Does Flattening Government Improve Economic Performance? Evidence from China*

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Abstract

We examine a causal relationship between the flattening of a government hierarchy and economic performance by exploiting a panel dataset on government reorganization in China from 1995 to 2012. Delayering has led to increases in revenue and intergovernmental transfers for county governments, but the associated enlarged span of control makes it difficult for the upper-level governments to coordinate and monitor more local ones. This has led to a reduction in county governments' total public expenditure and pro-growth expenditure, as well as an increase in land corruption. Overall, the flattening of the government hierarchy has a negative effect on economic performance.

Key words: Flattening; Government; Hierarchies; Organization structures; Province managing county

JEL Codes: H11, O12

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1 Introduction

The design of an organization's hierarchies deeply influences the information flow, agents' incentives, and ultimately performance. Among all the relevant attributes, the organization's depth—the number of vertical layers—and width—the spans of control—are attracting markedly increased attention. Organization structure involves a trade-off between horizontal coordination and vertical control (Mookherjee, 2006). While considerable progress has been made in empirically understanding corporate hierarchies (Rajan and Wulf, 2006), whether results based on firms can be reliably generalized to public organizations remains unknown. There have been few attempts to evaluate the effects of organizational structure on performance in the public sector in either a developed or a developing country context, largely due to the lack of fully compelling identification.

In this paper, we provide quantitative evidence about how a government's productivity measured by per capita GDP varies with the number of vertical layers in its hierarchy. Government bureaucracy is a hierarchical organization with official functions and well-established formal rules (Weber, 1947). It plays an important role in providing public goods, facilitating economic growth and reducing income inequality (Besley and Persson, 2010). In cross-country comparisons, lower income countries tend to have more local government tiers of larger size than in higher income countries (Ivanyna and Shah, 2014). However, it is difficult to establish causality between organization shape and development as the number of tiers is itself endogenous. To make progress, this study exploits a quasi-natural experiment—China's province-managing-county (PMC) reforms since 2003. After the reform a provincial government could by-pass the prefecture level and directly administer county governments with respect to fiscal matters in the same way it manages prefectural governments. In the period considered, there were rich spatial variations in the timing of the adoption of the PMC system, constituting a unique laboratory for studying the effect of delayering on the outcomes of interest. To the best of our knowledge, this is among the first pieces of empirical analysis to establish a connection between government organization and economic performance.

Improving the economic development of counties has become a priority for policy makers in China because of its large county-level population and concerns about rural poverty and inequality. On 72% of the Chinese territory, counties directly administer 70% of the total population and yet generate only 37% of the national GDP.[1] Against this background, the PMC flattening reform we evaluate aims to relieve financial strain on county-level govern-

[1] These numbers were computed based on the *China Statistical Yearbook 2013* and the *China City Statistical Yearbook 2013*.

ments, improve administrative efficiency, and stimulate local economic growth.

Our analysis proceeds in three stages. We first investigate the link between the PMC reform and a county's economic performance. Specifically, do PMC counties experience higher or lower per capita GDP over time? Then, to support a causal interpretation of our findings, we shed light on the channels through which the PMC system might influence economic performance. Specifically, what is the nature of the reform—does it involve simply the removal of one layer in the fiscal hierarchy with authority moved from prefectures to provinces, or does it also involve subtle changes in revenue and expenditure assignment among various layers of government? If the former, does the flattening on average improve a county's fiscal revenue and inter-government transfers—the goals of the reform? How does increased span of control impact the upper level government's ability to coordinate and monitor spending and land sales? Third, we examine how the PMC reform affects other economic outcomes such as household income, consumption, and inequality.

The analysis involves constructing a novel data set from a large number of official sources. The data cover 1,809 counties between 1995 and 2012. They contain very detailed information not only about GDP, fiscal revenue, transfers and expenditure, but also about changes in government's organization. For each county, we measure the change in organizational structure with: 1) a PMC reform indicator; 2) the span of control of the county government's supervising body. Such comprehensive panel data allows for an examination of China's county economies before and after the PMC reform, and the mechanism underlying such impacts.

The key challenge in identifying the effect of PMC reforms is selecting appropriate control groups for the treatment group. The validity of the difference-in-differences (DD) methods applied and the causal interpretation of the results rely on the assumption that non-PMC counties and counties which adopted PMC later are valid counterfactuals for what would have happened to earlier adopters in the absence of the PMC reform. However, the reformed counties are not randomly selected. To address the identification challenge, we control for the differences in the trends in outcomes between PMC counties and non-PMC counties depending on the key determinants in the selection of PMC counties, a strategy used by Gentzkow (2006). Beyond that, we restrict the sample to PMC counties, increasing confidence in the comparability of the treated and control groups. We also conduct a placebo test by randomly assigning the adoption of PMC reforms to counties. Finally, we use an event study to estimate year-wise changes in economic performance before and after the PMC reform with a window of 8 years.

The analysis yields several main findings. First, the adoption of PMC reforms reduces a county's GDP per capita by an average of 3.9 percent, which translates into a 0.44 percent

drop in the annual growth rate. These findings indicate that in this context a flattened hierarchy is detrimental to economic performance.

Second, both de-jure and de-facto evidence suggest that the PMC reform is mostly a flattening initiative with the fiscal authority moved from the prefectures to the province. The counties' fiscal revenue and transfers tend to increase after the elimination of the intermediate layer of city government in fiscal management. However, the enlarged span of control for the provincial government has weakened its monitoring and coordination capacity. In particular, both total public expenditure and pro-growth investment in PMC counties have declined on average after the reform. More land were sold through negotiation instead of market mechanisms and at lower prices in the affected counties, pointing to increased land corruption after the PMC reform. This, in turn, may have negatively influenced economic performance. These results demonstrate that such organizational change may well impose costs on the economies concerned that exceed the benefits, and they may also have implications for the design of an effective and productive organization.

Third, using alternative measures of performance, no significant effects on household income or income inequality are evident. Reassuringly, a negative and significant effect on consumption suggests that PMC reform does not in general improve social welfare.

This paper fits into a large existing literature on organizational forms. An important line of research has looked at hierarchical organization with boundedly-rational members (Garicano and Van Zandt, 2013). In a horizontal hierarchy, information flows smoothly across vertical layers of administration, resulting in fast execution (Patacconi, 2009). This, however, calls for intensive information processing, communication and coordination at the top of the hierarchy (Williamson, 1975). There are limits to communication and to the cognitive abilities of upper-level managers. A broad span of control will be demographically heterogeneous and large groups may create coordination and communication problems (Bandiera et al., 2014). While prior research has mainly focused on theoretical models, the empirical evidence of this study can help forge links between theory and data. Specifically, the findings confirm the theoretical logic that while flattening is expected to decrease delay, the increased span of control could cause distortions.

There has also been a broad strand of theoretical work that focuses on the role of incentives in hierarchies (Mookherjee, 2013; Besley and Ghatak, 2005). Qian (1994) has demonstrated that the benefit of having fewer tiers is that there is a reduction in cumulative loss across hierarchical levels, whereas the cost is that the effectiveness of supervision to reduce moral hazard decreases as a result of the increased span of control. Rajan and Zingales (2001) develop a theoretical framework to study the incentive problems resulting from different-shaped organizations. The main incentive problem in a vertical hierarchy is expro-

priability among upper-level managers. However, managers have an incentive to specialize due to their positional power. In a horizontal hierarchy, expropriability is dealt with, but this gives managers very little positional power, and therefore little incentive to specialize. The empirical findings of this study linking hierarchical change to organizational performance are consistent with these theories, predicting that expropriability should decrease after flattening and that the monitoring capacity by the higher levels would be adversely affected.

This study also complements a number of works on the organization of China's government. Several economic system analyses have compared China's multi-divisional structure to the unitary structure of the former Soviet Union. Maskin, Qian and Xu (2000) examine how organizational forms affect the quality of incentive schemes that can be offered to managers, and the resulting economic performance. In a similar vein, Qian, Roland and Xu (2006) focuse on coordination problems in conducting experiments associated with organizational forms. In contrast, this study exploits possibly exogenous within-country variations to examine delayering and county economies.

Lastly, our paper relates to a set of studies empirically testing the effects of changes in information technology, competition on the product market or openness to trade on the internal structure of firms (e.g., Acemoglu et al. (2007), Brynjolfsson and Hitt (2000), Bresnahan, Brynjolfssohn and Hitt (2002), Caroli and van Reenen (2001), Rajan and Wulf (2006)). Most of that work examines the causes of organizational change rather than the consequences, which is the focus of this study.

The remainder of the paper is organized as follows. Section 2 lays out the PMC reform background. Section 3 describes the identification strategies and data in detail. Section 4 presents our main empirical findings, followed by the mechanism underlying the PMC effects in Section 5. Section 6 concludes.

2 China's Administrative Structure and PMC Reform

China's administrative structure is among the most remarkable of human institutions. Its record of longevity and adaption to racially changed situations with minor disruption of its basic structure is unmatched by that of any other government system (Fitzgerald, 2002). Local administrative hierarchies have changed over the centuries, but counties have remained China's most stable administrative unit (Lin et al., 2013; Xu, 2011). An important issue in county governance is which administrative level should supervise the counties. Since 1949, China's hierarchical system of administration has been highly centralized. Provinces have gained significant power (Fitzgerald, 2002), but counties were tasked with almost all the functions and responsibilities of the provincial level. "Between these two spheres of real

power... there was much administration but little authority" (Shue, 1994).

From the late 1970s, there have been significant changes in the way China is governed, and these have been most pronounced at the local level. An important reform of the early 1980s was reshaping and reorganizing the prefectures, formerly the local organ of the provincial administration, as prefecture-level cities. This has gradually formed an additional formal layer in China's sub-national administration under the nationwide policy of "city managing county" (CPC). Provincial governments deal directly with city (prefecture) governments; those city governments deal with the county governments. There is no direct relationship, however, between the provincial and county governments (Lou and Wang, 2008). Figure 1 shows the administrative structure under the CPC policy. The average number of prefectures under a provincial government is 12, while the average number of counties under a prefecture is 8.

[Insert Figure 1 Here]

Fiscal arrangements follow the hierarchical system (Liu and Alm, 2015). Higher-level governments have much discretion in determining the fiscal arrangements of the level immediately below them. The tax sharing system since 1994 has clearly divided revenue assignments and expenditure responsibilities between the central and provincial governments. Meanwhile, the central government grants provincial governments the authority to set up their fiscal relationships within the provinces.[2] Provincial governments have directly determined their fiscal arrangements with prefecture governments, and have authorized prefecture governments to do so with the county governments (Martinez-Vazquez et al., 2008; Liu et al., 2014).

While relaying the mandates from above to their subordinate organizations, the governments in each tier also add their own, leading to a cascade effect so that the final burden on the county government can become very onerous (World Bank, 2002). For example, under the CPC system a prefecture-level city commonly tends to favour its city proper at the expense of its subordinate counties (Ma, 2005). The counties in poor regions have been harmed particularly severely because of this built-in bias in development strategy (Lam, 2009). The prefecture-county relationships are not conducive to giving rural residents equal access to services (World Bank; Development Research Center of the State Council, the People's Republic of China, 2014).

As a result, the merits of the "province-managing-county" system have been hotly debated since the 2000s. Under PMC a provincial government directly (and separately) manages its cities (prefectures) and counties. The fiscal relationship between the prefecture and

[2]See The Decision of the State Council on the Implementation of the Tax Sharing System, 1993.

the county has been removed (Lou and Wang, 2008). By flattening the governance hierarchies, this scheme aims to relieve financial strain on county-level governments, improve administrative efficiency, and stimulate local economic growth. According to the guidelines issued by the Ministry of Finance (MOF),[3] the PMC policies include the following provisions (Liu and Alm, 2015):

1. Provincial governments should reasonably determine the revenue sharing schemes among the province, the prefectures, and the counties. On the expenditure side, the prefecture or county should not shift its expenditure responsibilities to another party.

2. The provincial government decides fiscal transfers and rebates of taxes (value-added tax, consumption tax and income tax) and allocates separately and directly to the prefectures and counties.[4]

3. Provincial governments shall set up separate and independent accounts to manage all fiscal transactions between the province and the prefectures and counties. Fiscal transactions between prefectures and counties are no longer permitted.

4. Annual settlements of all financial accounts must be conducted between a province and its prefectures and counties directly.

5. Prefectural and county governments must separately and independently compile their own annual budgets and final financial reports.

As a supplementary measure, the provinces monitor reformed counties' budgets, transfers and use of funds. Taken together, the PMC reforms have established a direct fiscal management relationship between the counties and the provinces. They have moved the fiscal administration and supervision of the counties from the prefectural governments to the provincial governments.

Figure 2 illustrates the new administrative structure under the PMC system. Zhejiang and Hainan were among the first provinces to adopt the PMC scheme province-wide in the 1980s. However, during the 1990s the PMC fiscal reform was halted because rapid economic growth in some locales had allowed many counties to seek urban designations and "upgrades". Rampant "city fever" engendered masked urbanization and land use planning

[3] See Opinions of the Ministry of Finance on Boosting the Fiscal Reform of "Province-Managing-County" (2009).

[4] Any applications from prefectures and counties for additional ad hoc transfers have to be sent directly to the provincial government, and they must be evaluated and allocated directly by the provincial government.

contrary to the provincial and national policy (Kung et al., 2011), which finally forced the state to dampen the feverish upgrading in the late 1990s.

[Insert Figure 2 Here]

By 2003, there was growing fiscal inequality among China's regions, and some counties suffered from worsening budget problems. With its special emphasis on rural development and expanding accesses to public services, the PMC reform regained momentum. Experiments resumed in Fujian province in 2003, in Anhui, Henan and Hubei provinces in 2004, and in Hebei, Jilin and Jiangxi provinces in 2005. The central government issued a policy circular in 2006 which stated that the scheme should be gradually implemented in all counties except those in ethnic autonomous regions by the end of 2012. This goal was reaffirmed in China's 11th Five Year Plan. By 2012 the average number of subordinates (prefectures and counties) under a provincial government had displayed a remarkable increase to 52, while the average number of subordinates under a prefectural government was 5. Table A1 shows the number of counties which adopted the PMC system from 2001 to 2012. By 2012 over 1052 counties across 22 provinces had adopted it. Figures A1 and A2 show the geographic distribution of PMC counties before 2003 and in 2012, respectively.

3 Estimation Strategy

3.1 Data

For the empirical analyses, we assemble a dataset describing socioeconomic conditions in each county in the years from 1995 to 2012. The dataset contains comprehensive indicators collected from a wide range of official statistical publications and publicly-available databases.

- County-level GDP, retail sales, rural household income and urban wage data are collected from the annual statistical yearbooks of the 24 Chinese provinces, supplemented by city-level statistical yearbooks or a county's statistical communiqués.
- County-level financial information comes from the *National Prefecture and County Finance Statistics (NPCFS) 1995–2009*.
- County-level populations are extracted from *China's Sub-counties and Cities Nationwide Demographic Yearbook 1995–2012*, supplemented by *China Population Census 2000*.

- The average county slope and the altitude of each county seat are extracted using data from the space shuttle's radar topographic mission 90m digital elevation model.

- Luminosity data come from the US defense meteorological satellite program that reports images of the earth at night captured from 20:30 to 22:00 local time. Light intensity is reported as a six-bit digital number for every 30 arc-second output pixel (approximately 0.86 km^2 at the equator). The values range from 0 to 63, where a higher value reflects more light.

- Parcel-level data on land transactions are collected from the official website of China's Ministry of Land and Resources.[5] More than 1 million parcel transactions are recorded during the period studied. The land sales data have been more completely recorded since 2007, so data before 2007 are not used.

- The county-level land revenue data are collected from the NPCFS for the period 2002–2006. The NPCFS has stopped publishing land revenue data in 2007, but the series are extended to 2009 by aggregating parcel-level land data 2007–2009 to the county-level.

- The county-level variables of Table 2 are extracted from the annual statistical yearbooks of the 24 Chinese provinces, *China Population Census 2000*, and *Annual Survey of Industrial Firms 2000* conducted by China's National Bureau of Statistics.

To create a comprehensive and accurate county-level dataset, provincial statistical yearbooks are the main data source, since such data are the most consistent. In cases of data missing in that source, city-level statistical yearbooks or a county's statistical communiqués are used.

To address the county-level administrative changes during the sample period, statistical consistency is ensured by tracking the records on the website of the Ministry of Civil Affairs.[6] Counties with name changes are regarded as the same county if their administrative boundaries remain the same as in 1995. Those re-designated as urban districts between 1995 and 2012 are not included in the dataset.[7]

China experienced inflation with sizable differences in inflation rates among the regions. The technique of Brandt and Holz (2006) is therefore applied to adjust all the variables using provincial price deflators, with Beijing as the base province and 1999 as the base year.

[5] See http://landchina.mlr.gov.cn/

[6] See http://www.xzqh.org/html/

[7] During that period only 21 counties under 20 prefectural cities were changed into urban districts for various reasons.

All urban districts and counties governed under the four centrally-administered municipalities (Beijing, Tianjin, Shanghai, and Chongqing) are excluded. As the analyses focus on the PMC reforms in the 2000s, Hainan and Zhejiang provinces also are not included, since those two provinces adopted the PMC system in the late 1980s. All the counties in Tibet are excluded due to missing data. The sample for empirical analysis thus consists of a panel of 1,809 county-level units over the 1995–2012 period. Detailed variable definitions and descriptive statistics are presented in Table 1.

[Insert Table 1 Here]

3.2 Estimation Framework

To identify the effect of flattening the hierarchies on economic performance, we use time and geographic variations in the PMC reform since 2003. Specifically, DD estimation involves comparing the performance of counties before and after they adopted the PMC system with that of counties which had not yet adopted it during the same period.

Figure 3 illustrates the validity of our identification strategy. It shows the time trends of the logarithm of GDP per capita of the counties which adopted the PMC reform since 2003 and those which did not adopt it during the sample period. The treatment group and the control group show similar trends before 2003, a year before the start of the PMC reform. But they diverge significantly after 2003, when the growth in PMC counties lags behind that in non-PMC counties.

[Insert Figure 3 Here]

The baseline DD estimation has the following specification:

$$y_{ct} = \alpha_c + \beta PMC_{ct} + \gamma_t + \varepsilon_{ct}, \tag{1}$$

where c and t indicate county and year, respectively; y_{ct} represents an outcome such as the logarithm of GDP per capita; the α_cs are county fixed effects, capturing all the time-invariant characteristics of the counties which might influence the outcome of interest; γ_ts are year fixed effects, controlling for nation-wide shocks in a particular year likely to have affected all counties in a similar manner; and ε_{ct} is the error term.

PMC_{ct} is the regressor of interest, indicating the county's PMC status. Specifically, $PMC_{ct} = treatment_c \cdot Post_{ct}$, where $Treatment_c = 1$ if county c carried out the PMC reform during the sample period, and 0 otherwise. $Post_{ct}$ is a post-treatment indictor, taking a value of 1 if $t \geq t_{c0}$ where t_{c0} is the year that county c joined the PMC reform, and 0 otherwise. To address the potential serial correlation and heteroskadesticity, we cluster the

standard errors at the county level.

3.3 Identifying Assumption and Checks

The identifying assumption underlying the DD estimation is that the PMC counties would have followed the same time trends as the non-PMC counties if they had not adopted the PMC reform. A primary threat to this identifying assumption is that the PMC counties were not randomly selected, so the divergence in Figure 3 after 2003 may have been caused by some pre-existing differences between the PMC and non-PMC counties. To address this concern and improve the identification, we first follow an approach used by Gentzkow (2006).

Specifically, key determinants in the selection of PMC counties are identified, and then differential trends in outcomes between the PMC and non-PMC counties after the adoption of the PMC reforms caused by such determinants are controlled for. To this end, we look into the criteria the provinces used in selecting the PMC counties. For example, according to the central government's guidelines, those with a heavy financial burden, or with poverty county status, or with a large production of grain and cotton should in general be given priority to become pilot PMC counties. To reduce political and economic risk, in some provinces the PMC experiment was conducted in sparsely-populated and mountainous counties. Table A2 in the appendix lists in detail the criteria used. Eight key selection criteria are identified—county-level city, national poor county, major food-producing county, provincial boundary county, altitude, average slope, fiscal gap, and urbanization rate. The detailed definitions are summarized in Table 1.

Table 2 shows the balancing checks conducted to verify whether controlling for eight key determinants of PMC selection can lead to better balance between the treatment and control groups (for a similar practice, see Agarwal and Qian, 2014). Panel A shows the eight key selection criteria. 19% of the PMC counties are county-level cities, versus 17% of the non-PMC counties. 29% of the treatment group are national poor counties, while the proportion is 33% in the control group. 34% of treated counties are major agricultural production counties as opposed to 21% of the control counties. 40% of the PMC counties border another province while 35% of the non-PMC counties do so. On average, treated counties are at higher altitude and more sloping than control counties. And the PMC counties have lower ratios of fiscal revenue to expenditure and are less urbanized than the non-PMC counties. Overall, the data illustrate that most of these criteria play an important role in determining the treatment status.

[Insert Table 2 Here]

Panel B compares the treatment and control groups on various economic and social development variables in the initial year, ranging from illiteracy rate to service industry labor share. Column 3 shows that on many dimensions there are significant differences between the PMC and non-PMC counties. On average, PMC counties had a better education level, aged dependency ratio and manufacturing export intensity, but they had a lower road density, and agriculture and services were a smaller share of GDP. However, as shown in column 4, after controlling for eight key determinants of the treatment status, none of these characteristics exhibit any statistically or economically significant difference between the treatment and control groups. The treatment and control samples are balanced, which is crucial for the identification.

To control for differences in the chronological evolution of the outcome variables whose correlation with PMC is caused by the endogenous pattern of PMC's selection, we experiment with three specifications, which increasingly allow more flexibility in the estimation. The selection variables S is first interacted with a third-order polynomial function of time in equation (1), assuming the effect of S on the outcome variables to follow specific time trends. The interactions between S and $Post_{ct}$ then allow the effect of S on the outcome variables to differ between the pre- and post-treatment periods. Lastly, the S variables are interacted with the year dummies γ_t, which more flexibly control for the time effects of S on the outcome variables. Beyond that, we include treatment-specific linear time trends to control for the differences in time trends between the treatment and control groups. This produces the augmented DD specification:

$$\begin{aligned} y_{ct} &= \alpha_c + \beta PMC_{ct} + \psi Treatment_c \cdot t \\ &+ (\mathbf{S} \times \mathbf{f}(\mathbf{t}))' \boldsymbol{\theta} \quad + \gamma_t + \varepsilon_{ct}, \end{aligned} \tag{2}$$

where $f(\mathbf{t})$ could be a third-order polynomial function of t, or $Post_{ct}$, or γ_t.

As further checks on our identifying assumption, we conduct several other exercises in Section 4.4, including focusing on a sample of PMC counties, a placebo test with randomly assigned reform status, using Luminosity data to check the misreporting issue, alternative measurement of economic performance, and event study.

4 Empirical Findings

4.1 Flattening and GDP

The baseline estimation results are reported in column 1 of Table 3. They show a negative and statistically significant effect relationship between the PMC reform and GDP per capita. This finding implies that the flattening may have retarded economic development in the affected counties.

[Insert Table 3 Here]

Columns 2 to 4 report the results allowing interactions between a flexible function of time and all of the major determinants of the PMC introduction, as elaborated in the previous section. Specifically, interactions of the eight key selection variables with a third-order polynomial function of time are included in column 2. Interactions of the eight key selection variables with the $Post_{ct}$ variable are included in the estimation reported in column 3,[8] and year dummies in that of column 4. We consistently find a negative and statistically significant effect of the PMC reform, despite of a significant drop in its estimated magnitude.

4.2 Other Reforms

If other policy reforms occurred during the same period, the estimates may mistakenly capture the effects of those confounding factors rather than the effect of the PMC reform. In addition to the PMC reforms, another noteworthy reform of China's administrative system since 2003 has been the county-power-expansion (CPE) reform, which aims to empower some county-level governments. CPE involves the devolution and delegation of some economic administrative powers and authority (mostly from the prefecture) to county government (Liao, Li and Deng, 2013) within the CPC system.[9] For example, some approval powers such as over infrastructure construction, technology upgrading, and foreign-invested projects has been decentralized to counties. Certain projects in which investors invest within those pilot areas can now be verified and approved by the county authorities, simplifying the verification and approval process for such projects. However, specific CPE policies vary greatly among the reformed provinces. Some counties enjoy broad decentralization of project examination,

[8] The estimated coefficients of the interactions between the key determinants and post-treatment indicator are reported in Table A3. Economic development in the post-treatment period was faster in counties with steeper average and in counties with higher initial urbanization.

[9] As pointed out by Guizhengfa (2010), "The CPE reform mainly aims to enlarge some economic and social administrative power of counties, and improve their economic development without changing the current administrative system. Except for the PMC on fiscal matters, economic and social administration still operates under the CPC system." Unlike the PMC, CPE is decentralization without flattening.

approval and so on, while others have expanded their autonomy only within a limited range of regional matters.

By the end of the period under analysis (i.e., 2012), about 36% of the counties had conducted both the PMC and CPE reforms; 36% of counties had conducted neither; and the remaining 28% of counties had conducted either one or the other.

With these simultaneous reforms, one may be concerned that if the CPE reform casts a negative effect on economic development and the PMC reform happened in a CPE county, the estimated PMC effect may just reflect the CPE effect. To address this concern and isolate the effect of the PMC reform, a variable indicating whether a county government carried out a CPE reform is included as an additional control variable. Hence, the identification relies on a comparison between PMC and non-PMC counties with the same CPE reform status. As shown in column 5 of Table 3, the flattening of fiscal management structure still has a significant and negative effect on economic performance, with a modest increase in the magnitude. Since the CPE reform is an independent policy experiment with its own agenda, this result implies that the estimated PMC effect is not contaminated by the CPE reform.

4.3 Economic Magnitude

Using the estimates in column 5 to calculate the economic magnitude, the adoption of PMC policies predicts about 3.9 percent lower GDP per capita on average. Note that the PMC reform started in 2003 and the sample period is from 1995 to 2012. Hence the DD estimate captures the average treatment effect over nine years. In other words, the 3.9 percent drop in the GDP per capita caused by the adoption of PMC policies can be translated into about a 0.44 percent drop annually.

Another way to guage the economic magnitude of our estimated effect is to compare the estimates to the sample mean. As shown in column 5, the mean value of outcome variable (defined in logarithm of ¥ per capita) in our sample period is 8.679. Hence, our finding imply that the PMC reform reduced the logarithm of GDP per capita by 0.44 percent relative to the sample mean.

4.4 Robustness Checks

To further address concerns about the identifying assumptions and to corroborate the findings, a battery of robustness checks are conducted.

4.4.1 Sample of PMC Counties

The staggered adoption of the PMC system provides rich variation. The entire sample is used in the baseline analysis, which essentially compares early- with later-adopting counties as well as with non-PMC counties. This robustness check focuses on the PMC counties only (52% of the full sample), which are assumed to be more homogenous. Hence, the identification relies on comparing early-adopting counties with later-adopting ones (for another application of the same strategy, see Biderman, Mello, and Schneider, 2010).

Those estimation results using only PMC counties are reported in column 6 of Table 3. It shows a similar effect in terms of both statistical significance and magnitude.

4.4.2 Randomly Generated PMC Status

To check to what extent the results are influenced by any omitted variables, a placebo test is also conducted by randomly assigning the adoption of PMC reforms to counties (see Chetty et al., 2009; La Ferrara et al., 2012). Table A1 shows that during the sample period there are nine years in which PMC reforms took place. To preserve this fact (i.e., eight years with positive PMC adoption $\{58, 113, 75, 15, 256, 201, 153, 87\}$ as shown in Table A1) while allowing for at least one year before and one year after the PMC adoption (as required by the DD method), eight years between 2000 and 2011 are selected at random and within each year counties are randomly designated as the treatment group without replacement. As an illustration, consider that $t_1, ..., t_8$ are first randomly selected from the time set of 2000–2011. Then, for time t_1, 58 of all the counties are selected at random and assigned the status of having adopted PMC at t_1. For time t_2, 113 counties are randomly selected from the remaining non-PMC group to become PMC counties since t_2. This random selection process continues until t_8 where the last 87 PMC counties are selected from the by-then remaining non-PMC counties.[10] Using this false PMC status variable, a placebo DD estimation is conducted using the specification in column 5 of Table 3. Given the random data generation process, the false PMC variable should have produced no significant estimate with a magnitude close to zero; otherwise, it would indicate a mis-specification of the DD estimation. To increase the identification power of this placebo test, it is repeated 500 times.

Figure 4 shows the distribution of estimates from the 500 runs along with the benchmark estimate, -0.039, from column 5 of Table 3. The distribution of estimates from random

[10] An alternative random selection process tested involves keeping the real years of PMC adoption unchanged (i.e., 58 in 2003, 113 in 2004, 75 in 2005, 15 in 2006, 254 in 2007, 201 in 2009, 153 in 2010 and 87 in 2011), but randomly choosing the corresponding number of PMC counties for each real year. The results from this placebo test are similar to those with randomization of the PMC adoption year and adoption counties. These results are available on request.

assignments is clearly centered around zero and the standard deviation of the estimates is 0.012, suggesting that there is no effect with the randomly-constructed PMC reform. Meanwhile, the benchmark estimate is located outside the entire distribution. Combined, these observations suggest that the negative and significant effect of the PMC reform on economic performance is not driven by unobserved factors.

[Insert Figure 4 Here]

4.4.3 Misreporting and Luminosity Data

Any misreporting of GDP figures by local government officials would influence the results. If such reporting errors (or manipulations) changed systematically after the adoption of the PMC system, the estimates may simply reflect new incentives in GDP reporting. To address that possibility, the luminosity data obtained from the American defense meteorological satellite program are substituted for GDP (Henderson et al., 2012). The estimation results are reported in column 7 of Table 3. Very similar results are obtained with the light per capita as an alternative performance measure.

4.4.4 Alternative Measure of Economic Performance

As a robustness check, the annual growth rate of GDP is tested as an alternative outcome indicator. The lagged per capita GDP (in logarithm) is included to obtain an estimate of conditional convergence (Barro, 2015). The results are reported in column 8 of Table 3. The PMC reform is again found to have reduced economic development in the affected counties.

4.4.5 Event Study

Finally, an event study along the lines described by Jacobson et al. (1993) is conducted. Year-wise changes in economic performance before and after the PMC reform are estimated.

$$\begin{aligned} y_{ct} &= \alpha_c + \boldsymbol{\beta}_k \sum_{k>=-4}^{4+} \mathbf{D}_{t_{c0}-k} + \psi Treatment_c \cdot t \\ &\quad + \mathbf{S} \cdot \gamma_t + \gamma_t + \varepsilon_{ct}. \end{aligned} \tag{3}$$

The dummy variables, $D_{t_{c0}-k}$, jointly represent a window of 4 periods around the PMC reform event. In particular, t_{c0} denotes the year when county c carried out its PMC reform. $D_{t_{c0}-k}$ is a series of dummies indicating whether $t-t_{c0}=k$ with $k=-4,-3,-2,-1,0,1,2,3,4+$. The omitted time category is $k<-4$ so that the post-treatment effects are relative to the period more than 4 years prior to the start of the reform. In other words, the parameters of interest

β_k identify the effects of the PMC reform k years following its occurrence, assuming that the reform affects outcomes up to 4 years prior to the program. Interaction terms between selection variables S and year fixed effects are also included to allow for a more flexible specification of the evolution of outcome variables differing between PMC and non-PMC counties.

Table A4 reports estimation results. None of the four pre-treatment indicators shows any statistical power, suggesting that PMC and non-PMC counties followed similar time trends at least four years before the adoption of the PMC reform. Meanwhile, right after the adoption of PMC, the coefficients become statistically significant and gradually increase in magnitude. Taken together, these point estimates show that the difference in economic development between PMC and non-PMC counties begins to diverge with the implementation of the PMC reform.

5 Interpretation

In this section we shed light on the channels underlying the negative link between the PMC system and economic performance. We start with investigating the nature of the reform. We then examine whether China's implementation of the flattening strategy is flawed. Finally, we test whether the increased span of control for the provincial governments is the main pathway between PMC and GDP.

5.1 The Nature of the PMC Reform

Does the PMC reform reflect simply the removal of one layer in the fiscal hierarchy? Or does it introduce concurrent changes in revenue and expenditure assignment across various layers of governments? To understand the nature of the PMC reform, all the provincial government decrees issued on the implementation of PMCs are collected and examined. In line with the general guidelines of the MOF, the PMC reform mostly involves a flattening of fiscal management with authority moved up from the prefectures to the province. In most of the provinces (16 of 22), no de-jure evidence points to significant revenue and expenditure being decentralized to the county governments. For example, Guizhou province's PMC document explicitly states that "The existing revenue and expenditure assignment among the province, prefectures, and counties shall not be changed" (Qianfubanfa, 2009[95]). In the remaining six provinces (Hubei, Shandong, Sichuan, Yunnan, Shaanxi, and Hunan provinces), some general statements in the PMC documents suggest changes in revenue sharing among the province, prefectures and counties. For example, Shandong province's PMC document explicitly states

that "Prefectures in principle are not entitled to share reformed counties' fiscal revenue" (Luzhengfa, 2009[110]). Table A5 lists for each province the policy details of any adjustment in revenue and expenditure responsibilities across the different layers of governments.

Three exercises are conducted to further shed lights on whether our results are due to the flattening or to changes in revenue/expenditure responsibilities. First, the six provinces which may have made changes in the revenue responsibilities among the different governments are excluded. The estimation results are presented in column 1 of Table 4. The estimated coefficient of the PMC variable remains negative and statistically significant with similar magnitude, suggesting that the PMC effect arises mainly from the flattening reform.

[Insert Table 4 Here]

Second, whether there are any de-facto changes in revenue and expenditure assignment across three layers of governments, despite of a lack of de-jure change is also examined. Following Zhang and Zou (1998) and Liu, Qiao and Zhou (2014), a county's revenue (or expenditure) decentralization is defined as the ratio of the county's budgetary revenue (or expenditure) to the aggregate budgetary revenue (or expenditure) of the county, prefecture and provincial governments, all in per capita terms. Decentralization indicators for the prefecture and provincial governments are constructed similarly. These decentralization indicators for three layers of governments are regressed against the PMC reform variable using the same set of control variables. Estimation results are reported in columns 2–7 of Table 4, with columns 2–4 for the revenue and columns 5–7 for the expenditure assignment. The degree of both revenue and expenditure decentralization at the county level remains unchanged after the PMC reform. The decentralization indicators of the prefecture governments fall and those of the provincial governments increase. These results suggest that some revenue and expenditure responsibilities moved from the prefectural to the provincial governments with no significant change at the county level, supporting the nature of the PMC reform being flattening.

Third, whether PMC and non-PMC counties had substantial differences in their fiscal conditions before the introduction of the PMC reform is investigated. Table A6 shows both the unconditional and conditional comparison of the two group's initial fiscal characteristics. On most fiscal variables, the conditional mean differences are not economically significant, suggesting that the PMC and non-PMC counties are well balanced.

5.2 Fiscal Transfers and Revenue

The PMC reform essentially transferred the direct administration of the county governments on fiscal matters from the city governments to the provincial governments. Flattening the hierarchies presumably improves the allocation of funding to the county governments. However, if it did not achieve that first-order goal and worsened the county governments' fiscal situations, it may finally have led to a deterioration in economic performance.

To test such hypotheses, the impact of the reform on inter-government transfers and the county governments' total fiscal revenue are examined. Resulting addressing whether the PMC reform increases or decreases total budgetary transfers received by county governments are reported in column 1 of Table 5. A positive and statistically significant relationship between PMC reform and per capita budgetary transfers is evident.

[Insert Table 5 here]

Whether the county governments receive larger tax rebates after the PMC reform is also tested. The estimation results are reported in column 2. The positive and statistically significant coefficient of the PMC term suggests that the reform increases the tax rebates received by county governments. Combined, these two columns suggest that the PMC reform increases the funding distributed to the county governments.

Whether the fiscal revenue at the county level improves or not is examined in column 3. The reform increases the fiscal revenue of the PMC counties, despite an insignificant coefficient.

Since 1998, local governments (the prefecture and the county) have been assigned exclusive statutory rights to sell land. The resulting land conveyance fees are classified as "extra-budgetary revenue", which is not shared with upper-level authorities (Chen and Kung, 2015). Given the deterioration in their fiscal condition, county governments have been increasingly relying on the revenue from land transactions to fill fiscal gaps, a phenomenon known as land financing. If the PMC reform realized its first-order objective of improving the county governments' fiscal situations, the degree of land financing might be expected to fall. Column 4 supports this. Per capita land revenue decreased after the PMC reform. It is noteworthy that PMC documents address various aspects of fiscal management, but they do not involve land sale policy changes (e.g., tightening land sales). The results on land revenue cannot, therefore, be simply interpreted as due to restrictions imposed by upper-level governments.

Given the increasing importance of land sales in the county governments' revenue, whether or not the combined inter-government transfers, tax rebates, county budgetary revenue and land sales increase after the PMC reform is also examined. Note that the data on inter-

government transfers and county fiscal revenue are available from 1995 to 2009 while the land sales data are available from 2002 to 2012 when market mechanisms start to play an important role.[11] So the combined revenue can only be analyzed for the period 2002–2009. The results reported in column 5 show that the PMC reform improved the overall fiscal conditions in the affected counties.

Taken together, these results indicate that the county governments' fiscal situations improved after the PMC reform. The reform achieved its policy goals. These findings corroborate those of Rajan and Zingales (2001), which find that a vertical hierarchy suffers from organizational diseconomies of scale due to losses across vertical layers. And Crémer, Garicano, and Prat, (2007) have shown that vertical hierarchies increase delay because communication involves more steps. Expropriability and delay on fiscal matters are perhaps reduced in the PMC counties after the flattening.

5.3 Span of Control and Spending

A comparison between horizontal and vertical hierarchies has been shown to entail a trade-off of delay against communication and coordination costs (Van Zandt, 2013). When the number of subordinates increases, a horizontal hierarchy results in less precise communication and poorer coordination across units. Moreover, the incentive theory suggests that when supervision is used to mitigate moral hazard in a hierarchical organization, the probability of monitoring decreases with the span (Qian, 1994). If the provincial governments are unable to act as better administrators than the prefectures have been, the PMC reform may indeed have reduced administration efficiency. According to field evidence, management is indeed a key challenge for the provincial governments (Zhang, 2011). After the reform, the average span of control for the provinces has increased dramatically from 12 to 52, with a number of provinces' span even exceeding 80. Taking into account the scale of China's territory and population, on average a province occupies 28 million square kilometers with a population of 45 million.

This motivates testing whether the enlarged span of control caused by the flattening influences economic performance. To do this, a variable $Span_{ct}$ is defined to quantify the span of control of the county governments' supervising bodies. As an illustration of the variable's construction, consider the following example. Assume that in 2003 county c was under a prefecture city's administration and that the prefecture managed another 4 counties. The province had 15 prefectures. In 2004, assume that 3 counties in the prefecture, including

[11] A 2002 provision requested that all state-owned land appropriate for real estate development be allocated through a public process. Since 2002, land sales have increased dramatically. See the 11th provision issued by the Ministry of Land and Resources in May 2002.

c, adopted the PMC system and that there were 10 counties in the whole province which did so. $Span_{ct}$ was then 5 in 2003; and 25 in 2004. For non-PMC counties in the prefecture of county c, the span of control variable was 5 in 2003 and 2 in 2004.

Regressing $Span_{ct}$ on PMC_{ct} with the same controls as in equation (2) verifies whether the span of control increased in PMC counties after the adoption of the PMC reforms.

$$\begin{aligned} Span_{ct} &= \alpha_c + \delta \cdot PMC_{ct} + \psi Treatment_c \cdot t \\ &\quad + \phi S \cdot \gamma_t + \gamma_t + \varepsilon_{ct}. \end{aligned} \tag{4}$$

The regression results are reported in column 1 of Table 6. The PMC_{ct} term has a positive and statistically significant coefficient, supporting the argument that the PMC reform expands the span of control of the county governments' supervising bodies.

[Insert Table 6 Here]

To investigate whether the changes in the span of control significantly influences economic performance, $Span_{ct}$ is included as an additional control in the baseline DD specification (2). If the inclusion of $Span_{ct}$ leads to a substantial decrease in the coefficient of PMC_{ct}, this would imply that the span of control may be an important influence.[12] The regression results are reported in column 2. With $Span_{ct}$ included the coefficient of PMC_{ct} is no longer significant and the magnitude changes from -0.039 to $+0.017$. This suggests that the PMC reform substantially increases the span of control of the county governments' supervising bodies, which in turn negatively affects their economic performance.

To further shed light on how the increase in the span of control affects economic performance, components of county government spending are examined. Each county's total public investment is decomposed into productive investment—expenditure for capital construction, expenditures supporting rural production, agriculture, forestry, water management and meteorology—and other investment.[13] The regression results are reported in columns 3 and 4 of Table 6. Column 3 shows that the PMC reform significantly reduces public

[12] Specifically, assume the coefficient of PMC without the control for $Span$ to be β_1. In the regression with the control for $Span$, assume the coefficients of PMC and $Span$ to be β_2 and ρ, respectively. Hence, we have $\beta_1 = \beta_2 + \delta \cdot \rho$, where δ is the coefficient of $Span$ regressing on PMC with the same set of controls. In other words, $\delta \cdot \rho$ captures the effect of PMC via $Span$. For other examples of the same approach see, e.g., Acemoglu, Johnson and Robinson (2002); Maccini and Yang (2009), and a more formal exhibition of this decomposition, see Gelbach (2016).

[13] Expenditures on education, public health, social security, government administration and foreign affairs are considered non-productive investment. Due to a statistical change in 2007, consistent information on the expenditure composition is available only for the period from 1999 to 2006, which is used in the regression of columns 3 and 4.

investment by an average of 11.9%. In column 4, the estimated coefficient remains highly significant with a magnitude of -17%. Taken together, the PMC system seems to have qualitatively similar impacts on both total public investment and pro-growth investment in the reformed county. The provision of public services to the residents in the reformed county tends to be negatively affected.

5.4 Land Corruption

According to Cai, Henderson and Zhang (2013), before 2002 most land was allocated by "negotiation" in an opaque process. Under this scheme, the transaction price was usually much lower than the market value. Governments lost much revenue, accompanied by large economic rents for the officials and allocation inefficiencies. Concerns over corruption in land markets pushed the central government to conduct a series of reforms in the early 2000s. In particular, a 2002 provision and later 2004 notification requested all state-owned urban land appropriate for real estate development be allocated through public tender (zhaobiao), auction (paimai), or listing (guapai) after August 31, 2004.[14]

To investigate how the PMC reform affect local governments' behavior in land sales, parcel-level data on land transactions are collected from the official website of China's Ministry of Land and Resources from 2007 when the data coverage became more complete.[15] In our sample, the proportion of land sold through "negotiation" was 58.2% in 2007 and decreased to 37.2% in 2012, indicating an increasing importance of market mechanisms in land allocation.[16]

Those parcel-level land transactions are used to examine whether the PMC reform changed the way land was sold as well as the prices, conditional on the same set of previous controls along with land area, land usage type and land quality. Estimation results are reported in Table 7. The PMC reform apparently led to more land sold through negotiation and lower prices in the affected counties. The results provide suggestive evidence of increased land corruption after the PMC reform, which could be caused by the difficulty of monitoring the counties after the flattening. Given the dramatically enlarged span of control,

[14] See the 11th provision issued by the Ministry of Land and Resources in May 2002; Notification No. 71 issued by the Ministry of Land and Resources and the Ministry of Supervision.

[15] In 2007, the aggregated parcel-data starts to be closer to the China Land and Resources Statistical Yearbook's statistics at the regional level. Also, Chen and Kung (2015) use parcel-level data for their analysis starting from 2007.

[16] Note that Cai, Henderson and Zhang (2013) analyze 2302 transactions in 15 cities which held either English auctions (*paimai*) or two-stage auctions (*guapai*) from 2003 to 2007. Land allocations by tender (*zhaobiao*) or negotiation are not included. This study's comprehensive dataset covers 417,314 transactions in most cities from 2007 to 2012. The sample also includes all land use types (land for industrial use, real estate development, land for the use of the service sector, and other non-commercial land) and allocation methods.

the province may have had difficulty monitoring not only budgetary spending but also land sales. Motivated by economic rents, local officials in the PMC counties may have allocated more of their land through private negotiation compared to non-PMC counties. The findings are also consistent with the previous results that the PMC counties have experienced a drop in land sales. The lost land revenue could have been used for providing more local public goods, which might have enhanced economic performance. These results resonate with those of Chen and Kung (2015) that land revenue windfalls have fueled corruption and undermined the local leaders' incentives to spur economic growth at the county level.

[Insert Table 7 Here]

So the flattening achieves its first-order goal. The counties' revenue improved after the adoption of the PMC policies, due to the elimination of the intermediate city government layer. However, the increase in the span of control involved may have reduced county governments' spending and fueled corruption due to monitoring and coordination problems, which had a negative effect on economic performance.

5.5 Other Outcomes

Did the PMC reform affect other aspects of the county economy in a similar manner as per capita GDP? Columns 1 and 2 of Table 8 relate the PMC reform with average rural household income and the average urban household wage. Both outcomes are measured as log(¥) to facilitate the interpretation of the magnitude. PMC status shows no significant effect on either rural household income or urban wages. Figure A3 presents the time trends for the PMC and non-PMC groups, which show no difference before and after 2003. These results imply that neither rural nor urban residents benefit directly from the flattening of the government hierarchy.

[Insert Table 8 Here]

Column 3 intends to study the effect of the PMC reform on household consumption. Due to a lack of household-level data, the logarithm of retailing sales per capita is used as a proxy. The negative and statistically significant coefficient of the PMC_{ct} term suggests that counties adopting PMC policies witness a decline in consumption.

As for income inequality, without longitudinal household-level surveys in the sample period, income inequality can not be quantified directly. Instead, the luminosity data are used to calculate the standard deviation of light emission of all pixels within a county boundary as a proxy for county income inequality. The regression results are reported in column 4.

No statistically significant effect of the PMC reform is evident, indicating that the flattening reform did not influence income inequality significantly.

These alternative ways of measuring performance at the county level give results consistent with the previous findings, which show a negative effect of the PMC reform on per capita GDP. Due to the pattern of expenditure by the county governments, the increased revenue and transfers do not generate an increase in social welfare.

6 Conclusion

This paper exploits a natural experiment in the context of the largest developing country, China, to examine the effect of government flattening on organizational performance. These results suggest that a more horizontal government organization decreased delay and expropriation in fiscal transfers and revenue. But the increased span of control makes it difficult for the upper level government to coordinate and monitor local governments' spending and land sales. As a result, county economic performance measured by per capita GDP is negatively affected by such reforms.

Our analysis demonstrates the trade-off between a horizontal hierarchy and a vertical hierarchy emphasized by organization economics literatures. The optimal organization shape crucially depends on the resulting coordination, monitoring and control. When the benefits of reducing vertical control losses outweigh the costs of coordination and monitoring, a horizontal hierarchy will outperform a vertical one. A vertical hierarchy is better if coordination and monitoring problems are more prevalent. The results yield important policy insights that the governance structure is critical in designing an efficient organization and that it must be sensitive to the institutional environment within which the organization operates.

This study could be a useful first step towards better understanding government organizational forms in developing countries. Much remains to be done. A deeper analysis of political economy within organizations is an exciting avenue for future research. Detailed data on the interaction between upper and lower levels of government, such as on time use, would help enrich the micro-foundations of interactions associated with different organizational forms (Bandiera, Prat, Sadun and Wulf, 2014).

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Appendix Literature Comparison

During recent years, the PMC reform and its effects have been hotly debated in China. This section reviews five representative research papers published in Chinese economics journals after 2009. Four of the papers examine the impact of PMC on growth. Cai and Huang (2010), Zheng et al. (2011) and Liu et al. (2014) find positive effects of PMC on growth in county per capita GDP. By contrast, Jia et al. (2013) finds a negative relationship. Taking a different perspective, Chen and Lu (2014) focus on the impact of PMC reforms on a county's ratio of construction investment to its fiscal expenditure. They find that PMC reforms increases the proportion of a county's investment in construction.

Most studies have focused on the first wave of PMC reform before 2008. In contrast, this study considers both the first and second waves during 1995–2012. Also, those five papers use different samples and dependent variables, and some of the econometric problems are not properly dealt with. The following steps are taken to reconcile possible differences of the findings of those studies and those reported here, and to conduct a meaningful comparison. First, the same dependent variables and similar samples are used as the five papers. Second, the effects of PMC are estimated based on our specification, which rigorously addresses endogeneity problems.

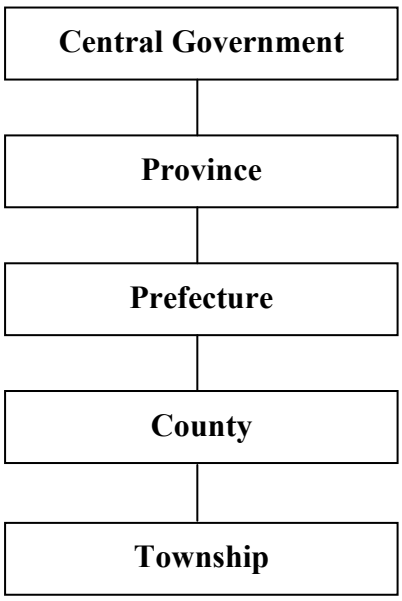
As shown in Table A7, there are some differences between the resulting estimates and those published previously. The reasons can be summarized as follows. First, all five studies estimate the PMC effect using the DD design, but their results could be biased because the PMC counties were not randomly selected. Meanwhile, the endogeneity problem and missing variable issue (e.g., in Liu et al. 2015 initial GDP is not included as a control) in the five studies could result in biased results. The specification here is largely free from these problems.

The main data sources used in these studies are NPCFS and the county Socio-economic Statistical Yearbooks (CSCCs). However, GDP data in those resources are of poor quality. For example, in some years the data are not consistent with those reported in provincial statistical yearbooks which are used in this study and which are more accurate, and reliable. They also suffer from abnormal and missing values. And a few studies do not take into account price levels, which are essential for meaningful inter-regional comparisons that involve measures of income (GDP). Jia et al. (2013) and Liu et al. (2014) use provincial CPIs to deflate GDP, but that too has shortcomings (Brandt and Holz, 2006).

Furthermore, for unknown reasons, a large number of counties are not included in most previous studies. Cai and Huang (2010) subjectively dropped a large number of counties, such as county cities, ethnic counties and Mongolian and Manchurian banners. Based on

some subjective criteria, Zheng et al. (2011) dropped 51 counties. Liu et al. (2014) dropped counties which were both PMC counties and CPE counties and also dropped some outliers with abnormal values. Therefore, their results could suffer badly from sample selection bias. It is also difficult to extrapolate general implications from those studies. As has been mentioned, Zhejiang and Hainan adopted the PMC system in the late 1980s. But Jia et al. (2015) and Liu et al. (2014) include the counties from those two provinces in their samples and regard them as non-PMC counties. Therefore, the PMC effects in those two studies could be overestimated.

Figure 1. China's Governance Structure before the PMC Reform

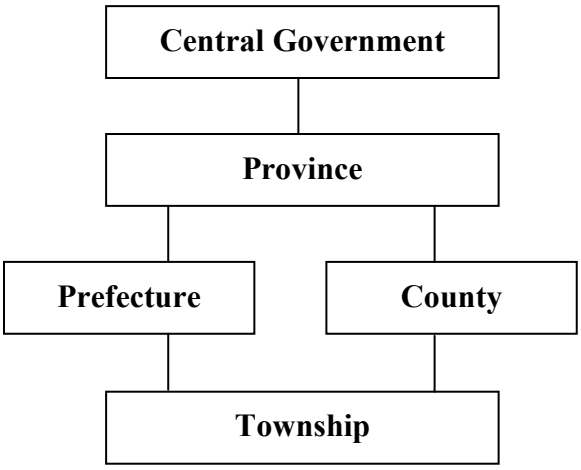


Span of control

Province		Prefecture	
Mean	SD	Mean	SD
12.33	4.38	8.30	3.90

Note: Means and standard deviations of spans of control before the PMC reform are reported. For the province, the span of control is measured as the number of subordinates the provincial government directly oversees. For the prefecture, the span of control is measured as the number of subordinates the prefecture government directly oversees.

Figure 2. China's Governance Structure after the PMC Reform

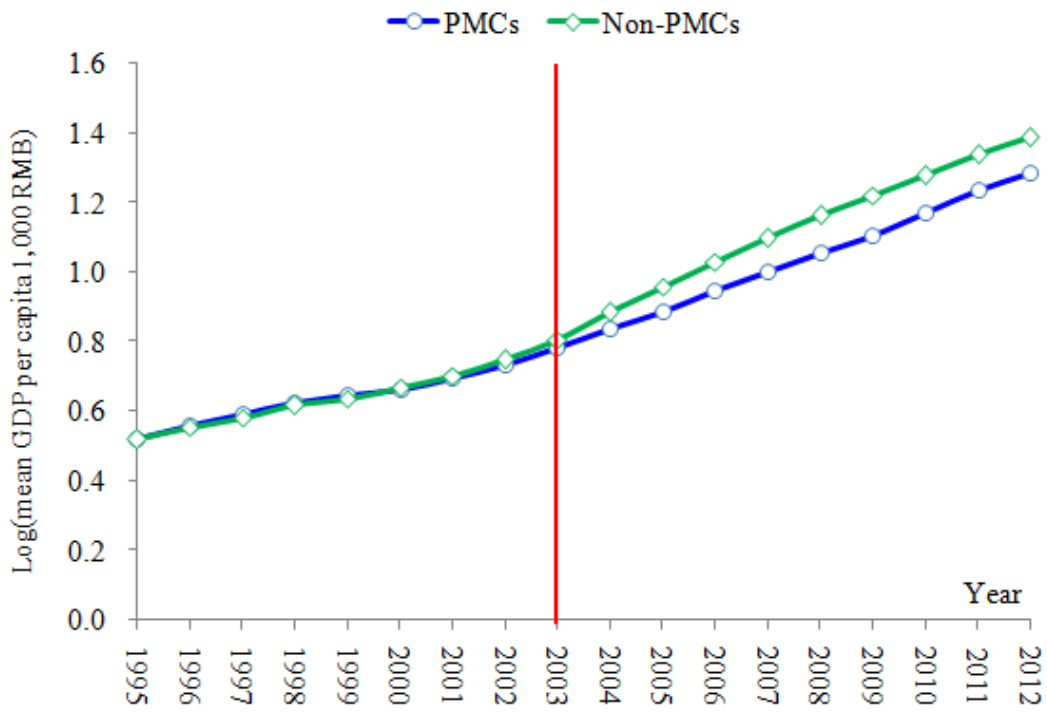


Span of control

Province		Prefecture	
Mean	SD	Mean	SD
51.82	30.06	5.36	3.79

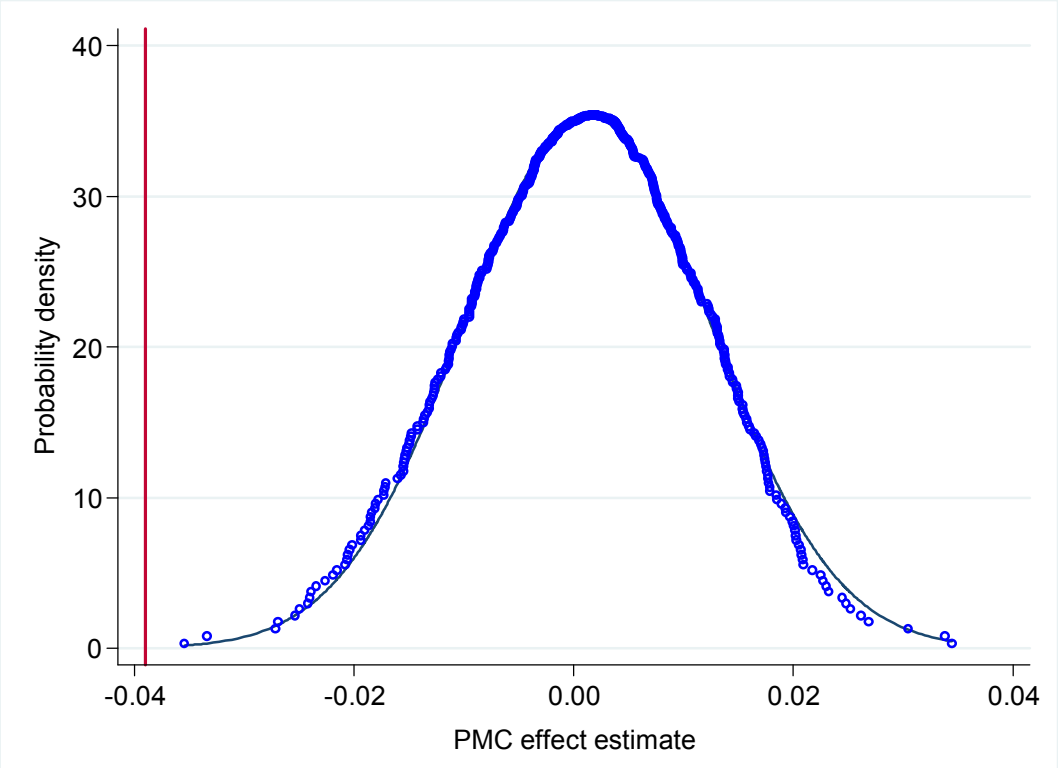
Note: Means and standard deviations of spans of control after the PMC reform are reported. For the province, the span of control is measured as the number of subordinates the provincial government directly oversees. For the prefecture, the span of control is measured as the number of subordinates the prefecture government directly oversees.

Figure 3. GDP per capita trend comparison 1995-2012



Note: The figure illustrates the time trends of GDP per capita (in log) of the PMC counties (i.e., counties that adopted the PMC reform since 2003) and that of non-PMC counties (i.e., counties that did not adopt the PMC reform during our sample period).

Figure 4. Distribution of Estimated Coefficients of Falsification Test



Note: The figure shows the cumulative distribution density of the estimated coefficients is from 500 simulations randomly assigning the PMC status to counties. The vertical line presents the result of column 5 in Table 3.

Figure A1.Spatial Distribution of PMC Counties before 2003

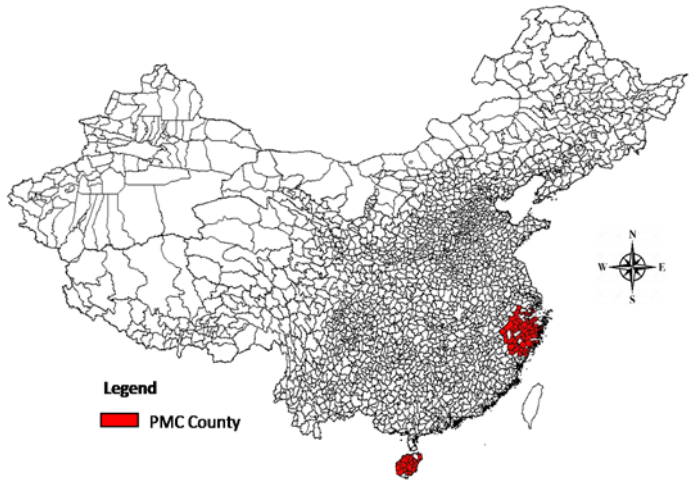


Figure A2.Spatial Distribution of PMC Counties in 2012

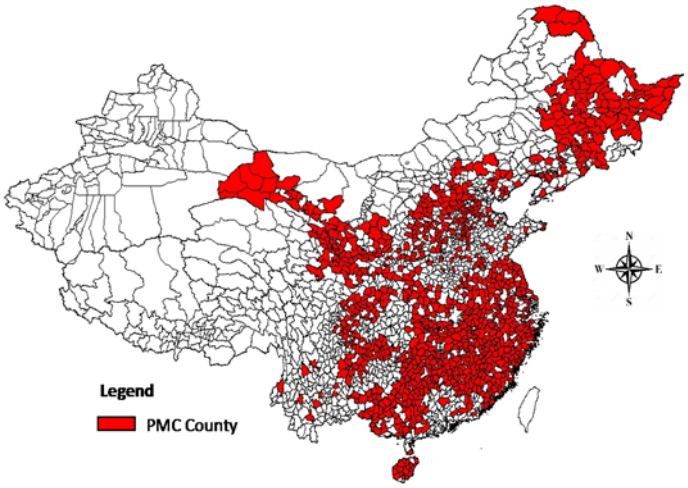
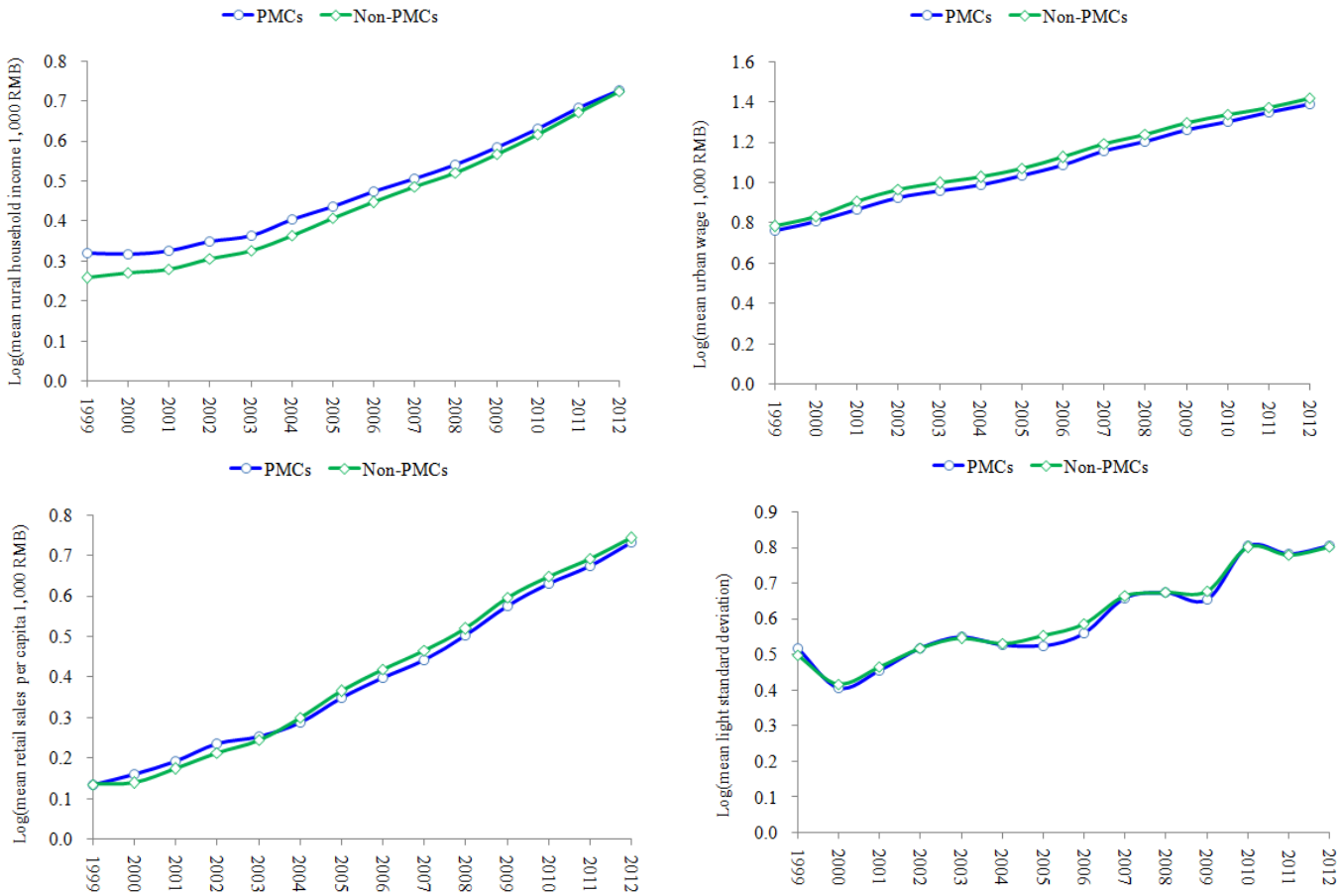


Figure A3. Other outcome varible trend comparision 1999-2012



Note: The figure illustrates the time trends of other outcome variables (*i.e.*, the dependent variables in Table 8) of the PMC counties (*i.e.*, counties that adopted the PMC reform since 2003) and that of non-PMC counties (*i.e.*, counties that did not adopt the PMC reform during our sample period).

Table 1

Summary Statistics

Variable	Definition	Mean	S.D.	Data Coverage
Organization Form				
Post_PMC	=1 if a county adopted PMC reform in year t and afterwards; =0 otherwise	0.16	0.37	1995–2012
Span	span of control of the county governments' supervising bodies	19.25	22.79	1995–2012
Selection Criteria				
County_City	=1 if a county is a county-level city; =0 otherwise	0.18	0.38	1999
Poor_County	=1 if a county is a national poverty county; =0 otherwise	0.31	0.46	1999
Food_County	=1 if a county is a national food or cotton production county; =0 otherwise	0.28	0.45	1999
ProvBoundary_county	=1 if a county's boundary (at least part of it) is overlapped with its provincial boundary; =0 otherwise	0.38	0.48	1999
Altitude	County seat's altitude (km)	0.69	0.84	1999
Slope	Average county slope (degrees)	8.94	6.86	1999
Fiscal_Gap99	Ratio of fiscal expenditure to fiscal revenue in year 1999	2.52	2.51	1999
Urban_Rate00	Percentage of non-agricultural population in the total population in year 2000	16.20	11.46	2000
Fiscal Variables				
GovRev_PerCapita	Budgetary government revenue per capita (¥)	299.43	552.52	1995–2009
Transfer_PerCapita	Fiscal transfers per capita (¥)	315.07	453.43	1995–2009
TaxRebate_PerCapita	Tax rebates per capita (¥)	65.06	91.80	1995–2009
LandSale_Percapita	Land sale revenue per capita (¥)	313.19	6288.38	2002–2012
GovAllRev_PerCapita	(Fiscal transfers + tax rebates + budgetary government revenue + land sale revenue)/ total population (¥)	1184.29	7388.75	2002–2009
GovExp_PerCapita	Budgetary government expenditure per capita (¥)	563.28	632.75	1995–2006
ProGrowthInvest_PerCapita	Pro-growth government investment per capita (¥)	86.83	191.00	1995–2006
Land parcel variables				
LandPrice	Total sale price of a land parcels (million ¥)	9.50	724.17	2007–2012
LandGov_Allocate	=1 if a parcel of land was sold through negotiation; =0 otherwise	0.46	0.50	2007–2012
Revenue_Decentralization				
County	(County budgetary government revenue per capita)/(county budgetary government revenue per capita+prefecture budgetary government revenue per capita+province budgetary government revenue per capita)	0.26	0.13	1995–2009
Prefecture	(Prefecture budgetary government revenue per capita)/(county budgetary government revenue per capita+prefecture budgetary government revenue per capita+province budgetary government revenue per capita)	0.11	0.11	1995–2009
Province	(Province budgetary government revenue per capita)/(county budgetary government revenue per capita+prefecture budgetary government revenue per capita+province budgetary government revenue per capita)	0.63	0.15	1995–2009
Expenditure_Decentralization				
County	(County budgetary government expenditure per capita)/(county budgetary government expenditure per capita+prefecture budgetary government expenditure per capita+province budgetary government expenditure per capita)	0.32	0.10	1995–2009
Prefecture	(Prefecture budgetary government expenditure per capita)/(county budgetary government expenditure per capita+prefecture budgetary government expenditure per capita+province budgetary government expenditure per capita)	0.11	0.07	1995–2009
Province	(Province budgetary government expenditure per capita)/(county budgetary government expenditure per capita+prefecture budgetary government expenditure per capita+province budgetary government expenditure per capita)	0.57	0.11	1995–2009
Outcome variables				
GDP_PerCapita	GDP per capita (¥)	9008.60	12505.50	1995–2012
Light_PerCapita	Light emissions at night per capita (original digital number × 100)	1.81	2.47	1999–2012
Retail_PerCapita	Retail sales per capita (¥)	2794.14	2977.76	1999–2012
Rural_Income	Rural household income (¥)	3065.63	1706.05	1999–2012
Urban_Wage	Urban worker wage (¥)	13707.95	6961.42	1999–2012
Light_SD	Standard deviation of light emission of all cells within a county boundary	4.19	3.21	1999–2012
Other Reform				
CPE	=1 if a county adopted county-power-expansion reform in year t and afterwards; =0 otherwise	0.15	0.36	1995–2012

Note: All variables are at the county-level. Definitions, means, standard deviation and time periods covered are reported. All monetary values are deflated using the provincial price deflators of Brandt and Holz (2006) with Beijing as the base province and 1999 as the base year. Data sources are described in full in section 3.1.

Table 2
Summary statistics

Variable	Treatment group	Control group	Unconditional diff.	Conditional diff.
	(1)	(2)	(3)	(4)
Panel A: Selection criteria				
County-level city	0.190	0.170	0.021	
(%)	[0.393]	[0.376]	(0.018)	
National poverty county	0.285	0.329	-0.043**	
(%)	[0.452]	[0.470]	(0.022)	
National food or cotton production county (%)	0.343	0.209	0.133***	
	[0.475]	[0.407]	(0.021)	
Provincial boundary county	0.400	0.348	0.052**	
(%)	[0.490]	[0.477]	(0.023)	
Altitude	0.475	0.947	-0.472***	
(km)	[0.633]	[0.970]	(0.039)	
Slope	8.229	9.779	-1.550***	
(degree)	[6.177]	[7.510]	(0.327)	
Ratio of fiscal expenditure to fiscal revenue 1999	2.073	3.053	-0.980***	
	[1.460]	[3.272]	(0.123)	
Urbanization rate 2000	15.637	16.860	-1.223***	
(%)	[10.051]	[12.898]	(0.551)	
Panel B: Other characteristics				
Illiteracy rate 2000	10.661	14.385	-3.724***	-0.148
(%)	[7.345]	[12.488]	(0.493)	(0.344)
Years of education 2000	7.123	6.824	0.301***	-0.016
(years)	[0.744]	[1.278]	(0.050)	(0.301)
Aged dependency ratio 2000	10.051	9.476	0.575***	-0.094
(%)	[2.170]	[2.555]	(0.113)	(0.097)
Road length per capita 2000	21.002	35.958	-14.956	-2.134
(km/person)	[42.407]	[55.300]	(2.349)	(2.560)
Manufacturing export intensity 2000	0.065	0.055	0.010*	-0.003
(%)	[0.119]	[0.115]	(0.006)	(0.006)
Herfindahl index 2000	0.624	0.618	0.005	-0.001
	[0.160]	[0.177]	(0.008)	(0.005)
Agriculture share of GDP 1999	36.102	37.648	-1.545**	-0.605
(%)	[14.056]	[16.285]	(0.722)	(0.666)
Service industry labor share 2000	13.627	14.916	-1.289***	-0.275
(%)	[6.567]	[9.693]	(0.396)	(0.267)
Observations	978	831		

Note: This table reports the summary statistics of our treatment and control samples. Panel A shows the comparison of selection criteria between the treatment and control groups. Panel B compares the treatment and control groups on various economic and social development variables in the initial year, both before and after controlling for the selection criteria. Columns 1 and 2 show means and standard deviations in square brackets. Column 3 reports the unconditional difference between the treatment and control group. Column 4 reports the conditional difference of these characteristics of a regression on the treatment dummy controlling for the selection criteria. The standard errors are reported in parentheses.

Table 3

The Impacts of the PMC Reform on Economic Development

Dependent variable	Log(*GDP_PerCapita*)						Log(*Light_PerCapita*)	*GDP_Growth*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post_PMC	-0.097***	-0.027***	-0.113***	-0.028**	-0.039***	-0.023*	-0.024*	-0.007*
	(0.013)	(0.011)	(0.035)	(0.011)	(0.011)	(0.012)	(0.013)	(0.004)
Dependent variable mean	8.679	8.679	8.679	8.679	8.679	8.653	0.081	0.111
County fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Treatment trend		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control × T		Yes						
Control × T^2		Yes						
Control × T^3		Yes						
Control × Post_PMC			Yes					
Control × Year dummy				Yes	Yes	Yes	Yes	Yes
Only PMC counties						Yes		
CPE dummy					Yes	Yes	Yes	Yes
Log(one-year lagged GDP)								Yes
Adjusted R-squared	0.929	0.933	0.930	0.933	0.933	0.935	0.922	0.158
Year coverage	1995–2012	1995–2012	1995–2012	1995–2012	1995–2012	1995–2012	1999–2012	1996–2012
No. of clusters	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809
No. of Observations	32,562	32,562	32,562	32,562	32,562	17,604	25,251	30,753

Note: *** denotes significance at 1%, ** at 5%, and * at 10%. All observations are at the county-year level. The variable "control" denotes eight key criteria the provinces used in selecting the PMC counties. In columns 1–6, the dependent variable is the natural log of the measure of per capita GDP. Interactions of the eight key selection variables with a third-order polynomial function of time are included in column 2. Beyond that, treatment-specic linear time trends are included to control for the differences in time trends between the treatment and control groups. Interactions of the eight key selection variables with the *Post_PMC* variable are included in the estimation reported in column 3, and year dummies in that of column 4. A variable indicating whether a county government carried out a CPE reform is included as an additional control variable in column 5. The estimation results using only PMC counties are reported in column 6. The luminosity data obtained from the American defense meteorological satellite program are substituted for GDP in column 7. The annual growth rate of GDP is tested as an alternative outcome indicator in column 8, in which the lagged per capita GDP (in logarithm) is included to obtain an estimate of conditional convergence (Barro, 2015). The standard errors are reported in parentheses, clustered by county. All regressions control for year fixed effects and county fixed effects.

Table 4

The Nature of the PMC Reform

Dependent variable	Log(*GDP_PerCapita*)	*Revenue_Decentralization*			*Expenditure_Decentralization*		
		County	Prefecture	Province	County	Prefecture	Province
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post_PMC	-0.043***	0.001	-0.013***	0.012***	0.001	-0.008***	0.007***
	(0.014)	(0.004)	(0.003)	(0.004)	(0.001)	(0.002)	(0.001)
Dependent variable mean	8.680	0.260	0.113	0.626	0.318	0.111	0.571
County fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control × Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Treatment trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CPE dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample drop	Yes						
Adjusted R-squared	0.929	0.798	0.849	0.866	0.854	0.841	0.895
Year coverage	1995–2012	1995–2009	1995–2009	1995–2009	1995–2009	1995–2009	1995–2009
No. of clusters	1,160	1,809	1,809	1,809	1,809	1,809	1,809
No. of Observations	20,880	27,096	27,097	27,097	27,097	27,097	27,097

Note: *** denotes significance at 1%, ** at 5%, and * at 10%. All observations are at the county-year level. In column 1, the dependent variable is the natural log of the measure of per capita GDP. Counties belonging to the six provinces (Hebei, Shandong, Hunan, Sichuan, Yunnan and Shanxi) which may have made changes in the revenue responsibilities among the different governments are excluded. In columns 2–7, the dependent variables are decentralization indicators for three layers of governments, with columns 2–4 for the revenue and columns 5–7 for the expenditure assignment. The standard errors are reported in parentheses, clustered by county. All regressions control for year fixed effects, county fixed effects, interactions of the eight key selection variables with year dummies, treatment-specic linear time trends and a CPE reform dummy.

Table 5

The Impact of the PMC Reform on Transfer and Revenue

Dependent variable	Log(*Transfer_PerCapita*)	Log(*TaxRebate_PerCapita*)	Log(*GovRev_PerCapita*)	Log(*LandSale_Percapita*)	Log(*GovAllRev_PerCapita*)
	(1)	(2)	(3)	(4)	(5)
Post_PMC	0.299***	0.110**	0.007	-0.193*	0.024**
	(0.061)	(0.047)	(0.027)	(0.108)	(0.010)
Dependent variable mean	4.304	3.714	5.206	2.466	6.730
County fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Control × Year dummy	Yes	Yes	Yes	Yes	Yes
Treatment trend	Yes	Yes	Yes	Yes	Yes
CPE dummy	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.627	0.631	0.720	0.587	0.930
Year coverage	1995–2009	1995–2009	1995–2009	2002–2012	2002–2009
No. of clusters	1,809	1,809	1,809	1,809	1,809
No. of Observations	27,135	27,135	27,135	19,899	14,472

Note: *** denotes significance at 1%, ** at 5%, and * at 10%. All observations are at the county-year level. In column 1–2, the dependent variable are the natural log of per capita budgetary transfers and tax rebates received by county governments. In column 3–4, the dependent variable are the natural log of per capita budgetary government revenue and land sales. In column 5, the dependent variable is the natural log of the combined per capita inter-government transfers, tax rebates, county budgetary revenue and land sales. The standard errors are reported in parentheses, clustered by county. All regressions control for year fixed effects, county fixed effects, interactions of the eight key selection variables with year dummies, treatment-specic linear time trends and a CPE reform dummy.

Table 6

The Mechanism of PMC: the Span of Control and Expenditure

Dependent variable	Log(*Span*)	Log(*GDP_PerCapita*)	Log(*GovExp_PerCapita*)	Log(*ProGrowthInvest_PerCapita*)
	(1)	(2)	(3)	(4)
Post_PMC	1.902***	0.017	-0.119***	-0.170***
	(0.007)	(0.029)	(0.017)	(0.033)
Log(*Span*)		-0.030**		
		(0.014)		
Dependent variable mean	2.531	8.679	6.036	3.831
County fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Control × Year dummy	Yes	Yes	Yes	Yes
Treatment trend	Yes	Yes	Yes	Yes
CPE dummy	Yes	Yes	Yes	Yes
Adjusted R-squared	0.919	0.933	0.929	0.855
Year coverage	1995–2012	1995–2012	1995–2006	1995–2006
No. of clusters	1,809	1,809	1,809	1,809
No. of Observations	32,562	32,562	21,670	21,670

Note : *** denotes significance at 1%, ** at 5%, and * at 10%. All observations are at the county-year level. In column 1, the dependent variable is the natural log of the span of control of the county governments supervising bodies. In column 2, the dependent variable is the natural log of per capita GDP and the "Span" variable is included as an additional control. In column 3–4, the dependent variables are the natural log of county government expenditure and pro-growth investment. Due to a change in definition in 2007, consistent statistics on the breakdown of expenditure are only available for the period from 1995 to 2006. The standard errors are reported in parentheses, clustered by county. All regressions control for year fixed effects, county fixed effects, interactions of the eight key selection variables with year dummies, treatment-specic linear time trends and a CPE reform dummy.

Table 7

Land sale results 2007-2012

	Log(*LandPrice*)	*LandGov_Allocate*
	(1)	(2)
Post_PMC	-0.056	0.077***
	(0.056)	(0.016)
Log(*Area*)	1.020***	-0.071***
	(0.006)	(0.016)
Dependent variable mean	3.252	0.462
County fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
Control × Year dummy	Yes	Yes
Treatment trend	Yes	Yes
CPE dummy	Yes	Yes
Land scale dummy	Yes	Yes
Land use type dummy	Yes	Yes
Adjusted R-squared	0.883	0.477
No. of clusters	1,789	1,789
No. of Observations	417,314	417,314

Note : *** denotes significance at 1%, ** at 5%, and * at 10%. All observations are at the parcel-county-year level. In column 1, the dependent variable is the natural log of land price. In column 2, the dependent variable is an indicator for whether the land was sold through negotiation. The standard errors are reported in parentheses, clustered by county. All regressions control for year fixed effects, county fixed effects, interactions of the eight key selection variables with year dummies, treatment-specic linear time trends and a CPE reform dummy along with land area, land usage type and land quality.

Table 8

The Impacts of the PMC Reform on Social Welfare Outcomes

	(1)	(2)	(3)	(4)
Log(*Rural_Income*)	-0.008			
	(0.008)			
Log(*Urban_Wage*)		-0.002		
		(0.007)		
Log(*Retail_PerCapita*)			-0.024***	
			(0.009)	
Log(*Light_SD*)				-0.008
				(0.009)
Dependent variable mean	7.882	9.401	7.586	1.333
County fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Control × Year dummy	Yes	Yes	Yes	Yes
Treatment trend	Yes	Yes	Yes	Yes
CPE dummy	Yes	Yes	Yes	Yes
Adjusted R-squared	0.930	0.933	0.938	0.948
Year coverage	1999–2012	1999–2012	1999–2012	1999–2012
No. of clusters	1,804	1,809	1,809	1,809
No. of Observations	25,248	25,267	25,324	25,251

Note : *** denotes significance at 1%, ** at 5%, and * at 10%. All observations are at the county-year level. In columns 1 and 2, the dependent variables are the natural log of average rural household income and average urban household wage. In column 3, the dependent variable is the natural log of retailing sales per capita. In column 4, the dependent variable is the natural log of the standard deviation of light emission of all pixels within a county boundary as a proxy for county income inequality. The standard errors are reported in parentheses, clustered by county. All regressions control for year fixed effects, county fixed effects, interactions of the eight key selection variables with year dummies, treatment-specic linear time trends and a CPE reform dummy.

Table A1

Number of counties adopting PMC and CPE reforms.

Year	PMC	CPE
Before 2001	74	31
2001	0	0
2002	0	0
2003	58	30
2004	113	168
2005	75	68
2006	15	161
2007	254	90
2008	0	64
2009	201	183
2010	153	12
2011	87	68
2012	22	65
Total	1052	940

Note: By the end of 2012, the PMC reform had been implemented across 22 provinces in China and the CPE reform had been implemented across 21 provinces.

Table A2

Province-Managing-County Criteria

Province	Implementation Phase			Simultaneous Implementation
	The First Wave	The Second Wave	The Third Wave	
Hebei	Economic strength, Development potential, Regional planning, Urbanization levels	Major grain-producing county	No criteria listed	
Shanxi	National Poor Counties	Major grain producing county, Major cotton producing county, Major oil producing county, Major pig-supplying county	No criteria listed	
Liaoning	No criteria listed	Location advantage, Natural resources, Development potential		
Jilin				Yes*
Heilongjiang				Yes
Jiangsu				Yes
Anhui	No criteria listed			
Fujian				Yes
Jiangxi	National poor counties	No criteria listed	No criteria listed	
Shandong	No criteria listed			
Henan	Regional planning, Aggregate economy, Fiscal status, Industrial development, Urbanization levels, Development potential	Location advantage	No criteria listed	
Hubei				Yes*
Guangdong	No criteria listed			
Guangxi	No criteria listed	the rest of the counties		
Sichuan	Aggregate Economy, Fiscal Status, Industrial Development, Sectoral Structure, Urbanization Levels, Development Potential	Major grain producing county, major oil producing counties and major pig-supplying counties; Aggregate Economy, Fiscal Status, Urbanization Levels, Development Potential		
Guizhou	Major grain producing counties, major oil producing counties and major pig-supplying counties, ecological preserving counties			
Yunnan	Aggregate Economy, Development Potential	No criteria listed		
Shaanxi	Ecological preservation, Fiscal status	Ecological preservation, Fiscal status		
Gansu	No criteria listed	No criteria listed	No criteria listed	
Qinghai	No criteria listed			
Ningxia	No criteria listed			

Note : * Excluding autonomous prefectures.

Source : Provincial government decrees 2003–2012.

Table A3

The Impacts of the PMC Reform on Economic Development

Dependent variable	Log(*GDP_PerCapita*)
Post_PMC	-0.120***
	(0.035)
County_City × *Post_PMC*	-0.026
	(0.030)
Poor_County × *Post_PMC*	0.042
	(0.026)
Food_County × *Post_MC*	0.011
	(0.025)
ProvBoundary_county × *Post_PMC*	0.008
	(0.021)
Altitude × *Post_PMC*	0.070***
	(0.024)
Slope × *Post_PMC*	-0.001
	(0.002)
Fiscal_Gap99 × *Post_PMC*	0.002
	(0.009)
Urban Rate00 × *Post PMC*	0.003***
	(0.001)
Dependent variable mean	8.679
County fixed effect	Yes
Year fixed effect	Yes
Treatment trend	Yes
CPE dummy	Yes
Adjusted R-squared	0.930
Year coverage	1995-2012
No. of clusters	1,809
No. of Observations	32,562

Note: *** denotes significance at 1%, ** at 5%, and * at 10%. All observations are at the county-year level. The variable "control" denotes eight key criteria the provinces used in selecting the PMC counties. The standard errors are reported in parentheses, clustered by county. The regression controls for year fixed effects, county fixed effects, treatment-specic linear time trends and a CPE reform dummy.

Table A4

Event study result

Dependent variable	Log(*GDP_PerCapita*)
PMC (-4)	0.006
	(0.008)
PMC (-3)	-0.004
	(0.009)
PMC (-2)	-0.007
	(0.012)
PMC (-1)	-0.022
	(0.014)
PMC (0)	-0.035**
	(0.017)
PMC (1)	-0.056***
	(0.021)
PMC (2)	-0.066***
	(0.024)
PMC (3)	-0.048*
	(0.027)
PMC (4+)	-0.048
	(0.035)
Dependent variable mean	8.679
County fixed effect	Yes
Year fixed effect	Yes
Treatment trend	Yes
Control × Year dummy	Yes
CPE dummy	Yes
Adjusted R-squared	0.933
Year coverage	1995-2012
No. of clusters	1,809
No. of Observations	32,562

Note: *** denotes significance at 1%, ** at 5%, and * at 10%. All observations are at the county-year level. The variable "control" denotes eight key criteria the provinces used in selecting the PMC counties. The standard errors are reported in parentheses, clustered by county. The regression controls for year fixed effects, county fixed effects, treatment-specic linear time trends, interactions of the eight key selection variables with year dummies and a CPE reform dummy.

Table A5

Adjustments in the revenue and expenditure resposnsiblity after PMC.

Province	PMC Policies on Revenue and Expenditure Assignment	Change
Hebei	There is no change on the revenue assignment of the central and provincial governments. Prefectures in principle are not entitled to share the reformed county's fiscal revenue anymore. But they are allowed to keep last year's shared revenue. The classification of expenditure responsibilities shall be in accordance with the revenue assignment. Prefectures in principle are not obligated to bear the newly increased expenditure of reformed counties.	Yes
Shanxi	Considering the revenue and expenditure assignment of prefectures and counties is not changed, prefectures continue to share the counties' revenue as well as the expenditure responsibilities.	No
Jilin	There is no adjustment on the revenue and expenditure assignment between the prefectures and counties.	No
Heilongjiang	Following the regulation of the central and provincial governments, within the framework of 1994 tax sharing regime in Heilongjiang, the counties' revenue and expenditure assignment shall be directly determined by the province.	No
Jiangsu	The existing fiscal interests of prefectures and reformed counties within the tax sharing regime shall be maintained. A direct fiscal relationship will be established between the province and its prefectures and counties.	No
Anhui	There is no adjustment on the revenue and expenditure assignment between prefectures and counties.	No
Jiangxi	There is no adjustment on the revenue and expenditure assignment between prefectures and counties, maintaining each layer's existing fiscal capacity.	No
Shandong	There is no change on the revenue assignment of the central and provincial goverments. Prefectures in principle are not entitled to share the reformed county's fiscal revenue anymore. Prefectures should continue to support the development of the counties.	Yes
Henan	The province adopts the principle of maintaining the existing interests of prefectures and reformed counties.	No
Hubei	There is no adjustment on the revenue and expenditure assignment.	No
Hunan	For main tax categories, the province shall separately share the revenue with the prefectures and counties at the same rate. For other fiscal revenue, the assignment among the province, prefectures and counties is not changed. The expenditure responsibilities shall be assigned reasonably.	Yes
Sichuan	The province will implement the same fiscal scheme with the reformed counties as that with the prectures. Prefectures and counties are not entitled to share another party's fiscal revenue. Expenditure responsibilities should be in accordance with the revenue assignments.	Yes
Guizhou	There is no adjustment on the existing revenue and expenditure assignment among the province, prefectures and counties.	No
Yunnan	Reformed counties' fiscal revenue are shared by the central, provincial and county government. Prefectures shall stop sharing reformed counties' fiscal revenue.	Yes
Shaanxi	Prefectures shall not share the reformed counties' fiscal revenue.	Yes
Gansu	The existing interests of prefectures and reformed counties shall be maintained. There will be no adjustment of current fiscal interests so that the the prefectures and counties' fiscal operation can run smoothly.	No
Qinghai	Given the current situation, there is no adjustment on the existing revenue and expenditure assignment among the province, prefectures and counties.	No
Ningxia	There is no adjustment on the existing revenue and expenditure assignment among province, prefecture and counties.	No
Liaoning	There is no adjustment on the existing revenue and expenditure assignment among province, prefecture and counties.	No
Guangxi	There is no adjustment on the existing revenue and expenditure assignment among province, prefecture and counties.	No
Fujian	There are no policy items related to revenue and expenditure adjustment.	No
Guangdong	There is no change on the existing tax sharing regime. Expenditure responsibilities should be in accordance with the revenue assignments. Prefecures and counties shall not shift their own expenditure responsibilities to another party.	No

Source : Provincial decrees on the implementation of PMCs, various issues.

Table A6

Summary statistics

Variable	Treatment group	Control group	Unconditional diff.	Conditional diff.
	(1)	(2)	(3)	(4)
Transfer per capita 1995	40.20	72.45	-32.24***	-10.06***
(¥)	[46.07]	[85.17]	(3.30)	(2.33)
Tax rebate per capita 1995	47.31	48.58	-1.27	-0.89
(¥)	[57.20]	[61.65]	(2.81)	(2.88)
Government revenue per capita 1995	109.76	115.36	-5.60	1.330
(¥)	[83.14]	[99.13]	(4.37)	(3.59)
Government expenditure per capita 1995	195.90	267.06	-71.16***	-23.64***
(¥)	[136.15]	[197.30]	(8.16)	(7.02)
Land sale revenue per capita 2002	5.20	5.56	-0.37	-0.42
(¥)	[15.41]	[14.74]	(0.71)	(0.73)
Observations	978	831		

Note: This table reports the initial fiscal characteristics of our treatment and control samples. Columns 1 and 2 show means and standard deviations in square brackets. Column 3 reports the unconditional difference between the treatment and control group. Column 4 reports the conditional difference of these characteristics of a regression on the treatment dummy controlling for the selection criteria. The standard errors are reported in parentheses.

Table A7

Results comparison

Dependent variable	GDP per capita growth		GDP growth						Construction investment Ratio	
	Cai and Huang (2010)	Our results	Zheng *et al*. (2011)	Our results	Jia *et al*. (2013)	Our results	Liu *et al*. (2014)	Our results	Chen and Lu (2014)	Our results
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Post_PMC	0.07***	-0.004	0.01*	-0.03	-0.02**	-0.06***	0.01***	-0.01	0.02***	0.00
	(0.01)	(0.01)	(0.01)	(0.02)	(1.02)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
County fixed effect	Yes	Yes		Yes		Yes		Yes	Yes	Yes
Year fixed effect		Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Control × Year dummy		Yes		Yes		Yes		Yes		Yes
Treatment trend		Yes		Yes		Yes		Yes		Yes
CPE dummy		Yes		Yes		Yes		Yes		Yes
Initial GDP/GDP per capita	Yes	Yes	Yes	Yes	Yes	Yes		Yes		
Other control variables	Fiscal deficit per capita, *etc.*		Investment rate, *etc*.		Lagged GDP per capita growth, *etc*.		GDP per capita, *etc*.		GDP per capita, *etc*.	
Data source	CSCC	See our data description	Henan Yearbooks	See our data description	NPCFS	See our data description	CSCC and NPCFS	See our data description	CSCC and NPCFS	See our data description
Year coverage	2000–2007	2000–2007	2000&2007	2000–2007	1998–2005	1998–2005	1997–2010	1997–2010	2002–2007	2002–2007
Province coverage	15	14	1	1	30	24	27	24	15	14
Deflation		Yes		Yes	Yes	Yes	Yes	Yes		
Sample size	3,000	2,499	94	756	13,148	12,663	24,064	23,517	3,590	2,745
Western counties	Dropped	Dropped							Dropped	Dropped
Four municipalities	Dropped	Dropped				Dropped	Dropped	Dropped	Dropped	Dropped
Zhejiang counties		Dropped				Dropped		Dropped		Dropped
Hainan counties	Dropped	Dropped				Dropped		Dropped	Dropped	Dropped
Tibetan counties	Dropped	Dropped			Dropped	Dropped		Dropped	Dropped	Dropped
Counties with boundary change		Dropped		Dropped	Dropped	Dropped		Dropped		Dropped
Other county units (*e.g*., banner)	Dropped	Dropped	Dropped				Dropped			

Note: This table reviews five representative research papers published in Chinese economics journals after 2009. In column 1, 3, 5, 7 and 9, Cai and Huang (2010), Zheng *et al*. (2011), Jia *et al*. (2013) and Liu *et al*. (2014) examine the effects of PMC on growth in county (per capita) GDP; Chen and Lu (2014) focus on the impact of PMC reforms on a county's ratio of construction investment to its fiscal expenditure. In column 2, 4, 6, 8 and 10, the following steps are taken to reconcile possible differences of the findings of those studies and those reported here, and to conduct a meaningful comparison. First, the same dependent variables and similar samples are used as the five papers. Second, the effects of PMC are estimated based on our specification, which rigorously addresses endogeneity problems.