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Chun Wang

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Can 'tight living' promote local government to improve the efficiency of fiscal expenditure?: Evidence from the VAT Reform in China

Chun Wang

School of Finance,
Renmin University of China,
No. 59 Zhongguancun Street,
Haidian District, Beijing, 100872, China
Email: wangchuncsh@ruc.edu.cn

Abstract: This paper analyses the comprehensive and sub-item fiscal expenditure efficiency data of 266 prefecture-level cities in China from 2006 to 2019. It uses the DID method to empirically examine the impact of fiscal pressure on local fiscal expenditure efficiency The research finds that: 1) the nationwide promotion of the pilot program of 'replacing business tax with VAT' has reduced local financial resources, increased financial pressure, and increased the efficiency of local government fiscal expenditures Still, the expenditure structure has mostly stayed the same; 2) the efficiency improvement effect of fiscal pressure in eastern regions and developed secondary industries is more significant; 3) these findings are crucial to revealing the impact of China's 'pressure-type' fiscal incentives on fiscal expenditure efficiency and even local government behaviour.

Keywords: fiscal expenditure efficiency; fiscal pressure; business tax replaced with VAT Reform; fiscal expenditure quality; local government; public finance; three-stage DEA; DID method; tax reform; industrial structure; DDD method; budget transparency; China.

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Biographical notes: Chun Wang is a PhD candidate in the School of Finance at Renmin University of China. Her research broadly focuses on local government budget performance, tax enforcement, and government spending behaviour.

1 Introduction

In March 2013, at the press conference of the National People's Congress and the Chinese People's Political Consultative Conference (NPC and CPPCC), Premier Li made the first request that "to enable the people to live a good life, the government must live a tight life." To this day, the government still calls for the government to 'live a tight life' as a normalised discipline requirement to save the people better, reduce administrative expenses, and strengthen the construction of a thrifty government. The government's

'tight life' has appeared in the government work report for seven consecutive years. At the same time, since 2013, the reform of 'Business Tax Replaced with VAT Reform' (VAT Reform) has been advancing rapidly. From August 1, 2013, the nationwide trial implementation of the business tax in the transportation and some modern service industries was replaced by the VAT. And the scope of the modern service industry has also expanded to the production, broadcasting, and distribution of radio, film, and television works, etc. Statistics show that by the end of 2013, about 2.7 million enterprises had realised tax system conversion, and the scale of tax reduction exceeded 140 billion yuan[1]. From 2013 to 2021, China will add a total of 8.8 trillion yuan in new tax and fee reductions[2]. Under the continuous implementation of the large-scale tax and fee reduction policy, fiscal revenue has been dramatically reduced, and fiscal expenditure has been rigidly increased. Under the double pressure of income and spending, what impact will it have on the efficiency of local government fiscal expenditure? This is the focus of this paper.

Fiscal and tax reform is an important fulcrum to leverage social and economic development. In the world, many countries have adopted fiscal and tax reform as a tool to promote economic transformation. Different countries have achieved different results, gained and lost, and there are various experiences and lessons for us to learn from. On 29 February 2017, the Lower house of the Indian Parliament passed the Goods and Services Tax Bill (GST) to unify the previously separate central and state tax systems. India's GST reform is similar to China's reform of replacing business tax with value-added tax, which is an indirect tax reform. Different from China's replacement of business tax with value-added tax to solve the non-unification of the tax system between the service industry and the manufacturing industry, GST is more important to end the non-unification of the tax system between India's previous states to a certain extent, and implement a unified tax system across the country. Different from China's tax system design dominated by the central government, India adopts a federal tax structure, the central government collects taxes on the production of goods and services, and the state government levies taxes in the final consumption link, and the state standards are different, there are many taxes that are repeatedly levied by the central and local governments, and if the transport of goods involves crossing the border of the states, there will be an 'inter-state sales tax'. Therefore, under the multiple tax laws, multiple taxation, and complex inter-state transactions, both local and international companies are somewhat 'confused' about India's complex tax system, which hinders the operation of the national unified market to a certain extent. The GST will be levied only on consumption (equivalent to VAT), only when goods are consumed, and will be taxed at a uniform rate across India. The implementation of the new tax law can effectively avoid the phenomenon of double taxation and effectively reduce the tax burden of enterprises in India.

In recent years, the number of countries (regions) imposing VAT has continued to increase. On October 1, 2019, Angola abolished the consumption tax and replaced it with a value-added tax at a uniform rate of 14%. On July 1, 2020, Bhutan promulgated the Goods and Services Tax Act, introducing a unified national goods and services tax to replace various indirect taxes such as sales tax, customs duty, and excise tax, which have different tax rates and cause double or even triple taxation. In addition, according to the Framework Agreement on VAT Cooperation signed by the Gulf Cooperation Council (GCC) in 2016, the six GCC member states plan to introduce VAT simultaneously in 2018, at a rate of 5%. Among them, Saudi Arabia and the UAE have launched the levy on

January 1, 2018, Bahrain has launched the levy on January 1, 2019, and the other three member states have not officially launched the levy, but the levy plan remains unchanged. On October 12, 2020, Oman signed the Value-added Tax Act, which decided to apply a uniform VAT rate of 5% on goods and services from April 10, 2021, when Oman will become the fourth GCC member state to introduce VAT.

As the largest tax in China for a long time, value-added tax has made great contributions to China's tax revenue, but unfortunately, there is still no single tax law to regulate the elements of value-added tax. The elements of the tax system (including taxation standards, taxation methods, etc.) should be maintained in a legal form to enhance the predictability of the tax system. According to China's previous VAT reform practice, local governments often issue various policy documents to supplement, adjust and modify the existing VAT system, which is inconsistent with the principle of tax legality, contrary to the basic requirements of the construction of a country under the rule of law, and has an adverse impact on the construction of a legal, efficient and transparent business environment. If local governments introduce local supplementary policies to expand tax sources, it will intensify tax competition among regions and weaken the anchoring role of VAT system. In the process of legalisation of VAT, it is necessary to focus on solving the problem that simple tax calculation method may weaken the integrity of VAT deduction chain. It is suggested that in the process of VAT legislation, the policy of applying simple tax calculation widely existing in the current tax system should be cleared up and standardised, so as to form a complete taxation chain constraint for all kinds of small-scale taxpayers and general taxpayers who are taxed according to simple tax calculation method, so as to achieve the purpose of improving the VAT system. Through normative VAT legislation, the application of simple tax calculation method should be reduced as much as possible, and the interference of simple tax calculation to the overall VAT system should be reduced.

The academic circles have extensively discussed the impact of Tax cuts on local fiscal conditions and government behaviour. Scholars have focused on the economic impact of Tax cuts, including the tax reduction effect (Ferede and Dahlby, 2012; Lan et al., 2020), industrial upgrading effect (Neu and Brown, 2005; Liu and Lu, 2014), income distribution effect (Kakwani, 1984; Rubolino and Waldenström, 2020), fiscal effects (Gnangnon and Brun, 2020). These studies generally believe that the Tax Reform makes the decline in the tax share of local governments have brought massive pressure on local finances under the circumstances of rigid expenditures, which in turn has a profound impact on the operation of finance itself and the macroeconomy.

As an essential practice of tax reform, the VAT Reform has directly shaken the foundation of the fiscal system of the tax-sharing system, which divides revenue by tax categories. Local governments have lost their primary tax sources, and local financial pressure has become prominent. Data show that since August 1, 2013, when the scope of the VAT Reform was extended to the whole country for trial implementation, the value-added tax (including previous business tax) revenue ratio dropped from 7.8% in 2012 to 6.8% in 2018[3]. Based on this, this paper takes the national promotion of the VAT Reform policy in 2013 as an assessment of the impact of local fiscal pressure. It uses the proportion of value-added tax revenue in fiscal expenditures in 2013 as an indicator of local fiscal stress to empirically test the impact of local fiscal pressure on fiscal implications for spending efficiency. The study found that, first, the fiscal pressure caused by the VAT Reform has significantly improved the fiscal expenditure efficiency of local governments. Still, the expenditure structure has mostly stayed the same. Second,

the heterogeneity analysis shows that the efficiency-enhancing effect of fiscal pressure is more significant in the eastern regions and regions with developed secondary industries. Third, the mechanism analysis shows that the higher the local budget implementation score, the higher the efficiency of fiscal expenditure; the higher the fiscal transparency, the higher the efficiency of fiscal expenditure; the higher the economic growth rate, the higher the efficiency of regional fiscal expenditure.

The contributions of this paper mainly include the following aspects: First, This paper uses the three-stage DEA model to calculate the comprehensive fiscal expenditure efficiency and sub-item fiscal expenditure efficiency, removes the influence of environmental factors and random factors, and accurately calculates the fiscal expenditure efficiency of prefecture-level cities. Second, this paper takes the nationwide promotion of the VAT Reform in 2013 as the impact to construct the fiscal pressure index, which effectively overcomes the endogeneity problem among variables and enriches the research on the reform effect of VAT Reform. Third, this paper reveals the local government's 'tight life' impact on the efficiency of fiscal expenditure since the VAT Reform. This paper enriches and expands the existing literature on fiscal expenditure efficiency and has important enlightening significance for adjusting the responsibility and efficiency of government expenditure.

The rest of the paper is structured into four main sections. Section 2 presents the literature review and hypothesis development. Section 3 describes the data explanation and method used to test these hypotheses. Section 4 analyses the impact of the government's 'tight life' on the efficiency of local fiscal expenditure. Finally, Section 5 offers some conclusions.

2 Literature review and hypotheses development

Theoretically speaking, in the face of the financial pressure brought about by the VAT Reform, the feasible strategies of local governments include reducing fiscal expenditure, opening up new sources of revenue, and improving the efficiency of fiscal expenditure.

First, from the perspective of expenditure, the reduction of fiscal expenditure mainly focuses on the total amount and structure of fiscal expenditure. China's long-term expansion of government expenditure is expected. According to Wagner's law, fiscal expenditure will increase at a greater rate when national income increases. In peacetime, fiscal expenditure growth tends to rise in a straight line; in wartime, fiscal expenditure growth jumps (Peacock and Wiseman, 1961). In the early stage of economic development, the government provided social infrastructure for economic development, such as roads, railways, bridges, and electricity, so public investment accounted for a relatively high proportion of total social investment. In the middle stage of economic development, public investment decreases, but due to market defects, government intervention intensifies, leading to an increase in public expenditure. When economic development enters a mature stage, the structure of public expenditure changes, and expenditures on education, healthcare, and social welfare increase, promoting public expenditure growth (Musgrave, 1969; Rostow, 1971). Therefore, from an economic and social development perspective, there is almost little room for reducing the total fiscal expenditure, and it is difficult to compress it.

In terms of adjusting the expenditure structure, local governments adjust the expenditure structure by reducing the proportion of expenditures related to people's

livelihood, such as education, and increasing expenditures on basic construction by "lightening people's livelihood and focusing on construction" (Yin and Zhu, 2012). There are still objections to local governments' adjustment of expenditure structure to ease fiscal pressure.

Second, from the income perspective, local governments may increase tax revenue by strengthening tax collection and management (Chen, 2017), increasing non-tax revenue collection and management to increase non-tax revenue and corporate non-tax burden (Ayupov and Kazakovtseva, 2014; Zhang and Huang, 2019). Through increasing land transfer income (Han and Kung, 2015), establishing local government financing platforms to raise funds through the financial system (Chen et al., 2016) and other methods to ease the financial pressure.

Although the taxation capacity and tax collection efforts of taxation departments at all levels have been greatly improved since the reform of the tax sharing system, with the implementation of the 'Golden Tax Project', the improvement of tax collection capacity is limited in the short term. At the same time, the improvement of tax collection efforts is also effective only when the tax gap is large and tax evasion is easy. Therefore, in the long run, the increase in tax revenue brought about by tax collection ability and tax collection efforts will decrease over time (López, 2017), and it is not sustainable. With the transfer of non-tax revenues such as water and soil conservation compensation fees and local reservoir resettlement support funds to the taxation department, the disorderly expansion of local financial resources has been weakened (Lv, 2021). The soaring housing prices and land costs in recent years and the significant risks involved in land finance have made the 'land financing' model unsustainable (Liu and Chen, 2020). After 2014, the central government issued a series of documents to supervise local financing platforms' behaviour strictly. The market-oriented transformation has become its development direction. In summary, relying on the income side to relieve financial pressure faces enormous risks.

According to the above analysis, improving the efficiency of fiscal expenditures has become an appropriate measure for local governments to cope with fiscal pressure. Therefore, this paper proposes hypothesis: the increase of local financial pressure caused by VAT Reform forces local governments to improve the efficiency of fiscal expenditure.

3 Data and empirical method

3.1 Data

This paper uses the panel data of 266 prefecture-level cities from 2006 to 2019 for empirical analysis. Based on data comparability considerations, prefecture-level cities such as Beijing, Tianjin, Shanghai, Chongqing, and Tibet are excluded. The missing values of some variables are replaced by the mean values of the two years before and after. The data mainly comes from the 'China City Statistical Yearbook', the China Economic Network statistical database, the CEIC database, and the China Research Data Service Platform (CNRDS). To avoid extreme values affecting the results, all variable values were indented. After the above processing, 3365 samples are finally left.

3.2 Variable description

3.2.1 Dependent variable

The dependent variable is the value of fiscal expenditure efficiency, which is calculated based on the three-stage DEA model of input orientation and increasing returns to scale (VRS). The input variable is per capita fiscal expenditure. The output variable is education, including primary school student-teacher ratio and middle school student-teacher ratio; medical care, including the number of hospitals per 10,000 people, The number of medical beds per 10,000 people, the number of doctors per 10,000 people; culture, including the number of public library books per 100 people; communication, including the number of mobile phones per 100 people; environment, per capita green area; infrastructure, per 10,000 people, The number of buses owned, urban road area per capita, water supply per capita. In the second stage of efficiency measurement, population density, per capita actual use of foreign capital, proportion of employees in the tertiary industry, per capita road freight volume, and per capita GDP are used as environmental variables. It is worth noting that, in calculating fiscal expenditure efficiency, we standardised the values of environmental variables. Since this paper uses urban panel data to eliminate the inconsistency of intertemporal frontiers, the input-output data are transformed into cross-sectional data so that there is only one maximum and minimum value for each variable. Construct the SFA regression function as follows:

$$S_{ni} = f\left(Z_i;\beta_n\right) + \in_{ni} + \mu_{ni} \tag{1}$$

S_{ni} is the slack value of the n input of the i decision-making unit, Z_i is the environmental variable, β_n is the coefficient of the environmental variable, $\in_{ni} + \mu_{ni}$ is the mixed error item, $\in_{ni}$ represents random disturbance, assuming a normal distribution, which represents the influence of random disturbance factors on input slack variables; μ_{ni} indicates management inefficiency, assuming it follows a half-normal distribution, indicating the impact of management factors on input slack variables. Finally, refer to the formulas of Luo (2012) to separate the management inefficiency item μ_{ni}, use the adjusted input-output variables to measure the efficiency of each decision-making unit again, and get the three-stage DEA efficiency value.

3.2.2 Independent variable

The independent variable uses the proportion of value-added tax revenue in the fiscal expenditure of prefecture-level cities in 2013 to measure the VAT Reform. The robustness test uses the proportion of business tax revenue in fiscal expenditures of prefecture-level cities in 2013 as an alternative indicator for VAT Reform.

3.2.3 Control variables

We also control a series of control variables. The control variables of population factors selected were population scale (POP), population density (DEN), and human capital (HR). The population size is the natural logarithm of the population at the end of the year (POP). The ratio of the region's total population to the land area calculates the population density (DEN). Human capital uses the balance of the number of students in ordinary colleges and universities to measure the number of household registration at the end of

the year (HR). Regarding economic development, fixed asset investment (INVEST) is represented by the ratio of fixed asset investment to GDP in each city. The logarithm of the utilisation of foreign capital per capita is used to express the actual utilisation of foreign capital (FD). The logarithm of per capita gross regional product represents regional economic strength (PGDP). The local fiscal self-sufficiency rate (FSSR) is a control variable at the local government level. It is measured by the proportion of local general public budget revenue to local general public budget expenditure. The industrial structure is measured by the ratio of the output value of the secondary industry to GDP (IS_2th) and the tertiary sector to GDP (IS_3th).The descriptive statistics of the main variables are shown in Table 1.

3.3 Model

In this paper, we use the DID method to estimate. The model is set as follows:

$$Score_{it} = \alpha_0 + \alpha_1 VATshare_i \times post + \alpha_2 X_{it} + \mu_i + \mu_t + \varepsilon_{ict} \quad (2)$$

The subscript i indicates the prefecture-level city, t indicates the year. The interaction term $VARshare_i \times post$ is the core independent variable, and coefficient α_1 measures the impact of the fiscal pressure on the local fiscal expenditure efficiency of the prefecture-level city government when the VAT reform impacts. *post* is a time dummy variable. Since August 1, 2013, the pilot program of VAT reform in the transportation and some modern service industries has been rolled out nationwide. The production, broadcasting, and distribution of radio, film, and television works have been included in the modern service industry. So the value is 1 when the *post*is greater than or equal to 2013, and the value is 0 if it is less than 2013. X_{it} is the control variable at the city level. μ_i and μ_t denote the city-fixed and year-fixed effects, respectively. ε_{ict} represents a random error item, and the standard errors are all clustered at the city level.

Table 1 Descriptive statistics of variables

Variable	*Obs.*	*Mean*	*Std. dev.*	*Min*	*Max*
Score	3,365	0.766	0.119	0.464	0.999
QPS	3,365	0.767	0.573	0.172	3.654
VATshare	3,365	0.056	0.04	0.01	0.201
BTshare	3,365	0.111	0.066	0.025	0.285
POP	3,365	5.912	0.609	4.304	7.066
DEN	3,365	446.087	302.284	18.236	1,326.069
HR	3,365	0.018	0.023	0	0.131
INVEST	3,365	0.703	0.301	0.101	5.442
FD	3,365	5.435	1.59	1.151	8.799
PGDP	3,365	10.404	0.69	8.82	11.96
FSSR	3,365	0.482	0.221	0.055	1.256
IS_2th	3,365	48.058	10.127	20.54	72.23
IS_3th	3,365	38.94	9.3	20.05	66.41

4 Empirical results

4.1 The impact of VAT reform on local fiscal resources

We first examine whether the VAT reform will increase the fiscal pressure on prefecture-level cities. Table 2 reports the estimated results of the impact of the VAT reform on local fiscal resources. The independent variable in column (1) is the logarithm of tax revenue, the independent variable in column (2) is the logarithm of general budget revenue, and the independent variable in column (3) is the logarithm of general budget expenditure, the dependent variable *VATshare*post* coefficients in columns (1)–(3) are all negative, indicating that the VAT reform has a significant negative impact on local fiscal resources, from Table 1 that the average value of *VATshare* is 5.6%. Therefore, the nationwide promotion of the VAT reform reduction will reduce tax revenue by 2.1% and general budget expenditure by 4%.

Table 2 The impact of VAT reform on local financial pressure

Variables	*(1)*	*(2)*	*(3)*
	Tax income	*General public budget revenue*	*General public budget expenditure*
*VATshare*post*	–0.374***	–0.011	–0.705**
	(–1.97)	(–0.05)	(–3.49)
Control variables	YES	YES	YES
Time FE	YES	YES	YES
City FE	YES	YES	YES
N	3365	3365	3365
R^2	0.986	0.991	0.983

Notes: The regression results are based on the robust standard errors of clustering at the city level; t values are in brackets; ***, ** and * indicate significance at 1%, 5% and 10% , respectively.

4.2 Baseline results

Columns (1) and (2) of Table 3 show the impact of VAT reform on the efficiency of local fiscal expenditures. Column (1) only controls the year-fixed effect and city-fixed effect. The coefficient of the interaction term is 0.078, which is significantly positive at the 5% level, indicating that the local financial pressure caused by the VAT reform has significantly improved the efficiency of local fiscal expenditure. (2) based on the first list, the control variables at the city level are further controlled, and the interaction term coefficient is significantly 0.09 at the 1% level. Considering that the value-added tax revenue accounted for an average of 5.6% of fiscal expenditure in 2013, the VAT reform has increased the efficiency level of local government fiscal expenditure by 0.5 percentage points. Baseline regression preliminarily verified the hypothesis that VAT Reform led to increased pressure on local finances and forced local governments to increase the efficiency of fiscal expenditures.

Considering that the calculation of efficiency indicators may not be representative, the quality of fiscal expenditure (QPS) was recalculated using principal component analysis for regression. The calculation of fiscal expenditure quality also selects education, including primary school student-teacher ratio and middle school student-teacher ratio; medical care, including the number of hospitals per 10,000 people, number of medical beds per 10,000 people, number of doctors per 10,000 people; culture public library collection; communication, number of mobile phones per 100 people; environment, per capita green area; infrastructure, including the number of buses per 10,000 people, per capita urban road area, per capita water supply. We use six first-level indicators, 11 for the secondary indicators, and a comprehensive indicator is formed after the weight is determined by the principal component analysis method. The observed values of the fiscal expenditure quality of prefecture-level cities from 2006 to 2019 are obtained. The regression results are in columns (3) (4) of Table 1. The results show that no matter whether the control variable is added or not, the coefficient of the interaction term is significantly positive at the 1% level. The result indicates that the fiscal pressure brought about by the VAT Reform did not lead to a decline in the quality of fiscal expenditures but significantly improved the quality of fiscal expenditures. The mean value of quality is 0.767, which means that the quality of local fiscal expenditure will increase by about 1.31 for every increase in financial pressure. Combining (1) to (4), when local governments face financial pressure, improving efficiency and reducing pressure have become the best choice for a 'tight life'.

Table 3 The impact of VAT reform and fiscal expenditure efficiency

Variables	*(1)*	*(2)*	*(3)*	*(4)*
	Score	*Score*	*QPS*	*QPS*
*VATshare*post*	0.078**	0.090***	1.816***	1.708***
	(2.28)	(2.76)	(5.49)	(5.17)
Control variables	NO	YES	NO	YES
Time FE	YES	YES	YES	YES
City FE	YES	YES	YES	YES
Cons	0.969***	0.831***	0.719***	2.052*
	(1089.56)	(9.09)	(83.17)	(1.81)
N	3365	3365	3365	3365
R^2	0.587	0.603	0.941	0.944

Notes: The regression results are based on the robust standard errors of clustering at the city level; t values are in brackets; ***, ** and * indicate significance at 1%, 5% and 10% , respectively.

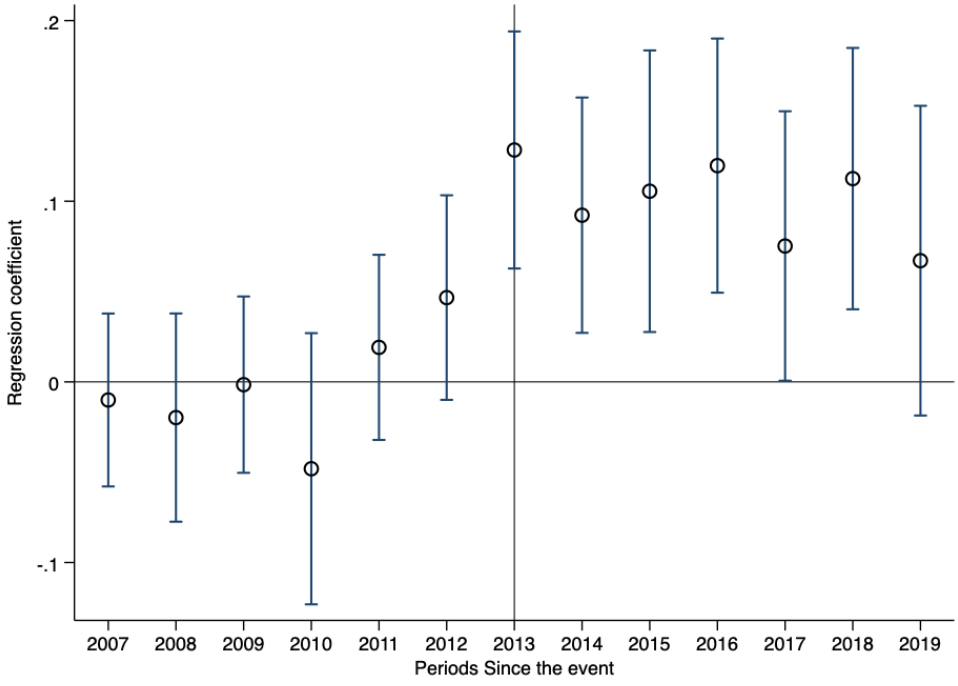
4.3 Parallel trend test

The premise of using DID Estimation is to satisfy the assumption of parallel trends, so we test the model as follows:

$$Score_{it} = \sum_{k=2007}^{2019} \beta_k \times VATshare_i \times year_t^k + \alpha_2 X_{it} + \mu_i + \mu_t + \varepsilon_{ict} \quad (3)$$

The first period of the sample is taken as the base year. That is, 2006 is used as the base year to estimate the model. Therefore, the value of k does not include 2006. The interaction coefficient β_k is shown in Figure 1. 2006, as the base year, the fiscal expenditure efficiency was not significantly affected in 2007- 2012. Since 2013, the fiscal expenditure efficiency has been significantly affected and was significantly positive. In 2019, the coefficient was no longer significant, indicating that the VAT Reform caused the impact of fiscal pressure on fiscal expenditure efficiency has gradually weakened. The above results show that the DID estimation model constructed in this paper satisfies the parallel trend assumption.

Figure 1 Dynamic effect on VAT reform



Notes: The graph shows the OLS regression coefficients from equation (3) and their 95% confidence intervals. Year 2006 is chosen as the baseline year. The coefficient and the prefecture level clustered standard error (in brackets) for each year [in squared brackets] is: –0.01 (0.03) [in 2007], –0.02 (0.04) [in 2008], –0.00 (0.03) [in 2009], –0.05 (0.05) [in 2010], 0.02 (0.03) [in 2011], 0.05 (0.003) [in 2012], 0.13 (0.04) [in 2013], 0.09 (0.04) [in 2014], 0.11 (0.05) [in 2015], 0.12 (0.04) [in 2016], 0.08 (0.05) [in 2017], 0.11 (0.04) [in 2018], 0.07 (0.05) [in 2019]. The coefficients suggest that the difference in the fiscal expenditure efficiency between cities do not change significantly before 2013; and that the fiscal expenditure efficiency increase more after 2013 in cities suffering greater tax revenue loss.

Table 4 Robustness test results

Variables	*(1)*	*(2)*	*(3)*
	Replace dependent variable	*Replace independent variable*	*Add control variable*
*BTshare*post*		0.051***	
		(2.87)	
*VATshare*post*	0.204*		0.083***
	(1.79)		(2.57)
FED			-0.106***
			(-5.26)
PGE			-0.000*
			(-2.11)
UUR			0.105
			(0.92)
Control variables	YES	YES	YES
Time FE	YES	YES	YES
City FE	YES	YES	YES
Cons	1.021**	0.847***	0.933***
	(2.43)	(9.42)	(9.39)
N	3339	3365	3365
R^2	0.868	0.601	0.624

Notes: The regression results are based on the robust standard errors of clustering at the city level; t values are in brackets; ***, ** and * indicate significance at 1%, 5% and 10% , respectively.

4.4 Robustness test

In order to avoid the impact of measurement errors on the model analysis, this paper conducted a robustness test on the baseline regression results by replacing the explained and explanatory variables and adding control variables. The results are shown in Table 4. Column (1) is the regression result of replacing the explained variable, and the efficiency value calculated in the first stage of DEA is used as the explained variable to regress. The coefficient of the interaction term is significantly positive at the 10% level, and the result supports the basic conclusion. Column (2) uses the proportion of business tax revenue in the fiscal expenditure of prefecture-level cities in 2013 as a substitute indicator for the reform of business tax to value-added tax. The interaction term coefficient is significantly positive at the 1% level, and the empirical results are still robust. In order to avoid endogenous problems caused by omitted variables, the decentralisation of fiscal expenditure (FED), natural population growth rate (PGE), and the urban unemployment rate(UUR) is further controlled in column (3). The results show that the coefficient of the interaction term is still significantly positive at the 1% level, which is consistent with the baseline. The regression results maintain good consistency. The above analysis shows that the empirical results of this paper are robust.

4.5 Heterogeneity analysis

China has a vast territory. Due to differences in resource endowments, population structures, and economic development levels among regions, the financial pressures faced by each region are different, which in turn, has different effects on the efficiency of fiscal expenditure. In order to explore whether the impact of fiscal pressure on fiscal expenditure efficiency varies from region to region, we use heterogeneity analysis to verify it.

First, China's economic regions are divided into eastern, central, and western areas. The regression results are in columns (1), (2), and (3) of Table 5. Only in the eastern region, the coefficient of the interaction item *VATshare*post* is significantly positive at the 1% level. It indicates that compared with the central and western regions, the fiscal pressure caused by the VAT Reform has a more significant effect on improving the fiscal efficiency of the eastern region. The possible reasons lie in that, on the one hand, the eastern region has fast economic development, relatively mature industrial development and sufficient fiscal revenue, and faces lower fiscal pressure than other regions. Fiscal expenditure can be more inclined to the natural expenditure such as education and medical care, and its public governance ability is relatively strong, which can steadily improve the efficiency of fiscal expenditure. On the other hand, the economic foundation of the central and western regions is relatively weak, and local governments pay more attention to the development of productivity, and funds are more likely to be invested in industries that increase economic growth rate in the short term, thus ignoring the improvement of public services.

Table 5 Heterogeneity analysis results

Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
	Eastern	*Central*	*Western*	*Underdeveloped*	*Developed*
*VATshare*post*	0.123***	0.034	0.085	0.047	0.073**
	(2.68)	(0.53)	(1.21)	(1.09)	(1.87)
Control variables	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES
Cons	1.300***	0.677***	0.746***	0.858***	0.810***
	(8.51)	(7.51)	(4.27)	(5.75)	(7.00)
N	1274	1237	806	1641	1645
R^2	0.622	0.627	0.665	0.723	0.585

Notes: The regression results are based on the robust standard errors of clustering at the city level; t values are in brackets; ***, ** and * indicate significance at 1%, 5% and 10% , respectively.

Secondly, considering whether the above results differ in the dimension of industrial structure, we use the ratio of the added value of the secondary industry to GDP as a basis to classify regions below the average value as underdeveloped regions of the secondary industry and regions above the average value as developed regions of the secondary industry area. The regression results are in columns (4) and (5) of Table 5. In areas with developed secondary industries, the coefficient of the interaction term *VATshare*post* is significantly positive at the 1% level, which means that compared with areas with

underdeveloped secondary industries, the efficiency improvement effect of fiscal pressure in areas with developed secondary industries is more significant. This is because the industrial foundation in the underdeveloped regions of the secondary sector needs to be stronger. The government may invest more funds in industrial development to promote economic growth, thereby ignoring the supply of essential public services, making it difficult to improve the efficiency of fiscal expenditures. At the same time, in areas with developed secondary industries, the basic construction of facilities is relatively complete, and the government pays more attention to the supply of public services. The expenditure in the field of people's livelihood is pretty sufficient, promoting the improvement of the efficiency of regional fiscal spending.

4.6 Alternative explanations

The above analysis proves that the 'tight life' has significantly promoted the efficiency of local government fiscal expenditures. Next, this article starts with the budget management process. It explores the specific path for the government to improve the efficiency of fiscal expenditure under the background of 'tight life' from budget preparation, budget implementation, and supervision.

In the budgeting stage, the government can reduce general expenditures, optimise the expenditure structure, and exchange 'subtraction' of public spending for 'addition' of expenses on people's livelihood, which can effectively offset the impact of local revenue cuts and increase expenditures. However, some scholars have also proved that under the influence of factors such as financial pressure and growth incentives, local governments are strongly motivated to "emphasize production and neglect people's livelihood". And have yet to choose to optimize the expenditure structure to improve the efficiency of fiscal expenditure (Xie et al., 2017). Therefore, this paper re-examines whether the 'tight life' affects the form of local fiscal expenditures through empirical evidence. The results are in Table 6.

Table 6 Expenditure structure test results

Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
	Edu.	*Env.*	*Trans.*	*Comm.*	*Culture*	*Med.*	*Infra.*
*VATshare*post*	0.004	–0.022	–0.014	–0.017	–0.021	–0.005**	0.025
	(0.17)	(–0.97)	(–0.65)	(–0.75)	(–0.92)	(–2.06)	(1.22)
Control variables	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES	YES	YES
Cons	0.577***	0.661***	0.678***	0.655***	0.655***	1.014***	0.727***
	(10.13)	(11.79)	(10.96)	(10.70)	(11.39)	(59.26)	(8.35)
N	3317	3317	3317	3317	3317	3317	3317
R^2	0.817	0.775	0.756	0.771	0.773	0.982	0.735

Notes: The regression results are based on the robust standard errors of clustering at the city level; t values are in brackets; ***, ** and * indicate significance at 1%, 5% and 10% , respectively.

The dependent variables in columns (1) to (7) of Table 6 are the fiscal expenditure efficiency of education, environment, transportation, communication, culture, medical care, and infrastructure. Since financial investment in various fields is not easy to measure, and there is a lack of corresponding data, the calculation of the efficiency value is consistent with the efficiency of the explained variable fiscal expenditure mentioned above. The per capita financial expenditure is used as the input variable and calculated by the three-stage DEA method. The regression results show that, except for the interaction coefficient of medical expenditure efficiency in column (6), which is significantly negative, the interaction coefficients of other columns are insignificant. It shows that the local government did not choose to respond to financial pressure by optimising the expenditure structure.

In the budget execution stage, whether the budget execution is standardised will directly affect the use efficiency of financial funds. Strict and standardised budget implementation and reasonable and compliant use of funds will help improve the quality and efficiency of financial funds. In the budget supervision stage, the openness and transparency of government information can produce accountability and restraint effects and form a joint force of supervision through disclosure to ensure high-quality completion of the goal of a 'tight life'. This paper uses the DDD model to test the impact of budget implementation and budget transparency on fiscal expenditure efficiency. Budget execution and budget transparency are measured by the budget execution score and fiscal transparency score of the "Chinese Municipal Government Fiscal Transparency Report" published by Tsinghua University over the years. The higher the budget execution score, the more standardised the budget execution; The higher the transparency score, the more open and transparent the government's financial information. The results are in columns (1) (2) of Table 7. The triple interaction coefficient in column (1) is significantly positive at the 5% level, indicating that the more standardised the budget implementation, the greater the effect of local financial pressure on the efficiency of fiscal expenditure. The triple interaction coefficient in column (2) is significantly positive at the 10% level, indicating that the more open and transparent the government information is, the more significant the effect of local fiscal pressure on fiscal expenditure efficiency will be.

In addition, China's cadre assessment mechanism has gradually shifted from a 'GDP-only theory' to a target system that combines efficiency and effectiveness. In areas with more mature economic development, the promotion assessment of officials will consider both efficiency and growth (Chen et al., 2005) to promote local governments' efforts to improve the efficiency of fiscal expenditures under the condition of limited resources. Therefore, this paper sets the GDP growth rate and the value-added tax revenue of prefecture-level cities in 2013 as a triple interaction item to test the proportion of fiscal expenditure. The results are in column (3) of Table 7. The coefficient of the triple interaction item at the 10% level is significantly positive, indicating that under the dual effects of fiscal pressure and promotion pressure, the higher the economic growth rate, the higher the efficiency of local government fiscal expenditure.

The above analysis shows that standardising budget execution, open and transparent fiscal information, and increasing economic growth rate are important ways to promote local governments to improve fiscal expenditure efficiency and ease fiscal pressure.

Table 7 Mechanism test results

Variables	*(1)* *Budget execution*	*(2)* *Fiscal transparency*	*(3)* *Economic growth*
*VATshare*post*BIscore*	0.155**		
	(2.63)		
*VATshare*post*Fscore*		0.154*	
		(1.81)	
*VATshare*post*Growth*			0.63*
			(1.74)
Control variables	YES	YES	YES
Time FE	YES	YES	YES
City FE	YES	YES	YES
Cons	1.027***	1.018***	0.701***
	(9.12)	(8.41)	(6.99)
N	1532	1532	3336
R^2	0.796	0.793	0.714

Notes: The regression results are based on the robust standard errors of clustering at the city level; t values are in brackets; ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

5 Conclusions and policy implications

This paper uses the panel data of 266 prefecture-level cities across the country from 2006 to 2019 and uses the three-stage DEA model to measure the efficiency of fiscal expenditures. With the help of the 2013 VAT Reform to capture the changes in financial pressure at the prefecture-level city level, it studies the impact of local government's 'tight life' on the efficiency of fiscal expenditure. The results show that the greater the financial pressure, the higher the efficiency of fiscal expenditure. The heterogeneity analysis shows that the fiscal pressure caused by VAT Reform has a more significant effect on improving the efficiency of fiscal expenditure in the eastern region. In areas where the secondary industry is more developed, the efficiency of fiscal expenditure is more affected by local financial pressure. The mechanism analysis finds that budget execution, budget transparency, and promotion pressure are essential ways to promote local governments to improve fiscal expenditure efficiency and alleviate fiscal pressure.

Under the background of the implementation of large-scale tax and fee reductions and the downward pressure on the economy, the conflict between the raising of local fiscal revenue and the rigidity of fiscal expenditure poses a challenge to fiscal sustainability. According to research, improving the efficiency of fiscal expenditure has become an important issue for local governments. In the face of financial pressure, it is an inevitable choice to 'live a tight life'.

Based on the conclusions above, this paper proposes the following policy recommendations: First, to improve the efficiency of local fiscal expenditure with moderate fiscal pressure. When further dividing fiscal expenditure responsibilities at all levels below the provincial level, thoroughly weigh the fiscal pressures faced by local

governments. Expenditure responsibilities are determined according to the principles of appropriate grassroots pressure and regional differences, with particular attention to authority and expenditure responsibilities in the field of public services.

Second, implementing the local government's efficiency improvement and decompression strategy has regional heterogeneity. The central government should consider regional heterogeneity when making transfer payments and policy preferences for local governments and strengthen financial guarantees for complex and underdeveloped areas. Direct access to funds and other methods promotes the sinking of financial resources and improves the ability of local governments to provide public services.

Third, pay attention to the allocation of fiscal expenditures. The government should strictly control general spending to 'live a tight life', allocate more funds to economic development and improvement of people's livelihood, promote the equalisation of essential public services, improve the quality of public services, and promote shared prosperity.

Fourth, strengthen budget preparation, implementation, and supervision, and implement the whole financial fund budget performance evaluation process to link the evaluation results with budget arrangements.

Fifth, reform the 'GDP-only theory' promotion mechanism and establish an index system that considers both efficiency and growth. Incorporate the performance indicators of public services, such as education, medical care, and health, into the performance appraisal system, encouraging and guiding local governments to actively fulfil their public service responsibilities.

In fact, in order to avoid the impact of COVID-19 on the research conclusion of this paper, we set the samples as 2006–2019. If assessing the impact of COVID-19 requires extending the sample to at least 2023, it is unfortunate that official statistics for prefecture-level cities in China can only be queried until 2020, but due to data availability limitations, the number of observations will be missing to varying degrees in some parts of the empirical analysis. And extending beyond 2020 is not enough to assess the impact of the pandemic. This is also worthy of further study in this paper.

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Notes

1 Portal website of the Chinese Central Government, in 2013, the tax cuts scale for the pilot business tax reform exceeded 140 billion yuan.

2 The data comes from the Chinese government website.

3 Specifically, It decreased by 0.9% in 2013, decreased by 2.4% in 2014, decreased by 3.1% in 2015, decreased by 4% in 2016, decreased by 2.9% in 2017, and increased by 0.3% in 2018. The data comes from the Chinese government's website.