales revenue to sectoral sales revenue. It can be seen from the estimates in Column (5) that the estimated coefficient of $debt \times link \times tfp_1$ passes the significance test of 1%. This shows that, in relative terms, low-productivity enterprises increase their market share significantly, which is pretty much in line with expectations, that is, in manufacturing sector highly related to infrastructure, the expansion of local government debt may promote low-productivity enterprises to increase their investment, so as to expand their capacity to meet rising external demand and thus occupy a larger market share. This also means that the market share of high-productivity enterprises could be squeezed. The estimated coefficient of $debt \times link$ proves it. Additionally, the SOE-based test also confirms this assertion. The even-numbered columns of Table 5 show the regression results with the interaction term of SOE dummy variables *soe* and $debt \times link$ as the core independent variable. When the enterprise is a state-owned enterprise, the value of *soe* is 1. When the enterprise is a private one, the value of *soe* is 0. According to the estimates, state-owned enterprises received more capital inflows in sectors which are highly related to infrastructure, and significantly increased their market share in the case of positive external demand.

According to the above analysis, enterprises with low initial productivity and state-owned enterprises are better able to seize market opportunities brought about by the expansion of local government debt. Based on the existing literature (Yang *et al.*, 2020), it can be inferred that this phenomenon results from the greater access of low-productivity enterprises and state-owned enterprises to credit resources because of the implicit guarantee of the government. Of course, the reason may also be that the manufacturing sector, which is highly related to infrastructure construction, contributes more to the local fiscal revenue, so it can get more fiscal subsidy or preferential treatment

in tax administration from the local government. Therefore, in Table 6, this paper further verifies the intermediate causes of resource misallocation among enterprises from three aspects: financing constraints, tax burden level and fiscal subsidy faced by enterprises. Among them, financing constraints *fincons* are expressed by the ratio of corporate interest expenditure to total liabilities. The higher the ratio, the higher the financing costs and the stronger the external financing constraints. The tax burden *taxbur* is expressed by the ratio of tax payable to main business income. The fiscal subsidy *subsidy* is represented by the logarithm of subsidy income. According to the estimates, the expansion of government debt significantly reduces the financing costs of both low-productivity enterprises and state-owned enterprises, which indicates that in sectors highly related to infrastructure, low-productivity enterprises and state-owned enterprises can obtain more credit funds in the face of external demand, so as to achieve investment and capacity expansion. This means Hypothesis 2 is true. From the perspective of tax burden and subsidy income, different categories of enterprises are not treated differently.

5.1.2. Entry and Exit of Enterprises

In addition to distorting resource allocation among enterprises in the sector, Table 6 also examines the influence of local government debt on the entry and exit of enterprises. Specifically, if the enterprise first appears in the sample or the year of appearance is the year of establishment, the enterprise entry is defined as *entry*=1; otherwise, it is 0; Similarly, if the enterprise exits the sample in the next year, the enterprise exit is defined as *exit*=1; otherwise, it is 0. Columns (7) and (8) of Table 6 show the regression results for the entry of enterprises with high initial productivity and state-owned enterprises. It can be seen that the estimated coefficient of *debt* $\times$ *link* is significantly negative at the level of 10% at least, while the estimated coefficient of the triple-interaction term fails the significance test, indicating that the expansion of local government debt inhibits the entry of high-productivity enterprises and private enterprises. The estimates in Columns (9) and (10) of Table 6, which take enterprise exit as the dependent variable, further show that the demand shock caused by the government debt expansion significantly reduces the probability of low-productivity enterprises and state-owned enterprises exiting the market. This confirms Hypothesis 3. Combined with the analysis of market share changes in Table 5, it can be seen that state-owned enterprises with low productivity gain a larger market share because of the external demand shock, thus reducing the critical productivity of their exit from the market and continuing to survive, while potentially productive private enterprises can hardly enter the sector due to financing constraints and other possible institutional barriers.

5.2. Heterogeneity Test

First, mechanism analysis shows that state-owned enterprises with low productivity

can occupy more resources in the face of external demand shocks due to the implicit guarantee, thus aggravating resource misallocation. This means that the greater the regional dependence on state-owned enterprises, the more likely local governments will intervene in resource allocation to protect the development of state-owned economy, thus aggravating the misallocation of sectoral resources. In order to verify this conjecture, this paper draws on the practice of Yang and He (2014), uses the mean value of the proportion of the output value of state-owned enterprises in the total industrial output value at the city level from 2005 to 2007 to measure the dependence on local state-owned enterprises, and divides the state-owned enterprises into two groups, i.e., the group of high dependence and the group of low dependence, according to the median. Columns (1) to (4) of Table 7 show the results of group test. It can be seen that whether $tfpsd_op$ or $tfpsd_lp$ is the dependent variable, the estimated coefficient of $debt \times link$ in the samples of cities with high dependence on state-owned enterprises can pass the significance test of 1% and is significantly positive. But this resource misallocation effect can only pass the significance test of 10% in cities with low dependence on state-owned enterprises, and the coefficient of the former is greater than that of the latter. This indicates that the sectoral resource misallocation effect of local government debt is indeed more prominent in cities with high dependence on state-owned enterprises.

Table 6. Influence of Local Government Debt on Enterprise Entry and Exit

Variable	Financing constraints		Tax burden		Subsidy income		Enterprise entry		Enterprise exit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$debt \times link$	0.082** (0.038)	0.047** (0.021)	0.027 (0.040)	0.041 (0.065)	0.212 (0.281)	0.008 (0.009)	-0.008** (0.004)	-0.011* (0.006)	0.019 (0.013)	0.015* (0.008)
$debt \times link$ $\times tfp_l$	-0.108** (0.053)		-0.014 (0.076)		0.621 (0.533)		0.009 (0.020)		-0.142*** (0.036)	
$debt \times link$ $\times soe$		-0.089** (0.029)		-0.020 (0.037)		1.086 (0.721)		0.013 (0.017)		-0.154*** (0.051)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1172233	1172233	1188735	1188735	1188722	1188722	1188735	1188735	1188735	1188735
R ²	0.229	0.228	0.230	0.231	0.276	0.279	0.314	0.320	0.436	0.435

Note: Like Table 5, all columns control the enterprises, cities and sector-year fixed effects.

Second, considering that local government debt is largely influenced by promotion incentives for government officials, infrastructure construction through debt has become an important way for local government officials to promote urban economic growth and seek political promotion, under the government performance appraisal system with economic growth as the core. Especially for officials under greater pressure of promotion, this effect may be more obvious. Wu and Zhou (2018) found that after the age of 55, the promotion probability of Party secretaries of prefecture-level cities would drop sharply. Therefore, the samples of prefecture-level cities are retained, and grouping regression is conducted based on whether the age of their Party secretaries reaches 55 years old or not, so as to examine the heterogeneous impact of local government debt on sectoral resource allocation efficiency under different promotion pressures. Columns (5) to (8) of Table 7 show the regression results. It is not hard to find that the estimated coefficient of $debt \times link$ is significantly positive in the sub-sample of municipal Party secretaries under the age of 55. In contrast, this effect is not significant in the subsample of cities with less pressure of promotion, which is consistent with the expectation of this paper.

Table 7. Heterogeneity Test Results

Variable	High dependence on state-owned enterprises		Low dependence on state-owned enterprises		Greater pressure of promotion		Less pressure of promotion	
	<i>tfpsd_op</i>	<i>tfpsd_lp</i>	<i>tfpsd_op</i>	<i>tfpsd_lp</i>	<i>tfpsd_op</i>	<i>tfpsd_lp</i>	<i>tfpsd_op</i>	<i>tfpsd_lp</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>debt</i>	0.071 (0.049)	0.053* (0.031)	-0.084 (0.152)	-0.091 (0.160)	0.055 (0.053)	0.087 (0.071)	-0.045 (0.039)	-0.021* (0.011)
<i>debt × link</i>	0.127*** (0.043)	0.165*** (0.037)	0.021* (0.012)	0.016* (0.009)	0.098** (0.042)	0.103*** (0.035)	0.018 (0.062)	0.012 (0.057)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	22672	22672	23145	23145	28168	28168	17642	17642
R ²	0.379	0.355	0.463	0.461	0.455	0.467	0.471	0.464

6. Conclusions and Policy Suggestions

Local governments promote public infrastructure investment through debt borrowing, which plays an important role in rapidly improving regional infrastructure and people's livelihood. However, since 2008, the excessive growth of the scale of government debt

in many regions has formed a big potential risk. With the transformation of China's economy from high-speed growth to high-quality development, how to achieve an organic unity of "stable growth" and "risk prevention" in the governance of government debt under the premise of forestalling systemic risks has become a real problem that local governments at all levels need to face. Considering that the core task of high-quality economic development is to continuously improve the resource allocation to improve total factor productivity, this paper answers the question whether local government debt can promote the improvement of resource allocation efficiency from the perspective of sectoral linkage, based on the matched data of relevant variables of Chinese industrial enterprises and cities from 2008 to 2013. The findings of this paper are as follows. First, compared with the manufacturing sector with little relation with infrastructure, the expansion of local government debt significantly reduces the efficiency of resource allocation in manufacturing sector that is highly related to infrastructure. This conclusion is always tenable after robustness test, such as changing the core indexes for measurement, controlling fixed effects at different levels, and using instrumental variable estimation. Second, the increase in demand for upstream infrastructure products and expected returns brought about by the expansion of local government debt not only leads to more capital flowing into inefficient state-owned enterprises, but also lowers the productivity threshold for low-productivity enterprises to exit the market. The misallocation of production resources and the failure of survival of the fittest mechanism aggravate the dynamic loss of resource allocation efficiency in the sector.

Since the implementation of the *New Budget Law* in 2015, the central government has established a whole set of local government debt management systems, bringing both the scale and risks of local government debt under effective control. However, in the context of economic downturn resulting from the change of macroeconomic environment at home and abroad, debt investment is still the main way for local governments to relieve financial pressure and stabilize economic growth. Therefore, improving the performance of local government debt funds and resolving local government debt risks, especially hidden debt risks, in high-quality development have become the top priority in the current local government debt governance. The research conclusions of this paper have the following policy implications for promoting the above work. First, allocate the quota of local government bonds in a scientific way, and strictly control the expansion of hidden debt. This paper finds that the excessive expansion of local government debt may reduce the efficiency of sectoral resource allocation. On the premise of adhering to the ceiling management of the total amount of local government debt, it is necessary to continue to improve the allocation of new debt quota among regions according to regional economic and financial strength, stock debt risk and other factors, and guide regional officials to establish a correct view of achievements, and strengthen the investigation and punishment of illegal debt. Second, optimize the investment of government debt funds, and strengthen performance management of debt investment. With the marginal growth effect of traditional

infrastructure investment declining year by year, it is necessary to gradually invest more debt funds in “soft” infrastructure construction such as people’s livelihood programs and business environment improvement according to the economic and social endowment conditions and development of each region, actively expand effective investment and foster new drivers of regional economic growth. Third, accelerate the market-oriented reform of factors allocation, and give play to the decisive role of the market in resource allocation. This paper shows that excessive involvement of local government in resource allocation may magnify the negative influence of local government debt expansion on productivity growth of micro sectors. Therefore, it is essential to speed up the building of a unified and open factor market system, establish a long-term mechanism where prices guide resource allocation, and constantly improve the efficiency of resource allocation.

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