Does Fiscal Decentralization Increase the Investment Rate? Evidence from Chinese Dynamic Panel Data*

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Abstract

It is puzzling why China has one of the highest investment rates in the world. In 1994 China introduced a new fiscal system. Using this natural experiment and the dynamic provincial panel data during the following period 1995-2002, we find that fiscal decentralization has a significant, positive effect on the physical capital investment rate in both LSDV (Least squares dummy variables) and system GMM (Generalized method of moments) estimations. The results are robust to controlling for other variables, and province and time effects. China's political centralization has been maintained during its economic decentralization. The provincial officials are not elected by the local constituents, but appointed by the central government. The central government disciplines them by linking their promotion with the performance of the local economy. Therefore, it is rational for provincial officials to raise investment rates to maximize local growth and thereby their chance of promotion, explaining our findings.

Keywords: Fiscal decentralization; Investment rate; Dynamic Panel data
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1 Introduction

The essence of China's reform and opening-up strategy is to introduce market mechanism to replace planning and command in eliciting people's initiative and creativity. Economic decision-making has been given to micro-level agents including individuals, firms and local governments. One important reform of China is fiscal decentralization that has been widely studied in the literature (e.g., Montinola et al., 1995; Qian and Roland, 1998; Zhang and Zou, 1998; Blanchard and Shleifer, 2001; Cai and Treisman, 2005). In this paper we focus on whether fiscal decentralization promotes the physical capital investment rate (hereafter investment rate) in China, which is important for the following reasons.

It is widely documented that China's investment rate has been one of the highest in the world (see Bai, Hsieh and Qian, 2006; Chow and Li, 2002). Figure 1 illustrates the high investment rate, measured as the ratio of nominal physical capital investment to nominal GDP (Gross domestic product), denoted as I/GDP, for three representative provinces in China (Shanghai, Zhejiang, and Inner Mongolia representing developed municipalities, coastal developed provinces, and interior undeveloped provinces, respectively). For instance, in 1995 the investment rates were as high as 63%, 51% and 45% for Shanghai, Zhejiang and Inner Mongolia, respectively, which also illustrates the substantial variations across provinces. It is puzzling why the investment rate is high in China and why there are substantial variations in investment rate across provinces. Empirically we find that fiscal decentralization and its provincial variations are the underlying driving forces.

[Figure 1 Here]

The rationale for our empirical finding is as follows. Under fiscal decentralization, the central government gives some decision-making (e.g., part of the locally collected tax revenues, the "carrots") to the local governments, but the carrots are no free lunches. The central government has "sticks": the local officials are not elected by the local constituents, but appointed by the central government. Blanchard and Shleifer (2001) highlight that China's political centralization is the key to explain why federalism in China promoted economic development: under the tight control of the communist party, the central government in China has been in a strong position both to reward and to punish local administrations. Qian and Xu (1993) and Maskin et al. (2000) further show that the reward mechanism is made possible by the multidivisional-form (M-form) structure of the Chinese economic system. To discipline the local officials, the central government primarily uses the growth rate of the local economy to evaluate and promote the local officials (Blanchard and Shleifer, 2001; Li and Zhou, 2005). Therefore, it is rational for the local officials to spend all the "carrots" in investment. In so doing, the growth rate of the local economy, and thereby their chance of promotion would be maximized.

Our contributions are as follows. First, our study complements Bai, Hsieh and Qian (2006). Bai, Hsieh and Qian find that the aggregate return to capital in China does not appear to be significantly lower than the return to capital in the rest of the world, which provides a rationale for the high investment rate in China. We take a different approach. We do not answer whether the high investment rate is efficient. Instead, we try to identify the causes for the high investment rate in China. Although our simple theoretical model shows that the investment rate is high because the return to investment is high, our empirical model focuses on identifying the causal effect of fiscal decentralization on investment rate. Even if the local administrations are driven to push up the investment rate in the Chinese institutional context (our finding), the return to investment does not appear to be significantly lower than the return to capital in the rest of the world (the finding of Bai, Hsieh and Qian). It implies that there may not be a large effiency loss when the local administrations are driven to push up the investment rate. Considering the importance of capital accumulation in China's growth as illustrated below, our analysis helps to explain China's past economic success.

Second, our study has strong implications for China's future growth. Chow and Li (2002) find that China's capital accumulation accounts for 54% of its growth, productivity increase accounts for 32%, leaving only 13% to labor for the period 1978-98. They predict that "in the next decade [2000-2010] the Chinese economy would still manage to grow at a substantial rate of at least 7% because of the expected high rate of capital formation of over 30% of GDP and the high capital elasticity of about 0.6." Given the slow-changing institutional framework and the on-going fiscal decentralization, China's investment rate would continue to be high in the future. Our analysis is clearly important in predicting the future investment rate and thereby the future growth rate of China.

Third, our analysis also contributes to uncovering the role of federalism in the process of economic development (see Oates, 2005, for a review). We identify investment as an important channel for the Chinese style federalism to impact the economy. Our mechanism complements previous channels such as tax competition (Zodrow, 2003), foreign direct investment (Kessing et al., 2009), the discipline imposed by federalism on local governments (Blanchard and Shleifer, 2001), and the interregional negative externalities (Cai and Treisman, 2005). Moreover, as investment is an important determinant of growth, our mechanism helps to solve the empirical debate on the fiscal decentralization-growth nexus in China (see Zhang and Zou, 1998; Qiao et al., 2008).

Specifically, concerning fiscal decentralization, in 1994, the Chinese government introduced the tax assignment system to replace the fiscal contracting system – detailed in Section 1.1. Using this natural experiment, we examine how the new fiscal decentralization impacted the investment rate during the following period 1995-2002 for 27 Chinese provinces. The dynamic panel data has many appealing features as presented below.

First, using data solely from the new fiscal system period provides a consistent underlying fiscal regime. The new fiscal system is a rule-based one of revenue-sharing between the center and the local governments, while the old one is discretion-based. That is, the new fiscal system established fixed formulas by the central government in sharing the tax revenues with the provincial governments. In contrast, in the old system, the central government and the local government negotiated a percentage or amount of locally collected revenues (could change year from year) to be remitted to the central government. Given the substantial difference between the two fiscal systems, it is appealing to use data from one system. It is more appealing to use data from the new system because it is rule-based (not subject to negotiations).

Second, the degree of rule-based fiscal decentralization still has substantial variations cross provinces and time, due to the gradual approach to reform in China. Following previous literature (e.g., Zhang and Zou, 1998; Montinola et al., 1995), we measure fiscal decentralization as the ratio of provincial per capita budgetary and extra-budgetary expenditures to the per capita budgetary expenditure of the central government, denoted as $EXPALL$, detailed in Section 3.4. Figure 2 illustrates the substantial variations in $EXPALL$ across the three representative provinces in China mentioned above. One can also observe the substantial time variations. The degree of fiscal decentralization steadily increases from 1995 to 1998, slightly dips in 1999, and then gradually increases after 1999. Our analysis exploits the substantial variations.

[Figure 2 Here]

Third, the dynamic panel data specification allows us to deal with the potential endogeneity of fiscal decentralization that arises because of, for instance, reverse causality. We use system GMM (Generalized method of moments) estimation (see Arellano and Bover, 1995; Blundell and Bond, 1998; Roodman, 2006) that only needs "internal" instruments – explained later – to deal with the endogeneity of all the explanatory variables including fiscal decentralization, establishing a causal relationship between fiscal decentralization and the investment rate in China.

Last, the unobserved fundamental differences across provinces are much smaller comparing to those across countries. Moreover, our panel data allows us to control for unobserved province characteristics, avoiding the bias from omitting such characteristics.

In summary, we find fiscal decentralization, measured as $ln(EXPALL)$, has a significant (at the 1% level) positive effect on the logarithm of physical capital investment rate (referred to as $ln(I/GDP)$) in China in both LSDV (Least squares dummy variables) and system GMM estimations. The results are robust to controlling for other variables, and province and time fixed effects. Our result suggests that China's fiscal decentralization is a significant causal factor for its high investment rate.

The estimated magnitude of system GMM regression is economically significant for the fiscal decentralization indicators. For example, all else equal, having a one standard deviation increase in the fiscal decentralization variable, $ln(EXPALL)$, would have allowed provinces to experience a 0.4 standard deviation increase in the logarithm of physical capital investment rate, $ln(I/GDP)$, in China annually.

The rest of the paper proceeds as follows. After we briefly introduce the institutional background, in Section 2 we illustrate the mechanism. Section 3 describes the data and the estimation strategy. Section 4 presents the regression results. Section 5 concludes.

1.1 Institutional Background

A comprehensive description of China's fiscal decentralization is beyond the scope of this paper (see Montinola et al., 1995; Wang, 1995, for details). Here, we give a brief summary.

In 1978, China initiated the market-oriented reform and opening-up. One important aspect of the market-oriented reform is the initiation of fiscal decentralization in 1980. That is, China adopted a fiscal contracting system between the central and provincial governments (and between any two adjacent levels of governments). The provincial government negotiates with the central government on the total amount (or share) of tax and profit revenue (negative values mean subsidies) to be remitted to the central government for the next several years. In 1994, a new fiscal system – the tax assignment system – was introduced to replace the old discretion-based system of revenue-sharing (the fiscal contracting system). We follow Wang (1995) to summarize the main characteristics of the new rule-based system of revenue-sharing below.

First, taxes now are divided into three distinct categories: central, local, and shared. Central taxes concern those with national interests and macroeconomic management. Examples of central taxes include tariffs, corporate income taxes and remitted profits of state-owned enterprises. Local taxes include corporate income taxes and remitted profits of local enterprises, personal income tax, and many others related to local economic activities. The shared taxes include the value added tax (VAT), resource tax, and securities exchange tax. Now central taxes and local taxes would go into the central budget and local budget, respectively. As for shared taxes, they are to be split between the central and provincial governments according to some established formulas. The established formulas are fixed (i.e., not subject to negotiation) and apply to all the provinces. For instance, 75% of the revenue from the VAT goes to the central government and the remaining 25% to the provincial governments; 50% of the revenue from securities exchange tax belongs to the central government and the other half to the provincial governments.

Second, tax administration has been centralized. Before 1994, local tax offices bore with the task of collecting virtually all taxes. After 1994, the center established its own revenue collection agency (i.e., the national tax service). Under the two parallel systems of

tax administration, the national system collects central taxes and the local system collects local taxes. Shared taxes are collected by the national system first, but the proceeds from these taxes would be divided between the central and subnational governments according to the formulas mentioned above. Third, tax rates have been standardized and the tax structure has been simplified. Some taxes, such as product tax, have been abolished. A universal tax rate of 33% has been imposed on all enterprises. Moreover, local governments are no longer allowed to grant tax breaks.

One aspect of fiscal decentralization is the expansion of the extra-budgetary funds (Montinola et al. describe them as certain categories of revenues collected by the local governments and ministries, including some retained profits of state-owned enterprises) in both fiscal contracting and tax assignment systems. Montinola et al. describe:

> The extra-budgetary revenue is wholly retained by the local government. Moreover, the local government has complete authority over the determination of taxes or fees that fall into the categories of extra budget. The decentralized nature of extra-budgetary revenues also increases local government security from predation by the central government, as such revenues are easier to hide from the higher governments.

As Montinola et al. summarize, China's fiscal decentralization provides for substantial independence of the provincial governments. However, as discussed, the substantial independence comes at a cost. In the Chinese institutional setup, the local officials are not elected by the local constituents. Instead, the central government is solely responsible for the appointment, evaluation, and promotion of the local officials. The central government disciplines the local officials by linking their evaluation and promotion with the economic performance of the local economy, as highlighted in Blanchard and Shleifer (2001), Qian and Xu (1993), Maskin et al. (2000) and Li and Zhou (2005). Given the reward and incentive structure, it is rational for the local officials to spend all the retained tax revenues in investment to maximize the local growth rate. Therefore, it is very likely that fiscal decentralization in China is an important contributing factor for its high investment rate.

2 An Illustrative Model

2.1 The Benchmark Model without Fiscal Decentralization

The economy consists of firms, financial intermediaries, a central government, and consumers. All the investment of firms is financed by financial intermediaries. Financial intermediaries absorb savings from consumers. For simplicity, we assume the utility function of the consumers is logarithmic. The number of consumers is L, which is normalized

to 1. This way, the aggregate variables would equal the per capita ones. We use a model of a representative consumer who lives forever.

All endogenous models can be boiled down to some types of AK model that exhibits constant marginal product of capital. Therefore, to focus on the things that we are interested in, we use the simplest AK model. There are two types of firms in the economy, both of which have an AK type production function. The first type of firms is more efficient than the second type, as reflected in their production functions:

$$Y_{Ht} = A^H K_{1t} \quad (1)$$

$$Y_{Lt} = A^L K_{2t} \quad (2)$$

where Y_{Ht} and Y_{Lt} are the output of the representative firm of the first type and the second type, respectively. A^H and A^L are constant productivity levels of the firms, with $A^H > A^L$. That is, the productivity level of the first representative firm is higher than that of the second type. Qian and Roland (1998), highlighting the soft-budget constraint problems in China, make the same assumptions. This assumption is consistent with the stylized facts of the Chinese economy, as discussed below.

In a prefect competitive market economy, there is no room for the second type of firms (i.e., the inefficient ones) to survive. However, in reality, especially in China where the economy gradually changes from a central-planned one to a market-oriented one, the inefficient firms exist for many reasons. The soft-budget constraint problem mentioned above and highlighted in Kornai (1986) can explain why the inefficient firms exist in China. For instance, the inefficient firms could be the state-owned enterprises in China. However, for social stability or for gradualism in reform, the government has to support the inefficient firms to keep the employment rate as high as possible. Moreover, some inefficient firms may be deemed essential for the economy, such as the heavy industries including machine building and military ones. The government tends to support these industries. Last, as Qian and Roland (1998) argue, we can deem the efficient first type of firms as the foreign firms in China and all the Chinese firms as the inefficient ones. Obviously, in attracting foreign direct investment (hereafter FDI) to promote the technology diffusion from aboard, the Chinese government would not let all the Chinese firms go bankrupt.

The types of firms are commonly observable. To show the room of existence of the inefficient firms, we assume that they enjoy priority in securing bank loans. Specially, we assume that the financial intermediaries, under the influence of the government, allocate a fraction of loans to the inefficient firms. The fraction is assumed to be λ, while the rest $(1 - \lambda)$ goes to the efficient firms. Of course the λ may be changed over time by fiscal decentralization, as detailed in Section 2.2.

2.1.1 The Behavior of the Central Government

Since here we do not consider fiscal decentralization, we ignore the existence of the provincial governments. We assume that the central government imposes a proportional tax on all firms. The proportional tax rate is t, which is a constant. We assume that the central government simply consumes the tax revenue without increasing the utility of consumers.

2.1.2 The Behavior of the Firms

The firms take their production function, the wage rate, the interest rate, and the tax rate as given, and maximize their profit. We normalize the price of the final product as 1. The wage rate and the interest rate are w and r respectively. Therefore, the representative firms' problems are

$$\begin{aligned} \underset{L,K}{Max}\pi_{it} &= Y_{it} - w_t L_{it} - r_{it} K_{it} \\ s.t. Y_{it} &= (1-t) A^i K_{it} \end{aligned} \tag{3}$$

where $i = H, L$. Therefore, the first-order conditions are $r_{it} = (1-t) A^i$, and $w_t = 0$. That is, the rental cost of capital is equal to the after-tax return to capital. Because it is an AK model, the wage rate is 0.

2.1.3 The Interest Rate

For financial intermediaries, we assume there is free entry into the intermediaries' services (or we assume Bertrand competition among the financial intermediaries). This assumption implies the zero-profit condition of the financial intermediaries. There is infinite number of both types of firms. Since the type of the firms is observable, the financial intermediaries change the rental cost of capital as the after-tax return to capital. Given that λ fraction of loans, under the command of the central government, goes to the inefficient firms, the remaining $(1-\lambda)$ to the efficient firms, the average or expected interest, $\overline{r}$, is given by

$$\overline{r} = (1-t)\left[(1-\lambda) A^H + \lambda A^L\right], \tag{4}$$

which says that the average interest rate equals the average after-tax return to capital.

2.1.4 The Equilibrium

Given our assumptions, the maximization problem of a representative consumer is

$$\begin{aligned} \underset{C,K}{Max} \int_0^\infty e^{-\rho t} \ln C_t dt \\ s.t. C_t + \dot{K} &= w_t L + (\overline{r} - \delta) K_t \end{aligned} \tag{5}$$

where C_t is the consumption of the consumer, ρ is its time preference, and δ is the depreciation rate of capital.

Solving equation (5) using Hamiltonian, and using equation (4), we get the growth rate of consumption for the representative consumer:

$$\frac{\dot{C}}{C} = \overline{r} - \delta - \rho = (1-t)\left[(1-\lambda)A^H + \lambda A^L\right] - \delta - \rho \tag{6}$$

For interesting cases, we assume that $(1-t)A^L > (\delta + \rho)$, which says that the after-tax return to capital is larger than the sum of the depreciation rate and the time-preference parameter. Therefore, the growth rate of consumption for the representative consumer will always be positive.

The resource constraint for the whole economy is $C_t + \dot{K} = \left[(1-\lambda)A^H + \lambda A^L - \delta\right]K_t$. Divided both sides by K_t, we can show that, on a balanced growth path, $\frac{C}{K}$ is a constant. That is, the growth rate of capital stock is equal to that of consumption. Therefore, the total output, $Y_t = \left[(1-\lambda)A^H + \lambda A^L - \delta\right]K_t$, also grows at the same rate. In summary, we have $\frac{\dot{C}}{C} = \frac{\dot{K}}{K} = \frac{\dot{Y}}{Y}$, which means the economy has a balanced growth path.

2.2 Introducing Fiscal Decentralization

Now we introduce fiscal decentralization into the benchmark model. Now we assume that there exist many provincial governments. To give the provincial governments more incentives, the central government shares the tax revenues with the provincial governments, according to a fixed sharing rule. We assume that the provincial government gets f share of the tax revenue collected from the province, while the rest $(1-f)$ goes to the central government. We ignore the competition among the provinces. Instead, we study a representative province that has a f changing over time. Introducing competition among the provinces would only strengthen our result. With competition, the provincial officials with the best growth performance are more likely to be promoted. Therefore, the provincial officials would be more pumped to raise the investment rate to push up the growth rate.

2.2.1 The Behavior of the Provincial Governments

To uncover the role of fiscal decentralization, we need to study the preference of the provincial governments. As discussed, Blanchard and Shleifer (2001), Qian and Xu (1993), Maskin et al. (2000) and Li and Zhou (2005) highlight that China's central government uses local economic performance as an important indicator in rewarding and punishing local officials. That is, in China, the local officials are not elected by the local constituents. Instead, the central government is solely responsible for the evaluation, promotion, and appointment of the local officials. Given the reward and incentive structure, it is a rational

choice for the local officials to maximize the local growth rate. Li and Zhou's evidence coupled with China's institutional framework provides a justification for why the local officials try to maximize the growth rate of the local economy.

With our assumption, the behavior of the local government is like a benevolent one that only cares about the welfare of its local residents (Zodrow and Mieszkowski, 1986; Wilson; 1999). Nonetheless, the local officials could also be rent-seekers as found by Wu (2007) and Arikan (2004). That is, the provincial government could also be a Leviathan (Brennan and Buchanan, 1980), which means the provincial government is a rent-seeker. We have shown that our results do not differ qualitatively when we assume that the provincial government's objective is to maximize a weighted average of the growth rate of the economy and its income from rent-seeking. Therefore, for simplicity, we assume that the local officials try to maximize the growth rate of the local economy. We assume that the preference of the local government is common knowledge.

2.2.2 The Role of Fiscal Decentralization

Given the preference of the provincial governments, now we can analyze the role of decentralization in shaping the behavior of the local governments. As stated, under the fixed share rule in fiscal decentralization, the provincial government gets f share of the tax revenue collected from the province, while the rest $(1-f)$ goes to the central government. The provincial government gets tax revenue

$$T_t = f \cdot t \left[(1-\lambda) A^H + \lambda A^L \right] K_t. \tag{7}$$

How would the provincial government spend the tax revenue? Would it simply consume it as we assumed for the central government? We argue that, when the objective of the local government is to maximize the local growth rate, it would rebate the tax revenue to the consumers. Suppose the local government rebates s share of the tax revenue to the consumers. Now the problem of the consumers becomes

$$\begin{aligned} & \underset{C,K}{Max} \int_0^\infty e^{-\rho t} \ln C_t dt \\ s.t. C_t + \dot{K} &= w_t L + (\overline{r} - \delta) K_t + s T_t. \end{aligned} \tag{8}$$

Solving (8) using Hamiltonian, we get the growth rate of consumption for the representative consumer:

$$\frac{\dot{C}}{C}^d = \overline{r} - \delta - \rho + s \cdot f \cdot t \left[(1-\lambda) A^H + \lambda A^L \right], \tag{9}$$

where the last term in equation (9) uses equation (7). Repeating similar steps, we can

show that the economy has a new balanced growth path, $\frac{\dot{C}}{C}^d = \frac{\dot{K}}{K}^d = \frac{\dot{Y}}{Y}^d$.

Now the balanced growth rate is higher. The reason is that, when making investment decisions, the consumer knows that the local government would rebate part of the tax revenue. It is like increasing the return to investment, which gives consumers higher incentive to invest, ending up raising the growth rate of the economy. Although our theory is purely illustrative, it is consistent with Bai, Hsieh and Qian (2006) who find that the aggregate return to capital in China does not appear to be significantly lower than the return to capital in the rest of the world, which provides a rationale for the high investment rate in China.

Now the objective function of the local provincial government becomes

$$\underset{s,\lambda}{Max} \qquad \overline{r} - \delta - \rho + s \cdot f \cdot t \left[(1-\lambda) A^H + \lambda A^L \right], \tag{10}$$

where we use equation (9). Obviously, the objective function of the local provincial government in equation (10) is an increasing function of s. Therefore, the local government would choose to rebate all the tax revenue to the consumers. In so doing, it would maximize the growth rate of the local economy. This way, the local government officials would have higher probability of being promoted by the central government.

It is worth pointing out that, the mechanism in the end is as if the government invests the tax revenue in raising capital stock. Originally, the central government would simply consume the tax revenues. After fiscal decentralization, the local government can keep part of the tax revenues. It can simply consume the retained tax revenue. However, it would spend the tax revenue in investment (via rebating the tax revenue to the consumers). A rational local provincial government chooses investment over consumption simply because the central government would evaluate and promote local provincial government officials mainly based on the growth performance of the provinces, as highlighted by Li and Zhou (2005), Blanchard and Shleifer (2001), and Qian and Xu (1993).

The investment-oriented behavior of the local provincial governments is commonly known. We show that the underlying driving force is fiscal decentralization. The China Statistical Yearbooks (hereafter CSY) provide the aggregate investment data for the whole economy. Therefore, we derive how the aggregate investment rate changes with fiscal decentralization. The aggregate gross investment for the economy is

$$\frac{\dot{K} + T_t + \delta K_t}{Y_t} = \frac{(1 - t + ft) \left[(1-\lambda) A^H + \lambda A^L \right] - \rho}{(1-\lambda) A^H + \lambda A^L}, \tag{11}$$

which is an increasing function of f. That is, a higher degree of fiscal decentralization (i.e., a larger value of f) increases the aggregate investment rate of the economy.

Moreover, by observing equation (10), the objective function of the local provincial

government is a decreasing function of λ (the share of loans allocated to inefficient firms). Therefore, the local government would choose to allocate more loans to efficient firms via influencing the financial intermediaries. In so doing, it would maximize the growth rate of the local provincial economy and thereby the probability of promotion of local officials. We summarize our predictions as follows:

Proposition 1 *A higher degree of fiscal decentralization would increase the aggregate gross investment rate of the economy. Moreover, a higher degree of fiscal decentralization would also increase the share of loans allocated to the efficient firms.*

The mechanism is already highlighted. To recap, under the tight control of the communist party, the central government determines the evaluation and promotion of the local government officials. The central government uses the growth performance of the local economy as a crucial criterion in rewarding/punishing local government officials. A higher degree of fiscal decentralization means the local government can retain a larger share of the locally collected tax revenue. The local government would invest (via rebating the tax revenue to the consumers) all the retained tax revenue. In so doing, they are more likely to be promoted given the reward mechanism in China. Therefore, fiscal decentralization would cause the provincial governments of China to be more investment-driven. As CSY provides data on aggregate gross investment, we can test the predictions.

3 The Data

3.1 The Empirical Specification

Before we construct the data, we present the empirical specification and identify the suitable independent variables. Our empirical formulation is

$$\ln\left(\frac{I}{GDP}\right)_{i,t} = \beta_0 + \beta_1 \ln\left(\frac{I}{GDP}\right)_{i,t-1} + \beta_2 \ln\left(FDC\right)_{i,t} + \beta_3 Growth_{i,t} + \beta_4 ln(Human)_{i,t} + \beta_5 ln(\frac{FDI}{GDP})_{i,t} + \beta_5 ln(\frac{EXP}{GDP})_{i,t} + u_i + T_t + \varepsilon_{i,t} \quad (12)$$

where $\frac{I}{GDP}_{i,t}$ is the ratio of investment to GDP for the i^{th} province in year t; FDC is the degree of fiscal decentralization; u_i and T_t stand for fixed province and time effects respectively. The reason to control for other independent variables is presented below.

First, the growth rate of the economy is one important explanatory variable. According to economic theory (e.g., Mankiw et al., 1992), physical capital investment is an important component of GDP. As discussed, in the Chinese institutional context, the priority of local governments is to maximize the growth rate of the economy. Therefore, we control

for the rate of economic growth, denoted as $Growth$. Second, according to the production function, human capital and physical capital are two important inputs. There may exist complementarity between them. That is, human capital investment would raise the marginal product of physical capital investment. Therefore, we control for human capital investment (denoted as $Human$). Last, Chinese economy is an open one. The degree of openness would affect the investment behavior of local governments. Therefore, we first control for the openness to international trade (EXP/GDP). Openness involves FDI besides trade. FDI has been important for world frontier technologies and management know-how to flow to China, raising the technological progress of the Chinese economy. Higher rate of technological progress would increase the return to investment, and thereby raise the investment rate. Of course, FDI may crowd-in/crowd-out domestic investment (see He, 2012, and the references therein). Nonetheless, we control for FDI, measured as FDI/GDP. These variables are the main macroeconomic variables that may impact investment in the literature. There may be omitted variables that may be captured by the fixed province and time effects.

According to our theory, fiscal decentralization is very likely to be exogenous to the investment process. Nonetheless, there may still exist reverse causality between fiscal decentralization and investment rate (detailed in Section 4.2), which may bias our estimation. The dynamic panel data specification allows us to use system GMM estimation to deal with the potential endogeneity problem of the explanatory variables. Arellano and Bover (1995) and Blundell and Bond (1998) show that system GMM estimator can dramatically improve efficiency and avoid the weak instruments problem in the first-difference GMM estimator. Moreover, the advantage of system GMM estimation is that it only needs "internal" instruments. That is, the system GMM estimator estimates a system of two simultaneous equations, one in levels (with lagged first differences as instruments) and the other in first differences (with lagged levels as instruments). Therefore, we estimate our model with system GMM estimator.

The identification in system GMM estimator is not commonly known to those who have not studied or used it. We follow Roodman (2006) to give a simple illustration. The general model of the data-generating process is

$$\begin{aligned} y_{it} &= \alpha y_{i,t-1} + x'_{it}\beta + \varepsilon_{it} \\ \varepsilon_{it} &= u_i + v_{it} \\ E[u_i] &= E[v_{it}] = E[u_i v_{it}] = 0, \end{aligned} \tag{13}$$

where β is a column of coefficients. The disturbance term has two orthogonal components: the fixed effects, u_i, and the idiosyncratic shocks, v_{it}. The lagged dependent variable may not be strictly exogenous. Some regressors may be endogenous.

The first-difference transformation of equation (13) is

$$\Delta y_{it} = \alpha \Delta y_{i,t-1} + \Delta x'_{it}\beta + \Delta v_{it} \tag{14}$$

One can see that the fixed effects are gone. The lagged dependent variable ($\Delta y_{i,t-1}$) is still endogenous because it is correlated with Δv_{it}. This is because the $y_{i,t-1}$ component in $\Delta y_{i,t-1} = y_{i,t-1} - y_{i,t-2}$ is correlated with $v_{i,t-1}$ in $\Delta v_{it} = v_{i,t-1} - v_{i,t-2}$. However, deeper lags of the regressors (e.g., $x_{i,t-4}$, $x_{i,t-5}$, etc.) are orthogonal to the error, and they are available as instruments for the first difference equation in equation (14).

As Blundell and Bond (1998) demonstrate, if y_{it} is close to a random walk, then difference GMM performs poorly because untransformed lags are weak instruments. Developing an approach outlined in Arellano and Bover (1995), Blundell and Bond pursue a more efficient strategy. Rather than transforming the regressors, it transforms the instruments to make them exogenous to the fixed effects. That is, it uses differences of regressors as instruments for the level equation in (13). This is valid assuming that the differences of regressors are uncorrelated with the fixed effects. In general, if x_{it} is endogenous in (13), $\Delta x_{i,t-1}$ is available as an instrument if $\Delta x_{i,t-1} = x_{i,t-1} - x_{i,t-2}$ is not correlate with v_{it}. Earlier realizations of Δx can be valid instruments as well.

To use all moment conditions, the system GMM estimator proposed by Blundell and Bond estimates a system of two simultaneous equations: one in levels as in equation (13) (with lagged first differences as instruments) and the other in first differences as in (14) (with lagged levels as instruments). The instruments are valid as illustrated above. This is the essence of identification in system GMM estimation.

3.2 The Data Sample

We use the Chinese provincial data for the period 1995-2002. Our data sample begins at 1995 because the new fiscal system was implemented in 1994 in China (see section 1.1). Given the structural break, we only consider the consistent regime after 1994. The reason to choose 2002 for our ending year is double-fold. First, there is another around of reform on fiscal decentralization in year 2003 (see Zhang and Gong, 2005). Second, China entered the WTO (World trade organization) in December 2001. Therefore, to avoid the inconsistent in the underlying regimes, we do not cover the years after 2002.

Before 1998, among the 31 provincial governments in China, four are municipalities and four are autonomous regions. We delegate the usage 'province' to all. Before 1997, Chongqing was a city of Sichuan province, hence both of them are excluded from the sample. Hainan was part of Guangdong before it became an independent province. Since there is a complete set of data for Guangdong, it is kept in the data sample while Hainan is dropped. Tibet is excluded because there are many missing data. In summary, the data

sample comprises panel data of 27 provinces and 8 years (1995-2002), which produces a balanced panel with 216 observations.

3.3 Measuring Investment Rate

The provincial investment data and the GDP data are available from the CSY. China's physical capital investment generates controversy in previous literature (see Young, section VI). According to Young, the deflator of physical capital investment (the gross capital formation in CSY) has been downwardly reported by the Chinese provincial statistical bureaus. Therefore, if one uses the gross capital formation and its indexes to calculate real investment, some provinces would have unbelievably high real investment rates. In this paper we use nominal investment rate, which is the ratio of nominal physical capital investment to nominal GDP.

3.4 Measuring Fiscal Decentralization

The Finance Yearbook of China (FYC) contains the complete data on the budgetary income and expenditure of all provincial governments; on the budgetary income and expenditure of the central government (for the whole country, i.e., all the provinces); on the inter-governmental transfers (i.e., bilateral transfers between the central government and the provincial governments), and on the extra budgetary income and expenditure of all provincial governments. Table 1 presents the data for the three representative provinces mentioned above, namely Shanghai, Zhejiang and Inner Mongolia.

[Table 1 Here]

Following the previous literature on China's fiscal decentralization (Jin, Qian and Weingast, 2005; Montinola et al., 1995; Zhang and Gong, 2005), we consider budgetary amount of provincial government and extra-budgetary funds. We construct the following two measures of fiscal decentralization:

1. $EXPALL$, which is the ratio of the sum of budgetary and extra-budgetary expenditures of a provincial government to the budgetary expenditure of the central government (for the whole country), divided by total population of the province. In our data sample, the ratios of extra-budgetary expenditure to budgetary expenditure are 36% and 21% in 1995 and 2002 respectively. Therefore, extra-budgetary funds are important.

2. $REVALL$, which is the ratio of the sum of budgetary and extra-budgetary incomes of a provincial government to the budgetary income of the central government (for the whole country), divided by total population of the province.

To give a visual picture, we calculate $EXPALL$ as follows. Take Shanghai as an example. In year 1995, its $EXPALL$ and $REVALL$ would be

$$EXPALL = \frac{\text{budgetary expenditure (240.0)+extra-budgetary expenditure (72.8)}}{\text{budgetary expenditure of the central government(20.45)}\times\text{Population of Shanghai(14)}} = 1.08$$

$$REVALL = \frac{\text{budgetary income (212.4)+extra-budgetary income (78.6)}}{\text{budgetary income of the central government (32.19)}\times\text{Population of Shanghai (14)}} = 0.64,$$

where the data can be found in Table 1.

Our model uses the share of locally collected tax revenues (i.e., f) kept by the local province to measure the degree of fiscal decentralization. We argue that $EXPALL$ is a suitable measure for f. To avoid digression, we leave the argument to Section 4.3. Here we argue that the expenditure indicator of fiscal decentralization ($EXPALL$) is more suitable than the income indicator ($REVALL$) in measuring the fiscal autonomy and independence of the provincial governments, as elucidated below.

Given the essence of fiscal decentralization and China's institutional framework (see Section 1.1 and our theoretical model), how much of the tax revenue (including extra-budgetary funds that become more and more important) the local government can keep (and spend) matters more to the local officials and thereby the local economy. This is because there are large transfers between the provincial governments and the central government. That is, the local governments cannot spend all the income from tax. The local governments have to remit to the central government and receive transfers/subsidies from the central government. For example, in 2002, Shanghai's transfer of income from the central government is 33% of its budgetary expenditure, while its transfers to the central government is around 14% of its budgetary expenditure. The corresponding numbers for the poorer province Inner Mongolia that relies on the transfer from central government for its expenditure are 62% and 0.004%, respectively. Therefore, the central government tends to receive more transfers from the rich provinces and subsidize the poor provinces. That is why the extra-budgetary funds become more important as time goes by in China, as highlighted above and in the quotation of Montinola et al. (1995) in Section 1.1. Therefore, the expenditure indicator of fiscal decentralization ($EXPALL$) is more appealing than the income indicator ($REVALL$) in measuring the fiscal autonomy and independence of the provincial governments.

3.5 Measuring Other Variables

The CSY provides nominal GDP and GDP indexes for each province. With the nominal GDP, the GDP indexes and 1978 as our base year, we multiply the nominal GDP in 1978 by the GDP index in that year then divide the result by 100.

To calculate the growth of real GDP per worker, we need data on the labor force.

However, there is a large statistical adjustment in 1990 on labor force. This has been analyzed in Young (2003, 1233-1234). For instance, the provincial statistical bureau of Jiangsu reported its labor force by using a new measurement detailed in Young. Its labor force jumps from 35.19 million in 1989 to 42.25 million in 1990, while the CSY lists its labor force at 35.69 million in 1990. The provincial statistical bureau reports 6.56 million more workers. Around half of Chinese provinces made the changed in 1990. One can infer that it is not the case that the provincial statistical bureau has made up the numbers. Instead, it is just the change in statistical caliber as detailed in Young. Fortunately, CSY has maintained the original statistical caliber and provided the data on provincial labor force.[1] Therefore, this relative more consistent series provided by CSY allow us to cover the periods before and after 1990 to avoid "spurious labor force growth" (Young, p. 1234).

Now with the labor force data and the real GDP data, we can calculate two needed variables: the growth rate of real GDP per worker ($Growth$) and the human capital investment rate ($Human$). The CSY provides complete data on the student enrollments for all levels of education in China: the primary, the secondary and the higher education levels. We follow Mankiw et al. (1992) to measure human capital investment rate as the ratio of secondary school enrollment (grade 7 to 12) to labor force. FDI/GDP and EXP/GDP are nominal values of FDI and export to nominal GDP respectively. The FDI data are in US dollars, and we multiply them by the fixed yearly exchange rate of the Chinese currency against the US dollar to get the FDI data in Chinese currency. The data are all from CSY. Table 2 presents the summary statistics of the final data.

[Table 2 Here]

4 Empirical Results

4.1 LSDV Estimation Results

We first use LSDV estimation (i.e., OLS (Ordinary least squares) estimation that includes 27 province dummies and 7 time dummies) and present the results in Table 3.

According to regression 3.1 in Table 3, the estimated coefficient on our expenditure measure of fiscal decentralization ($ln(EXPALL)$) is positive and significant at the 1% level. That is, fiscal decentralization is significantly and positively correlated with the investment rate in China, after controlling for other factors that may affect investment rate, and fixed time and province effects. The estimated coefficient on the lagged value of

[1] For the majority of the years and provinces, the labor force data provided by CSY seem reasonable. However, we also find out some rare anomaly in it. For instance, the labor force datum for Beijing jumps to 7.99 million in 2002 from 6.29 million in 2001, while the provincial statistical yearbook lists the numbers in 2002 and 2001 as 6.79 and 6.29 million respectively.

the investment rate is positive and significant at the 1% level. The estimated coefficients on other variables, however, are insignificant, although with expected signs.

According to regression 3.2, the estimated coefficient on the income measure of fiscal decentralization ($ln(REVALL)$) is positive but insignificant at the 10% level. The estimated coefficient on the lagged value of the investment rate is positive and significant at the 1% level. The estimated coefficient on $ln(FDI/GDP)$ is positive and significant at the 5% level. The estimated coefficients on other variables, however, are insignificant, although with expected signs.

In summary, the expenditure measure of fiscal decentralization is significantly and positively correlated with the physical capital investment rate in China, while the income measure of fiscal decentralization has no correlation with the investment rate in China. This is expected, according to the discussion at the end of Section 3.3. That is, comparing to the income indicator ($REVALL$), the expenditure indicator of fiscal decentralization ($EXPALL$) truly measures the fiscal independence of the provincial governments.

[Table 2 Here]

4.2 System GMM Estimation

As discussed, fiscal decentralization may be endogenous, thus blurring the relationship between fiscal decentralization and investment. One source of endogeneity might be two-way causality. Although the implementation of macro policies in China looks like a top-down approach, China's reform is usually initiated by the demand of economic agents (a bottom-up approach). As illustrated in our simple theory, fiscal decentralization would make the local government spend a larger share of the local revenue on investment, ending up raising economic growth. Higher growth may cause the local government to push the central government for a higher degree of fiscal decentralization. Even with a fixed sharing rule of fiscal decentralization, higher growth may push the local government to increase extra-budgetary funds to support investment. Our measures of fiscal decentralization (both $EXPALL$ and $REVALL$) involve extra-budgetary funds. Therefore, there may exist reverse causality between investment rate and fiscal decentralization.

Our model has the characteristics (especially "large N and small T") listed in Roodman (2006). Therefore, we use the most efficient system GMM estimator to establish a causal relationship between investment rate and fiscal decentralization. Since we use the macro-level data, it is possible that the other explanatory variables may also be endogenous due to reverse causality. Since we use yearly data, we have enough observations to deal with the potential endogeneity problem of all the important explanatory variables. In using the system GMM estimation, we treat lagged variables as predetermined and the

other variables as endogenous. Moreover, following Roodman (2006), the fixed province dummies are excluded, while the time dummies are used as exogenous instruments in xtabond2 in Stata (the proprietor program written by Roodman, 2006, and used in our analysis), as Roodman (p. 31) highlights:

> In system GMM, one can include time-invariant regressors ... Asymptotically, this does not affect the coefficients estimates for other regressors. This is because all instruments for the levels equation are assumed to be orthogonal to fixed effects, thus to all time-invariant variables ... *However, it is still a mistake to introduce explicit fixed effects dummies, for they would still effectively cause the With Groups transformation to be applied as described in subsection 3.1.* In fact any dummy that is 0 for almost all individuals, or 1 for almost all, might cause bias in the same way, especially if T is very small.

Moreover, because the two-step GMM is asymptotically more efficient than the corresponding one-step GMM, we use the two-step system GMM estimation. However, the two-step GMM presents estimates of the standard errors that tend to be severely downward biased. To solve this problem, Windmeijer (2005) proposes a small-sample correction for the two-step standard errors that would facilitate two-step robust estimations to be more efficient than corresponding one-step estimations, especially for system GMM. We take the Windmeijer correction into account in using two-step system GMM estimations. The two-step system GMM estimation results are presented in Table 4.

According to regression 4.1, both the Hansen and the Sargan tests for over-identifying restrictions confirm that the instrument set can be considered valid. The F-test shows that the overall regression is significant. The Arellano-Bond AR(1) test rejects the hypothesis of no autocorrelation of the first order. The Arellano-Bond AR(2) test accepts the hypothesis of no autocorrelation of the second order. Following Roodman (2006), we have collapsed the instruments. Now the number of instruments (26) is smaller than the number of groups (i.e., 27). These support system GMM estimation.

[Table 4 Here]

According to regression 4.1 in Table 4, the estimated coefficient on our expenditure measure of fiscal decentralization (i.e., $ln(EXPALL)$) remains positive and significant at the 1% level in system GMM estimation. The magnitude of the estimated coefficient on $ln(EXPALL)$ gets slightly smaller than that in LSDV regression in Table 3. It is worth discussing the source of identification in system GMM estimations. According to the quotation of Roodman, we have to exclude the fixed province effects from the system GMM regressions. However, the instruments in system GMM regressions are not capturing the

fixed province effects. From the illustration in Section 3.1, the source of identification in system GMM is using "internal" instruments: differences and lagged differences of regressors as instruments for the level equation. According to Blundell and Bond, the validity of the instruments relies on the assumption that the differences and the lagged differences of regressors are uncorrelated with the fixed province effects. Does this assumption hold? Although the over-identifying tests are known to be weak, both the Hansen test and the Sargan test for over-identifying restrictions confirm that the instrument set can be considered valid (see Table 4). Therefore, the system GMM estimation provides a valid and consistent identification of the effect of the fiscal decentralization on investment rate. Therefore, the significant effect of fiscal decentralization on the investment rate is causal.

According to regression 4.2 in Table 4, the estimated coefficient on the income measure of fiscal decentralization ($ln(REVALL)$) remains positive but becomes significant at the 10% level, with a much larger magnitude than that in LSDV regression in Table 3. The estimated coefficient on the lagged value of the investment rate remains positive and significant at the 1% level. The estimated coefficients on other variables, however, remain insignificant, although with expected signs.

The estimated magnitude of system GMM regression is economically significant for the expenditure measure of fiscal decentralization ($ln(EXPALL)$). For example, using regression 4.1, all else equal, having a one standard deviation increase in $ln(EXPALL)$ would have allowed provinces to experience a 0.4 standard deviation increase in the logarithm of physical capital investment rate, $ln(I/GDP)$, in China annually.

Although there are limitations for system GMM estimation (see Roodman, 2009, p. 156), our results hold up in both LSDV and system GMM estimations. Therefore, the significant positive effect of the expenditure measure of fiscal decentralization on physical capital investment rate in China is robust.

4.3 Making Sense of the Data

To further appreciate our result, we need to look deep into the data to see whether our measures of the fiscal decentralization and thereby the results make sense.

First, is our measure of fiscal decentralization ($EXPALL$) closely related to f (the share of locally collected tax revenues kept by the local province in our illustrative theory)? Second, since the rules for revenue-sharing are fixed and apply to all provinces in the new fiscal system, why would there be substantial variations in our measures of fiscal decentralization ($EXPALL$ and $REVALL$)? The answers to these questions determine whether our measures of fiscal decentralization and our results make sense.

The substantial provincial and time variations in $EXPALL$ illustrated in Figure 2 drive our results. To identify the source of the substantial variations, we rely on the data presented in Table 1. We can observe some patterns of the data.

First, the budgetary expenditure of a province roughly equals the sum of its budgetary income, extra-budgetary income, and net transfer from the central government. The net transfer from the central government equals the subsidies from the central government less the remittance to the central government. That is, the funding of the budgetary expenditure of a province mainly comes from three sources: budgetary income, extra-budgetary income, and net transfer from the central government. From the transfers data, all the provinces have positive net transfer from the central government. Therefore, the central government subsidizes the provincial governments, which is financed by its tax-revenues from the central taxes, the shared taxes, and the remittance from the provincial governments. For instance, the central government has budgetary income of 321.9 and 797.3 billion Yuan (the Chinese currency) in 1995 and 2002 respectively.

Second, from the transfers data, for the three representative provinces, their remittances to the central government change little from 1995 to 2002, while the subsidies from the central government increase substantially. However, the poorer provinces, like Inner Mongolia, experience much larger increases in subsidies from the central government. In 2002 Inner Mongolia receives 28.77 billion Yuan subsidies from the central government, while it receives 6.31 billion subsidies in 1995. The increase in subsidy is 22.5 billion Yuan. In comparison, the corresponding numbers for Shanghai are 28.03 billion and 18.02 billion in 2002 and 1995 respectively, with an increase of 10 billion. In summary, the central government would rebate some of the tax revenues to the provincial governments. However, on average it would rebate more to the poorer provinces.

Third, given the second pattern, the rich provinces would think that they have subsidized the poorer provinces. Therefore, as Montinola et al. state, the local governments want to prevent the predation by the central government. In China, the extra-budgetary revenue is wholly retained by the local government. Given the decentralized nature of the extra-budgetary revenues, the expansion of extra-budgetary revenues increases local government security from predation by the central government. Observing Table 1, one can see the expansion of the extra-budgetary income of the rich provinces. The extra-budgetary income of rich provinces (Shanghai and Zhejiang) almost doubled from 1995 to 2002, while that of the poor province Inner Mongolia increased less than 50% from 1995 to 2002. The rich provinces expand the extra-budgetary income more. In so doing, they prevent the predation from the central government and avoid subsidizing other provinces.

Fourth, the provinces almost spend all their the extra-budgetary income on the extra-budgetary expenditures. For instance, in 2002 the extra-budgetary income of Zhejiang province is 35.36 billion, and its extra-budgetary expenditure is 30.31 billion. The corresponding numbers for Inner Mongolia are 4.09 billion and 3.83 billion. That is, the local provinces use the extra-budgetary income to finance the extra-budgetary expenditure. Moreover, the extra-budgetary income/expenditure becomes more and more important

as time goes by. For instance, in 2002 Zhejiang's extra-budgetary expenditure is about 34% of its budgetary expenditure (89.66 billion). For Inner Mongolia that replies on the subsidies from the central government to finance its budgetary expenditure, the ratio is only 8%. The extra-budgetary income of Zhejiang province is 35.36 billion, and its budgetary income is 46.36 billion. The extra-budgetary income is almost as important as the budgetary income. Therefore, the expansion of the extra-budgetary income/expenditure increases the fiscal autonomy and independence of the local provinces.

Now we can identify the substantial variations in our measures of fiscal decentralization ($EXPALL$ and $REVALL$). For the expenditure measure of fiscal decentralization, $EXPALL$, the provincial variations mainly come from two sources. First, the extra-budgetary expenditure explains a large part of the variations. As shown above, in 2002 the extra-budgetary expenditure of Zhejiang province is about 34% of its budgetary expenditure, while the corresponding number for Inner Mongolia is only 8%. Second, the net transfer from the central government also explains a lot of the variations. For instance, in 2002 Zhejiang receives a net transfer of 19.63 billion from the central government, which contributes to 22% of its budgetary expenditure. In comparison, Inner Mongolia receives a net transfer of 28.59 billion from the central government, which contributes to 62% of its budgetary expenditure. For the income measure of fiscal decentralization, $REVALL$, the provincial variations mainly come from the extra-budgetary income.

Moreover, the fiscal decentralization data patterns show that the extra-budgetary income/expenditure is closely related to f (the share of locally collected tax revenues kept by the local province) under the rule-based fiscal system. Therefore, $EXPALL$ and $REVALL$ are suitable measures of fiscal autonomy at the provincial level. Nonetheless, they may not be perfect. Although $EXPALL$ takes account of the fiscal autonomy of the rich provinces, it tends to over-estimate that of the poor provinces because they receive more subsidies from the central government and thereby have higher budgetary expenditure. However, a measure that only uses the extra-budgetary expenditures is not better. Although the extra-budgetary expenditures are important, the budgetary expenditures are still dominating in magnitude for all provinces. Therefore, we have to take the budgetary expenditures into account in measuring the fiscal independence of the provinces. Therefore, we believe $EXPALL$ is the best we can get.

The essence of China's fiscal decentralization is to increase the fiscal autonomy of the provincial governments. In this paper we focus on identifying the effect of the fiscal autonomy on the local economy. Therefore, the expenditure indicator of fiscal decentralization ($EXPALL$) is more appealing than the income indicator ($REVALL$). This is because the provinces cannot keep all the tax revenues and the central government subsidizes the provinces. What the provinces can spend matters more to the local economy.

In summary, even if the new fiscal system is rule-based, there are still substantial

variations in the degree of fiscal autonomy across provinces. Our indicators of fiscal autonomy can suitably measure the different degree of fiscal autonomy across provinces. Therefore, our data and hence the results make sense and can be subject to scrutiny.

5 Conclusions

In 1994 the Chinese government introduced the tax assignment system as the new fiscal system. Using this natural experiment and the dynamic provincial panel data during the following period 1995-2002, we find that fiscal decentralization has a significant, positive effect on the physical capital investment rate in both LSDV regression and system GMM estimation that overcomes the endogeneity of fiscal decentralization. The results are robust to controlling for other variables, and province and time effects.

The fiscal autonomy of the local governments is no free lunch. The local officials are not elected by the local constituents. Instead, the central government solely determines their appointment and thereby disciplines them by linking their promotion with the performance of the local economy (Blanchard and Shleifer, 2001; Li and Zhou, 2005). It is, therefore, rational for local officials to raise investment rate and thereby growth to maximize their chance of promotion, explaining our findings.

It is puzzling why China's investment rate has been one of the highest in the world (Bai et al., 2006; Chow and Li, 2002). Our result offers one explanation for the high investment rate in China: given the reward structure for officials in a non-democratic institutional setup, fiscal decentralization is an important driving force for the persistently high investment rate in China. Our analysis contributes to uncovering the role of federalism in the process of economic development, which has strong policy implications for other transitional economies. Moreover, given the slow-changing institutional framework and the on-going fiscal decentralization, China's investment rate would continue to be high in the future. Our analysis is clearly important in predicting the future investment rate and thereby the future growth rate of China.

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Table 1: Data on China's Fiscal System

	Shanghai		Zhejiang		Inner Mongolia		China	
	1995	2002	1995	2002	1995	2002	1995	2002
Budgetary Expenditure	240.0	851.8	226.0	896.6	110.8	461.8	2045	6412
Extra-Budgetary Expenditure	72.8	116.3	157.7	303.1	25.4	38.3		
Budgetary Income	212.4	606	108.3	463.6	40.2	100.6	3219	7973
Extra-Budgetary Income	78.6	149.3	171.5	353.6	27.3	40.9		
Subsidies from the Central Government	180.2	280.3	116.5	246.5	63.1	287.7		
Remittance to the Central Government	128.3	123.1	48.4	50.2	0.8	1.85		
Population (million)	14.15	16.25	43.19	46.47	22.84	23.79		

Note: the income, expenditure and transfers data are in 100 million Yuan.

Data Source: *Finance Yearbook of China*, Beijing: China Finance Press 1996-2003 (annual).

Table 2: Descriptive Statistics

	Mean	Standard deviation	Minimum	Maximum
ln(I/GDP)	3.80	0.19	3.42	4.50
ln(EXPALL)	-1.18	0.51	-2.05	0.36
ln(REVALL)	-2.08	0.62	-3.09	-0.31
Growth	0.09	0.03	−0.14	0.24
ln(Human)	2.38	0.23	1.76	2.95
ln(FDI/GDP)	0.55	1.22	−3.09	2.82
ln(EXP/GDP)	2.22	0.90	0.81	4.52

Observations: 216. The panel data comprise 27 provinces and 8 years. Except for Growth, EXPALL and REVALL, the other variables are multiplied by 100 and then taken logarithms.

Table 3: LSDV Regressions between Investment Rate and Fiscal Decentralization

Dependent variable: annual investment rate $\ln(\frac{I}{GDP})$: 1995-2002

	Regression number	
Independent Variable	3.1	3.2
ln(EXPALL)	0.21^{***}	
	(0.06)	
ln(REVALL)		0.02
		(0.07)
$\ln(\frac{I}{GDP})$t-1	0.47^{***}	0.53^{***}
	(0.06)	(0.06)
Growth	0.02	0.09
	(0.18)	(0.19)
ln(Human)	0.05	0.04
	(0.09)	(0.10)
$\ln(\frac{FDI}{GDP})$	0.02	0.027^{**}
	(0.01)	(0.013)
$\ln(\frac{EXP}{GDP})$	-0.061^{*}	-0.066^{*}
	(0.032)	(0.034)
Time FE	Yes	Yes
Province FE	Yes	Yes
R^2	0.92	0.92
Observations:	188	188

***Significant at the 0.01 level, ** at the 0.05 level, * at the 0.10 level

(Standard error in parentheses)

Table 4: System GMM Regressions between Investment Rate and Fiscal Decentralization
Dependent variable: annual investment rate $\ln(\frac{I}{GDP})$: 1995-2002.
Dynamic panel-data estimation, two-step system GMM

	Regression number	
Independent Variable	4.1	4.2
ln(EXPALL)	0.147^{***}	
	(0.046)	
ln(REVALL)		0.146^{*}
		(0.083)
$\ln(\frac{I}{GDP})_{t-1}$	0.88^{***}	0.71^{**}
	(0.14)	(0.29)
Growth	0.30	0.27
	(0.37)	(0.38)
ln(Human)	0.03	−0.12
	(0.14)	(0.18)
$\ln(\frac{FDI}{GDP})$	0.01	0.01
	(0.04)	(0.06)
$\ln(\frac{EXP}{GDP})$	−0.07	−0.10
	(0.05)	(0.06)
Time FE	Yes	Yes
Hansen OverID test (p-value)	0.292	0.05
Sargan OverID test (p-value)	0.298	0.38
Number of Instruments	19	19
Arellano-Bond test for AR(1)	Pr>z = 0.003	Pr>z = 0.05
Arellano-Bond test for AR(2)	Pr>z = 0.26	Pr>z = 0.30
F-test	26975***	7395***
Observations	188	188

Note: Lagged variables are treated as predetermined. All other variables except the time dummies are treated as endogenous. Time dummies are used as instruments.
***Significant at the 0.01 level, ** at the 0.05 level, * at the 0.10 level
(Standard error in parentheses)

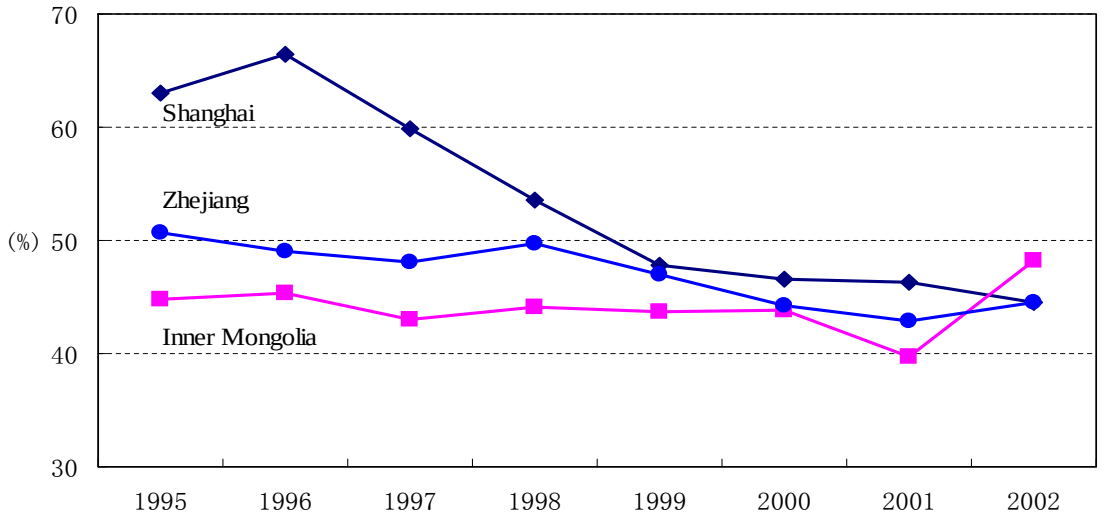

Figure 1: Physical Capital Investment Rate (I/GDP) for Three Representative Chinese Provinces: 1995-2002.

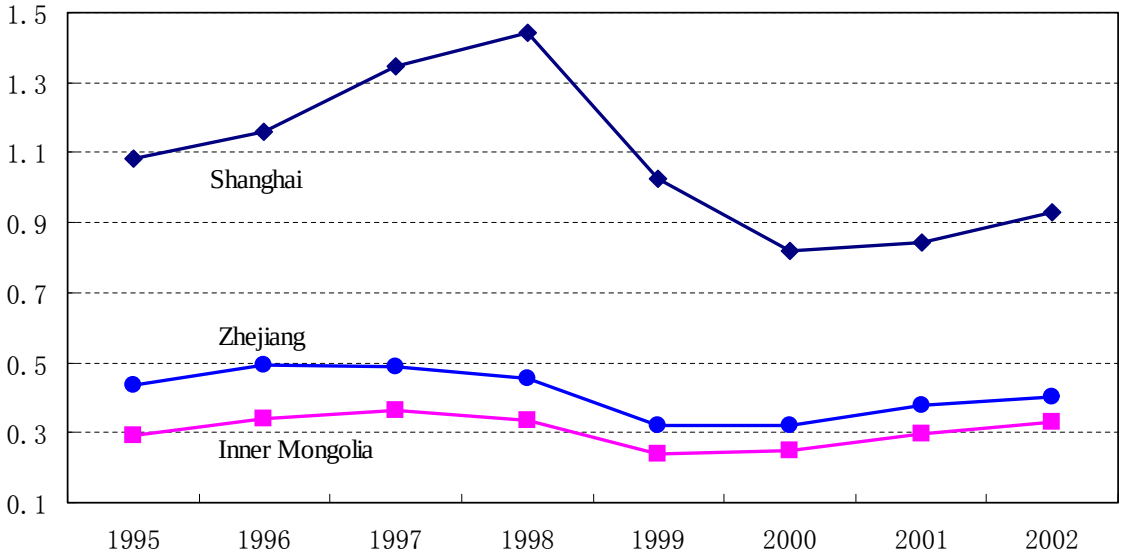

Figure 2: Degree of Fiscal Decentralization (EXPALL) for Three Representative Chinese Provinces: 1995-2002.