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Fiscal decentralization and China's provincial economic growth: a panel data analysis for China's tax sharing system

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Abstract Theoretical studies suggest that there is a close association between fiscal decentralization and economic growth. However, whether this linkage holds in China or not is a matter of ongoing debate in recent empirical studies. In this paper, we investigate the impact of the 1994 tax sharing system on economic growth in China. Using a panel dataset for 29 provinces in China over the 1995–2014 period in a simultaneous equations system that controls for the simultaneity of fiscal decentralization, physical capital accumulation and economic growth, the influence of decentralization on economic growth is estimated. The estimation results indicate that there is an inverted-U shaped relationship between fiscal decentralization and economic growth. Because the optimal level of fiscal decentralization that maximizes economic growth is higher than the data for most provinces, further decentralization is in general helpful to China's economic growth.

Keywords Fiscal decentralization · Economic growth · Simultaneous equations system · Panel data · China

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1 Introduction

The contribution of institutional reform to China's economic performance has been investigated by numerous works in recent years. Among them, one of the key reform programs that have had a profound impact on China's economic growth is the fiscal decentralization. Fiscal decentralization in China is roughly the same as in the other countries of the world, meaning that the central government gradually loosens its fiscal control and grants fiscal autonomy to the local governments (Lin and Liu 2000). Despite a unitary political system and its idiosyncrasies in the collection and distribution of fiscal resources, the fiscal distribution in China has made a significant progress alongside the rapid growth of China's economy.

According to the classic theory developed by Tiebout (1956), the most advantage of fiscal decentralization is that, due to proximity and informational advantages, local governments are able to respond better to local needs and services, thereby promoting economic growth. Hence, labor mobility and cross-regional competition for public goods and services force local governments to listen closely to the needs of the local communities. The conventional wisdom indicates that fiscal decentralization promotes economic growth (e.g., Tiebout 1956; Musgrave 1959; Oates 1972). There has been a growing body of literature that examined and verified the conventional wisdom using different samples, of which the representative studies include Desai et al. (2005), Iimi (2005) and Buser (2011). However, in contrast to the arguments in favor of fiscal decentralization, an increasing number of studies have shown that the effects of fiscal decentralization have seldom lived up to expectations (e.g., Davoodi and Zou 1998; Morgan 2006, 2007; Bodman 2011). This skepticism is usually fuelled by the various practical problems that emerged alongside fiscal decentralization, such as higher government deficits, the inefficiency of government decisions, corruption, and a fragmented national market, all of which can harm overall economic growth (Prud'Homme 1995; Yang 1997; Young 2000). Thornton (2007) claimed that when fiscal decentralization is defined as the revenues over which sub-national governments have full autonomy, it does not have significant impact on economic growth. As fiscal decentralization and political decentralization is closely related, the empirical results of Ezcurra and Rodríguez-Pose (2013) indicated that relationship between political decentralization and economic growth is insignificant, therefore the impact of fiscal decentralization on growth is also not significant. Besides, Enikolopov and Zhuravskaya (2007) argued that the results of fiscal decentralization depend on the countries' political institutions: a strong national party system that preserves their accountability to the local constituencies is necessary for efficient decentralization. More recently, Rodríguez-Pose and Ezcurra (2011) and Baskaran and Feld (2013) both found that fiscal decentralization has negative impacts on economic growth in Organization for Economic Co-operation and Development (OECD) countries. Some recent studies found that the fiscal revenue decentralization and fiscal expenditure decentralization have different impacts on economic growth. Nguyen and Anwar (2011) found empirical evidence that economic growth in Vietnam is positively associated with fiscal revenue decentralization but negatively related with fiscal expenditure decentralization. Interestingly, using a panel dataset of 23 OECD countries between 1972 and 2005, Gemmell et al. (2013) also found similar results for OECD countries.

With respect to China, Lin and Liu (2000) claim that fiscal decentralization coupled with the household responsibility system are the two most important reform programs that were implemented during the reform period. Some scholars even argue that fiscal decentralization has played a fundamental role in China's economic success (Oi 1992;

Qian and Weingast 1997; Qian 1999). Despite the theoretical advantages, the empirical evidence of the effects of fiscal decentralization on China's economic growth is controversial. For example, as an influential early work, Zhang and Zou (1998) utilized a provincial panel data from 1970 to 1992 to obtain empirical evidence that is contrary to the theoretical expectations. They claimed that China's fiscal decentralization had a negative impact on the provincial economic growth. In a follow-up study, Jin and Zou (2005) reported a similar negative relationship for an extended dataset that covered up until 1999, except for the period of 1994–1999. Using a similar dataset, however, Lin and Liu (2000) found that fiscal decentralization has positive impacts on economic growth; and Zhang and Gong (2005) showed that the contribution of fiscal decentralization to provincial economic growth was significantly negative before 1994 but turned to significantly positive afterward. Qiao et al. (2008) found that fiscal decentralization has led to not only economic growth but also a significant increase in regional inequality. Similarly, Chu and Zheng (2013) found evidence for the positive relationship between fiscal decentralization and regional economic growth in China using a simultaneous equations system which incorporates output, fiscal decentralization, physical capital and human capital. Besides, some recent studies also reported that fiscal decentralization led to higher fiscal expenditures of local governments (Jia et al. 2014) and FDI inflow (He and Sun 2014), since both government expenditure and FDI are generally contribute to economic growth, these recent researches also provided evidence for the positive relationship between fiscal decentralization and economic growth.

The above results, however, have to be taken with a grain of salt. In empirical studies, the effect of fiscal decentralization on economic growth is usually estimated using a growth regression model in which the economic growth rate is the dependent variable and fiscal decentralization is one explanatory variable, while the physical capital accumulation or private investment is often included in the model as another explanatory variable. However, such research design might be unable to detect the actual influence of fiscal decentralization on economic growth. It should be noted that the level of fiscal decentralization restricts the ability of local governments to conduct ambitious infrastructure investment programs, and these restrictions, in turn, affect the local economic growth as investment becomes an increasingly important growth engine for China's economy.[1] However, robust economic growth increases the tax base and the various extra-budgetary fiscal revenues (such as the land granting income of local governments), which could in turn improve fiscal resource abundance of local governments and thereby promote fiscal decentralization. Hence, the existing studies have not considered the simultaneity; therefore, their estimation results could suffer from simultaneity bias and are therefore insufficient[2] To overcoming such problem, a simultaneous equation model (SEM) should be conducted.

Measurement error poses another problem in previous studies. Most studies have employed data from before 1994, when the tax sharing system (TSS) was adopted. Because of frequent policy adjustments in the early stages of fiscal decentralization, the early data could be prone to inconsistency and measurement error. Moreover, the fiscal

[1] According to the statistics from China's Statistic Yearbooks, China's capital formation rate had increased from 38.2 % in 1978 to 45.9 % in 2014, while the final consumption rate had decreased from 62.1 to 51.4 % during the same period. The empirical estimations of Chow and Lin (2002) and Miyamoto and Liu (2005) indicated that investment has indeed played an important role in China's economic growth in the post-reform era since 1978.

[2] For instance, Qiao et al. (2008) have tried to control for the simultaneity of economic growth and the geographic distribution of fiscal resources. However, the simultaneous problem discussed here is probably more important and relevant considering the important role of investment in China's economic growth.

decentralization indicator was apparently improperly measured in some studies, which could lead to problematic estimation results.[3]

Given the drawbacks in the empirical aspect, a SEM is carefully designed to control for the potential simultaneity of fiscal decentralization, capital accumulation and economic growth. Using a panel dataset from 1995 to 2014 (i.e. the time after the implementation of the TSS), we estimated the effects of fiscal decentralization on economic growth, which is the main contribution of this study. Moreover, because the existing estimation results on the relationship between economic growth and fiscal decentralization is rather controversial, the possible nonlinear relationship between economic growth and fiscal decentralization may exist. Hence, the potential nonlinear relationship is explicitly explored by simultaneously incorporating the level of fiscal decentralization and its squared term, which is another contribution of this study. In this regard, this study also contributes to the theory that there might exist an "optimal level" of fiscal decentralization for a transitional economy like China. The estimation results also have important policy implications for China nowadays at a crossroad of further fiscal system reform: if the "optimal level" of fiscal decentralization indeed exists, there would be a limit for expanding fiscal decentralization to benefit future economic development in China, and the fiscal policies should differentiate across different regions to maximize the positive effects of fiscal decentralization.

The remainder of the paper is structured as follows. Section "Historical background: Fiscal decentralization in China" provides a brief review of fiscal decentralization history in China. Section "Hypothesis, estimation methodology and data" describes the set-ups of the simultaneous equations model (SEM) and the data used for estimation. In section Estimation results and robustness tests, the estimation results of the SEM are reported and discussed in the light of previous studies. Finally, section "Conclusion and policy implications" concludes and discusses corresponding policy implications.

2 Historical background: fiscal decentralization in China

2.1 The fiscal responsibility system (FRS): 1980–1993

Before 1978, Chinese provinces had no fiscal autonomy at all, while the central government fully disposed all of the fiscal resources, including the way and the amount how they were collected and distributed. The early experiments of fiscal decentralization in China were carried out in 1980. In the first 5 years—the exploring period of the FRS—the revenue sharing rules changed frequently. In 1985, a significant change in the fiscal arrangement was made to raise the portion of the shared revenue in the total government budget to a sufficiently high level. Under the 1985 fiscal arrangement, the central government relied on the local governments to increase the total revenues and to provide resources to the central government. Despite much fine-tuning in the following years, the 1985 arrangement remained the cornerstone of the FRS before it was replaced by the Tax Sharing System (TSS) in 1994.

[3] For example, Lin and Liu (2000) use the marginal retention rate on the revenue increments by the provincial governments as the measure of fiscal decentralization. Therefore the subsidy-receiving provinces have a 100 % retention rate, similar to the provinces that remit a fixed amount of their revenues to the central government. As shown in Table 1 of their paper, the fiscal decentralization for 25 out of 28 provinces reached 100 % in 1988.

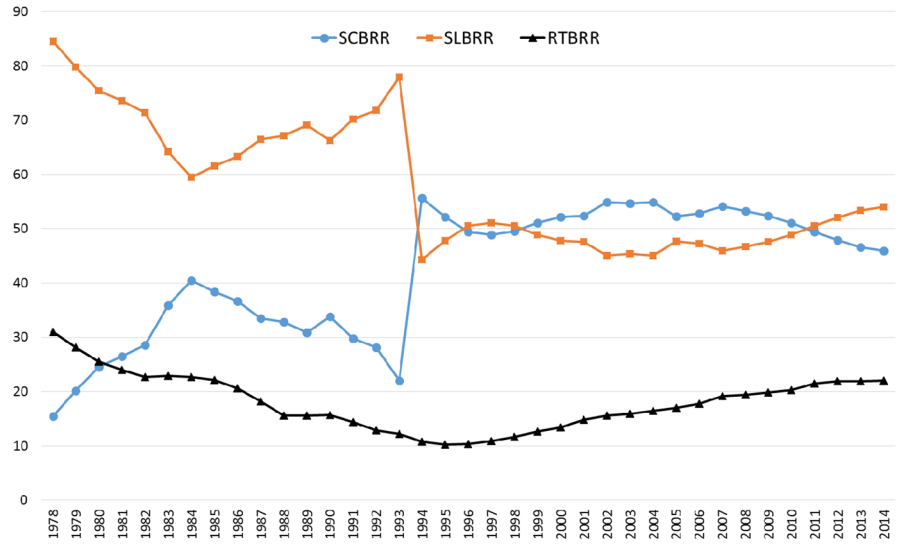

Fig. 1 The Share of Central Budgetary Revenue Relative to Total Fiscal Revenue (SCBRR), the Share of Local Budgetary Revenue Relative to Total Fiscal Revenue (SLBRR), and the Ratio of Total Budgetary Revenue Relative to GDP (RTBRR), 1978–2014, %

However, the 1985 fiscal decentralization arrangement did not effectively stimulate the local governments to collect the shared revenues, and the local governments gradually reduced the tax burden of the local enterprises to promote local economic growth. Meanwhile, to maintain the ability to finance local expenditures, the local governments turned to various out-of-system revenues.[4] These efforts were expended at a cost to the central government: the ratio of the central government revenue sharing to that of the local governments decreased steadily from 35 % in 1978 to 12 % in 1992 (see Fig. 1).

2.2 The tax sharing system (TSS): 1994–today

Because of the undesirable consequences of the FRS, the central government launched a brand-new system in 1994—the "TSS"—which for the first time explicitly defined central, shared, and local taxes between the central government and the provinces. The tax collection was also split into central and provincial administrations, with the former collecting the central and shared taxes and the latter collecting the provincial taxes. The effect of the TSS is obvious: in 1994, the first year after the TSS was introduced, the share of fiscal revenues for the central government to the total fiscal revenue saw a substantial leap to 56 % from 22 % in the previous year (see Fig. 1), and this ratio remained above 50 % between 2000 and 2010. In recent years, the ratio of central government fiscal revenues to total fiscal revenues fell slightly below 50 to 45.9 % in 2014.

[4] Before 1993, China's state-owned enterprises (SOEs) were generally controlled and operated by local governments. Local governments were allowed to keep the retained revenues of the local SOEs as extra-budgetary revenue; hence, they tended to provide various types of advantageous conditions to the local SOEs, such as tax relief and administrative privileges to keep the local SOEs from cross-regional competition. In turn, many local SOEs were required to share the spending responsibilities of the local governments. To a certain extent, the local governments played the role of a de facto agency of the local SOEs (Steinfeld 1999).

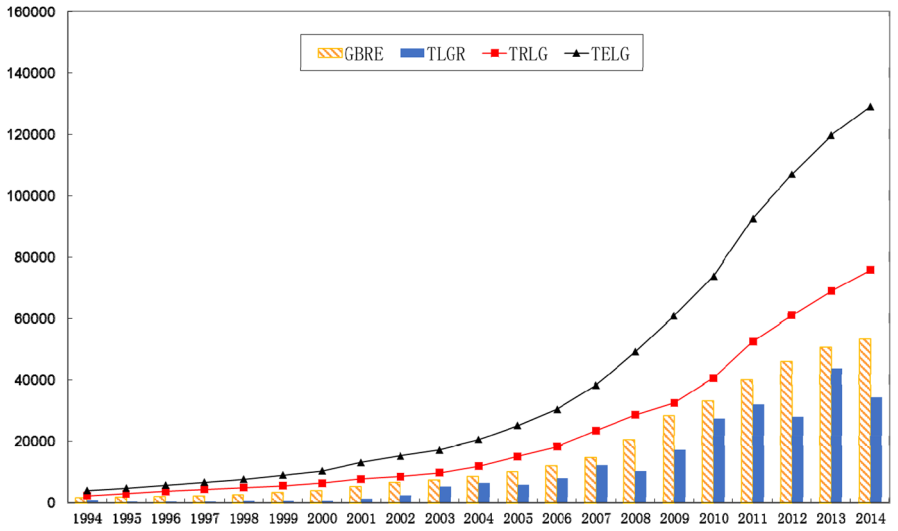

Fig. 2 The Total Revenues of Local Governments (TRLG), The Total Expenditures of Local Governments (TELG), the Gap Between the Revenues and the Expenditure of Local Governments (GBRE), and the Total Land Granting Revenues (TLGR), 1994–2014, 100 million yuan

Although the TSS reform caused a decrease in the revenue share of the local governments, the expenditure burden of the local governments did not correspondingly reduce.[5] Therefore, the TSS has essentially shifted the fiscal burden onto the local governments. Even though the central government has increased the transfer payments to the local governments over time, the budgetary revenue of the local governments still fell short of their expenditure needs (Hao 2015; also see Fig. 2). The persistent fiscal difficulties forced the local governments to look for extra income beyond the fiscal arrangement. Since the housing commercialization reform was launched in 1999, the land granting income has become the most important source of extra-budgetary revenue (see Fig. 2). Another important source of extra-budgetary fiscal revenue for the local governments is various loans from commercial banks. Although China's local governments were never supposed to borrow in the first place, the central authority tacitly allowed them to borrow money from banks by setting up so-called local government financing vehicles. According to a report from the National Audit Office, in 2010, the local-government debts totaled as 10.7 trillion yuan ($1.65 trillion) or 27 % of China's gross domestic product that year.[6] The ballooned extra-budgetary revenues of the local governments have mitigated the effort of

[5] A recent case for the mismatch of financial resources and responsibilities between the central and the local governments was the stimulation program that was designed to cushion China's economy from the eruption of the global financial crisis in late 2008. The central government supplied only 1.2 trillion yuan of the total 4 trillion yuan project, with the other 2.8 trillion yuan being contributed by the local governments and private investors. Eventually, the local governments additionally spent up to 10.7 trillion on the various complementary local stimulation programs.

[6] See http://www.bloomberg.com/news/2010-06-28/china-tackling-local-government-debt-risks-may-undermine-growth-cicc-says.html. Some analysts believed that the National Audit Office's figure failed to count certain types of local government debt, implying that the actual total could be even higher. For example, soon after the release of China's official report, Moody's said that according to their own estimate, the debt levels of China's local governments might be RMB 3500 billion higher than the officially admitted number.

the fiscal revenue recentralization after the implementation of the TSS, but the increasing reliance of local governments on the extra-budgetary revenues has also caused new problems.[7]

The latest dramatic move in China's fiscal reform is to replace business tax by value added tax (VAT). After 4 years' pilots in selected industries and regions, Chinese government has decided to expand the reform and introduce VAT on financial services, construction and real estate, and consumer services such as food, catering and accommodation in 2016.[8] The main purpose of this reform is to reduce the cost of enterprises and investment by avoiding double taxation. This reform also has significant impacts on fiscal decentralization. Because business tax belongs to a local tax while VAT is a central tax, the expansion of the reform would cause an increase in central fiscal revenues at the expense of local fiscal revenues. As a result, the broader introduction of VAT suggests a lower degree of fiscal revenue decentralization. Because local fiscal expenditure is closely related with local fiscal income, the fiscal expenditure decentralization is also expected to be decreased under reform.

3 Hypothesis, estimation methodology and data

3.1 Estimation methodology

Given the potential endogeneity between fiscal decentralization and economic growth, it is necessary to utilize a simultaneous equations model (SEM) as the estimation method, as Bodman (2011) and Chu and Zheng (2013) did. The first equation of this SEM should be a growth regression based on Levine and Renelt (1992) and Woller and Phillips (1998). Moreover, as mentioned previously, to investigate whether there is a nonlinear relationship between economic growth and fiscal decentralization, the squared term of fiscal decentralization is also introduced, as Akai et al. (2007) and Qiao et al. (2008) did. Concretely, the *growth equation* has the following form:

$$GR_{i,t} = \alpha_0 + \alpha_1 FD_{i,t} + \alpha_2 \left(FD_{i,t}\right)^2 + \alpha_3 INV_{i,t} + \alpha_4 Control_{i,t} + u1_i + \varepsilon 1_{i,t} \quad (1)$$

where $GR_{i,t}$ represents the real GDP per capita growth rate, $FD_{i,t}$ is the measure of the fiscal decentralization level, $(FD_{i,t})^2$ is the squared term of $FD_{i,t}$, $INV_{i,t}$ is the growth rate of per capita physical capital in real terms, and $Control_{i,t}$ is a set of additional control variables that are believed to be highly related to China's economic growth. The subscripts i and t represent the corresponding province and year, respectively. The unobserved province-specific factors are captured by the time-constant province-specific error $u1_i$; $\varepsilon 1_{i,t}$ is an idiosyncratic error. Because this equation is the central concern of the study, the measurement of FD and the choice of the control variables will be elaborated in detail in the next subsection.

[7] For example, the rocketing real estate prices in China have already become a social and political problem. However, because the real estate market boom is the premise for local governments to obtain high land granting revenue from the real estate developers, they do not have an incentive to curb the recent, rampant speculation in the real estate market.

[8] For more information, please refer to http://www.reuters.com/article/us-china-economy-tax-idUSKCN0V31AB and https://www.dlapiper.com/en/us/insights/publications/2016/03/global-tax-news-mar-2016/china-expands-vat-reform-to-new-sectors/.

Next, the *capital accumulation equation* and the *fiscal decentralization equation* are defined in the following way:

$$INV_{i,t} = \beta_0 + \beta_1 FD_{i,t} + \beta_2 GR_{i,t} + \beta_3 I\_1_{i,t} + \beta_4 R_{i,t} + \beta_5 GDP\_1_{i,t} + u2_i + \varepsilon 2_{i,t} \quad (2)$$

$$FD_{i,t} = \gamma_0 + \gamma_1 INV_{i,t} + \gamma_2 TAX_{i,t} + \gamma_3 RW_{i,t} + \gamma_4 LANDI_{i,t} + u3_i + \varepsilon 3_{i,t} \quad (3)$$

In the *capital accumulation* Eq. (2), *INV* is the dependent variable, and *FD* and *GR* are two explanatory variables. In addition, according to economic theory, the real interest rate (*R*) affects investment and is added as an explanatory variable.[9] Considering the fact that the level of economic development would affect the capital accumulation growth rate, the Moving average of per capita real GDP in previous five years (*GDP_1*) is also introduced as an explanatory variable.

Regarding the *fiscal decentralization Eq.* (3), *INV* is necessarily included as an explanatory variable.[10] Because the determination of the fiscal decentralization has to take into account the regional historical development level and the differences across regions, a relative wealth indicator-*RW*, measured by the ratio of per capita provincial GDP to per capita national GDP, are added as an explanatory variable. Because the tax revenues are the main resources for the local budgetary revenues, the composite tax rate (*TAX*, measured as the ratio of total tax revenue to GDP) is also introduced as a regressor. In addition, to estimate the effect of the land granting revenue on fiscal decentralization, the ratio of the land granting income to GDP (*LANDI*) is added as another explanatory variable. Because some factors, such as geographic land area, are basically invariable over time, the effects of these factors are captured by the time-invariable residual $u3_i$.[11]

The SEM consists of the Eqs. 1, 2 and 3. All of these equations are fully identified because for each equation there is at least one exogenous or predetermined variable in another equation that is not contained in that equation, which satisfies the rank conditions for the identification of an SEM. The basic estimation method for the identified SEM is a two-stage least squares (2SLS) method, which is essentially an instrument variable (IV) estimate with multiple instruments. Because there might be a contemporaneous correlation of disturbances across the equations in this SEM, the more appropriate estimation method should be a three-stage least squares (3SLS) estimation. 3SLS is generally recommended over 2SLS when the disturbances of the separate equations are correlated and is considered to be consistent and asymptotically more efficient (Kennedy 2011).

It should be noted that, although Chu and Zheng (2013) also utilized a simultaneous equations system to investigate the relationship between fiscal decentralization and economic growth in China, their study has at least four important disparities comparing with

[9] The real interest rate is defined as the difference between the nominal interest rate and the inflation rate. In this study, we use the difference in the one-year benchmark loan interest rate and the GDP deflator as the measure of the real interest rate. Although China's monetary policy, including the decisions on key interest rates, has been tightly controlled by the central authority and the commercial banks and financial institutions have no right to set nominal interest rates on their own, the different inflation rates in the different provinces cause real interest rate variation among provinces.

[10] Panizza (1999) and Arzaghi and Henderson (2005) have described a similar relationship that economic development determines fiscal decentralization.

[11] According to Panizza (1999) and Arzaghi and Henderson (2005), other factors that influence fiscal decentralization include ethnic fractionalization, geographic area and the level of democracy. The geographic area of a province does not change over time, and its effect is reflected in the time-constant error u3i. The other two factors change slowly over time, and their effect is incorporated in the first lag of fiscal decentralization.

our work. First of all, the potential nonlinear relationship between economic growth and fiscal decentralization is investigated explicitly in this study, while Chu and Zheng (2013) merely examined the conventional linear relationship. Second, Chu and Zheng (2013) assumed that fiscal decentralization does not affect economic growth directly, instead its impact on economic development is obtained through its effects on physical and human capital stock. However, as Zhang and Zou (1998) and Zhang and Gong (2005) have clarified, fiscal decentralization has direct influences on economic development, which might dominant the indirect effects that Chu and Zheng (2013) focused on. As a result, in this study, we focus on the direct influences of fiscal decentralization on economic growth through an appropriate simultaneous equation system. Third, the time period examined by Chu and Zhang (2013) is 1996–2005, while in this study we chose 1995–2014 as the sample period. Considering the fact that China's economy developed very fast since early 1990 s, covering a longer time period could give us a more comprehensive understanding of the nexus of China's fiscal decentralization and economic growth. Fourth, we have used panel 3SLS, 2SLS as well as conventional panel data Fixed effects and ordinary least squares (OLS) methods to test and verify the robustness of the estimations, while Chu and Zhang (2013) just made a one-shot estimation without any robustness check.

3.2 The data

We use a panel dataset for 29 of China's provinces over the 1995–2014 period.[12] The beginning year of the TSS, 1994, is excluded from the sample period because the central-to-provincial government transfers started to be recorded in the budget in 1995. A province is treated as the lowest subnational level of governments in my dataset because the fiscal arrangements of the TSS are generally between the central and the provincial governments.[13]

3.2.1 The measurement of fiscal decentralization

As discussed previously, a reasonable and accurate measurement of this indicator is a necessary precondition for a meaningful and correct estimation result from the SEM.

According to classic fiscal decentralization theory, the devolution of fiscal powers and responsibilities from the national to the subnational governments is related to four main interrelationships among the different government levels: (1) expenditure decisions, (2) taxing and revenue-raising powers, (3) intergovernmental fiscal transfers and (4) subnational borrowings (Vo 2010).[14] Therefore, the reasonable fiscal decentralization

[12] There are currently 23 provinces, four Centrally Administered Municipalities, and five autonomous regions in the mainland of China's territory. Because these entities are administratively equal, we use the term "province" throughout the paper. Chongqing was a prefecture-level city in Sichuan province and only became a new municipality in 1997. Therefore, in my database, Chongqing's statistics are added back to those of Sichuan for the years after 1997. Tibet is dropped from the dataset because of data unavailability.

[13] China's fiscal system has five hierarchical levels of government: (1) central, (2) provincial, (3) prefecture, (4) county, and (5) township. In the context of China, the fiscal revenue and expenditure arrangements of the lower-level governments are tightly controlled by the higher-lever counterparts; therefore, the fiscal rights of the last three tiers of the government are essentially in the hand of the provincial governments.

[14] These four aspects of fiscal decentralization belong to "the first generation theory" of fiscal decentralization, according to Vo (2010). The second generation theory of fiscal decentralization, characterized in terms of two motivating issues, incentives and knowledge (Vo 2008), is only newly emerging and does not appear to represent a coherent system of analysis yet. Therefore, in this paper, we only focus on the mature first generation theory of fiscal decentralization.

measurements should consider all of these four relationships. In the context of China, currently, the power of the expenditure decision might be the most important aspect of these four core responsibilities. The reason for the importance of this power is straightforward: the expenditure of a local government directly determines how much investment it can finance. As a result, we define the first fiscal decentralization as the expenditure decentralization indicator: the share of the provincial composite fiscal expenditure within the national composite fiscal expenditure in per capita terms (denoted as FD1, hereafter).[15] Regarding the revenue-raising power, a similar fiscal revenue decentralization indicator is defined as the share of the provincial composite fiscal revenues (the sum of the budgetary and the extra-budgetary revenues) within the national composite fiscal revenues in per capita terms (denoted as FD2, hereafter). Figure 3 depicts the distributions of the indicator FD1 in 1995 and 2014 by province. Because of the high correlation between the provincial composite expenditure and revenue (the correlation coefficient is 0.918), the geographical distribution of FD2 is very similar to that of FD1. The figures reveal a clear pattern of fiscal decentralization's geographical distribution: the ethnic autonomous areas, remote border areas, and economically undeveloped areas and the prosperous megacities tend have higher fiscal decentralization level. For example, in 2014, the western and northern provinces (Inner Mongolia, Xinjiang, Qinghai, and Ningxia) and three eastern municipalities (Beijing, Shanghai and Tianjin) are on the top half of the fiscal decentralization ranking table.

Conventionally, classic fiscal decentralization theory argues that the matching of revenue means and expenditure assignments at the subnational level benefits economic growth. As a result, after considering the average levels of the revenue and the expenditure share, the signs on the coefficient of FD1 and FD2 should elucidate the question of whether the convergence or the divergence of revenue and expenditure decentralization fosters economic growth.

The intergovernmental fiscal transfers are essentially a second-order (or non-constitutional level) issue, according to classic fiscal decentralization theory. The necessity for the fiscal transfers is due to the vertical fiscal imbalance under the prevailing assignment of revenue and expenditure responsibilities (Vo 2010). For China, the intergovernmental fiscal transfer was intended to equalize the economic development across regions. However, the World Bank (2003) evaluated the current system of intergovernmental transfers and considered them poorly designed for addressing the regional fiscal disparities or for supporting the financing of vital social services.[16] Since the current transfer system is seriously flawed and there is a lack of consistent data, there is no particular fiscal decentralization indicator designed for the intergovernmental fiscal transfers. Because of the lack of data, no specific fiscal decentralization indicator is designed for the final aspect of fiscal decentralization theory—the subnational borrowing responsibility.

To sum up, we adopt two fiscal decentralization indicators, FD1 and FD2, to indicate the relative power of the expenditure and the revenues of the provincial governments, respectively. Although these indicators are not perfect and do not reflect information on the

[15] The composite fiscal expenditure is the sum of the budgetary expenditure and the extra-budgetary expenditure. The composite fiscal expenditure is utilized instead of its components (e.g., Expenditure for Education and Expenditure for Medical and Health Care) because the fiscal arrangement of the TSS is primarily for the distribution of total fiscal resources between central and local governments.

[16] For example, according to chart 4 of Shen et al. (2012), in 2004, the largest three central-provincial fiscal transfer programs were the revenue sharing transfers (469.5 billion yuan), the tax rebate (404.97 billion yuan) and earmarked grants (322.33 billion yuan), which together amounted to over 80 % of the total central-provincial transfers. Comparatively, the equalization transfer that year was a mere 74.5 billion yuan, or approximately 5 % of the total transfers.

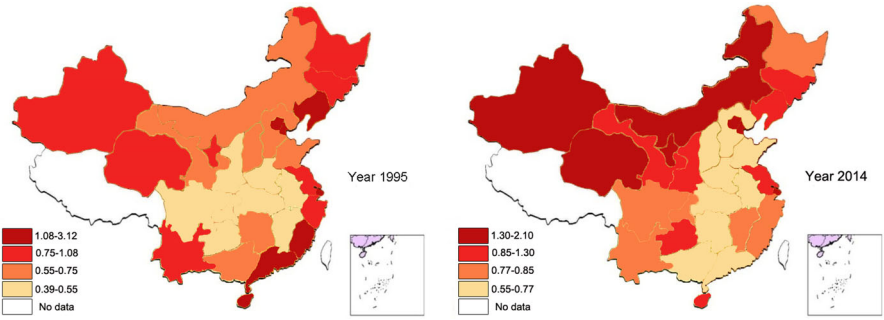

Fig. 3 The fiscal decentralization indicator FD1, 1995 (*left*) and 2014 (*right*)

distribution of decision-making authority between the levels of government, these measures still provide a useful proxy for the relative level of countries' fiscal decentralization, and in practice they are also used in the empirical literature (Qiao et al. 2008; Rodríguez-pose and Krøijer 2009).

3.2.2 Other explanatory variables in growth regression equation

In this subsection we will briefly discuss the other explanatory variables that are used in the growth regression Eq. (1).

It is commonly recognized that the physical capital stocks are difficult to estimate because of the difficulty in determining the depreciation rates, the initial capital stock and the appropriate deflators. In the current literature, many researchers took a shortcut and used the investment rate (defined as the ratio of investment to provincial GDP) (Zhang and Zou 1998; Jin and Zou 2005) or the growth rate of the fixed asset investment (Lin and Liu 2000; Qiao et al. 2008) instead. However, because Eq. (1) is adapted from the standard growth regression, which originates from the Cobb-Douglas production function, the most relevant control variable for capital should be the capital growth rate. We thus utilized the perpetual inventory method suggested by He et al. (2007) to compile the provincial capital stock data.

Of course, human capital stock data for China is even more difficult to obtain. In this study, we follow the estimation method developed by Funke and Hao (2009) to measure the human capital stock as the product of the employed workers and their average educational years. The human capital defined in this way captures the features of the labor force and of education, which are considered to be the most important aspects of human capital to promoting technological advances and economic growth.[17] To eliminate the effects of population scale, the human capital in per capita terms is utilized. In this way, the provincial human capital is the average schooling years of the provincial total population.

[17] In the empirical studies regarding the relationship between fiscal decentralization and economic growth, other human capital indicators have also been used, such as the illiteracy rate (RODRÍGUEZ-POSE and KRØIJER 2009) and the high school graduation rate (Akai and Sakata 2002). However, these indicators only reflect a particular facet of education and are therefore not used in this study. Other factors beyond the scope of education, such as on-the-job training and firm-specific human capital investments, could contribute to the improvement of the human capital stock. Unfortunately, because of measurement difficulties and missing data, these factors are excluded from this study.

Table 1 Variable definitions, means, and standard deviations

Variable	Mean	Standard deviation	Definition
GR	9.879	2.937	Growth rate of per capita real GDP (%)
FD1	0.947	0.561	The ratio of provincial composite fiscal expenditure to national composite fiscal expenditure in per capita terms
FD2	0.655	0.573	The ratio of provincial composite fiscal revenues to national composite fiscal revenues in per capita terms
INV	10.988	3.870	Growth rate of per capita physical capital (%)
HK	1.854	4.872	Growth rate of per capita human capital (%)
FDIPC	0.213	0.560	Per capita real foreign direct investment (thousand constant 1978 yuan, calculated based on average exchange rate)
GDP_1	0.386	0.401	Moving average of per capita real GDP in previous 5 years (10000 constant 1978 yuan)
I_1	1.322	1.371	Moving average of per capita capital stocks of previous 5 years in real term (10000 constant 1978 yuan)
R	3.143	4.355	Real interest rate, equal to the difference of nominal interest rate and inflation rate (%)
TAX	13.550	8.235	The ratio of total tax revenue to GDP (%)
RW	1.336	1.028	The ratio of per capita provincial GDP to per capita national GDP
LANDI	3.226	2.706	The ratio of land granting income of provincial governments to provincial GDP (%)

In fact, this indicator for human capital has been commonly used in previous studies, including Barro and Lee (1996) and Soukiazis and Antunes (2012).

Because of the former Chinese leader Deng Xiaoping's inspection in South China to call for more and rapid pro-marketization reforms in 1992, foreign direct investment (FDI) poured into China and played an increasingly important role in China's economic growth.[18] To control for the contribution of FDI, we use per capita utilized FDI in real term (FDIPC) as an explanatory variable.

Finally, in order to test whether late-development advantages across China's provinces exist, the moving average of per capita real GDP for the previous 5 years (GDP_1) is introduced as a control variable.

The calculations for two fiscal decentralization indicators, FD1 and FD2, are based on the fiscal data from the *Finance Yearbook of China* (various issues). The provincial real capital stock data before 2003 are taken directly from table A11 and table A12 of He et al. (2007); the corresponding data presented afterward are calculated by the author. All of the other variables are taken or estimated from the data in the *Chinese Statistical Yearbook* (various issues), the *Tax Yearbook of China* (various issues), the *Chinese Land and Resources Yearbook* (various issues), and the various provincial statistical yearbooks. As a brief summary, Table 1 lists the definitions and the statistical information for the key variables. Besides, the provincial levels of fiscal decentralization — the key variable of this study—are listed in Table 4 in the Appendix.

[18] For example, Curran et al. (2007) employ the ratio of FDI to local GDP as one regressor in the growth regression for China. Using cross-sectional data at county- and city-levels, they report a significant positive contribution of FDI to local economic growth.

4 Estimation results and robustness tests

4.1 Basic regression results

Table 2 reports the estimation results by 3SLS and 2SLS.

Because the data for provincial land granting revenues are only available since 1998, the sample period is between 1998 and 2014 when the ratio of land granting income of provincial governments to provincial GDP (LANDI) is incorporated into the fiscal decentralization equation. When LANDI is not included, the sample period is 1995–2014. To investigate the impacts of fiscal expenditure decentralization and fiscal revenue decentralization on economic growth respectively, FD1 and FD2 are utilized separately. Considering the fact that FD1 and FD2 are highly correlated, the estimation results using FD2 could also be treated as a robustness check of the estimation results using FD1.

The major findings from the estimation results shown in Table 2 can be summarized as follows:

First, contrary to the classic decentralization, the relationship between economic growth and fiscal decentralization in China is indeed nonlinear. Specifically, the positive coefficient of FD and negative coefficient of $(FD)^2$ indicate that the relationship is inverted-U shaped: as fiscal decentralization is low, higher decentralization is beneficial to economic growth; when the level of fiscal decentralization is high enough, further increase in the level of fiscal decentralization would be harmful to growth. This finding is quite robust because the estimation results are basically consistent for the fiscal decentralization for government expenditure and income and by 3SLS and 2SLS estimators. These results are similar to Akai et al. (2007) and Qiao et al. (2008). Because the nexus of economic growth-fiscal decentralization is inverted-U shaped, there could be an "optimal level" of decentralization that could maximize the economic growth rate. As shown in Table 2, the optimal levels for both fiscal expenditure decentralization and fiscal revenue decentralization are between 2.0 and 2.6 (except for the 3SLS estimation results for models (3) and (4), in which the optimal level for fiscal revenue decentralization is estimated to be over 4.0). For the majority of provinces (except for the prosperous megacities like Beijing and Shanghai), by 2014 the level of fiscal decentralization had not reached the optimal level, suggesting that the higher level of fiscal decentralization is economically beneficial for most provinces. To some extent, this finding could be treated as a compromise of previous mixed estimation results of Zhang and Zou (1998) that claimed the relationship between economic growth and fiscal decentralization is negative, and Lin and Liu (2000), Qiao et al. (2008) and Zhang and Gong (2005) that found economic growth is positively related with fiscal decentralization. Furthermore, because of the potential simultaneity of investment growth, capital accumulation and fiscal decentralization, there exists a positive indirect contribution of fiscal decentralization to economic growth through its impact on capital accumulation.

Second, the land granting revenue of the local governments makes a significant contribution to fiscal revenue decentralization, but it does not affect the fiscal expenditure decentralization significantly. In the fiscal decentralization equation, the coefficients of LANDI are positive and statistically significant in models (4) and (8) when fiscal revenue decentralization is used as the dependent variable, while its coefficients turn out to be insignificant in models (2) and (6) when fiscal expenditure decentralization is used as the dependent variable. One possible explanation for this finding is that land selling income is a key complementary fiscal resource for local governments. The

Table 2 3SLS and 2SLS estimation results of the SEM

Estimation method	3SLS	3SLS	3SLS	3SLS	2SLS	2SLS	2SLS	2SLS
Model no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample period	1995–2014	1998–2014	1995–2014	1998–2014	1995–2014	1998–2014	1995–2014	1998–2014
Variable								
Growth equation								
Intercept	−6.523 (2.214)***	−3.630 (1.469)***	−5.778 (1.937)***	−8.164 (1.585)***	0.003 (2.331)	0.738 (1.591)	−5.387 (2.424)**	−5.845 (2.087)***
FD1	11.794 (2.146)***	9.199 (1.686)***			7.106 (2.262)**	6.090 (1.778)***		
FD2			6.333 (1.752)***	9.194 (1.728)***			10.903 (2.212)***	11.805 (−2.508)***
$(FD1)^2$	−2.549 (0.546)***	−1.793 (0.445)***			−1.714 (0.575)**	−1.376 (0.469)***		
$(FD2)^2$			−0.665 (0.469)	−1.138 (0.448)**			−2.530 (0.605)***	−2.508 (0.599)***
HK	0.029 (0.020)	0.017 (0.018)	0.025 (0.021)	0.016 (0.015)	0.023 (0.021)	0.025 (0.021)	0.031 (0.028)	0.034 (0.028)
INV	0.911 (0.105)***	0.788 (0.066)***	1.265 (0.135)***	1.408 (0.099)***	0.566 (0.109)***	0.560 (0.075)***	1.073 (0.171)***	1.114 (0.143)***
FDIPC	0.931 (0.220)***	0.718 (0.197)***	0.261 (0.214)	0.232 (0.152)	0.903 (0.238)***	0.904 (0.228)***	0.528 (0.291)*	0.594 (0.289)**
GDP_1	−5.062 (0.539)***	−4.693 (0.450)***	−5.155 (0.580)***	−6.406 (0.637)***	−3.258 (0.567)***	−3.338 (0.471)***	−4.948 (0.725)***	−5.937 (0.769)***
Capital accumulation equation								
Intercept	3.962 (3.390)	4.589 (1.732)***	2.016 (1.115)*	5.453 (1.125)***	16.614 (3.834)***	7.514 (2.052)***	10.692 (2.190)***	6.562 (1.644)***
FD1	−4.769 (0.379)***	−4.436 (0.335)***			−2.147 (0.491)***	−2.735 (0.411)***		
FD2			−3.723 (0.255)***	−4.193 (0.240)***			−2.617 (0.334)***	−3.421 (0.332)***
GR	0.883 (0.290)***	0.864 (0.143)***	0.923 (0.091)***	0.648 (0.091)***	−0.317 (0.334)	0.536 (0.169)***	0.153 (0.192)	0.540 (0.137)***
I_1	−1.704 (0.432)***	−1.659 (0.369)***	−0.347 (0.188)*	−0.224 (0.126)	−0.170 (0.635)***	−0.402 (0.462)	−1.600 (0.428)***	−0.751 (0.373)**

Table 2 continued

Estimation method	3SLS	3SLS	3SLS	3SLS	2SLS	2SLS	2SLS	2SLS
Model no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample period	1995–2014	1998–2014	1995–2014	1998–2014	1995–2014	1998–2014	1995–2014	1998–2014
R	0.236 (0.087)***	0.089 (0.053)*	0.184 (0.030)***	0.056 (0.031)*	−0.208 (0.100)**	0.021 (0.067)	−0.058 (0.062)	0.058 (0.057)
GDP_1	10.982 (1.378)***	10.126 (1.131)***	5.431 (0.804)***	4.897 (0.628)***	6.542 (1.846)***	3.491 (1.370)**	7.310 (1.316)***	5.478 (1.157)***
Fiscal decentralization equation								
Intercept	0.926 (0.115)***	0.785 (0.133)***	1.112 (0.134)***	1.123 (0.192)***	1.069 (0.131)***	0.753 (0.151)***	1.283 (0.150)***	1.427 (0.234)***
INV	−0.056 (0.009)***	−0.045 (0.010)***	−0.097 (0.010)***	−0.100 (0.015)***	−0.069 (0.010)***	−0.043 (0.012)***	−0.110 (0.012)***	-0.125 (0.019)***
TAX	0.013 (0.002)***	0.017 (0.002)***	0.007 (0.002)***	0.008 (0.003)***	0.016 (0.002)***	0.021 (0.003)***	0.004 (0.003)	0.004 (0.004)
RW	0.342 (0.018)***	0.305 (0.019)***	0.385 (0.017)***	0.347 (0.021)***	0.314 (0.020)***	0.273 (0.021)***	0.394 (0.022)***	0.321 (0.030)***
LANDI		−0.001 (0.007)		0.017 (0.008)**		−0.001 (0.008)		0.039*** (0.012)
Optimal level of decentralization	FD1 = 2.313	FD1 = 2.565	FD2 = 4.762	FD2 = 4.040	FD1 = 2.073	FD1 = 2.213	FD2 = 2.155	FD2 = 2.353
Obs.	580	493	580	493	580	493	580	493

Model no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Growth	5746.679	3833.416	7577.061	7401.669	3472.865	2832.687	6082.922	5064.299
Capital accumulation	6693.291	5109.781	4814.865	3776.901	10157.28	4531.036	6098.997	3843.944
Fiscal decentralization	65.763	48.78	72.892	58.569	76.401	47.484	89.543	86.208

Note: The number in parentheses represents the standard error associated with each coefficient

*, ** and *** indicate significant at the significance levels of 10, 5, and 1 %, respectively. The sum squared error (SSR) of each equation is as follows

statistics reveal that in most provinces the income obtained from land selling accounted for over 25 % of total government fiscal revenue, in some provinces (such as Anhui and Shandong) the revenues from land selling were even nearly half of the tax revenues. According to the estimation results, the importance of land granting revenues to government expenditure is even higher than that of TAX. The disproportionately high importance of land granting revenues to fiscal decentralization reflects the fact that provincial governments have higher disposal power and flexibility on the land granting revenues than the tax revenues.

Third, the estimated coefficients of most control variables in the growth regression (1) turn out to be basically as expected, with the physical capital growth rate and the per capita FDI both being positively and significantly associated with provincial economic growth. The human capital stock growth rate exhibits a positive association with the provincial economic growth, but and the effect is not significant at the 10 % level. The relatively economically minor contribution of the human capital growth rate is broadly consistent with some previous research on the economic impact of fiscal decentralization in which human capital is considered (e.g., Akai and Sakata 2002; RODRÍGUEZ-POSE and KRØIJER 2009).[19] The relatively minor effect of the human capital growth rate could reflect the fact that investment rather than technological progress or human capital accumulation played the role of growth engine for China's economy over the last two decades during the sample period. Besides, the significant and negative sign of historical per capita real GDP (*GDP_1*) verifies that there has been a conditional convergence process across the provinces, as Weeks and Yao (2003) and Zou and Zhou (2007) found.

Finally, in the *capital accumulation equation*, the coefficient of the real interest rate (R) is significantly positive by 3SLS estimations, but this coefficient presents a negative or insignificant when 2SLS estimator is used. This apparently unconventional finding to some extent reveals that investment decisions in China are not essentially made by administrative determination rather than on the basis of the market mechanisms (Fan et al. 2007; Chen et al. 2011). In practice, investment largely relies on the monetary policy environment: monetary loosening can directly lead to an investment boom while monetary tightening is usually followed by an investment slowdown (Zhang 2009; Huang et al. 2012). Because China's monetary policy has a strong countercyclical feature, the capital growth rate therefore sometimes exhibits positive associations with the real interest rate. In addition, the significantly positive coefficient of the historical level of economic development (*GDP_1*) implies that the growth rate of capital stocks is highly related with recent economic performance.

4.2 Robustness tests for the alternative specifications and estimation methods

The 3SLS estimates in Table 2 are broadly consistent with the corresponding 2SLS estimates but have smaller standard deviations (and therefore higher t-values) for most variables. This observation is consistent with the theory that 3SLS is generally more efficient

[19] Akai and Sakata (2002) utilized the percentage of high school graduates in the total population as the measure of human capital stock and reported its coefficients ranging from 0.09 to 0.12 in the panel regression results. RODRÍGUEZ-POSE and KRØIJER (2009) investigated the influence of fiscal decentralization on economic performance in central and eastern European transition countries. They employed the illiteracy rate as the proxy for human capital and their estimation results implied that a one-percent decrease in the illiteracy rate could contribute to economic growth of between 0.01 and 0.1 %, depending on how many years of lags were considered.

Table 3 Estimates of alternative specifications and estimation methods for the *growth equation*. Dependent variable: growth rate of per capita real GDP

Estimation method	3SLS				Fixed effect panel data		OLS
Model	(9)[a]	(10)[a]	(11)	(12)	(13)	(14)	(15)
Sample period	1995–2014	1998–2014	1995–2014	1998–2014	1995–2014	1998–2014	1998–2014
Obs.	580	493	580	493	580	493	493
Constant	2.044 (0.998)***	4.059 (0.799)***	−26.097 (4.007)***	−9.158 (1.767)***	5.084 (0.788)***	4.589 (0.910)***	4.273 (0.579)***
FD1	8.118 (1.012)***	6.679 (0.736)***	25.899 (3.425)***	11.330 (1.902)***	0.675 (1.335)	2.002 (1.553)	1.750 (0.777)**
$(FD1)^2$	−4.389 (1.165)***	−2.890 (0.987)***	−5.646 (0.943)***	−2.672 (0.517)***	−0.228 (0.354)	−0.704 (0.405)*	−0.265 (0.224)
EAST*FD1			2.014 (0.852)**	2.745 (0.506)***			
HK	0.036 (0.022)	0.016 (0.020)	0.050 (0.029)*	0.015 (0.019)	0.021 (0.019)	0.020 (0.020)	0.023 (0.020)
INV	1.138 (0.118)***	0.881 (0.072)***	1.947 (0.212)***	1.179 (0.089)***	0.508 (0.034)***	0.544 (0.039)***	0.464 (0.028)***
FDIPC	0.871 (0.234)***	0.741 (0.214)***	0.911 (0.322)***	0.618 (0.207)***	0.440 (0.210)**	0.503 (0.213)**	0.738 (0.210)***
GDP_1	−6.482 (0.621)***	−5.614 (0.489)***	−11.242 (1.135)***	−7.182 (0.622)***	−3.281 (0.423)***	−4.464 (0.505)***	−2.508 (0.339)***
Sum squared error	10,363.96	5413.03	26,153.19	6106.97			
R^2					0.437	0.453	0.397
Control for simultaneity	Yes	Yes	Yes	Yes	No	No	No

Note: The number in parentheses represents the standard error associated with each coefficient. The other two equations of SEM models 1–4 are also estimated but their estimation results are not reported

* Indicates a significance level at 10 %

** Indicates a significance level at 5 %

*** Indicates a significance level at 1 %

[a] FD1 is introduced in logarithm form

than 2SLS. In the following estimations, only FD1 is used as the fiscal decentralization indicator. The various estimation results are summarized in Table 3. In the columns 1–4 of Table 3, in order to save space, only the regression results of the *growth Eq.* (1) are reported.

First of all, an interactive term of FD1 and a regional dummy, EAST, is introduced to examine whether the effect of fiscal decentralization differ in different regions.[20] The significantly positive sign of this product indicates that the direct contribution of fiscal decentralization to economic growth is considerably higher in more prosperous eastern region than in other areas of China. According to the statistics, the eastern provinces generally had higher levels of fiscal decentralization, which partly explain that the eastern region is more prosperous in economic development than central and western regions. The coefficients of the other variables hardly change after this product is added.

To test the robustness of the estimation results when alternative forms of fiscal decentralization is utilized, FD1 in logarithm form and its squared term are incorporated in models (9) and (10). As shown in Table 3, the estimation results of these alternative models using logarithmic form of fiscal decentralization do not change remarkably compared with the results of the benchmark models (1) and (2) in Table 2. In other word, the estimation results are quite robust to different forms of fiscal decentralization used.

The purpose of using 3SLS and 2SLS methods is to control for potential simultaneity. It is still meaningful and reasonable to estimate the system when this endogeneity is not controlled for and to compare the results with those obtained previously. To this end, the *growth Eq.* (1) is conducted with panel data using fixed effects estimators (models 13 and 14 of Table 3). The estimation results do not differ significantly from the benchmark results shown in Table 2, although the estimated coefficients of fiscal decentralization are statistically insignificant.

As a comparison, the OLS estimation is also applied. Compared with benchmark results shown in models (2) and (6) in Table 2, the coefficient of squared term of FD1 turns out to be insignificant, and the "optimal level" of FD1 calculated based on the estimation results is also considerably higher than those acquired from the benchmark results. Comparing this result with the result shown in model (15), the estimated insignificant coefficient of $(FD1)^2$ using OLS should be caused by the failure to account for the potential endogeneity.

5 Conclusion and policy implications

This research was an attempt to explore the contribution of fiscal decentralization to provincial economic growth in China after the implementation of the Tax Sharing System in 1994. This study adds to a growing body of literature that investigates the relationship between decentralization and local economic growth. In line with the majority of recent studies investigating China's economic growth, it has been shown that institution indeed matters. The potential simultaneity of physical capital growth, fiscal decentralization, and provincial economic growth has been carefully controlled for through a specifically designed simultaneous equations model. The impact of fiscal decentralization on provincial economic growth is inverted-U shaped: when the level of

[20] The EAST dummy is equal to 1 for the following provinces while 0 for all of the others: Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan.

fiscal decentralization is low, higher fiscal decentralization would foster economic growth; while when fiscal decentralization is high enough, to increase the level of decentralization further would damage economic development. To some extent, this finding could be considered as a compromise of the classic fiscal decentralization theory which claims that fiscal decentralization promotes economic growth and some recent empirical studies that found a negative relationship between fiscal decentralization and economic growth.

Chinese Tax Sharing System reform adopted in 1994 has reversed the trend of decreasing central fiscal revenue share. However, its cost is also obvious: local governments have to hunt for extra fiscal resources to finance their growing expenditure needs. Since 1998, local governments rely increasingly on extra-budgetary revenues especially land granting revenues and loans of various kinds. The amount of land granting revenues has become comparable to the conventional tax revenues, and in some eastern provinces the land granting revenues are close to or even higher than one half of total tax revenues. Given that the estimated "optimal level" of fiscal decentralization that maximizes economic growth has not been reached in most provinces except two prosperous megacities Beijing and Shanghai, the corresponding policy implication is clear: in order to maintain and further foster local economic growth, more fiscal resources as well as policy flexibility should be distributed from central authority to local governments especially the central and western provinces where the levels of fiscal decentralization are still considerably low. By the same token, the effects of some recent fiscal reforms on economic growth should be carefully evaluated. For instance, granting the right to issue local bonds directly to local government is beneficial to local economic growth, because it allows provincial governments an important source of income and therefore may raise the fiscal decentralization level.[21] In contrast, the reform program to replace the business tax with a VAT may to some degree affect local economic development since business tax accounted for a considerable fraction of local fiscal revenues while VAT is a typical tax category that belongs to central fiscal revenues. As a result, the switch may decrease the level of fiscal decentralization and be harmful to local economic growth.

Appendix

See Table 4.

[21] Please refer to http://online.wsj.com/article/SB10001424052970204485304576642470825957018.html.

Table 4 Fiscal decentralization by provinces, 1995–2014

	Expenditure decentralization by province						Revenue decentralization by province					
	Province	Obs	Mean	S.D.	Min	Max	Province	Obs	Mean	S.D.	Min	Max
1	Beijing	20	2.424	0.351	1.895	2.891	Beijing	20	2.288	0.329	1.823	2.786
2	Tianjin	20	1.627	0.123	1.486	2.028	Tianjin	20	1.354	0.129	1.200	1.704
3	Hebei	20	0.566	0.034	0.513	0.642	Hebei	20	0.376	0.059	0.311	0.519
4	Shanxi	20	0.756	0.068	0.652	0.872	Shanxi	20	0.516	0.064	0.411	0.641
5	Inner Mongolia	20	1.060	0.277	0.725	1.486	Inner Mongolia	20	0.537	0.140	0.355	0.740
6	Liaoning	20	1.100	0.085	1.009	1.361	Liaoning	20	0.810	0.116	0.704	1.152
7	Jilin	20	0.871	0.077	0.763	1.009	Jilin	20	0.439	0.090	0.344	0.705
8	Heilongjiang	20	0.826	0.044	0.758	0.930	Heilongjiang	20	0.445	0.114	0.331	0.736
9	Shanghai	20	2.836	0.591	1.820	3.691	Shanghai	20	2.668	0.513	1.792	3.344
10	Jiangsu	20	0.913	0.077	0.760	0.993	Jiangsu	20	0.829	0.068	0.668	0.913
11	Zhejiang	20	1.021	0.118	0.817	1.200	Zhejiang	20	0.940	0.134	0.726	1.124
12	Anhui	20	0.535	0.103	0.424	0.711	Anhui	20	0.320	0.065	0.243	0.480
13	Fujian	20	0.865	0.149	0.719	1.247	Fujian	20	0.737	0.183	0.524	1.096
14	Jiangxi	20	0.581	0.089	0.483	0.770	Jiangxi	20	0.345	0.046	0.286	0.450
15	Shandong	20	0.658	0.047	0.593	0.807	Shandong	20	0.542	0.068	0.465	0.726
16	He'nan	20	0.488	0.062	0.410	0.576	He'nan	20	0.296	0.045	0.238	0.407
17	Hubei	20	0.595	0.083	0.479	0.765	Hubei	20	0.363	0.051	0.309	0.484
18	Hu'nan	20	0.584	0.059	0.493	0.680	Hu'nan	20	0.354	0.067	0.292	0.509
19	Guangdong	20	1.045	0.211	0.750	1.372	Guangdong	20	0.966	0.199	0.679	1.228
20	Guangxi	20	0.570	0.069	0.469	0.685	Guangxi	20	0.339	0.077	0.265	0.532
21	Hainan	20	0.844	0.178	0.648	1.106	Hainan	20	0.522	0.154	0.343	0.904
22	Sichuan	20	0.617	0.141	0.472	0.829	Sichuan	20	0.372	0.055	0.284	0.464
23	Guizhou	20	0.559	0.170	0.396	0.910	Guizhou	20	0.264	0.050	0.218	0.380
24	Yun'nan	20	0.761	0.111	0.610	1.015	Yun'nan	20	0.387	0.101	0.284	0.624

Table 4 continued

	Expenditure decentralization by province						Revenue decentralization by province					
	Province	Obs	Mean	S.D.	Min	Max	Province	Obs	Mean	S.D.	Min	Max
25	Shannxi	20	0.726	0.166	0.471	0.966	Shannxi	20	0.414	0.060	0.330	0.520
26	Gansu	20	0.679	0.131	0.512	0.884	Gansu	20	0.272	0.043	0.225	0.377
27	Qinghai	20	1.327	0.461	0.831	2.174	Qinghai	20	0.340	0.049	0.272	0.435
28	Ningxia	20	1.058	0.214	0.752	1.436	Ningxia	20	0.439	0.041	0.379	0.510
29	Xinjiang	20	1.051	0.142	0.838	1.315	Xinjiang	20	0.496	0.094	0.391	0.712

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