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A COMPARATIVE STUDY OF FISCAL DECENTRALIZATION IN CHINA AND INDIA

BY

YINGHUA JIN

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree
of
Doctor of Philosophy
in the
Andrew Young School of Policy Studies
of
Georgia State University

GEORGIA STATE UNIVERSITY
2009

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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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ACKNOWLEDGMENTS

I am deeply indebted to my chair, Dr. Mark W. Rider, who accepted me when I was in the most difficult time of my life. His commitment helped drive me to make this finally happen. I appreciate his precious advice and friendly reminders. This study would never have been accomplished without the help of his profound knowledge, brilliant ideas, and sophisticated methods. I also appreciate his allocation of weekends to polish my essays and his efforts in seeking funding for me. I am also grateful for his generosity, including the use of his SkyMiles to get an airline ticket to visit my family.

I am also indebted to my committee members, Dr. Roy W. Bahl, Dr. Shiferaw Gurmu, Dr. Penelope B. Prime, and Dr. Yongsheng Xu. With their insightful comments, I was able to take a step back from the individual trees and have another look at the forest. I would also like to thank Dr. Paul Kagundu and Dr. Baoyun Qiao for their valuable comments at the proposal stage. Special thanks go to Dr. Baoyun Qiao for sharing his data with me for the robustness check.

My gratitude also goes to many friends: Dr. Li Zhang, Dr. Weimin Zhang, Dr. Matthew Sartin, Dr. Wenchun Zhang, Dr. Zhiqiang Yan, Ping Meng, Yongzheng Liu, Xi Rao, Junwei Zou, Guchuan Yang, Wenhui Huo, Huiping Du, Abdullah Khan, Harini L. Kannan, and other fellow graduate students who began in 2004, for their data support, draft editing, document printing, and numerous encouragements to overcome my depression and autism.

My deep appreciation and respect go to Judge Robert E. Flournoy, III; his wife, Julie B. Flournoy; his mother, Pam Flournoy; and other family members for their great kindness and help throughout my American life. Judge Flournoy and his family provided me with a valuable internship opportunity, introduced me to the common law system, sponsored a museum

membership, and invited my family and me to spend many holidays together with them. I and my family have enjoyed staying with them so much.

My appreciation also goes to Hanxu Yu and Mark S. Gatewood for their part-time work opportunities and personal help.

My thanks also go to many other Chinese and American friends in China and in the United States. I will not name them here but I did enjoy all the get-together time with them. Thank you, my friends, brothers and sisters.

My deepest love, gratitude, and indebtedness go to Dad, Damin Jin, who rests in peace in another world; Mom, Xingchun Luo, who still lives alone in a remote mountainous area waiting for me; my elder brother, Yingde Jin; and two elder sisters, Yinglian Jin and Yingju Jin, for their unconditional love, trust, and support. Dad, Mom, brother and sisters, I love you all forever. I would like to thank my brother and sisters for taking care of Mom during these years.

My deepest indebtedness also goes to Dad-in-law, Tulong Li and Mom-in-law, Lishui Liu. They have not asked for anything from me but have given too much to me. I would also thank my pretty sister-in-law, Zhizhen Li, who has helped me on many personal things at home.

Last but not least, my deepest love, gratitude, and indebtedness are for my wife, Zhiqing Li, and my daughter, Joy L. Jin. Both of them are my sweethearts. Honey, I know both of you are not living an easy life in a place so far away from me. I am sorry that I am not a good husband and daddy. I love you.

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ABSTRACT

A COMPARATIVE STUDY OF FISCAL DECENTRALIZATION IN CHINA AND INDIA

BY

YINGHUA JIN

DECEMBER 2009

Committee Chair: Dr. Mark W. Rider

Major Department: Economics

This dissertation provides an empirical test of the effects of fiscal decentralization and horizontal fiscal equalization on economic growth and examines the potential trade-off between horizontal fiscal equalization and economic growth in both China and India.

Chapter II examines the effects of both fiscal decentralization and horizontal fiscal equalization on economic growth in China, particularly the effect of the Tax Sharing System reform enacted in 1994. Compared with previous studies, using more complete data providing better measures and more econometrically sophisticated instrumental variable procedures, we find that there is no substantial evidence of a trade-off between horizontal fiscal equalization and growth. The 1994 Tax Sharing System reform has positively contributed to both economic growth and horizontal fiscal equalization. In addition, we find that fiscal decentralization (FD) has a non-linear effect on growth. For values of FD less than 21, fiscal decentralization has a negative effect on growth, but for values greater than 21, fiscal decentralization has a positive effect on growth.

Chapter III examines the effects of both fiscal decentralization and horizontal fiscal equalization on economic growth in India, particularly the effects of the 1991 economic reforms. Using state-wide data covering the period from 1980 through 2005, we find that fiscal

decentralization has a negative effect on economic growth initially but that, beyond a certain value of fiscal decentralization, the effect on growth becomes positive. However, further decentralization could have a negative effect on horizontal fiscal equalization. These results are robust. In the meanwhile, there is no evidence of a trade-off between horizontal fiscal equalization and economic growth; instead, there is evidence of a positive effect of economic growth on equalization. In addition, the 1991 economic reform has contributed to economic growth.

A comparative study of China and India has shown that the degree of fiscal decentralization in both countries is far from the point where its effect on economic growth becomes positive. Despite the dangers of widening disparities in terms of interregional fiscal resource distribution from further decentralization, no substantial evidence shows a trade-off between horizontal fiscal equalization and growth in either country. An in-depth and more thorough going fiscal decentralization with greater emphasis on equalization of fiscal disparities are required in order to effect sustainable economic growth as well as social harmony in these two Asian countries.

Chapter I: Introduction

As newly emerging economic powers on the global stage, China and India are the subjects of great interest, especially in light of their remarkable record of economic growth in recent years. As part of their adoption of market reforms, both countries are pursuing fiscal decentralization reforms.[1] Many students of public finance believe that fiscal decentralization leads to greater allocative efficiency of the public sector and thus promotes economic growth. As Robin Boadway (2006) points out, fiscal decentralization also may give rise to fiscal disparities among sub-national governments due to interregional differences in local preferences, the cost of providing services, revenue-raising capacities, and local fiscal policies among sub-national governments. However, interregional fiscal disparities can be moderated by an intergovernmental transfer system designed to equalize public-service provisions nationwide. In this dissertation, we examine the effect of fiscal decentralization and horizontal fiscal equalization on economic growth in China and India.

There are a variety of definitions of fiscal decentralization. According to Jennie Litvack and Jessica Seddon (1999), fiscal decentralization is the transfer of fiscal authority and responsibility from the central government to sub-national governments. Richard M. Bird (1993) describes it in terms of top-down and bottom-up approaches. A top-down approach is the central government delegating or decentralizing authority to local governments to increase the allocative efficiency of the public sector. A bottom-up approach stresses the greater responsiveness of government and greater opportunity for political participation in local government. In short,

[1] By fiscal decentralization we mean the devolution of specific government functions by the central government to sub-national governments with the administrative authority and fiscal revenue to perform those functions.

fiscal decentralization does not have a precise definition and can be measured only with difficulty and imprecisely.

There is a large theoretical literature describing the advantages of fiscal decentralization, including increased allocative efficiency, increased productive efficiency, greater innovation, and greater accountability of government to local residents. For example, Friedrich A. Hayek (1945) contends that the aggregation of individual preferences for public goods by the central government involves comparably greater costs than would occur with decentralization of decision-making to local governments. In his seminal article on local government, Charles M. Tiebout (1956) shows that 'voting with your feet' results in efficient allocation of fiscal resources. George J. Stigler (1957) contends that representative democracy works best when government is closest to the people. Wallace E. Oates (1972) contends that, in the absence of scale economies and inter-jurisdictional spillovers, decentralized provision is always superior in terms of economic efficiency to centralized and therefore uniform provision of local public goods. Yingyi Qian and Barry R. Weingast (1997) describe the benefits for private property rights of "market-preserving federalism". Wallace E. Oates (1999) describes "laboratory federalism," in which best-practices can be identified by competing sub-national governments trying novel economic experiments in a decentralized system of governance. Finally, John J. Wallis and Wallace E. Oates (1988) and Timothy Besley and Stephen Coate (2003) contend that sub-national governments can better tailor the provision of local public goods to diverse preferences through decentralization, which is the preference-matching argument.

Although the literature identifies many potential benefits from fiscal decentralization, there are some risks described in the literature, as well. Remy Prud'homme (1995) describes the possible risks of fiscal decentralization, such as fragile preconditions for the potential gains,

regional disparities, and macro-economic instability. Govinda Rao and Nirvikar Singh (1999) describe a "race to the bottom" in which competing sub-national governments engage in tax competition to attract mobile factors of production, particularly capital, under provide local public goods, and undermine the advantages of a domestic common market. Vito Tanzi (1996) further cautions that fiscal decentralization could result in economic distortions due to excessive regulation by sub-national governments and local corruption.

Since fiscal decentralization involves potential benefits and costs, the overall impact of fiscal decentralization on economic growth is uncertain. What is more, the empirical evidence is mixed, as well. Using provincial level data for the period 1980 through 1993, Tao Zhang and Heng-Fu Zou (1998) find that fiscal decentralization has a negative effect on China's economic growth. In contrast, Justin Yifu Lin and Zhiqiang Liu (2000); Kunrong Shen and Wenlin Fu (2005); Ying Ding (2005); and Baoyun Qiao, Jorge Martinez-Vazquez and Yongsheng Xu (2008) find that fiscal decentralization has a positive effect on China's economic growth. These studies are discussed in greater detail below. To the best of our knowledge no one has examined the effect of fiscal decentralization on India's growth.

Before discussing the potential relationship between horizontal fiscal equalization and economic growth, it is important to understand the concept of net fiscal residual which is the difference between the benefit from public goods and services and their cost in terms of tax burden. According to James M. Buchanan (1950), differences in net fiscal residuals across regions may induce interregional migration from regions with low net residuals to regions with high residuals. As people move to regions with high net fiscal residuals, the cost of providing a constant level of local public goods increases due to increased congestion of local public goods, and, as people leave regions with the low net fiscal residuals, the cost of providing a constant

level of the local public good decreases as congestion of the local public goods decreases. Thus, in the Buchanan model, differences in net fiscal residuals among the regions of a country induce migration which, in turn, eliminates the interregional differences. Thus, in equilibrium, there is no incentive for people to move from one region to another due to differences in net fiscal residuals.

One drawback to the Buchanan and Tiebout models is the assumption of a highly mobile population. This assumption does not apply to very many countries. In particular it does not apply to traditional societies like those in China and India. The lack of mobility in these countries is often attributed to the strong attachments of people to particular localities due to customs, such as ancestor worship in the case of China, and local languages and ethnic fractionalization in the case of India. In contrast to Buchanan's model, elimination in net fiscal residuals among the regions of a country with an immobile population can only be achieved by purposeful central government policies to transfer resources to eliminate such differences.

Another important rationale for horizontal fiscal equalization is provided by Paul Bernd Spahn (2007), especially for countries like China and India. He points out that achieving social cohesion and a sense of a national identity is particularly challenging in these two large countries. Political unrest and regional separatist tendencies are on-going concerns. Indeed, there is concern that growing interregional disparities within both countries are weakening national cohesion and solidarity. There is a need for centripetal policies, such as equalizing transfers to help address the concerns of aggrieved ethno-linguistic minorities and other potential secessionists.

In this study, we focus on horizontal fiscal equalization as a result of purposeful government policy. As pointed out by Michael Smart (2007), the principle objective of horizontal fiscal equalization is to eliminate differences in net fiscal benefits across regions

instead of reducing differences in individual incomes across regions. Thus, horizontal fiscal equalization differs from the conventional role of government which is to redistribute income in order to satisfy concerns about interpersonal equity. Horizontal fiscal equalization does not ensure equitable treatment of individuals in similar circumstances. Instead, it seeks to equalize the fiscal capacities of regional governments in order to achieve a balanced distribution of resources among the regions.

As with fiscal decentralization, the effect of horizontal fiscal equalization on economic growth is ambiguous. Robert M. Solow (1956); Gregory Mankiw, David Romer, and David N. Weil (1992); Robert J. Barro and Xavier Sala-i-Martin (1995); Xavier Sala-i-Martin (1996); and others model regional convergence in per capita incomes as the result of diminishing marginal returns. Similarly, suppose the rate of return to a marginal increase in expenditures on infrastructure and social services is higher in low-income regions than in high-income regions due to diminishing marginal returns. Then, a central government policy of transferring fiscal resources from high- to low-income regions will lead to a higher aggregate national growth rate. Similarly, if equalizing transfers provide a social safety-net for the poor and thereby reduces civil unrest arising from interregional fiscal disparities, then horizontal fiscal equalization would have a positive effect on the aggregate national growth rate.

If, however, the taxes used to finance the equalizing transfer system are distortionary and/or the transfer system itself is distortionary, then there may be a trade-off between horizontal fiscal equalization and growth. Alternatively, low-income recipient regions may not use fiscal resources as efficiently as high-income donor regions, perhaps due to differences in the quality of governance among low- and high-income regions. The result would be a trade-off between equalization and growth.

This dissertation focuses on the effect of two major policies on growth in China and India, specifically fiscal decentralization and horizontal fiscal equalization. There are important reasons to focus on the effect of these two policies on economic growth in China and India. On the one hand, both countries are experiencing high economic growth rates. On the other hand, the rural poor in both countries are not fully sharing in the benefits of rapid economic growth. In part, expenditure decentralization reforms are meant to empower local governments to pursue economic development that best suits local preferences and comparative advantage. Horizontal fiscal equalization is a means of addressing concerns about growing interregional disparities in the quality of public services that may result from fiscal decentralization due to differences in regional attributes and policies. Therefore, examining the combined impact of fiscal decentralization and horizontal fiscal equalization on economic growth is an important policy concern in both China and India.

This dissertation intends to enrich our limited knowledge of the effects of fiscal decentralization and horizontal fiscal equalization on economic growth. There are important reasons to focus on China and India. First, China and India are the two fastest-growing and largest emerging economies in the world. Eswar Prasad and Thomas Rumbaugh (2004) calculate that, between 2001 and 2003, China accounted for almost one-quarter of global growth in gross domestic product (GDP) when output is measured using purchasing power parity exchange rates. Second, both countries are pursuing a gradualist approach to economic reform as opposed to the "big-bang" approach to reform adopted in many countries of the former Soviet Union, Eastern Europe, and Indonesia. Third, both central governments have been devolving more and more power, resources, and responsibility for service delivery to sub-national governments.

Despite these remarkable similarities, there are interesting contrasts between the two countries, as well. China is the world's largest unitary country in terms of population, while India is the world's largest federal country. India is ethnically diverse; while China's population is relatively homogeneous. China is governed by one-party rule, while India is the world's most populous democracy, with competitive multi-party elections. This comparative study should shed light on the performance of their decentralization policies in terms of their effects on economic growth in China and India. The size and importance of these two developing countries in and of itself should make this comparative study interesting to students of public finance and to students of economic develop. The results of this study may also provide useful lessons to other developing countries considering or currently pursuing reforms of their fiscal system.

We find that fiscal decentralization has a non-linear effect on economic growth in both countries. For low values of fiscal decentralization, the effect on growth is negative. Beyond a value of approximately 20, fiscal decentralization begins to have a positive effect on growth. It is somewhat surprising that the point where fiscal decentralization switches from having a negative effect on growth to a positive effect is nearly identical in both countries: the value is between 20 and 21 for China and India, respectively. It is also interesting to note that the negative (positive) effect of fiscal decentralization on economic growth is stronger for India compared to China, in both absolute terms and relative to GDP per capita. In contrast to Baoyun Qiao et al. (2008), we also find no substantial evidence of a trade-off between economic growth and horizontal fiscal equalization for either country.

The remainder of this dissertation is organized as follows. Chapter 2 re-examines the potential trade-off between horizontal fiscal equalization and growth in China, Chapter 3

presents an examination of the potential trade-off between horizontal fiscal equalization and growth in India, and Chapter 4 concludes.

Chapter II: Re-Examining the Potential Trade-Off between Horizontal Fiscal Equalization and Growth in China

Introduction

During the past quarter of a century, China has experienced rapid growth in per capita income in both absolute and relative terms. In 1980, at the outset of China's opening to global trade and market reforms, China's per capita income was $192 in purchasing power parity (PPP) terms, which ranked 141st among approximately 145 countries.[2] By 2005, China's per capita income was $1,720 (PPP), which ranked 108th in the world. This impressive record of economic growth also reduced income inequality among China's provinces. In 1981 Shanghai had the highest per capita income of all provinces in China, with a gross regional product (GRP) of $808 per capita.[3] The poorest sub-national jurisdiction was Guizhou, with a GRP of $44 per capita. Thus, Shanghai's per capita income was more than 18 times that of Guizhou's at the outset of the reforms.[4] By 2005, however, Shanghai's income per capita was 10 times that of Guizhou, or $7,533 versus $776, respectively. Although there is clearly substantial interregional income inequality in China, these figures reflect substantial progress in reducing interregional income inequality during this period.

As Figure 1 shows, the coefficient of variation (CV) of per capita provincial expenditures was about 79 percent in 1985 and decreased to 54 percent in 1993. In 1994, as discussed in greater detail below, China adopted the TSS reforms to equalize public expenditures among the provinces. During the following decade, as a result of TSS, the CV of per capita provincial

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[2] According to the CIA World Factbook and World Development Indicator Database, the dollar figures for GDP are converted from domestic currencies using annual exchange rates.
[3] We use the RMB-U.S. dollar exchange rate, which was 0.146321 on April 12, 2009 (www.xe.com/ucc/convert.cgi).
[4] China Statistical Yearbook (1982, 2005).

expenditures has been increasing and peaked at 82 percent in 2004. After 2004, the CV of per capita expenditures sharply declined to 62 percent in 2006, as a result of a significant increase in transfers during those years. As a whole, the equalization impact of the transfer system is rather modest, as evidenced by the effect of the 1994 TSS reforms on the CV of per capita expenditures pre- and post-1995.

Without central government transfers, however, the interregional disparities in per capita expenditures would have been much greater. As Figure 1 shows, the CV of per capita expenditures, without transfers and deficits, varies between 122 percent in 1997 to 540 percent in 2004. These figures are significantly greater than the peak CV of per capita expenditures after transfers of 82 percent in 2004. Even after transfers, though, disparities in per capita expenditures remain large. Figure 1 clearly shows that central government transfers and provincial borrowing are having an equalizing effect on provincial expenditures. As previously noted, the effect of provincial borrowing on interregional fiscal disparities is often ignored in the literature on China due to the lack of data.

Bert Hofman and Susana Cordeiro Guerra (2005) also find that disparities in provincial expenditures per capita are declining as a result of the transfer system. They note that the income elasticity of provincial expenditures per capita is less than the income elasticity of provincial revenues per capita. These finding imply that the transfer system is having an equalizing effect on provincial per capita expenditures, which is consistent with the patterns observed in Figure 1 and summarized above. Nevertheless, the CV of provincial expenditures per capita, after the TSS reforms, remains large. We show below that some components of the central transfer system are equalizing, while others are counter-equalizing. Another point discussed in greater detail below is that provincial government borrowings in China are having an equalizing effect on provincial

per capita expenditures. This is a fact often overlooked in the literature on China's local government finances.

The question that arises from the foregoing analysis is whether China's twin policies of fiscal decentralization (FD) and horizontal fiscal equalization (HFE) are growth promoting. From a theoretical perspective, we contend that the effects of FD and HFE on economic growth are ambiguous.

There are a number of reasons to expect a trade-off between HFE and growth. Generally speaking, HFE involves shifting resources from high- to low-income regions. This transfer of resources may reduce public infrastructure investments in high-income regions and presumably increases pubic infrastructure investments in low-income regions. In low-income regions, however, capital investments may not necessarily increase by the same magnitude as the decrease in high-income regions.

First, according to Per-Olov Johansson (1991), the central government must use distortionary taxes to finance the intergovernmental transfer system. The hypothesized positive effect of equalization transfers on the national growth rate due to diminishing marginal returns and the negative effect on growth of distortionary taxes would have an offsetting effect on growth. Depending upon which effect is stronger, HFE could have a positive or negative effect on the aggregate national growth rate.

Second, Charles E. McLure, Jr. (1995) points out that the intergovernmental transfer system itself may be distortionary -- like Arthur Okun's (1975) leaky bucket – which may result in a trade-off between HFE and growth. Third, if the transferred resources cannot be utilized by low-income regions as efficiently as by high-income regions, then HFE may have a negative effect on economic growth.

In contrast, a positive relationship between HFE and economic growth could arise. For example, horizontal fiscal equalization may reduce social instability and create an investment environment that is more favorable to economic growth. Paul Bernd Spahn (2007) contends that social cohesion is very important in a country like China where political and ethnic unrest and regional separatist's movements are important concerns. Narrowing interregional fiscal disparities through a purposeful policy of HFE could moderate social unrest and thereby create a better climate for investment. At the same time, equalizing transfers could be used to finance improved education and health in low-income provinces and thereby promote human capital formation among the poor. In an endogenous growth model, Kevin James Bowman (2007) shows that initial educational inequality reduces the subsequent economic growth rate. Therefore, reducing initial educational inequality through a policy of HFE should have a beneficial effect on economic growth.

In addition, according to the growth model of Robert M. Solow (1956), the rate of return to public capital per capita may be higher in low-income provinces than in high-income provinces due to diminishing marginal returns. In this case, a policy of transferring fiscal resources from high- to low-income provinces may have twin virtues: equalizing per capita expenditures and increasing the aggregate growth rate. If the transfers can be used more efficiently by low-income regions, and if there are higher returns to capital in low-income regions, then HFE should have a positive effect on the national growth rate, even in the presence of Okun's leaky bucket. In short, we contend that, from a theoretical perspective, the effect of fiscal equalization on the rate of economic growth is ambiguous.

Finally, Georgia Guess, William Loehr and Jorge Martinez-Vazquez (1997); Elliott Parker and Judith Thornton (2007); and Baoyun Qiao, Jorge Martinez-Vazquez and Yongsheng Xu (2008) find empirical evidence of a trade-off between HFE and growth.

The purpose of this study is to examine the effect of China's policy of FD and HFE on growth. Following the work of Qiao et al. (2008), we estimate a simultaneous equations model (SEM). In the growth equation, we control for many of the conventional growth determinants—such as capital investment, labor growth, openness, agriculture share, inflation rate, foreign direct investment, natural catastrophes, and the 1994 TSS reforms. Furthermore, we account for the potential endogeneity of FD, HFE, and growth, using an instrumental variables approach. We estimate a variety of models, using provincial data for the period 1985 to 2006.

This paper improves upon the existing literature in the following ways. First, we use annual provincial data for the period 1985 to 2006, which straddles the enactment of the important 1994 TSS fiscal reforms. More specifically, these data include nearly all time periods examined in previous studies and more completely covers the pre- and post-1994 TSS reform period. Second, we employ better measures of FD and HFE. In contrast to Qiao et al. (2008), our measures account for extra-budgetary funds not only of sub-national governments but also those of the central government. In contrast to others, our HFE measure additionally accounts for the equalization policy pursued by China's central government after 1994. Third, we account for the potential endogeneity of FD, HFE, and growth over time and across provinces. Finally, we exploit the panel nature of our data by estimating fixed effects models (FE), two-stage least squares models with fixed effects (2SLS FE), and two-step generalized method of moments models (GMM).

We find that FD has a non-linear effect on growth. For values of the fiscal decentralization index ranging from 0 to 20, the effect of FD on growth is negative. For values of the index greater than 20, the effect is positive. This finding is robust to alternative econometric specifications and time periods. In contrast to Baoyun Qiao et al. (2008), we find no substantial evidence in favor of a trade-off between HFE and growth. Finally, we find that the 1994 TSS reforms are having a positive effect on economic growth. Meanwhile HFE improved modestly after the enactment of the 1994 TSS reforms. In part, though, the increase in HFE is the result of increased provincial borrowings rather than the implementation of an equalizing transfer system.

The remainder of this chapter is organized as follows. The next section provides some background on China's intergovernmental fiscal system. In the third section, we summarize the previous literature on the effects of FD on China's growth. The fourth section describes the empirical strategy, data, and variable construction. In the fifth section, we discuss the empirical results, and the final section concludes.

China's Intergovernmental Fiscal System

This section describes the evolution of China's fiscal decentralization reforms; elaborates on China's intergovernmental fiscal system, including China's four pillars of fiscal decentralization, with special emphasis on the 1994 TSS reforms and the transfer system introduced in 1994; and briefly describes China's system of extra-budgetary finance.[5]

Institutionally and legally, the People's Republic of China has a unitary form of government with five levels of government hierarchically arranged in a pyramid-like fashion

[5] The four pillars of fiscal decentralization are the following: expenditure assignments, revenue assignments, intergovernmental transfer system, and regulation of sub-national borrowing autonomy. For a good discussion of the four pillars of decentralization in the context of the United Republic of Tanzania, see Jameson Boex and Jorge Martinez-Vazquez (2006).

with the central governmental naturally at the peak.[6] The recent evolution in the direction of greater FD has been a gradual process. In 1978, fiscal reforms started with the devolution of control over resources and decision-making power to sub-national governments as well as to state owned enterprises (SOEs).

Although the fiscal reform initiatives have provided sub-national governments with incentives to develop their local economy, the uncontrolled decentralization and case-by-case bargaining between the central and sub-national governments introduced by several fiscal reform packages in the 1980s and early 1990s led to a sharp decline in total central government revenues. As a result of arbitrary tax exemptions granted to local SOEs and the shifting of taxes from budgetary revenues to extra-budgetary revenues by sub-national governments, as shown in Figure 2, the share of central government revenues in GDP dropped from 22 percent in 1985 to 12 percent in 1993, and the central government's share of total revenues dropped from 38 percent in 1985 to 22 percent in 1993.

These two declines in revenue shares caused the central government to initiate the 1994 TSS reforms and to begin re-centralizing revenue collections in 1995. According to Zhihua Zhang and Jorge Martinez-Vazquez (2003a), the purpose of the 1994 TSS reforms was to increase total fiscal revenue as a share of GDP and to increase the share of central government revenue in total fiscal revenues. As summarized in Table 1, several important sources of tax revenues, like the value-added tax (VAT), the corporate income tax (CIT), and the personal income tax (PIT), were shared taxes before 1995, with the exception of the CIT which only became a shared tax after 1994.

[6] See Figure 4.1 of Baoyun Qiao and Anwar Shah (2006) for the structure of government in China and its political system.

After the 1994 TSS reforms, the central government takes the major share of these taxes. Taxes exclusively assigned to sub-national governments are low-yielding types such as slaughter taxes. Meanwhile, tax administration was divided into two systems: the National Tax Service (NTS) and the Local Tax Service (LTS). Wanda Tseng, Hoe Ee Khor, Kalpana Kochhar, Dubravko Mihaljek and David Burton (1994) report that NTS is responsible for the collection of exclusively central and shared taxes. The LTS exclusively collects local revenues. As a result of this clear-cut division, fiscal decentralization prevents sub-national governments from hiding local resources in black boxes.[7]

As a result of the 1994 TSS reforms, the four pillars of China's intergovernmental fiscal system are characterized by highly decentralized expenditures, highly centralized revenues, a high degree of sub-national government transfer dependence, and hidden sub-national borrowings. The previously poor inland provinces became even worse off in terms of revenue capacity because their limited own revenues were centralized. This makes them even more dependent on central government transfers as well as on hidden sub-national borrowings to finance their operations.

A fiscal system with highly centralized revenues and highly decentralized expenditures makes reliance on intergovernmental transfers unavoidable. The 1994 TSS reforms introduced the current transfer system. This system consists of three types of intergovernmental transfers: tax rebates, general-purpose grants, and special-purpose grants. To address the political opposition of high-income sub-national governments to the TSS reforms, the system of tax

[7] Before the TSS reform in 1994, sub-national governments had an incentive to provide tax exemptions to local SOEs on an ad hoc basis and to shield the exempted tax revenues from the central government; however, after the separation of the two tax administrations by TSS, sub-national governments neither have incentives nor ability to make them. For details about sub-national government's use of tax exemptions, see Wanda Tseng (1994).

rebates are derivation based. Accordingly, tax rebates conflict with the equalization goal of the 1994 TSS reforms. To achieve greater horizontal fiscal equalization, the share of tax rebates was decreased from 75 percent in 1994 to 19 percent in 2008, while that for general purpose grants increased from 4 to 38 percent during the same period. Special-purpose grants compromise a third type of intergovernmental transfer and are intended to realize specific objectives of the central government. The share of special-purpose grants in total transfers also increased from 21 percent in 1994 to 43 percent in 2008. In short, the equalization purpose of the transfer system is compromised by the counter-equalizing effect of tax rebates.

Although sub-national governments are prohibited from borrowing except upon special approval of the central government, almost all sub-national governments are circumventing these restrictions by borrowing "off the books." Baoyun Qiao and Anwar Shah (2006) describe the "off the books" channels of local government borrowings. Examples of such channels include borrowings from local commercial banks by sub-national government-controlled enterprises (such as local SOEs) with local government guarantees; establishment of new companies through collective financing by local governments or employee's of local SOEs; borrowing from pension funds, unemployment insurance funds, or government employee salary funds; borrowing from extra-budgetary funds, and so on. Interestingly, these sub-national borrowings are having a partial equalizing effect on provincial expenditures per capita, as shown by the square-dotted line and the triangle-dotted line in Figure 1.

Although there are extensive concurrent expenditure responsibilities, more than 74 percent of national revenues were spent by sub-national governments in 2005 as opposed to 47.5 percent in 1984. As shown in Table 2, many expenditure responsibilities are shared by central and sub-national governments, including social security, education, medical services, public

health, and economic development. A heavy burden of providing basic public services rests largely on sub-national governments. More specifically, 98 percent of health expenditures were shouldered by sub-national governments in 2007. Furthermore, the politically centralized system makes it easy for the central government to shift expenditures downward to sub-national governments, although major revenues have been recentralized since enactment of the 1994 TSS reforms.

Table 1 shows tax and non-tax revenue shares in total revenues for central and sub-national governments before and after the TSS reform. The revenue recentralization evident in Table 1 is mainly the result of the 1994 TSS reforms. As a result, the percentage of shared tax revenues in total tax revenues increased from 55 percent in 1994 to 70 percent in 2005. Before the 1994 TSS reforms, the share of sub-national tax revenues in total revenues was 79 percent in 1993, with the remaining 21 percent of revenue accruing to the central government. However, in 2007, the situation was reversed. In 2005, central government transfers to sub-national governments accounted for 57 percent of total central expenditures and 46 percent of total sub-national expenditures after accounting for extra-budget accounts.

For the case of China, there exists another critical source of finance. That is off-budget finance, which consists mainly of extra-budgetary funds together with user fees and various local levies. Off-budget finance constitutes a fiscal dual track, together with budget finance and sub-national extra-budgetary accounts and is under the full discretion of sub-national governments. The size of extra-budgetary funds grew rapidly in the 1980s and 1990s, finally becoming equivalent in size to budgetary funds in 1991.[8] As a result of several policy reforms that shifted

[8] See Christine Wong (1998) for the size evolution and detailed categories of off-budget funds.

extra-budgetary funds to budgetary funds, extra-budgetary funds started to decline.[9] In 2005, extra-budgetary expenditures dropped to about 16 percent of budgetary expenditures on average. Since the off-budget funds are levied on the same tax base as budget funds, off-budget funds, like extra-budgetary revenues, are positively related to own source revenues, which is an important source of interregional disparities in per capita provincial expenditures.[10]

Literature Review

This section begins by discussing some issues with measuring fiscal decentralization which is an obvious challenge in studies like this one; then we proceed with a discussion of the evidence of HFE in China. Finally we conclude this section with a summary of previous findings on the effect of FD and HFE on growth in China.

Due to the lack of a precise definition of fiscal decentralization, there are many studies offering operational definitions of FD. Nevertheless, there is no conclusive result: no measure is obviously superior to all others. The criticism is that no single scalar measure of FD can capture the entire panoply of sub-national fiscal discretion and control. In any event, two measures are frequently used to measure the degree of fiscal decentralization in a country: an expenditure measure and a revenue measure. The expenditure measure is the ratio of sub-national government expenditures to consolidated government expenditures. A larger value of this ratio indicates a greater degree of expenditure decentralization and thus greater fiscal decentralization. The revenue measure is the ratio of sub-national own-source revenues to consolidated government revenues. Again, a greater value of this ratio indicates greater revenue decentralization and thus greater fiscal decentralization.

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[9] See, for example, State Council Document No. 29 (1996).
[10] See, for example, Christine Wong (1998) for detailed empirical investigation of extra-budgetary funds and Xuejin Zuo (1996) for local levies, among others.

Many students of public finance believe that the 'true' measure of fiscal decentralization is best captured by revenue decentralization. For example, Robert D. Ebel and Serdar Yilmaz (2002) contend that for there to be genuine fiscal decentralization, local governments must have the authority to tax their "own sources." Roy W. Bahl (2005) also stresses that the "essence" of decentralization is the empowerment of sub-national governments to raise their own revenues by having control over the tax rate of at least one broad-based tax (i.e., property tax, income tax, consumption tax).

In the case of China, none of these requirements of revenue decentralization are completely satisfied. Sub-national governments are not allowed to introduce new taxes or change tax rates on major tax bases, although they can make full use of their tax capacity through efforts to grow their tax bases or strengthen tax collections.[11] In the case of China, the degree of revenue decentralization is very limited, so the literature tends to focus on the degree of expenditure decentralization. Shaoguang Wang (1997) contends that China is over-decentralized according to the expenditure measure of decentralization because more than 70 percent of national government spending is conducted by sub-national governments.

We follow the conventional approach by using expenditure decentralization to gauge the degree of fiscal decentralization in China. We believe that this measure best captures the evolution of fiscal decentralization in China and has the added benefit of allowing us to compare

[11] Roy W. Bahl (1999) summarizes several ways in which sub-national governments in China have acted against centralized taxation power, which he calls "backdoor federalism". Provincial governments shift tax revenues from budget accounts to extra-budgetary accounts; arbitrarily exempt taxes of sub-national SOEs and then cooperate with them under the table to finance sub-national spending; influence banks at the sub-national level to grant policy loans to many unqualified projects; infiltrate the national tax administration at the sub-national level to change the division of tax revenues between the central and sub-national governments; levy informal surcharges and fees on public goods and services; and so on.

our results with previous findings in the literature.[12] As previously noted, our measure of expenditure decentralization is more comprehensive than those used in the existing literature because our data allow us to account for both central and provincial government extra-budgetary expenditures.

Turning to HFE in China, there is substantial evidence of the equalizing effect of China's transfer system. For his analysis of the effects of equalization grants in China, Bo Zhang (2006) uses an absolute indicator, which is the gap between Gini coefficients for per capita revenues and per capita expenditures; a relative indicator, which is the ratio of the absolute indicator to the Gini coefficient of per capita fiscal revenue; and the Theil index of per capita provincial revenue and expenditure. He finds that fiscal transfers have only partially achieved their equalization goal, although inequality in per capita provincial expenditures is less pronounced than before the 1994 TSS reforms. David Dollar and Bert Hofman (2008) find that the transfer system has a limited equalization impact using budget data -- they do not account for extra-budget data -- in fiscal year 2003. Lou Jiwei and Ehtisham Ahmad (1997); Jiwei Lou (2008); Christine Wong (2009); and Zhihua Zhang and Jorge Martinez-Vazquez (2003b) all conclude that the reforms have not entirely achieved the intended goal of equalizing provincial per capita expenditures.

Re-examining the effects of fiscal decentralization and fiscal equalization on economic growth is quite important. As Jorge Martinez-Vazquez and Robert McNab (1997) point out in their review of the literature on fiscal decentralization, the state of knowledge about the effects of fiscal decentralization is extremely limited. Most existing empirical studies examine the relationship between fiscal decentralization and economic growth; only a few have examined the effect of fiscal equalization on growth. Furthermore, this literature provides conflicting evidence

[12] See Kunrong Shen and Wenlin Fu (2005), Andrew Feltenstein and Shigeru Iwata (2005), Nobuo Akai and Masayo Sakata (2002), Tao Zhang and Hengfu Zou (1998), etc.

on decentralization's effect on growth. Finally, there is limited empirical evidence on the potential trade-off between fiscal equalization and growth. The exception is Qiao et al. (2008) who use a panel of provincial data for the period 1985 through 1998. They find evidence of a trade-off between horizontal fiscal equalization and economic growth. One limitation of their study is that their data only include the initial years of the 1994 TSS reforms.

Table 3 provides a list of variable definitions, and Table 4 summarizes previous empirical results on the impact of fiscal decentralization and fiscal equalization on economic growth in China. Turning to Table 4, Tao Zhang and Heng-Fu Zou (1998) find that fiscal decentralization has a negative and statistically significant effect on economic growth. However, none of the conventional variables in growth equations, like capital and labor, is statistically significant at conventional levels.

Justin Yifu Lin and Zhiqiang Liu (2000) and Ying Ding (2005) find that fiscal decentralization has a positive effect on growth, using data for the periods 1970-1993 and 1994-2002, respectively. However, their empirical strategies do not account for the potential endogeneity of fiscal decentralization in the growth equation. Finally, Baoyun Qiao et al. (2008), using data for the period 1985-1998, find that fiscal decentralization has a non-linear effect on growth. For small values of the fiscal decentralization index ($0 < FD < 0.5$), the effect on growth is positive but the effect becomes negative for values of FD greater than 0.5. The mean value of FD in their sample is 0.7, which implies that on average fiscal decentralization is having a negative effect on economic growth in China, at least during the period spanned by their data.

The data used in these studies do not provide adequate coverage of the periods both before and after enactment of 1994 TSS reforms. These reforms alone are sufficiently important to merit further study. They also provide exogenous variation in fiscal decentralization and

horizontal fiscal equalization that may be useful in identifying their effects on China's economic performance. We proceed below with a description of our empirical strategy.

Empirical Strategy

To examine the effect of fiscal decentralization and equalization on growth, we estimate two equations: a growth equation and an equalization equation. For the growth equation, we adopt a production-function-based model that has been widely used in the empirical literature on growth, including the studies of Robert M. Solow (1956), Trevor Swan (1956), Gregory Mankiw, David Romer and David N. Weil (1992), Hamid Davoodi and Heng-Fu Zou (1998), among others. For the equalization equation, we include variables that economic intuition suggests may influence equalization.

Following Baoyun Qiao et al. (2008), we estimate the following system of equations:

$$\begin{aligned} G_{it} &= \alpha_0 + \alpha_1 E_{it} + \alpha_2 FD_{it} + \alpha_3 FD_{it}^2 + \alpha_4 K_{it} + \alpha_5 L_{it} + \alpha_6 F_{it} + \alpha_7 R_{it} + \alpha_8 FDI_{it} \\ &+ \alpha_9 AGS_{it} + \alpha_{10} TE_{it} + \alpha_{11} TE_{it}^2 + \alpha_{12} CDEV_{it} + \alpha_{13} GOVS_{it} + \alpha_{14} TSS_{it} + \alpha_{15} CATD_{it} \\ &+ \alpha_{16} TIN_{it} + \alpha_{17} ASIAC_{it} + \mu_i + \upsilon_{it} \end{aligned} \tag{1}$$

$$\begin{aligned} E_{it} &= \beta_0 + \beta_1 G_{it} + \beta_2 FD_{it} + \beta_3 FD_{it}^2 + \beta_4 K_{it} + \beta_5 F_{it} + \beta_6 AGS_{it} \\ &+ \beta_7 TE_{it} + \beta_8 TE_{it}^2 + \beta_9 CDEV_{it} + \beta_{10} GOVS_{it} + \beta_{11} MWS_{it} + \beta_{12} LNPOP_{it} \\ &+ \beta_{13} XBGT_{it} + \beta_{14} TSS_{it} + \beta_{15} CATD_{it} + \alpha_{16} TIN_{it} + \alpha_{17} ASIAC_{it} + \delta_i + \varepsilon_{it} \end{aligned} \tag{2}$$

The subscript *i* is the observation unit, province; *t* is the time unit, year. G is the growth rate in real GRP per capita. E is an index of equalization and follows the definition of Qiao et al. (2008). More specifically, we compute the difference in year t between a province's per capita expenditures in year t and the mean of provincial expenditures in year t, for every province and year in our sample. We convert these differences into 'distances from the mean per capita provincial expenditures in year t', by taking the absolute value of these figures. Then, we

normalize these year t 'distances' by dividing each of them by the year t mean per capita provincial expenditures. Finally, we apply a minus sign to these figures in order to give our index of equalization (E) a more intuitive interpretation. As E approaches zero from the left, the province's per capita expenditures are becoming closer to the mean of per capita provincial expenditures and thus becoming more equal.

Following Tao Zhang and Heng-Fu Zou (1998), the degree of fiscal decentralization (FD) is the ratio of provincial government per capita expenditures and central government per capita expenditures. For this purpose provincial (central) government expenditures include both provincial (central) budgetary and extra-budgetary expenditures. Including FD and FD-squared in the model allows the degree of fiscal decentralization to have a non-linear effect on the dependent variable.

The growth equations include a vector of control variables that are typically used in empirical growth models. Capital (K) is measured by the growth rate of investment in total fixed assets. Labor (L) is measured by the growth rate in employment. According to economic theory, K and L should have a positive effect on growth. Openness to international trade (F) is measured by the share of exports plus imports in GRP. Previous studies, like those by Xiaojuan Jiang (2004) and Kunrong Shen and Jian Li (2003), find that the degree of openness promotes economic growth. R is the percentage change in the general retail price index. On the one hand, Tao Zhang and Heng-Fu Zou (1998) contend that a higher inflation rate can encourage people to invest more in capital and reduce real balance holdings which is the Tobin portfolio-shift effect.[13] In this case, inflation would promote economic growth. On the other hand, a higher

[13] See James Tobin (1956) for a detailed discussion.

inflation rate increases the costs of consumption and investment and thus may impede economic growth.

FDI is the natural logarithm of per capita foreign direct investment, which also is expected to have a positive effect on growth. In addition, we include the share of agriculture in total GRP (AGRS), which is expected to have a negative effect on economic growth. Provincial tax effort (TE) is the share of provincial revenues in GRP. Provincial revenues include the revenue from all shared taxes that go to sub-national governments, including tax rebates, as well as local taxes, transfers, and non-tax revenues. TE is expected to have a negative effect on growth since taxes distort the economic behavior of consumers and firms. We include the square of TE because of the potential non-linear effect of tax effort on the dependent variable. Infrastructure investment (CDEV) is equal to central government development expenditures. Provincial government size (GOVS) is the share of provincial budgetary and extra-budgetary expenditures in GRP. Economic theory and previous empirical work suggest that these two variables should have a positive effect on economic growth.

TSS is a vector of time dummy variables set equal to “1” after 1994 when the TSS reforms became effective. Given the goals of these reforms described above, we expect this variable to have a positive effect on growth. CATD is a set of natural catastrophe dummy variables that are expected to have an adverse affect on agricultural production. CATD is set equal to “1” for the province and in the year in which the catastrophe occurs and “0” otherwise. TIN is a time dummy variable set equal to “1” in 1989 which is the year of the Tian’anmen Square incident and “0” otherwise; ASIAC is a time dummy variable set equal to “1” in 1997 -- the year of the Asian financial crisis -- and “0” otherwise. Both variables are included to account

for the adverse economic shocks of these two events and are expected to have a negative effect on growth.

In the equalization equation, we include the growth rate (G), fiscal decentralization (FD), and FD-squared. As previously discussed, the effect of growth on equalization is ambiguous. Fiscal decentralization is likely to give rise to interregional disparities. Therefore, FD is likely to have a negative effect on equalization. We include FD-squared to allow fiscal decentralization to have a potentially non-linear effect on equalization. Capital (K), openness (F), and share of agriculture (AGS) are expected to increase fiscal disparities. TE captures the effect of tax effort on equalization. As discussed by Tao Zhang and Heng-Fu Zou (1998), tax effort is expected to have a positive effect on equalization (E) because greater tax effort, everything else held constant, should result in greater spending per capita. CDEV are equalizing transfers and therefore should have a positive effect on equalization. The formula used to distribute development funds ensures that this variable is exogenous. Government size (GOVS) is expected to have a negative effect on equalization because a larger government crowds-out private investment which impedes economic growth, narrows the tax base, and lowers tax revenues.

We include the share of missing women in the total population (MWS). Using the method of Ansley J. Coale and Judith Banister (1994), we calculate the number of hypothesized missing women for each province and in each year in our sample. MWS is expected to have an adverse effect on equalization. For example, increased pensions are required for elderly men who never marry because of China's adverse sex ratio that results from the cultural preference in China for a male child which many believe is exacerbated by China's one child only policy.[14] LNPOP is the natural logarithm of the provincial population which is expected to have a positive

[14] See, for example, Quanbao Jiang, Marcus W. Feldman and Xiaoyi Jin (2005) for the adverse effects of missing women.

effect on equalization. There is a widespread belief among students of China's local public finances that extra-budget funds are a main contributor to interregional fiscal disparities in China.[15] Thus XBGT, defined as the ratio of extra-budget expenditures and budgetary expenditures, is included to capture this effect. Given the goals of the TSS reform, we expect this variable to have a positive effect on equalization. CATD, TIN, and ASIAC are expected to increase fiscal disparities.

The terms μ_i and δ_i in equations (1) and (2), respectively, are unobserved, time-invariant provincial effects on the dependent variable. The terms υ_{it} and ε_{it}, in (1) and (2) respectively, are idiosyncratic shocks that are time-varying and represent unobserved factors that change over time and affect the dependent variable. In this SEM, a change in any disturbance term of equation (1) leads to a change in the potentially endogenous variable E that it directly determines. This, in turn, changes the other potential endogenous variable, G. Similar logic applies to the effects of a change in any disturbance term in equation (2).

The data used in this study come from the China Data Center of the University of Michigan and covers the period from 1985 through 2006. The data on extra-budgetary revenues, extra-budgetary expenditures, and central transfers come from the Ministry of Finance (retrieved on October 2008 from www.mof.gov.cn). This period covers the main years of previous studies and straddles the 1994 TSS reform. The extra-budgetary data also are available for this period.

Naturally, there is concern that China's government may be manipulating economic data for political reasons. According to Thomas G. Rawski (2001), the intentional falsification of data, in terms of GRP statistics in particular, is common at all levels of government in China. In contrast, Gregory Chow (2006) concludes that China's official statistics are generally reliable

[15] See, for example, World Bank (2000) and World Bank (2001).

and consistent with China's economy, although some data must be used with caution, as with any other data for any other country. In particular, the extra-budgetary data from the Ministry of Finance is considered to be reliable.

Our sample spans the years from 1985 to 2006 and includes data on 31 provinces of mainland China, including Tibet, but does not include data for the island governments of Hong Kong, Macau, or Taiwan. In 1997, the municipality of Chongqing separated from Sichuan Province, and in 1988 Hainan separated from Guangdong Province. Data for Chongqing and Hainan Provinces are available for the years after the bifurcations created these new provinces in 1997 and 1988, respectively. In estimating the two-step GMM, we lose a year of data. Consequently, there should be 638 observations in our data: 29 provinces over a 21 year period, Hainan Province for 19 years, and Chongqing Province for 10 years (29 × 22 = 638). However, we must drop 8 observations due to missing values, resulting in a sample consisting of 630 observations. In the case of the other studies, they lose many more observations as a result of missing values. So, again, we believe that our data have advantages over those used in previous studies.

Table 5 provides summary statistics for our sample of 630 observations. The average growth rate in real GRP per capita (G) in our sample is 9.45 percent per annum, the maximum growth rate is 38.1 percent, and the minimum is -3.7 percent. The CV of the provincial growth rates in our sample is 43.5, meaning that the standard deviation of the growth rates is 43.5 percent of the mean growth rate in our sample. The degree of fiscal decentralization (FD) ranges from 0.86 to 17.85, with a mean value of 3.34. Horizontal fiscal equalization (E) varies between -3.46 and 0.0, with a mean value of -0.46. The average growth rate of fixed asset investment (K) is 20.46 percent per annum, which is substantial, and the average growth rate of employment (L)

is 1.84 percent per annum. The average rate of inflation (R) is 5.86 percent, and the average share of agriculture in GRP (AGS) is 21.4 percent. The average share of provincial revenues in GRP (TE) is 14 percent, and the average share of extra-budgetary funds in budget funds (XBGT) is 0.44 percent. Finally, the average share of missing women is 4 percent of the provincial population, and varies between 1 and 6 percent in our sample. Now, we turn to a discussion of our empirical results.

Empirical Results

This section begins by reporting the estimation results for a variety of specifications. Second, we carry out detailed specification tests. Third, we conduct an "extreme bounds analysis" (EBA) for the growth equation to justify our selection of the baseline model reported in Table 6. Fourth, we use data for the period 1949 through 2008 and replicate the specification of Qiao et al. (2008) to further check the robustness of our results.

Table 6 provides the main results. We begin by discussing fixed effects (FE) estimates of the growth and equalization equations. This specification of the model does not account for the potential simultaneous nature of growth and equalization or the potential endogeneity of fiscal decentralization (FD) and FD-squared in the two equations. However, we believe that it is useful to report and discuss these estimates to show that our main results are robust to alternative specifications and not merely reflective of some kind of econometric chicanery.

The FE estimates are reported in the first columns of the two columnar-panels in Table 6, labeled growth equation and equalization equation. The Hausman test leads us to favor a fixed effect specification over random effects. Starting with the growth equation, the estimated coefficient of equalization (E) is positive but statistically insignificant at conventional levels. The estimated coefficient of fiscal decentralization (FD) is equal to -1.48 and is nearly four times its

standard error (SE = 0.36), and the estimated coefficient of FD-squared is 0.07 (SE = 0.02) and statistically significant at conventional levels. The combined effect of FD and FD-squared has a negative effect on growth for values of FD less than 21, and a positive effect for values greater than 21. The effect of FD reaches a minimum at a value of 10.6. Since the average value of FD in our sample is equal to 3.34, the average level of fiscal decentralization during the period spanned by our data reduces the growth rate of GRP per capita by 4.2 percent which is substantial in economic terms. In the equalization equation, the estimated coefficients of G and FD are positive but statistically insignificant at conventional levels. However, FD-squared is negative and statistically significant at conventional levels.

Although these results are certainly suggestive, the FE estimates, as previously noted, may be biased and inconsistent due to the potential endogeneity of FD, FD-squared, E, and G. Therefore, we estimate a simultaneous equation model (SEM) using two-stage least squares with fixed effects (2SLS FE).

To identify these two equations, the two control sets cannot contain exactly the same set of regressors; there must be valid exclusion restrictions in both equations. According to Jeffrey M. Wooldridge (2002), the order condition for identification is satisfied for an equation in any simultaneous equation model (SEM) if the excluded exogenous variables in the equation are not less than the number of right-hand-side endogenous variables. The rank condition further requires that at least one of the exogenous variables excluded from equation (1) must have a nonzero coefficient in equation (2). As discussed in greater detail below, the rank condition is satisfied for our SEM. The identification of equation (2) is the mirror image of that for equation (1).

To implement 2SLS, we need instrumental variables for our potentially endogenous variables. To be valid, the proposed instrumental variables must be correlated with the potentially endogenous variables but uncorrelated with the error term. In the growth equation, the excluded variables are the share of missing women (MWS), the natural logarithm of population (LNPOP), and the extra-budgetary factor (XBGT). These variables serve as instruments for the potentially endogenous variables in the growth equation. The share of missing women (MWS) should influence the demand for equalization. Since the share of missing women is unlikely to affect the growth rate, we believe that it is legitimate to exclude this variable from the growth equation. We include the employment growth rate (L) in the growth equation and exclude it from the equalization equation, and we include the natural logarithm of the population (LPOP) in the equalization equation and exclude it from the growth equation.

Christine Wong (1998) points out that, extra-budgetary funds (XBGT) are counter-equalizing, so XBGT should be correlated with E. To address the potential endogeneity of FD-squared, we use lagged values, higher moments, and interactions of the instruments as additional instruments. In the equalization equation, one-lag of G, one- and two-lags of FD, and squared values of these variables are used as instruments. We believe that our identification strategy is justified by economic and econometric theory. To address any remaining concerns about our identification strategy, we also subject these specifications to a battery of statistical tests to verify that our instruments are indeed valid.

The 2SLS FE estimates of the growth equation are reported in the second column of Table 6. The estimated coefficient of equalization (E) has a positive but statistically insignificant effect on the growth rate of real GRP per capita. The estimated coefficient of fiscal decentralization (FD) is equal to -1.79 which is more than twice its standard error (SE = 0.74),

and the estimated coefficient of FD-squared is 0.19 (SE = 0.04) and statistically significant at conventional levels. The non-linear effect of fiscal decentralization on growth is illustrated in Figure 3. The negative effect of FD on growth reaches a minimum of -19 for a value of FD equal to approximately 10, meaning that when the index of fiscal decentralization is equal to 10, the growth rate decreases by 19 percent. As illustrated in Figure 3, fiscal decentralization has a negative effect on economic growth for values of FD less than 20 and a positive effect for values greater than 20.

As previously noted, the average degree of fiscal decentralization in China during the period spanned by our data is substantially less than 10. The mean value of fiscal decentralization in our sample is about 3.34, and this degree of FD reduces the growth rate by approximately 10 percent. That is to say, this degree of fiscal decentralization currently prevailing in China does not allow it to realize the potential positive effects of FD on economic growth. This is consistent with the findings of a negative reported in Tao Zhang and Heng-Fu Zou (1998) and inconsistent with the positive effect reported in Justin Yifu Lin and Zhiqiang Liu (2000); Ying Ding (2007); and Qiao et al. (2008). In contrast to Tao Zhang and Heng-Fu Zou's findings, however, FD has a non-linear effect on growth in our model.

The estimated coefficients of many of the control variables in the growth equation generally have the expected signs and are statistically significant at conventional levels. The estimated coefficients of the following variables are positive and statistically significant at conventional levels: the growth rate of investment in fixed assets (K), openness to trade (F), the TSS reform dummy variable (TSS), central government development spending (CDEV), government size (GOVS), rate of inflation (R), and the natural logarithm of foreign direct

investment (FDI). The estimated coefficient of the share of agriculture in GRP is negative and statistically significant at conventional levels, as expected.

Turning now to the 2SLS FE estimates of the equalization equation reported in the second column of the right-hand-side columnar-panel, we find that economic growth (G) has a positive effect on equalization but is statistically indistinguishable from zero at conventional levels. Similarly, fiscal decentralization is positive but statistically insignificant at conventional levels. FD-squared, however, has a negative and statistically significant effect on equalization.

The estimated coefficients of the control variables have the anticipated signs and many are statistically significant. More specifically, agricultural share (AGS), the TSS reforms (TSS), central government development spending (CDEV), and the natural logarithm of population (LNPOP) have a positive effect on equalization. Meanwhile, openness to trade (F), the share of provincial revenues in GRDP (AET), government size (GOVS), extra-budgetary funds (XBGT), and the share of missing women (MWS) have a negative effect on equalization. Regarding the effect of extra-budgetary funds (XBGT), our findings are consistent with the findings of Christine Wong (1998) and the World Bank (2000, 2001), and World Bank (2001) that extra-budget funds are contributing to interregional fiscal disparities. Perhaps the most gratifying finding is that the 1994 TSS reforms appear to be increasing growth and equalization which were major goals of the reforms.

Sometimes, 2SLS FE can be problematic and even worse than ordinary least squares.[16] Since the number of IVs is greater than the number of potentially endogenous variables, the system is over-identified. Lars Peter Hansen (1982) suggests GMM as a solution. Two-step GMM, with IVs to deal with over-identification, allows for arbitrary autocorrelation and cross-

[16] John Bound, David Jaeger, and Regina Baker (1996) point out that if the instruments are weakly correlated with endogenous variables, IV estimation could be worse than OLS.

sectional heteroskedasticity. The estimated coefficients of the two-step GMM specification of our model are provided in the third columns of the two-columnar panels in Table 6. However, these results are nearly identical to those for FE and 2SLS FE.

We test for the potential endogeneity of fiscal decentralization (FD), FD-squared, horizontal fiscal decentralization (E), and growth (G) and conduct a number of other specification tests. Table 7 summarizes the results of this battery of tests. Following Jerry A. Hausman (1978), we estimate the Hausman test of exogeneity. We fail to reject the joint null hypothesis of exogeneity for our set of potentially endogenous variables (E, G, FD, FD-squared) in both equations. We further estimate a Durbin-Wu-Hausman chi-squared test statistic for the null hypothesis that a given variable is exogenous independently of the other potentially endogenous variables. The small values of the test statistics for FD, and E in the growth equation lead us to fail to reject the exogeneity of these two variables, one independently of the other. However, we reject the null hypothesis that FD-squared is exogenous at the 10 percent significance level. In the equalization equation, the chi-squared statistic for G is too small to reject the null hypothesis of exogeneity. However, we soundly reject the exogeneity of FD and FD-squared in the equalization equation.

Since endogeneity may go undetected due to weak instruments, James H. Stock and Motohiro Yogo (2005) provide a rule-of-thumb test for weak instruments and critical values for this statistic. The null hypothesis for this test is that all IVs are sufficiently correlated with the potentially endogenous variables that the small sample bias of 2SLS is less than the bias of FE. Using the Cragg-Donald Wald F values, the weak identification tests show that the bias of the IV estimate of the growth equation is less than 20 percent that of the OLS estimates and less than 5 percent of OLS estimates in the equalization equation. In other words, the set of instruments are

sufficiently, strongly correlated with the potentially endogenous variables that the small sample bias of 2SLS is small relative to that of OLS.

Finally, John D. Sargan (1958), Lars Peter Hansen (1982), and Lars Peter Hansen and Kenneth J. Singleton (1982) show in a GMM context that when the number of moment conditions exceeds the number of parameters to be estimated, a chi-square test can be used to determine whether the instruments are orthogonal to the error term. The values of the Sargan statistics for the test of over identifying restrictions in the growth and equalization equations are 10.53 and 0.54, respectively. These values fail to reject the null hypothesis that the instruments are exogenous.

To further test the robustness of these results, we use our data to conduct an "extreme-bounds analysis" (EBA) for the growth equation, based on the work of Edward Leamer (1978, 1983, and 1985), Ross Levine and David Renelt (1992), and Tao Zhang and Heng-Fu Zou (1998). In our base scenario, we include the variables of primary interest (I), specifically fiscal decentralization (FD) and horizontal fiscal equalization (E), and the main model variables (M), including capital (K), labor (L), openness (F), and inflation rate (R). We proceed by estimating thousands of variations of the base scenario described above, by adding every combination of the remaining 16 variables in sets including 0 to four (4) optional variables (O). Then, we identify the control set of optional variables that give us minimum and maximum values of the estimated coefficients of each of the primary variables of interests and the main variables.

Table 8 summarizes the results of our extreme bounds analysis. Among the set of interesting (I) and main (M) variables, only the estimated coefficients of K and L are same signed and more than two standard deviations from zero for all combinations up to 4 of the optional variables. Therefore, capital and labor are the only robust variables among all the

growth determinants considered in this study. The base and lower bound estimates for fiscal decentralization (FD) are negative while the upper bound is positive. The extreme bounds for equalization (E) cannot be found. Therefore, these two variables are fragile, as are the other main models variables. Based on these findings, we are somewhat assured that it is appropriate to include fiscal decentralization, equalization, capital, labor, openness, and the rate of inflation in the growth equation.

The reason that the results discussed above differ from those of Qiao et al. (2008) may be due to the different time periods employed in the two studies. To explore this issue, we examine the robustness of our results by replicating Qiao et al. (2008), using their variable definitions and model specifications and different time periods of our data. Because extra-budget data are not available for the years before 1985 or after 2006, the definitions of fiscal decentralization and equalization include provincial budget expenditures only.

The regression results of these experiments are summarized in Table 9. For ease of comparison, we report the estimated results reported in Qiao et al. (2008) for ease of comparison in the first columnar-panel. In the second columnar-panel, we report the estimated coefficients based on their specification and time period but using our data which differ slightly from theirs. In the third columnar-panel, we report the estimated coefficients based on their specification, our time period (1985-2006), and our data. Finally, in the fourth columnar-panel, we report the estimated coefficients from estimating their specification using an expanded time period (1949-2006), and our data. The finding of these experiments is that our results appear to be robust to their specification and a variety of different time periods.

Conclusions

We find that fiscal decentralization has a non-linear effect on economic growth. For values between 0 and 20, fiscal decentralization has a negative effect on economic growth. In this range, our finding of a negative effect is consistent with that of Tao Zhang and Heng-Fu Zou (1998), but inconsistent with the findings of a positive effect of Justin Yifu Lin and Zhiqiang Liu (2000); Ying Ding (2005); and Qiao et al. (2008). Beyond the value of 20, fiscal decentralization has a positive effect on economic growth. Qiao et al. (2008) report evidence of a trade-off between equalization and growth. In contrast, we find evidence of a weak positive relationship between equalization and growth.

Based on these results, it would appear that a significant deepening of fiscal decentralization in China would have a beneficial effect on the performance of the economy in terms of equalization and growth. A higher growth rate may have a weak, positive effect on equalization but certainly does not lead to greater interregional fiscal disparities, which appears to be the concern of many students of China's local public finances. Finally, equalization does not appear to influence the growth rate. Finally, we find that the 1994 TSS reforms are having a positive effect on the performance of China's economy, both in terms of growth and equalization.

Chapter III: Examining the Potential Trade-off between Horizontal Fiscal Equalization and Growth in India

Introduction

Following the economic reforms of the early 1990s, India has experienced an acceleration of economic growth and a reduction in its poverty rate. During the past five years, the annual growth rate of real gross domestic product (GDP) has averaged almost nine percent, in contrast with a four percent growth rate during the period from 1950 to 1989. As result of this recent period of extraordinary growth, the poorest members of Indian society have benefitted: almost 30 million people escaped poverty during the period 1980 to 2005. This accounts for nearly 4.5 percent of the global population in poverty, based on the dollar-per-day poverty standard used by the World Bank.[17]

However, this impressive record of growth has also increased income inequality among the states. Specifically, in 1980 Goa was the richest state, with a real gross state domestic product (GSDP) of $252 per capita.[18] In contrast, the poorest state was Bihar, with a real GSDP of $46 per capita. In other words, Goa's real GSDP per capita was five times that of Bihar's. Interregional income inequality remained stable until the outset of the 1992 economic reforms. By 2005, Goa's real GSDP per capita increased from five times that of Bihar's to nearly eight times, or $1,230 versus $157 per capita, respectively.

With the recent upward revision in its poverty norm from one dollar-per-day to one and a quarter dollars per day, the number of people living in poverty in India's increased by 35.3 million, according to a World Bank study conducted by Shaohua Chen and Martin Ravallion

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[17] See the World Development Report from 1990 for information about the poverty standard.
[18] We use the INR-U.S. dollar exchange rate, which was 0.0211797 on May 24, 2009 (http://www.xe.com/ucc/convert.cgi).

(2008). However, the percentage of people living on less than this new poverty line has come down from 60 in 1981 to 42 in 2005.

Besides increased per capita income inequality, inequality in per capita expenditures by sub-national governments has also increased. For example, in 1981 Nagaland had the highest government expenditures, with $36 per capita. The lowest state government per expenditures was in Uttar Pradesh, with $6 per capita, or one-sixth that of Nagaland's per capita expenditures. By 2005, the highest state government expenditures occurred in Sikkim, with $795 per capita, which is more than 13 times greater than that of Bihar, the lowest, at $54 per capita. According to Figure 4, the coefficient of variation (CV) of state total consolidated expenditures per capita was 64 percent in 1981, which increased to 80 percent in 2005. Several previous studies find that the equalization effect of the intergovernmental transfer system in India is not performing well, at least in terms of equalizing expenditures per capita. Govinda Rao and Nirvikar Singh (2000) charge that the lack of coordination among the myriad of different transfers working at cross-purposes to one another have led to an increase in fiscal disparities among the states. Roy Bahl, Eunice Heredia-Ortiz, Jorge Martinez-Vazquez and Mark Rider (2005a) attribute the lack of an adequate equalization transfer system to the lack of a clear link between fiscal capacity and expenditure needs as well as lack of transparency and the less equalizing Gadgil formula. D. K. Srivastava (2002) shows some variation in state fiscal capacities in terms of state per capita expenditures on services with data for the period from 1996 to 1998.

However, C. Rangarajan and D. K. Srivastava (2008) find that despite different state fiscal capacities, a high degree of horizontal fiscal equalization has been achieved through recommended transfers by the Twelfth Finance Commission. Based on our data, the intergovernmental transfer system in India has resulted in greater equalization in state per capita

expenditures since the beginning of the economic reforms in the early 1990s. For example, the CV of state expenditures per capita excluding gross devolution was 89 percent in 2005 and declined to 80 percent when taking into account gross devolution. As Figure 4 shows, gross devolution began to have an equalizing effect on state per capita expenditures after 1994. Figure 4 also shows the trend in the CV for state per capita expenditures less grants, and the trend in the CV for state per capita expenditures less grants and less state share of central taxes. These trends clearly show that central government transfers have had an equalizing effect on state expenditures per capita.

The question that arises from this analysis of India's recent growth experience is whether India's policy of fiscal decentralization (FD) and horizontal fiscal equalization (HFE) has encouraged or impeded economic growth. From a theoretical perspective, we contend that the effects of FD and HFE on economic growth are ambiguous.

The reasons for an ambiguous relationship between HFE and economic growth are similar to those for the case of China; therefore we will only briefly review some of the arguments here. HFE involves shifting resources from high- to low-income regions, resulting in less public infrastructure investments in high-income regions. However, the resulting decrease in growth promoting public infrastructure investments in high-income regions may be more than the increase in public infrastructure investments in low-regions because of the distortionary taxes used to finance the transfer system. Furthermore, low-income regions may not use transfers as efficiently as high-income regions. Even though, the investment resources are transferred completely and may not be utilized in low-income regions as at least efficiently as in high-income regions. Finally, equalizing transfers may be useful in reducing civil unrest in low-

income regions populated by minority groups or other aggrieved people. From a theoretical perspective, equalizing transfers have an ambiguous effect on the aggregate national growth rate.

The empirical evidence is mixed, as well. Georgia Guess, William Loehr and Jorge Martinez-Vazquez (1997), Elliott Parker and Judith Thornton (2007), and Baoyun Qiao, Jorge Martinez-Vazquez and Yongsheng Xu (2008) find that there is a trade-off between HFE and growth. The purpose of this study is to examine the effect of India's policy of fiscal decentralization and horizontal fiscal equalization on economic growth. Following the work of Qiao et al. (2008), we use a simultaneous equations model (SEM). Using an instrumental variables approach, this allows us to account for the potential endogeneity of fiscal decentralization, the square of fiscal decentralization, horizontal fiscal equalization, and growth. We apply a variety of estimation methods using state-wide data for India covering the period from 1980 to 2005.

This study makes the following contributions to the existing literature on fiscal decentralization and growth. First, there is no previous research that explicitly examines the relationship between the twin policies of fiscal decentralization and horizontal fiscal equalization on economic growth in India. This study attempts to fill this gap. Second, we use state-wide yearly data from 1980 to 2005, which straddles the market and decentralization reforms initiated in the early 1990s. This panel data set enables us to more thoroughly evaluate the performance of economic reforms in the early 1990s. Third, we employ a complete measure of fiscal decentralization and horizontal fiscal equalization, by accounting for both revenue expenditures and capital expenditures. Fourth, we account for the potential endogeneity of fiscal decentralization, the square of fiscal decentralization, horizontal fiscal equalization, and economic growth in our two equation model over time and among the states. Finally, we exploit

the panel nature of our data by estimating ordinary fixed effects (FE), two-stage least squares fixed effects (2SLS FE), and two-step generalized method of moments (GMM) models.

The remainder of this chapter is organized as follows. The next section provides some background on the legal and institutional aspects of India's intergovernmental fiscal system. In the third section, we summarize the previous literature on fiscal decentralization in India and some issues in measuring in fiscal decentralization. The fourth section describes the econometric model, variable construction, and data. Section five discusses our empirical results, and the final section concludes.

India's Intergovernmental Fiscal System

India is the most populous democracy in the world. It has a parliamentary system in which the prime minister, as the head of the central government and the cabinet are chosen by the party or party coalition that wins a majority of the votes. India is a federal republic comprising one central government (the Union), twenty-eight states, and seven union territories (the States), including the National Capital Territory of Delhi. Since its foundation in 1947 up to the early 1990s, India has been a two-tier federation with a constitutional demarcation of responsibilities and finances between the Union and the States, which have separate legislative, executive, and judicial organs of governing. Fiscal decentralization never went beyond the state level until the enactment of the Constitutional amendments in 1992, granting statutory recognition to rural and urban local self governments, although these local bodies long pre-dated independence in 1947. There are about 610 districts (*Zila Parishads*) in total, which are further divided into about 6,000 blocks (*Panchayat Samiti*) and 250,000 villages (*Gram Panchayats*) in rural areas. Municipal corporations, municipalities, and councils constitute the third-tier of urban

governments.[19] Compared to the leader-subordinate relationship in the center-provincial framework of China, both India's executive officer of the central government and that of the state government are accountable first to the corresponding legislature and second to the voters, though a guiding administrative relationship exists between the Union and the states. It is the legislative power that dominates in the institutional system.

At the same time, India has a long history of local self-governance, through the gradual evolution of decentralization, which can be dated back to Lord Mayo's Resolution in 1870 with the introduction of an elected president in the municipalities. However, local self governments only gained constitutional status and federal recognition with the 73rd and 74th amendments to the Constitution in 1992, granting greater powers and fiscal resources to rural and urban local self governments, respectively. The 11th Schedule lists 29 items as the responsibilities of rural bodies, and the 12th Schedule lists 18 items as responsibilities of urban local bodies. Govinda Rao and Nirvikar Singh (1999) point out several institutional failures with India's Constitutional arrangements, including a clear centripetal bias in the distribution of fiscal powers, the separation principle of taxing powers as opposed to concurrent tax assignments, concurrent expenditure assignments rather than exclusive expenditure assignments, and constitutional permission to tax inter-state trade that hinder development of an effective intergovernmental fiscal system in India.

Before the 1980s, fiscal centralization dominated the national economy. Beginning in the mid-1980s, fiscal decentralization was the focus for revitalizing the economy. Fiscal decentralization, together with market reforms, brought about high fiscal deficits as well as a high economic growth rate. The combined gross fiscal deficit of the Union and state governments as a percentage of GDP increased from 7.4 in 1980 to 9.4 in 1990. The combined

[19] Data is retrieved in December, 2008 from http://districts.gov.in/, government of India. National Informatics Centre (NIC).

outstanding liabilities of the central and state governments as a percentage of GDP increased from 54 in 1984 to 67 in 1990. The economic reforms initiated in the 1980s did not change the fundamental framework of the fiscal policy or development policy. Driven by the debt crisis in the early 1990s, the Indian government began a process of deregulation, privatization, and liberalization of the economy, together with enlarging the tax bases, compressing expenditures, and strengthening state fiscal discipline with the enactment of the Fiscal Responsibility and Budget Management Bill in 2000. The new round of economic reforms has resulted in lower fiscal deficits as well as a remarkable increase in the annual economic growth. As a result, the combined central and state gross fiscal deficit fell to 6.7 percent of the GDP in 2005, although the high outstanding liabilities remain. This chapter examines the influence of India's policy of fiscal decentralization and horizontal fiscal equalization on economic growth.

We turn now to a description of India's four pillars of fiscal decentralization. First, India's expenditure assignments, as provided in Article 246 of the India Constitution (also known as the Seventh Schedule), have three distinct lists: the Union list (List 1) specifies those functions which are the exclusive competence of the Union government; State list (List 2: State List) specifies those functions which are the exclusive competence of the state governments; and the Concurrent List (List 3) specifies those functions that are the current responsibility of Union and state governments. Table 10 provides a summary of India's statutory expenditure assignments. The murkiness lies in the current responsibilities in List III in which the role of states is unclear. Due to the lack of accountability resulting from the extensive use of concurrent expenditure responsibilities, a large share of state revenues are spent on relatively unproductive expenditures, such as administration, debt services, and pensions. Non-development expenditures as a share of total recurrent expenditures increased from less than 19 percent in

1980 to 34 percent in 2005. In the meantime, over 60 percent of agricultural services and nearly 90 percent of educational, public health, family welfare, electricity, and irrigation expenditures are shouldered by state governments.

Table 11 summarizes revenue assignments as provided by the three lists in the Seventh Schedule. The most productive taxes are exclusively assigned to the Union government. At the same time, the states have been assigned a number of tax handles. However, from the viewpoint of productivity and buoyancy, only the sales and purchase taxes are important. Since the 80th Amendment to the Constitution in 2000, instituted to improve state finances, the net proceeds of all Union taxes and duties are now shared taxes between the Union and the States. Furthermore, the 88th Amendment to the Constitution in 2003 includes taxes on services in List I as shared taxes with the states. Figure 5 shows the trends in Union and state shares of total revenues and expenditures. The proportion of all fiscal revenues shared by the Union and States changed from 60:40 before 2000 to 50:50 in 2005. In addition, although 29 expenditure items under the 73rd amendment and 18 expenditure items under the 74th amendment have been assigned to rural *Panchayats* and urban municipalities, respectively, neither of them has sufficient revenue autonomy. For the third-tier government in rural areas, only *Gram Pachayat* has independent revenues, such as non-agricultural property tax, title tax, water usage fees, and others. However, Melville L. McMillan (2007) estimates that these own source revenues account for less than one-quarter of total local revenue for the State of Karnataka which is relatively advanced in terms of development and decentralization to the local level.

The vertical and horizontal imbalances created by the revenue and expenditure assignments are well known. The Constitution provides for an equalization grant, and the Union government administers a large number of centrally sponsored schemes (CSS) to help finance

state and local expenditure responsibilities. There are several channels through which intergovernmental transfers are received by sub-national governments. The first channel is the tax share in centrally levied taxes, which are determined and transferred by the Finance Commission of the Union. The recommendations and transfer formulas by the Finance Commission rely heavily on per capita income to measure the backwardness of the recipient states. The second channel is the Central Planning Commission's capital grants and loans. In general, these plan grants and loans were project oriented, but they were later based on the so-called Gadgil formula, which has been modified several times with a proportionate mix of grants and loans. These grants and loans can be roughly classified into two categories: central assistance and additional central assistance. The third channel is through central ministries and departments, under which a broad range of development programs known as Centrally Sponsored Schemes (CSSs) are initiated by the Union and implemented by various departments of the states. The number of CSS types is estimated to number well over two hundred and cover a variety of development tasks like poverty alleviation, family planning, irrigation, and education.

Among the three main components of gross devolution, shares in central taxes and central grants follow a similar increasing trend, while loans from the Union have shrunk significantly since 2003 to less than 10 percent of total gross devolution. This is due to the desire of the Union government to impose fiscal discipline on state governments. Grants from the Union, non-plan schemes, centrally sponsored schemes, and state plan schemes account for a more than 90 percent of total revenues in recent years. The multiplicity of transfer channels, together with the lack of coordination between the Finance Commission and the Planning Commission, undermines the fiscal autonomy of sub-national governments and may foster a lack of fiscal discipline due to the high level of transfer dependency. Additionally, Roy Bahl et al. (2005a),

and Eunice Heredia-Ortiz and Mark Rider (2005) point out several shortcomings of the Planning Commission's transfers. Although the transfer system in India has received much criticism, the transfers have decreased the CV of state per capita expenditures, as shown in Figure 4.

Finally, sub-national borrowings are allowed in India with certain restrictions, such as no access to direct foreign borrowings. Besides borrowings in the form of plan loans from the Union, domestic bonds and policy loans from international organizations provide market loans. Since 2003, central loans have decreased, and states have resorted to more market borrowings, which involve heavy interest payments by the state.

As discussed in greater detail in Roy Bahl et al. (2005a), India's intergovernmental fiscal system is characterized, much like China's system, by an over centralization of revenues, and over decentralization of expenditures, high level of transfer dependency, and excessive sub-national borrowing.

Literature Review

To the best of our knowledge there are no rigorous empirical studies of the type undertaken here. However, there is an enormous literature on fiscal decentralization in India. Govinda Rao and Nirvikar Singh (1999) contend that fiscal decentralization can give rise to an unhealthy "race to the bottom" among sub-national governments competing to attract mobile factors of production, particularly capital. In addition, such competition can hinder the development of a common market, particularly when there are no Constitution prohibitions against taxes on inter-state trade. Catriona Purfield (2004) concludes that institutional factors play a key role in the differing fiscal performances among the states of India. In his study, state fiscal performance is mainly measured by fiscal deficits and debts. He uses panel data from 1985

to 2000 for the 15 largest states and finds a significantly positive relationship between fiscal decentralization and the size of the state fiscal deficit.

Govinda Rao (2003) conducts a comparative analysis of fiscal decentralization in China and India. He identifies the emerging challenges and puts forward a solution or overall approach. Jorge Martinez-Vazquez and Mark Rider (2006) link fiscal decentralization to economic growth in China and India and conclude that poor service delivery and poor fiscal self-discipline at the sub-national level threatens the ability of both countries to sustain high rates of economic growth over the long-run.

As previously discussed, there is no single measure of fiscal decentralization. Like China, India has chosen to centralize revenues and decentralize expenditures. Therefore, we use expenditure decentralization as an index of fiscal decentralization among the states of India over time. Accordingly, our index of fiscal decentralization (FD) is the ratio of state expenditures to central government expenditures in per capita terms. This index includes both revenue expenditures and capital expenditures at the central and state levels. This measure is used in a number of well-known studies of fiscal decentralization.[20]

Empirical Strategy

In this section, we describe our empirical model, variable construction, and the data used in this analysis. As previously noted the effect of fiscal decentralization and horizontal fiscal equalization on economic growth is ambiguous. To gauge this relationship, we estimate a simultaneous equation model (SEM), consisting of two equations: growth equation and an equalization equation. This model is very similar to examine the case of China; therefore, we refer the interested reader to Chapter II for further details.

[20] Kunrong Shen and Wenlin Fu (2005), Andrew Feltenstein and Shigeru Iwata (2005), Nobuo Akai and Masayo Sakata (2002), Tao Zhang and Hengfu Zou (1998), etc.

Following Qiao et al. (2008), we estimate the following SEM:

$$G_{it} = \alpha_0 + \alpha_1 E_{it} + \alpha_2 FD_{it} + \alpha_3 FD_{it}^2 + \alpha_4 K_{it} + \alpha_5 LNPOP_{it} + \alpha_6 CT_{it} + \alpha_7 ST_{it} + \alpha_7 CATD_{it} + \alpha_8 ER_{it} + \mu_i + \upsilon_{it} \quad (3)$$

$$E_{it} = \beta_0 + \beta_1 G_{it} + \beta_2 FD_{it} + \beta_3 FD_{it}^2 + \beta_4 LNPOP_{it} + \beta_5 FSR_{it} + \beta_6 FDR_{it} + \beta_7 MWS_{it} + \beta_8 CATD_{it} + \beta_9 ER_{it} + \delta_i + \varepsilon_{it} \quad (4)$$

The variable definitions are as follows. The subscript *i* is the observation unit, province; *t* is the time unit, year. G is the growth rate in real GRP per capita. E is an index of equalization and follows the definition of Qiao et al. (2008). More specifically, we compute the difference in year t between a province's per capita expenditures in year t and the mean of provincial expenditures in year t, for every province and year in our sample. We convert these differences into 'distances from the mean per capita provincial expenditures in year t', by taking the absolute value of these figures. Then, we normalize these year t 'distances' by dividing each of them by the year t mean per capita provincial expenditures. Finally, we apply a minus sign to these figures in order to give our index of equalization (E) a more intuitive interpretation. As E approaches zero from the left, the province's per capita expenditures are becoming closer to the mean of per capita provincial expenditures and thus becoming more equal.

Other control variables in the growth equation include capital (K) measured as the natural logarithm of capital outlays per capita, and labor (L) measured as the natural logarithm of the state population due to the unavailability of actual labor force data. According to neo-classical growth models like that of Robert J. Barro (1990), both of these variables are expected to have a positive impact on G. In addition, the Union governments average effective tax rate (CT) defined as central revenue receipts as a share of GDP, and state average effective tax rate (ST), defined as state revenue receipts as a share of GSDP, are included to control the effect of tax effort. Since these are distortionary taxes, they are expected to have a negative effect on growth.

Jean-Philippe Meloche, Francois Vaillancourt and Serdar Yilmaz (2004) contend that the rate of fiscal self-reliance (FSR) and rate of transfer dependence (FDR) are very important determinants of the horizontal fiscal balance among sub-national governments. Therefore, these two variables are included in the equalization equation. FSR is the share of state's own revenues in state revenue receipts, and FDR is the share of central government grants in total state revenue. Furthermore, we include the share of missing women (MWS) in the total state population, which is assumed to have an adverse effect on horizontal equalization. For example, increased pensions are required for elderly men who never married because of a biased sex ratio due to the strong cultural preference for a male child.[21] Based on the method of Ansley J. Coale and Judith Banister (1994), we calculate the number of hypothesized missing women for each state according to the hypothetical sex ratio in Amartya Sen (1990).

CATD is a dummy variable set equal to "1" in the year and state in which there was a natural catastrophe that one would expect directly to influence agricultural production and regional fiscal capacity. ER is a time dummy variable set equal to "1" for years after 1991 and "0" otherwise. This variable controls for the economic reforms that came into effect in 1992. We pursue the same identification strategy as before and refer the interested reader to the discussion in Chapter II.

The terms μ_i and δ_i are unobserved regional effects, which are time-invariant. The terms υ_{it} and ε_{it} are idiosyncratic error terms, which are time-varying and represent unobserved factors that change over time and influence the dependent variable.

The data used in this study are state-wide for the years 1980 through 2005. The main source for India's state fiscal and general national accounts data is the Reserve Bank of India

[21] See, for example, Quanbao Jiang, Marcus W. Feldman and Xiaoyi Jin (2005) for the adverse effects of missing women.

(retrieved in December, 2009 from www.rbi.org.in). All-India data are from the Central Statistical Organization, and population data are from India's Office of the Registrar General. Data on natural catastrophes are from Natural Disaster Management, Ministry of Home Affairs. All real GSDP per capita figures have been adjusted to 1993–1994 base year.

The following union territories are excluded from the sample: Andaman and Nicobar Islands, Chandigarh, Dadra and Nagar Haveli, Daman and Diu, Lakshadweep, and Puducherry. Thus, there are a total of 28 state governments and the national capital territory of Delhi, making for 29 states or comparable units. These 29 state governments include the States of Chhattisgarh, Jharkhand, and Uttaranchal which were established through the bifurcation of the States of Andra Pradesh, Bihar, and Uttar Pradesh in 2000. Therefore, the data for Chhattisgarh, Uttaranchal, and Jharkhand are available only for the 6 year period from 2000 to 2005. The resulting sample would consist of 694 observations ($26 \times 26 + 3 \times 6 = 694$). In calculating state growth rate in real GSDP per capita, we lose the first year of our data or 29 observations. In addition, complete data for Mizoram are only available for the period beginning in 2000, and complete data for Arunachal Pradesh and Goa are available for the period beginning in 1986. Complete data for Nagaland, Sikkim and Delhi is available beginning in 1994. Consequently, there are 562 ($= 694 - 2\times29 - 1\times20 - 2\times6 - 3\times14$) observations in the sample used to estimate the FE specifications. For the 2SLS FE and GMM specifications, the number of observations is somewhat less than that for the FE specifications because of missing values for some of the instrumental variables.

Table 12 provides a summary of the variable definitions, and Table 13 provides summary statistics for our sample of 562 observations used to estimate the FE specifications. The average growth rate in real GSDP per capita (G) in our sample is 4.67 percent, the maximum growth rate

is 81.67 percent, and the minimum is -43.7 percent. The CV of the provincial growth rates in our sample is 292.3 percent, meaning that the standard deviation of the growth rates in our sample is nearly 300 percent of the mean growth rate. The degree of fiscal decentralization (FD) in our sample ranges from 0.27 to 12.18, with a mean value of 1.65. Horizontal fiscal equalization (E) varies between -4.78 and 0.0, with a mean value of -0.51. The average of the natural logarithm of capital outlays per capita (K) is 5.55, and the average of the natural logarithm of state population (LNPOP), which serves as a proxy variable for the size of the labor force, is 16.64. The average share of central revenue receipts in GDP (CT) is 9 percent, and the average share of state revenue receipts in GSDP (ST) is 25 percent. The average share of state own tax and non-tax revenues in total revenue receipts (FSR) is 50 percent and the average share of central grants in consolidated receipts (FDR) is 29 percent. Finally, the average share of missing women (MWS) is 3 percent of the state population, and varies between 0.3 and 6 percent in our sample. Now, we turn to a discussion of our empirical results.

Empirical Results

This section begins by reporting the estimation results for a variety of specifications. Second, we carry out detailed specification tests. Third, we conduct an "extreme bounds analysis" (EBA) for the growth equation to justify our selection of the baseline model reported in Table 14.

Table 14 provides the main results for our baseline specifications. We begin by discussing the fixed effects (FE) estimates of the growth and equalization equations. This specification of the model does not account for the potential simultaneous nature of growth and equalization or the potential endogeneity of fiscal decentralization (FD) and FD-squared in the

two equations. However, we believe that it is useful to report and discuss these estimates to show that our main results are robust to alternative specifications.

The FE estimates are reported in the first columns of the two columnar-panels in Table 14, labeled growth equation and equalization equation. The Hausman test leads us to favor a fixed effect specification rather than a random effects specification. Starting with the growth equation, the estimated coefficient of equalization (E) is positive but statistically insignificant at conventional levels. The estimated coefficients for both fiscal decentralization (FD) and FD-squared are positive but statistically insignificant at conventional levels. In the equalization equation, the estimated coefficient of G is positive and statistically significant at the 10 percent level. This means that growth (G) has a positive effect on equalization (E), rather than growth exacerbating fiscal disparities among the states. As for the effects of fiscal decentralization, both FD and FD-squared are negative and statistically significant at conventional levels.

Although these results are certainly suggestive, the FE estimates, as previously noted, may be biased and inconsistent due to the potential endogeneity of FD, FD-squared, E, and G. Therefore, we estimate a simultaneous equation model (SEM) using two-stage least squares with fixed effects (2SLS FE). To identify these two equations, the two control sets cannot contain exactly the same set of regressors; there must be valid exclusion restrictions in both equations. According to Jeffrey M. Wooldridge (2002), the order condition for identification is satisfied for an equation in any simultaneous equation model (SEM) if the excluded exogenous variables in the equation are not less than the number of right-hand-side endogenous variables. The rank condition further requires that at least one of the exogenous variables excluded from equation (3) must have a nonzero coefficient in equation (4). As discussed in greater detail below, the rank

condition is satisfied for our SEM. The identification of equation (4) is the mirror image of that for equation (3).

To implement 2SLS, we need instrumental variables for our potentially endogenous variables. To be valid, the proposed instrumental variables must be correlated with the potentially endogenous variables but uncorrelated with the error term. In the growth equation, the excluded variable: the share of missing women (MWS) is used to serve as instrument for the potentially endogenous variables in the growth equation. The share of missing women (MWS) should influence the demand for equalization, but it is unlikely to affect the growth rate. Therefore, we conclude that it is appropriate to exclude this variable from the growth equation.

To address the potential endogeneity of FD-squared, we use lagged values, higher moments, and interactions of the instruments as additional instruments. In the growth equation, one-lag of E, one-lag of FD, interacted values, squared values, and cubic values of these variables are used as instruments. In the equalization equation, one-lag of G, one-lag of FD, and squared values of these variables are used as instruments. We believe that our identification strategy is justified by economic and econometric theory. To address any remaining concerns about our identification strategy, we also subject these specifications to a battery of statistical tests to verify that our instruments are indeed valid.

The 2SLS FE estimates of the growth equation are reported in the second column of Table 14. The estimated coefficient of equalization (E) is negative but statistically insignificant effect at conventional levels. The estimated coefficient of fiscal decentralization (FD) is equal to -62.38, which is about five times its standard error (SE = 12.71), and the estimated coefficient of FD-squared is 3.05 (SE = 1.04) and statistically significant at conventional levels. The non-linear effect of fiscal decentralization on growth is illustrated in Figure 6. The negative effect of FD on

growth reaches a minimum of -319 for a value of the FD index equal to approximately 10. Meaning that when the index of fiscal decentralization is equal to 10, the growth rate decreases by 319 percent. As illustrated in Figure 6, fiscal decentralization has a negative effect on economic growth for values of FD less than 21 and a positive effect for values greater than 21.

As previously noted, the average degree of fiscal decentralization in India during the period spanned by our data is substantially less than 10. The mean value of fiscal decentralization in our sample is about 1.65, and this degree of FD reduces the growth rate by approximately 100 percent. That is to say, this degree of fiscal decentralization currently prevailing in India does not allow it to realize the potential positive effects of FD on economic growth. This is consistent with our findings for China. It is also noteworthy that the minimum point and the point where the effect of FD switches from a negative effect to a positive effect are remarkably similar for these two countries.

The estimated coefficients of the other control variables in the growth equation generally have the expected signs. The natural logarithm of capital outlays per capita (K) is positive and statistically significant at the 1 percent level. The central revenue share in GDP (CT) is negative and the state revenue share in GSDP (ST) is positive, but both are statistically insignificant at conventional levels. The estimated coefficient of the economic reform dummy variable (ER) is positive but statistically insignificant at conventional levels. The natural logarithm of state population (LNPOP) is negative and statistically significant at conventional levels, which may indicate that state population is a poor proxy for the size of the labor force.

Turning now to the 2SLS FE estimates of the equalization equation reported in the second column of the right-hand-side columnar-panel, we find that economic growth (G) has a positive effect on equalization and is statistically significant at conventional levels. The

estimated coefficient of growth (G) is equal to 0.008 and is more than twice its standard error (SE = 0.003). This estimate implies that a percentage increase in the growth rate of real GSDP per capita increases equalization by 0.01. Fiscal decentralization (FD) is positive and statistically significant at conventional levels in contrast to the negative effect obtained with the FE specification. The possible reason being FD is endogenous and therefore the FE estimate is not consistent. FD-squared is negative and statistically significant at conventional levels.

The estimated coefficients of the other control variables are as following. Missing women (MWS) has the anticipated negative sign and is statistically significant. The natural logarithm of population (LNPOP) has a positive effect on equalization and is statistically significant at conventional level. Meanwhile, the rate of grant dependence rate (FDR) is positive but statistically insignificant at conventional levels. The rate of fiscal self-reliance rate (FSR) is negative and statistically significant at conventional levels. The economic reform time dummy variable (ER) is negative sign but statistically indistinguishable from zero at conventional levels.

Sometimes, 2SLS FE can be problematic and even worse than ordinary least squares.[22] Since the number of IVs is greater than the number of potentially endogenous variables, the system is over-identified. Lars Peter Hansen (1982) suggests GMM as a solution. Two-step GMM, with IVs to deal with over-identification, allows for arbitrary autocorrelation and cross-sectional heteroskedasticity. The estimated coefficients of the two-step GMM specification of our model are provided in the third columns of the two-columnar panels in Table 14. However, these results are nearly identical to those obtained with the 2SLS FE specification.

We test for the potential endogeneity of fiscal decentralization (FD), FD-squared, horizontal fiscal decentralization (E), and growth (G) and conduct a number of other

[22] John Bound, David Jaeger, and Regina Baker (1996) point out that if the instruments are weakly correlated with endogenous variables, IV estimation could be worse than OLS.

specification tests. Table 15 summarizes the results of this battery of tests. Following Jerry A. Hausman (1978), we estimate the Hausman test of exogeneity. We fail to reject the joint null hypothesis of exogeneity for our set of potentially endogenous variables in the equalization equation while soundly rejecting the joint null hypothesis of exogeneity in the growth equation. We further estimate a Durbin-Wu-Hausman chi-squared test statistic for the null hypothesis that a given variable is exogenous independently of the other potentially endogenous variables. The large values of the test statistics for FD, FD-squared and E in the growth equation lead us to reject the exogeneity of these three variables again. In the equalization equation, the chi-squared statistic for FD-squared is too small to reject the null hypothesis of exogeneity. However, we soundly reject the exogeneity of FD and G in the equalization equation.

Since endogeneity may go undetected due to weak instruments, James H. Stock and Motohiro Yogo (2005) provide a rule-of-thumb test for weak instruments and critical values for this statistic. The null hypothesis for this test is that all IVs are sufficiently correlated with the potentially endogenous variables that the small sample bias of 2SLS is less than the bias of FE. Using the Cragg-Donald Wald F values, the weak identification tests show that the bias of the IV estimate of the growth equation is less than 5 percent that of the OLS estimates. In other words, the set of instruments are sufficiently, strongly correlated with the potentially endogenous variables that the small sample bias of 2SLS is small relative to that of OLS.

Finally, John D. Sargan (1958), Lars Peter Hansen (1982), and Lars Peter Hansen and Kenneth J. Singleton (1982) show in a GMM context that when the number of moment conditions exceeds the number of parameters to be estimated, a chi-square test can be used to determine whether the instruments are orthogonal to the error term. The values of the Sargan statistics for the test of over identifying restrictions in the growth and equalization equations are

5.04 and 0.07, respectively. These values fail to reject the null hypothesis that the instruments are exogenous, providing further evidence that the instruments are valid.

To further test the robustness of these results, we use our data to conduct an "extreme-bounds analysis" (EBA) for the growth equation, based on the work of Edward Leamer (1978, 1983, and 1985), Ross Levine and David Renelt (1992), and Tao Zhang and Heng-Fu Zou (1998). In our base scenario, we include the variables of primary interest (I), specifically fiscal decentralization (FD), squared fiscal decentralization and horizontal fiscal equalization (E), and the main model variables (M), including capital (K), labor (L) as approximated by natural logarithm of state population, central revenue share in GDP (CT), and state revenue share in GSDP (ST). We proceed by estimating thousands of variations of the base scenario described above, by adding every combination of the remaining 28 variables in sets including 0 to four (4) optional variables (O). Then, we identify the control set of optional variables that give us minimum and maximum values of the estimated coefficients of each of the primary variables of interests and the main variables.

Table 16 summarizes the results of our extreme bounds analysis. Among the set of interesting (I) and main (M) variables, only the estimated coefficients of central revenue share in GDP (CT) are same signed and more than two standard deviations from zero for all combinations up to 4 of the optional variables. Therefore, CT is the only robust variable among all the growth determinants considered in this study. The lower bound estimate for fiscal decentralization (FD) is negative while the base and upper bound values are positive. All the three estimates for FD-squared are positive but the base estimate is statistically insignificant at conventional levels. The three estimates for equalization (E) are negative but the upper and base bounds are statistically insignificant at conventional levels. Therefore, these two variables are

fragile, as are the other main model variables. Based on these findings, we are somewhat assured that it is appropriate to include fiscal decentralization, equalization, capital, labor, and central revenue share in GDP (CT) in the growth equation.

Conclusions

We do not find evidence in support of the hypothesized trade-off between economic growth and horizontal fiscal equalization. Instead, we find that growth has a positive effect of on horizontal fiscal equalization. We also find that fiscal decentralization has a non-linear effect on growth. In the 0 to 21 range, the effect is negative and for values greater than 21 the effect is positive. In our sample, however, the index of fiscal decentralization is substantially less than 21, meaning that fiscal decentralization is having a negative effect on growth in India. Surprisingly, we find no evidence to support claims that the economic reform program enacted in India in the early 1990s is having any effect on growth or horizontal fiscal equalization.

Chapter IV: Conclusions

In this chapter, we try to pull together the results from these two case studies of China and India's experience with fiscal decentralization and horizontal fiscal equalization. China and India's growth experiences are extremely important if for no other reason that the number of people effected by their economic policies. Inequality, in terms of either per capita regional income or per capita regional expenditures, still remains substantial in both China and India. Based on the 2008 United Nations Human Development Report, about 16 percent of the population in China and 42 percent in India are still living under 1.25 dollars a day in 2006, in purchasing-power parity terms. Economic growth with inequality in both countries has displaced millions of rural and urban poor from their land and livelihoods. The underbelly of this growth experience is unprecedented level of regional disparities, unrest, and worsening human well-being in rural areas, at least in the modern era.

Horizontal fiscal equalization is playing a role in achieving a more uniform level of public-service provision nationwide, at least in terms of per capita expenditures. We do not find any evidence in either country to support the hypothesized trade-off between horizontal fiscal equalization and economic growth. In fact, we find evidence that economic growth is having a weak positive effect of economic growth, at least in the case of India.

That our results for China differ from those of Qiao et al. (2008) may have several potential explanations. First, in both cases, we fully account for the dual fiscal accounts, namely budget and extra-budget accounts for China. In the case of India, we account for the revenue and capital accounts. Second, we extend the study period to 2005, while Qiao et al. (2008) only cover the period through 1998. The longer study period in our study better captures the effects of the 1994 TSS reform in China. Our data also straddle the 1991 economic reforms in India. Third, we

address the potential endogeneity of fiscal decentralization (and its second moment), equalization, and growth. Fourth, in the case of China, we use a more complete control set, such as openness to international trade, foreign direct investment, and the rate of inflation in the growth equation and the share of missing women in the equalization equation. Fifth, our data are from the China Data Center at the University of Michigan, which is a neutral third-party and therefore may be more reliable than the data used in Qiao at al. (2008). Finally, this study examines both China and India, and the results are generally consistent in both cases. This perhaps gives us more confidence in concluding that there is no trade-off between equalization (E) and growth (G). Our findings also stress the importance of accounting for extra-budget accounts in China, as Qiao et al. (2008), Christine Wong (1998), and others stress in their writings on China.

The implications of our findings are straightforward. First of all, fiscal decentralization has different effects in different countries, possibly because the details matter and the details differ. Therefore, cross country growth regressions with a single scalar measure of fiscal decentralization are undoubtedly highly problematic. For the case of India, we find substantial evidence that economic growth contributes to horizontal fiscal equalization. Furthermore, the policy of interregional fiscal equalization does not appear to hurt growth.

In both countries, fiscal decentralization has a non-linear effect on growth. The relationship between fiscal decentralization and growth for China and India is illustrated in Figure 7. Several features of this graph are noteworthy. The minimum point (FD = 10) and the point (FD = 20, 21) where fiscal decentralization changes from having a negative to a positive effect on growth are remarkably similar for these two countries. Finally, fiscal decentralization seems to be having a greater impact on growth in India than in China. This may reflect the fact

that in India fiscal decentralization has not gone beyond the state level. Whereas, in China, the third-tier of government or local government plays an important role in development policy.

The economic reforms in China and India are delivering tremendous economic benefits to the people of both countries. China's 1994 Tax Sharing System reform not only is increasing economic growth but also equalization of per capita provincial expenditures. India's policies of in-depth marketization and liberalization are increasing the economic growth rate of the country, but the effect on equalization of per capita expenditures is not as favorable as in the case of China. This finding is somewhat surprising that India is a democracy, and China is not. This may point to the problem with patronage politics in ethnically fragmented countries like India. But, that is a story for another day.

Appendix A

Table 1: China's Statutory Revenue Assignments in 1993 and 2007

Assignment of functions	Main Revenues	1993		2007	
		central	sub-national	central	sub-national
Exclusively assigned to the central government	Customs duties	100	0	100	0
	Value added taxes and excise taxes on imports	100	0	100	0
	Tax reimbursements for export of foreign trade businesses	100	0	100	0
Exclusively assigned to sub-national governments	Urban maintenance & construction taxes (other than from railways corporations, banks, & non-bank financial institutions like insurance businesses)	0	100	0	100
	Vehicle and vessel sales, use taxes	0	100	0	100
	Profit remittances from sub-national SOEs	0	100	0	100
	Real estate taxes in urban and township areas and land use-related taxes	0	100	0	100
	Stamp taxes other than those on security	0	100	0	100
	Deed taxes	0	100	0	100
	Fixed asset investment regulation taxes (suspended in 2000)	0	100	0	100
	Banquet taxes (mostly abolished in 2002)	0	100	n.a.	n.a.
	Agricultural taxes (abolished in 2005)	0	100	n.a.	n.a.
	Slaughter taxes (abolished in 2006)	0	100	n.a.	n.a.
Shared taxes	Value Added Taxes (VAT)	12	88	75	25
	Product / Excise taxes	57	43	100	0
	Corporate Income Taxes (CIT)	78	22	64	36
	Personal Income Taxes (PIT)	0	100	60	40
	Business taxes	8	92	3	97
	Stamp taxes on security transaction	50	50	97	3
	Agricultural sector taxes	8	92	97	3
	Other taxes	n.a.	n.a.	20	80
	Tax revenues	21	79	58	42
	Non-tax revenues	98	2	24	76
	Total revenues	33	67	54	46

Sources: Document No. 85 about 1994 Tax Sharing System Reform by the State Council, other State Council documents since 1994, Finance Yearbook of China 1994, 2008 and reports from Ministry of Finance.

Notes:

1) CIT in 1993 refers to SOEs only.

2) The product taxes were replaced by excise taxes/consumption tax in 1994.

3) Taxes on the agricultural sector include husbandry tax, contract tax, special agricultural product taxes, arable land use tax and other agriculture-related taxes and charges.

Table 2: China's Statutory Expenditure Assignments in 1993 and 2007

Assignment of function	Main Responsibilities	1993		2007	
		central	sub-national	central	sub-national
Exclusive responsibility of the central government	National defense	100	0	100	0
	Foreign affairs, aid and debt service	100	0	100	0
	International trade policies	100	0	100	0
	National fiscal and monetary policies	100	0	100	0
	National infrastructure	100	0	100	0
	Operation of the central government and central judicial organs	100	0	100	0
	National projects	100	0	100	0
	Technical renovation, research and development by central SOEs	100	0	100	0
	Macroeconomic control, coordination among regions, redistribution like transfers among regions	100	0	100	0
Exclusive responsibility of sub-national governments	Local parks, recreation, fire safety and other local public services	0	100	0	100
	Sub-national projects, infrastructure and housing	0	100	0	100
	Technical renovation, research and development by sub-national SOEs	0	100	0	100
	Operation of sub-national governments and sub-national judicial organs	0	100	0	100
	Sub-national water, power, sewage, waste disposal and welfare	0	100	0	100
Concurrent responsibility	Expenses on economic development such as capital investment and accumulation	69	31	69	31
	Education and culture	11	89	7	93
	Public health and sanitation	49	51	2	98
	Science and technology	33	67	52	48
	Social security such as pensions and unemployment insurance	1	99	6	94
	Subsidies on agriculture and others	10	90	9	91
	Public security	25	75	17	83
	Expenditures on industry, transportation and commerce including environmental protection, urban maintenance and construction	32	68	34	66
	Administration expenses	8	92	25	75
	Interest payments on debts	100	0	94	6

Sources: the Constitution of People's Republic of China in 1982 and amendments through 2004, Finance Yearbook of China 1994 and 2008.
Notes: Capital construction in 2007 is calculated by the author based on reports from the Ministry of Finance in 2008 due to the expenditure accounting change in 2007.

Table 3: Variable Definitions for the China Regressions

D	Dependent variables
E	The degree of horizontal fiscal equalization measured by the distance between provincial budgetary expenditure per capita and the mean value of provincial budgetary expenditures per capita, normalized by the mean value.
G (1)	The real growth rate of provincial income.
G (2)	The rate of growth in nominal Gross Regional Product (GRP) per Capita.
G (3)	The rate of growth in nominal GRP.
G (4)	The rate of growth in real GRP per Capita.
I	**Explanatory variables of interest**
FD (1)	The degree of fiscal decentralization as measured by the ratio of provincial budgetary expenditures to central budgetary expenditures in per capita terms.
FD (2)	The degree of fiscal decentralization as measured by the ratio of consolidated provincial expenditures to consolidated central expenditures in per capita terms.
FD (3)	The degree of fiscal decentralization measured by the marginal retention rate of provincial budgetary revenues.
FD (4)	The degree of fiscal decentralization as measured by the share of provincial budgetary expenditures in the sum of provincial budgetary expenditures and central budgetary expenditures in per capita terms.
FDSQR	The square of the degree of fiscal decentralization.
M	**Main explanatory variables**
CT	Central budget revenues as a share of Gross Domestic Product.
K (1)	The change in the stock of capital as measured by the ratio of fixed assets investment to provincial income.
K (2)	The change in the stock of capital as measured by the growth rate of fixed assets investment.
L (1)	The growth rate of provincial labor force.
L (2)	The growth rate of total population.
PT	The average provincial tax rate as measured by provincial tax revenues as a share of provincial income.
PTSQR	The square of the provincial tax rate to control for possible nonlinear effects.
Z	**Optional explanatory variables of interest**
AGRS	Agricultural share in GRP.
CADM	The share of central budgetary administration expenditures in total central budgetary expenditures.
CATD	Catastrophe dummy for natural disasters like flood, earthquake, etc.
CDEV	The share of central budgetary development expenditures in total central budgetary expenditures (development expenses include capital construction, enterprise upgrading, technical R&D and subsidies to agricultural sector).
CDFN	The share of central budgetary defense expenditures in total central budgetary expenditures.
CHUM	The share of central budgetary human capital expenditures in total central budgetary expenditures (human capital expenditure includes culture, education, healthcare and science).
F	The degree of openness measured by the share of total exports plus imports in provincial income.
FISCAP	Fiscal capacity as measured by a 3-year moving average of real GRP per capita.
FPMP	The price of farm products relative to the price of non-farm products as measured by the ratio of the real procurement price index of farm products to the real price index of manufactured goods in rural areas.
GOVS	Government size measured by the share of consolidated expenditures in GRP
HRS	A measure of the household responsibility system as measured by the percentage of production teams in rural areas that adopted the system.
LNFDI	Log of foreign direct investment per capita.
LNPOP	Log of provincial total population.
MWS	The share of missing women in total population based on methods by A. Coale and J. Banister (1994).
NSOESH	The share of output value of non-State Owned Enterprises in the total value of industrial output.
NT	The national tax rate defined as the share of national budgetary revenues in GDP.
PADM	The share of provincial budgetary administration expenditures in total provincial budgetary expenditures.
PDEV	The share of provincial budgetary development expenditures in total provincial budgetary expenditures.
PHUM	The share of provincial budgetary human capital expenditures in total provincial budgetary expenditures.
POPSHR	The rate of growth in the rural population.
PSSS	The percentage of graduates in primary schools entering into secondary schools
PURB	The share of provincial budgetary urban maintenance expenditures in total provincial budgetary expenditures.
R	Inflation rate as measured by the percentage change in the general retail price index.
TSS	Fiscal regime reform dummy, “0” for years before 1994 and “1”, otherwise.
XBGT	The ratio of extra-budgetary expenditures to budgetary expenditures.

Table 4: Summary of Previous Findings for China

	Variable Name	Zhang and Zou (1998)[1]		Lin and Liu (2000)[1]	Ding (2007)[2]	Q-M-X (2008)[3]	
		model (1) 1980-1992	model (2) 1987-1993	1970-1993	1994-2002	Growth equation 1985-1998	Equalization equation 1985-1998
Variables of interest: I	G	G (1)	G (1)	G (2)	G (3)	G (3)	-0.003 (-1.68)
	E					-41.598 (-4.92)	G (3)
	FD (1)	-0.011 (-2.743)	-2.504 (-2.765)				
	FD (2)				0.217 (3.030)		
	FD (3)			0.0362 (2.703)			
	FD (4)					367.137 (3.23)	-1.687 (-5.27)
	FDSQR (4)					-368.043 (-3.85)	
Main variables: M	K (1)		-0.055 (0.581)				
	K (2)			0.0478 (3.819)	0.093 (8.460)	0.125 (4.95)	
	L (1)	0.088 (0.221)	0.295 (0.685)			1.323 (7.13)	
	L (2)			-0.209 (-1.612)			
	CT	0.38 (0.841)					
	PT	-0.204 (-1.525)				-1.932 (-4.16)	-0.024 (-1.95)
	PTSQR					0.05 (4.43)	0.001 (3.12)
Optional variables: Z	NT		-14.699 (-2.514)				
	F		0.068 (0.750)		0.229 (5.050)		
	R		-0.120 (-0.737)				
	CADM		9.216 (3.283)				
	CDEV		1.681 (2.311)				
	CDFN		-7.795 (-3.352)				
	CHUM		-0.377 (-0.442)				
	PADM		-0.332 (-1.813)				
	PDEV		-0.254 (-2.006)				
	PHUM		0.304 (1.65)				
	PURB		0.155 (0.413)				
	HRS			0.0372 (1.768)			
	FISCAP			-0.144 (-5.308)			
	NSOESH			0.142 (3.163)			
	FPMP			0.0107 (1.158)			
	POPSHR			0.0446 (0.630)			
	XBGT						0.321 (4.99)
Obs.		308	125	534	227	392	392
Degree of freedom		304	111	526	224	378	382
Adj. R^2		0.039	0.688	0.52	0.375	0.49	0.24
Methods		fixed effects	random effects	fixed effects	fixed effects	2SLS fixed effects	2SLS fixed effects

Notes:
T-statistics are provided in parentheses.
[1]Zhang and Zou (1998) and Lin and Liu (2000) include 28 provinces; exclude Chongqing, Tibet and Hainan.
[2]Ding (2007) includes 30 provinces; excludes Chongqing.
[3]Baoyun Qiao, Jorge Martinez-Vazquez and Yongsheng Xu (2008) include 30 provinces; excludes Tibet; Chongqing data are combined with Sichuan's; and Hainan data are combined with Guangdong's.

Table 5: Summary Statistics for the China Sample (1985-2006)

Variable	Observation Number	Mean (Standard Deviation)	Coefficient of Variation (percent)	Minimum	Maximum
G (growth rate in real GRP per capita)	630	9.45 (4.11)	43.49	-3.70	38.10
E (horizontal fiscal equalization)	630	-0.46 (0.53)	-115.22	-3.46	0.00
FD (fiscal decentralization)	630	3.34 (2.53)	75.75	0.86	17.85
FDSQ (FD-squared)	630	17.60 (35.78)	203.30	0.73	318.46
K (growth rate of fixed asset investment)	630	20.46 (16.70)	81.62	-22.91	116.26
L (growth rate of employments)	630	1.84 (3.96)	215.22	-23.18	33.17
F (degree of openness)	630	23.94 (32.38)	135.25	2.13	184.51
R (inflation rate)	630	5.86 (7.66)	130.63	-5.5	30.20
LNFDI (natural logarithm of foreign direct investment)	630	1.75 (2.33)	133.14	-5.21	6.18
TSS (fiscal regime dummy, "1"for years ≥ 1994, "0"otherwise)	630	0.63 (0.48)	76.19	0.00	1.00
AGRS (agriculture share)	630	21.35 (10.07)	47.17	0.88	50.90
PT (provincial tax rate)	630	14.03 (6.76)	48.18	5.33	53.73
PTSQ (PT-squared)	630	242.36 (282.27)	116.47	28.38	2886.63
XBGT (extra-budget factor)	630	0.44 (0.30)	68.18	0.01	1.58
CDEV (central government development spending)	630	45.62 (12.11)	26.55	29.01	68.03
MWS (missing women share)	630	0.04 (0.01)	18.2	0.01	0.06
GOVS (government size)	630	0.20 (0.10)	50.00	0.08	0.83
LNPOP (natural logarithm of population)	630	17.19 (0.90)	5.23	14.57	18.40
CATD (catastrophe dummy)	630	0.34 (0.47)	138.23	0	1

Data Source:
1) China Data Center of the University of Michigan and the Ministry of Finance;
2) Catastrophe dummy for each year, Tian'anmen Square incident dummy and Asian Financial crisis dummy are not reported. China flood data is retrieved in April 2009 from http://www.chinawater.net.cn/flood, level B and above with "1", otherwise, "0"; other catastrophe data is retrieved in April 2009 from http://zzys.agri.gov.cn.

Table 6: Regression Results for China (1985-2006 provincial data**)**

	Growth Equation Dependent variable: G (Growth rate in real GRP per capita)			Equalization Equation Dependent variable: E (Horizontal Fiscal Equalization)		
Independent variables	**Fixed Effects**	**2SLS Fixed Effects**	**2-Step GMM**	**Fixed Effects**	**2SLS Fixed Effects**	**2-Step GMM**
G (per capita real GRP growth rate)				0.002 (0.002)	0.004 (0.006)	0.004 (0.005)
E (horizontal fiscal equalization)	1.01 (0.98)	2.28 (1.63)	2.28 (1.58)			
FD (fiscal decentralization)	-1.48*** (0.36)	-3.79*** (0.74)	-3.79*** (0.72)	0.02 (0.014)	0.03 (0.03)	0.03 (0.03)
FDSQ (squared FD)	0.07*** (0.02)	0.19*** (0.04)	0.19*** (0.04)	-0.007*** (0.0007)	-0.01*** (0.001)	-0.01*** (0.001)
K (growth rate of fixed asset investment)	0.11*** (0.01)	0.11*** (0.01)	0.11*** (0.01)	-0.0002 (0.0004)	-0.001 (0.001)	-0.001 (0.001)
F (openness)	0.01 (0.01)	0.02* (0.01)	0.02* (0.01)	0.0008** (0.0004)	0.001*** (0.0004)	0.001*** (0.0004)
AGRS (agriculture share)	-0.22*** (0.04)	-0.31*** (0.05)	-0.31* (0.05)	-0.005** (0.002)	-0.004* (0.0025)	-0.004* (0.0024)
TSS (fiscal regime dummy since 94)	2.19** (0.86)	2.92*** (0.92)	2.92*** (0.89)	0.05 (0.04)	0.09** (0.045)	0.09** (0.044)
PT (provincial tax rate)	-0.08 (0.12)	-0.06 (0.13)	-0.06 (0.13)	0.03*** (0.005)	0.04*** (0.006)	0.04*** (0.006)
PTSQ (squared PT)	-0.001 (0.002)	-0.0002 (0.003)	-0.0002 (0.002)	-0.001*** (0.0001)	-0.001*** (0.0001)	-0.001*** (0.0001)
CDEV (central government development spending)	0.13*** (0.04)	0.12*** (0.04)	0.12*** (0.04)	0.006*** (0.002)	0.008*** (0.002)	0.008*** (0.002)
GOVS (government size)	11.15** (4.47)	12.88** (5.19)	12.88*** (5.03)	-1.20*** (0.18)	-0.74*** (0.21)	-0.74*** (0.20)
L (growth rate of employments)	0.02 (0.03)	0.03 (0.03)	0.03 (0.03)			
R (inflation rate)	0.08*** (0.03)	0.13*** (0.03)	0.13*** (0.03)			
LNFDI (foreign direct investment)	0.44*** (0.13)	0.62*** (0.14)	0.62*** (0.14)			
XBGT (extra-budget factor)				-0.17*** (0.04)	-0.27*** (0.04)	-0.27*** (0.04)
LNPOP (population)				0.31** (0.13)	0.26* (0.15)	0.26* (0.14)
MWS (share of missing women)				-3.49*** (1.22)	-2.51* (1.35)	-2.51* (1.31)
Constant	7.18*** (2.49)	13.20*** (3.23)		-5.77** (2.29)	-5.26** (2.58)	
Number of observations	630	630	630	630	630	630
R-squared:	0.58	0.44	0.60	0.27	0.48	0.42
Weak identification (Stock and Yogo 2005)			8.04 The bias of IV estimates < 20% of OLS			13.75 The bias of IV estimates < 5% of OLS.
Sargan statistic			10.53 Prob=0.65			0.54 Prob=0.76

1) Standard errors are provided in parentheses.
2) *** Statistically significant at 1 percent; ** significant at 5 percent; and * significant at 10 percent.
3) Because of the simultaneity of SEM, 2SLS fixed effects and 2-step GMM for both equations are estimated with IVs.
4) Each year's catastrophe dummy, Tianánmen Square incident dummy and Asian Financial crisis dummy estimates are not reported and available upon request.

Table 7: Specifications Tests for the China Regressions

	Hausman test: IV regression versus regression without IV [1]		**Durbin-Wu-Hausman test [2]**					
	Growth equation	Fiscal Equalization Equation	Growth Equation			Fiscal Equalization Equation		
			E	FD	Squared FD	G	FD	Squared FD
Chi-Square	14.25	43.64	0.95	0.13	3.35	0.18	27.34	54.43
P-value	0.99	0.15	0.33	0.72	0.07	0.67	0.00	0.00
Implication of test	Fail to reject the null	Fail to reject the null	Fail to reject exogeneity	Fail to reject exogeneity	Reject the exogeneity at 10%	Fail to reject exogeneity	Soundly reject exogeneity	Soundly reject exogeneity

Notes:
[1] For the Hausman test, the null hypothesis is that the two system estimates are not statistically significantly different from each other.
[2] For the Durbin-Wu-Hausman tests, the null hypothesis is that the tested variable is exogenous.
*The instruments for E, FD and Squared FD in the growth equation are: XBGT, CDFN, MWS, one and two lagged-value of FD, one lagged value of E, the interactive of XBGT and MWS, the interactive of XBGT and CDFN, the interactive of MWS and CDFN, squared MWS, squared XBGT, squared CDFN, the interactive of squared XBGT and CDFN, the interactive of cubic XBGT and CDFN, the cubic CDFN, the interactive of squared MWS and squared CDFN;
**The instruments for G, FD and Squared FD in the equalization equation are: one and two lagged-value of FD, one lagged-value of G, squared one lagged value of G, squared one lagged value of FD.

Table 8: Extreme Bounds Analysis for China
(Dependent Variable: Growth Rate of Real Per Capita GRP, 1949-2008, Fixed Effect)

Variable type	Variables		Coefficient	Standard error	t value	# of Obs.	R - square	Other variables	Robust / Fragile
I variables	FD	high	0.65	0.31	2.09	1151	0.43	CT, PHUM, CHUM, LNFISCAP	Fragile
		base	-0.35	0.26	-1.36	1237	0.36		
		low	-1.09	0.29	-3.72	900	0.33	PDEV, AGRS, PSSS, CATD	
	Squared FD	high	0.06	0.024	2.56	900	0.33	PDEV, AGRS, PSSS, CATD	Fragile
		base	0.013	0.02	0.62	1237	0.36		
		low	0.03	0.014	1.97	702	0.50	CT, LNFDI, PADM, CDFN	
	E	high	N/A	N/A	N/A	N/A	N/A	N/A	Fragile
		base	-0.24	0.61	-0.39	1237	0.36		
		low	N/A	N/A	N/A	N/A	N/A	N/A	
M variables	K	high	0.15	0.007	21.68	659	0.52	LNFISCAP, NT, CT, XBGT	Robust
		base	0.12	0.006	21.36	1237	0.36		
		low	0.08	0.006	14.75	904	0.35	CT, CADM, CDFN, PSSS	
	L	high	0.31	0.05	5.92	1164	0.38	CDEV, PDEV, CHUM, PHUM	Robust
		base	0.23	0.05	4.86	1237	0.36		
		low	0.08	0.04	2.00	914	0.36	LNFISCAP, CDFN, AGRS, PSSS	
	F	high	0.03	0.009	3.24	883	0.37	LNFISCAP, PADM, AGRS, PSSS	Fragile
		base	0.012	0.009	1.39	1237	0.36		
		low	0.01	0.005	1.97	654	0.53	XBGT, LNFDI, PADM, CDEV	
	R	high	0.10	0.02	4.69	575	0.51	CDEV, XBGT, CHUM, PSSS	Fragile
		base	-0.006	0.007	-0.82	1237	0.36		
		low	-0.006	0.007	-0.82	1237	0.36		

Notes:

1) Regression model form: $Y_{it}=\beta_i I_{it} + \beta_m M_{it}+ \beta_z Z_{it} +\mu_i + e_{it}$ based on Levine and Renelt (1992), where I_{it} are the explanatory variables of interest, M_{it} are the main explanatory variables, and Z_{it} are the other explanatory variables. The base estimates are from the regression that includes the explanatory variables of interest (I-variables) and the main explanatory variables (M-variables), which are included in every regression.
2) The robust/fragile designation follows that of Levine and Renelt (1992). if the high, base, and low estimated coefficients all have the same sign and are more than two standard deviations from zero, then the variable is said to be robust; otherwise, it is said to be fragile.
3) N/A implies that no bounds are found at the conventional 95% confidence intervals.

Table 9: Comparison of Results for China

Q-M-X model

	The original estimates of Q-M-X, 1985-1998		1985-1998, our data		1985-2006, our data		1949-2008, our data	
	Growth equation	**Equalization equation**	**Growth equation**	**Equalization equation**	**Growth equation**	**Equalization equation**	**Growth equation**	**Equalization equation**
Intercept	-75.711** (-2.05)	0.551** (2.08)	3.99 (67.30)	0.30 (0.30)	102.84* (56.30)	-0.13 (0.17)	16.18*** (4.00)	-0.74*** (0.08)
G (growth)		-0.003 (-1.68)		0.002 (0.002)		0.002 (0.0018)		-0.001 (0.001)
E (equalization)	-41.598*** (-4.92)		-5.40 (7.84)		24.16** (12.05)		11.77*** (3.60)	
FD (fiscal decentralization)	367.137*** (3.23)	-1.687*** (-5.27)	79.14 196.60)	-1.05** (0.42)	-276.77** (164.84)	-0.575** (0.27)	-22.85** (11.10)	1.61*** (0.27)
Squared FD	-368.043*** (-3.85)		-103.22 (151.60)		238.49* (128.67)		40.7*** (10.00)	-2.14*** (0.26)
Number of observations	392	392	364	364	588	588	1461	1461
R-squared	0.51	0.26	0.23	0.01	0.06	0.002	0.30	0.17

Notes: 1) Q-M-X model refers to the model in Baoyun Qiao, Jorge Martinez-Vazquez and Yongsheng Xu (2008); 2) All of the estimates are panel 2SLS fixed effects; 3) *** Statistically significant at 1 percent; ** significant at 5 percent; and * significant at 10 percent; 4) In parentheses are standard errors of relevant estimates except those for the original estimates of Q-M-X, whose are t-statistics; 5) The ratio of extra-budget over budget expenditures is available from 1985 to 2006; 6) Employment growth rate is a proxy for labor force growth rate in (Qiao et al. 2008); 7) Other explanatory variable estimates are not reported in this table and available upon request.

Table 10: India's Statutory Expenditure Assignments

Main Responsibilities	Assignments
National defense and others related to intelligence & forces of the Union Foreign affairs, foreign loans & public debts International trade, treaties, conferences, and social order on the high seas International civil affairs like naturalization, migration, & pilgrimages, etc. National fiscal and monetary tools like currency, Reserve Bank of India, Post Office Savings Bank, lotteries, banking, insurance, stock market, future market, & other derivative markets. National infrastructures like airways, railways, national highways, national waterways, maritime shipping & navigation, lighthouses, ports, posts & telegraphs, telephones, wireless, broadcasting, properties of the Union Interstate trade and commerce, Intellectual Property Rights protection Establishment of standards of weight and measure; Regulation of goods to be exported abroad or interstate Natural resources regulation, Cultivation, manufacture, and sale for export of opium Coordination and standardization of higher education and research National heritages and institutions, Union public services, All-India services, Census Elections to Parliament and Legislatures of the states, Offices of President Operation of the Union government, Parliament and the Union judicial organs Audit of the accounts of the Union and the States Interstate migration and quarantine Jurisdiction and powers of all matters on List I except the Supreme Court; Any other matter not in List II or List III	List I-Union List
Criminal laws & procedures about the matters not in List I & II Transfer of property other than agricultural land; Many domestic civil laws concerning marriage, family, and so on Contracting other than agricultural land; Bankruptcy and insolvency, Trust and Trustees Administration of Justice except the Supreme Court and the High Courts Vagrancy; nomadic, and migratory tribes; National environment, animal and plants protection Economic and social planning including family planning; Commercial and industrial monopolies, combines, and trusts Trade unions; industrial and labor disputes; Charities and religions Social security and social insurance, welfare of labor; Education and Legal, medical, and other professions Interstate public health; Vital statistics; Price control; Mechanically propelled vehicles, factories, boilers, electricity, Jurisdiction and powers of all matters on List III except the Supreme Court	List III-Concurrent List for the Union and State
Public order except that subject the control of the Union Operation of State governments & local governments, the Legislatures of the states, the State judicial and correction Public goods and services such as public health & sanitation, pilgrimages, social relief, regulation of intoxicating burials & cremations, public libraries & museums, communications not in List I, water, land, fisheries, gas, markets & fairs, inns, sports, entertainments, gambling, incorporations other than those in List I Agriculture, Trade and Commerce within the State Public debt of the State, Treasure trove Jurisdiction and powers of all matters on List II except the Supreme Court	List II-State List

Summarization and compilation by author based on the Seventh, Eleventh and Twelfth Schedules of the Constitution of India and the Amendments until Dec 2007.

Table 11: India's Statutory Revenue Assignments

Main tax revenues	Assignments
Taxes on income other than agricultural income Duties of customs including export duties Duties of excise on tobacco and other goods Corporation tax Estate duty with respect to property other than agricultural land Taxes on the capital value of the assets, exclusive to agricultural land Estate duty with respect to property other than agricultural land Duties with respect to succession to property other than agricultural land Terminal taxes on goods or passengers carried by railway, sea, or air, on railway Taxes other than stamp duties on transactions in stock exchanges and future Rates of stamp duty with respect to bill of exchange, cheques, promissory notes, letters of credit, policies of insurance, transfer of shares, debentures, proxies, Taxes on the sale or purchase of newspapers and on advertisements published Taxes on the consignments of interstate goods trade or commerce Taxes on services Residuary tax powers not specified in List II and III Fees in respect of any of the matters in List I	List I-Union List
Recovery in a State of claims with respect to taxes and other public demands arrears of land-revenue and sums recoverable as such arrears, arising outside Stamp duties other than duties or fees collected by means of judicial stamps, but including rates of stamp duty Fees with respect to any of the matters in List III	List III-Concurrent List for the Union and State
Taxes on agricultural income Duties with respect to succession to agricultural land Estate duty with respect to agricultural land Taxes on lands and buildings Taxes on mineral rights Duties of excise on the following goods manufactured or produced in the state Taxes on the entry of goods into a local area for consumption, use or sale Taxes on the consumption or sale of electricity Taxes on the sale or purchase of goods except newspapers and advertisements on Taxes on advertisements other than advertisements published in the newspapers Taxes on goods and passengers carried by road or on inland waterways Taxes on vehicles, boats, and animals; tolls Taxes on professions, trades, callings, and employment Capitation taxes Taxes on luxuries, entertainment, and gambling Rates of stamp duty with respect to documents other than those specified in List I Fees in respect of any of the matters in List II	List II-State List

Summarization and compilation by author based on the Seventh, Eleventh and Twelfth Schedules of the Constitution of India and the Amendments until Dec 2007

Table 12: Variable Definitions for the India Regressions

D	Dependent variables
E	The degree of horizontal fiscal equalization measured by the distance between provincial budgetary expenditure per capita and the mean value of provincial budgetary expenditures per capita, normalized by the mean value.
G	Growth rate of real Gross State Domestic Product (GSDP) per capita.
I	**Explanatory variables of interest**
FD	The degree of fiscal decentralization as measured by the ratio of consolidated state expenditures to consolidated central expenditures in per capita terms (including revenue expenditures and capital expenditures).
FDSQR	The square of the degree of fiscal decentralization.
M	**Main explanatory variables**
CT	Central tax rate defined as central revenue receipts as a share of nominal Gross Domestic Product (GDP).
K	Log of capital outlays per capita.
LNPOP	Log of state population as a proxy of labor force.
ST	State tax rate defined as state revenue receipts as a share of nominal GSDP.
Z	**Optional explanatory variables of interest**
CERE	The ratio of capital expenditures over revenue expenditures.
CETE	The capital expenditures as a share of consolidated expenditures.
CRTR	The capital receipts as a share of consolidated receipts.
ER	Economic reform dummy since 1991, “1”for years 1991 and after 1991, “0”, otherwise.
FDR	The fiscal dependence rate defined as central grants share in consolidated receipts.
FSR	The fiscal self-reliance rate defined as state own tax and non-tax revenues as a share of total revenue receipts.
MWS	The share of missing women in total population based on hypothetical ratio by Sen (1990).
CATD	Catastrophe dummy for natural disasters like flood, earthquake, etc.
GDTE	The transfer dependence rate defined as gross devolution as a share of consolidated expenditures.
GLTD	The net central loans as a share of state outstanding liabilities.
GOVS	Government size measured by the share of consolidated expenditures in nominal GSDP.
GTR	Gross fiscal deficit as a share of consolidated revenues.
IPGD	The interest payment and repayment as a share of gross devolution.
LEPC	Log of consolidated expenditures per capita.
LRPC	Log of consolidated revenues per capita.
MLTD	The net market loans as a share of state outstanding liabilities.
NDD	The net devolution dependence defined net devolution as a share of consolidated expenditures.
NDGD	The net devolution as a share of gross devolution.
NT	National tax rate defined as national revenue receipts as a share of nominal GDP.
NTA	Non-tax autonomy defined as own non-tax revenues as a share of total revenue receipts.
PDG	The primary deficit as a share of nominal GSDP.
PDTR	The primary deficit as a share of total revenue receipts.
RDG	The revenue deficit as a share of nominal GSDP.
RDTR	The revenue deficit as a share of total revenue receipts.
TA	Tax autonomy defined as sum of own tax revenues and share in central taxes as a share of total revenue receipts.

Notes: Other optional explanatory variables that produce neither highest estimates nor lowest estimates are not reported here and can be available upon request.

Table 13: Summary Statistics for the India Sample (1980-2005**)**

Variable	Observation Number	Mean (Standard Deviation)	Coefficient of Variation (percent)	Minimum	Maximum
G (growth rate in real GSDP per capita)	562	4.67 (13.65)	292.30	-43.70	81.67
E (horizontal fiscal equalization)	562	-0.51 (0.55)	-107.84	-4.78	0.00
FD (fiscal decentralization)	562	1.65 (1.48)	89.70	0.27	12.18
FDSQ (FD-squared)	562	4.93 (14.58)	295.74	0.07	148.35
K (log of capital outlays per capita)	562	5.55 (1.27)	22.88	1.07	8.71
LNPOP (log of state population as a proxy of labor force)	562	16.64 (1.59)	9.55	13.00	19.15
CT (central tax rate)	562	0.09 (0.006)	6.67	0.09	0.11
ST (state tax rate)	562	0.25 (0.23)	92.00	0.07	1.95
FSR (fiscal self-reliance rate)	562	0.50 (0.26)	52.00	0.06	0.95
FDR (fiscal dependence rate)	562	0.29 (0.24)	82.76	0.03	1.00
MWS (missing women share)	562	0.03 (0.01)	33.33	0.003	0.06
CATD (catastrophe dummy)	562	0.17 (0.38)	223.53	0	1

Data Sources:
1) Directorate of Economics & Statistics of respective State Governments, and for All-India -- Central Statistical Organization;
2) Reserve Bank of India;
3) Missing women data is hypothetical and calculated by author based on Sen (1990);
4) Catastrophe dummy for each year is not reported. Natural disaster data is retrieved in October 2009 from http://www.ndmindia.nic.in

Table 14: Regression Results for India (1980-2005 state-wise data**)**

	Growth Equation Dependent variable: G (growth rate of real GSDP per capita)			Equalization Equation Dependent variable: E (Horizontal Fiscal Equalization)		
Independent variables	**Fixed Effects**	**2SLS Fixed Effects**	**2-Step GMM**	**Fixed Effects**	**2SLS Fixed Effects**	**2-Step GMM**
G (growth rate of real GSDP per capita)				0.0008* (0.00043)	0.008*** (0.003)	0.008*** (0.003)
E (horizontal fiscal equalization)	7.13 (4.43)	-9.61 (11.27)	-9.61 (10.96)			
FD (fiscal decentralization)	4.93 (3.75)	-62.38*** (12.71)	-62.38*** (12.35)	-0.16*** (0.03)	0.33* (0.18)	0.33* (0.18)
FDSQ (squared FD)	0.11 (0.31)	3.05*** (1.04)	3.05*** (1.02)	-0.015*** (0.002)	-0.04*** (0.01)	-0.04*** (0.01)
LNPOP (log of state population)	-19.25*** (4.30)	-50.86*** (7.89)	-50.86*** (7.67)	0.04 (0.04)	0.44*** (0.16)	0.44*** (0.16)
ER (Economic reform dummy, "1"for years ≧ 1991, "0"otherwise)	-4.70** (2.21)	3.76 (3.26)	3.76 (3.17)	0.12*** （0.02）	-0.01 （0.06）	-0.01 （0.06）
K (log of capital outlay per capita)	4.04*** (1.26)	13.25*** (2.15)	13.25*** (2.09)			
CT (central tax rate)	252.18* (128.96)	-54.98 (182.53)	-54.98 (177.46)			
ST (state tax rate)	-23.30*** (14.28)	16.87 (33.27)	16.87 (33.34)			
MWS (missing women share)				-4.28*** (1.34)	-6.75*** (2.13)	-6.75*** (2.07)
FSR (fiscal self-reliance rate)				-0.10 (0.13)	-0.79** (0.40)	-0.79** (0.39)
FDR (grants dependence rate)				0.12 (0.10)	0.05 (0.15)	0.05 (0.15)
Constant	282.22*** (72.09)	859.85** (139.60)		-0.74 (0.70)	-7.69*** (2.73)	
Number of observations	562	522	522	562	502	502
R-squared:	0.002	0.003	-0.44	0.70	0.36	0.10
Weak identification (Stock and Yogo 2005)			14.55 The bias of IV estimates < 5% of OLS			3.04 The critical values are not availabel.
Sargan statistic			5.04 Prob=0.17			0.07 Prob=0.80

1) Standard errors are provided in parentheses.
2) *** Statistically significant at 1 percent; ** significant at 5 percent; and * significant at 10 percent.
3) Because of the simultaneity of SEM, 2SLS fixed effects and 2-step GMM for both equations are estimated with IVs.
4) Each year's catastrophe dummy estimate is not reported and available upon request.

Table 15: Specifications Tests for the India Regressions

	Hausman test: IV regression versus regression without IV [1]		**Durbin-Wu-Hausman test [2]**					
	Growth equation	Fiscal Equalization Equation	Growth Equation			Fiscal Equalization Equation		
			E	FD	Squared FD	G	FD	Squared FD
Chi-Square	48.80	10.60	3.52	52.24	8.46	12.43	6.20	0.68
P-value	0.006	0.99	0.06	0.00	0.00	0.00	0.01	0.41
Implication of test	Soundly reject the null	Fail to reject the null	Reject exogeneity at 10%	Soundly reject exogeneity	Soundly reject exogeneity	Soundly reject exogeneity	Soundly reject exogeneity	Fail to reject exogeneity

Notes:
[1] For the Hausman test, the null hypothesis is that the two system estimates are not statistically significantly different from each other.
[2] For the Durbin-Wu-Hausman tests, the null hypothesis is that the tested variable is exogenous.
*The instruments for E, FD and Squared FD in the growth equation are: MWS, one lagged-value of FD, one lagged value of E, squared one lagged value of E, cubic term of one lagged value of E, the interactive between one lagged value of E and one lagged value of FD;
**The instruments for G, FD and Squared FD in the equalization equation are: one lagged-value of FD, one lagged-value of G, squared one lagged value of G, squared one lagged value of FD.

Table 16: Extreme Bounds Analysis for India
(Dependent Variable: Growth Rate of Real Per Capita GSDP, 1980-2005, Fixed Effects)

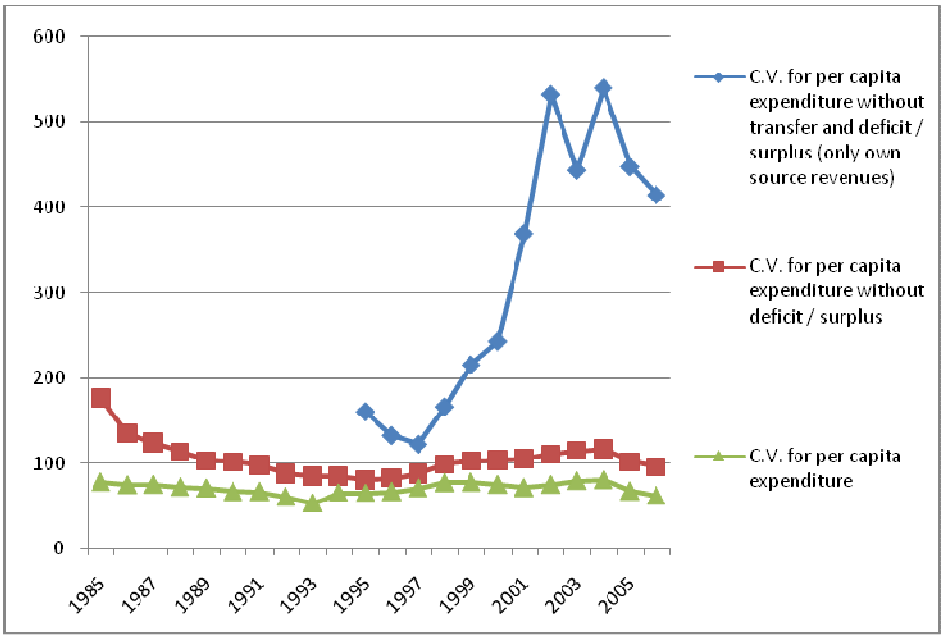
Variable type	Variables		Coefficient	Standard error	t-value	Number of Observations	R-square	Other variables	Robust / Fragile
I - variables	FD	high	6.09	2.80	2.18	508	0.06	FSR, NT, GOVS, IPGD	Fragile
		base	0.84	2.10	0.40	596	0.02		
		low	-17.03	4.82	-3.53	499	0.07	TA, MLTD, PDG, LEPC	
	Squared FD	high	1.09	0.29	3.78	580	0.07	FSR, RDG, LEPC, GLTD	Fragile
		base	0.03	0.21	0.14	596	0.02		
		low	0.45	0.23	1.97	596	0.06	CRTR, LRPC, CETE, NT	
	E	high	-0.15	2.62	-0.06	596	0.02		Fragile
		base	-0.15	2.62	-0.06	596	0.02		
		low	-15.66	4.10	-3.82	499	0.07	TA, MLTD, PDG, LEPC	
M - variables	K	high	N/A	N/A	N/A	N/A	N/A	N/A	Fragile
		base	0.23	1.33	0.17	596	0.02		
		low	N/A	N/A	N/A	N/A	N/A	N/A	
	LNPOP	high	2.21	1.12	1.97	582	0.07	FSR, CRTR, LRPC, DR	Fragile
		base	-0.24	0.92	-0.27	596	0.02		
		low	-0.24	0.92	-0.27	596	0.02		
	CT	high	1476.13	353.88	4.17	500	0.06	PDTR, IPGD, GLTD, NT	Fragile
		base	236.76	101.19	2.34	596	0.02		
		low	197.86	100.13	1.98	596	0.06	FSR, RDTR, KG, LEPC	
	ST	high	44.87	20.53	2.19	549	0.04	CETE, GOVS, MLTD, NT	Fragile
		base	-9.30	6.98	-1.33	596	0.02		
		low	-52.90	12.39	-4.27	596	0.08	FSR, CRTR, LRPC, RDG	

Notes:

1) Regression model form: $Y_{it}=\beta_i I_{it} + \beta_m M_{it}+ \beta_z Z_{it} +\mu_i + e_{it}$ based on Levine and Renelt (1992), where I_{it} are the explanatory variables of interest, M_{it} are the main explanatory variables, and Z_{it} are the other explanatory variables. The base estimates are from the regression that includes the explanatory variables of interest (I-variables) and the main explanatory variables (M-variables), which are included in every regression.
2) The robust/fragile designation follows that of Levine and Renelt (1992). if the high, base, and low estimated coefficients all have the same sign and are more than two standard deviations from zero, then the variable is said to be robust; otherwise, it is said to be fragile.
3) N/A implies that no bounds are found at the conventional 95% confidence intervals.

Appendix B

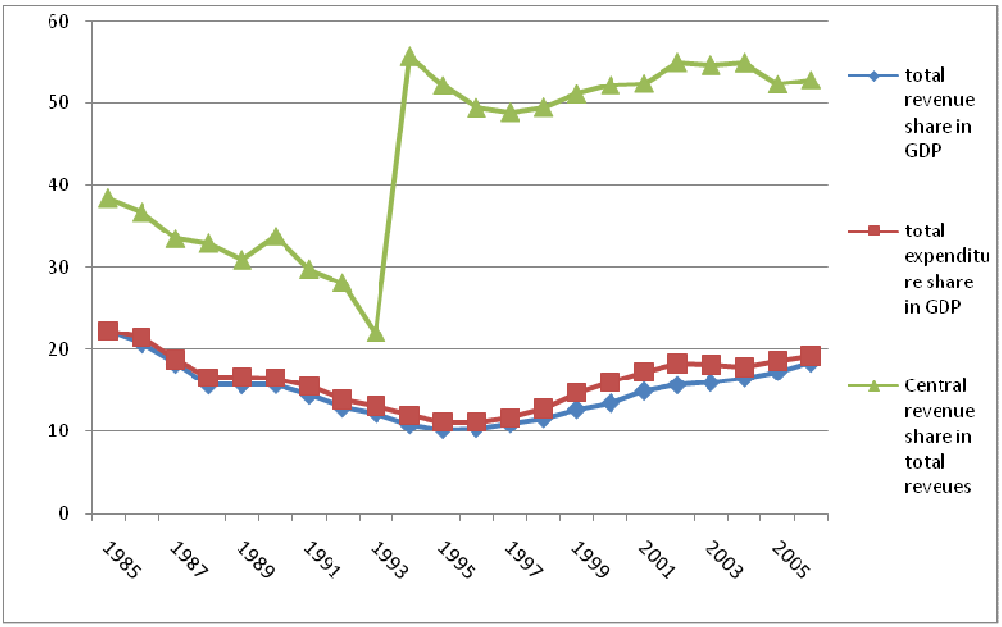
Figure 1: Trends in the Coefficients of Variation for Provincial Expenditures Per Capita in China, 1985-2006



Notes:

1) Data source: National Statistics of Bureau and Ministry of Finance, China
2) The transfer data is not available before 1995 since the transfer system is introduced by TSS in 1994;
3) The distance between the square-dotted line and the diamond-dotted line is the equalization effect of transfers;
4) The distance between the square-dotted line and the triangle-dotted line is the equalization effect of fiscal deficits/surplus.

Figure 2: Shares of Total Revenues and Expenditures in GDP and the Share of Central Revenues in Total Revenues, for China (1985-2006)



Data Source: National Statistics of Bureau, China

Figure 3: The Non-Linear Effect of Fiscal Decentralization on Growth for China

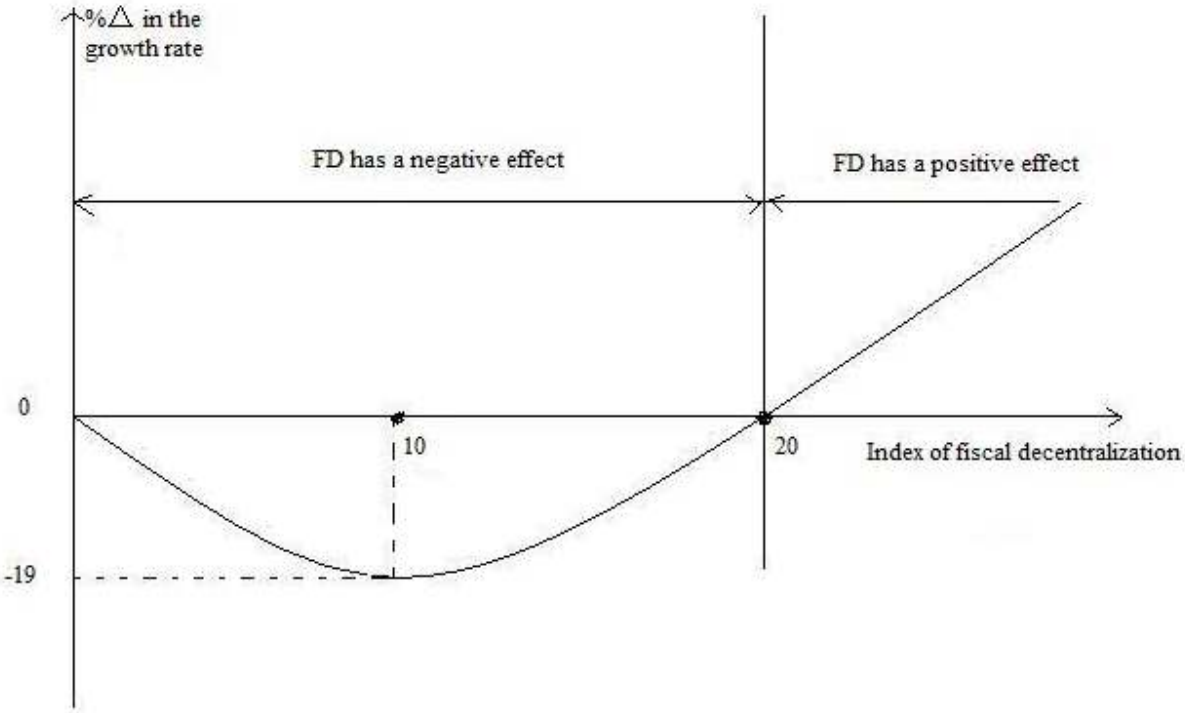
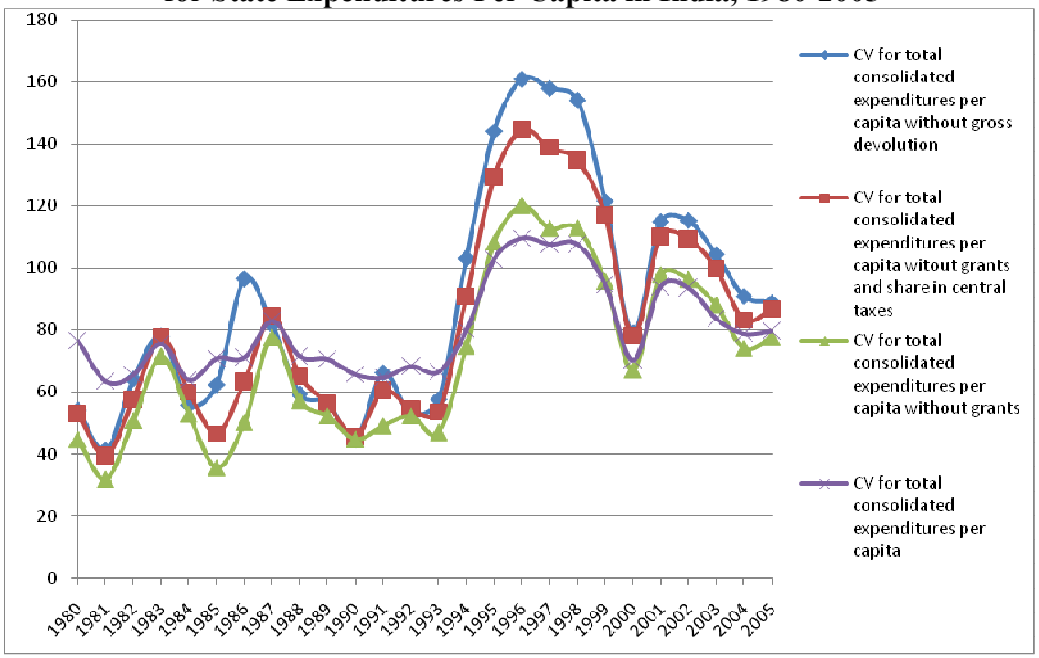
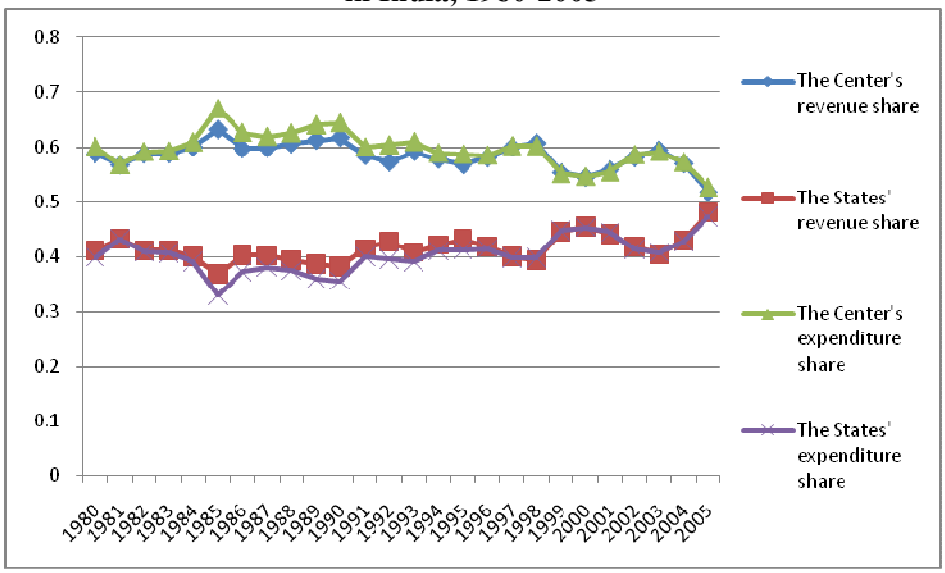


Figure 4: Trends in the Coefficients of Variation for State Expenditures Per Capita in India, 1980-2005



Data Source: Reserve Bank of India.

Figure 5: Center and State Revenue and Expenditure Shares in India, 1980-2005



Data Source: Budget documents of the Government of India and the State Governments.

Figure 6: The Non-Linear Effect of Fiscal Decentralization on Growth in India

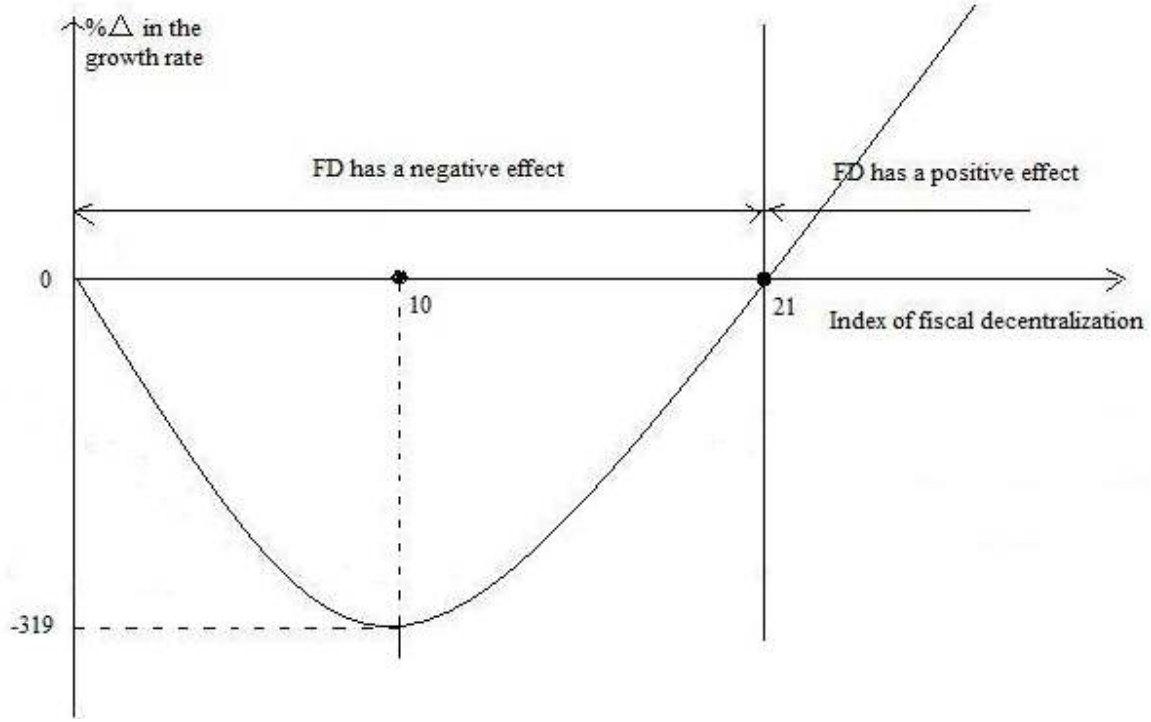
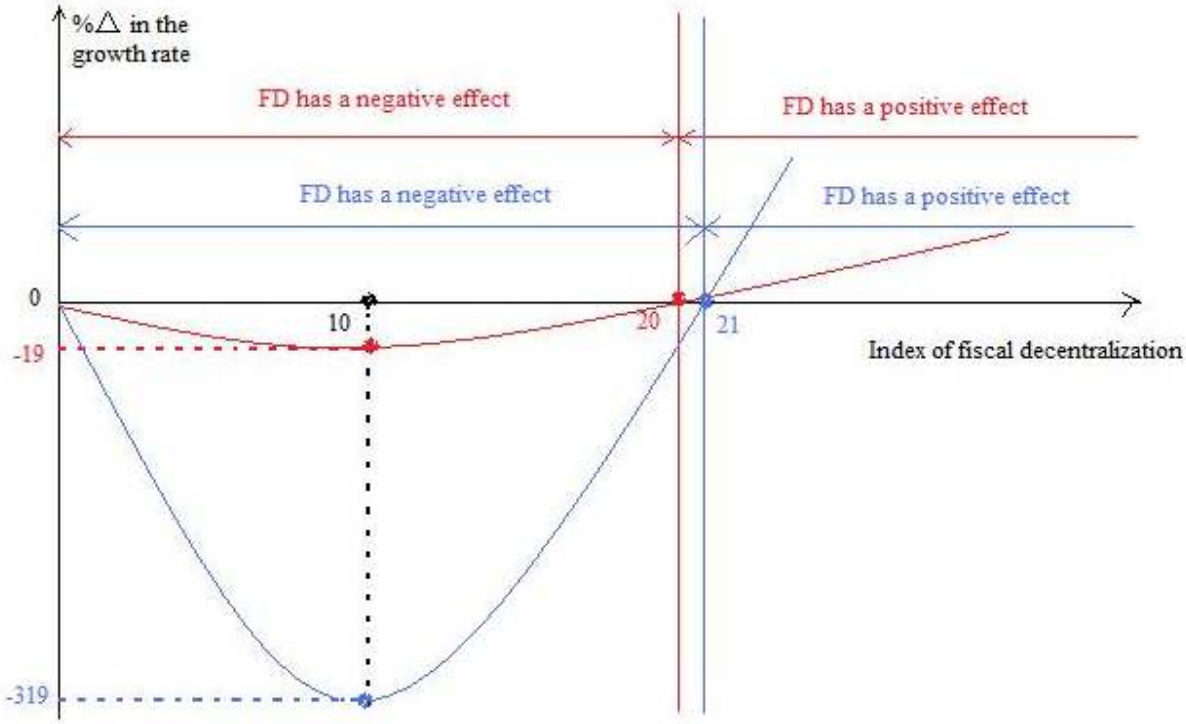


Figure 7: The Non-Linear Effect of Fiscal Decentralization on Growth for China and India



Notes: 1) The red curve represents China.

2) The blue curve represents India.

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