Government Fragmentation and Metropolitan Economic Performance: Evidence from China

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Abstract

Decentralized governance of economic growth under centralized political power plays an important role in understanding China’s development in recent decades. However, the existing literature focuses exclusively on the inter-provincial and inter-metropolitan scales in China, despite that decentralized governance of economic growth operates in a similar fashion within cities, the engine of China’s economic growth. In addition, the administrative and political dimensions of decentralization have not been subjected to any empirical test in China. Using data from 286 major cities, this study examines the existence and nature of the relationship between metropolitan government fragmentation and city-wide labor productivity in China. After controlling for factors such as physical and human capital and population size, regional economic growth model estimates indicate that labor productivity increases with the number of urban districts, but the further increase in district number results in diminished and eventually negative marginal productivity. This result is robust to the potential endogeneity of district number, which is instrumented by historical district number and river density. Moreover, the optimal number of urban districts increases with city population size. This study yields important policy implications for the rapidly growing Chinese cities, where sub-municipal administrative structure keeps evolving and is often determined with little consideration of the effects of government fragmentation on metropolitan economic growth.

Key words

Decentralization, fragmentation, economic performance, number of urban districts, Chinese city

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1. Introduction

China has sustained its rapid economic growth since 1978. Along with the transition from a centrally planned economy into a mixed market economy, China has become increasingly urban. From 1978 to 2007, the share of the non-agricultural sector grew from 72% to 90% in terms of GDP and from 31% to 74% in terms of employment (Zhu, 2012). An important explanation of China’s economic growth is the active role played by highly motivated subnational governments.1 “China is the only country [in the world] where the local governments have played a leading role in increasing rates of growth” (Bardhan and Mookherjee, 2006, p.48). In effect, it is the sub-national levels of government that implement China’s national development agenda. According to the World Bank (2002), nearly 70% of total public expenditure in China takes place at the sub-national level (i.e., provincial, prefecture, county, and township), of which more than 55% takes place at sub-provincial levels.2

The Chinese system that drives economic growth differs from all other major economies. This system has been described as “market-preserving federalism” (Montinola et al., 1995; Qian and Weingast, 1996; Qian and Weingast, 1997; Qian and Roland, 1998; Jin et al., 2005) and more recently “regionally decentralized authoritarian” (Xu, 2011). The most distinctive features of China’s growth-driving system include decentralization and inter-jurisdictional political competition. Decentralization refers to the fiscal, administrative, and political arrangement in which subnational governments have influence or even direct control rights over a substantial amount of resources (e.g., land, firms, financial resources, energy, raw materials, etc.) and are largely responsible for initiating and coordinating reforms, providing public services, and making and enforcing laws within their jurisdictions (Faletti, 2005). Under China’s centralized political power, competition among officials of subnational governments occurs because when a region has a higher growth rate than others, the head of the region will enjoy greater power and

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1 Many believe that China’s recent economic growth has been investment-driven. However, despite China’s well-documented sky-high rates of saving and investment, growth accounting shows that China’s rapid growth over the last three decades has been driven by productivity growth rather than by capital investments, and that labor participation rate and human capital improvement have only moderately contributed to China’s productivity growth since 1978 (Zhu, 2012).

2 One of the most important initiatives taken by many subnational governments was the development of nonstate firms, including foreign direct investment (FDI) and indigenous firms (e.g., the township-village enterprises), which has been the most important engine of China’s economic growth since the mid-1980s (Xu, 2011).
will more likely be promoted. It has been widely shared that decentralization and tournament-like political competition for economic growth enable and motivate subnational officials to invest in infrastructure, attract outside investment, initiate and implement market-oriented reforms, and even simultaneously limit corruption (Xu, 2011).

There are some empirical evidence supporting the above theories. For example, using provincial-level panel data to study the impact of fiscal decentralization on regional economic growth, Lin and Liu (2000) and Jin et al. (2005) find that fiscal decentralization (measured by marginal revenue retention rate) contributed to regional growth in general, and to the development of the regional non-state sector in particular. Moreover, studies also support the important link between economic performance and political promotion among subnational governmental officials, suggesting that tournament-like regional competition is at work. At the provincial level, using a panel dataset of party secretaries and governors, Li and Zhou (2005) find that officials’ promotions are determined by the performance of their jurisdiction relative to the national average, while Chen et al. (2005) stress the importance of officials’ performances relative to both the national average and their immediate predecessors. Less evidence is available for promotion tournament within provinces. Using a large panel dataset covering all counties in China from 1993 to 1997, Li (2011) finds that, all else equal, counties with a higher growth rate were more likely to get city status, which means higher political rank and more power of local officials. In general, the existing literature seems to focus on the relationship between the central/upper-level government and the regional/lower-level governments, especially with regard to the split of fiscal revenues, and on government units above or at, instead of within, cities. Decentralization reforms that characterize many OECD and non OECD countries since the 1990s (Rodden et al., 2003; Arzaghi and Henderson, 2005; Bardhan and Mookherjee, 2006) involved not just the devolution of power to sub-national governments (e.g., fiscal decentralization), but also the increase in the number of sub-national units of government (i.e., government fragmentation).

This study aims to broaden the current empirical literature’s scope in terms of both the dimensions of decentralization and the territorial/jurisdictional unit of analysis. Instead of focusing on the relationship between the central/upper-level government and the regional/lower-level governments to describe decentralization, we focus on the fragmentation of government.
Specifically, we consider the number of urban districts within a city as an indicator of the extent of decentralization in the governance of metropolitan economic growth and implicitly, the related extent of motivation for promotion tournament among officials at the sub-metropolitan level. As the lowest-level government in Chinese cities, urban district governments have been directly handling key economic reform tasks such as the privatization of state-owned enterprises, setting economic development zones, and urban land leasehold and development, a crucial tool for urban economic development since the urban land and housing reforms in the 1990s. The number of districts within a city, although seldom considered to be a factor in urban economic development, is a natural indicator of the number of political competitors (e.g., urban district governors and party secretaries) seeking the promotion from sub-metropolitan to metropolitan level positions.

However, given the scarcity of previous evidence on government fragmentation’s impact on economic growth, especially in China, it is hard to suggest any a priori effect of urban district number on city-wide economic growth. Maximizing economic growth within jurisdiction may or may not be consistent with the maximization of economic growth of a multi-jurisdictional region as there could be negative spillovers such as “races to the bottom” in local tax rates or in the provision of some local public goods (Keen and Marchand, 1997), exporting taxes or pollution to neighbors (Gordon, 1983; Oates and Schwab, 1988), and local protection in the factor or product market. The rest of the paper introduces model and data (Section 2), presents our empirical findings (Section 3), and concludes with policy implications (Section 4).

2. Method

To examine the effect of government fragmentation on metropolitan economic productivity, we begin with a production-function-based regression analysis framework that has been widely adopted in the empirical literature on economic growth. In the prevailing Cobb-Douglas production function, total metropolitan product (Q) can be a function of physical capital (K), labor quantity (L), labor quality or human capital (H), and land capital (N), as shown in

\[ Q = AK^\alpha L^\beta H^\gamma N^\delta, \]

(1)
in which α, β, γ, and δ represent the output elasticities of each of the input factors. The multiplier A is an efficiency parameter, accounting for effects in total output not caused by the above measured inputs. Assuming constant returns to scale (α+β+γ+δ=1), equation (1) can be rewritten as

\[ \frac{Q}{L} = A \left( \frac{K}{L} \right)^\alpha \left( \frac{H}{L} \right)^\gamma \left( \frac{N}{L} \right)^\delta. \]  

(2)

Taking natural log of both sides of equation (2) and interpreting A as the multiplication of factors \( X_1 \) through \( X_J \), we have

\[ \ln \left( \frac{Q}{L} \right) = \theta_0 + \alpha \ln \left( \frac{K}{L} \right) + \gamma \ln \left( \frac{H}{L} \right) + \delta \ln \left( \frac{N}{L} \right) + \sum \theta_j \ln X_j + \varepsilon, \]  

(3)

in which \( X_j \) may reflect the urbanization externalities (economies of agglomeration), government quality, and the structure of metropolitan governance (e.g., fragmentation), the focus of this study.

To estimate equation (3), we obtain data from 286 Chinese cities at the prefecture level and above (except Lhasa due to data unavailability) for year 2010. The collected data reflect characteristics of the city proper (urban districts), excluding counties and towns in the administrative region of each city. Similar to other studies of urban economic performance (Meijers and Burger, 2010; Brülhart and Mathys, 2008; Ciccone, 2002), we choose economic output (measured by gross domestic product, or GDP) per worker (\( Q/L \)) in the industrial and service sectors as the dependent variable. Average human capital per worker (\( H/L \)) is approximated by the average years of education of all residents 15 years and older in each city.

Without a census of capital stock in China, we estimate urban physical capital stock per worker (\( K/L \)) using the perpetual inventory method (Goldsmith, 1956) as described in

\[ K_{i,t} = K_{i,t-1}(1 - \delta_{i,t}) + I_{i,t}, \]  

(4)

where \( K \) is capital stock, \( I \) is the annual flow of new capital, \( \delta \) is discount rate, and \( i \) and \( t \) index city and year, respectively. \( K \) and \( I \) are measured in constant 1995 price. Using the annual capital investment data for the 286 cities during 1995-2009 (Xiang, 2011),\(^4\) we obtain \( I_{i,1995} \) to \( I_{i,2010} \) after adjusting for the changes in urban administrative boundary during this period. The initial

\(^3\) Annual flow of new capital is calculated by multiplying annual fixed asset investment to rate of delivery (Wang and Fan, 2000, p57).

\(^4\) Capital investment data in 2010 are collected by the authors.
capital stock \( (K_{i,1995}) \) is estimated using Hall and Jones (1999) and Young (2000)’s method, which estimates \( K_{i,1995} \) as \( I_{i,1995} \times \sum_{n=1}^{\infty} \left[ \frac{(1-\delta)}{(1+g_i)} \right]^{n} \), which equals \( I_{i,1995} \times \frac{(1+g_i)}{(g_i+\delta)} \), where \( g_i \) is the average growth rate of \( I_i \) during 1995-2010. A national average capital discount rate (\( \delta \)) of 9.6% is assumed according to Zhang et al. (2004).

### Table 1. Descriptive statistics of variables (N=286)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP per worker in million yuan (ln)</td>
<td>2.315</td>
<td>0.427</td>
<td>0.559</td>
<td>3.616</td>
<td>a, c</td>
</tr>
<tr>
<td>Physical capital stock per worker in million yuan (ln)</td>
<td>2.483</td>
<td>0.432</td>
<td>1.265</td>
<td>3.705</td>
<td>c, self-calculation</td>
</tr>
<tr>
<td>Average years of education (ln)</td>
<td>2.285</td>
<td>0.096</td>
<td>1.883</td>
<td>2.499</td>
<td>c</td>
</tr>
<tr>
<td>Urban land per worker in km² (ln)</td>
<td>5.367</td>
<td>0.401</td>
<td>3.714</td>
<td>6.507</td>
<td>b, c</td>
</tr>
<tr>
<td>Ratio of government consumption to GDP (ln)</td>
<td>-2.143</td>
<td>0.483</td>
<td>-3.707</td>
<td>-0.500</td>
<td>a</td>
</tr>
<tr>
<td>Urban population in person (ln)</td>
<td>13.51</td>
<td>0.920</td>
<td>11.64</td>
<td>16.82</td>
<td>c</td>
</tr>
<tr>
<td>Number of urban districts, 2010 (ln)</td>
<td>0.817</td>
<td>0.724</td>
<td>0</td>
<td>2.944</td>
<td>c</td>
</tr>
<tr>
<td>Number of urban districts, 1984 (ln(n+1))</td>
<td>0.951</td>
<td>0.849</td>
<td>0</td>
<td>3.045</td>
<td>d</td>
</tr>
<tr>
<td>Length of rivers within 3km to city center in km</td>
<td>0.838</td>
<td>2.419</td>
<td>0</td>
<td>14.59</td>
<td>e</td>
</tr>
</tbody>
</table>

Note: data sources include a. China City Statistical Yearbook 2011, b. China Urban Construction Statistical Yearbook 2010, c. Tabulation on the 2010 Population Census of the People’s Republic of China, d. China City Statistical Yearbook 1985, and e. 1997 1:4 million Basic Geomatics Data, from the National Geomatics Center of China (http://ngcc.sbsm.gov.cn/). Zero is assigned to a small number of cities formed after 1984 as the number of urban districts, so the ln form is calculated as ln(n+1).

Three variables are selected to be included in vector X: urban population, ratio of government consumption defined by the ratio of government expenditure excluding education expenditure (Barro, 1998) to urban GDP, and the number of urban districts. It is possible, however, that the number of urban districts is determined endogenously, as government structure may be affected by local economy (Nelson, 1990; Fisher and Wassmer, 1998). To address the potential bias in estimation, we use the historical number of urban districts in 1984 and the length of medium to large rivers (Grade three and above according to national standards) within three kilometers from city center as instrumental variables for the number of urban districts in 2010. Historical numbers of urban districts influences those of today, but won’t be affected by today’s economic performance. The use of rivers to instrument urban space segregation and development is inspired by Culter and Glaeser (1997), Hoxby (2000), and Saiz (2010). Table 1 describes all variables and their sources.

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5 Pinggui Management District of Hezhou, Guangxi Province, and Liuzhi Special District of Liupanshui, Guizhou Province, are excluded as the former is not a formal district recognized by the State Council and the latter is actually a county.
3. Findings

In the regression results presented in Table 2, Model 1 serves as the baseline ordinary least-squares (OLS) estimate of the urban production function excluding the effects of the number of urban districts. As we expect, physical capital, human capital, and land input positively contribute to per-worker economic output. The size of urban population has a statistically significant positive effect on productivity, supporting the existence of positive agglomeration effect, which has also been found by Au and Henderson (2006) for Chinese cities. The ratio of government consumption to GDP has a statistically significant negative impact on urban productivity, a suggestive evidence of the excess governmental control among Chinese cities potentially through channels such as the crowding-out of private sector investment and market distortions due to government regulations and interventions. Model 2 adds the number of urban districts as an additional dimension of the urban efficiency parameter \( \Delta \). We find a small but statistically significant positive elasticity of labor productivity on the number of urban districts – doubling the number of urban districts is associated with a 6.67% increase in per-worker output. All other coefficient estimates are similar to those in Model 1, except that urban population size becomes insignificant.

In response to the endogeneity concern of urban district number, we run a two-stage least-squares (2SLS) regression in Model 3 using historical numbers of urban districts and river density as instrumental variables. The Kleibergen-Paap rk LM statistic (34.897) is significant at the 1% level, and the Kleibergen-Paap rk Wald F statistic (21.420) exceeds the 10% threshold value proposed by Stock and Yogo (2005), suggesting that the instrumental variables are not weak instruments (Kleibergen and Paap, 2006). The instrumental variables also pass the over-identification test with an insignificant Hansen J Statistic (1.017). Assuming the validity of the instrumental variables, the Hausman test result (Prob>chi2 =0.9983) suggests that the number of urban districts is in fact exogenous. Indeed, the OLS and 2SLS results (Models 2 and 3) are similar, except the loss of statistical significance of the land input and district number variables in Model 3. This isn’t surprising because OLS estimation is more efficient than 2SLS estimation given the exogeneity of urban district number (Woodridge, 2002, p97).
### Table 2. Statistical regression results (N=286)

<table>
<thead>
<tr>
<th>Dependent Variable: GDP per worker (ln)</th>
<th>Model 1 OLS</th>
<th>Model 2 OLS</th>
<th>Model 3 2SLS</th>
<th>Model 4 OLS</th>
<th>Model 5 OLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln(physical capital stock per worker)</td>
<td>0.5681***</td>
<td>0.5602***</td>
<td>0.5515***</td>
<td>0.5533***</td>
<td>0.5402***</td>
</tr>
<tr>
<td></td>
<td>(0.0453)</td>
<td>(0.0454)</td>
<td>(0.0495)</td>
<td>(0.0445)</td>
<td>(0.0459)</td>
</tr>
<tr>
<td>Ln(average years of education)</td>
<td>0.4740**</td>
<td>0.4674**</td>
<td>0.4584**</td>
<td>0.4262**</td>
<td>0.4275**</td>
</tr>
<tr>
<td></td>
<td>(0.1893)</td>
<td>(0.1878)</td>
<td>(0.1865)</td>
<td>(0.1923)</td>
<td>(0.1925)</td>
</tr>
<tr>
<td>Ln(urban land per worker)</td>
<td>0.0906**</td>
<td>0.0778*</td>
<td>0.0566</td>
<td>0.0962**</td>
<td>0.1111**</td>
</tr>
<tr>
<td></td>
<td>(0.0450)</td>
<td>(0.0465)</td>
<td>(0.0469)</td>
<td>(0.0468)</td>
<td>(0.0483)</td>
</tr>
<tr>
<td>Ln(urban population)</td>
<td>0.0751***</td>
<td>0.0299</td>
<td>-0.0174</td>
<td>0.0558</td>
<td>0.0528</td>
</tr>
<tr>
<td></td>
<td>(0.0202)</td>
<td>(0.0323)</td>
<td>(0.0615)</td>
<td>(0.0365)</td>
<td>(0.0360)</td>
</tr>
<tr>
<td>Ln(ratio of government consumption to GDP)</td>
<td>-0.2723***</td>
<td>-0.2872***</td>
<td>-0.3085***</td>
<td>-0.2822***</td>
<td>-0.2873***</td>
</tr>
<tr>
<td></td>
<td>(0.0357)</td>
<td>(0.0370)</td>
<td>(0.0425)</td>
<td>(0.0380)</td>
<td>(0.0379)</td>
</tr>
<tr>
<td>Ln(number of urban districts in 2010)</td>
<td>0.0667*</td>
<td>0.1328</td>
<td>0.1557***</td>
<td>0.2623***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0364)</td>
<td>(0.0865)</td>
<td>(0.0545)</td>
<td>(0.0695)</td>
<td></td>
</tr>
<tr>
<td>[ln(number of urban districts in 2010)]²</td>
<td></td>
<td>-0.0571**</td>
<td></td>
<td>-0.1230***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0273)</td>
<td></td>
<td>(0.0373)</td>
<td></td>
</tr>
<tr>
<td>Ln(urban population)*</td>
<td></td>
<td></td>
<td></td>
<td>0.0542**</td>
<td></td>
</tr>
<tr>
<td>Ln(number of urban districts in 2010)</td>
<td></td>
<td></td>
<td></td>
<td>(0.0243)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-2.2627***</td>
<td>-1.6350***</td>
<td>-0.9392</td>
<td>-1.9669***</td>
<td>-2.0247***</td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0031)</td>
<td>(0.3176)</td>
<td>(0.0009)</td>
<td>(0.0005)</td>
</tr>
<tr>
<td>F</td>
<td>103.8903</td>
<td>88.2418</td>
<td>95.1326</td>
<td>75.1421</td>
<td>69.4086</td>
</tr>
<tr>
<td>R²</td>
<td>0.6617</td>
<td>0.6658</td>
<td>0.6617</td>
<td>0.6708</td>
<td>0.6743</td>
</tr>
</tbody>
</table>

Note: robust standard errors in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01.

Given the limited improvement in model interpretability of Models 2 and 3 over Model 1, and the expectation that the effect of urban district number on productivity may be nonlinear, Models 4 and 5 introduce the quadratic form of urban district number and the interaction between district number and population size as additional regressors. Results support the nonlinearity of the effect of urban district number. While the coefficient estimates of other regressors in Models 4 and 5 are qualitatively indifferent from those in Model 2, there is a clear quadratic relationship between district number and urban productivity, suggesting that the increase of urban district number contributes to urban productivity up to a certain point before the marginal benefits become negative. Given the estimates of Model 4, the optimal number of districts is 3.9, where urban productivity is roughly 10% higher compared to the case of a single district for the whole city. Beyond the optimal district number, the marginal productivity gain of adding more districts...
becomes negative. A city could have up to about 15 districts before its productivity falls below the scenario of one district.\textsuperscript{6}

Moreover, the quadratic relationship between district number and urban productivity shifts with urban population size, as suggested by the results of Model 5. The optimal number of urban districts increases with city population size. The population-adjusted efficiency gain is larger for larger cities. Figure 1 illustrates our findings. Setting three districts brings the most productivity gain for cities with a population of half a million to one million, while having four and five districts seems better fit cities with three and 10 million residents, respectively. The population-adjusted efficiency gain at the optimal points is nearly twice as high for a city of 10 million residents (about 28\% at five districts, compared to a single district) compared to a city of one million residents (about 15\% at three districts, compared to a single district).

![Figure 1. Productivity gain of adding urban districts for cities of different population sizes.](image)

It is also worth to mention that the labor productivity gain by adding number of districts is asymmetrical on the two sides of the optimal number of urban districts. Under the sample average city population size (1.28 million residents), the optimal district number is three, with a relative efficiency gain of 16\%. Adding two more districts only reduces the gain by 2\%, far less than the effect of reducing the district number from three to one.

\textsuperscript{6} Detailed calculation is omitted here but available upon request.
4. Conclusion

Numerous studies have tried to examine the linkage of political institutions to a country’s economic development (e.g., Knack and Keefer, 1995; Olson, 2000). But scholars have rarely paid attention to the parallel question at the sub-national and especially the metropolitan level. This study is an early investigation of the relationship between metropolitan economic performance and government fragmentation measured by the number of urban districts, the only sub-metropolitan level of government in China. Using cross-sectional data of 286 Chinese cities (the vast majority of cities at the prefecture and above levels in China), our study empirically shows that the number of urban districts affect urban labor productivity, suggesting that fragmentation of governance matters for metropolitan economic output. Specifically, our results indicate the existence of a population size-dependent optimal level of metropolitan government fragmentation, beyond which urban labor productivity is reduced.

This study contributes in a unique way to the literature using decentralization and political competition among officials of subnational governments to explain China’s rapid economic growth. However, this study breaks into new grounds given its focus at the sub-city level and its investigation of government fragmentation. Although consistent with the hypothetical mechanism that the number of competitive players affects economic performance in a tournament-style political competition, our results do not directly link government fragmentation to official motivation and economic performance.

This study yields important policy implications for the rapidly growing Chinese cities, where sub-municipal administrative structure keeps evolving and is often determined with little evidence of the effects of government fragmentation on urban economic growth. A direct use of our study is the estimated optimal numbers of urban districts. While cities may be below, at, or above their optimal levels of government fragmentation, among the 286 cities in our sample, nearly 35% have only one district and nearly 55% have no more than two districts. Comparing the actual versus optimal numbers of districts for the 286 cities, we find that 62% of our sample cities are under their optimal numbers of urban districts. It is thus beneficial for many medium and large-sized cities in China to consider increasing the number of districts, especially given the
expectation of urban population growth and the fact that more districts than the optimal number is less harmful than fewer districts.

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