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Fiscal decentralization and the imbalance between consumption and investment in China

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Abstract

This research aims to explore the influences of fiscal decentralization on the imbalance between consumption and investment from theoretical and empirical perspectives. First, it analyzes how fiscal decentralization affects the ratio of consumption to investment under the framework of endogenous growth theory. Findings demonstrate that fiscal decentralization and the ratio of consumption to investment display a U-shaped relationship. Then, it empirically explores this question with a panel of 31 administrative regions in China from 1998 to 2015. Findings further show that empirical results verify the correctness of the theoretical results. Results are tested for robustness using different methods. A clear understanding of this project may help the central government in China as well as local governments to determine the reasonable rate of consumption to investment via fiscal means.

JEL Classification E25 · H77

1 Introduction

Consumption and investment are twin variables. Economic factors mutually affect consumption and investment (Dammon et al. 2001). The conflicts between them are not conducive to the long-term economic and social development. Consumption increases, but investment decreases when the ratio of consumption to investment is high. This finding indicates that current consumption was considered, and the reserve force of growth is insufficient. Consumption decreases and investment increases when the ratio of consumption to investment is low. This finding indicates insufficient current consumption, which results in insufficient aggregate demand and economic depression. Given these findings, social planners should properly balance short- and long-term profits (the Hamiltonian function considers the balance of present and future

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profits). These findings also indicate the significance of reasonable rate of consumption to investment. During the past few decades, China has experienced rapid economic growth, and this growth has been accompanied by serious internal imbalances, including underconsumption and overinvestment (Du et al. 2014); moreover, how well China responds to this internal imbalance will determine whether a country obtains healthy and sustainable development (Yang 2012).

Given these dynamics, this study aims to explore how fiscal decentralization affects the imbalance between consumption and investment in China. China's internal imbalance largely stems from the prioritized economic development strategy of the Chinese government. To achieve the strategic objectives, China has established a regionally decentralized authoritarian regime characterized by political centralization and economic decentralization (Du et al. 2014). Numerous studies argue that China's fiscal decentralization has become a driving force for its economic growth (Lin and Liu 2000; Jin et al. 2005; Qiao et al. 2008). A question that has not been thoroughly addressed is whether the China's fiscal decentralization is to blame for its internal imbalance of underconsumption and overinvestment. As China continues to decentralize the powers of fiscal and administrative to lower levels of government, understanding whether the fiscal decentralization generates difficulties for current China's transition from an investment-led growth model to a consumption-investment balanced growth model is becoming increasingly important.

The present study contributes to the literature on fiscal decentralization and the imbalance between consumption and investment in two important ways.

First, from an academic perspective, the existing literature on the relationship between China's fiscal decentralization and the ratio of consumption to investment remains in its infancy. Hence, considering the role of the government in the decision-making process for consumption and investment, this study begins to address the research gap by constructing a theoretical model on the influence of fiscal decentralization on the ratio of consumption to investment and then conducting the related empirical analysis.

Second, the results are practically valuable and significant to ascertain the rational ratio of consumption to investment and provide a policy reference for economic restructuring. Therefore, using panel data for China's provinces, this study empirically attempts to investigate the nonlinear effects of fiscal decentralization on the ratio of consumption to investment.

The remainder of this paper proceeds as follows. Section 2 highlights the relation and contribution of this research to the pertinent literature. Section 3 describes an endogenous growth model that contains fiscal decentralization and the ratio of consumption to investment. Sections 4 and 5 introduce the empirical strategy and data and results, respectively. Finally, Sect. 6 concludes and discusses policy implications.

2 Literature review

Over the last several decades, decentralization has become one of most influential movements as well as most controversial policy focuses in the world of development (Faguet 2004). Since implementing fiscal reforms in the 1980s and 1990s, China

has been a highly decentralized economy (Wu and Heerink 2016). The development of China's fiscal and taxation system can be divided schematically into the following three stages: the highly centralized fiscal management system (before 1978), the fiscal contracting system (1979–1993), and the tax sharing system (1994–present). China's fiscal reform, especially the 1994 tax reform, has achieved obvious changes in fiscal decentralization policy (Shen et al. 2012). Indeed, the latter offers a great opportunity for exploring the impact of fiscal decentralization as well as its nonlinear impact. Many studies tend to justify fiscal decentralization on economic grounds (Rodríguez-Pose and Sandall 2008; Diaz-Serranoa and Rodríguez-Pose 2015), such as the link between fiscal decentralization and economic growth (Qian and Xu 1993; Lin and Liu 2000; Jin and Zou 2005) and between fiscal decentralization and public spending (Rodden 2003; Wang et al. 2011; Liberati and Sacchi 2013). Despite the scholars' attention to vices and virtues of fiscal decentralization policy, the impact of fiscal decentralization on the ratio of consumption to investment remains an unexplored issue. Accordingly, this section briefly outlines existing studies on fiscal decentralization and discusses how fiscal decentralization affects the ratio of consumption to investment.

Fiscal decentralization not only affects the investment but also affects the consumption. The correlation between fiscal decentralization and the ratio of consumption to investment is not clear-cut. First generation theory of fiscal decentralization (FGT) has shown that the decentralized provision of public services has the advantage of efficiency, because local governments perform better than the central government in the delivery of public services that match local needs and preferences[1] (Hayek 1945; Tiebout 1956). FGT depends on the assumption that public decision-makers are benevolent maximizers of social welfare (Musgrave 1959; Oates 1972; Rubinfeld 1987). On the one hand, local governments are encouraged to provide efficient public services and thus enhance the entire social welfare, which stimulates household consumption. On the other hand, as long as the public services provided by local governments match the needs and preferences of the public, investing in any expenditure project is reasonable for the governments. In that case, judging whether local fiscal expenditure is biased toward infrastructure is difficult. Obviously, determining the relationship between fiscal decentralization and the ratio of consumption to investment is difficult as well.

Second generation theory of fiscal decentralization (SGT) builds on FGT but supposes that public officials have clear goals induced by political institutions that diverge from maximizing social welfare (Qian and Weingast 1997; Garzarelli 2004; Oates 2005; Weingast 2014). The typical form of SGT is "market-preserving federalism," and China's fiscal decentralization is representative of this kind of fiscal federalism (Montinola et al. 1995). Within the Chinese institutional context and from

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[1] The cost of centralization is less responsive to the preferences and needs of regions in choosing public services provided by the government (Oates 1972), which may be not conducive to the improvement of the social welfare level and then discourage household consumption. Moreover, public services are provided as the same per capita quantity to each region when regional public services are provided centrally (Lockwood 2002). Thus, judging whether public infrastructure is increased is difficult. Apparently, the relationship between centralization and the ratio of consumption to investment is uncertain.

the economic and political perspectives, China has maintained economic decentralization and political centralization[2] (Qian and Xu 1993; Maskin et al. 2000; Blanchard and Shleifer 2001). Local officials are not elected by local citizens but are appointed by upper-level officials (He 2015). The central government employs the growth rate of the local economy to evaluate and promote the local officials (Blanchard and Shleifer 2001; Li and Zhou 2005; Xu 2011). Consequently, local officials may tend to put fiscal resources into public infrastructure that can quickly drive economic growth in the short term for political promotion. In this case, their chance of promotion will be maximized (He 2015). This phenomenon results in a government expenditure structure biased toward infrastructure and against social welfare provision when the degree of fiscal decentralization is low and the central government has sufficient fiscal resources to adjust the structure of regional fiscal expenditure. This situation encourages investment and discourages household consumption, thereby causing a decrease in the ratio of consumption to investment. However, when the degree of fiscal decentralization exceeds its critical value, the fiscal resources of the central government are insufficient to maintain the balanced adjustment of the regional fiscal expenditure structure, indicating that local governments may increase social welfare provision and decrease infrastructure, because they cannot continue relying on the central government's expenditure adjustment. This phenomenon leads to an increase in the ratio of consumption to investment.

In summary, we find the following two important problems. First, none of the existing studies explore the ratio of consumption to investment from the perspective of fiscal decentralization. This study therefore provides a comprehensive effort to fill the gap in the existing literature. Second, the relationship between fiscal decentralization and the ratio of consumption to investment is ambiguous, which may be nonlinear. The previous section illustrates how we attempt to deal with these limitations.

3 Model

Given that Sect. 2 indicates the possible effect of fiscal decentralization on the ratio of consumption to investment but provides no clear finding, we further explore the question by using an endogenous growth model. We suppose that a closed economy exists, which consists of three sectors, namely, the productive sector, the household sector, and the government. In Sect. 2, this study analyzes the influence of fiscal decentralization on the ratio of consumption to investment from the perspectives of FGT and SGT. The idea of FGT is to provide public services, and the production function often does not consider government expenditure. However, China's fiscal decentralization is the representative of SGT. These governments have a high enthusiasm for economic construction, and the required production function embeds the

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[2] Under political centralization context, the performance evaluation system of officials establishes the incentive structures for local governments, while economic decentralization gives local governments the necessary economic decision-making power to ensure the effectiveness of the incentive effects.

central and local government expenditures. In such case, the theoretical model of this study is constructed under the framework of SGT.

Following Davoodi and Zou (1998), the production function has four factors of production: private capital, federal government expenditure, state government expenditure, and local government expenditure. Notably, all factors are measured on a per capita basis. We depart from the Davoodi and Zou model by assuming that public expenditure is carried out by two levels of government: central and local. Moreover, considering the structural characteristics of the government itself with multiple government levels, the study divides fiscal revenue into the fiscal revenue of the central and local governments. The budget of the government is balanced, and the total government expenditure is allocated between the central and local government tax revenues.

Every household is supposed to maximize her lifetime utility arising from consumption and public expenditure subject to its budget constraint. The lifetime utility is defined as the infinite integral of the discounted present value of instantaneous utility, where instantaneous utility is supposed to be a concave function of private consumption, central government expenditure, and local government expenditure.

Following Barro (1990), Turnovsky and Fisher (1995), and Gong and Zou (2002), the fiscal expenditures of the local and central governments can affect the households' utility. Both central and local expenditures are considered public goods and services provided by the governments. Expenditures and consumption may present a complementary relationship: an increase in the governments' provision of public goods and services will also increase marginal utility of personal consumption in households. Consequently, both expenditures are embedded in the utility function improving household welfare.

The following equations describe the model:

$$\Delta = \max \int_0^{+\infty} u(c, f, s) e^{-\rho t} dt, \tag{1}$$

subject to

$$y = k^\alpha f^\beta s^\gamma, \tag{2}$$

$$g = \left(\tau_f + \tau_s\right) y, \tag{3}$$

$$\dot{k} = \left(1 - \tau_f - \tau_s\right) y - c. \tag{4}$$

Equation (1) expresses social welfare maximization function, where $u(c, f, s)$ is the utility function, and ρ is the positive time discount rate. As to the utility function, we assume the function is $u(c, f, s) = \left[\left(c^{1-\sigma} - 1\right) + \left(f^{1-\sigma} - 1\right) + \left(s^{1-\sigma} - 1\right)\right] / (1 - \sigma)$, where $u_c > 0, u_{cc} < 0; u_f > 0, u_{ff} < 0; u_s > 0, u_{ss} < 0$, and σ is the risk aversion coefficient and $\sigma > 0$.

Equation (2) expresses the production function, where y is the level of output, k is the private capital, f is the central government expenditure, and s is the local government expenditure; all parameters are measured on a per capita basis and similar

to those in Davoodi and Zou (1998). This production function is of Cobb–Douglas type satisfying increasing returns to scale in private capital and public expenditure. In addition, α, β, and γ stand for elasticities of output with respect to capital, central government expenditure, and local government expenditure; and $\alpha + \beta + \gamma = 1$.

Equation (3) expresses the budget constraint for the government, where τ_f and τ_s are the flat income taxes at rates for the central and local governments, respectively; g is total government expenditure per capita and $g = f + s$. The allocation of total government expenditure among different levels of government takes the following form: $\vartheta_s = s/(f + s)$ and $\vartheta_f = f/(f + s)$, where ϑ_s gives the degree of fiscal decentralization and $0 < \vartheta_s < 1$, and $\vartheta_s + \vartheta_f = 1$.

Equation (4) expresses the dynamic accumulation equation of private capital. Post-tax disposable income is used for consumption and capital accumulation. No capital depreciation occurs.

In summary, the decision problem of the representative households is a dynamic optimization problem based on the consumption level. To determine the equilibrium solution, combined with all of these equations, the pertinent Hamiltonian to be maximized by the social projector at each point of time is provided by

$$H(\cdot) = u(c, f, s) + \lambda\big[(1 - \tau_f - \tau_s)y - c\big]. \tag{5}$$

In Eq. (5), λ is the Hamiltonian multiplier. Using the first-order optimality conditions with respect to c and k, we obtain

$$\begin{cases} \partial H/\partial c = c^{-\sigma} - \lambda = 0 \\ \partial H/\partial k = \lambda(1 - \tau_f - \tau_s)\alpha k^{\alpha-1} f^\beta s^\gamma = \rho\lambda - \dot{\lambda} \end{cases}. \tag{6}$$

Using Eqs. (2), (3), and (6), we obtain the economic growth rate on the equilibrium path as follows:

$$g_c = \frac{\dot{c}}{c} = \frac{1}{\sigma}\left[(1 - \tau_f - \tau_s)\alpha(\tau_f + \tau_s)^{\frac{1-\alpha}{\alpha}}(1 - \vartheta_s)^{\frac{\beta}{\alpha}}\vartheta_s^{\frac{\gamma}{\alpha}} - \rho\right]. \tag{7}$$

By substituting Eq. (4) into Eq. (7), we arrive at the ratio of capital to consumption by

$$k/c = \sigma\left[(\sigma - \alpha)(1 - \tau_f - \tau_s)(\tau_f + \tau_s)^{\frac{1-\alpha}{\alpha}}(1 - \vartheta_s)^{\frac{\beta}{\alpha}}\vartheta_s^{\frac{\gamma}{\alpha}} + \rho\right]^{-1}. \tag{8}$$

Combining Eq. (4) with Eq. (8), we derive the ratio of consumption to investment as

$$\text{CI}_{\text{-ratio}} = c/\dot{k} = \frac{\sigma B(1 - \vartheta_s)^{\frac{\beta}{\alpha}}\vartheta_s^{\frac{\gamma}{\alpha}}}{\alpha B(1 - \vartheta_s)^{\frac{\beta}{\alpha}}\vartheta_s^{\frac{\gamma}{\alpha}} - \rho} - 1, \tag{9}$$

where $B = (1 - \tau_f - \tau_s)(\tau_f + \tau_s)^{\frac{1-\alpha}{\alpha}} > 0$, $\dot{k}$ denotes the investment in the economy, and $\text{CI}_{\text{-ratio}}$ represents the ratio of consumption to investment.

From Eq. (9), we find that the ratio of consumption to investment CI$_{-ratio}$ is the function of fiscal decentralization ϑ_s. Therefore, this study constructs the basic theoretical framework and logical way of the effect of fiscal decentralization on the ratio of consumption to investment.

Proposition *Ceteris paribus, fiscal decentralization and the ratio of consumption to investment provide a U-shaped relationship.*

Proof By taking the partial of Eq. (9) with respect to ϑ_s, we can derive the relationship between them as follows.

$$\partial\left(\mathrm{CI}_{-\mathrm{ratio}}\right)/\partial\vartheta_s = \left[-\rho\sigma B\left(1-\vartheta_s\right)^{\frac{\beta}{\alpha}-1}\vartheta_s^{\frac{\gamma}{\alpha}-1}\left(\frac{\gamma}{\alpha}-\frac{\beta+\gamma}{\alpha}\vartheta_s\right)\right]\Big/\left[\alpha B\left(1-\vartheta_s\right)^{\frac{\beta}{\alpha}}\vartheta_s^{\frac{\gamma}{\alpha}}-\rho\right]^2,$$
(10)

where $\vartheta_s < \gamma/(\beta+\gamma) \rightarrow \partial\left(\mathrm{CI}_{-\mathrm{ratio}}\right)/\partial\vartheta_s < 0$, which indicates that the ratio of consumption to investment decreases with the increase in the degree of fiscal decentralization; $\vartheta_s > \gamma/(\beta+\gamma) \rightarrow \partial\left(\mathrm{CI}_{-\mathrm{ratio}}\right)/\partial\vartheta_s > 0$, which indicates that a significant increase in the degree of fiscal decentralization will lead to the rise of the ratio of consumption to investment. Hence, we can prove that the ratio of consumption to investment exhibits a U-shaped relationship with the degree of fiscal decentralization.

The rationale for the nonlinear impact is attributed to the fact that the functions of government are to provide public goods and services, relax market failure, and foster a sound investment environment for enterprises. When the degree of fiscal decentralization is small, local governments have the initiative to develop the local economy with the increasing degree of fiscal decentralization. Such development makes the government expenditure structure biased toward public infrastructure (investment increases) and against social welfare provision (consumption decreases), thereby inducing the decline in the ratio of consumption to investment. However, when the degree of fiscal decentralization exceeds a critical level, the expenditure responsibilities of local governments expand with the improvement of fiscal decentralization. Thus, a mismatch arises between the fiscal and the administrative powers of local governments. In addition, local governments should guarantee the provision of basic public services to the public. Hence, the expenditure of economic construction is squeezed. By doing so, such phenomenon eventually causes the rise in the ratio of consumption to investment.

4 Empirical strategy and data

Our empirical analysis aims to determine the impact of fiscal decentralization on the ratio of consumption to investment. Therefore, the basic econometric strategy is to ascertain whether the degree of fiscal decentralization can help explain high investment and low consumption, which is a notable phenomenon. This section introduces and discusses the econometric strategy and the empirical data used.

4.1 Model specification and estimation

Using an endogenous growth model, this study analyzed the theoretical relationship between fiscal decentralization and the ratio of consumption to investment. To verify the applicability of the theoretical results in a real economy, this study takes the ratio of consumption to investment as the dependent variable, the degree of fiscal decentralization and the square of this variable as the independent variables, and these factors that affect the ratio of consumption to investment as the control variables into the regression equation. The concrete econometrics model in logarithmic form is expressed as follows:

$$\ln\left(CI_{\text{-ratio}}\right)_{it} = \varphi_0 + \varphi_1 \ln FD_{it} + \varphi_2 \ln\left(FD_{\text{-square}}\right)_{it} + \delta \ln X_{it} + \pi_t + \mu_i + \epsilon_{it}, \quad (11)$$

where the subscript i and t denote province and year, respectively; $CI_{\text{-ratio}}$ refers to the consumption divided by the investment; FD and $FD_{\text{-square}}$ denote the fiscal decentralization measure and its squared term; X is a vector of the provincial control variables; π_t and μ_i stand for year and province fixed effects[3] (year and province FE), respectively, where year FE indicates a group of year dummies to consider time-specific effects, and province FE captures the unobserved heterogeneity across provinces; ϵ_{it} is a random error term; and φ_0, φ_1, φ_2, and δ are the parameters to be estimated.

Notably, the coefficients φ_1 and φ_2 are of main interest in testing our theoretical results. These two coefficients reflect the nonlinear relationship between fiscal decentralization and the ratio of consumption to investment. If this nonlinear relationship conforms to the U-shaped characteristic predicted by the theoretical model (Sect. 3), the coefficient φ_2 is positive ($\varphi_2 > 0$). Meaning, a critical point of reversing the relationship exists between the degree of fiscal decentralization and the ratio of consumption to investment, where this critical point is $FD^* = \exp\left(-\varphi_1/2\varphi_2\right)$. When $FD < FD^*$, the effect of fiscal decentralization is negative but when $FD > FD^*$, the effect of fiscal decentralization is positive.

4.2 Data and variables

This section further introduces and discusses the dependent, independent, and control variables that we use in the econometric model. Table 1 lists the variable definitions and sources. The dependent variable measures the ratio of consumption to investment in a given year. We introduce this indicator by following the corresponding approaches proposed by Du et al. (2014) to carry out empirical analysis, where consumption and investment stand for the household consumption and the total value of fixed capital formation, respectively. On the one hand, the formation of fixed capital has notably deducted land expenditure and expenditure for maintenance of existing machinery and equipment; and on the other hand, these data have been

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[3] Following Wooldridge (2012), the fixed effects estimator is more efficient than the random effects estimator.

Table 1 Variable definitions and sources

Variable	Description	Source
Ratio of consumption to investment (CI$_{ratio}$)	Household consumption/total value of fixed capital formation (%)	CSY and FYC
Fiscal decentralization (FD)	Local budgetary fiscal expenditure per capita/(local + central) budgetary fiscal expenditure per capita (%)	CSY and FYC
GDP per capita (GDPPC)	Regional GDP per capita (yuan)	CSY
Urbanization rate	Urban population/regional population (%)	CSY
Trade openness	Gross import and export/regional GDP (%)	CSY
Population size	Regional population (ten thousand)	CSY
Financial development	Financial value added/regional GDP (%)	CSY

CSY China Statistical Yearbook, *FYC* Finance Yearbook of China

incorporated into the investment of small investment projects. Thus, such indicator can better reflect the actual investment situation.

Furthermore, the main variable of interest includes the fiscal decentralization variable. The complexity of fiscal decentralization in China causes a controversy among any measures of fiscal decentralization. Fiscal decentralization is manifested in two aspects, namely, revenue budget and expenditure budget. Given the complexity of the distribution of fiscal revenue between central and local governments, the real fiscal resources owned by different levels of government seem vague. Accordingly, this study chooses the level of expenditure to measure fiscal decentralization, which is also consistent with the theoretical model. Fiscal decentralization is defined as local budgetary fiscal expenditure per capita divided by the sum of local budgetary fiscal expenditure per capita and central budgetary fiscal expenditure per capita (Liu et al. 2019; Liu and Li 2019). An increase in this measure also raises the degree of fiscal decentralization. Notably, this study adopts the population-adjusted fiscal decentralization measures to avoid overestimating the degree of fiscal decentralization for large provinces (Yang 2016).

To illustrate other factors that affect the ratio of consumption to investment, some control variables are included. Table 1 also explains these control variables. First, following Du et al. (2014), we include both GDP per capita and its square term as control variables in the regressions to incorporate the potential U-shaped relationship. Second, we control for the effects of globalization and regional integration on the ratio of consumption to investment by using the trade openness variable. Third, we control for the effects of demographic characteristics on the ratio of consumption to investment by using the population size and urbanization rate variables. Finally, we control for the effect of financial development on the ratio of consumption to investment.

This study uses a panel of annual data for 31 administrative regions of China observed from 1998 until 2015 in the process of empirical analysis. The reasons for this choice are twofold. First, the number of regions considered depends on the availability of data on the dependent and independent variables of interest. Second, our data set starts in 1998, because the tax sharing system was implemented in 1994,

Table 2 Descriptive statistics for the variables used

Variable	Observations	Mean	Median	Max	Min	Std. Dev.
CI$_{\text{ratio}}$	558	84.578	78.753	200.482	21.797	34.935
FD	558	79.711	81.324	96.330	33.942	9.417
GDPPC	558	24,867.010	18,284.000	107,960.000	2364.000	21,103.740
Urbanization rate	558	45.111	44.044	89.607	13.385	16.309
Trade openness	558	31.339	12.866	184.289	3.164	40.744
Population size	558	4208.009	3768.500	10,849.000	252.000	2675.320
Financial development	558	4.584	3.805	17.060	0.635	2.676

Data cover 31 administrative regions during the period 1998–2015

Variable definitions and sources: see Table 1

and Chongqing in 1997 became a full-fledged municipality seceded from Sichuan province. Consequently, the data sample of this study comprises panel data from 31 administrative regions and 18 years (1998–2015), which produce a balanced panel with 558 observations. All variables are entered into the estimation model in logarithm form.[4] Table 2 presents the descriptive statistics.

5 Results of the analysis

This section presents the empirical analysis, which focuses on discussing the imbalance between consumption and investment from the perspective of fiscal decentralization. First, we conduct stationarity analysis on all variables before using the regression analysis to avoid false correlation produced by the nonstationary economic variables. Second, according to Eq. (11), we explore whether the baseline results are consistent with theoretical results. Third, we check whether the baseline results are robust to some changes of the baseline models.

5.1 Stationarity

To avoid the problem of spurious regression caused by the non-stationarity of variables, we check the panel unit root and cointegration tests of variables before proceeding to regression analysis. Following Sadorsky (2013), unit root tests that suppose cross-sectional independence are inapplicable in testing the stationarity of variables if estimated on data that possess cross-sectional dependence (CD). Considering this possibility, this study employs the CD test developed by Pesaran (2004) to examine cross-sectional dependence. As reported in Table 3, the tests indicate that each series shows cross-sectional dependence.

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[4] The purpose of logarithms is to reduce the volatility and heteroscedasticity of the data, and to facilitate subsequent measurement and analysis.

Table 3 Results for panel cross-sectional dependence and unit root tests

Variable	CD-test		CIPS-test	
	Level	First difference	Level	First difference
CI_{ratio}	56.560***	12.590***	− 1.918	− 3.200***
FD	76.890***	65.960***	− 2.148	− 4.889***
$FD_{-square}$	77.050***	65.970***	− 2.112	− 4.830***
GDPPC	85.810***	57.960***	− 1.653	− 2.967***
$GDPPC_{-square}$	85.790***	59.930***	− 1.708	− 2.867***
Urbanization rate	61.740***	24.650***	− 2.370	− 3.197***
Trade openness	33.360***	43.280***	− 2.069	− 3.486***
Population size	33.520***	4.940***	− 1.972	− 3.493***
Financial development	42.490***	32.210***	− 2.099	− 3.367***

Variables are in logarithmic form included in all models

These tests were estimated with a constant term, 2 lags and trend

The null hypothesis of CD test is no cross-sectional dependence

The null hypothesis of CIPS test exists in the unit root

*Significant at 10%, **significant at 5%, ***significant at 1%

Accordingly, the unit root test is conducted for all variables by utilizing the CIPS test (Pesaran 2007) that allows for cross-sectional dependence. The results reveal that the levels of all variables have a unit root, whereas the corresponding first differences are stationary. Given this finding, each series is integrated in order one, and then cointegration relationships among variables may exist as expected.

5.2 Baseline results

Table 4 shows the results from the baseline models. In the first and second columns (Model 1), we present the results when all the control variables are included, and the independent variable is excluded. In subsequent columns (Model 2), we display the results when the independent variable is included with year and province fixed effects. The results in the two models pertain to the ratio of consumption to investment.

As expected, the statistical results that correspond to F test are significant, indicating the significance of the two sets of regression models. Furthermore, on the basis of verifying the stationarity among the examined variables, we test whether these variables are cointegration in the equations. Combined with the objectivity of empirical data, this study adopts the extensively used Kao ADF test to determine the stability of residuals among equations in the simultaneous equations. The results indicate that residuals among equations are stationary variables, which confirm the presence of long-run and stable equilibrium among the examined variables in any of the two models. Simultaneously, we consider that the results possess good validity and credibility.

	Model 1 FE		Model 2 FE	
	Coef.	SE	Coef.	SE
FD			− 1.540***	0.371
FD$_{-square}$			0.274***	0.064
GDPPC	− 1.776***	0.326	− 2.027***	0.327
GDPPC$_{-square}$	0.063***	0.016	0.072***	0.016
Urbanization rate	0.138***	0.033	0.079***	0.030
Trade openness	0.081***	0.028	0.153***	0.039
Population size	0.789***	0.203	1.039***	0.208
Financial development	− 0.133***	0.031	− 0.122***	0.031
Province FE	Yes		Yes	
Year FE	Yes		Yes	
F test	15.930		16.410	
Cointegration test	− 9.418		− 14.093	
Adjusted R-squared	0.795		0.802	
Observations	558		558	

Table 4 Regression results for the ratio of consumption to investment

Variables are in logarithmic form except for the year dummies included in all models

Standard errors are in parentheses

*Significant at 10%, **significant at 5%, ***significant at 1%

According to the estimated results, the coefficients on the fiscal decentralization variable and its square term are significantly negative and positive (Model 2), indicating a nonlinear effect on the ratio of consumption to investment. This finding implies that the ratio of consumption to investment decreases with the increase in the degree of fiscal decentralization. However, when the degree of fiscal decentralization exceeds its turning point at 16.614, this effect becomes positive. Thus, further fiscal decentralization is suggested to promote the improvement of the ratio of consumption to investment and thus provides support for our theoretical result (see Sect. 3). Based on the sample data, we find that all provinces of China have leaned toward the right part of the U-shaped curve where the ratio of consumption to investment rises with the degree of fiscal decentralization during 1998–2015. This finding indicates that fiscal decentralization alleviates the imbalance between consumption and investment at the present stage.

Apart from the fiscal decentralization variables, all control variables are also significant. Moreover, the coefficients on these variables generally satisfy the expected signs and remain statistically significant and stable by using different model specifications. The estimated coefficients on the GDP per capita and its square term are significantly negative and positive, which are consistent with the results of Du et al. (2014). The urbanization rate variable is consistently significant and positive, which show that urbanization easily drives rapid growth of residents' consumption. The trade openness variable is consistently significant and positive, which indicate that the ratio of consumption to investment rises with the increase in trade

openness. This phenomenon is explained by the fact that as the level of trade openness increases, the capability to absorb employment in the region is strengthened with a generally increased level of per capita disposable income, which stimulates rapid growth in consumption. The population size variable is consistently significant and positive. This finding indicates that increased population size leads to further government investment in social welfare provision, which stimulates household consumption. Finally, the financial development variable is consistently significant and negative, which indicate that financial development has a certain driving effect on public infrastructure and raises investment.

5.3 Robustness checks

The study further discusses the potential endogeneity problem. First, the fiscal decentralization variable may be endogenous, because government investment and fiscal decentralization may influence each other, which blurs the relationship between fiscal decentralization and the ratio of consumption to investment. Second, the other variables may also be endogenous, because the study uses the macro-level data for regression estimates (He 2015). If such feedback effects are present, the estimations obtained may be a little biased. Table 5 displays the results.

First, the fiscal decentralization variable and its square term are lagged one year to avoid this potential problem. The Hausman test for possible endogeneity is performed to authenticate that the lagged decentralization variables are not endogenous. Moreover, lagging the policy variable is sensing as it requires time for the policy to create an impact on the economy (Yang 2016). Furthermore, to avoid potential endogeneity problem, all these control variables are lagged one year. According to the results (Model 3) with year and province fixed effects, F test is significant, which indicates the significance of the regression model. Cointegration test implies that the examined variables are clearly cointegrated in this regression model. The estimated first- and second-order coefficients on fiscal decentralization indicator are significantly negative and positive, respectively, which reveal a U-shaped relationship.

Second, we adopt the two-step system Generalized Method of Moments (Sys-GMM) estimator to address this problem. A further discussion about the detailed specifications of the system GMM estimator is developed. (1) We treat the independent variable and its square of this variable and the GDP per capita and its square of this variable as endogenous variables.[5] (2) Following Jia et al. (2014), we take the second lag of the endogenous variables as instruments for the difference equation and the first lag of the difference of the endogenous variables as instruments for the level equation. According to the results (Model 4), the *p* value for the Hansen test is larger than 0.1, indicating that the instrumental variables can be considered valid. The Arellano–Bond AR (2) test accepts the hypothesis of no autocorrelation of the second order. These results support the validity of the system GMM estimation.

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[5] As discussed by Xu and Wang (2007), investment affects economic growth. Therefore, we consider the GDP per capita variable and its square term as endogenous variables.

Table 5 Regression results for the ratio of consumption to investment

	Model 3 FE		Model 4 Sys-GMM	
	Coef.	SE	Coef.	SE
FD	− 14.318***	5.078	− 1.691*	0.957
FD$_{-square}$	1.847***	0.630	0.343**	0.170
GDPPC	− 2.355***	0.366	− 1.483**	0.699
GDPPC$_{-square}$	0.083***	0.018	0.072**	0.033
Urbanization rate	0.145***	0.034	− 0.068	0.053
Trade openness	0.048***	0.030	− 0.001	0.065
Population size	1.005***	0.225	0.077	0.048
Financial development	− 0.140***	0.033	− 0.016	0.020
$(CI_{-ratio})_{t-1}$			1.127***	0.147
Province FE	Yes			
Year FE	Yes		Yes	
F test/AR(2) test(p value)	17.380		0.201	
Cointegration test/Hansen test(p value)	− 11.806		0.675	
Adjusted R-squared	0.788			
Observations	527		527	

Variables are in logarithmic form except for the year dummies included in all models

Standard errors are in parentheses

*Significant at 10%, **significant at 5%, ***significant at 1%

Using Sys-GMM method does not change the results with decentralization and its square variables.

Overall, we find in this set of robustness checks that the results with regard to the decentralization variables from the baseline regressions are confirmed. That is, fiscal decentralization and the ratio of consumption to investment still show a U-shaped relationship. The results meet our expectations.

6 Conclusion and policy implications

Despite the growing literature that discusses the effect of China's fiscal decentralization from an economic perspective, little is known about the influence of fiscal decentralization on the imbalance between consumption and investment. At the outset, this study explores the theoretical relationship between these concepts under the framework of endogenous growth theory, obtains a solution through the Hamiltonian function, and determines the dominant relation via a partial derivative. Results demonstrate that fiscal decentralization and the ratio of consumption to investment have a U-shaped relationship. Furthermore, to examine the applicability of theoretical results in the real economy of China, the study uses province-level panel data for 31 Chinese administrative regions over the period

1998–2015 to perform an empirical analysis. Results show that fiscal decentralization on the ratio of consumption to investment actually exhibits a U-shaped relationship. When the selected sample data are used, a positive correlation is noted between fiscal decentralization and the ratio of consumption to investment. Finally, the study conducts a series of robustness tests on the baseline results, and these results are robust.

This study is thus the first to theoretically and empirically investigate the effect of fiscal decentralization on the ratio of consumption to investment and identify the nonlinear effect of fiscal decentralization. The nonlinear impact found in this research implies that the ratio of consumption to investment decreases first and then increases with the increasing degree of fiscal decentralization. Through this approach, this study provides a comprehensive analysis of the unbalanced relationship between investment and consumption from the perspective of fiscal decentralization.

These results have important practical implications for the design of a financial system. Consequently, this study proposes the following policies and recommendations. First, social planners should fully understand the significance of the double-edged sword effects of fiscal decentralization on the imbalance between consumption and investment and then ensure reasonable decentralization for the local governments. Second, social planners should fully realize that fiscal decentralization can relieve the imbalance between consumption and investment at the present stage and continue to optimize and consolidate the results of current fiscal decentralization and subsequently institutionalize these results.

This study offers new theoretical and empirical evidence on the effect of fiscal decentralization on the ratio of consumption to investment. First, to the best of our knowledge, the direction of reasonable decentralization mentioned above is to balance the short- and long-term interests of the central and local governments. However, such a difficult problem is beyond the scope of this study. Determining an accurate approach that will promote reasonable decentralization is of interest for future research. Second, compared with other decentralization indicators, such as local budgetary fiscal expenditure per capita as a share of central budgetary fiscal expenditure per capita (Zhang and Zou 1998; Chen 2004) and local fiscal expenditure per capita as a share of total fiscal expenditure per capita (Yang 2016), this indicator of decentralization (measured as local budgetary fiscal expenditure per capita divided by the sum of local budgetary fiscal expenditure per capita and central budgetary fiscal expenditure per capita) has enough variations across different regions and years. However, the variations of this indicator simply come from local budgetary fiscal expenditure across provinces. The construction of decentralization indicator is also explored in future research. Finally, the study opens new avenues for further research that will help us understand the phenomenon of high investment and low consumption in other countries from the perspective of fiscal decentralization.

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