

Impacts of financial decentralization on economic growth and inflation in China

Fu Yong, Li Liangsong*

Fiscal decentralization and promotion incentives are main elements that inspire local governments in China to compete for economic growth with each other; but this regime is only part of reason that local governments in China have more effects on economic cycle than their counterparts in other countries. The authors think that financial decentralization should be taken into account. Empirical results indicate that excess financial decentralization would cause high risk of inflation and economic overheating. After tax-sharing reform in 1994, the central government could adjust the boundary of financial decentralization and the local governments may borrow more money during the economic downturn. The authors suggest that a two-tiered financial supervisory system should be set up in the new round of financial reform and financial decentralization should be adjusted to the changing market economy in China.

Keywords: financial decentralization, fiscal decentralization, economic growth, inflation

1. Introduction

In the transition to socialist market economic system in China, fiscal and financial system reform are two important clues. Lots of literatures held the view that economic incentives with the core of fiscal decentralization provided motivation mechanism for local governments competing for economic growth (Montinola *et al.*, 1995; Qian and Roland, 1998; Lin and Liu, 2000; Akai and Sakata, 2002; Martinez and McNab, 2003; Jin *et al.*, 2005; Frascini, 2006). And recent literatures emphasized the role of political incentive mechanism contained in China's decentralization in promoting economic growth (Blanchard and Shleifer, 2000; Zhou, 2004; Zhang and Gong, 2005; Shen and Fu, 2005; Fu and Zhang, 2007; Fu, 2008; Fu, 2010). Above-mentioned China's decentralization¹ framework explained economic growth mechanism,

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¹ China's decentralization is different from western federal states, China maintains centralized political system of appointing government officials while decentralizing fiscal power.

structural distortion, economic cycle and inflation well (Zhou and Zhang, 2008; Zhao and Zhou, 2009; Brandt and Zhu, 2001; Tan and Zhou, 2015), but this framework ignores financial system reform, so it is difficult to explain why local governments' impact on economic finance is greater than their counterparts in some federal states.

Fiscal and political incentives offer local governments incentives with which other countries cannot compete to promote economic growth, but fiscal resources are only one part of local governments participating in economic competition, even only a slice of the competition. Because of relatively fixed fiscal system and local governments' inability to issue bonds, there is little room for local governments to mobilize fiscal resources. Besides fiscal resources, local governments mobilize more resources for growth competition by getting deeply involved in financial system and using financial leverage. On one hand, local governments intervene in existing financial institutions to intensify the support for local development (Ji *et al.*, 2014; Li and Qian, 2012). On the other hand, local governments try to establish easily controlled local financial institutions (Guo, 2014), and use platform company to finance in loans, bonds, stock and trust markets. Therefore, in order to study the impact of local governments' behavior on macro-economy, it is important not to ignore financial decentralization system. Besides, the tax-sharing reform relatively stabilized central-local fiscal system and left little room for macro-control in 1994., in contrast, the central government can supervise local governments in financing more flexibly. All in all, from the perspective of local governments' behavior affecting macro-economy, fiscal intervention is only one reason, the other reason why local governments can invest so much persistently and cause China economy's characteristics of "easily to get hot instead of cold" is local governments' disordered participation in financial system. If fiscal decentralization and promotion incentives stimulate local governments' investment passion, the realization of this passion depends on the arrangement of financial system.

Similar to fiscal decentralization, China also has power boundary between central government and local governments in financial sector, which is called financial decentralization. Different from fiscal decentralization, there is no fixed power boundary between central government and local governments in financial sector, which varies according to changes of macro-control and financial innovation trend to a large extent.

Previous researches were mostly about local governments' intervening finance (Zhou, 2003), only some literatures analyzed financial decentralization or centralization. Qian and Roland (1998) suggests that money centralization, together with fiscal decentralization could stiffen local governments' budget constraint and decrease inflation; however, if local governments have applied money decentralization while applying fiscal decentralization, it would lead to high inflation because of excessive competition among local governments. Ba *et al.* (2005) illustrates that local governments influenced financial reform and financial institutions' behavior in various ways, while central government and bank system resisted local governments' seizing

power through continuously completing management system and perfecting risk management mechanism.

Generally speaking, previous studies discussed local governments' intervention in financial system in different dimensions, yet few of them analyzed changes of financial management system into the same level as analyzing fiscal decentralization, let alone to study the interaction between fiscal and financial system and its impact on macro-economy systematically. This paper suggests that excessive financial decentralization can notably drive up inflation and the risk of economic overheating, thus incur administration and regulation from the central government. After enlargement of fiscal decentralization, it will need certain financial centralization. We believe that financial decentralization is only a special financial system arrangement in transition economy, it used to be merely a method for central government to regulate economy. However, after gradual perfection of market economy, financial decentralization cannot be overused as a countercyclical tool. The paper proceeds as follow: the second part defines financial decentralization, and establishes a theoretical model to analyze the economic impact of financial decentralization; the third part constructs a financial decentralization indicator; the fourth part presents empirical results; the last part is conclusion and policy implications.

2. Financial decentralization and theoretical analysis

2.1. Financial decentralization and facts

Under different economic systems, there are a lot of differences in financial system arrangements among different countries. Government has certain control on the distribution of financial resources, especially credit resources, which can be called financial decentralization in general. There are two levels of financial decentralization; one is the power boundary between government and market on financial resource allocation and credit creation, such as the decision of interest and exchange rates, credit allocation and so on. Generally, in developed economies, the level of marketization is high, the capital price is fully decided by the market; however, under the planned economic system, capital price and credit resources are decided and allocated by the government.

The other is the power boundary among different departments of government, central and local governments on financial resource allocation and credit creation, such as credit allocation, currency issuance, base money management power and monetary policy decision etc. In planned economy and economies with transition characteristics, government has great power on financial resources allocation. In most market economies, the central bank has powers on currency issuance, base money management and monetary policy, while in some countries, because of central bank

financing fiscal deficit, fiscal department actually shares partial currency issuance. Besides, in order to encourage local governments to develop economy, the central government would allow local governments to administrate certain credit resources.

These two levels of financial decentralization are differentiated and connected with each other, the boundary between government and market is the base of deciding how much the market can work and the boundaries between governments. Only under this circumstance, different departments of government, central and local governments can divide their powers within government's scope of work. For example, in market economy, credit allocation is entirely decided by market instead of government, so there is no boundary between central and local governments on credit allocation.

From the very beginning of the reform, under planned economic system, financial resources are allocated by central government. So economic regime transition is not only the process of central government delegating power to market, but also is the process of central government delegating power to local governments. Local governments gradually gained financial power including guiding national financial institutions operating in localities and establishing local financial institutions, enhancing the management of rural credit cooperative (rural commercial banks), getting loan and issuing bonds and trust products through the platform company.

Since the tax reform in 1994, the fiscal power of local governments has been relatively fixed, there are few changes of financial resources distribution between central and local governments. However, there is no relatively fixed boundary of financial decentralization, which changes with macro-control and financial innovation. The power boundary between central and local governments in financial sector is blurred, on one hand, local governments have multi financial powers, and on the other hand, the central government has strong regulation power on local governments. The fluctuation of local governments' debt was an outstanding example, local government debt increased drastically during two crises in 1998 and 2008. After economic stabilization and recovery, the central government cleared local government debt, the growth rate of local government debt also declined.

China's financial decentralization experienced five stages. Stage One (1949-1978), financial power was highly concentrated by government, the characteristics of fiscal and financial capital were blurred, the power of financial institution and credit allocation were highly concentrated.

Stage Two (1979-1993). The central government gradually delegated financial resources allocation power to local governments. Firstly, local governments shared credit resources allocation power, implemented credit and capital management regulation of "unified plan, level-to-level administration, credit and loan combination, full responsibility of balance" and "unified plan, capital allocation, actual loans and deposits, mutual allocation", the essence of this regulation was to deposit and loan as much as possible. Moreover, credit capital allocation carried out "central and municipal

governments joining together” mechanism since 1984. Between 1986 and 1993, the People’s Bank and branches of specialized banks had certain capital power, and they all implemented profit retaining system, so that these institutions had the motive to win more credit resources for local governments. Secondly, local governments and local financial institutions were related closely. Non-bank financial institutions such as urban credit cooperative and trust and investment corporations were gradually established, and inter-bank lending market was built in each province, which made it convenient for local governments to intervene into financial resources.

Stage Three (1994–2008). The central government retrieved financial resources allocation power from local governments. Firstly, the central bank retrieved capital management power from its branches; every commercial bank strengthened the concept of only their head office as their legal persons, supervisory institutions adopted indirect methods to manage credit and loan and removed “separate management” of credit and loan scale. Secondly, China implemented standardization of financial institutions system management. In 1998, the Party committees and personnel of the central bank and state-owned commercial banks’ branches detached from local governments and administered by head offices directly. Three supervisory institutions were gradually established, so as to form a financial supervisory system of “segregated operation and augmented supervision”. Three policy banks were established, and promoted the reform of the share-holding system of the state-owned commercial bank. Thirdly, China established a national unified capital and foreign exchange market and standardized business operation of financial institutions.

Stage Four (2009–2012). The central government delegated financing power to local governments greatly. Firstly, local governments’ financing platform accepted lots of financing, local governments’ measures of affecting financial resources allocation tended to get more and more hidden. Secondly, local governments issued bonds gradually in pilot areas. The central government issued bonds and loaned to local governments, then the central government issued local governments’ bonds on local governments’ behalf since 2009, some local governments were allowed to issue bonds in 2011.

Stage Five (2013 till now). Financial decentralization between central and local governments is gradually standardized. At the Third Plenary Session of the Eighteenth Central Committee of the Communist Party of China in November 2013, it confirmed series of important reform measures such as completing financial market system, strengthening macro-control system, deepening fiscal and tax reform, one of the most important issues is to regulate local governments’ financing and improve local governments’ debt to be transparent, standardized as well as market-oriented.

2.2. Theoretical analysis

The goal of central government’s macro-control can be simplified to mainly

maintain economic growth while take inflation into account. According to Kiefer (2008), the central government's objective function is:

$$U_t = -\frac{1}{2} \times [(g_t - \hat{g}_t)^2 + \lambda \times \pi_t^2] \quad (1)$$

Among them, g_t represents economic growth rate in t year, $\hat{g}_t$ represents expected economic growth rate, π_t represents inflation rate. The maximum of central government utility function is 0, which means inflation is 0 while the goal of economic growth $\hat{g}_t$ is achieved, but it is difficult to achieve this goal. In reality, the central government should balance between economic growth and inflation. λ ($\lambda > 0$) represents the central government's emphasis on inflation, the bigger λ is, the greater the weight given by the central government to inflation is. Economic growth is determined by Lucas Aggregate Supply Equation, by simple transformation, the output equation is, $g_t = g_t^* + a \times (\pi_t - \pi_t^e)$, g_t^* represents potential economic growth rate, π_t^e represents expected inflation rate, a represents sensitivity of output to unexpected change of inflation rate. So the objective function of the central government is:

$$U_t = -\frac{1}{2} \times [(g_t^* + a \times (\pi_t - \pi_t^e) - \hat{g}_t)^2 + \lambda \times \pi_t^2] \quad (2)$$

Take the first derivative of π_t ,

$$\pi_t = \frac{a}{\lambda + a^2} \times (\hat{g}_t - g_t^*) + \frac{a^2}{\lambda + a^2} \times \pi_t^e \quad (3)$$

In short term, suppose inflation is a monetary phenomenon, when currency flow is constant and other institutional factors are stable, inflation is mainly determined by money supply, which means $\pi_t = \Delta m_t$.

Let $\pi_1 = \frac{a}{\lambda + a^2} \times (\hat{g}_t - g_t^*) + \frac{a^2}{\lambda + a^2} \times \pi_t^e$, representing central government's optimal currency growth rate.

From the perspective of local governments, it can be simplified as local governments only care about economic growth instead of inflation, means $\lambda = 0$.

Assume local governments are homogenous and all local governments aim at central government's expected economic growth rate, the equation is as follows:

$$\pi_{it} = \frac{1}{a} \times (\hat{g}_t - g_t^*) + \pi_t^e \quad (4)$$

Among them, i represents the i^{th} government.

Let $\pi_2 = \frac{1}{a} \times (\hat{g}_t - g_t^*) + \pi_t^e$, because all local governments' behavior is unanimous, π_2 is local government's expected optimal currency growth rate. Obviously, $\pi_2 > \pi_1$,

means that local governments are pursuing economic growth, without considering inflation, the required currency supply growth will be faster.

If local governments are heterogeneous (In reality, different provinces in China make their own economic growth goals respectively), so take the i^{th} government as an example, equation (4) can be transformed into:

$$\pi_{it} = \frac{1}{a} \times (\hat{g}_{it} - g_{it}^*) + \pi_t^e \quad (5)$$

The average inflation rate across country is:

$$\frac{1}{n} \times \sum_{i=1}^n \pi_{it} = \frac{1}{a} \times \left(\frac{1}{n} \times \sum_{i=1}^n \hat{g}_{it} - \frac{1}{n} \times \sum_{i=1}^n g_{it}^* \right) + \pi_t^e \quad (6)$$

When it comes to the whole country, the average potential economic growth rate of all provinces equals to national growth rate, and we suppose that unexpected disturbance has the same effects on the whole country,

$$\text{i.e. } \frac{1}{n} \times \sum_{i=1}^n g_{it}^* = g_t^*, \text{ so,}$$

$$\frac{1}{n} \times \sum_{i=1}^n \pi_{it} = \frac{1}{a} \times \left(\frac{1}{n} \times \sum_{i=1}^n \hat{g}_{it} - g_t^* \right) + \pi_t^e \quad (7)$$

Let $\pi_3 = \frac{1}{a} \times \left(\frac{1}{n} \times \sum_{i=1}^n \hat{g}_{it} - g_t^* \right) + \pi_t^e$, which is the expected optimal currency growth rate under local governments' competition. Because of the incentives of GDP growth, local governments tend to pursue higher economic growth goal, i.e. $\frac{1}{n} \times \sum_{i=1}^n \hat{g}_{it} > \hat{g}_t$, so, $\pi_3 > \pi_2 > \pi_1$.

The result of local governments' autonomous decision-making is that local governments' required currency growth rate is much higher than central government's optimal currency growth rate. If financial decentralization is too great, the financing demand from local governments' investment passion could be satisfied, but it could evidently cause inflation, which is also one of the most important reasons for two severe inflations in 1980s. Therefore we have some theoretical deductions as follows:

Deduction 1: When the extent of financial decentralization increases, the pressure caused by inflation and economic overheat will increase.

If the extent of financial decentralization is high enough, the local governments would have impetus and capacity to invest, which would lead to overheat of macro-economy.

Deduction 2: When there is a great economic downturn pressure, local governments' debt would increase sharply.

When economy encounters external crises, such as Asian financial crisis and international financial crisis in 2008, economic growth rate decreases distinctively,

the central government would encourage local governments to increase investment to promote economic growth; hence local governments' debt would increase sharply.

Deduction 3: While China has fiscal decentralization, it still maintains financial centralization.

When local governments are pursuing economic growth, besides fiscal decentralization, they hope to gain more credit resources, namely they require financial decentralization. However, when it comes to the whole country, it will amplify macro risks (inflation) and increase economic fluctuation. So the result of the game is that the central government has to mobilize local governments by fiscal decentralization in order to develop economy and maintain social stability, but the higher degree fiscal decentralization is, the more control over financial system is required. After repeated experimentation, China has ultimately established a framework of "fiscal decentralization and financial centralization".

3. Research design and data specification

3.1. Measurement of fiscal decentralization

There are many researches on fiscal decentralization home and abroad. Foreign scholars use local governments' expenditure (revenue)/central government's expenditure (revenue) as indicator of fiscal decentralization, to analyze differences of limits of authority on expenditure or revenue among local governments in different countries. Theoretically, when the fiscal and tax system is fixed in one country, the degree of decentralization between central and local governments is fixed, if the fiscal and tax system remains unchanged, then the degree of decentralization would remain unchanged. So the above-mentioned indicator is appropriate for cross country analysis, but it is inappropriate for analyzing local governments' fiscal decentralization within one country. In practice, local governments' tax revenue or expenditure changes every year, and different local governments' financial power is different within the same year, the above-mentioned indicator has certain feasibility to analyze practical changes and difference in fiscal decentralization. Therefore, many researches in China use above-mentioned indicator to measure fiscal decentralization. Chen and Gao (2012) demonstrate that different indicators of fiscal decentralization have different influences on empirical results, sometimes the results are contrary, so it should be prudential to analyze the practical meaning of each indicator, so to chose reasonable indicator according to sample period.

Considering that different fiscal decentralization indicator has different results, we plan to adopt two indicators used in most researches, which are expenditure indicator and fiscal autonomy indicator to analyze the robustness of the model.

3.2. *Measurement of financial decentralization*

How to measure financial decentralization is the biggest challenge and the core of this paper. Fiscal decentralization can be measured by the ratio of central government's expenditure to local governments' expenditure. However, financial decentralization cannot be measured in this way, because the volume of national loan is equal to total volume of local governments' loan, there is no such situation that central government and local governments loan respectively. He and Miao (2016) use the ratio of loan from each province to national loan as financial decentralization indicator, which can provide reference for appraising each province's ability to get loan, but there are two points should be considered. Firstly, using the ratio of loan from each province to national loan as financial decentralization indicator means that the sum of all provinces decentralization indicators equals to 1 every year, namely the average national financial decentralization indicators are the same every year, which means that from the perspective of time, the degree of financial decentralization remains the same nationwide. Secondly, as for credit, the central financial administration has the same requirements for every province, and the scale of each province's loan is influenced by economic development to a large extent, more loans cannot represent higher degree of financial decentralization.¹

From the perspective of financial management system, it is not difficult to find changes of financial decentralization or centralization, but it is hard to quantify those changes. We plan to use econometric method to solve this problem and use above-mentioned ratio of each province to carry out robustness testing.

Considering data availability, this paper mainly analyzes the degree of financial decentralization from the perspective of credit.² China's credit management system experienced four stages since 1981. Stage one was from 1981 to 1983, when credit capital management of "unified plan, level-to-level administration, credit and loan combination, full responsibility of balance" were implemented. Stage two was from 1984 to 1993, when credit capital management of "unified plan, capital allocation, actual loans and deposits, mutual allocation" were implemented, and credit capital allocation obeyed the rule of "central and municipal governments joining together". In 1984, all specialized banks' RMB credit capital were included in national comprehensive credit plan, People's Construction Bank of China was included in November 1985. However, in 1988, credit was out of control, which led to economic overheating, and then the central bank began to implement "limit loan" management over specialized banks. Stage three was from early 1994 to 1998, when the principle

¹ He and Miao (2016) notice that. Of course, there is similar problem with fiscal decentralization indicator.

² As an economy mainly depends on indirect financing, credit is the main channel for local governments to intervene and acquire financing.

of credit capital management shifted to “aggregate control, proportion management, classification guidance, market financing”, turning direct control of credit scale management to indirect control of using multiple financial measures. Stage four was after 1998, when credit scale management was cancelled, on the basis of gradually carrying out asset-liability ratio management and risk management, credit capital management of “planned guidance, self balance, proportion management, and indirect regulation” were implemented.

Credit management system is the main factor influencing financial decentralization and decides the loan scale of local governments. If we could find the change of every province’s credit balance which was influenced by credit management system, we could use it as the factor of financial decentralization. Data show that every province’s loan is greatly correlated and converged. Specifically, in statistics, we use factor analysis to study factors influencing credit in 31 provinces in China, and separates factors influenced by credit management system.

Factor analysis emphasizes on explaining the correlation among observed variables, while analyzing 31 provinces’ loan growth rate, there are many reasons for their correlations, including shared influencing factors and special factors. The essence of factor analysis is to use several potential but unobservable independent random variables to describe the correlations among these variables.

$$\begin{aligned}
 Z_1 &= l_{11} \times F_1 + l_{12} \times F_2 + \dots + l_{1m} \times F_m + \varepsilon_1 \\
 Z_2 &= l_{21} \times F_1 + l_{22} \times F_2 + \dots + l_{2m} \times F_m + \varepsilon_2 \\
 &\dots \\
 Z_p &= l_{p1} \times F_1 + l_{p2} \times F_2 + \dots + l_{pm} \times F_m + \varepsilon_p
 \end{aligned} \tag{8}$$

i.e., $Z = L \times F + \varepsilon$, and $E(F) = 0$, $COV(F, F) = I$, $COV(\varepsilon, F) = 0$.

We use China’s 31 provinces’ loan balance growth rate at year-end as sample, to study main factors promoting each province’s loan growth, see Table 1.

Table 1
Factor analysis result of 31 provinces’ loan growth rate

Factors	Variance	Accumulative variance	Explaining power	Accumulative explaining Power
Factor 1	8.271840	8.271840	0.346012	0.346012
Factor 2	6.797172	15.06901	0.284326	0.630338
Factor 3	3.991332	19.06034	0.166958	0.797296
Factor 4	2.238833	21.29918	0.093651	0.890947
Factor 5	1.598480	22.89766	0.066865	0.957812
Factor 6	1.008567	23.90622	0.042188	1.000000
Total	23.90622	110.5043	1.000000	

Table 1 shows that there are six factors to explain 31 provinces' loan growth rate, among them, the first three factors' explaining power is 35%, 28% and 17% respectively, the accumulative explaining power is 80%. We believe that factor 3 is the factor to describe credit management system and could be used as financial decentralization indicator because:

Firstly, except few provinces, most provinces' loan growth rate variables have positive factor loads on first three factors, which means the first three factors are positively related to each province's loan growth rate, while factor 4, 5 and 6 have an accumulative explaining power of 20%, and different provinces have different positive or negative factor loads on these factors, which means the last three factors are more suitable to describe differentiated characteristics of each province's loan growth rate. Generally, the main factor affecting a province's loan condition should be local physical economic demand, national macroeconomic situation and credit management requirements of financial authorities, which could be the first three factors.

Secondly, factor 1 has the most explaining power, so it should be local physical economic demand factor, which is agreeable with the practice that local loan is mainly affected by local economic development, and factor 1 has low correlation with national economic growth, which does not match the stages of credit management system.

Thirdly, factor 2 has the most correlation with national macroeconomic growth. At 2% confidence level, factor 2 has a correlation of 0.39 with national real GDP growth rate. In order to facilitate comparison, we standardize real GDP; factor 2 has a strong consistency with standardized real GDP trend (see Figure 1), which matches previous theoretical assumption.

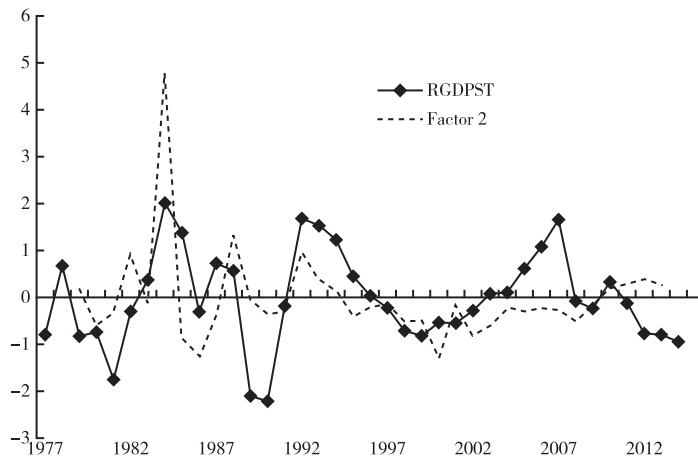


Figure 1. Factor 2 and standardized real GDP (RGDPST) trend

Fourthly, factor 3 matches those stages of credit management system most. We describe the trend of factor 3 (see Figure 2), in which the shadow parts are four different stages of credit management system.

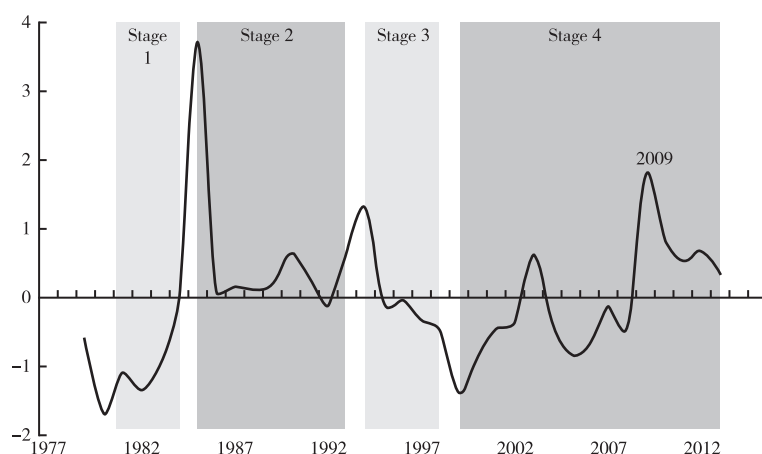


Figure 2. Factor 3 trend and credit management system evolution

Figure 2 shows that factor 3's trend is highly related to credit management system. At the early stage of reform and opening-up, credit management was highly concentrated in central government; local governments had little financial decentralization. With the new credit management system started from the end of 1984, local governments' intervention in credit resources highly increased, which stimulated local governments' investment impulse to a certain degree. However, in several years after the credit was out of control, the central government strictly implemented austerity policy of "all should be controlled by central government", so it was difficult for local governments to intervene in credit resources allocation and caused a low degree of financial decentralization. The central government decided to establish socialist market economic system in November 1993. A series of financial laws such as the Law on the People's Bank of China, the Law of Commercial Banks were published successively after 1995, which was the official beginning of financial system reform. In 1998, the Central Committee of the Communist Party of China decided to set up financial work committee of the Central Committee of the Communist Party of China and the Party committee of financial institutions, the Party Committees and personnel of the central bank and state-owned commercial banks' branches detached from local governments, the power of local governments intervening in financial resources allocation declined obviously, so factor 3 declined sharply in 1999. The degree of local governments' financial decentralization has been quite low since 2000. In order to cope with financial crisis, the central government delegated local governments more power

to intervene in credit in 2009, so factor 3 increased largely, then declined sharply.

Overall, from the beginning of reform and opening-up to 1994, the degree and fluctuation of financial decentralization was large. The financial management system further centralized and the power for local governments intervening in credit resources allocation declined sharply since 1998 (except 2009), factor 3 captures this institutional feature well. Hence we use factor 3 as the variable of measuring the degree of financial decentralization.

3.3. Other indicators and data sources

The data structure of this paper is panel data including: real GDP growth rate, inflation, capital (measured by fixed asset investment growth rate, *invest*), workers (measured by annual employment, *wkr*), macro taxation (measured by expenditure/local governments' GDP, *tax*), trade openness (measured by trade volume/local governments' GDP, *trade*), fiscal decentralization (measured by local average expenditure/national average expenditure (*EXPER*) and local fiscal autonomy (*RVEX*), local fiscal autonomy equals local revenue/local expenditure), financial decentralization (measured by factor 3 and each province's average loan balance's proportion of national average loan balance (*avgloan*)). Data resources are CEIC, Wind database, CEInet database, China and local governments' statistical yearbooks. Sample period is between 1977 and 2014 (see Table 2).

Table 2
Descriptive statistics of main economic variables

Variables	Observation	Means	Standard deviation	Minimum	Maximum
GDP growth rate (<i>grgdp</i> , %)	1115	10.91	4.27	-9.20	41.50
Real GDP growth rate per capita (<i>grgdp_avg</i> , %)	1115	9.74	4.58	-11.05	39.68
Inflation rate (<i>Inflation</i> , %)	1011	5.53	6.50	-3.30	29.40
Investment growth rate (<i>invest</i> , %)	1116	22.56	18.73	-32.60	190.38
Workers (<i>wkr</i> , 10 thousand)	1077	1982	1433	93	6554
Tax (<i>tax</i> , %)	1081	10.33	6.59	0.64	62.03
Openness of economy (<i>trade</i> , %)	1065	21.18	48.66	0.00	1280.55
Proportion of average expenditure (<i>exper</i>)	1109	1.36	0.92	0.44	6.73
Fiscal autonomy (<i>rvex</i>)	1081	0.78	0.72	0.01	9.15
Financial decentralization (<i>f3</i> , exponent)	1085	0.00	0.98	-1.66	3.72
Average loan (<i>avgloan</i> , %)	1116	1.24	1.31	0.28	7.22

4. Empirical research of financial decentralization

4.1. Analysis of the impact of financial decentralization on output and inflation

4.1.1. Panel data model analysis

This paper takes unobservable effect into account, so the model can be established as follows:

$$y_{it} = c + u_i + \beta \times x_{it} + e_{it} \quad (9)$$

u_i represents individual effect, if we directly use mixed least-squares estimation instead of considering individual effect, it could lead to endogenous problem and a deviate result. If u_i is nonrandom variable, then it could be used as explanatory variable, so it must be estimated by fixed effect model:

$$y_{it} - \bar{y}_i = \beta \times (x_{it} - \bar{x}_i) + (e_{it} - \bar{e}_i) \quad (10)$$

Among them, $\bar{y}_i$, $\bar{x}_i$ and $\bar{e}_i$ are average values, first take means in each group of data according to time, u_i does not change over time, so unobservable effect can be removed by equation (10), so we get consistent estimates.

If u_i is random disturbance, it can be part of disturbances, which means that random effect exists, let $v_i = u_i + e_{it}$, use random effect model or mixed least-squares estimation to estimate. The random effect estimation model is:

$$y_{it} - \lambda \bar{y}_i = (x_{it} - \lambda \bar{x}_i) \beta + (v_{it} - \lambda \bar{v}_i) \quad (11)$$

Among them, λ is estimated by $\hat{\lambda}$, $\hat{\lambda} = 1 - \{ 1 / [1 + T \times (\hat{\sigma}_e^2 / \hat{\sigma}_u^2)] \}^{0.5}$.

The mixed least-squares estimation is:

$$y_{it} = x_{it} \beta + v_{it} \quad (12)$$

We find that equations (10), (11) and (12) can be integrated in framework of equation (11), when $\lambda = 1$, or when $T \rightarrow \infty$ or $\hat{\sigma}_e^2 / \hat{\sigma}_u^2 \rightarrow \infty$, equation (11) is equation (10), there is no difference between fixed effect and random effect. When $\lambda = 0$, or when $\hat{\sigma}_e^2 / \hat{\sigma}_u^2 \rightarrow 0$, equation (11) becomes equation (12), there is no difference between random effect model and mixed least-squares estimation. However, when unobservable effect exists, this assumption does not hold. So we believe that there is deviation if we use mixed least-squares estimation, we have to use Hausman testing to determine whether we should use fixed effect model or random effect model, test statistic is:

$$H = (\hat{\delta}_{FE} - \hat{\delta}_{RE})' \times [A \text{ var}(\hat{\delta}_{FE}) - A \text{ var}(\hat{\delta}_{RE})]^{-1} \times (\hat{\delta}_{FE} - \hat{\delta}_{RE}) \xrightarrow{D} \chi^2_M \quad (13)$$

Among them, $\hat{\delta}_{FE}$ and $\hat{\delta}_{RE}$ are the coefficient of fixed effect and random effect respectively, M is the number of parameters to be estimated.

Considering each province's economic growth and inflation are affected by above-mentioned mutual factors, in addition, there are some individual effects, so the following estimation model is established:

$$\begin{aligned} y_{it} &= c + u_i + \beta_1 \times invest_{it} + \beta_2 \times wkr_{it} + \beta_3 \times tax_{it} + \beta_4 \times trade_{it} + \beta_5 \times fin_{it} + \beta_6 \times f3_{it} + e_{it} \\ \pi_{it} &= c + u_i + \beta_1 \times invest_{it} + \beta_2 \times wkr_{it} + \beta_3 \times tax_{it} + \beta_4 \times trade_{it} + \beta_5 \times fin_{it} + \beta_6 \times f3_{it} + e_{it} \end{aligned} \quad (14)$$

Besides, considering there might be a reverse causality between economic growth rate and financial decentralization, which could cause endogenous problem, this paper adopts generalized method of moments (GMM) to do dynamic estimation of panel data model, see Table 3 and Table 4.

Table 3
Factors affecting the growth rate of real GDP

	(1) fe1	(2) fe2	(3) re1	(4) re2	(5) SYSGMM1	(6) SYSGMM2
<i>invest</i>	0.1038*** (15.541)	0.1037*** (15.468)	0.1049*** (15.616)	0.1034*** (15.247)	0.0882*** (18.360)	0.0915*** (18.193)
<i>wkr</i>	0.0005** (2.035)	0.0005** (2.012)	0.0004*** (3.722)	0.0001 (1.425)	0.0004*** (7.321)	0.0001* (1.664)
<i>tax</i>	-0.1736*** (-6.938)	-0.1894*** (-4.532)	-0.1501*** (-7.194)	-0.1952*** (-5.133)	-0.1592*** (-8.008)	-0.1871*** (-4.076)
<i>trade</i>	-0.0003 (-0.108)	-0.0000 (-0.015)	0.0051** (2.124)	0.0081*** (3.553)	0.0034*** (2.613)	0.0052*** (3.148)
<i>exper</i>	0.3908 (1.085)		0.6632*** (3.552)		0.7689*** (9.367)	
<i>f3</i>	0.2098* (1.757)	0.2082* (1.727)	0.2233* (1.874)	0.2621** (2.157)	0.1774* (1.655)	0.0784 (0.763)
<i>rvex</i>		0.1787 (0.505)		0.6128** (1.976)		0.4477 (0.816)
<i>_cons</i>	8.7503*** (10.710)	9.2850*** (13.865)	8.2895*** (18.062)	9.6215*** (25.090)	6.3334*** (10.843)	7.6440*** (9.674)
<i>R²</i>	0.2714	0.2707	0.2670	0.2597		
<i>sarganp</i>					1	1
<i>ar1p</i>					0.0007	0.0008
<i>ar2p</i>					0.2208	0.2543

Notes: *t* statistics are shown in brackets, * represents $p < 0.1$, ** represents $p < 0.05$, *** represents $p < 0.01$, the same below.

Table 4
Factors affecting inflation rate

	(1) fe1	(2) fe2	(3) re1	(4) re2	(5) SYSGMM1	(6) SYSGMM2
<i>invest</i>	0.0244* (1.871)	0.0193 (1.491)	0.0261** (1.985)	0.0202 (1.544)	0.0728*** (18.376)	0.0659*** (10.186)
<i>wkr</i>	-0.0031*** (-6.463)	-0.0030*** (-6.530)	-0.0003 (-1.606)	-0.0006*** (-3.563)	-0.0003*** (-4.519)	-0.0004*** (-5.617)
<i>tax</i>	-0.1477*** (-2.782)	-0.4719*** (-5.282)	-0.0152 (-0.368)	-0.3242*** (-4.251)	0.0518* (1.915)	-0.1929** (-2.352)
<i>trade</i>	-0.0057 (-1.192)	-0.0033 (-0.692)	-0.0085** (-1.988)	-0.0087** (-2.187)	-0.0014** (-1.968)	-0.0020*** (-4.010)
<i>exper</i>	0.2844 (0.394)		-0.0417 (-0.126)		-0.3559** (-2.052)	
<i>f3</i>	2.1436*** (9.498)	2.3433*** (10.305)	2.0392*** (8.985)	2.2380*** (9.815)	1.1741*** (13.115)	1.3748*** (12.411)
<i>rvex</i>		3.0012*** (4.431)		2.7137*** (4.738)		1.6922** (2.214)
<i>_cons</i>	12.6308*** (7.453)	13.8864*** (10.713)	5.9227*** (7.308)	7.5407*** (10.477)	0.8058* (1.793)	2.1251*** (3.582)
<i>R²</i>	0.1499	0.1685	0.1144	0.1407		
<i>sarganp</i>					1	1
<i>ar1p</i>					0	0
<i>ar2p</i>					0.084	0.1844

In terms of factors affecting GOP growth rate, Hausman testing shows that the model has no random effect. Identification of panel data model with fixed effect is statistically significant and all coefficients are stable. Model 1 and model 2 demonstrate that the increase of investment and workers can effective promote economic growth while heavy pressure of macro taxation could affect economic growth; economic openness's contribution to economic growth is not significant. No matter measured by local average expenditure/national average expenditure (*exper*) or local fiscal autonomy (*rvex*), fiscal decentralization's contribution to economic growth is not significant. At 10% confidence level, financial decentralization indicator's role of promoting economic growth is significant.

Statistical results show that there is no random effect, but authors list the estimation result of random effect model, see model 3 and model 4. In model 3 and model 4, coefficients are significant, economic openness can promote economic growth significantly. Besides, at 5% confident level, two fiscal decentralization indicators have a significant role in promoting economic growth and financial decentralization has more significant role than in fixed effect model.

Model 5 and model 6 are estimation result of GMM, besides economic openness plays a significant role in promoting economic growth, *exper* also plays a more significant role while coefficients of other variables and significance remain the same.

So the overall model is robust and can demonstrate that financial decentralization can promote economic growth in a certain degree.

In terms of factors affecting inflation rate, Hausman testing shows that the model has no random effect. Identification of panel data model with fixed effect is statistically significant and all coefficients are stable. Model 1 and model 2 demonstrate that financial decentralization plays a significant role in pushing forward inflation. Specifically, speeding investment growth does not push forward inflation significantly; the increase of labor supply will bring the production cost down and lower products' price, which means a significant decrease of price level; heavy pressure of macro taxation is harmful to economy, so as to prohibit aggregate demand and lower the price level; economic openness's influence on inflation is not significant. Different fiscal decentralization indicators has different influences on inflation, when it is measured by local average expenditure/national average expenditure (*exper*), its influence on inflation is not significant, while measured by local fiscal autonomy (*rvex*), its influence on inflation is significant. At 1% confidence level, financial decentralization can influence price level significantly, the higher the degree of financial decentralization is, the higher the inflation is.

We also list the estimation result of random effect model, see model 3 and model 4. The coefficients' significance level in model 3 and model 4 are quite different, especially the coefficient of local average expenditure/national average expenditure (*exper*) is negative which shows that the model is unstable. Two indicators of fiscal decentralization have opposite influences on inflation, on one hand, it demonstrate that fiscal decentralization's influence on inflation is not certain; on the other hand, it is important to adopt Hausman testing to determine whether the model is fixed effect model or random effect model. He and Miao (2016) only list the estimation result of fixed effect and random effect panel data model, but do not clarify which model to use, so this can be improved. Besides, random effect panel data model also shows that high economic openness can reduce domestic inflation, this agrees with China's overall inflation's downturn trend since China joining in WTO. In random effect panel data model, financial decentralization indicator has significant influence on inflation; moreover, change of the coefficient is quite small which means that financial decentralization's influence on inflation is stable.

Model 5 and model 6 are estimation result of GMM. Coefficient of trade is negative and statistically significant, which is similar to result of random effect model, indicating that China's economy integrating into globalization is beneficial to lowering domestic inflation. Similar to Chen and Gao's results (2012), the choice of fiscal decentralization indicator matters greatly to empirical research results, in GMM estimation, if we use local average expenditure/national average expenditure (*exper*) as fiscal decentralization indicator, its influence on inflation is negative, while the influence is significantly higher if we use local fiscal autonomy (*rvex*) as fiscal decentralization indicator. Besides, in model 5, macro taxation (*tax*) coefficient is positive and significant at 10% confidence

level; other five models vary greatly and do not fit theoretical analysis. So we believe that the estimation result of model 6 is more understandable, coefficients are smaller but financial decentralization significantly pushes forward inflation.

The above-mentioned research results shows that financial decentralization can significantly push forward inflation, moreover, at 10% confidence level, it has positive influence on economic growth, which proves Deduction 1.

4.1.2. Robustness testing

In this part, we will test the robustness of model from two aspects, one is financial decentralization's influence on real GDP per capita, and the other is to adopt average loan as financial decentralization indicator to analyze its influence on economic growth and inflation.

In this part, we use the growth rate of real GDP per capita as explained variable, Table 5 lists estimation results. Currently, we do not have real GDP per capita at provincial level, let Y_t be real GDP, P_t represents population, so we can deduce the following equation in theory: $\log(Y_t/P_t) - \log(Y_{t-1}/P_{t-1}) = [\log(Y_t) - \log(Y_{t-1})] - [\log(P_t) - \log(P_{t-1})] = g_t - p_t$, so we have the growth rate of real GDP per capita equal to real GDP growth rate minus population growth rate.

Table 5

Panel data of factor affecting the growth rate of GDP per capita

	(1) fe1	(2) fe2	(3) re1	(4) re2	(5) SYSGMM1	(6) SYSGMM2
<i>invest</i>	0.1117*** (15.420)	0.1112*** (15.311)	0.1121*** (15.480)	0.1109*** (15.209)	0.0993*** (10.404)	0.1001*** (11.900)
<i>wkr</i>	0.0011*** (4.063)	0.0011*** (4.074)	0.0005*** (4.422)	0.0003*** (3.265)	0.0004*** (4.915)	0.0003*** (4.530)
<i>tax</i>	-0.1683*** (-6.203)	-0.2018*** (-4.457)	-0.1685*** (-7.376)	-0.2207*** (-5.376)	-0.1874*** (-8.343)	-0.2027*** (-5.167)
<i>trade</i>	-0.0026 (-0.914)	-0.0023 (-0.790)	0.0008 (0.321)	0.0029 (1.181)	0.0012*** (16.376)	0.0019*** (15.233)
<i>exper</i>	0.2728 (0.698)		0.4104** (1.961)		0.4577** (2.516)	
<i>f3</i>	0.1403 (1.083)	0.1519 (1.163)	0.1780 (1.385)	0.2177* (1.667)	0.0116 (0.078)	0.0900 (0.726)
<i>rvex</i>		0.3622 (0.946)		0.6226* (1.858)		0.3533 (0.713)
<i>_cons</i>	6.3710*** (7.191)	6.7763*** (9.337)	7.3170*** (14.139)	8.2671*** (19.863)	5.9110*** (8.903)	6.9237*** (9.963)
<i>R²</i>	0.2711	0.2714	0.2783	0.2786		
<i>sarganp</i>					1	1
<i>ar1p</i>					0.0005	0.0008
<i>ar2p</i>					0.1055	0.0701

Compared with Table 3, we adopt the growth rate of real GDP per capita as explained variable, most coefficients change a little bit, but their signs and significance remain the same. In fixed effect model, the role of fiscal and financial decentralization is not significant, while fiscal and financial decentralization indicators significantly promote the growth rate of real GDP per capita at 10% confidence level in random effect model. Similar to Table 3, GMM estimation shows that trade significantly promote economic growth, coefficient of local average expenditure/national average expenditure (*exper*) becomes more significant. Overall, estimation in Table 3 is relatively robust and coefficient of financial decentralization in Table 3 is more significant.

He and Miao (2016) used each province's loan volume/national loan volume as financial decentralization indicator. We believe that the absolute loan volume is mainly influenced by each province's economic scale. According to what we have done with fiscal decentralization indicator, we use each province's average loan/national average loan as financial decentralization indicator, other variables remaining the same, estimation results are listed in Table 6.

Table 6

Other financial decentralization indicators' influences on economic growth and inflation

	Economic Growth		Inflation	
	Model 1-Random	Model 2-Fixed	Model 3-Fixed	Model 4-Fixed
Investment (<i>invest</i>)	0.1047***	0.1025***	0.0530***	0.0528***
Worker (<i>wkr</i>)	0.0004**	0.0006**	-0.0025***	-0.0024***
Tax (<i>tax</i>)	-0.129***	-0.0873**	-0.2083***	-0.3872***
Openness (<i>trade</i>)	0.004	0.0004	-0.0071	-0.0053
Average expenditure (<i>exper</i>)	0.3426		-0.8568	
Fiscal autonomy (<i>rvex</i>)		-0.2794		2.0479***
Financial decentralization (<i>avgloan</i>)	0.3109**	-0.2273	1.3565*	0.4849
Constant	8.26***	8.68***	11.42***	11.34***
Within group/Overall R ²	0.2509	0.2398	0.0574	0.0656

From the economic growth affecting factors model, if we choose average expenditure ratio (*exper*) as fiscal decentralization indicator, so random effect exists; if we choose fiscal autonomy (*rvex*) as fiscal decentralization indicator, so fixed effect exists. Estimation results show that investment and increasing workers can significantly promote economic growth, while the increase of macro taxation can significantly decrease economic growth. However, regardless measured by average expenditure ratio (*exper*) or fiscal autonomy (*rvex*), fiscal decentralization's influence on economic growth is not significant, which is the same as above-mentioned conclusion. At 5% confidence level, in model 1, financial decentralization indicator significantly promotes economic growth while it is not significantly in model 2.

From inflation affecting factors model, Hausman testing shows that random

effect does not exist. The explaining power of fixed effect model is weak, within group/Overall R^2 is only about 0.06. The model shows investment, workers and tax has similar influences on inflation as mentioned above. The enlargement of fiscal decentralization measured by fiscal autonomy (*rvex*) can promote inflation, while financial decentralization's influence is not so significant; this result is different from above-mentioned conclusion because the construction of financial decentralization indicator is unreasonable.

Financial decentralization indicators in Table 6 are totally different from Table 3 and Table 4. However, coefficients of other explaining variables except financial decentralization have small changes and same signs, which indicates that estimation results of Table 3 and Table 4 are robust. This paper also adopts maximum-likelihood estimation and generalized estimation to re-estimate Table 3 and Table 4; the results are robust but not listed because of the length of this paper.

4.2. When there is pressure of economic downturn, increase of local governments' debt speeds up

We compare data of local governments' debt growth rate¹ published by National Audit Office in 2011 with economic growth rate, see Figure 3.

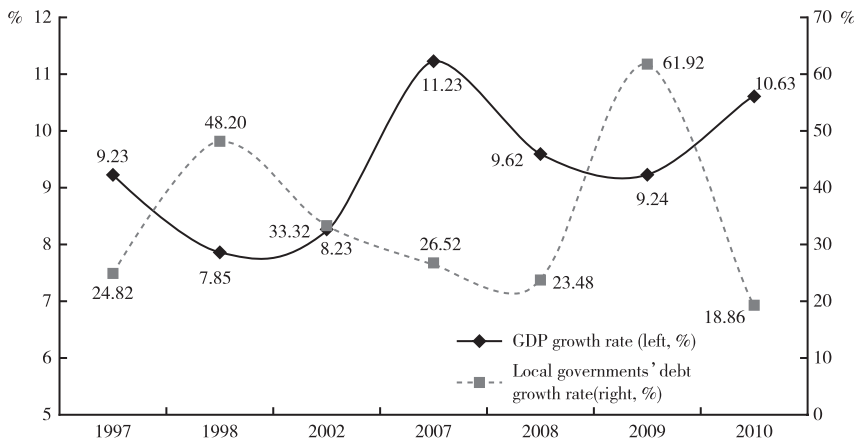


Figure 3. Changes of local governments' debt affected by reverse-cycle regulation

Sources: State Statistical Bureau, National Audit Office.

There is significant negative correlation between local governments' debt growth rate and real GDP growth rate, and the coefficient is -0.52. The mechanism is when

¹ Debt growth rate of 2002 was average growth rate from 1998 to 2002; Debt growth rate of 2007 was average growth rate from 2002 to 2007; real GDP data is the same.

there is a pressure of economic downturn, the central government loosens control of local governments so that local governments can expand debt to increase investment to promote economic stability and recover. This mechanism was obvious during two crises, so Deduction 2 is proved.

4.3. Policy framework of China's fiscal decentralization and financial centralization

Based on the calculation of fiscal decentralization indicator of 31 provinces, we calculate annual mean value of expenditure (*exper*) and fiscal autonomy (*rvex*) as well as the trend of fiscal and financial decentralization, see Figure 4.

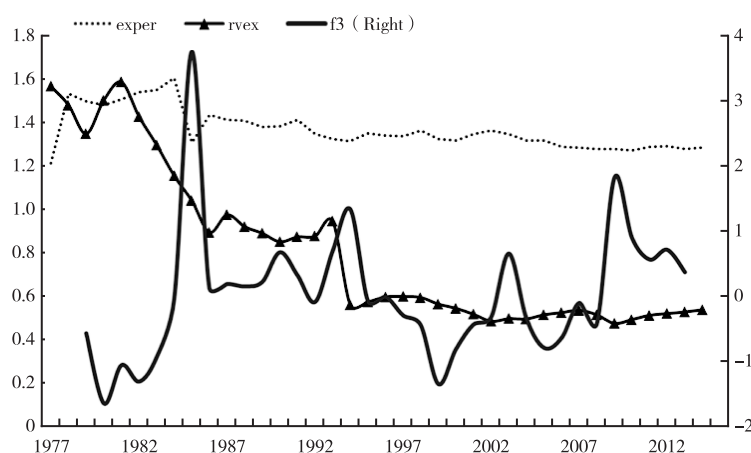


Figure 4. Trend of fiscal and financial decentralization

Figure 4 shows the degree of fiscal decentralization obviously decreased and stabilized after 1994 from the perspective of fiscal autonomy, which is the result of tax-sharing reform. According to per capital fiscal expenditure, the degree of fiscal decentralization increased sharply in 1978 while decreased and stabilized after 1985. Two fiscal decentralization indicators illustrate that there was few changes of fiscal decentralization. Moreover, we study the relationship between fiscal and financial decentralization, see Table 7.

Table 7

Correlation between financial decentralization and fiscal decentralization

	1977-2014	1977-1993	1994-2014
<i>f3</i> and <i>exper</i>	-0.41**	-0.68***	-0.37
<i>f3</i> and <i>rvex</i>	-0.24	-0.58**	-0.34

Overall, there is negative correlation between fiscal and financial decentralization, and this correlation was more significant before tax-sharing reform in 1994. This conclusion proves that the initial combination of fiscal and financial decentralization gradually transitioned to fiscal decentralization and financial centralization between 1977 and 1993, or a loosening and tightening combination of fiscal and financial system and proves Deduction 3. The fiscal relationship between central and local governments has been gradually standardized and the degree of fiscal decentralization has been relatively stable since tax-sharing reform in 1994. Meanwhile, the central government enhanced financial centralization out of the demand of overall macroeconomic management and financial stability instead of coordinating with fiscal decentralization, which is the main reason why there was no significant correlation between fiscal and financial decentralization since 1994.

5. Conclusions

Theoretical analysis and empirical research show that excessive financial decentralization will cause inflation and economic overheat as well as macroeconomic fluctuations. This paper also discovers that there was significant negative correlation between fiscal and financial decentralization before tax-sharing reform. The tax-sharing reform made the central-local fiscal system relatively fixed, so the central government depends more on financial regulation, namely the central government let local governments intervene into financial system to get credit resources to stabilize economic growth when under economic downturn cycle, otherwise the central government would regulate local governments' investment and financing when under economic overheating cycle, which causes local governments' debt growth rate to show reverse cycle changes. Therefore, from perspective of the central government, financial decentralization and centralization are reverse-cycle supervisory measures, but financial decentralization could also be the central government's governing goal when financial decentralization causes economic overheat. The main policy implications of this paper are as follows:

Firstly, to standardize central-local financial management functions and shift the trend of delegating power to local governments as reverse-cycle supervisory measures. Under the circumstance of relatively stable fiscal system, impact of financial management system alteration on macro economy has increased significantly since 1994. There still are many blurred fields of financial management boundary between the central government and local governments, it is convenient for the central government's reverse-cycle regulation but also causes overshooting and enlarges economic fluctuations. We recommend the above-mentioned problem should be coordinated properly during financial supervisory system reform, it is important to identify the boundary for local governments to participate in financial market and

management and gradually establish central-local two-tiered financial supervisory system. We believe that market will play a much more decisive role in financial resources allocation as the financial decentralization system is relatively fixed, it will be beneficial to eliminate macroeconomic fluctuations and prevent financial risks such as illegal financial and pseudo financial innovation.

Secondly, to enhance fiscal policy's function of stabilizing economy and reduce over reliance on financial regulation. In recent years, China's fiscal system has achieved a lot on transparency and standardization but less on its automatic stabilizer role. The central government should grant local governments more space to take actions that suit local conditions, make diversifications and reverse-cycle decision and release flexibility contained in fiscal decentralization system in order to lead local governments' competition to fields such as improving local ecological system and public service while regulating local governments' improper financing actions. As for central government fiscal situation, there is more to do to realize cross-cycle budget balance because of the healthy balance sheet. Especially under economic downturn cycle, it is important for fiscal policy to play a major role in moderately expanding aggregate demand and conducting structural reform because monetary policy is quite loose and the marginal effect is decreasing.

Thirdly, monetary policy regulation should transform to market-oriented price regulation system. Under the circumstance of speeding financial innovation, measures of local governments' intervening into financial market are increasingly diversified and hidden, traditional quantity regulation cannot efficiently prohibit local governments' investment impulse while price tools such as interest rate can better influence local governments' investment behavior.

We sense that how to construct a clear and persuasive financial decentralization framework and how to better measure financial decentralization indicator is still a great challenge. This paper can only try to measure financial decentralization from the perspective of credit management because of data availability. It would be better if we could use financial data in a broader sense and accurately define the traits of government's intervention. Besides, it would be a good research direction to use micro data from financial institutions and enterprises to capture local governments' financial power.

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