The tradeoff between growth and equity in decentralization policy: China’s experience

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Abstract

This paper investigates the potential tradeoff between economic growth and regional equity in the design of fiscal decentralization policy in the context of China’s experience. We develop a theoretical model of fiscal decentralization, where overall national economic growth and equity in the regional distribution of fiscal resources are the two objectives pursued by the central government. The model is tested using panel data for 1985–98. We find that fiscal decentralization in China has led to economic growth as well as to significant increases in regional inequality.

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1. Introduction

The fundamental objective behind China’s economic reform starting in the early 1980s was to develop the country’s economy in view of the failure of the socialist planning model. A basic premise of this strategy was to decentralize decision making with the belief that local governments could allocate some of the available resources more efficiently than the central government had done until then. Close to twenty years of decentralization reforms have followed during which the share of central government expenditure in the general public sector budget decreased from about half in the beginning of the 1980’s to a little over one-fourth in 1998. China’s economic strategy explicitly accepted that economic growth would not benefit all regions the same, but would let at least some of them have more opportunities to catch up with the global economy. As former leader Deng Xiaoping had put it: “Let part of us be richer first.” The relationship between growth and equity in the distribution of income has been widely discussed in the economics literature. There has been

1 Distribution of income is defined across the population as opposed to across regions.
2 The growing consensus is that there is a negative relationship between inequality and growth Barro and Sala-i-Martin (1995) and that initial inequality is detrimental to long-run growth (Benabou, 1996).
much less research on the relationship between growth and inequality in the geographic distribution of resources or fiscal disparities, though there has been a recent debate in the decentralization literature as to whether fiscal decentralization accelerates or retards economic growth. On the other hand, there seems to be a general agreement in the decentralization literature that, all else being equal, unfettered fiscal decentralization can lead to a concentration of resources in a few geographic locations. To the best of our knowledge, no empirical analysis of the impact of decentralization on the geographical distribution of resources has been done.

The purpose of this paper is two-fold. We first develop a theoretical model of fiscal decentralization, where overall national economic growth and equity in the distribution of fiscal resources among subnational governments are the two objectives pursued by the policy maker, to examine the tradeoff between growth and equity in the context of China’s fiscal decentralization policy. The theoretical model allows us to investigate the conditions under which a policy tradeoff between these two objectives arises. Second, we test the model predictions with data covering the 1985 to 1998 period of fiscal decentralization in China.

The rest of the paper is organized as follows. Section 2 briefly reviews China’s decentralization policy over the last 20 years. Section 3 develops the theoretical model and presents its implications. Proofs of our formal results in Section 3 are organized in the Appendix. The empirical tests are conducted in Section 4. Section 5 concludes the paper.

2. Fiscal decentralization in China

Fiscal decentralization has been one of the most important policy thrusts undertaken by the Chinese government during the last two decades of economic reform from planned socialism (Qian and Weingast, 1996; Demurger et al., 2002). Although far from being highly decentralized, at least by conventional measures (Bahl, 1999), China has undergone considerable decentralization. Decentralization has been shaped by the two major fiscal reform thrusts that took place during this period. The first reform started in 1985, and became known as the “Fiscal Responsibility System” (FRS), and the second reform started in 1994, and was termed as the “Tax Sharing System” (TSS).

Historically, China had a centrally planned economy and unitary fiscal system in its “Soviet Socialism” era. After several fiscal decentralization experiments in the 1978–84 period, particularly the reforms known as “eating from separate kitchens” in 1980, fiscal reforms started in earnest in 1985 with the FRS. The essence of the FRS was a contracting system, whereby the central government allowed provincial governments to retain part of the tax revenues remaining after the remittance of a fixed sum to the central government for a certain period of time. In 1988, the central government introduced the Fiscal Contracting Reform, which established more stable schemes in the contracting system, lasting until 1993. A key aspect of the FRS was that provincial governments could get more fiscal revenue by collecting more tax. On the other hand, the FRS created several problems for the central government. For example, to have a higher local economic growth, local governments could contribute fewer fiscal resources to the central government. This could be the case if local governments tried to slow the growth of budget revenues by giving local enterprises more direct resources and incentives, such as tax exemptions frequently at the expense of central government revenues. This weakness of the FRS eventually led to the decrease of the central government share in total budgetary revenues and to a lower share of total budgetary revenue in GDP. Extra-budgetary funds provided a way to shield tax collections from the central government and also an alternative way to finance local governments’ expenditure without the risk of an eventual claw-back by the central government (Bahl, 1999; Wong, 2000). Extra-budgetary funds actually were used to finance all types of local government expenditure needs.

Realizing these shortcomings of the FRS, the central government adopted the TSS in 1994. Major goals of the

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3 See for example Devarajan et al. (1996) and Qian and Weingast (1996).
4 See for example Prud’homme (1995) and Murphy et al. (1995).
5 Jin et al. (1999) note the strong fiscal incentives provided by this reform leading to “market preserving federalism.” In contrast Knight and Shi (1999) argue that the high marginal rates effectively levied by the central government on the revenues collected by the province had a significant negative impact on subnational tax effort.
6 Actually, the lack of strict tax laws and influence on the tax administration gave provincial governments power over their effective tax rates and actual tax bases, even if local governments did not have legal authority over either.
7 Wong (2000) argues that the piecemeal intergovernmental reform in China led to a mismatch between expenditure responsibilities and revenue sources at the local level. In this context, extra-budgetary funds have worked as a safety valve allowing subnational governments to provide basic service levels, which would not have been affordable from regular budgetary financing.
TSS were to increase (i) the shares of government revenues in GDP, and (ii) the share of central government revenue in the total budgetary revenue. The key measures in the TSS included the introduction of a value added tax as the major revenue source and the setting up of uniform tax-sharing rates for major taxes including VAT, which replaced the previous fixed-amount remittance scheme in the FRS. An important measure of the TSS was to split up the old tax service in two and set up a national tax services (NTSs) in all provinces to collect central taxes and shared taxes, and a separate local tax services (LTSs) for the collection of the taxes assigned to local governments. While the major thrust of the TSS reform was the recentralization of revenues, the TSS also provided better incentives for local revenue mobilization by creating separate tax administrations and through the removal of the ceiling imposed de facto by the FRS on the increase in local revenues.

The two rounds of reforms significantly changed China’s fiscal landscape including the relationship between central and local governments and the relationship between the public sector and non-public sector. The most salient features of this process of change include the following:

(i) A significant level of resources shifted from the government to non-government sectors during the reforms (see Fig. 1). The overall budgetary revenue in GDP decreased from 22.9% in 1985 to 12.4% in 1998, and the overall budgetary expenditure in GDP decreased from 22.4% in 1985 to 13.6% in 1998. The impact of the TSS reform was more strongly felt after 1998; by 2002, the share of budgetary revenues had increased to 22% of GDP, with the central government taking some 60% of the revenues.

(ii) More resources shifted from the central government to local governments (see Fig. 1). The share of local government budgetary expenditure in total government budgetary expenditures increased from 60.3% in 1985 to 71.1% in 1998. Note that after 1996, the share of local government expenditures decreased over time but only slightly.\(^8\)

(iii) More resources at the subnational level shifted from the budget to extra-budgetary funds (see Fig. 1). The ratio of extra-budgetary expenditure to budgetary expenditure of local governments kept increasing with only the exception of 1998.\(^9\)

Because the main focus of this paper is on the potential tradeoff in fiscal decentralization policy between the objectives of economic growth and equity in geographical distribution of fiscal resources, we also take a look at the performance of China’s system along those two dimensions. The rate of economic growth in China has been quite high but changing during the sample period. Inequality in the distribution of fiscal resources across provinces has tended to increase over

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\(^8\) The share of local government budgetary revenue in total government budgetary revenues shows a random trend because methods of calculating changed during the period.

\(^9\) The big downward jump in 1993 was not a real change but simply reflected a change in statistical methodology.
time as measured by the coefficient of variation (C.V.) of per capita budgetary expenditure across provinces. Note that while the index decreased during the FRS period, reaching the lowest value of 0.50 in 1992, it increased very quickly during the TSS period and reached the highest value of 0.79 in 1997. In 1998 expenditure per capita in Shanghai were over nine times larger than in Henan province. It is fair to say that there has been a lack of consensus in the literature about the actual impact of economic reform on income inequalities over the last two decades in China. Some studies (for example, Lee, 1995; Jin et al., 1999; Wei and Wu, 2001) conclude that the regional distribution of income was not very much affected, or actually was improved. However, an even larger number of studies find a lack of convergence of per capita incomes across provinces (for example, Chen and Fleischer, 1996; Sun and Chai, 1998; Kanbur and Zhang, 1999; Shi, 2001; Dayal-Gulati and Husain, 2002; Demurger et al., 2002).

In summary, the review of the basic data shows that equity in the geographical distribution of fiscal resources, in the aggregate, has become worse while the rate of economic growth has remained very high. We proceed now to examine under what conditions, in a theoretical sense, we may expect a tradeoff between regional equity and growth to exist, and whether empirically such tradeoff has existed in China.

3. The theoretical model

Consider an economy with a central government and two local jurisdictions $J_1$ and $J_2$. The two jurisdictions have the same population and have budget constraints $B_1$ and $B_2$, respectively, with $B_1 > B_2$. In what follows, we shall refer to $J_1$ as the rich jurisdiction and $J_2$ as the poor jurisdiction. The central government is modeled as a benevolent social planner who decides how much of the available fiscal resources, measured by government expenditure, is to be allocated to the central government as well as to the two local jurisdictions in a given time period.\footnote{See Hofman and Yusef (1995) for a discussion of causes.}

The available fiscal resources at the local and central levels are those contained in $B_1$ and $B_2$. To keep focus on the growth–equity tradeoff, it is assumed that (i) $B_1$ and $B_2$ reflect the choices between public goods and private goods made by the social planner at the central level, and (ii) $B_1$ and $B_2$ are fixed.\footnote{In our model, $B_1$ and $B_2$ are generated locally with a fraction of each goes to central expenditure $C$. As a consequence, the proportion $\alpha$ of $C$ comes from $J_1$ and the $(1-\alpha)$ proportion of $C$ comes from $J_2$. Alternatively, but we think not as insightful, one could model that the revenue is generated by the central government with a portion goes to $J_1$ and another portion goes to $J_2$, while the central government retains some.}

The available fiscal resources in $B_1$ and $B_2$ are allocated as follows: (i) a portion goes to central government expenditure, denoted by $C$,\footnote{Central government expenditure $C$ is composed of budgetary funds and extra budgetary funds.} (ii) the remainder goes o local expenditures: $L_1$ for jurisdiction $J_1$ and $L_2$ for jurisdiction $J_2$. The central expenditure $C$ is assumed to be a pure public good, benefitting both local jurisdictions. Funding for central expenditure comes from contributions by the two local jurisdictions with share $\alpha$ for $J_1$ and, consequently, $(1-\alpha)$ for $J_2$.\footnote{Changing levels of taxes and government expenditures in the economy may be expected to affect economic growth. In particular, raising taxes for central and local expenditure programs will be accompanied by distortions in the economy, which should expected to reduce income and the rate of growth. For simplicity, we abstract from those effects and concentrate instead on the effects of the decentralization of expenditure. The explicit recognition of those effects would have changed the particular equilibrium values in our model but would have not changed the nature of the equilibrium, or the qualitative implications we obtain from our model below. See Martinez-Vazquez et al. (2004) for a model where the available financial resources are endogenous with the choice of government policies.}

Local fiscal expenditure $L_i = \alpha L_i = L_i - \alpha \beta C$, and $L_2 = \alpha \beta C - (1-\alpha) C$. In our simplified context, fiscal decentralization is defined as a decrease in the share of the central government expenditures in total government expenditures, that is, a decrease in $c = C/(B_1+B_2)$. We further assume that, due to the concern of fairness, the social planner restricts the value of $\alpha$ to the following range: $\alpha \leq (B_1-B_2+C)/2 C$ and $\alpha \geq B_1/(B_1+B_2)$. The first restriction tells us that at any central expenditure level, the richer jurisdiction always has no less local fiscal resources than the poorer jurisdiction, while the second restriction says that the richer jurisdiction’s contribution share of fiscal resources to...
the central governments is not less than the share of its budgetary resources in total budgetary resources.15

The social planner cares about two objectives: overall economic growth rate in the country, and equity in the distribution of fiscal resources (public expenditures) between the two jurisdictions.16 More specifically, the social welfare function (of the social planner) \( U \) is a function of \( g \), the overall growth rate in the country as defined below, and \( E \), the normalized coefficient of equity in the distribution of fiscal expenditure which is also defined below. For tractability and to capture government’s preferences of \( g \) over \( E \) in a simple way, we will assume that \( U \) takes a linear form:17

\[
U = wg + E. \tag{1}
\]

The coefficient, \( w \), attached to the growth rate, \( g \), in Eq. (1) reflects the benevolent planner’s concern about growth vis-à-vis equity. In particular, we assume that \( w \in (0, \infty) \). Thus, the higher the value of \( w \), the more the central planner is concerned about growth vis-à-vis equity.

As \( w \) approaches infinity, the social planner cares only about growth.

The overall growth rate \( g \) in Eq. (1) is expressed by the equation

\[
g = p_1g_1 + p_2g_2, \]

where \( p_1 \) and \( p_2 \) are weights, with \( p_1 = G_1/G \) and \( p_2 = G_2/G \), and where \( G \) represents total output in the previous time period, and \( G_i \) represents output in each jurisdiction \( J_i \), \( i \in 1,2 \), also in the previous time period. The growth function of local jurisdiction \( J_i \), \( g_i \), \( i \in 1,2 \), is assumed to be a function of central fiscal expenditures \( C \), its local fiscal expenditure \( L_i \), its capital growth rate \( k_i \), and its labor growth rate \( h_i \). Public expenditures in the national public good \( C \) (e.g., research in new technologies or air traffic control) increase productivity in all jurisdictions, while expenditures in local public goods (e.g., local roads and bridges) are assumed to increase productivity only in the respective jurisdiction. Since \( L_1 \) and \( L_2 \) are functions of \( C \) and \( \alpha \), as defined above, \( g_i \) can be expressed in terms of \( C \), \( \alpha \), \( k_i \), and \( h_i \). We assume that the capital growth rate and the labor growth rate in both jurisdictions are exogenous and are not affected by the fiscal policy change, i.e., central expenditure \( C \) and the respective contribution shares to central expenditure, or \( \partial k_i/\partial C = 0 \), \( \partial h_i/\partial C = 0 \), \( \partial k_i/\partial \alpha = 0 \), \( \partial h_i/\partial \alpha = 0 \), \( i \in 1,2 \).18 Both \( g_1 \) and \( g_2 \) are strictly concave and have continuous second-order derivatives with respect to \( C \) and \( \alpha \). In particular, we assume \( \partial^2 g_i/\partial C^2 < 0 \), \( \partial^2 g_i/\partial \alpha^2 < 0 \), \( i \in 1,2 \). It follows that for the overall growth function \( g \), we have \( \partial^2 g/\partial C^2 < 0 \), and \( \partial^2 g/\partial \alpha^2 < 0 \). We also assume \( \partial^2 g/(\partial C \partial \alpha) \geq 0 \).

The equity term, \( E \), in Eq. (1) is defined not in terms of outcomes, such as per capita income or equal economic growth across different jurisdictions, but rather in terms of opportunity.19 Equity in the geographical distribution of fiscal resources is formally defined20 as

\[
E = -(L_1 - L_2)/(L_1 + L_2).
\]

When \( E = 0 \), we have perfect equity in local expenditures. Alternatively, \( E \) can be written as a function of \( C \) and \( \alpha \):

\[
E(C, \alpha) = -[B_1 - B_2 - (2\alpha - 1)/(B_1 + B_2) - C].
\]

Note that, by definition, the equity function \( E \) is strictly increasing in each of \( \alpha \) and \( C \). Given that \( \alpha \in [(B_1/(B_1 + B_2), (B_1 - B_2 + C)/2C] \), it follows that \( E \in [-(B_1 - B_2)/(B_1 + B_2), 0] \).21 Clearly, for any \( C > 0 \), when \( \alpha = (B_1 - B_2 + C)/2C, E = 0 \), and when \( \alpha = (B_1/(B_1 + B_2), E = -(B_1/(B_1 + B_2)) \). It can be shown that \( \partial E/\partial C < 0 \) for \( \alpha = (B_1/(B_1 + B_2)(B_1 - B_2 + C)/2C \) and \( \partial E/\partial C > 0 \) if \( \alpha = (B_1 - B_2 + C)/2C \).

18 Again, this assumption is to allow us to focus alone on the role played by decentralization.

19 The choice of variables relating to opportunity in defining \( E \) is based on the assumption that government can control fiscal resources but not income levels or growth rates. These latter criteria are determined by many other factors well beyond ordinary government control. Most intergovernmental fiscal policies in the international experience, for example, equalization grant systems, are defined in terms of fiscal resources and expenditures, not income or growth rates.

20 This measure is derived from the sum of the negative value of the distance from the relative share of local fiscal resources in total local fiscal resources to the perfect equal share of local fiscal resource, or

\[
e = -1 / \sum \left[ \frac{L_i}{(L_1 + L_2)/2} \right] - 1 \].
\]

Since \( L_1 > L_2, E \) can be written as \( -(L_1 - L_2)/(L_1 + L_2) \).

21 From the definition of \( E \), we know \( \partial E/\partial \alpha = 2C/(L_1 + L_2) \). For any \( C > 0 \) and \( L_1 + L_2 > 0 \), we have \( \partial E/\partial \alpha > 0 \). If \( \alpha = B_1/(B_1 + B_2), E = -(B_1 - B_2)/(B_1 + B_2) \). If \( \alpha = (B_1 - B_2 + C)/2C > B_1/(B_1 + B_2) \) for \( C > 0, E = 0 \). We also eliminate the case for which \( \alpha > (B_1 - B_2 + C)/2C \), where \( E \) is negative.

22 From the definition of \( E \), we know \( \partial E/\partial C = 2/[L_1 + L_2] (L_1 - L_2)/(L_1 + L_2) \). For any \( L_1 + L_2 > 0 \), and \( B_1/(B_1 + B_2) < \alpha < (B_1 - B_2 + C)/2C, \) we have \( \partial E/\partial C > 0 \). If \( \alpha = (B_1 - B_2 + C)/2C \), we have \( \partial E/\partial C = 0 \).
3.1. The general model

The social planner has perfect information about fiscal resources and growth functions and solves the following maximization problem:\[23:\]

**Problem 1.**

\[
\begin{align*}
\text{Max } & U = w[p_1g_1(C,(B_1-\alpha C)) + p_2g_2(C,(B_2-(1-\alpha)C))] \\
\text{s.t. } & \alpha \leq \frac{(B_1-\alpha + C)}{2C} \\
& \alpha \geq \frac{B_1}{B_1 + B_2}.
\end{align*}
\]

The following proposition, Proposition 1, summarizes the implication of Problem 1. Its proof can be found in the Appendix.

**Proposition 1.** Let \((C,\alpha)\) be the solution to Problem 1 and recall that \(c\) is the share of the central government expenditures in total government expenditures. Then,

1. If \((B_1-\alpha + C)/(B_1 + B_2) > \alpha > B_1/(B_1 + B_2)\), then \(\frac{\partial c}{\partial w} < 0\) and \(\frac{\partial \alpha}{\partial w} > 0\);
2. If \(\alpha = (B_1-\alpha + C)/(B_1 + B_2)\), or \(\alpha = B_1/(B_1 + B_2)\), then \(\frac{\partial c}{\partial w} = 0\) and \(\frac{\partial \alpha}{\partial w} = 0\).

According to Proposition 1, starting with \(\alpha\) given \(w\), if the optimal fiscal resource allocation is not a perfect equal allocation of fiscal resources and the contribution share to the central government by the richer jurisdiction is not equal to its budgetary resource share in total fiscal resources, then decentralization occurs when the social planner cares more about overall growth, or as \(w\) increases. Decentralization implies a decreasing contribution share to the central expenditure by the richer jurisdiction, and consequently an increasing contribution share to the central expenditure by the poorer jurisdiction with the decrease of central fiscal expenditure. In addition, decentralization decreases equity in the allocation of fiscal resources among jurisdictions along with the improvement of economic growth.

On the other hand, starting with any given \(w\), if the optimal resource allocation is a perfect equal allocation of fiscal resources or if the contribution share to the central government by the richer jurisdiction is equal to its budgetary resource share in total fiscal resources, then the allocation of fiscal resources may not change when the social planner cares more about the overall growth in the economy vis-à-vis equity in the allocation of fiscal resources. This suggests in part that our results are not driven exclusively by our assumption that the government may experience preference changes.

3.2. Special cases

Some special cases of the general model above would seem to better fit and illustrate different periods of decentralization policy choices made by China over regional equity and economic growth. In the first special case (i), which we will call the best growth model, the central government only cares about growth, so \(U\) now becomes \(U=g\). This case would seem to fit best the framework of China’s economic reforms in the 1980s and 1990s, as encapsulated in Deng Xiaoping dictum “Let part of us be richer first.” In the second special case (ii), which we will call the given equity model the government’s objective is to maximize growth subject to a minimum equity constraint, so that \(E=E\). This case seems to fit best current policy of China’s government. Although nowadays there continues to be a major emphasis on economic growth, there is an explicit effort to put into place policies that would bring a minimum of redistribution to the poorer provinces in the center and western provinces of the country. In the third special case (iii), the government is more concerned about equity but it wishes to satisfy a minimum constraint for the growth rate, so that \(g=g\). This case seems to fit best a major portion of the Mao era when there was a great emphasis on regional equity but explicit growth targets were set in the multiyear economic plans. We now turn to the analysis of these special cases:

(i) *The “best growth” model.* The social planner in this case cares about the overall growth rate only. This case is equivalent to the situation in which \(w\) becomes “very large” in the general model. Viewed in this way, the optimal values of \(C_b\) and \(\alpha_b\) for the best growth model can be obtained, respectively, from the optimal values of \(C\) and \(\alpha\) of the general model by allowing \(w\) approaches to \(\infty\). From Proposition 1, \(C_{b_i} \geq C\) and \(\alpha_{b_i} \geq \alpha\) hold. Further, the central government expenditure and the share of contribution to the central expenditure by the richer jurisdiction reach their lowest values in the best growth model.

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\[23:\] For the ease of presentation, our theoretical model consists of two jurisdictions. However, we can extend our model to \(n\) jurisdictions by defining the equity index and introducing the contribution share of each jurisdiction to central revenue properly. For example, \(E\) may be defined as follows: Let \(L = \sum L_i\) and \(l_i = L_i - L\) for all \(i = 1,\ldots,n\), and then define \(E\) as \(E = (l_1 + \ldots + l_n)/L\). The restrictions on \(\alpha_i\) jurisdiction \(i\)'s contribution share to central expenditure, may be formulated as follows: \(\alpha_i \geq B_i/(B_1 + \ldots + B_n)\), \(\alpha_i \geq (nB_i - \sum B_j + C)/nC\) if \(L_i \leq L\), \(\alpha_i \leq (nB_i - \sum B_j + C)/nC\) if \(L_i \geq L\), and \(\alpha_1 + \ldots + \alpha_n = 1\).
(ii) The ”given equity” model: In this case, the problem for the social planner becomes: Problem 2

\[
\begin{align*}
\text{Max } U & = w[p_1 g_1(C, (B_1 - xC)) + p_2 g_2(C, (B_2 - (1 - x)C))] \\
& + \frac{[B_1 - B_2 - (2x - 1)C]}{B_1 + B_2 - C}
\end{align*}
\]

s.t. \( E = \bar{E}, \ x \leq \frac{(B_1 - B_2 + C)}{2C}, \) and \( x \geq \frac{B_1}{B_1 + B_2}. \)

The property of the solution to Problem 2 is summarized in the following proposition. Its proof can be found in the Appendix.

**Proposition 2.** Assume that \( w \) is given. Let \( E^*_g \) be the optimal equity level of the general model (Problem 1), and let \( (C, \alpha) \) be the solution to Problem 1 while \( (C', \alpha') \) is the solution to Problem 2. Then, (i) \( C = C' \) and \( \alpha = \alpha' \) if \( \bar{E} \geq E^*_g \) and (ii) \( C' > C \) and \( \alpha' > \alpha \) if \( \bar{E} < E^*_g \).

It is not surprising that, when the target equity level is no more than the optimal equity level obtained from the general model, \( C \) and \( \alpha \), and therefore the growth rate, would be the same as obtained from the general model. When the target equity level exceeds the optimal equity level obtained from the general model, both \( C \) and \( \alpha \) are greater than the ones obtained from the general model leading to a lower growth rate. A special case is in which the required equity level is the perfect equity” level or \( \bar{E} = 0 \). The perfect equity solution is similar to the solution of the general model with \( w \rightarrow 0 \). The reason is that as \( w \) gets close to 0, we can find an optimal resource allocation \( (C, \alpha) \) such that \( \alpha \rightarrow (B_1 - B_2 + C)/2C \). It is easy to find that unless \( E^*_g = 0 \), we always have \( \bar{E} > E^*_g \), and the optimal resource allocation \( (C_0, \alpha_0) \) for this perfect equal distribution of fiscal resources has a higher central expenditure and a higher contribution share to the central expenditure by the richer jurisdiction than those in the general model, which are necessarily higher than those in best growth model. Therefore, the central expenditure and the share of contribution to the central expenditure by the richer jurisdiction reach the highest levels in this perfect equity solution. \(^{24}\)

(iii) The given growth” model: In this case, the problem for the social planner becomes: Problem 3

\[
\begin{align*}
\text{Max } U & = w[p_1 g_1(C, (B_1 - xC)) + p_2 g_2(C, (B_2 - (1 - x)C))] \\
& + \frac{[B_1 - B_2 - (2x - 1)C]}{B_1 + B_2 - C}
\end{align*}
\]

s.t. \( g = \bar{g}, \ x \leq \frac{(B_1 - B_2 + C)}{2C}, \) and \( x \geq \frac{B_1}{B_1 + B_2}. \)

The property of the solution to Problem 3 is summarized in the following proposition. Its proof can be found in the Appendix.

**Proposition 3.** Assume that \( w \) is given. Let \( g^*_\alpha \) be the optimal growth rate of the general model (Problem 1), and let \( (C, \alpha) \) be the solution to Problem 1 while \( (C', \alpha') \) be the solution to Problem 3. Then, (i) \( C = C' \) and \( \alpha' = \alpha' \) if \( \bar{g} \geq g^*_\alpha \), and (ii) \( C' > C \) and \( \alpha' > \alpha \) if \( \bar{g} < g^*_\alpha \).

Therefore, to achieve a required growth level \( \bar{g} \), the optimal central government expenditure \( C' \), the share of contribution to the central expenditure by the richer jurisdiction \( \alpha' \), and consequently, the overall growth rate and the equity level in the given growth model are the same as those in the general model if \( \bar{g} \geq g^*_\alpha \). On the other hand, any required growth rate \( \bar{g} \) which is higher than the optimal growth rate in the general model \( g^*_\alpha \) will lead to a less central expenditure \( C \) and a smaller share of contribution to the central government by the richer jurisdiction, \( \alpha \), and this policy results in a lower level of equity in the distribution of fiscal resources to achieve the higher growth rate \( \bar{g} \).

3.3. A summary of different models

The results from the different models for \( C, \alpha, \) the overall growth rate, and the equity level are summarized in Table 1.

Of the five models, the solution of the perfect equity model, or given equity model with equity equal to zero, has the largest central expenditure and the highest share of contribution to the central expenditure by the richer jurisdiction, and is always located on the frontier line with \( \alpha = (B_1 - B_2 + C)/2C \). Since other solutions have smaller \( C \) and \( \alpha \), the tradeoff curve is in the left-down and right-up direction. The solution of the best growth model has the lowest central expenditure and the smallest share of contribution to the central expenditure by the richer jurisdiction. The optimal solution of the general model has a solution in between. In the given equity model, if the given equity level is higher than that in the general model, this policy will lead to fiscal centralization. In the given growth model, if the minimum growth rate is higher than that in the general model solution, this policy will lead to fiscal decentralization.

Fig. 2, illustrates the tradeoff between the growth rate and the equity level with respect to decentralization.

For any point on the curve in Fig. 2, we have an overall growth rate \( \bar{g} \) and an equity level \( E^* \) such that for any other allocations there always exists \( g \leq g^* \) if \( E = E^* \), or \( E \leq E^* \) if \( g = g^* \). In other words, there is a tradeoff between the overall growth and equity in the distribution of fiscal resources. Fiscal decentralization

\(^{24}\) From the definition of \( E \), we know \( \partial E/\partial C = [2(B_1 + B_2)/[\alpha - \alpha' (L_1 + L_2)]] \). For any \( L_1 + L_2 > 0 \), and \( B_1 (B_1 + B_2) < 2 \alpha (B_1 - B_2 + C)/2C \), we have \( \partial E/\partial C > 0 \). If \( \alpha (B_1 - B_2 + C)/2C \), we have \( \partial E/\partial C = 0 \).
However, the episode of high rates of economic growth for China’s central government in the early 1980s. Decentralization was an obvious choice of fiscal reform fiscal resources benefiting the poorer interior provinces. resources, and, to some extent as a side effect supported by Chairman Mao, to a relatively equal distribution of fiscal resources benefiting the poorer interior provinces. De decentralized was an obvious choice of fiscal reform when economic growth became the most important goal for China’s central government in the early 1980s. However, the episode of high rates of economic growth appears to have been accompanied by increasing fiscal disparities across local governments. Therefore, China’s recent experience would seem to provide a good case for testing the implications of our theoretical model. Thus, the basic question we examine in this section is whether China’s decentralization policy has been subject to a tradeoff between economic growth and equity in the regional distribution of resources.

4. Empirical analysis

Before the process of fiscal decentralization and other reforms started in China in December 1978, the desire to control the economy would appear to have been a more important objective for China’s central government than either economic growth or the equitable regional distribution of fiscal resources. The political concern for social and economic control as well as the military considerations led to an over-centralization of fiscal resources, and, to some extent as a side effect supported by Chairman Mao, to a relatively equal distribution of fiscal resources benefiting the poorer interior provinces. Decentralization was an obvious choice of fiscal reform when economic growth became the most important goal for China’s central government in the early 1980s. However, the episode of high rates of economic growth appears to have been accompanied by increasing fiscal disparities across local governments. Therefore, China’s recent experience would seem to provide a good case for testing the implications of our theoretical model. Thus, the basic question we examine in this section is whether China’s decentralization policy has been subject to a tradeoff between economic growth and equity in the regional distribution of resources.

4.1. The empirical model

To allow for the potential simultaneity of economic growth and the geographical distribution of fiscal resources, we use a simultaneous equations model with economic growth” and equity” as dependent variables (see Eqs. (4.3) and (4.4)) and with fiscal decentralization as the main explanatory variable of interest in both equations. From our theoretical model we expect decentralization to lead to economic growth. But clearly, all other things equal, ever increasing decentralization may not always lead to a higher economic growth. To allow for a nonlinear relationship between fiscal decentralization and growth, we introduce both fiscal decentralization and the square of fiscal decentralization as explanatory variables in the growth Eq. (4.3). As predicted by our theoretical model, we expect a negative relationship between equity (in the geographical distribution of fiscal resources) and economic growth. This is based on the premise, which seems to have been shared by Chinese decision makers, that some provinces are better equipped and are likely to grow faster than others if economic resources are left in those provinces, as opposed to distributing those resources to poorer areas of the country.

26 From the viewpoint of our theoretical model the degree of fiscal decentralization is a policy instrument and therefore should be treated as an exogenous variable. However, as explained below, we check that empirically this assumption is actually warranted.

27 It is worth stressing that $\bar{E}=0$ in the given equity model differs from a model in which social planners pursue only perfect equity in the distribution of fiscal resource, or $w=0$. Assuming that the social planner wants to make a perfect equal distribution of fiscal resources between the two jurisdictions and does not care about the overall growth, given any central expenditure larger than zero, then it is easy to find that there exist multiple choices, or that the optimal condition is achieved for any central expenditure larger than zero by setting the value of $\alpha$ with $\alpha=(B_1-B_2+C)/2C$. The social planner can pick any $C$ and $\alpha$ such that $\alpha=(B_1-B_2+C)/2C$ and $C>0$ and achieve a perfect equity level in the distribution of fiscal resources.

---

25 See the discussion in Bahl and Martinez-Vazquez (2006).
The measurements of fiscal decentralization and equity in the geographical distribution of fiscal resources require careful attention. Given the complexity of decentralization in China, the issue of measuring the level of fiscal decentralization presents something of a challenge. China’s decentralization has taken place on both the revenue side and the expenditure side of the budget. Although far from perfect, we choose the expenditure side as the basis for measuring decentralization because fiscal revenues in China are reallocated between central and local governments in a complex web of flows (revenue sharing, rebates, many types of transfers, extra-budgetary funds and so on), which tend to obscure the real fiscal resources available to the different government levels. Thus, fiscal decentralization will be defined as the share of provincial fiscal expenditure in total fiscal expenditure in per capita terms, or:

\[
\text{Decentralization}_t = \frac{LX_i}{\text{POP}_i} \times \frac{LX_i + CX_i}{\text{POP}_t + \text{POP}_t}. \tag{4.1}
\]

Where, \(LX_i\) stands for the provincial fiscal expenditure for province \(i\) in year \(t\), \(CX_i\) stands for the central expenditure in year \(t\), \(\text{POP}_i\) stands for the population for province \(i\) in year \(t\), and \(\text{POP}_t\) stands for the total population in year \(t\). By this measure, China experienced an increasing decentralization trend over the sample period. Zhang and Zou (1998) and Lin and Liu (2000) use similar measures of decentralization. An alternative measure of decentralization is the marginal retention rate used by Jin et al. (1999). This latter measure focuses on the incentive response of local governments to decentralization. However, we believe that the measure of decentralization in Eq. (4.1) better matches the allocation of fiscal resources between the central and local governments, the focus of our research. Nevertheless, as with other similar measures of decentralization used in the fiscal federalism literature, the measure in Eq. (4.1) is far from ideal; for example, there may be expenditures going through the provincial budgets, for which provincial governments do not have much discretion. This is relevant because in China the central government often uses guidelines and mandates for different types of local expenditures. Thus, the presumption of absolute authority by local governments over their expenditures may not hold entirely. Other distortions may arise from using Eq. (4.1); for example, a central government tax cut would result in a higher degree of decentralization for all provinces, albeit in a different way for each and every one of the provinces. Overall, given the present level of information, there is no ideal
measure of decentralization, but we believe our proposed measure of fiscal decentralization is the best available for our purposes. At the very least, it captures well the changes in decentralization, with higher shares of provincial expenditure in total fiscal expenditure reflecting a move toward a more decentralized system.

We measure equity in the regional distribution of fiscal resources by:

\[
Equity_{it} = -\frac{\sum LX_{it} - \sum POP_{it}}{\sum POP_{it}} - 1.
\]

(4.2)

This measure of equity is based on the concept of the relative share of fiscal resources. Let us define the ratio of the share of fiscal resources to the share of population of a province as the province’s relative share of fiscal resources, then, our equity measure in Eq. (4.2) is the absolute value of the distance from the relative share to the perfect equal share.\(^{30}\) With perfect equality, or an ideal equity situation, the share of fiscal resources of a region is equal to the share of population in the entire country and the relative share of fiscal resource equals one for all provinces in a given year. For provinces with an initial relative share of fiscal resources higher than one, an increase in their share would indicate that decentralization leads to less equity and a decrease in their share would mean a more equitable outcome. Similarly, equity would decrease if provinces with an initial relative share of less than one were to see their shares decreased further, moving away from one due to decentralization, and so on. The larger the distance in absolute terms, the lower the equity in the inter-jurisdictional distribution of fiscal resources as measured in Eq. (4.2).

Besides the level of fiscal decentralization and the level of inter-jurisdictional equity, we introduce several other control variables in the growth equation. Following the neoclassical model\(^{31}\), we include the growth rates of capital (Capital) and labor (Labor) as two basic control variables driving economic growth. In addition, we include the effective tax rate at the provincial level (Tax) and its square (Tax Square) as proxies for the impact on the growth rate of different allocations of resources between the public and private sectors.

Similarly, we use several explanatory variables in the equity equation besides the level of fiscal decentralization and the rate of economic growth. An explanatory variable of particular interest is the provincial government’s reliance on extra-budgetary funds.\(^{32}\) Previous quantitative studies of decentralization in China either treated extra-budgetary funds as exactly identical to ordinary budgetary expenditure (for example, Zhang and Zou, 1998), or just ignored them (for example, Lin and Liu, 2000). Since our research focuses on the distribution of all public resources, we use the ratio of extra-budgetary expenditure to budgetary expenditure as a proxy for fiscal decentralization.

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\(^{30}\) There are other possible ways to quantify equity, for example those involving measures of variance, coefficient of variation, or other forms of cross-sectional inequality. However, these alternative measures would have significantly limited the available degrees of freedom for our estimations (for example, computing the variance will take all the cross section observations for each particular year); conceptually these alternative measures may not superior to our measure, which fully reflects how a given region is advantaged/disadvantaged in terms of fiscal resources relative to other regions.

\(^{31}\) See, for example, Barro (1990).

---

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>Percent growth rate of nominal per capita GDP</td>
</tr>
<tr>
<td>Decentralization</td>
<td>Fiscal decentralization: per capita provincial fiscal expenditure as a percentage of total per capita fiscal expenditure, which is the sum of per capita central fiscal expenditure and per capita provincial expenditure.</td>
</tr>
<tr>
<td>Equity</td>
<td>Fiscal inequality: the absolute value of the difference between the relative share of fiscal resource and 1. Relative share of fiscal resources is the ratio of the share of fiscal resource to the share of population. In the empirical work we enter Equity with a negative sign so to allow a more direct interpretation of the results: a larger value of Equity means a more equal distribution of resources.</td>
</tr>
<tr>
<td>Tax</td>
<td>Tax rate: provincial total tax revenue as a percentage of total provincial GDP</td>
</tr>
<tr>
<td>Extra Budget</td>
<td>The ratio of extra-budgetary expenditure to budgetary expenditure</td>
</tr>
<tr>
<td>Labor</td>
<td>Growth rate of labor</td>
</tr>
<tr>
<td>Capital</td>
<td>Growth rate of capital investment</td>
</tr>
</tbody>
</table>

---

\(^{32}\) Extra-budgetary accounts provide more flexibility and discretion in the use of the funds because their use usually lacks specificity and rarely contains detailed criteria (Wong, 1998). Extra-budgetary accounts can also be used to shield tax collections from the revenue sharing agreements with the central government (Bahl, 1999). Extra-budgetary funds have a diffuse nature (where they come from, how they are spent, etc.), but their exclusion from the data could lead to serious specification biases. Not only are extra-budgetary funds fully controlled by sub-national governments during the entire sample period, but also the availability and size of extra-budgetary funds differ considerably across sub-national units. Therefore, their presence has significant meaning for equity in the geographical distribution of fiscal resources and differential opportunities for growth.
may affect equity in the distribution of budgetary resources. Richer provinces, which have a higher number of large enterprises, are more likely to be able to raise extra-budgetary funds. In this sense, the availability of extra-budgetary funds will tend to worsen equity. On the other hand, because extra-budgetary funds can be used to alleviate the shortage of budgetary funds, poor provinces may make more frequent use of this type of financing and therefore shorten differences in the distribution of overall fiscal resources. That is, extra-budgetary funds give poorer provinces the ability or flexibility to exercise a higher overall fiscal effort. Other control variables introduced in the equity equation include the effective tax rate and its square to help capture any impact on regional equity from the fiscal revenue side.

Finally, in both the growth equation and the equity equation, we introduce several time period dummies. We use a dummy variable dum94d\(^*\) for observations after 1994 set to 1 and other years set to 0 to allow for the differential impact on both of growth and equity of the 1994 Tax Sharing System fiscal reform. Another dummy variable we use is dum88d\(^*\) for observations from 1988 to 1993 set to 1 and other years set to 0 to allow for the differential impact on growth and equity of the 1988 Fiscal Contracting reform. In addition, we use the dummy variable dumX\(^*\) to control for the change in the computational method introduced that year. The year dummies for 1989, 1990, and 1991 (dum89, dum90, and dum91, respectively) are introduced to control for the potential impact of the 1989 events in Tianmen Square on economic growth.\(^{33}\) Two last dummy year variables are introduced in both equations for 1987 (dum87) and 1993 (dum93) because of the special role those two years played in terms of public sector accounts: 1987 was used as the base year for the 1988 Fiscal Contracting reform, and 1993 was used as the base year for the 1994 Tax Sharing System fiscal reform. In order to facilitate the implementation and acceptance of these two important reforms, the central government allowed many local governments, after a long bargaining process, to introduce favorable (to the local governments) adjustments to their fiscal base\(^*\) for those two years.

\(^{33}\) The assumption is that Deng Xiaoping restatement of the reform policy goals in 1992 puts an end to the negative influences on economic growth of the Tianmen Square events.

### Table 3
Data descriptive statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>C.V</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>18.83</td>
<td>8.64</td>
<td>0.46</td>
<td>48.68</td>
<td>0.85</td>
</tr>
<tr>
<td>Equity</td>
<td>0.44</td>
<td>0.44</td>
<td>0.99</td>
<td>3.12</td>
<td>0.00</td>
</tr>
<tr>
<td>Decentralization</td>
<td>0.70</td>
<td>0.10</td>
<td>0.14</td>
<td>0.93</td>
<td>0.46</td>
</tr>
<tr>
<td>Decentralization square</td>
<td>0.50</td>
<td>0.14</td>
<td>0.28</td>
<td>0.87</td>
<td>0.21</td>
</tr>
<tr>
<td>Tax</td>
<td>9.75</td>
<td>4.68</td>
<td>0.48</td>
<td>39.47</td>
<td>3.31</td>
</tr>
<tr>
<td>Tax square</td>
<td>116.93</td>
<td>145.34</td>
<td>1.24</td>
<td>1557.94</td>
<td>10.98</td>
</tr>
<tr>
<td>Labor</td>
<td>1.74</td>
<td>2.17</td>
<td>1.25</td>
<td>7.26</td>
<td>13.14</td>
</tr>
<tr>
<td>Capital</td>
<td>21.98</td>
<td>18.50</td>
<td>0.85</td>
<td>94.15</td>
<td>−23.83</td>
</tr>
<tr>
<td>Extra Budget</td>
<td>0.59</td>
<td>0.29</td>
<td>0.46</td>
<td>1.66</td>
<td>0.10</td>
</tr>
</tbody>
</table>

In summary, our estimating simultaneous equation model can be expressed (suppressing the time dummies) as follows:

\[
\begin{align*}
\text{Growth}_{it} &= \beta_0 + \beta_1 \text{Decentralization}_{it} \\
&\quad + \beta_2 \text{Decentralization}^2_{it} + \beta_3 \text{Tax}_{it} \\
&\quad + \beta_4 \text{Tax}^2_{it} + \beta_5 \text{Equity}_{it} + \beta_6 \text{Labor}_{it} \\
&\quad + \beta_7 \text{Capital}_{it} + \mu_i + \nu_{it} \\
&= \beta_0 + \beta_1 \text{Decentralization}_{it} \\
&\quad + \beta_2 \text{Decentralization}^2_{it} + \beta_3 \text{Tax}_{it} \\
&\quad + \beta_4 \text{Tax}^2_{it} + \beta_5 \text{Equity}_{it} + \beta_6 \text{Labor}_{it} \\
&\quad + \beta_7 \text{Capital}_{it} + \mu_i + \nu_{it} \\
(4.3) &
\end{align*}
\]

\[
\begin{align*}
\text{Equity}_{it} &= \alpha_0 + \alpha_1 \text{Decentralization}_{it} \\
&\quad + \alpha_2 \text{Growth}_{it} + \alpha_3 \text{Extra Budget } t_{it} \\
&\quad + \alpha_4 \text{Tax}_{it} + \alpha_5 \text{Tax}^2_{it} + \mu_i + \nu^*_it \\
&\quad + \text{Decentralization}^2_{it} + \text{Tax}_{it} + \text{Equity}_{it} \\
&= \alpha_0 + \alpha_1 \text{Decentralization}_{it} \\
&\quad + \alpha_2 \text{Growth}_{it} + \alpha_3 \text{Extra Budget } t_{it} \\
&\quad + \alpha_4 \text{Tax}_{it} + \alpha_5 \text{Tax}^2_{it} + \mu_i + \nu^*_it \\
(4.4) &
\end{align*}
\]

where \(i\) stands for region \(i\), \(t\) stands for year \(t\), \(\mu_i\) and \(\rho_i\) are the unobserved regional effects, and \(\nu_{it}\) and \(\nu^*_it\) are the idiosyncratic errors.\(^{34}\) The variable definitions are summarized in Table 2.

#### 4.2. The data

The empirical analysis is based on panel data consolidated at the provincial level for the period 1985 to 1998. We chose 1985 as the starting for the sample period because prior to the FRS reform of 1985, provincial governments had practically no discretion over their expenditures, even though there had been some fiscal reform experiments in several isolated provinces before 1985. The descriptive statistics for the variables are summarized in Table 3.\(^{35}\)

\(^{34}\) The alternative approach is a two-way error specification. We believe the one-way specification is more proper in this context since we already account for time effects with a complete set of time dummy variables.

\(^{35}\) Because of some inconsistencies in the data we include 28 of the 31 provinces, Autonomous Region, and Directly Administered Municipalities in the data set. The province of Hainan is combined into Guangdong province, and the Directly Administered Municipality of Chongqing is combined into Sichuan province. Because of the lack of data, Tibet is excluded entirely from the panel.

**4.3. Estimation approach and results**

Because of the potential simultaneity of growth and fiscal equity, we use the two-stage least square approach to estimate Eqs. (4.3) and (4.4), and, obviously, the system of equations is identified. Since we are using panel data across quite different provinces, the unobserved time constant fixed effects need to be taken into account in our estimation. Since the provincial data and the observations across the provinces may not be considered as random draws from a larger population and we expect these unobserved factors to be correlated with other explanatory variables, the correct estimation approach is a fixed effects model. The estimation results are reported in Table 4.

To test the validity of our assumption that that fiscal decentralization is exogenous, we alternatively regard fiscal decentralization as an endogenous variable. Some of the variables that possibly may affect the level of fiscal decentralization include fiscal decentralization level in the previous year, the level of extra-budgetary funds, and all the year dummy variables. However, a Hausman test shows the assumption of exogeneity of decentralization cannot be rejected for both growth and equity equations. Similarly we were not able to reject the exogeneity of the effective tax rate variable.

The major findings from the estimation can be summarized as follows:

First, fiscal decentralization significantly affected economic growth. These findings contrast with those obtained by Zhang and Zou (1998). The negative relationship these authors find may be explained not only by the differences in the specifications of econometric models used in the two papers, but also by the difference in the time periods covered by the two data sets. Our result shows that, consistent with the logic of China’s fiscal reform, fiscal decentralization improved economic growth, but at the cost of less geographical equity. However, as expected, the relationship between the level of decentralization and the rate of growth is significant.

![Table 4](https://example.com/table4.png)

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>Intercept</td>
</tr>
<tr>
<td>-75.711 (-2.05)</td>
<td>0.551 (2.08)</td>
</tr>
<tr>
<td>Decentralization</td>
<td>Decentralization</td>
</tr>
<tr>
<td>367.137 (3.23)</td>
<td>-1.687 (-5.27)</td>
</tr>
<tr>
<td>Square Decentralization</td>
<td>Growth</td>
</tr>
<tr>
<td>-368.043 (-3.85)</td>
<td>-0.003 (-1.68)</td>
</tr>
<tr>
<td>Equity</td>
<td>Tax</td>
</tr>
<tr>
<td>-41.598 (-4.92)</td>
<td>-0.024 (-1.95)</td>
</tr>
<tr>
<td>Tax</td>
<td>Tax²</td>
</tr>
<tr>
<td>1.932 (-4.16)</td>
<td>0.001 (3.12)</td>
</tr>
<tr>
<td>Square Tax</td>
<td>Extra Budget</td>
</tr>
<tr>
<td>0.05 (4.43)</td>
<td>0.321 (4.99)</td>
</tr>
<tr>
<td>Labor</td>
<td>dumX</td>
</tr>
<tr>
<td>1.323 (7.13)</td>
<td>0.016 (0.48)</td>
</tr>
<tr>
<td>Capital</td>
<td>dum88d</td>
</tr>
<tr>
<td>0.125 (4.95)</td>
<td>0.194 (5.33)</td>
</tr>
<tr>
<td>dum94d</td>
<td>dum97</td>
</tr>
<tr>
<td>10.924 (3.76)</td>
<td>0.077 (2.07)</td>
</tr>
<tr>
<td>dum87</td>
<td>dum93</td>
</tr>
<tr>
<td>5.985 (3.82)</td>
<td>0.2 (3.79)</td>
</tr>
<tr>
<td>dum89</td>
<td>dum90</td>
</tr>
<tr>
<td>-1.944 (-1.12)</td>
<td>-7.471 (-4.89)</td>
</tr>
<tr>
<td>dum91</td>
<td>dum91</td>
</tr>
<tr>
<td>-4.876 (-3.13)</td>
<td>-4.876 (-3.13)</td>
</tr>
<tr>
<td>dum93</td>
<td>dum93</td>
</tr>
<tr>
<td>9.722 (5.37)</td>
<td>9.722 (5.37)</td>
</tr>
</tbody>
</table>

Number of observations: 392  
$R^2$: 0.51  
$t$-statistics in parentheses.

36 For example, the geographical location of provinces is quite likely correlated with the rate of growth of capital investment across provinces.

37 The Hausman test rejected a random effects treatment in favor of the fixed effect model.
economic growth was non-linear.\(^{38}\) In addition, fiscal decentralization policies in China significantly decreased equity in the regional distribution of fiscal resources. The coefficient of fiscal decentralization in the equity equation is \(-1.687\). This provides statistical support to the proposition of our theoretical model that a growth-oriented fiscal decentralization policy leads to lower equity in the distribution of fiscal resources. The result on fiscal decentralization and equity reinforces those in the previous literature on the lack of convergence of per capita incomes across provinces (Chen and Fleischer, 1996; Kanbur and Zhang, 1999; Shi, 2001; Dayal-Gulati and Husain, 2002; Demurger et al., 2002).

Second, there was some evidence of a tradeoff between economic growth and equity in the distribution of resources. In the growth equation, a more equal distribution of fiscal resources appears to retard economic growth. For example, an increase of 0.01 in the equity coefficient would have implied a sacrifice of 0.42 percent in economic growth at the margin. In the equity equation, a faster economic growth contributes to a more unequal distribution of fiscal resources. For example, an increase of 0.01 in the equity coefficient would have implied a sacrifice of 0.42 percent in economic growth at the margin.

\(^{38}\) The implied optimal level of fiscal decentralization for economic growth can be obtained by allowing for simultaneity and equating the first derivative to zero. From our estimates, this yields \(67.137 + 41.598 \times 1.687 - 2 \times 368.43 \times FD = 0\). Thus, the implied optimal level of fiscal decentralization for economic growth is 0.59. Thieben (2003) also found for OECD countries that decentralization affects economic growth in a non-linear way.

### Table 5
Regression results for alternative specifications

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Decentralization</td>
<td>738.056</td>
<td>2821.523</td>
<td>238.662</td>
<td>Decentralization</td>
<td>-1.629</td>
<td>-2.337</td>
<td>-1.689</td>
</tr>
<tr>
<td></td>
<td>(3.64)</td>
<td>(4.71)</td>
<td>(1.43)</td>
<td></td>
<td>(-5.58)</td>
<td>(-5.07)</td>
<td>(-6.03)</td>
</tr>
<tr>
<td>Square</td>
<td>-609.743</td>
<td>-2195.872</td>
<td>-199.236</td>
<td>Growth</td>
<td>-0.004</td>
<td>-0.003</td>
<td>-0.004</td>
</tr>
<tr>
<td>Decentralization</td>
<td>(-3.72)</td>
<td>(-4.85)</td>
<td>(-1.48)</td>
<td></td>
<td>(-2.07)</td>
<td>(-1.76)</td>
<td>(-2.16)</td>
</tr>
<tr>
<td>Equity</td>
<td>-50.049</td>
<td>-86.606</td>
<td>-20.119</td>
<td>Tax</td>
<td>-0.028</td>
<td>-0.052</td>
<td>-0.028</td>
</tr>
<tr>
<td></td>
<td>(-4.08)</td>
<td>(-5.22)</td>
<td>(-1.95)</td>
<td></td>
<td>(-2.37)</td>
<td>(-2.31)</td>
<td>(-2.37)</td>
</tr>
<tr>
<td>Tax</td>
<td>-1.190</td>
<td>-4.928</td>
<td>-1.087</td>
<td>Tax²</td>
<td>0.001</td>
<td>0.002</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(-3.66)</td>
<td>(-5.02)</td>
<td>(-3.27)</td>
<td></td>
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\(t\)-statistics in parentheses.
overall economic growth improved, but at the same time, the distribution of fiscal resources became more unequal. These results confirm the proposition of our theoretical model that the formulation of fiscal decentralization policy generally faces a tradeoff between economic growth and equity in the geographical distribution of fiscal resources.

Third, the level of tax effort had a non-linear effect on economic growth. Too few or too many resources shifted from the private sector to the public sector can be detrimental to economic growth. This is shown by the negative and significant coefficient for Tax and the positive and significant coefficient for Tax Square in the growth equation.

Fourth, the availability and use of extra-budgetary funds worked to alleviate the provincial inequality in the distribution of fiscal resources. Thus, even though richer provinces may find it easier to raise extra-budgetary funds, the relatively higher use of extra-budgetary funds by poorer provinces leads to a reduction in fiscal disparities. This contrasts with the common belief that extra-budgetary funds contribute to fiscal disparities.39

Fifth, as expected, the coefficients for capital and labor growth were positive and statistically significant in the growth equation, which was consistent with the neoclassical model of economic growth.

Finally, the majority of the time dummy variables performed as expected. The Tianmen square incidents led to a slower growth for several years. The years following the major fiscal reforms of 1988 and especially 1994, after Deng Xiao Ping’s tour to the south, led to a faster growth but also to a greater equality in the distribution of resources vis-à-vis prior years in our sample. This latter result contrasts with the generalized belief that the geographical distribution of resources became more unequal over time as economic growth accelerated. The base year adjustments in 1987 and 1993 had similar impacts. However, the change in the measurement of extra-budgetary funds had no effects on equity.

To test the robustness of our estimates, first we use GLS to estimate an alternative specification that includes a regional dummy variable, dumreg,40 in both the growth and equity equations to control for the economic advantages offered to the coastal provinces by geographic location and the early policy advantage of being able to attract foreign direct investment. Second, we reduce the time period to 19981998 so to eliminate the years before the 1988’s Fiscal Contracting reform, and use fixed effect estimation. Third, we try a random effect estimation of our original model. The results from all three alternative estimations, reported in Table 5, are consistent with those obtained in our original estimation.

5. Conclusion

In this paper, we have investigated the possibility of a tradeoff between economic growth and regional equity in decentralization policy, in the context of China’s recent history with decentralization. Our empirical results have given qualified support to the existence of this type of tradeoff. The tradeoff would appear to put China policymakers on the horns of a dilemma. While the rate of economic growth in China has been quite high over approximately the last two decades, inequality in the distribution of fiscal resources across local governments has increased significantly.

To facilitate our investigation, we have developed several theoretical models of fiscal decentralization, where overall national economic growth and equity in the distribution of fiscal resources among subnational governments are the two objectives pursued by the policy maker. According to our theoretical models, under some general conditions, there is a tradeoff between economic growth and regional equity.

Our theoretical predictions have been tested using panel data covering the 1985 to 1998 period of fiscal decentralization in China. Two other findings are noteworthy apart from the finding confirming the existence of a tradeoff between economic growth and regional equity.

First, fiscal decentralization significantly affected economic growth. A higher level of decentralization led to a higher growth, but as expected, this relationship was non-linear. At the same time, decentralization policies in China led to significant increases in inequality in the geographical distribution of fiscal resources. Second, contrary to some common belief, the existence and use of extra-budgetary funds helped to alleviate disparities in the distribution of fiscal resources.

It is hoped that our results will shed some additional light on the debate regarding the impact of China’s decentralization policy on economic growth and the distribution of fiscal resources across different regions. What to do about this tradeoff may represent the most important and difficult decision in intergovernmental fiscal reform currently facing the Chinese authorities. There are some indications in recent reforms that China’s central government is ready to redistribute additional

39 See, for example, World Bank (2000, 2001).
40 Regional dummy is equal to 1 for the following provinces while equal to 0 for all other provinces: Beijing, Tianjin, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi.
resources from the rich to the poor provinces. According to our results, these new reforms emphasizing equity may lead to a slower economic growth in China.

It should be noted that the impact of fiscal decentralization policy on economic growth and regional equity and the possible tradeoff between them are important issues for many other countries with active fiscal decentralization programs. It would be interesting to know if any future research would reveal similar findings for other countries with active decentralization policies.

Appendix A

Note that, since \( B_1 + B_2 \) is fixed, \( \frac{\partial C}{\partial w} \) and \( \frac{\partial C}{\partial c} \) will have the sign. In the following discussion, we will focus on \( \frac{\partial C}{\partial w} \).

Proof of Proposition 1. From Eq. (2) we have the Lagrangian:

\[
\ell = w g(C, \alpha) - \frac{B_1 - B_2 - (2\alpha - 1)C}{B_1 + B_2 - C} - \lambda_1 \left( \frac{B_1}{B_1 + B_2} - \alpha \right)
- \lambda_2 \left[ \alpha - \frac{(B_1 - B_2 + C)}{2C} \right]
\]

The first order condition for the Lagrangian is:

\[
\frac{\partial \ell}{\partial C} = w \frac{\partial g}{\partial C} + 2 \frac{\alpha(B_1 + B_2) - B_1}{(B_1 + B_2 - C)^2} - \frac{(B_1 - B_2)}{2C^2} = 0
\]

\[
\frac{\partial \ell}{\partial C} = w \frac{\partial g}{\partial C} + 2 \frac{C}{(B_1 + B_2 - C)^2} + \lambda_1 - \lambda_2 = 0
\]

where \( \lambda_i \geq 0, \ i \in 1,2; \lambda_1 = 0 \) if \( (B_i(B_1 + B_2) - \alpha) < 0 \), and \( \lambda_2 = 0 \) if \( \alpha - (B_1 - B_2 + C)/2C < 0 \).

To ensure a unique local maximum, we assume that the following matrix \( H \) at the optimum is negative definite.

\[
H = \begin{pmatrix}
\frac{\partial^2 g}{\partial C^2} + 4 \frac{\alpha(B_1 + B_2) - B_1}{(B_1 + B_2 - C)^2} & \frac{\partial^2 g}{\partial C \partial \alpha} + 2 \frac{(B_1 + B_2)}{(B_1 + B_2 - C)} \\
\frac{\partial^2 g}{\partial C \partial \alpha} + 2 \frac{(B_1 + B_2)}{(B_1 + B_2 - C)} & \frac{\partial^2 g}{\partial \alpha^2} + 4 \frac{\alpha(B_1 + B_2) - B_1}{(B_1 + B_2 - C)^2}
\end{pmatrix}
\]

For \( (B_1 - B_2 + C)/2C > \alpha > B_1/(B_1 + B_2) \), \( \lambda_1 = 0 \) and \( \lambda_2 = 0 \). From Eqs. (A1.1) and (A1.2), we obtain

\[
\frac{\partial g}{\partial C} = -2 \frac{\alpha(B_1 + B_2) - B_1}{(B_1 + B_2 - C)^2} < 0
\]

\[
\frac{\partial g}{\partial C} = -2 \frac{C}{(B_1 + B_2 - C)^2} < 0
\]

Differentiating Eqs. (A2.1) and (A2.2) with respect to \( w \), we obtain:

\[
\left[ \frac{\partial^2 g}{\partial C^2} + 4 \frac{\alpha(B_1 + B_2) - B_1}{(B_1 + B_2 - C)^2} \right] \frac{\partial C}{\partial w} + \frac{\partial^2 g}{\partial C \partial \alpha} \frac{\partial \alpha}{\partial w} + \frac{\partial g}{\partial \alpha} = 0
\]

\[
\frac{\partial^2 g}{\partial C \partial \alpha} + 2 \frac{(B_1 + B_2)}{(B_1 + B_2 - C)^2} \frac{\partial \alpha}{\partial w} + \frac{\partial g}{\partial \alpha} = 0
\]

Solving the simultaneous Eqs. (A3.1) and (A3.2), we have:

\[
\frac{\partial C}{\partial w} = \frac{|D_1|}{|H|}
\]

\[
\frac{\partial \alpha}{\partial w} = \frac{|D_2|}{|H|}
\]

where

\[
|D_1| = -w \frac{\partial^2 g}{\partial \alpha^2} \frac{\partial g}{\partial C} + \left[ \frac{\partial^2 g}{\partial C \partial \alpha} + 2 \frac{(B_1 + B_2)}{(B_1 + B_2 - C)^2} \right] \frac{\partial g}{\partial \alpha}
\]

\[
|D_2| = -w \frac{\partial^2 g}{\partial C^2} + 4 \frac{\alpha(B_1 + B_2) - B_1}{(B_1 + B_2 - C)^2} \frac{\partial g}{\partial \alpha}
\]

Note that \( \frac{\partial g}{\partial C} < 0 \) and \( \frac{\partial g}{\partial \alpha} < 0 \). Combining with our assumptions that \( H \) is negative definite and that \( \frac{\partial^2 g}{\partial C \partial \alpha} \geq 0 \), we obtain \( |D_1| < 0 \) and \( |D_2| < 0 \). Therefore, noting that \( |H| > 0 \), we obtain

\[
\frac{\partial C}{\partial w} < 0
\]

\[
\frac{\partial \alpha}{\partial w} < 0.
\]

\[\text{For example, starting in January 2002 the central government has decreased the sharing rates for the provinces in personal income tax revenues, which affects mostly the 9 or 10 richest provinces, and earmarked these revenues for distribution through equalization grants.} \]
For \( \alpha = B_1/(B_1 + B_2) < (B_1 - B_2 + C)/2C \), the objective function becomes \( wg(C, \alpha) + (B_1 - B_2)/(B_1 + B_2) \), and the first order condition can be written as

\[
\frac{\partial g}{\partial C} = 0 \quad \text{(A6.1)}
\]

Note that the optimal \( C \) is independent of \( w \), therefore \( \frac{\partial C}{\partial w} = 0 \). Since \( \alpha = B_1/(B_1 + B_2) \), it follows that \( \frac{\partial C}{\partial \alpha} = 0 \).

Finally, for \( \alpha = (B_1 - B_2 + C)/2C > B_1/(B_1 + B_2) \), we obtain \( 2\alpha C = B_1 - B_2 + C \). Therefore, the objective function in this case becomes \( wg(C, \alpha) \) and the first order condition becomes: \( w \frac{\partial g}{\partial C} - \frac{\partial g}{\partial \alpha} = 0 \). It is then clear that in this case, \( \frac{\partial C}{\partial w} = 0 \) and \( \frac{\partial C}{\partial \alpha} = 0 \). \( \square \)

**Proof of Proposition 2.** The Lagrangian for the maximization problem given an equity level can be written as:

\[
\ell = wg(C, \alpha) - (1 + \lambda) \frac{B_1 - B_2 - (2\alpha - 1)C}{B_1 + B_2 - C} - \lambda_1 \left( \frac{B_1 - B_2}{B_1 + B_2} - \alpha \right) - \lambda_2 \left[ \frac{(B_1 - B_2 + C)}{2C} \right] = -\lambda E.
\]

The first order condition is:

\[
\frac{\partial \ell}{\partial C} = w \frac{\partial g}{\partial C} + 2(1 + \lambda) \frac{g(B_1 + B_2 - B_1)}{(B_1 + B_2 - C)^2} - \lambda_2 \frac{(B_1 - B_2)}{2C^2} = 0 \quad \text{(B1.1)}
\]

\[
\frac{\partial \ell}{\partial \alpha} = w \frac{\partial g}{\partial \alpha} + 2(1 + \lambda) \frac{C}{(B_1 + B_2 - C)} + \lambda_1 - \lambda_2 = 0 \quad \text{(B1.2)}
\]

\[
E + \frac{[B_1 - B_2 - (2\alpha - 1)C]}{(B_1 + B_2 - C)} \leq 0 \quad \text{(B1.3)}
\]

where \( \lambda \geq 0, \lambda_i \geq 0, \overline{\lambda} = 0 \) if \( \bar{E} + [B_1 - B_2 - (2\alpha - 1)C] \geq 0 \), \( \lambda_1 \geq 0 \) if \( B_1/(B_1 + B_2 - \alpha) \leq 0 \), and \( \lambda_2 = 0 \) if \( \alpha - (B_1 - B_2 + C) < 0 \).

Eqs. (B1.1) and (B1.2) can be written as:

\[
w' \frac{\partial g}{\partial C} + 2 \frac{g(B_1 + B_2 - B_1)}{(B_1 + B_2 - C)^2} - \lambda_2 \left( \frac{B_1 - B_2}{2C^2} \right) = 0 \quad \text{(B2.1)}
\]

\[
w' \frac{\partial g}{\partial \alpha} + 2 \left( \frac{C}{(B_1 + B_2 - C)} \right) - \lambda_1 - \lambda_2 = 0 \quad \text{(B2.2)}
\]

where \( w' = \frac{w}{1 + \lambda}, \lambda_1 = \frac{\lambda_1}{1 + \lambda}, \lambda_2 = \frac{\lambda_2}{1 + \lambda} \).

If \( \bar{E} + [B_1 - B_2 - (2\alpha - 1)C]/(B_1 + B_2 - C) < 0 \), then \( \lambda \geq 0 \). It is clear that \( w' \leq w \). From Proposition 1, by comparing Eqs. (B2.1) and (B2.2) with Eqs. (A1.1) and (A1.2), we obtain that the optimal pair \( (C, \alpha) \) for this case is no less than the optimal pair \( (C, \alpha) \) for the general case. If \( \bar{E} + [B_1 - B_2 - (2\alpha - 1)C]/(B_1 + B_2 - C) < 0 \), the first order condition becomes:

\[
\frac{\partial \ell}{\partial C} = w \frac{\partial g}{\partial C} + 2 \left[ \frac{g(B_1 + B_2 - B_1)}{B_1 + B_2 - C} - \lambda_2 \left( \frac{B_1 - B_2}{2C^2} \right) \right] = 0 \quad \text{(B3.1)}
\]

\[
\frac{\partial \ell}{\partial \alpha} = w \frac{\partial g}{\partial \alpha} + 2 \left( \frac{C}{B_1 + B_2 - C} \right) + \lambda_1 - \lambda_2 = 0 \quad \text{(B3.2)}
\]

which is exactly the same as the optimal condition in the general model. \( \square \)

**Proof of Proposition 3.** The first order condition for the maximization problem given a growth rate can be expressed as follows:

\[
\frac{\partial \ell}{\partial C} = (w + \lambda) \frac{\partial g}{\partial C} + 2 \left[ \frac{g(B_1 + B_2 - B_1)}{B_1 + B_2 - C} \right] - \lambda_2 \left( \frac{B_1 - B_2}{2C^2} \right) = 0 \quad \text{(C1.1)}
\]

\[
\frac{\partial \ell}{\partial \alpha} = (w + \lambda) \frac{\partial g}{\partial \alpha} + 2 \left( \frac{C}{B_1 + B_2 - C} \right) + \lambda_1 - \lambda_2 = 0 \quad \text{(C1.2)}
\]

\[
\bar{g} - g \leq 0 \quad \text{(C1.3)}
\]

where \( \lambda_i \geq 0, \overline{\lambda_i} = 0, \overline{\lambda} \leq 1, \lambda_1 = 0 \) if \( g(g_1, g_2) - \bar{g} \geq 0 \); \( \lambda_2 = 0 \) if \( (B_1/(B_1 + B_2 - \alpha) \leq 0 \); and \( \lambda_3 = 0 \) if \( \alpha - (B_1 - B_2 + C) < 0 \).

Noting that \( w + \lambda \geq w \), by following similar arguments as in the proof of Proposition 2, we obtain Proposition 3. \( \square \)

**References**


