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**Vertical Fiscal Imbalance and Local Fiscal
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Abstract

Using a nationwide city-level panel dataset for China for the years 1999-2009, this paper examines the effects of vertical fiscal imbalances (VFI) on local fiscal discipline, and explicitly explores the institutional conditions under which these effects may take place. We find that higher VFI levels induce fiscal indiscipline by reducing tax effort of local governments. We exploit the unique Chinese fiscal institution of assigning taxing power for local taxes and shared taxes to two separate authorities (i.e., the local tax bureau and the central tax bureau, respectively) in several ways. We show that local governments respond to the presence of the VFI by lowering their tax effort on local taxes, but do not do so for shared taxes. In addition, we show that the (in)disciplining effect of the VFI is not present for extra-budgetary revenues, which reflects the institutional fact that extra-budgetary revenues are not considered for the determination of central fiscal transfers to local governments, thus creating no incentive for local governments to respond in this area.

Keywords: Vertical fiscal imbalance; Local fiscal discipline; Common pool problem; Soft budget constraint; China

JEL codes: H20; H71; H77

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1. Introduction

The past decades have witnessed wide implementation of fiscal decentralization reforms in a vast number of developed and developing countries. The primary theoretical justification for this movement is that fiscal decentralization is an effective tool for increasing the economic efficiency of public expenditures in a variety of ways, including increased competition among subnational governments in delivering public services (see, for example, Tiebout, 1956; Oates, 1972; Brennan and Buchanan, 1980; Qian and Roland, 1998). Nevertheless, the theory supporting fiscal decentralization faces some criticism. In particular, fiscal decentralization may distort the incentives of subnational governments if it is not well designed. Based on the experience of many decentralized economies, the most common flaw in design has been the mismatch between the devolution of expenditure responsibilities to local governments and the assignment of devolved revenue sources to the same government levels. That is, while many important spending responsibilities are decentralized to local governments, the control of the major sources of revenues are retained and controlled by the central government level. This asymmetry has been justified in different ways, including the comparative advantage of central tax collection, the need to preserve macroeconomic stability, or the objective of equalizing access to public services across all jurisdictions. However, it also gives rise to what is known in the literature as the “vertical fiscal imbalance,” which becomes itself a source of distortionary incentives, threatening to undo the same efficiency gains associated with fiscal decentralization (Rodden et al., 2003; Bouton et al., 2008; Eyraud and Lusinyan, 2013).¹

Some level of vertical fiscal imbalance (hereafter: VFI) can be vital for the central government to achieve certain political objectives (Dahlby, 1996; Boadway and Keen, 1996).² Yet, a common concern in the literature is that high VFI levels and heavy reliance on fiscal transfers may lead to local fiscal indiscipline in the form of overspending or lowering local governments’ tax effort (e.g., Stein, 1999; Velasco, 2000; Borge and Rattso, 2002;

¹ The existence of vertical fiscal imbalance implies that subnational governments have to rely on intergovernmental transfers and borrowing in order to finance a large part of their expenditures.

² For instance, intergovernmental fiscal transfers are good instruments to achieve redistribution objectives by correcting horizontal fiscal imbalance across jurisdictions, or for helping address externality issues among subnational jurisdictions via conditional grants.

Rodden et al., 2003; Eyraud and Lusinyan, 2013). Two arguments pinpoint this concern. First, in the presence of the VFI, while practically all benefits of public expenditure are obtained at the local level, they are at least partly financed from a common pool of national resources, implying that the perceived costs of public services at the local level are lower than the actual costs. This, in turn, generates an overspending pressure demanding more central government funds and/or a disincentive for taxing local sources of revenue since the relative price of this financing source is relatively higher than that of grants (i.e., the common pool problem). Second, high reliance on intergovernmental transfers or borrowing, as a consequence of the presence of the VFI, “softens” the budget constraint of subnational governments, which may induce bailout expectation by the central government, and, beyond over borrowing, may possibly lead to strengthening strategic behaviors for overspending and/or lowering tax effort.

The existing empirical studies examining the relationship between the VFI and local fiscal indiscipline focus largely on the side of public spending. Particularly, they test the hypothesis that a high VFI level undermines fiscal discipline by motivating local governments to further expand their expenditures (e.g., Ehdaie, 1994; Stein, 1999; Jin and Zou, 2002; Rodden, 2003; Jia et al., 2014). Additionally, a few studies analyze the link between the VFI and the overall fiscal balance at the national level. For instance, using cross-country panel datasets, both Rodden (2002) and Eyraud and Lusinyan (2013) find supporting evidence that higher VFI levels are detrimental to governments’ fiscal performance and lead to increased fiscal deficits. De Mello (2000) also argues that the presence of the VFI is likely to result in a deficit bias in decentralized policy-making, especially in the case of developing countries, where the central government exercises less stringent control on subnational finances. Despite these relevant works, little effort has been explicitly devoted to identify the impact of the VFI on the other important side of local fiscal indiscipline—local government taxing behaviors. In addition, the literature to date seems to largely ignore the discussion on the institutional conditions under which the impact of the VFI may actually take place. For instance, when there is no tax autonomy—in the sense of not having the ability to change tax bases or rates—for local governments, the presence of the VFI may not necessarily induce their behavioral response of lowering tax effort simply because of its administrative infeasibility.

Our paper fills this gap and makes three main contributions to the current literature. First, we are among the first to conduct an empirical examination of the impact of the VFI on local government taxing behaviors. The extant literature, which mainly focuses on overspending behaviors and overall fiscal performance of local governments, has little to say about whether the VFI may induce another important form of fiscal indiscipline, by local governments changing their level of tax effort. China offers a good case study to test this theoretical argument, as the Chinese provincial governments have been granted substantial discretion in determining their own fiscal decentralization policy towards sub-provincial governments within their borders, which actually gives rise to a high level of variation in the VFI in sub-provincial treatments. This variation is so substantial that it even outweighs that of fiscal decentralization policies across European countries (Dollar and Hofman, 2008). Thus, a panel study of city-level VFI in China presents the additional advantage of avoiding the potential unobserved heterogeneity that may exist in the relevant cross-country studies of fiscal decentralization.

Second, we explicitly explore the institutional conditions under which the impact of the VFI on local government taxing behaviors may take place. We argue that local tax autonomy and incentive compatibility are two important institutional factors shaping the effects of the VFI on local government behaviors.³ Taking advantage of the unique feature of China's fiscal decentralization architecture, which assigns the tax administration of local taxes and shared taxes to two separate tax bureaus (the local tax bureau and the central tax bureau, respectively),⁴ we validate the first institutional condition (i.e., local tax autonomy) by hypothesizing that the only feasible way for local governments to make a strategic response to the presence of high VFI is to change their taxing behaviors on local taxes (but not shared taxes), which are under the direct administration of local governments. Next, we shed some light on the second institutional condition (i.e., incentive compatibility) by analyzing the taxing behaviors of local governments on extra-budgetary revenues. Since the extra-budgetary revenues are outside the formal fiscal budgetary system in China, they are

³ In this paper, incentive compatibility refers to scenarios where the fiscal actions taken by local governments are changed because they can directly affect the resources they receive from the central government. A typical example of this and one that we highlight in this paper is that an increase in local fiscal capacity measured by actual tax revenues collected may result in a reduction in fiscal transfers from the central governments.

⁴ See a more detailed discussion on China's fiscal institutional framework in the next section.

not considered for the determination of central fiscal transfers to local governments. Thus, our conjecture is that in the case of extra-budgetary revenues, local governments have no incentive to respond to the presence of the VFI,⁵ which in turn provides an opportunity to test the second hypothesized institutional condition.

Third and last, we explicitly address the endogeneity issue of VFI in the estimations by employing an instrumental variable approach. From a technical perspective, a crucial yet unsolved issue with the existing empirical literature on the impact of the VFI is that most contributions fail to address the endogeneity of the VFI, or do so in a satisfactory manner. As a consequence, it is far from clear in the past literature how to isolate the effect of the VFI from other confounding factors and how to know whether the VFI is a cause or itself also an effect of the policies and institutional changes in which we are interested (i.e., local government taxing behaviors in our context). In this paper, we exploit the change in the predicted school-age population as a potential instrument for the VFI. The rationale is that the change in the predicted school-age population presents as an exogenous shock varying across cities and over time to local public (education) expenditure, and thus, the VFI of the cities, while this shock should not be directly affected by the taxing behaviors of local governments or vice versa.

Using a nationwide city-level panel dataset for the years 1999-2009 and applying both fixed effects and instrumental estimation strategies, we find strong support for our conjectures. Specifically, we find the following. (i) Higher VFI levels reduce the ratio of total fiscal revenues to gross domestic product (GDP) and the ratio of total tax revenues to GDP significantly,⁶ supporting the main argument that higher VFI levels may induce fiscal indiscipline by reducing tax effort of local governments. (ii) While higher VFI levels reduce the ratio of local taxes (and its main components, including urban infrastructure taxes and agriculture taxes) to GDP significantly, its impact on the ratio of shared taxes (and its main components, including value-added tax (VAT) and income taxes) to GDP is statistically

⁵ That is, using less extra-budgetary revenues will not affect the size the transfers received from upper level governments.

⁶ Total fiscal revenues are composed of total tax revenues and total non-tax revenues. Total tax revenues are revenues from local taxes and shared taxes elaborated in subsection 2.1. Total non-tax revenues include administrative fees, penalty and confiscatory revenue, stated-owned assets operating revenue, and miscellaneous non-tax revenues; but not transfers from the central government or any subnational borrowings, or any extra-budgetary revenues.

insignificant. These results confirm the theoretical argument that local tax autonomy is a necessary institutional condition for local governments to take strategic responses to the presence of the VFI. In particular, under the current Chinese fiscal regime, only local taxes are subject to the direct control of local governments, while shared taxes are collected and regulated by the central tax bureau on behalf of the central government, which makes it administratively very difficult to be affected by the presence of the VFI.⁷ (iii) Higher VFI levels have no impact on the ratio of extra-budgetary revenues to GDP, backing the institutional condition of incentive compatibility through which the functioning mechanism of the VFI may work. Finally, our results are shown to be robust across alternative specifications and measures of the VFI.

The rest of the paper is organized as follows. Section 2 introduces the fiscal institutions in China. Section 3 summarizes the theoretical arguments on the potential impact of the VFI on local government taxing behaviors, and derives the baseline hypotheses for empirical tests. Section 4 discusses the empirical methodology, measurements of key variables, and the dataset. Section 5 presents the main empirical results and robustness checks, and Section 6 concludes.

2. Institutional Background

An important feature of China's vertical structure of government is the strong hierarchical link between the different levels of government. Currently, there are five hierarchical levels of government in China (Liu et al., 2015). Starting with the highest, these levels are the center, provinces, prefecture-level cities, counties, and townships. During China's transition from a highly planned to a market economy since 1978, intergovernmental fiscal relations between the central and local governments in China have experienced several major reforms.⁸ However, these reforms have largely concentrated on the revenue side of the budgets, and

⁷ Local authorities may always try to influence the behaviors of central tax bureaus through the offer of local housing and other benefits but in reality cannot have the kind of control they actually exert over local tax bureaus. This finding provides support for De Mello's (2000) claim that the loose control of the central government for subnational finances triggers the VFI, inducing the fiscal indiscipline behaviors of local governments.

⁸ Local governments, ranging from the provincial government all the way down to the township governments, are broadly referred to as subnational governments.

generally have not been coordinated with an explicit strategy for the reform of expenditure assignments.⁹ As such, much of the revenue assignment authority has been re-centralized at the central level, while leaving the expenditure responsibilities largely decentralized at different levels of local government. Below, we discuss the current tax-sharing system and its implication for VFI in more detail.

2.1 The 1994 Tax-Sharing System Reform and the VFI

In 1994, the Chinese government implemented the tax-sharing system (TSS) reform, classifying all taxes into three categories: central taxes, local taxes, and shared taxes between the central and local governments. Mainly composed of the business tax, urban infrastructure tax, and agriculture tax, local taxes are entirely retained by local governments,¹⁰ while revenues from the shared taxes are shared proportionally between the central government and local governments. Specifically, the TSS reform defined the VAT being shared at a ratio of 75% (central) and 25% (local), and personal and corporate income taxes being shared at a ratio of 60% (central) and 40% (local).¹¹ The total tax revenues of local governments are thus composed of local taxes and the local portion of the shared taxes.

Meanwhile, during the 1994 TSS reform separate central and local tax bureaus were established at the provincial, prefectural, county, and township levels. The central tax bureaus were put in charge of collecting central taxes¹² and the majority of the shared taxes,¹³ while the local tax bureaus were made mainly responsible for the collection of all local taxes and the remaining small portion of the shared taxes. The shared taxes are under the direct supervision

⁹ There has been no apparent change in either the policy framework or the practice of expenditure assignments between the central government and sub-national governments or among the sub-provincial governments since even before the start of the market-oriented reforms in the late 1970s (Liu et al., 2015).

¹⁰ A complete list of local taxes includes: the business tax and urban infrastructure tax (other than the tax on the headquarters of banks, insurance companies, and rail transportation), urban land use tax, farmland occupation tax, VAT on land, contract tax, motor-vehicle and ship use tax, agriculture tax, tax on agricultural products, livestock tax, livestock slaughter tax, and the farmland conversion tax. It is notable that the agriculture tax, tax on agricultural products, livestock tax, and livestock slaughter tax were abolished in 2006.

¹¹ The sharing ratio for the personal and the corporate income taxes was 50:50 (central:local) in 2002 and was rescheduled to 60:40 (central:local) in 2003.

¹² Central taxes include the tariff and tonnage tax, the consumption tax and value-added tax (VAT) levied by the customs department, vehicle purchase tax, business tax, income tax, and urban infrastructure tax collected from rail transportation, state post, state-owned commercial banks, and head office of insurance companies.

¹³ Recall that the shared taxes include the VAT, corporate income tax, and personal income tax. Personal income tax, which accounts for approximately 6% of total tax revenues in China, is collected by the local tax bureau but it is under the strict supervision of the central government. Additionally, for those firms that were not affiliated to the central government and were established before 2002, their corporate income taxes were collected by local tax bureau. Later on in subsection 5.3, we take advantage of this special setup to check the robustness of our results.

of the central government, and largely, local governments have no practical influence on the collection effort of shared taxes. On the contrary, local taxes, which are collected and administrated at some discretion of local governments, form an important source of revenue for local governments. Even though local governments have little authority to change the statutory rates of the local taxes,¹⁴ they have considerable scope to manipulate their tax enforcement to change the actual taxes being collected (see, for example, Liu and Martinez-Vazquez, 2014).

Meanwhile, it is important to note that the 1994 TSS reform only explicitly stipulates the tax sharing rules between the central government and provincial governments, leaving space for the provincial governments to specify their own sharing rules for their retained revenues at the sub-provincial level. In practice, the business tax, the resource tax, and the retained shared taxes (including 25% of total VAT and 40% of total income tax) are usually shared in a ratio of 50:50 (provincial:sub-provincial) or other ad hoc negotiation ratios across provinces,¹⁵ while sub-provincial governments are generally allowed to retain 100% of the urban infrastructure tax and the agriculture tax.¹⁶

By setting the VAT and income taxes as shared taxes, and assigning the central government with the largest share of these major tax instruments, the 1994 TSS reform successfully recentralized revenues to the central level and met the twin reform objectives of raising the central government's revenues and strengthening the control of the central government over the fiscal system. Immediately after the TSS reform, the share of total fiscal revenues assigned to the central government increased from 22.0% in 1993 to 55.7% in 1994 and has remained at around 52.0% since then (Jia et al., 2014). Nevertheless, as pointed out above, expenditure assignments at the different levels of government today are largely what they were decades ago, which assigned sub-national governments (especially city and county governments) with, what may be considered by international norms, excessive expenditure responsibilities. Consequently, the TSS reform started a period of severe VFI for the Chinese local governments, especially for prefecture-level city governments. Figure 1 illustrates the

¹⁴ For some local taxes, for instance the business taxes for certain sectors, local governments are allowed to select a particular tax rate from a given range of tax rates set by the central authority.

¹⁵ For example, the sub-provincial governments in Jiangsu Province were allowed to retain 50% of the provincial share of VAT in 2000, as compared to 80% in Hunan Province (Jia et al., 2014).

¹⁶ See Li (2010) for a comprehensive description of the sub-provincial fiscal system in China.

general tendency of the VFI at the city level for the sample period of 1999-2009.¹⁷ As shown, the average revenue size of city governments in the sample, denoted by the ratio of total fiscal revenues to GDP, is relatively stable at around 5%, experiencing only a slight increase after 2006. By contrast, the average expenditure size of city governments—the ratio of total fiscal expenditure to GDP—has increased continuously, from 9.4% in 1999 to 19.8% in 2009. This gap in revenue and expenditure assignments has contributed to a continuous increase in the VFI over the years.

(Insert Fig. 1 Here)

Largely, fiscal transfers from the central government have worked to compensate for the rising VFI shown in Figure 1.¹⁸ Our data show that, in 1999, 39.7% of city government expenditures on average were financed through intergovernmental transfers and other resources. Further, this ratio rose to 58.1% in 2009.

2.2 Extra-Budgetary Revenue as a Source of Local Revenue

The 1994 TSS reform clearly defined the (budgetary) fiscal revenues for local governments, which are composed of tax revenues and non-tax revenues.¹⁹ It also, for the first time in China, introduced rules-based intergovernmental fiscal transfer programs with the objective of accommodating gaps in fiscal capacity and expenditure needs across local jurisdictions. Nevertheless, the recentralization of revenue assignments after the 1994 reform and the weakness of revenue bases have led local governments to search for more sources of revenue outside the budget system, mainly in the form of extra-budgetary revenues (see, for example, Liu and Martinez-Vazquez, 2014; Han and Kung, 2015).

¹⁷ The VFI is defined as the share of a city's own spending not financed through own revenues (i.e., the difference between a city's own spending and own revenues) to its own spending. By definition and in correspondence to the Chinese fiscal institutions, a city's own spending equals to the city's total fiscal expenditure, while its own revenues equal its total fiscal revenues. The counterparts of VFI are mainly transfers received from the upper-level governments and other deficit financing. For more detailed discussion of its measure, see subsection 4.2.2.

¹⁸ Under the current setting, fiscal transfers from the central government to local governments can be categorized into tax rebates, equalization transfers, and ad hoc transfers. While the first two items are formula-based, the ad hoc grants (also known as earmarked grants) are program-based and allocated for special purposes such as emergency funding for natural catastrophes. See Liu et al. (2014) for a more detailed discussion on fiscal transfers in China.

¹⁹ Tax revenues are revenues from local taxes and shared taxes elaborated in subsection 2.1. Non-tax revenues include administrative fees, penalty and confiscatory revenue, stated-owned assets operating revenue, and miscellaneous non-tax revenues.

Extra-budgetary revenues largely come from tax surcharges, land conveyance fees, and sometimes “illegal” fees, in the sense that they are not authorized by the central or provincial government levels. Unlike budgetary revenue, which is subject to the TSS rules, extra-budgetary revenues are wholly controlled by local governments and are not included in the formal budget. In addition, local governments have complete authority over deciding which fees and funds should be allocated to the extra budget (Montinola et al., 1995). Figure 2 provides an overview of the quantitative importance of extra-budgetary revenues at the prefecture-city level in China. As shown, extra-budgetary revenues of city governments grew from less than 0.23% of GDP (i.e., 17.03 billion RMB) in 1999 to about 2.91% of GDP (i.e., 957.69 billion RMB) in 2009.

(Insert Fig. 2 Here)

3. Theoretical Review and Basic Hypotheses

The theoretical literature on fiscal federalism often emphasizes that fiscal decentralization coupled with large VFI may undermine the fiscal discipline of local governments in decentralized economies. In particular, two theoretical constructs, the common pool problem and soft budget constraint, explain how the presence of VFI may affect local government fiscal behaviors. The common pool problem originates from the well-known theory of “the tragedy of the commons” (Hardin, 1968). Weingast et al. (1981) extend it to the fiscal framework and reach an important implication, namely that governments having access to common pool resources would fail to internalize the full cost of public expenditures that benefit their own jurisdictions. Intergovernmental fiscal transfers from the central government are usually deemed as a typical type of common pool resource in a partial decentralized fiscal system, where the central government collects the majority of total revenues and finances local expenditures using transfers (Stein, 1999).²⁰ When fiscal

²⁰ In a multilevel government framework, when local governments have full revenue autonomy and the authority to make policies, the tax bases shared by the central and local governments also create a common pool problem. This is so because the existence of vertical tax competition between the central and local governments tends to result in an inefficient high local tax rate, given that local governments generally ignore the vertical externality generated by their own tax decisions (e.g., Keen and Kotsogiannis, 2002; Brülhart and Jametti, 2006; Devereux et al., 2008; Berry, 2008). Nevertheless, the shared taxes in China are under the direct control of the central government, and therefore, the associated common pool problem is not relevant in our context.

transfers fill up the VFI, the perceived costs of public services at the local level become lower than the actual costs. At the same time, this creates a wedge in the perceived marginal costs in raising funds from own revenue sources and intergovernmental transfers (with the perceived marginal cost of own taxation being larger than the perceived marginal cost of funds from inter-governmental transfers). Thus, local governments face the incentive(s) to expand their public expenditures and/or lower their costly tax effort on own source revenues, thus shifting part of their cost of expenditures to other jurisdictions through the intergovernmental fiscal transfers system (e.g., Stein, 1999; Velasco, 2000; Rodden et al., 2003). The larger the VFI, the more severe the common pool problem becomes.

The literature on soft budget constraint also provides consistent implications for the indisciplining effects of the VFI. It argues that the existence of large VFI with transfer dependence may soften local governments' budget constraints because it creates expectations of potential bailouts for local governments. Specifically, because of local governments' limited ability in raising revenues in the event of a financial crisis, local voters and creditors may find it difficult to fault local governments and feel compelled to believe that it would be the central government's responsibility to solve the crisis. Thus, such expectations deteriorate local fiscal discipline and aggravate the common pool problem among local governments (Von Hagen and Eichengreen, 1996; Qian and Roland, 1998; Pisauero, 2003; Rodden et al., 2003). This problem perhaps is exacerbated in the Chinese context because of the role of the central government in the political system. Historically, the Chinese Communist Party and the State's primary task has been to preserve local social political order and stability, which essentially prevents the central government from making a credible commitment not to bail out those local governments in a financial crisis. Thus, the central government is bound to pay a price to ensure that functional local governments maintain political order and social stability, and this price manifests itself in the form of a growing number of transfers, some of which occur at a massive scale, consequently leading to local fiscal indiscipline (Guo, 2008).

Given that our primary focus is on the revenue disciplining effect of the VFI, we encapsulate the prediction of the theoretical framework into the following testable Hypothesis

1:²¹

***Hypothesis 1:** Higher VFI levels undermine local fiscal discipline by discouraging local tax effort.*

Even though this classic view provides valuable insights into the disciplining effect of the VFI, it does not mean that the implicit functioning mechanism of the VFI will work under any conditions. A closer look at this point reveals two necessary (institutional) conditions. The first essential premise, which is somehow straightforward, is that local governments are capable to respond freely to the changes in local fiscal conditions (for instance, the presence of the VFI). In other words, local governments should enjoy at least certain degree of tax autonomy so they can influence their tax collections. Despite its importance, none of the studies in the previous literature explicitly identifies the role of local tax autonomy in shaping the disciplining effect of local governments in response to the presence of the VFI.

As elaborated previously in subsection 2.1, the TSS reform in China has assigned local taxes and shared taxes to two separate tax bureaus, with local taxes being collected and administrated by local governments, and shared taxes by the central tax bureau on behalf of the central government. This unique institutional setup in China provides us with an opportunity to test the local tax autonomy condition by hypothesizing that the only feasible way for local governments to lower local revenue collection is to change their tax effort on local taxes and not so for shared taxes. This prediction is summarized in testable Hypothesis 2:

***Hypothesis 2:** Higher VFI levels undermine local fiscal discipline by discouraging local tax collection but not so for shared taxes.*

²¹ The literature on tax competition contains an argument that the presence of equalization transfers in decentralized economies may potentially serve as a corrective device for harmful inter-jurisdictional tax competition and thus mitigate the “race to the bottom” competition in tax rates (see, for example, Egger et al., 2010; Liu, 2014). However, this is less likely to be an important concern in the Chinese context largely because of the limited amount of equalization transfers in the total transfers of the system, especially in the early years. We also deal with this concern by excluding the equalization transfers from the measure of the VFI. The results are largely unchanged.

The second condition, which is perhaps less straightforward and which we call the incentive compatibility condition, is that some changes in local fiscal behaviors will directly affect the central policy toward local governments and therefore that will affect how local government actually behave. In the spirit of both the common pool and soft budget constraint theories, local governments may lower their costly tax enforcement either because they anticipate an offsetting compensation in the form of central transfers or simply a bailout from the central government. Thus, in the presence of institutions that effectively disconnect the link between local fiscal behaviors and central policies, we should expect a break in the functioning mechanism powered by the VFI.

In the Chinese context, extra-budgetary revenues are not only under the full discretion of local governments, but they are also outside the fiscal budgetary system. This means that extra-budgetary revenues actually are not considered when determining the amounts of fiscal transfers to be received by local governments. This implies the lack of a direct linkage between local performance regarding extra-budgetary revenues and the central policy.²² Thus, straightforward logic follows that local governments should have no incentive to change their collecting (taxing) behaviors for extra-budgetary revenues regardless of the VFI level faced by the localities. This unique fiscal regime, thus, has profound policy implications and provides a good opportunity for conducting a placebo test to check the incentive compatibility condition for the functioning mechanism of the VFI. A confirmation of our main question of interest would predict an insignificant effect of the VFI on the collection of extra-budgetary revenues. We summarize the same in Hypothesis 3.

Hypothesis 3: Higher VFI levels should have no impact on local collection effort of extra-budgetary revenues.

²² Although a few studies argue that the steady increase in extra-budgetary revenues is partially due to the heavy expenditure pressure (e.g., Fan, 1996; Jin et al., 2005), the use of extra-budgetary revenues to supplement budgetary revenues is indeed rather limited. The institutional changes in the past decade have put extra-budgetary revenues under strict supervision. For instance, the “tax-for-fee” reform in the late 1990s converted various extra-budgetary fees into budgetary revenues. Meanwhile, the “two distinct avenues of revenue collection and spending” (*shouzhi liangtiao xian*) reform in 1999 are of great significance in that they put extra-budgetary revenues and expenditures under increasing scrutiny; they explicitly stipulate that the use of extra-budgetary revenues should be subject to regulatory mandates. Thus, clear management of the extra-budgetary accounting system implies that the growth of extra-budgetary revenues neither contributes to the expansion of budgetary expenditures nor the filling up of the budgetary fiscal gaps.

4. Econometric Methodology, Measurement of Key Variables, and Data

4.1. Econometric Methodology

4.1.1. Baseline Specification

In this section, we discuss the empirical specification with the objective of testing Hypotheses 1-3. Specifically, to assess the impacts of the VFI on local revenue indiscipline, we estimate a standard two-way fixed effects model of the form

$$I_{i,pt} = \alpha + \beta VFI_{i,pt} + \mathbf{X}_{i,pt} \delta + \eta_i + u_{pt} + v_t + \varepsilon_{i,pt} \quad (1)$$

where i represents a prefecture-level city, p represents the home province of city i , and t denotes the year. The dependent variable $I_{i,pt}$ is a series of indicators capturing local fiscal discipline on the side of taxing behaviors; $VFI_{i,pt}$ is the measurement of the vertical fiscal imbalance of a city;²³ $\mathbf{X}_{i,pt}$ represents a set of control variables, including real GDP per capita, the shares of the secondary and tertiary sectors in GDP, population density, government size, cultivation land per capita, FDI, the length of highways, total numbers of passengers, number of cities in a province, number of counties in a city, a dummy variable for the rural tax-for-fee (RTF) reform, and a series of characteristics of the city party secretary. To capture the potential heterogeneous time patterns of the outcome variables across the provinces, we control for a full set of province-year fixed effects (denoted by u_{pt}). Furthermore, the model includes city dummies (η_i) to control for unobserved heterogeneity that are constant over time across cities as well as year dummies (v_t) to control for year effects that affect all cities; $\varepsilon_{i,pt}$ is an idiosyncratic error term.

As control variables, real GDP per capita, the shares of the secondary and tertiary sectors in GDP, and cultivation land per capita capture the general effects of economic development and economic structure on local revenue policy. Population density and the number of counties in a city are employed to capture the possible scale effects in the collection of local revenues. Government size, measured by the ratio of fiscally supported population (consisting of civil servants and employees in public service sectors) to the city's total population, is included to account for the revenue need of the government. The length of

²³ See the next subsection for detailed definitions for both I_{ipt} and VFI_{ipt} .

highways and the number of total annual passengers can be interpreted as a proxy for the quality of city infrastructure. The number of cities in a province captures the potential effect of inter-jurisdictional competition on local revenue collection. We also control for a dummy variable of the RTF reform in rural China aiming to control for the potential influence of the reform on local revenue policy.²⁴ To further isolate the impact of political promotion incentives on local taxing behaviors, we additionally control for a series of characteristics of the city secretary, including his/her age, education, and a dummy variable indicating whether he/she is an ethnic minority.

4.1.2. Instrumental Variable Estimations

A potential concern is that the endogeneity of the VFI may bias the estimates in our baseline regressions. In theory, this issue may arise because of reverse causality, omitted variable bias, and measurement errors. In our particular context, the reverse causality is likely to emerge for two primary reasons. First, since the VFI is measured by the ratio of the difference between city total fiscal expenditures and revenues to its total fiscal expenditures, any change in city revenue collection will have a mechanical effect on the VFI through the accounting relationship. Second, intergovernmental transfers from the central government are usually responsive to city governments' fiscal performance, especially their revenue capacities. Thus, local expenditures financed by the intergovernmental transfers are intrinsically connected to city revenue collection. Besides reverse causality, the endogeneity may well be rooting in the potential measurement errors of the VFI, which, as discussed in subsection 4.2.2, might be captured by different dimensions, and which, by nature is difficult to be measured accurately with limited data information.

To circumvent the endogeneity issue and identify the causal impact of the VFI on local fiscal discipline, we use an instrumental variable estimation. Specifically, we use as an instrument *the change in predicted school-age population (0-14 years old) between two consecutive years*. The predicted school-age population ($PSAP_{i,pt}$) is calculated by using the actual school-age population in 1999 as the base and assuming an exponential growth

²⁴ There may be a concern that this dummy variable may not be able to capture the heterogeneous effects of the reform across cities. As a robustness check, we replace it with the ratio of the RTF reform subsidies to total local government expenditures and re-estimate the model. The RTF reform subsidy is made by the central government for compensating the revenue losses of local governments in the post-RFT reform period. The results are largely unchanged. These results are not reported but available from the authors.

over years, that is

$$PSAP_{i,pt} = SAP_{i,p1999} \times (1 + \widehat{Popgr}_{i,pj})^{t-1999}, t = 2000, 2001, \dots, 2009$$

where $SAP_{i,p1999}$ is the actual school-age population for city i in province p in year 1999, and $\widehat{Popgr}_{i,pj}$ is the simulated natural population growth rate for city i in province p in year j .²⁵ To ensure the exogeneity of the population growth rate for city i in the calculation of the instrument, we do not use the actual natural population growth rate for city i , but instead we construct it (i.e., $\widehat{Popgr}_{i,pj}$) as the weighted average of the actual population growth rate for all other cities (except city i itself) in the same province.²⁶

The validity of the instrument can be justified as follows. Given that the primary concern of the endogeneity of the VFI concerns the reverse causality between local revenue collection and the VFI, our strategy is to search for instruments with some exogenous variations that may explain local expenditures but not local revenue collection. School-age population falls in this range. As we previously noted, China has maintained a rather decentralized system in terms of expenditure assignments, with local governments providing the majority of essential public services, especially (compulsory) elementary and middle school education. In particular, the share of education expenditure in total local government expenditure is around 20% on average in our sample for the period between 1999 and 2009 at the prefecture-city level. Additionally, the 1995 “Education Law of the People’s Republic of China” explicitly stipulates that the growth rate of education expenditure should exceed the growth rate of government revenues, and per student budgetary education expenditure should increase annually (Article 55).²⁷ These institutional facts suggest a high correlation between local public education expenditure and the VFI. Since school-age population is a major predictor for the demand and increase in basic education, but not directly for local revenue collection, this justifies the use of school-age population as an arguably good candidate for

²⁵ The predicted school-age population in 1998 is calculated as $SAP_{i,p1999} \times \frac{1}{1 + \widehat{Popgr}_{i,p1999}}$. It is also noted that annual data on actual population age structure are not available at the sub-provincial level. The most comprehensive and authoritative data on population age structure can be sourced from the population census conducted by the central government every five years since 1990.

²⁶ The weight is total population of the city. The argument here is that the population growth rate in city i is correlated with the population growth rate in other cities in the same province.

²⁷ The requirement that the ratio of education expenditures to GDP should be higher than 4% is often regarded as a political objective for local governments in China.

instrumenting local expenditures, and thereby, the VFI.

Using *change in the predicted values of school-age population* as an instrument presents two additional benefits. First, by its construction, the simulated natural population growth rate is almost certain to be exogenous to factors that may affect local government revenue behaviors, and hence, using the predicted values of school-age population, largely reduces the risk of potential endogeneity. Second, since the VFI is measured as the degree of divergence between total fiscal expenditures and total fiscal revenues, which potentially captures the change in expenditure needs due to the external shocks; thus the change in the predicted values tends to better explain the degree of such divergence than the stock values do. In summary, the change in predicted school-age population represents an exogenous shock to the change in local public expenditure (and not so the change in own revenues), and thus acts as a valid instrument for the VFI.²⁸

4.2. Measures of Key Variables

4.2.1. Local Fiscal Discipline

As we have stressed previously, our primary focus is on the local fiscal discipline in terms of taxing behaviors ($I_{i,pt}$); thus, the first task is to come up with a comparable measure of $I_{i,pt}$ to use as a dependent variable. Recall that Hypothesis 1 predicts a crowding out effect of the VFI on local revenue collection (i.e., tax effort). Thus, we follow the conventional empirical literature to measure $I_{i,pt}$ in a straightforward way, as both the ratio of total fiscal revenues to GDP and the ratio of total tax revenues to GDP of a city.²⁹ Other factors being equal, cities with larger values of these ratios should stand for higher levels of revenue/tax collection effort, and thus, stronger fiscal discipline.

Following the same logic, we employ the ratio of local taxes to GDP and the ratio of shared taxes to GDP as dependent variables to test Hypothesis 2 for uncovering the local tax autonomy condition under which the impact of the VFI functions. As robustness checks, we also utilize the ratios of individual components for both local taxes (including business taxes, urban infrastructure taxes, and agriculture taxes) and shared taxes (including the VAT and

²⁸ In subsection 5.2, we perform formal tests to check the validity of the instrument.

²⁹ Recall that total fiscal revenues include both tax revenues and non-tax revenues. Tax revenues are revenues from local taxes and shared taxes elaborated in subsection 2.1. Non-tax revenues include administrative fee, penalty and confiscatory revenue, stated-owned assets operating revenue, and miscellaneous non-tax revenues.

income taxes) to GDP as dependent variables to re-conduct the analysis.

Lastly, for conducting the placebo analysis and providing evidence for the incentive compatibility condition as summarized in Hypothesis 3, we employ the ratios of both the overall and the specific components of extra-budgetary revenues to GDP as the dependent variables.

4.2.2. Vertical Fiscal Imbalance

Different measures of the VFI have been used in the literature. For instance, Boadway and Tremblay (2006) theoretically define it as the level of deviation from the optimal vertical fiscal gap, while most empirical studies use “transfer dependency”, calculated as the share of intergovernmental transfers in total local expenditures (or total local revenues), as a proxy (e.g., De Mello, 2000; Bird and Smart, 2002; Rodden, 2002). Essentially, the VFI represents the degree of mismatch between local governments’ expenditures and their own source revenues. Intergovernmental transfers, as well as some additional revenues such as local borrowings and other deficit financing usually fill the gap. Thus, the transfer dependency indicator may not be an accurate measure of the VFI in this regard.

In this paper, we follow Eyraud and Lusinyan (2013) and Jia et al. (2014) to measure the VFI as the share of a city’s own spending not financed through own revenues (i.e., the difference between a city’s own spending and own revenues) to its own spending. By definition and in correspondence to the Chinese fiscal institutions, a city’s own spending equals to the city’s total fiscal expenditure, while its own revenues equal its total fiscal revenues.³⁰ As previously pointed out, the gap between a city’s total fiscal expenditure and revenues is mainly filled by transfers received from the upper-level governments and budget deficits (even though such deficits are not legally allowed by the central authority). As shown in Figure 1, city governments in China evolved a severe mismatch between expenditure responsibilities and their revenue capacities from 1999 to 2009, with an average VFI of 51.21% during this period (see Table 1).

Table A in the Appendix provides a detailed description and sources of all the variables, while their summary statistics are reported in Table 1.

³⁰ Recall that a city’s total fiscal revenues are composed of total tax revenues (i.e., sum of local taxes and city portion of the shared taxes) and total non-tax revenues, but not including any transfers from upper-level governments.

(Insert Table 1 Here)

4.3. Data

The panel dataset we use for the quantitative analysis covers 325 prefecture-level cities in China for the years 1999-2009. We exclude the four province-level municipality cities, Beijing, Tianjin, Shanghai, and Chongqing, as the legal status of these municipalities is non-comparable to other regular cities. Cities in Tibet are also excluded from the sample because of data unavailability. Since data on some of the key variables such as personal income taxes and corporate income taxes are only available from 1999, we select 1999 as the starting period in our analysis; the end year of the panel dataset, 2009, is the last year that disaggregated fiscal data at the sub-provincial level were released.

Data used for the calculations of the key variables are taken from the *Prefecture, City, and County Public Finance Statistics (Quanguo Dishixian Caizheng Tongji Ziliao, 2000-2010)*. This is the most detailed and disaggregated data source on subnational public finances and some basic economic and socio-economic variables (such as GDP, shares of secondary and tertiary sectors in GDP, and fiscally supported population, etc.). Data on the natural population growth rate, FDI, the length of highways, and total number of passengers, are collected from various issues of the *China Statistical Yearbook for Regional Economy* (National Bureau of Statistics, 2000-2010). Information on population in school age (i.e., 0-14 years old) in 1999 is obtained from the *Provincial Tabulation on the 2000 Population Census* (National Bureau of Statistics, 2001) for each province. The city party secretaries' background information is obtained from their curriculum vitae, which is publicly available online.

5. Empirical Results

5.1. Fixed Effects Results

The estimation results from the fixed effects regressions of the disciplining effects of the VFI are presented in Table 2. Columns (1)-(3) and Columns (4)-(6) alternatively use the ratio of total fiscal revenues to GDP and the ratio of total tax revenues to GDP as the dependent variables. The table presents estimated coefficients and robust standard errors with different

sets of control variables. In all estimations, we include city fixed effects, year dummies, and the full set of province-year dummies to control for unobserved heterogeneity and specific province-time fixed effects.

To begin with, we examine the effect of the VFI on local fiscal discipline without adding any other explanatory variables to the model. As shown in Column (1) of Table 2, the coefficient of the VFI is negative and statistically significant at the 1% level, supporting Hypothesis 1 that the presence of the VFI reduces local revenues collection. Our main result persists if we use the alternative dependent variable (Column 4). We then continuously add to the model with a rich set of economic explanatory variables and city leader's characteristics in Columns (2)-(3) and Columns (5)-(6), respectively. Again, we find a negative impact of the VFI on local fiscal discipline on the side of revenue collection, independently of the use of alternative dependent variables. The magnitudes of the coefficients vary across alternative dependent variables and model specifications and range from -0.121 to -0.033. Specifically, based on our preferred specifications, with multiple variables controlled, the estimate of the VFI in Column (3) (Column (6)) is -0.121 (-0.033), indicating that a one-percentage point increase in the VFI is associated with a reduction of the share of total fiscal revenues (total tax revenues) in GDP by 0.121 (0.033) percentage points. At the mean values, this translates into an equivalent reduction of 2.33% (0.87%) in GDP (i.e., $0.121/5.19$ ($0.033/3.80$)) in the share of total fiscal revenues (total tax revenues).³¹ In addition, the magnitudes of the estimated coefficients also reveal that the quantitative impacts of the VFI tend to be larger when the share of total fiscal revenues in GDP is used as the dependent variable, which in turn is consistent with the fact that total fiscal revenues are a broader concept than total tax revenues, thus implying a larger scope for strategic responses.

(Insert Table 2 Here)

5.2. Instrumental Variable Estimation Results

From a technical perspective, a valid instrument needs to meet both the relevance and exogenous conditions. Here, before we present the instrumental variable (IV) estimation results, we provide some evidence that these two conditions are indeed satisfied with the

³¹ Mean values are shown in Table 1.

selected instrument. To start with, Table 3 reports the first-stage estimation results in the instrumental variable estimations. We find that the instrument (i.e., the change in predicted school-age population) is positively and significantly correlated with the VFI, confirming our argument for the relevance of using school-age population as an effective predictor for local expenditures, and thus, the VFI. Meanwhile, for all specifications, the F-statistic is always over 10, suggesting that our IV estimates are not prone to the weak instrument concern. Next, we check for the exogenous condition, which means that the instrument should have affected the local government taxing behaviors *only* through its impact on the VFI. To validate this, we include the instrument as an additional explanatory variable to the baseline specification (1) and anticipate an insignificant result of it in this augmented specification; otherwise, it would indicate that the instrument does have other channels to influence local taxing behaviors after controlling for its impact on VFI. Table 4 reports the results for the augmented specification. There we find the estimates of the instrument to be consistently insignificant across different specifications. Taken all together, it significantly increases our confidence of the validity of the instrument.

(Insert Tables 3 & 4 Here)

The IV estimation results are presented in Table 5. They clearly show that VFI, after being instrumented, still has a negative and statistically significant impact on local fiscal discipline on taxing behavior, which further supports Hypothesis 1. In our preferred IV specifications of Column (3) in Table 5, the coefficient of the VFI is -0.106. Hence, a one-percentage point increase in the VFI tends to result in a decrease of 0.106 percentage points in the share of total fiscal revenues to GDP. When we use the ratio of total tax revenues to GDP as the dependent variable, the coefficients of the VFI in all specifications (i.e., Columns (4) to (6)) echo our findings in Table 2: the indisciplining effect of the VFI on local revenue collection is independent of the use of alternative dependent variables.

(Insert Table 5 Here)

5.3. Exploring the Institutional Conditions

5.3.1 The Importance of Local Tax Autonomy

Having obtained strong empirical support for Hypothesis 1, we now proceed to test Hypothesis 2 for the heterogeneous effects of the VFI on different sources of revenue (mainly

local taxes versus shared taxes), and also as a way to validate the condition of local tax autonomy under which the impact of the VFI will take place. As discussed in some details in Section 3, our identification strategy is based on the insight that subject to the management of different taxing authorities, the collection of local taxes and shared taxes might be influenced differently by local governments' taxing behaviors. While the collection of local taxes is somehow at the discretion of local governments, and thus might be vulnerable to the changes in incentive faced by local governments, the collection of shared taxes is under the direct and strict control of the central government, and thus might not be sensitive to the presence of the VFI at the local level. To shed some light on this, we extend our analysis by decomposing total tax revenues into two main categories: revenues from local taxes and revenues from the local portion of shared taxes. We then re-estimate the effects of the VFI. Given the limits on space, we report only the IV estimation results of the subsequent analysis.

Tables 6 and 7 document the results for the use of the ratio of local taxes (along with its main individual tax categories including business taxes, urban infrastructure taxes, and agriculture taxes) to GDP, and the ratio of shared taxes (along with its main individual tax categories, including the VAT and corporate income taxes) to GDP as the dependent variables, respectively. As shown in Table 6, regardless of the use of aggregated local taxes or individual local taxes as the dependent variable, the coefficients of the VFI are consistently negative in all four specifications, supporting the first part of Hypothesis 2 that city governments respond to the VFI by reducing their taxing effort on local taxes. However, we note that even though the estimate of the VFI is negative, it is not statistically significant when the ratio of business taxes to GDP is used as the dependent variable. This is not surprise though. As we have already mentioned in subsection 2.1, even though the business tax is a type of local tax collected by local tax bureaus, it is commonly shared between provincial governments and sub-provincial governments (including cities, counties, and townships) at certain ratios varying across provinces. Thus, local collection of business tax may be still under full scrutiny by the upper level authorities (i.e., the provincial governments) because they also share in the tax. To give an example of how the scrutiny takes place, provincial governments frequently set up annual tax planning targets for their subordinated governments regarding shared taxes, leaving little room for prefecture-city governments to manipulate

their taxing behavior in the case of the business tax.³² Consequently, even though local tax bureaus collect the business tax, prefecture-city level governments actually have very little tax autonomy on this tax.

Quantitatively, the VFI appears to have the largest impact on the collection of agricultural taxes. This result may be because the agriculture sector represents the hardest to tax sector in the economy, and given the rising opposition among farmers to the many diverse local charges in rural China in the period examined, local governments have had more leeway to change their taxing behaviors for the agriculture sector in the presence of the VFI.

(Insert Table 6 Here)

Table 7 provides strong evidence for the second part of Hypothesis 2. As predicted, the VFI turns out to have no significant impact on the collection of either aggregate shared taxes or its main components, including the VAT and income taxes. Moreover, the results do not show either any discernible pattern for the effect of the VFI on different types of shared taxes, where we observe a negative estimate for the VAT and a positive estimate for income taxes.

While, in general, the insignificant findings for the shared taxes are in line with our theoretical prediction, we have to be cautious when interpreting the results for corporate income tax. This is so because the tax collection power for corporate income tax has *only* been shifted from local tax bureaus to central tax bureaus in 2002, a result of the important income tax reform in that year. More specifically, the reform stated that firms established on and after 2002 are assigned to central tax bureaus for corporate income tax collection, while firms established before 2002 remain the task of local tax bureau for corporate income tax collection. This implies that our estimations in Table 7 based on aggregated data will not be able to capture this confounding factor. To further investigate this point, we rely on firm-level data from the Annual Survey of Industrial Firms conducted by the National Bureau of Statistics of China³³ for the period (i.e., 1999-2007) to identify whether the firms were

³² As a matter of fact, some of the business tax revenues are shared between local governments and the central governments. For instance, 37.5% of business tax from the financial and insurance sectors belongs to the central government, while the rest is shared among different levels of sub-provincial governments.

³³ This dataset has been widely used in the literature (for example, Hsieh and Klenow, 2009; Guariglia et al., 2011; Brandt et al., 2012; Feenstra et al., 2014). The dataset includes all industrial firms that are either state-owned, or non-state firms with sales above 5 million RMB. The industrial firms operate in mining, manufacturing, and public utility sectors, spanning 31 provinces and province-equivalent municipal cities. We follow the method proposed by Brandt et al. (2012) to clean the dataset. On average, nearly 220,000 firms per

established before or after 2002. Then we calculate separate indexes of effective corporate tax rates for these two groups of firms (which were under supervision of local tax bureau and central tax bureau, respectively) at the city-year level. Finally, we perform separate estimations by using the aggregated effective corporate tax rate at the city level for firms established before and after 2002 as alternative dependent variables.³⁴ The results in columns (4) and (5) of Table 7 show that while the estimates of VFI are negative in both cases, they are only statistically significant (at the margin) for the former case, where the effective tax rates for firms established before 2002 (and so under the control of local tax bureau) are used as the dependent variable. These additional results largely support our main argument that local governments will be able to respond to the presence of VFI only when they are provided with certain taxing powers.

(Insert Table 7 Here)

In sum, our analysis validates Hypothesis 2 and confirms the hypothesized condition that local governments lessen their fiscal discipline behaviors by reducing their taxing effort on local taxes in China. This finding highlights the importance of tax autonomy for understanding the effect of the VFI.

5.3.2 Incentive Compatibility and Placebo Test

In a way, the previous results regarding the shared taxes can be treated as a placebo test for the main hypothesis of the paper (i.e., Hypothesis 1), as the shared taxes are not controlled by local governments. In this subsection, we present another placebo test to our main argument by analyzing extra-budgetary revenues, which is an incentive-incompatible element as it does not enter the budgetary system and is not considered in the determination of intergovernmental transfers for local governments. That is, fiscal transfers from the central government will not compensate the lowering collections of extra-budgetary revenues, as the allocation of fiscal transfers is solely based on budgetary fiscal performance of local governments. Thus, we may expect to see no significant impact of the VFI on the

year for the period from 1999 to 2007 are included in the dataset. The dataset contains basic information on firms' operation statement including income tax payable and earnings before interest and tax (EBIT), which enables us to compute the effective corporate income tax rate for the firms.

³⁴ Effective corporate tax rate faced by the firms is defined as the ratio of income tax payable to earnings before interest and tax. In order to aggregate the effective corporate income tax rate to the city level, we alternatively calculate the weighted average of effective corporate income tax rate for firms established before and after 2002 in a city. The weight is a firm's added-value.

extra-budgetary revenue collection of local governments, as described in Hypothesis 3.

The estimation results for the effect of the VFI on local collection of extra-budgetary revenues are summarized in Table 8. Column (1) reports the results for the use of the ratio of total extra-budgetary revenues to GDP as the dependent variable, while Columns (2)-(4) do the same for the ratios of the three specific components of extra-budgetary revenues (i.e., industry and transportation sector funds, agriculture sector funds, and land conveyance fees) to GDP as the dependent variables. Although the estimates of the VFI are negative, they are highly insignificant in all specifications. These results reinforce our main argument and confirm the incentive compatibility condition underlining the functioning mechanism of the VFI.

(Insert Table 8 Here)

5.4. Robustness Checks

In this subsection, we conduct a set of further robustness checks on our baseline results. To begin with, we re-calculate the instrument (i.e., the change in the predicted school-age population) using historical data on school-age population in 1989 (instead of 1999) as the base in order to ensure that we avoid the endogeneity concern. The results are reported in Panel A of Table 9.³⁵ As shown, the results are quite comparable to the corresponding baseline ones, confirming our notion that local governments respond to the presence of the VFI by reducing local revenue collection, particularly by lowering the collection of local taxes under the direct control of local governments.

(Insert Table 9 Here)

Second, we check whether our findings might be driven by the measurements of the VFI. As we highlighted in subsection 4.2, transfer dependency, defined as the ratio of intergovernmental transfers received from the upper-level governments to local government expenditures, is another indicator of VFI that has been widely used in the literature (e.g., De Mello, 2000; Bird and Smart, 2002; Jin and Zou, 2002; Rodden, 2002). Thus, we repeat the empirical tests for Hypotheses 1-3 using this new measure of the VFI and report the corresponding results in Panel B of Table 9. Largely consistent to our previous main results,

³⁵ In this section, we only report the results for aggregated dependent variables, including total fiscal revenue, total tax revenue, local tax revenue, shared tax revenue, and extra-budgetary revenues. The results for specific individual tax are presented in Appendix from Table B1 to Table B4.

we find that the transfer dependency has a negative and statistically significant effect on the ratio of total fiscal revenues to GDP, ratio of total tax revenues to GDP, and ratio of local taxes to GDP. And simultaneously, it has no significant impact on the ratio of shared taxes to GDP and the ratio of extra-budgetary revenues to GDP. The magnitudes of the estimated coefficients for transfer dependency are only slightly smaller than those obtained using VFI as the explanatory variable. This may simply reflect the fact that fiscal transfers are close to, but do not fully capture, the actual fiscal gap of local governments due to the existence of the net remittances and deficits.

Third, some might be concerned about the needs for using GDP as a general reference for revenue collection, and the aforementioned results might be confounded by the potential effect of the VFI on GDP (the denominator) rather than actual tax revenues collected (the numerator). To address this concern and as robustness check, we use directly the actual revenues collected (in logarithm terms) as the dependent variables in our baseline specification and re-estimate models. The results are presented in Table 10, and they are quite robust and largely unchanged from those in Tables 5-8, lessening the concern over the measures of the dependent variables.

(Insert Table 10 Here)

Lastly, given that local officials care about their own political promotion, there may be a concern that in the presence of VFI, local officials may in turn face stronger incentives to increase (rather than reduce) their tax effort in order to finance sufficient revenues for development. In order to deal with this potential confounding factor and to show the robustness of the results, we further restrict our sample to those cities whose leaders (party secretaries) are under the age of 53; this age is usually regarded as a threshold of the final chance for getting promoted to (Chinese) city party secretaries (Yu et al., 2016). If political promotion concern does matter for local taxing behaviors, we would expect that in the estimations for this subsample, the negative effects of VFI may be reduced. Our results in Table 11 indicate that the estimates for VFI in all specifications are very close to what we obtained in the baseline estimations in terms of both magnitudes and significance level, suggesting that political promotion incentives might not be a first-order concern in our analysis of taxing behaviors.

(Insert Table 11 Here)

6. Conclusions

Since the TSS reform in 1994, the Chinese fiscal system has been characterized by the marked presence of VFI at the local level, giving rise to the twin common pool and soft budget constraint problems with the potential of significantly distorting the fiscal discipline of local governments. Using a large panel dataset at the city level in China for the years 1999-2009, this paper is the first to examine the effects of the VFI on local fiscal discipline in the context of taxing behaviors, while it explicitly explores the institutional conditions under which the impact of the VFI may actually take place.

We find that the VFI significantly reduces both the ratio of total fiscal revenues to GDP and the ratio of total tax revenues to GDP, supporting the prevailing argument that higher levels of the VFI may induce fiscal indiscipline by reducing tax effort of local governments. We take advantage of the unique Chinese fiscal institutional framework that assigns the taxing power for local taxes and shared taxes to two separate authorities (i.e., the local tax bureau and the central tax bureau, respectively), and we further explore the heterogeneous effect of the VFI on the revenue collection of local taxes and shared taxes. In doing so, we clearly identify the importance of local tax autonomy as an institutional backup for the functioning of the VFI. Specifically, our results reveal that local governments respond to the presence of the VFI by lowering their tax effort on local taxes, for which they have certain tax autonomy. However, higher levels of the VFI have no significant impact on the collection of shared taxes, which in turn come under the direct administration of the central government. We further show that the disciplining effect of the VFI does not exist for extra-budgetary revenues, which in turn, favors the institutional fact that extra-budgetary revenues are not incentive-compatible to the functioning mechanism of the VFI in China. Our results are shown to be robust across different specifications, correcting for the endogeneity of the VFI, and for alternative measures of the VFI.

From a policy perspective, if the continued expansion of the VFI at the local level and the resulting distorted taxing behaviors of local governments are deemed undesirable by the

Chinese national authority, then there will be a need to rebalance the expenditure assignments and revenue assignments to local governments. In theory, either assigning more revenue sources to local governments or recentralizing some of the existing expenditure responsibilities to the central government should help in that direction. In practice, since many social expenditure responsibilities in public welfare, including unemployment compensation and pensions, have long been wrongly assigned to subnational governments, especially at the lowest level (Liu et al., 2015), there is plenty of scope for China's central government to reassign and centralize those expenditure responsibilities. As the findings of this paper attest, this type of policy—or providing local governments with greater tax autonomy—would contribute significantly towards raising the fiscal discipline of local governments in China.

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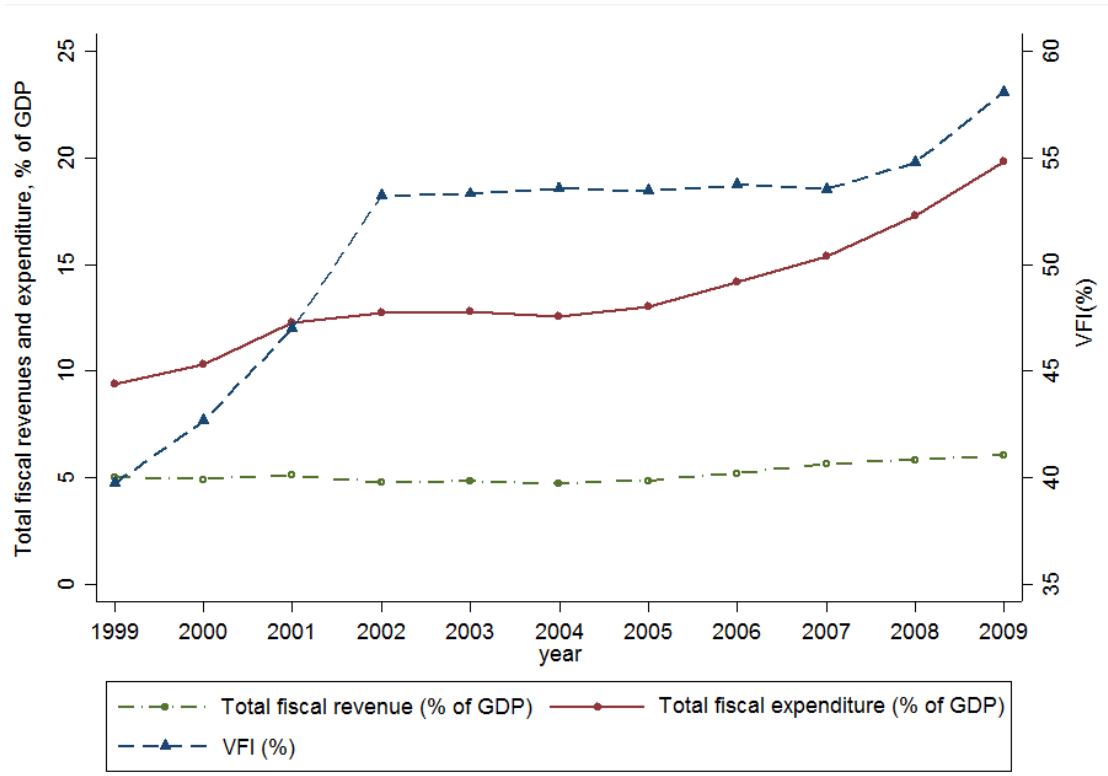


Fig. 1. Total fiscal revenue and expenditure, and the VFI of city governments

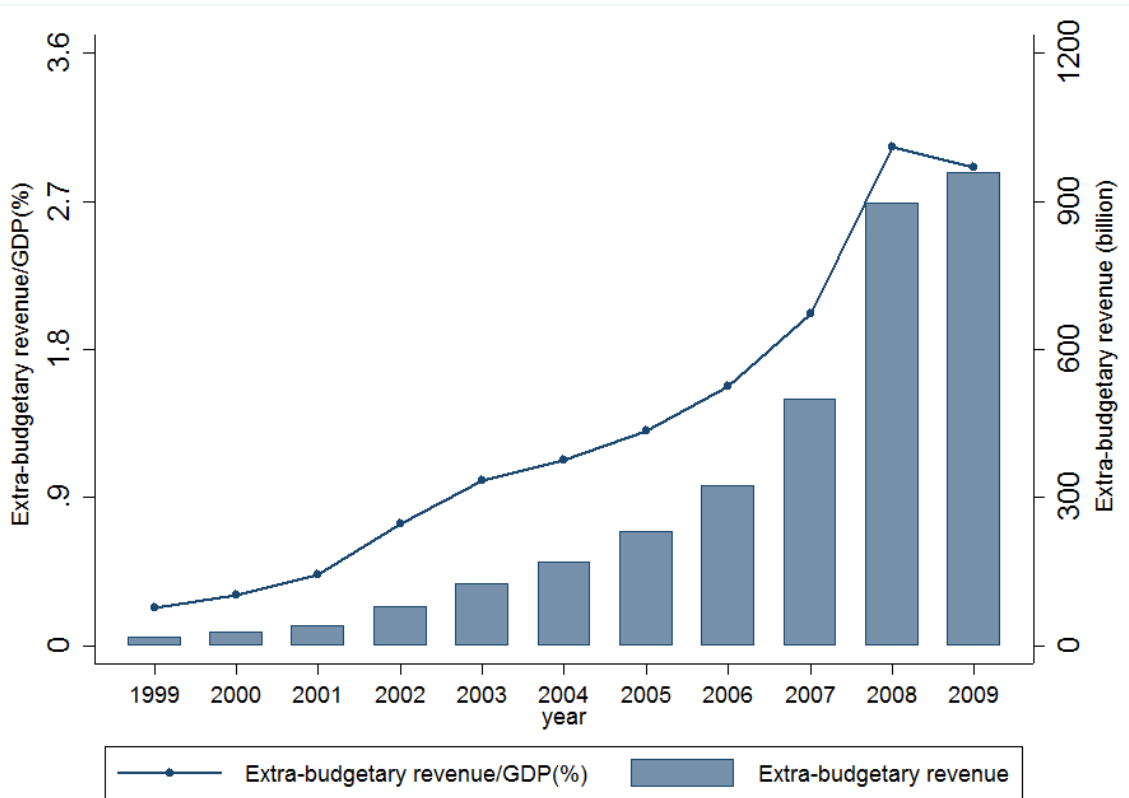


Fig. 2. The size of extra-budgetary revenue of city governments

Table 1. Summary statistics

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
Total fiscal revenue (% of GDP)	3,494	5.19	1.93	0.84	23.80
Total tax revenue (% of GDP)	3,469	3.80	1.65	0.34	18.17
Local tax revenue (% of GDP)	2,782	1.92	0.82	0.35	7.52
Business tax revenue (% of GDP)	3,477	1.15	0.67	0.15	6.65
Agriculture tax revenue (% of GDP)	2,797	0.51	0.38	0.01	2.93
Urban infrastructure tax revenue (% of GDP)	2,823	0.30	0.20	0.05	2.39
Shared tax revenue (% of GDP)	3,140	1.53	0.84	0.11	6.65
VAT revenue (% of GDP)	3,477	0.89	0.54	0.07	5.93
Corporate income tax revenue (% of GDP)	3,142	0.41	0.37	0.01	3.48
Personal income tax revenue (% of GDP)	3,475	0.24	0.17	0.02	2.61
Extra-budgetary revenue (% of GDP)	3,308	1.27	1.37	0.04	6.82
Industry and transportation sector fund (% of GDP)	1,822	0.03	0.05	0.00	0.40
Agriculture sector fund (% of GDP)	1,893	0.03	0.04	0.00	0.25
Land conveyance fee (% of GDP)	2,185	0.37	0.42	0.01	2.03
VFI (%)	3,560	51.22	23.10	-46.39	97.46
Log (real GDP per capita)	3,493	9.19	0.79	7.07	12.60
Log (population density)	3,507	5.34	1.36	-0.44	8.45
Share of secondary industry, as % of GDP	3,507	44.73	12.70	8.15	90.97
Share of tertiary sector, as % of GDP	3,467	35.60	7.69	8.50	85.34
Log (cultivation land per capita)	3,321	6.50	0.79	2.76	8.98
FDI/GDP (%)	2,870	2.45	3.56	0.00	51.41
Log (highway)	3,528	8.66	0.78	5.36	10.62
Log (passengers)	2,979	8.37	0.88	4.81	11.89
Number of cities	3,575	13.96	3.89	2	21
Number of counties	3,559	5.73	3.68	0	22
Rural Tax-for-Fee reform	3,452	0.73	0.44	0	1
Fiscally supported population, as % of total population	3,497	3.38	1.15	0.55	12.01
Log (age of the city party secretary)	3,371	3.93	0.09	1.61	4.25
Minority dummy for the city party secretary	3,383	0.92	0.27	0	1
Education of the city party secretary	3,318	4.66	0.82	1	7
Transfer dependency, as % of government expenditure	3,500	49.03	21.40	-7.59	98.80
Natural growth rate of population (‰)	3,283	5.75	3.43	-3.35	20.00
School-age (0-14 years) population in 1999 (10,000 persons)	3,542	83.11	53.28	2.82	277.28

Table 2. Fixed effects estimations: the disciplining effect of the VFI

Dependent variable	Total fiscal revenue (% of GDP)			Total tax revenue (% of GDP)		
	(1)	(2)	(3)	(4)	(5)	(6)
VFI	-0.103*** (0.014)	-0.120*** (0.016)	-0.121*** (0.017)	-0.036*** (0.007)	-0.035*** (0.008)	-0.033*** (0.008)
Economic controls	No	Yes	Yes	No	Yes	Yes
Political controls	No	No	Yes	No	No	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.653	0.787	0.792	0.524	0.560	0.562
Observations	3,081	2,559	2,416	3,071	2,552	2,409
Number of cities	292	266	266	292	266	266

Note: Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.

Table 3. First-stage estimation results for the IV estimations

	(1)	(2)	(3)	(4)	(5)	(6)
Change in the predicted school-age population (IV)	9.311*** (2.489)	7.432*** (2.300)	7.405*** (2.329)	9.339*** (2.486)	7.437*** (2.302)	7.399*** (2.331)
Economic controls	No	Yes	Yes	No	Yes	Yes
Political controls	No	No	Yes	No	No	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
IV first stage F-stat	13.99	10.44	10.11	14.11	10.44	10.08
Observations	3,077	2,559	2,415	3,067	2,552	2,408
Number of cities	288	266	265	288	266	265

Note: The dependent variable in the first-stage regressions is the *VFI*. The dependent variable in the second-stage regressions in Columns (1)-(3) is *Total fiscal revenue (% of GDP)*, while in Columns (4)-(6) it is *Total tax revenue (% of GDP)*. Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.

Table 4. IV validity test

Dependent variable	Total fiscal revenue (% of GDP)			Total tax revenue (% of GDP)		
	(1)	(2)	(3)	(4)	(5)	(6)
VFI	-0.102*** (0.014)	-0.120*** (0.016)	-0.121*** (0.017)	-0.035*** (0.007)	-0.034*** (0.008)	-0.032*** (0.008)
Change in the predicted school-age population (IV)	-0.320 (0.548)	0.027 (0.236)	0.111 (0.246)	-0.641 (0.461)	-0.382 (0.245)	-0.348 (0.262)
Economic controls	No	Yes	Yes	No	Yes	Yes
Political controls	No	No	Yes	No	No	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.654	0.787	0.792	0.526	0.561	0.562
Observations	3,081	2,559	2,416	3,071	2,552	2,409
Number of cities	292	266	266	292	266	266

Note: Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.

Table 5. IV estimations: the disciplining effect of the VFI

Dependent variable	Total fiscal revenue (% of GDP)			Total tax revenue (% of GDP)		
	(1)	(2)	(3)	(4)	(5)	(6)
VFI	-0.137** (0.055)	-0.116*** (0.025)	-0.106*** (0.026)	-0.104** (0.048)	-0.086*** (0.027)	-0.079*** (0.028)
Economic controls	No	Yes	Yes	No	Yes	Yes
Political controls	No	No	Yes	No	No	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
IV first stage F-stat	13.99	10.44	10.11	14.11	10.44	10.08
R-squared	0.386	0.633	0.629	-0.230	-0.066	-0.043
Observations	3,077	2,559	2,415	3,067	2,552	2,408
Number of cities	292	266	266	292	266	266

Note: Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.

Table 6. IV estimations: the effect of the VFI on local taxes

Dependent variable	Local tax revenue (% of GDP)	Business tax revenue (% of GDP)	Urban infrastructure tax revenue (% of GDP)	Agriculture tax revenue (% of GDP)
	(1)	(2)	(3)	(4)
VFI	-0.047*** (0.014)	-0.003 (0.011)	-0.007** (0.004)	-0.040*** (0.010)
Economic controls	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes
IV first stage F-stat	9.80	10.12	10.96	9.98
R-squared	-0.110	0.187	-0.024	-0.495
Observations	1,974	2,414	1,989	1,982
Number of cities	265	265	265	265

Note: Given data availability, the year coverage for the business tax is 1999-2009, and the year coverage for the urban infrastructure tax and the agriculture tax is 1999-2007. Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.

Table 7. IV estimations: the effect of the VFI on shared taxes

Dependent variable	Shared tax	VAT	Corporate	Effective corporate income	
	revenue	revenue (%)	income tax	tax rate (%)	
	(% of GDP)	of GDP)	revenue (% of GDP)	Firms established before 2002	Firms established after 2002
	(1)	(2)	(3)	(4)	(5)
VFI	-0.004 (0.013)	-0.003 (0.011)	0.005 (0.008)	-0.462 [†] (0.304)	-0.047 (0.426)
Economic controls	Yes	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes
IV first stage F-stat	12.27	10.12	12.60	11.00	8.48
R-squared	0.125	0.110	-0.065	-0.110	0.016
Observations	2,242	2,414	2,243	1,960	1,401
Number of cities	265	265	265	265	260

Note: Given data availability, the year coverage for the VAT is 1999-2009, and the year coverage for the corporate income tax is 2000-2009. The dependent variables in Columns (4) and (5) are the weighted effective corporate income tax rate at prefecture-city level for firms who were established before and after 2002, respectively. Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. † represents significance at the 10% level under a one-tail test.

Table 8. IV estimations: the effect of the VFI on extra-budgetary revenues

Dependent variable	Extra-budg- etary revenue (% of GDP)	Industry and transportation sector fund (% of GDP)	Agriculture sector fund (% of GDP)	Land conveyance fee (% of GDP)
	(1)	(2)	(3)	(4)
VFI	-0.042 (0.033)	0.002 (0.002)	0.000 (0.001)	-0.015 (0.015)
Economic controls	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes
IV first stage F-stat	15.78	4.93	7.00	17.83
R-squared	-0.015	-0.048	0.027	-0.044
Observations	2,336	1,365	1,408	1,606
Number of cities	265	244	241	262

Notes: Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.

Table 9. Robustness checks: alternative measures of the instrument and the VFI

Dependent variable	Total fiscal revenue (% of GDP)	Total tax revenue (% of GDP)	Local tax revenue (% of GDP)	Shared tax revenue (% of GDP)	Extra-budgetary revenue (% of GDP)
	(1)	(2)	(3)	(4)	(5)
<i>Panel A: Alternative measure of the instrument</i>					
VFI	-0.139*** (0.033)	-0.091*** (0.030)	-0.055*** (0.014)	0.005 (0.015)	-0.047 (0.041)
Economic controls	Yes	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes
IV first stage F-stat	8.47	8.37	9.73	8.75	11.41
R-squared	0.631	-0.129	-0.284	0.038	-0.041
Observations	2,325	2,318	1,899	2,158	2,246
Number of cities	255	255	255	255	255

Panel B: Transfer dependency as an alternative measure of the VFI

Transfer dependency	-0.099*** (0.029)	-0.071** (0.029)	-0.050*** (0.015)	-0.002 (0.013)	-0.047 (0.030)
Economic controls	Yes	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes
IV first stage F-stat	11.75	11.83	10.49	13.67	20.88
R-squared	0.146	0.093	-0.033	0.108	0.078
Observations	2,386	2,379	1,952	2,216	2,308
Number of cities	264	264	263	264	264

Note: Instrumental variable estimations are employed in the estimations. Alternative measure of the instrument (i.e., the change in the predicted school-age population) is calculated by using the 1989 school-age population as the base. Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.

Table 10. Robustness check: alternative measures of dependent variables

Dependent variable	Log(total fiscal revenue)	Log(total tax revenue)	Log(local tax revenue)	Log(shared tax revenue)	Log(extra- budgetary revenue)
	(1)	(2)	(3)	(4)	(5)
VFI	-0.020*** (0.005)	-0.019*** (0.007)	-0.028*** (0.007)	0.001 (0.011)	-0.003 (0.021)
Economic controls	Yes	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes
IV first stage F-stat	10.11	10.08	9.800	12.27	15.78
R-squared	0.745	0.349	0.227	0.171	0.163
Observations	2,415	2,408	1,974	2,242	2,336
Number of cities	265	265	265	265	265

Note: Instrumental variable estimations are employed in the estimations. Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.

Table 11. Robustness check: subsample with city leader under 53 years old

Dependent variable	Total fiscal revenue (% of GDP)	Total tax revenue (% of GDP)	Local tax revenue (% of GDP)	Shared tax revenue (% of GDP)	Extra-budge tary revenue (% of GDP)
	(1)	(2)	(3)	(4)	(5)
VFI	-0.102*** (0.021)	-0.097*** (0.027)	-0.051*** (0.013)	-0.009 (0.011)	-0.022 (0.029)
Economic controls	Yes	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes
IV first stage F-stat	12.14	12.06	10.67	13.68	22.11
R-squared	0.677	-0.217	-0.127	0.178	0.109
Observations	1,716	1,710	1,394	1,603	1,659
Number of cities	190	190	190	190	190

Note: Instrumental variable estimations are employed in the estimations. Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.

Appendix

Table A. Variable description and data source

Variables	Definition	Source
Total fiscal revenue (% of GDP)	Ratio of total fiscal revenues to GDP	Prefecture, City, and County Public Finance Statistics
Total tax revenue (% of GDP)	Ratio of total tax revenues to GDP	Prefecture, City, and County Public Finance Statistics
Local tax revenue (% of GDP)	Ratio of local tax revenues to GDP	Prefecture, City, and County Public Finance Statistics
Business tax revenue (% of GDP)	Ratio of business tax revenue to GDP	Prefecture, City, and County Public Finance Statistics
Agriculture tax revenue (% of GDP)	Ratio of agriculture tax revenue to GDP	Prefecture, City, and County Public Finance Statistics
Urban infrastructure tax revenue (% of GDP)	Ratio of urban infrastructure tax revenue to GDP	Prefecture, City, and County Public Finance Statistics
Shared tax revenue (% of GDP)	Ratio of shared tax revenues to GDP	Prefecture, City, and County Public Finance Statistics
VAT revenue (% of GDP)	Ratio of value-added tax revenue to GDP	Prefecture, City, and County Public Finance Statistics
Corporate income tax revenue (% of GDP)	Ratio of corporate income tax revenue to GDP	Prefecture, City, and County Public Finance Statistics
Personal income tax revenue (% of GDP)	Ratio of personal income tax revenue to GDP	Prefecture, City, and County Public Finance Statistics
Extra-budgetary revenue (% of GDP)	Ratio of total extra-budgetary revenues to GDP	Prefecture, City, and County Public Finance Statistics
Industry and transportation sector fund (% of GDP)	Ratio of industry and transportation sector fund to GDP	Prefecture, City, and County Public Finance Statistics
Education sector fund (% of GDP)	Ratio of education sector fund to GDP	Prefecture, City, and County Public Finance Statistics
Agriculture sector fund (% of GDP)	Ratio of agriculture sector fund to GDP	Prefecture, City, and County Public Finance Statistics
Land conveyance fee (% of GDP)	Ratio of land conveyance fee GDP	Prefecture, City, and County Public Finance Statistics
VFI (%)	Ratio of the difference of a city's total fiscal expenditures and revenues to its total fiscal expenditures	Prefecture, City, and County Public Finance Statistics
Log (real GDP per capita)	Log of real GDP per capita	China Statistical Yearbook for Regional Economy
Log (population density)	Total population divided by the area (log)	China Statistical Yearbook for Regional Economy

Share of secondary sector	Ratio of value-added of secondary sector to GDP	Prefecture, City, and County Public Finance Statistics
Share of tertiary sector	Ratio of value-added of tertiary sector to GDP	Prefecture, City, and County Public Finance Statistics
Log (cultivation land per capita)	Log of cultivation land per capita	China Statistical Yearbook for Regional Economy
FDI/GDP (%)	Ratio of foreign direct investment to GDP	China Statistical Yearbook for Regional Economy
Log (highway)	Log of the length of highways	China Statistical Yearbook for Regional Economy
Log (passengers)	Log of the total number of annual passengers	China Statistical Yearbook for Regional Economy
Number of cities	The number of cities in a province	China Statistical Yearbook
Number of counties	The number of counties in a city	China Statistical Yearbook
Rural Tax-for-Fee reform	=1 if the city has implement the rural Tax-for-Fee reform	Official documents from provincial governments
Fiscally supported population	Ratio of fiscally supported population to total population	Prefecture, City, and County Public Finance Statistics
Log(age of the city party secretary)	Log of the age of the party secretary of the city	Public information from the prefecture-city government's bulletins
Minority dummy for the city party secretary	=1 if the party secretary of the city is from ethnic minorities	Public information from the prefecture-city government's bulletins
Education of the city party secretary	The level of the education of the party secretary of the city. 1:technical secondary school; 2: high school; 3: junior college; 4: bachelor degree; 5: master degree; 6: doctorate; 7: post-doc.	Public information from the prefecture-city government's bulletins
Transfer dependency (%)	Ratio of total transfers to total fiscal expenditures	Prefecture, City, and County Public Finance Statistics
Natural growth rate of population	Natural population growth rate (‰)	China Statistical Yearbook for Regional Economy
School-age population	School-age (0-14 years) population in 1999 (10,000 persons)	Provincial Tabulation on the 2000 Population Census

Table B1. Robustness checks: alternative measures of the instrument

Dependent variable	Local tax revenue			Shared tax revenue		Extra-budgetary revenue		
	Business tax revenue (% of GDP)	Urban infrastructure tax revenue (% of GDP)	Agriculture tax revenue (% of GDP)	VAT revenue (% of GDP)	Corporate income tax revenue (% of GDP)	Industry and transportation sector fund (% of GDP)	Agriculture sector fund (% of GDP)	Land conveyance fee (% of GDP)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VFI	-0.000 (0.011)	-0.010** (0.004)	-0.051*** (0.013)	0.004 (0.012)	0.007 (0.009)	0.004 (0.003)	-0.000 (0.001)	-0.011 (0.015)
Economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IV first stage F-stat	8.47	11.22	9.88	8.47	8.89	3.91	5.30	17.27
R-squared	0.171	-0.132	-1.142	0.035	-0.121	-0.473	0.047	-0.007
Observations	2,324	1,914	1,907	2,324	2,159	1,314	1,351	1,546
Number of cities	255	255	255	255	255	234	231	252

Note: Instrumental variable estimations are employed in the estimations. Alternative measure of the instrument (i.e., the change in the predicted school-age population) is calculated by using the 1989 school-age population as the base. Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.

Table B2. Robustness checks: alternative measures of the VFI

Dependent variable	Local tax revenue			Shared tax revenue		Extra-budgetary revenue		
	Business tax revenue (% of GDP)	Urban infrastructure tax revenue (% of GDP)	Agriculture tax revenue (% of GDP)	VAT revenue (% of GDP)	Corporate income tax revenue (% of GDP)	Industry and transportation sector fund (% of GDP)	Agriculture sector fund (% of GDP)	Land conveyance fee (% of GDP)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Transfer dependency	-0.001 (0.011)	-0.008** (0.004)	-0.045*** (0.011)	-0.001 (0.011)	0.004 (0.008)	0.002 (0.003)	0.000 (0.002)	-0.019 (0.019)
Economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IV first stage F-stat	11.75	11.79	10.13	11.75	14.24	5.51	8.25	20.20
R-squared	0.168	0.004	-0.495	0.106	-0.039	-0.099	0.032	-0.025
Observations	2,385	1,967	1,959	2,385	2,217	1,352	1,395	1,590
Number of cities	264	263	263	264	264	243	240	260

Note: Instrumental variable estimations are employed in the estimations. Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.

Table B3. Robustness check: subsample with city leader under 53 years old

Dependent variable	Local tax revenue			Shared tax revenue		Extra-budgetary revenue		
	Business tax revenue (% of GDP)	Urban infrastructure tax revenue (% of GDP)	Agriculture tax revenue (% of GDP)	VAT revenue (% of GDP)	Corporate income tax revenue (% of GDP)	Industry and transportation sector fund (% of GDP)	Agriculture sector fund (% of GDP)	Land conveyance fee (% of GDP)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VFI	-0.004 (0.009)	-0.006** (0.003)	-0.044*** (0.010)	-0.005 (0.010)	0.001 (0.007)	0.001 (0.001)	0.001 (0.001)	-0.011 (0.013)
Economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IV first stage F-stat	12.15	10.73	10.29	12.15	13.68	9.68	13.51	23.76
R-squared	0.224	0.035	-0.631	0.145	0.042	-0.018	-0.022	-0.016
Observations	1,715	1,402	1,402	1,715	1,603	964	993	1,124
Number of cities	190	190	190	190	190	175	173	188

Note: Instrumental variable estimations are employed in the estimations. Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.

Table B4. Robustness check: alternative measure of dependent variables

Dependent variable	Local tax revenue			Shared tax revenue		Extra-budgetary revenue		
	Log(business tax revenue)	Log(urban infrastructure tax revenue)	Log(agriculture tax revenue)	Log(VAT revenue)	Log(corporate income tax revenue)	Log(industry and transportation sector fund)	Log(agriculture sector fund)	Log(land conveyance fee)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VFI	0.007 (0.009)	-0.016* (0.008)	-0.060*** (0.021)	0.000 (0.012)	0.001 (0.023)	-0.007 (0.049)	-0.010 (0.046)	-0.012 (0.025)
Economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Political controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province × Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IV first stage F-stat	10.12	10.96	9.975	10.12	12.60	4.932	6.997	17.83
R-squared	0.319	0.085	0.028	0.241	0.086	0.048	0.044	-0.002
Observations	2,414	1,989	1,982	2,414	2,243	1,365	1,408	1,606
Number of cities	265	265	265	265	265	244	241	262

Note: Instrumental variable estimations are employed in the estimations. Economic control variables include *Log (real GDP per capita)*, *Log (population density)*, *Share of secondary sector*, *Share of tertiary sector*, *Fiscally supported population*, *Log (cultivation land per capita)*, *FDI/GDP*, *Log (highway)*, *Log(passengers)*, *Rural Tax-for-Fee reform*, *Number of cities*, and *Number of counties*. Political control variables include *Log (age of the city party secretary)*, *Square of Log (age of the city party secretary)*, *Minority dummy for the city party secretary*, and *Education of the city party secretary*. Robust standard errors are reported in parentheses. *, **, and *** denote the significance at the 10%, 5%, and 1%, respectively.