Centralization or Decentralization? The Financing of Public Primary Education in China

Xiaoyang Ye
Postdoctoral Researcher
Annenberg Institute for School Reform
Brown University
Providence, RI 02906
e-mail: xiaoyang.ye@brown.edu

Wei Ha
Associate Professor
Graduate School of Education/Institute of Economics of Education
Peking University
Beijing, China 100871
e-mail: wha@pku.edu.cn

Dongyang Chen
Ph.D. Candidate
Graduate School of Education/Institute of Economics of Education
Peking University
Beijing, China 100871
e-mail: dy.chen@pku.edu.cn

ABSTRACT

There are large variations in the choice of a decentralized or centralized education finance system across countries. We examine the financing of public primary education in China as a unique case study. China has successfully established modern universal basic education in the century from 1912 with very different education finance systems in different historical periods, ranging from a completely decentralized education finance system to a completely centralized system. This chapter presents a brief summary of China's public primary education finance reforms and then provides a credible causal evaluation of its most recent centralized reform in 2006 using confidential school finance data as well as survey and census data. Similar to the recent literature on the centralization education finance reforms in the United States, we find that the 2006 reform in China leads to an increase in educational spending that translates to increases in student school enrollment and academic achievement. We also document unintended reform consequences that call for further research and policy design improvements.

Keywords: Education finance reform, centralization, intergovernmental transfer, China

Introduction

One of the most important education finance policies is the choice between decentralization to local governments and centralization to upper-level governments. This policy choice varies dramatically across countries. Decentralizing revenue and expenditure, used by most of the developed countries, has long been seen to increase fiscal spending efficiency by Tiebout-style competition (Tiebout, 1956; Oates, 1972, 1993). In contrast, centralization models dwell on the unequal educational expenditures across school districts (Courant & Loeb, 1997; Fernandez & Rogerson, 2003; Fischel, 2006). In the past few decades, there has been a trend of increased centralization of education funding in developed countries with highly decentralized fiscal systems. For example, according to data from the U.S. Department of Education National Center for Education Statistics, more than 80% of U.S. public education spending was at the local government level in the 1920s; however, this share reduced to about 45% in the 2016-17 fiscal year with 47% at the state level and 8% at the federal level. Meanwhile, many developing countries with centralized systems started to favor assigning more responsibilities to local governments (Zhang & Zhou, 1998; Enikolopov & Zhuravskaya, 2007).

The financing of public primary education in China is a unique case study in education finance. While the United States and European countries started to publicly provide mass schooling in the 18th century (Goldin & Katz, 1999), China was one century later to start the national attempt to replace its thousand-year long, traditional, Confucian education system with a modern system (Gao, 2019). In a century from 1912, China has successfully transformed its traditional Confucian education system to modern universal basic education. Primary education enrollment increased from 1.2% in 1912 to 12% in the 1930s, 20% in 1949, 62% in 1957, 99% in the 1990s, and more than 99.9% in 2019 (Hannum, 2003; Lindert, 2004; Smith & Joshi, 2016;

China Ministry of Education, 2019). For comparison, the school enrollment rate of 5- to 19-year-old students in the United States was 59.2% in 1910 (Snyder, 1993).

Moreover, this rapid increase in school enrollment was achieved even with constant changes in the system of financing, with either a weak state or a strong state, during wartime or during rapid economic development period, and under fiscal decentralization or centralization. In particular, China adopted very different education finance systems in different historical periods, ranging from a completely decentralized education finance system in which local governments shared all the spending responsibility to a completely centralized system in which the central government controlled all the revenues and expenditures in different historical periods.

Since the establishment of the People's Republic of China, the fiscal system has gone through a centralization-decentralization-centralization process. Accordingly, the education finance system has also gone through several distinct stages: from centralized financing and hierarchical management, to decentralized financing and management, to county-level management, and then to county-level management with central and provincial transfer grants. After decades of alternating between a centralized system and a decentralized system, the 2006 Chinese Education Finance Reform has set the institutional foundation for a decentralized public education management system with general transfer grants from the central government and the provincial governments.

In this chapter, we summarize China's public primary education finance reforms in the past 100 years. We then focus on the most recent reform in 2006 by documenting the details of relevant policy designs and analyzing the growing literature on the causal impacts of the reform on school revenues and expenditures, family spending, and student outcomes. As one of the world's largest intergovernmental transfer programs for education finance, the 2006 reform has

shaped China's education finance system for not only primary schools, but also preschools, secondary schools, and vocational schools. However, credible causal evaluation of the reform in the existing literature does not exist because of the lack of high-quality data and knowledge about the policy details.

Using the unique and newly available school finance data and details on the reform at the county-level, we apply a difference-in-differences model to revisit the policy effects of the 2006 reform on school expenditures and student outcomes. Similar to the recent study by Ding et al. (2020), we find robust evidence that the reform has increased budgetary school operational spending, which is subsidized by transfer grants and closely monitored by upper-level governments; however, local governments' incentives for extra-budgetary spending might be negatively affected by transfer grants. Applying the new methods proposed in Goodman-Bacon (2018) and De Chaisemartin, & d'Haultfoeuille (2020), we find that the variation in reform timing might result in heterogeneous treatment effects, which is consistent with the explanations of local government accountability and incentives. However, the variation in timing does not overturn the main findings.

We also combine county-level school expenditure data and household survey and census data to examine the effects of the 2006 reform on student outcomes with respect to school enrollment and educational attainment, as measured by primary school graduation and years of schooling. On average, students in counties with increased transfer grants and school spending are more likely to enroll in K-9 schools and graduate. A 100 CNY (approximately 5% increase from the control mean in 2006; CNY stands for Chinese yen) in school spending each year for all 6 years of primary school is associated with a 1 percentage point increase in K-9 school enrollment and with 0.073 more completed years of education for both the survey data and the

census data. The estimate is similar to but smaller in magnitude than that observed in the U.S. Jackson et al. (2016) estimated that a 10% increase in per-pupil spending each year for all 12 years of public schooling led to 0.31 more completed years of education. Hyman (2017) found that the students exposed to 10 percent more spending were 3 percentage points more likely to enroll in colleges.

The education finance reform literature lacks well-identified causal evidence in non-US contexts (Jackson, 2018). This chapter presents some of the first evidence to fill this notable knowledge gap. Our extensive and thorough summary of the evolution of Chinese education finance reforms over of period of more than 100 years and the related research will provide researchers and policymakers with a panoramic view of the causes, effects, and mechanisms of centralized and decentralized education finance reforms in a low-income, developing country. Additionally, our empirical focus on the 2006 Chinese Education Finance Reform provides new evidence for understanding the intended and unintended consequences of intergovernmental transfers. Fiscal transfers have been widely recommended as a solution to the inadequate provision of local public education. However, empirical evidence primarily focusing on developed countries remains mixed and inconclusive. Understanding the incentives and behaviors of governments and school districts in education expenditures helps improve education finance policy designs and implementation.

Background: The Financing of Public Primary Education in China Since the Cultural Revolution

This section briefly reviews the evolution of public primary education finance in China before the 2006 Chinese Education Finance Reform. It took almost a century for China to build the modern universal education system and to explore various fiscal options for public education

regarding central-local intergovernmental relationships between decentralization and centralization, as well as different funding sources.

Primary education finance in the People's Republic of China has never had a relatively independent tax base or source of revenue (e.g., local property tax) but has been a subsystem of the overall public finance system. The reform of the primary education finance system has often been closely linked to the reform of the national public finance system (Huang, 2010; Ha et al., 2017). Figure 6.1 describes the increases in both enrollment and school expenditures in primary education, which are also largely affected by the national development. School expenditures increased dramatically due to the economic reforms since 1978.

[Figure 6.1 Here]

1980-1993: Decentralized Public Finance with Diversified Financing Sources of Primary Education

In the late 1970s, China ended the Cultural Revolution and started its market-oriented economic reform, transforming from an economy dominated by state-owned industries and central planning to a socialist market economy. For more than 4 decades, the Chinese economy has experienced unprecedented growth with an annual rate of increase of more than 9%.

The fiscal system shifted from centralization to decentralization. Following the decentralization fiscal reform, local governments were required to finance primary and secondary education. The lack of shared fiscal responsibilities among different levels of governments led to increasing inequalities in educational expenditures between the economically developed and underdeveloped regions (Tsang & Ding, 2005; Lü, 2014). Low-income regions with limited fiscal revenues largely relied on education surcharges, tuition, and fees (Zhao,

2009). The central government started to provide subsidies in the late 1980s, but basic education remained the primary responsibility of the local governments.

1994-2005: Fiscal Centralization with Primary Education Managed by the County Government

Decentralization reforms weakened the central government's fiscal capacity. In the 1994 Tax Sharing Reform, the central government recentralized fiscal revenues and expenditures by redistributing the tax sources and ratios between the central and local governments and elucidating the expenditure responsibilities and revenue scope of each level of government. The reform enabled the central government to capture a larger share of fiscal revenue; however, it also evoked a heavier financial burden on the local governments. This incentivized the local governments to rely on informal and extra-budgetary revenues, including land rents and surcharge fees.

After the 1994 reform, local governments undertook almost all the expenditure responsibilities pertaining to primary and secondary education. To support township and village governments, the central government required the county governments to take the primary responsibility of financing and managing compulsory education. This county-level re-centralization was expected to improve local education finance. However, the Rural Tax-for-Fee Reform in 2000 required the abolition of administrative fees, governmental funds, and collections levied on the farmers (including rural education collection funds), which greatly reduced rural education funding. The foundation of the financial system of compulsory education in rural areas, namely the multi-channel financing mechanism, no longer existed; this exacerbated the financial burdens faced by the local governments in low-income rural areas.

The 2006 Chinese Education Finance Reform

The 1994 Tax Sharing Reform reduced local governments' fiscal abilities to fund primary and secondary education, which resulted in large variations in the financing and quality of rural education. These effects led to the call for fiscal transfer grants from the central government (Tsang & Ding, 2005). The central government piloted several transfer grants that eventually informed the comprehensive Chinese Education Finance Reform in 2006. One major pilot grant was the "Two Waivers and One Subsidy" from 2001 that provided need-based tuition and fee exemption, free textbooks, and a living stipend for rural, poor students in compulsory education in Central and Western China (Wang, 2008; Ding, 2012; Chiy & Zhou, 2014).

On December 23, 2005, Premier Wen Jiabao presided over an executive meeting of the State Council, which decided to reform the mechanism for guaranteeing the funding of compulsory education through program-based educational transfer grants with a proportional cost-sharing formula between the central government and local governments. Subsequently, the Compulsory Education Law, which was amended in 2006, explicitly included compulsory education in the scope of national public financial protection, providing a legal guarantee for compulsory education funding. The reform marked a historical watershed as compulsory education was always regarded as the responsibility of the county governments (Ha & Yan, 2018). This top-down reform increased the spending efforts of both the central government and local governments for public K-12 education. As shown in Figure 6.2, per-pupil spending in primary schools slightly increased before the reform but rapidly increased since the reform. In 2008, China achieved free compulsory education in both rural and urban areas.

[Figure 6.2 Here]

The Chinese Education Finance Reform formally came into being in 2006, first in rural schools in the western and central regions of China and then in the eastern regions and in urban

schools. The reform included increasing funding in 4 programs: (1) “Two Waivers and One Subsidy,” (2) school operational spending, (3) school building maintenance, and (4) teacher salary. For each program, the central and provincial governments provided block grants to county governments according to the designated expenditure benchmark amounts and cost-sharing ratios. The block transfer grants target the first two programs which were eventually consolidated into one item in 2007: per-pupil operational expenditure. The last two programs were implemented using special fiscal channels.

The grant for per-pupil operational expenditure is a product of two parameters in the cost-sharing formula: designated school operating expenditure benchmark and subsidy rate. While each province set the expenditure benchmark in 2006 and 2007, the central government set a national benchmark in 2008 with 300 CNY for rural primary schools and 500 CNY for rural middle schools. The benchmark has since been adjusted upward every year according to the consumer price index. The subsidy rate from the central government takes two values: 80% for western counties and 60% for central counties and some of the eastern counties. The subsidy rates at the provincial and/or prefectural levels are set by each provincial or prefectural government. Economically underdeveloped counties receive larger subsidy rates than economically developed counties, some of which are fully covered by the intergenerational transfer grants from upper-level governments for school operational spending.

The transfer grant involved in the 2006 Chinese Education Finance Reform is a form of fiscal aid that falls between the traditional general transfer payments and special transfer payments, which lays the foundation of the Chinese K-12 education finance system in the past 15 years. As shown in Figure 6.3, while the 1994 Tax Sharing Reform largely reduced the support from the central government to less than 5%, the central government now provides more than

35% of the funding for primary schooling, mainly through the transfer grant, as designated in the 2006 reform.

[Figure 6.3 Here]

Prior Research: What Can We Learn from the Chinese Experience?

Cheng (1935) provided the first comprehensive factual analysis of public education finance in China, which motivated this chapter. Cheng estimated that 3.04% of the national income was required for educational expansion and improvement, compared with 4.15% in the U.S. in 1930. China met its 4% goal nearly 80 years later. Cheng also proposed the distribution of the educational budget between the central, provincial, and county governments with the central and provincial governments accounting for more than 55% of the school expenditures. Except during the centrally planned economy periods before the economic reform, this centralized expenditure plan was only partially achieved after the 2006 Chinese Education Finance Reform.

Contemporary research on Chinese education finance began with a focus on the decentralization period from the mid-1980s to the 1990s (Tsang, 1994, 1996, 2000). Primary education was mainly financed by fiscal expenditures from local governments and school fees paid by families, with county-level and lower governments assuming the main financing responsibility. This decentralized education finance system is conducive to mobilizing local autonomy in school operations, broadening extra-budgetary funds and non-governmental resources, and improving the efficiency of financial provision. However, a large body of research has documented many problems from this highly decentralized system, such as the excessive burden on farmers in poor areas, inadequate financial supply, inefficient financial management,

and the unequal development of education among regions (Wei & Yang, 1997; Hannum, 1999; Tsang & Ding, 2003; Wang, 2003; Zhou, 2004).

To address some of those problems, in the early 2000s, free tuition and subsidies were provided to low-income rural families. While the pre-2006 reforms increased voluntary educational spending (*intra-household flypaper effect*) (Shi, 2012), their effects on school enrollment were mixed. Chyi and Zhou (2014) concluded that tuition control had a minimal effect on school enrollment, and the tuition waiver and subsidy policy had a significantly positive effect on the school enrollment of rural girls, but not rural boys. Shi (2016) found that the reform only affected students in junior high schools.

Given the importance of the 2006 Chinese Education Finance Reform, Chinese scholars have extensively examined the impact of this centralization reform on schools and students. Early empirical studies relied on small-scale survey data and simple descriptive analysis to compare school finance and family expenditures before and after the reform (Ding et al., 2008; Sun & Chang, 2008; Wang & Chang, 2008; Zhang & Li, 2008; Xue & Ding, 2009; Liang & Hu, 2013). These studies found that the reform, in the short term, reduced the burden on rural families, increased school enrollment, and improved the level of public funding for rural primary and secondary schools; however, there were still problems with partial payment, inadequate expenditure on teachers' salaries and infrastructure maintenance, poor families' financial difficulties, and school indebtedness. The regional and rural-urban inequality remained unchanged. Liu and coauthors focused on the policy impacts on teachers and found that the 2006 reform re-centralized teacher management to the upper-level governments and might have undermined the incentives for teacher performance, thus partially offsetting the positive effects of increased school expenditures (Li et al., 2008; Liu et al., 2009; An et al., 2010).

With increased data availability and a further understanding of the reform, researchers have started to conduct causal evaluations. Using a sample of county-level and school-level data collected by the Asian Development Bank's Compulsory Education Finance Reform Project for 3 provinces, Sun et al. (2010) and Lu (2014) applied difference-in-differences (DID) and matching estimators to evaluate the reform impact. They found that the reform improved the level and equality of budgetary funding but did not affect the total funding. Ha and coauthors used nationwide county-level administrative data on school finance to study reform effects and intergovernmental relations. In the short run, the reform increased budgetary operational spending and crowded out out-of-budgetary operational spending, as well as teacher salaries (Yang & Ha, 2017). This is because local governments adopted a strategy of prioritizing budgetary operational expenditures that were clearly regulated, and the centralization decreased local governments' incentives to spend on schooling (Yang et al., 2017). In the long term, the reform only increased the total operational spending in the economically developed provinces (Ha & Liu, 2018; Liu & Ha, 2019).

Ding et al. (2020) conducted the most comprehensive analysis of the reform impacts on school expenditure and local government behaviors. They found that the transfers crowded out pre-existing local public education investments in extra-budgetary accounts that were not scrutinized and audited by upper-level governments. The reform only improved public school spending in counties where public employees had a greater means of holding local governments accountable. Due to the large heterogeneity in the reform effects, school enrollment and completion rates increased in counties where the reform increased transfer grants and school spending (Xiao et al., 2017; Ha & Liu, 2018; Ha & Yan, 2018). Furthermore, Lü (2014) found that policy awareness during the 2006 reform enhanced citizens' trust in China's central

government, but not in local governments. Tang et al. (2020) concluded that exposure to free compulsory education significantly reduced the incidence of child labor for boys but had no significant effect on the likelihood of child labor for girls.

Revisiting the effects of the 2006 Chinese Education Finance Reform

Until recently, there was a lack in the credible evidence on the impact of the 2006 Chinese Education Finance Reform on school expenditures and student outcomes due to limitations of data and knowledge about the reform. Some recent studies have attempted to use quasi-experimental designs such as difference-in-differences. However, researchers did not fully understand the details of the reform and were mostly only aware of the information on cost-sharing between the central government and provincial governments; they did not pay attention to sub-provincial cost-sharing. For example, Xiao et al. (2017) explored the long-term effect of free tuition during the reform but inappropriately omitted the main component of this reform (central grants); they also incorrectly formed their control group by pooling the respondents in eastern provinces, where some county-level governments received transfer grants, as do those in central and western provinces.

The recent study by Ding et al. (2020) addressed most of these problems. Notably, the authors used the confidential county-level itemized education finance data from the Chinese Ministry of Education. By closely examining the official documents of each local government, the authors also corrected 3 categories of special treatment cases (275 out of 1,500 counties) in the central regions that received the same treatment as the western regions but were not appropriately classified in previous studies. However, two questions remain unanswered. First, Ding et al. (2020) only estimated the impact of the difference in the transfer grants from the central government, but cost-sharing at the provincial and prefectural levels was largely

neglected. For this reason, the authors excluded eastern provinces from the analysis as they did not know the subsidy rates in those provinces. Second, we still have relatively limited information about the impact of the reform on student outcomes.

To fill these gaps, this section revisits the impact of the 2006 reform. We use unique data on detailed cost-sharing subsidy rates at the central, provincial, and prefectural levels as well as on designated school operation expenditure benchmarks for each county. Ding et al. (2020) used only a national benchmark that omits the regional variations. Yang and Ha (2017) collected the initial data by coding the published implementation plans on the provincial governments' websites and contacting every provincial and prefectural government in China. Using a detailed list of subsidy rates and expenditure benchmarks, they conducted a DID analysis using data from 2005 and 2006. We extend the data by adding the policy details of those counties that started the reform in 2007.

To address the second question, we combine the same confidential education finance data with large-scale individual survey data and national census data to measure the student outcomes in terms of school enrollment and educational attainment. These outcome measures enable us to evaluate the impact of the centralized education finance reform on student academic outcomes in the short term (enrollment) and in the long term (attainment).

Effects on School Expenditures

Extending Ding et al.'s (2020) study using the sample of 1,562 counties in the western and central provinces, we use all the 1,843 Chinese rural counties with non-missing school finance data (from 1,884 rural counties) to estimate the following DID (difference-in-differences) model on the impact of the 2006 Chinese Education Finance Reform on school expenditures:

$$Y_{ijt} = \beta_0 + \beta_1 * Grant_{it} * Post_t + \gamma * \boldsymbol{X}_{ijt} + \delta_i + \theta_t + \varepsilon_{ijt}, \quad (1)$$

where Y_{ijt} is the county-level school expenditure for county i in province j in year t. $Post_t$ is a dummy indicator that equals 1 if he reform started in county i in 2006 or 2007. δ_i and θ_t are the county- and year-fixed effects, respectively. $\boldsymbol{X}_{ijt}$ includes a vector of county-level time-varying covariates, including the number of schools, population, the share of the rural population, number of townships, gross domestic product (GDP) per capita, ratio of local fiscal revenue and expenditure, and ratio of fiscal revenue and GDP. Robust standard errors are clustered by province.

The treatment variable $Grant_{it}$ is different from the treatment variable $Policy_{ijt}$ used in Ding et al. (2020). $Policy_{ijt}$ only takes two values: it equals to 0.8 for western counties (including the 243 central counties that have had the western county status since 2007) and 0.6 for central counties. $Grant_{it}$ is the estimated grant amount from the central, provincial, and prefectural governments to the rural schools of county i (=total subsidy rate*designated school operating expenditure benchmark). $Grant_{it}$ is measured in 100 CNY (in 2011 price); hence, the parameter of interest β_1 identifies the impact of each 100 CNY transfer grant that county i receives from upper-level governments. Figure 6.4 shows the national distribution of the treatment variable $Grant_{jt}$.

[Figure 6.4 Here]

Unlike the 0.8 or 0.6 subsidy rate for the transfer grant received from the central government, subsidy rates at the provincial and prefectural levels may not be set exogenously for each county. Less-developed counties and ethnicity and revolutionary bases are the factors determining the percentage of costs that are shared by higher-level governments. However, the designated school operating expenditure benchmark was exogenously set by the provincial or

prefectural levels at the early stage of the reform (2006-2008) and in later years by the central government. Since $Grant_{it}$ is the produce of the two factors, the variations in $Grant_{it}$ can be treated as if from a natural experiment.

[Figure 6.5 Here]

Figure 6.5 presents the event study estimates of the impact of the reform on school operational spending, which decompose the coefficient β_1 to each event year. Event years are centered around the year before a county started to experience the reform (2005 or 2006 for those started in 2006 or 2007) as year 0. The other model specifications (sample, controls, and weights) are the same as those presented in column 3 of Table 6.1. Panel A shows clear evidence of null pre-trends; there was no difference in the rural public K-6 school operational spending between counties that received a high level of transfer grant and those that received a lower level of transfer grant. After the reform, transfer grants largely increased school operational spending. The first 2 years of the reform experienced "local capture" in that schools spent less than their designated grant amount. In 2008, the central government established the first national expenditure benchmark and increased its monitoring efforts. On average, each 100 CNY transfer grant resulted in an approximately 100 CNY increase in school operational spending. However, there exist variations in the policy effect. Panel B suggests that the reform did not affect the school operational spending in the early stage; even after the first 2 years, rural schools in the western and central provinces only spent half of the designated transfer grant. This finding is consistent with Ding et al. (2020) that while the reform increased the budgetary expenditure, it crowded out extra-budgetary expenditure; this was a main funding source for local public education before the 2006 reform.

[Table 6.1 Here]

Table 6.1 presents the corresponding pooled DID estimates. Column 1 estimates the DID regression without covariates, column 2 adds the covariates as described in Model (1), and column 3 (our preferred specification) adds the province-year linear trends to account for the heterogeneous time trends among provinces. The results are consistent across different model specifications. Columns 3 shows that each 100 CNY transfer grant from the upper-level governments during the reform increased school operating expenditure by approximately 80 CNY (about a 25% increase from the control mean). However, this high policy compliance comes with the cost of a 113 CNY decrease in personnel expenditure, particularly teacher salaries. This finding is also consistent with Ding et al. (2020): Chinese news reports indicate that in order to make ends meet, many county-level governments have frozen teachers' salary increments since the 2006 reform. The effects on the nominal teacher salary are indistinguishable from zero. Finally, as many local governments or schools combined transfer grants with other school construction funds, the transfer grant also increased capital expenditure. Overall, the reform did not statistically significantly change the total school expenditure. For simplicity, columns 4-6 use a dichotomous treatment variable that equals to 1 if the estimated transfer grant is greater than the national median; otherwise, it equals to 0. The mean transfer grant for this treatment group is 150 CNY. The results are qualitatively unchanged.

Ding et al. (2020) found that the reform effects are highly heterogeneous with regard to the share of public employees, the share of rural residents, per-capita GDP, fiscal capacity, and pre-reform public education quality. We find quite similar results using the conventional DDD (difference-in-differences-differences) regressions. Below, we explore additional heterogeneities.

Goodman-Bacon (2018) showed that the two-way fixed effects estimate of DID with variation in treatment timing can be decomposed into a weighted average of (1) comparisons

between the earlier treated group and the later treated group over the periods when the later treated group is not yet treated, (2) comparisons between the earlier treated group and the later treated over the periods when the earlier treated group is treated, and (3) comparisons between the treated group and the never-treated group. In our context, some counties started the reform in 2006 (earlier treated) and some other counties started in 2007 (later treated). The Goodman-Bacon decomposition results presented in Figure 6.6 show heterogeneous effects. Since there is only a one-year difference in the treatment timing, more than 90% of the estimated average effects are from the comparison between the treated counties and the control counties (defined as in columns 4-6 of Table 6.1). The earlier treated group (mostly in western provinces) had larger treatment effects than the later treated group (in central and eastern provinces). The small but positive "earlier treatment vs. later control" effect and negative "later treatment vs. earlier control" effect are consistent with the small treatment effect in the first 2 years in the event study results, which suggests that the treatment effects change over time. Therefore, using the already treated units as controls would bias the estimates. As the weight of the two comparisons was less than 10%, the bias was minimal.

[Figure 6.6 Here]

Another way to examine the heterogeneous treatment effects is to calculate the weight of each DID comparison (De Chaisemartin & d'Haultfoeuille, 2020). Under the common trend assumption, we use the *twowayfeweights* Stata package to estimate the weights: 5,963 average treatment-on-the-treated effects (ATTs) are positive and only 278 ATTs are negative. The positive weights sum to 1.011 and the negative weights sum to -0.011. It is unlikely that all of the ATTs are of a different sign than the estimated ATE (average treatment effects) as the standard deviation of the ATTs across all the treated cells need to be no less than 725.559.

However, the weights are correlated with a number of control variables (including the linear year variable) that are likely to be associated with the intensity of the treatment effect in each cell.

To address the problem of heterogenous treatment effects over time or across counties, we apply the new DID estimator proposed by De Chaisemartin and d'Haultfoeuille (2020), which estimates the average treatment effects across county-year cells whose treatment changes from the previous year to the current year. We find a treatment effect of 133.4 (s.e.=56.338) on school operational expenditure, which is 35.6% larger than the estimate in column 6 of Table 6.1. The placebo estimators, for which the treatment start time is assigned in years prior to the real reform years are small and insignificantly distinguishable from zero. This result is consistent with the common trends shown in Figure 6.5.

Effects on Student Outcomes

Further, we combine the county-level school expenditure data and household survey and census data to examine the effects of the 2006 reform on student outcomes, including school enrollment and educational attainment, as measured by primary school graduation and years of schooling. Our first analytical dataset is obtained from the China Nutrition and Health Survey (CHNS), one of the longest-running household surveys in China, which has been conducted by the University of North Carolina and the Chinese Center for Disease Control and Prevention since 1989. The survey covers 12 provinces that vary substantially in terms of geography, economic development, public resources, and health indicators. A multistage, random cluster process was used to draw the sample surveyed in each of the provinces, resulting in a total of 3,780 households with 15,745 individuals in 1989.

We utilize cross-sectional data from 6 western and central provinces in 5 waves (2000, 2004, 2006, 2009, and 2011) that straddle the introduction of the transfer grant. Our analytical

sample includes 24 counties: 6 high-income counties, 12 middle-income counties, and 6 poor counties. Within each county, 3 rural villages were covered. Given that 20 households in each village were interviewed, the maximum number of households we look at is 1440. We further limit our sample to children aged from 6-16 years to examine the effects of the transfer grants on K-9 education. Appendix Table 6.1 presents the summary statistics.

CHNS uses two questions to collect children's schooling status and educational attainment in terms of years of schooling completed: Are you currently in school? How many years of formal education have you completed in a regular school? We use these 2 questions to construct 3 outcome variables: a dummy variable indicating whether a child is enrolled in school, a dummy variable indicating whether a child has completed primary schooling, and a continuous variable measuring the years of schooling completed.

As we did with school expenditures, we take advantage of the variations in the subsidy rates and designated expenditure levels in a DID setup, which teases out the potential negative selection in the design of transfer grants that poor counties with lower educational attainment would have received higher levels of the transfer grant. The identification assumption is that without the differential transfer grant levels, the school enrollment and educational attainment trends between counties would have been the same. Given that the counties with higher transfer grant levels are likely to be poor and interior counties, and therefore, improvement in educational attainment is likely to be slower and more limited than in richer counties, our identification strategy provides a lower bound estimate of the true effect of the transfer grant on educational attainment. Empirically, we construct two types of treatment-control comparisons based on children's exposure to the reform.

In the first approach, we compare the primary school completion rates and years of schooling completed for birth cohorts whose compulsory schooling was completed just before (younger cohorts) or after the transfer grant was provided (older cohorts). Those children born between 1994 and 1995 were 11-13 years old in 2006 and 2007; therefore, they had more or less passed the schooling age for primary school or were about to complete their primary schooling (5th-7th grade). Their completion of primary school should not have been affected by the transfer grant to the same degree as the younger cohorts. Therefore, they can serve as a control group for the younger cohorts. On the contrary, the 1996-1997 cohorts were 9-11 years old and were the beneficiaries of the transfer grant, as they were still in the 3rd-5th grade in 2006 and 2007.

We estimate the following regression equation to parameterize the DID strategy for educational attainment:

$$Y_{ijc} = \beta_0 + \beta_1 * Grant_{jc} * Post_c + \gamma * \boldsymbol{X}_{ijc} + \delta_j + \theta_c + \varepsilon_{ijc}, \quad (2)$$

where Y_{ijt} is the educational attainment outcome for student i in village community j of birth cohort c: a dummy variable indicating whether a child has completed primary school or a continuous variable indicating the years of schooling a child completed. $Grant_{jc}$ (measured in 100 CNY) is the estimated per-pupil grant amount that the central, provincial, and prefectural governments provided to the rural schools of the county where a student lived in. $Post_c$ is an indicator that equals 1 when a child was born after 1995. δ_j and θ_c are community and birth-year fixed effects, respectively. In order to improve the precision of our estimates, we control for a number of individual, household, and community variables ($\boldsymbol{X}_{ijt}$). Individual demographic variables include age, gender, ethnicity of a child, whether a child lives together with their mother, and parental educational attainment. Household characteristics include the ownership of

refrigerators, household size, and household income per capita. Community-level controls include the number of households, number of schools, average wage, labor market participation, and health insurance coverage.

In the second approach, we compare school enrollment of children surveyed in years before the existence of the transfer grants and of those surveyed in years after the transfer grants. In the following model:

$$Y_{ijt} = \beta_0 + \beta_1 * Grant_{it} * Post_t + \gamma * \boldsymbol{X}_{ijt} + \delta_i + \pi_t + \varepsilon_{ijt}, \quad (3)$$

we compare the school enrollment status of the students aged 6-16 years old in the 2000, 2004, and 2006 waves of CHNS (pre-reform) with the students of the same age in the 2009 and 2011 waves of CHNS (post-reform). The enrollment status of the individuals aged from 6-16 years in the pre-reform waves should not have been affected by the transfer grant as it did not kick in until 2006 or 2007, unlike that in the post-reform waves. We replace the birth-year fixed effects θ_c with the survey-year fixed effects π_t. $Post_t$ is an indicator that equals 1 when a child was surveyed in year t after the reform. We present linear probability model estimates for dichotomous outcomes, which are qualitatively unchanged from non-linear model results.

These reduced-form intent-to-treat (ITT) estimates are useful in linking education outcomes to the transfer grant of the 2006 Chinese Education Finance Reform; however, this does not shed light on the causal mechanism behind any effects. Did the transfer grant actually improve education outcomes through increased education spending or through increased awareness of the importance of compulsory education due to the mass-communication campaign? To further ascertain the causal link, we estimate a two-stage least squares (2SLS) model using the designated amounts of transfer grant a county received from higher-level governments to instrument the actual per-pupil school expenditure. We should note that, due to

the small sample size and the small number of clusters (by counties and survey years), the estimates are under-powered in several specifications. However, taken all the estimates together, we provide consistent results on the effects of the centralized education finance reform.

[Table 6.2 Here]

Table 6.2 presents the regression estimates of the effects of the transfer grant on total school expenditure in grades 1-6 and the level of students' educational attainment. We limited the sample to village students who were born between 1990-1999, were at least 11 years old in the CHNS survey, and were in central and western provinces. Columns 1 and 3 of Panel A indicate that a 100 CNY yearly transfer grant increased school expenditure in grades 1-6 by 650 CNY. In columns 2 and 4, we account for the differences in the years of exposure to the transfer grant by adding a linear trend term. The results are similar in that each year of exposure to a 100 CNY yearly transfer grant increased the yearly expenditure by 106 CNY.

Panel B estimates the intent-to-treat effect. A 100 CNY yearly transfer grant from upper-level governments in grades 1-6 increased primary school graduation rate by 14.8 percentage points (19% increase of the sample mean in 2006) and completed years of schooling by 0.245 years (sample mean in 2006 is 6.88 among students of ages 11-16). While the OLS estimates in Panel C suggest no association between school spending and student educational attainment, the 2SLS results in Panel D provide robust evidence that the transfer grant in the 2006 Chinese Education Finance Reform improved schooling through increased school spending.

[Table 6.3 Here]

In Table 6.3, we examine the impact on current school enrollment using the sample of village students aged 6-16 in the CHNS survey years 2000-2011 in central and western provinces. Columns 1 and 2 show similar results as discussed in Table 6.1. Since the sample

includes younger students, on average, they received an increased amount of school expenditure for each 100 CNY designated transfer grant. Increased transfer grant and school expenditure significantly increased K-9 school enrollment by 1.1 to 1.7 percentage points (sample mean in 2006 is 94%). Figure 6.7 shows that, in the CHNS sample, the effects of transfer grants do not largely vary by household income or mother's education. However, female students experienced a 2 percentage-point larger increase in school enrollment than male students.

[Figure 6.7 Here]

Misspecification Tests and Robustness Checks

Since the existing research on the impact of the transfer grant relies solely on its variation at the regional level (western provinces versus central provinces), we demonstrate in this subsection that this inaccurate measure of treatment intensity could lead to erroneous results. This may explain the ambiguous results on the effects of the transfer grant in prior research. In columns 3 and 4 (misspecification 1), we aggregate the continuous variation in grant level and sharing ratio (used to construct the estimated block grant) to a dummy indicator that is equal to one when estimated grant>248 CNY (sample mean). This resembles the method used by Ding et al. (2020), in which the authors manually collected information on the variations within each province and used a dichotomous treatment variable. However, this method only captures the cost-sharing between the central government and provincial governments and pays no attention to sub-provincial cost-sharing; it does not include the information of different designated spending benchmarks at the provincial or prefectural level. Our results suggest that this method results in qualitatively similar but underestimated impacts of transfer grants on school enrollment.

Misspecification 2 has been applied in most of the existing studies on the 2006 reform that defines western provinces as the treatment group as rural schools in western provinces receive 80% of expenditure subsidies from the central government, while central provinces and some eastern provinces receive 60% from the central government. Even worse, some studies coded eastern provinces as receiving zero grants. Columns 5 and 6 show that this approach leads to a serious underestimation of the effects of the block grant on enrollment, and even results in the wrong direction in the case of the effects on school enrollment.

Our first robustness check explores the sensitivity of our results to different sample definitions. Our baseline results only used a rural village sample from the western and central provinces in the CHNS surveys. In fact, in many provinces, the transfer grant covered the schools at county seats. More importantly, rural counties in eastern provinces also received a subsidy from the central government and provincial governments, albeit at a lower rate. The results are robust to the choice of different samples including/excluding eastern provinces and/or county communities. Furthermore, the results are also unchanged using different samples of age spans (Appendix Table 6.2), different samples of survey year spans, and household fixed effects.

One may be concerned about the endogenous selection of the transfer grant because of the possibility that the poor and inland counties may have received more through other types of intergovernmental transfers from higher level governments. A more subtle challenge to our identification assumption is the law of diminishing returns. Specifically, a rich county that has already done rather well in terms of enrolling its children for compulsory schooling prior to the reform may not have much room for improvement compared to a poor county. This is less of a concern when we use the years of schooling completed as the outcome variable. Nonetheless, we provide formal falsification tests where we examine whether the enrollment status or education

attainment of students is related to transfer grants using waves of the CHNS surveys prior to the reform. For school enrollment, we use the 2000, 2004 and 2006 waves of the CHNS survey and pretend that the transfer grants came into effect in 2004. For educational attainment, we use the 2000, 2004 and 2006 waves. As shown in Appendix Table 6.3, no significant positive "placebo" policy effects are detected. In contrast, we find similar results to our main specifications when using the 2009 and 2011 waves.

There is an important caveat in the CHNS analysis. We only have 24 counties in our analytical sample and therefore 24 variations of the treatment variables, which limits the external validity of the findings. We now conduct an additional analysis using the restricted-use 2010 Chinese census data. Through a data agreement from the National Bureau of Statistics of China, we gained access to a random 1% sample. Similar to the dichotomous treatment variable in Table 6.1, we constructed a comparison group of counties ranked in the top quarter of receiving the transfer grant to counties ranked in the bottom quarter.

[Figure 6.8 Here]

Figure 6.8 plots the average graduation rate by birth cohort in primary school and middle school, respectively. Panel A and C plots by birth month and Panel B and D plots by birth-year. For students who had not experienced a transfer grant from the 2006 Chinese Education Finance Reform (older cohorts), those in counties with lower levels of the transfer grant that were on average richer counties had higher graduation rates in both primary school and middle school. Because primary school and middle school are compulsory, the graduation rate was already very high. However, a sizable gap still existed between poor and rich counties. After the introduction of the transfer grant from upper-level governments, students in poorer counties that received

higher levels of the transfer grant started to have higher average graduation rates. This treatment effect trend is similar in both primary school and middle school.

The corresponding DID estimate suggests that the intent-to-treat effect of each 100 CNY designated transfer grant is about one percentage point ($p<0.001$) for both primary and middle school. This national average treatment effect is smaller than that in the CHNS analysis (0.024, $p<0.05$). Similarly, female students benefit slightly more than male students. As the census data do not have direct information on family socioeconomic status, we use the avaliablility of home piped water to classify students. The transfer grant effect was smaller and statistically insignificant for relatively richer students with home piped water (0.003, s.e.=0.003). Students from lower-income families without piped home water largely benefited from the transfer grant (0.009, s.e.=0.003).

Conclusion

As the first professional educator from the West to visit China for many years after 1947, Luawerys (1957) noted that "every village and every hamlet is asking for a school." The Chinese experience of providing universal basic education showcases how a poor developing country has struggled, searched for, and worked on an effective education finance system. In the past 100 years, the history of public primary education finance in China has been marked by the tension between decentralization and centralization. This provides a unique nationwide policy experiment case study to the literature. Although presenting the details of the 100-year long reforms goes beyond the scope of this chapter, we hope the summary of the causes, designs, and consequences of each reform could provide a good reference for many other countries, particularly less-developed countries, in their designs of education finance systems.

Our evaluation of the 2006 Chinese Education Finance Reform speaks to the growing literature on education finance reforms in the United States (see summary in Jackson & Mackevicius, 2021). While U.S. state governments attempt to centralize education finance to the state level, China's reform targets expanding intergenerational transfers in a centralized system. Both routes lead to the similar goal of combining local and central funding sources to equalize the disparities in educational spending. We find that the impact of the Chinese reform are similar to that in the U.S. state education finance reforms: both types of reforms lead to an increase in educational spending that translates to improvements in student school enrollment and academic achievement. Furthermore, consistent with the U.S. literature that the centralization reforms have distributional effects that low-income families could have benefited more from increased transfers and spending from upper-level governments (e.g., Jackson et al., 2016; Hyman, 2017; Lafortune et al., 2017; Candelaria & Shores, 2019; Abott et al., 2020), we present some of the first evidence on such distributional education finance reform effects in developing countries.

While the choice between decentralization and centralization largely depended on different countries' specific contexts, the parallels in the education finance reforms in the U.S. and China indicate that combining a centralized fiscal system with intergovernmental transfers and decentralized management seems effective. However, some unintended consequences, such as imperfect compliance, crowding-out effect, and reduced teacher incentives, call for further improvements in the policy designs. Ding et al. (2020) found that the 2006 Chinese reform impacts depended on local governments' accountability incentives. Similarly, in the U.S., Brunner et al. (2020) concluded that teacher unions affected the fraction of reform-induced state aid that passed through to local spending. These results suggest that education finance reforms may not always succeed in all settings (Woessmann, 2016). The Chinese experiences of trying

different centralized or decentralized reforms demonstrate the difficulty of building an effective system for public education finance.

More generally, policymakers in both developing countries and developed countries need to weigh the tradeoff in using centralization to ensure adequacy and to reduce regional inequality versus using decentralization to increase incentives for the provision of public education of local governments, schools, and families. Future work can examine how to best design an effective education finance system to improve education spending, and what kinds of spending could improve student outcomes the most.

References

Abott, C., Kogan, V., Lavertu, S., & Peskowitz, Z. (2020). School district operational spending and student outcomes: Evidence from tax elections in seven states. *Journal of Public Economics*, *183*, 104142.

An, X., Li, X., & Liu, M. (2010). The personnel system and teacher incentive mechanism of rural education in Western China in the context of "county-based" education. *Teacher Education Research, 22*(3), 49-55.

Brunner, E., Hyman, J., & Ju, A. (2020). School finance reforms, teachers' unions, and the allocation of school resources. *Review of Economics and Statistics*, *102*(3), 473-489.

Candelaria, C. A., & Shores, K. A. (2019). Court-ordered finance reforms in the adequacy era: Heterogeneous causal effects and sensitivity. *Education Finance and Policy*, *14*(1), 31-60.

Chauncey, H. R. (1992). *Schoolhouse Politicians: locality and state during the Chinese Republic* (Vol. 454). Honolulu, HI: University of Hawaii Press.

Chen, G. (2015). *History of education in the revolutionary base areas of China (Series 1)*. Shanghai: East China Normal University Press.

Cheng, Y. (1935). *The financing of public education in China: A factual analysis of its major problems of reconstruction*. Doctoral dissertation at Columbia University.

Chyi, H., & Zhou, B. (2014). The effects of tuition reforms on school enrollment in rural China. *Economics of Education Review, 38*, 104-123.

Courant, P. N., & Loeb, S. (1997). Centralization of school finance in Michigan. *Journal of Policy Analysis and Management, 16*(1), 114-136.

De Chaisemartin, C., & d'Haultfoeuille, X. (2020). Two-way fixed effects estimators with heterogeneous treatment effects. *American Economic Review, 110*(9), 2964-96.

Ding, Y. (2012). The problems with access to compulsory education in China and the effects of the policy of direct subsidies to students: an empirical study based on a small sample. *Chinese Education & Society, 45*(1), 13-21.

Ding, Y., Lu, F., & Ye, X. (2020). Intergovernmental transfer under heterogeneous accountabilities: The effects of the 2006 Chinese Education Finance Reform. *Economics of Education Review*, *77*, 101985.

Ding, Y., Xue, H., & Wang, L. (2008). A preliminary study on the effect of the reform of "new mechanism for guaranteeing rural compulsory education funds". *Education and Economy*, (04), 6-10.

Dong, D. (1991). *History of education in the revolutionary base areas of China*. Beijing: Educational Science Press.

Enikolopov, R., & Zhuravskaya, E. (2007). Decentralization and political institutions. *Journal of Public Economics*, *91*(11-12), 2261-2290.

Fernandez, R., & Rogerson, R. (2003). Equity and resources: An analysis of education finance systems. *Journal of Political Economy*, *111*(4), 858-897.

Fischel, W. A. (2006). The courts and public school finance: Judge-made centralization and economic research. *Handbook of the Economics of Education*, *2*, 1279-1325.

Gao, P. (2019). Risen from the chaos: The emergence of modern education in China. In *Globalization and the Rise of Mass Education* (pp. 279-309). New York, NY: Palgrave Macmillan.

Goldin, C., & Katz, L. F. (1999). The shaping of higher education: The formative years in the United States, 1890 to 1940. *Journal of Economic Perspectives*, *13*(1), 37-62.

Goodman-Bacon, A. (2018). *Difference-in-differences with variation in treatment timing* (No. w25018). National Bureau of Economic Research.

Ha, W., & Liu, Y. (2018). Does the "new mechanism" promote the completion of compulsory education? -- An empirical study based on municipal-level data in central and western China. *Chinese Journal of Education*, (11), 62-69.

Ha, W., & Liu, Y. (2018). The impact of the "new mechanism" policy on education expenditure: an empirical study based on provincial panel data in rural China. *Economic Review of Education*, *3*(04), 45-63.

Ha, W., & Yan, F. (2018). Does money matter? The effects of block grants on education attainment in rural China: Evidence from intercensal population survey 2015. *International Journal of Educational Development*, *62*, 174-183.

Ha, W., Chen, X., Liu, Y., & Zhang, Z. (2017). A forty-year review of China's rural compulsory education funding system reform. *Education Academic Monthly,* (12), 3-11.

Hannum, E. (1999). Political change and the urban-rural gap in basic education in China, 1949-1990. *Comparative Education Review, 43*(2), 193-211.

Hannum, E. (2003). Poverty and basic education in rural China: Villages, households, and girls' and boys' enrollment. *Comparative Education Review*, *47*(2), 141-159.

Huang, B. (2010). The Deviation between Reality and Policy Intentions: The History and Prospects of the Change of China's Compulsory Education Financial System. *Education and Economics*, (04), 6-11.

Hyman, J. (2017). Does money matter in the long run? Effects of school spending on educational attainment. *American Economic Journal: Economic Policy*, *9*(4), 256-80.

Jackson, C. K. (2018). Does school spending matter? The new literature on an old question. *NBER Working Paper No. 25368.*

Jackson, C. K., & Mackevicius, C. (2021). The distribution of school spending impacts. *NBER Working Paper No. w28517.*

Jackson, C. K., Johnson, R. C., & Persico, C. (2016). The effects of school spending on educational and economic outcomes: Evidence from school finance reforms. *The Quarterly Journal of Economics*, *131*(1), 157-218.

Lafortune, J., Rothstein, J., & Schanzenbach, D. W. (2018). School finance reform and the distribution of student achievement. *American Economic Journal: Applied Economics*, *10*(2), 1-26.

Lampton, D. M. (1979). The roots of interprovincial inequality in education and health services in China. *American Political Science Review,* 459-477.

Lauwerys, J. A. (1957). Problems of educational policy in Communist China. *Comparative Education Review, 1*(2), 4-6.

Li, X., Liu, M., & An, X. (2008). Fiscal reform and personnel power structure changes in western rural education. *Beijing University Education Review*, (04), 62-77.

Liang, W., & Hu, Y. (2013). A study on the financial fairness of rural compulsory education before and after the implementation of the "new mechanism". *Education Research, 34*(08), 61-69.

Liao, Q. (1936). *Education in Changing China: A Study of Wen County in Shandong Province*. Shandong: Education Study Press.

Lindert, P. (2004). *Growing Public: Social Spending and Economic Growth Since the Eighteenth Century* (Vol. 1). Cambridge: Cambridge University Press.

Liu, M., Murphy, R., Tao, R., & An, X. (2009). Education management and performance after rural education finance reform: Evidence from Western China. *International Journal of Educational Development, 29*(5), 463-473.

Liu, Y., & Ha, W. (2019). The impact of the "new mechanism" policy on education expenditure in eastern rural counties: an empirical study based on double difference and triple difference. *China Education Policy Review*, (00), 45-74.

Lu, K. (2014). Evaluation of the impact of the "new mechanism" on the balanced allocation of financial resources in education: an estimation based on a pairwise model. *Beijing University Education Review, 12*(01), 156-166.

Lü, X. (2014). Social policy and regime legitimacy: the effects of education reform in China. *American Political Science Review*, 423-437.

Ministry of Education of the People's Republic of China. (2019). *National Statistical Bulletin on the Development of Education in 2018*. http://www.moe.gov.cn/jyb_sjzl/sjzl_fztjgb/201907/t20190724_392041.html

Oates, W. (1972). *Fiscal Federalism*. Edward Elgar Publishing.

Oates, W. E. (1993). Fiscal decentralization and economic development. *National Tax Journal*, *46*(2), 237-243.

Shi, X. (2012). Does an intra-household flypaper effect exist? Evidence from the educational fee reduction reform in rural China. *Journal of Development Economics, 99*(2), 459-473.

Shi, X. (2016). The impact of educational fee reduction reform on school enrolment in rural China. *The Journal of Development Studies, 52*(12), 1791-1809.

Smith, W. C., & Joshi, D. K. (2016). Public vs. private schooling as a route to universal basic education: A comparison of China and India. *International Journal of Educational Development, 46*, 153-165.

Snyder, T. D. (1993). *120 years of American education: A statistical portrait*. US Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

Sun, B., & Chang, B. (2008). Analysis of the policy effects of "two exemptions and one subsidy" for compulsory education in western rural areas. *Education and Economics*, (3), 14-18.

Sun, Z., Du, Y., & Li, T. (2010). Financial reform of compulsory education: incremental and distributional effects. *Peking University Education Review*, *8*(01), 83-100.

Tang, C., Zhao, L., & Zhao, Z. (2020). Does free education help combat child labor? The effect of a free compulsory education reform in rural China. *Journal of Population Economics*, *33*(2), 601-631.

The Second Historical Archives of China. (1991). *Compilation of archival materials on the history of the Republic of China - Three series – Education*. Nanjing: Jiangsu Ancient Books Publishing House.

Tiebout, C. M. (1956). A pure theory of local expenditures. *Journal of Political Economy*, *64*(5), 416-424.

Tsang, M. C. (1994). Costs of education in China: Issues of resource mobilization, equality, equity and efficiency. *Education Economics*, *2*(3), 287-312.

Tsang, M. C. (1996). Financial reform of basic education in China. *Economics of Education Review*, *15*(4), 423-444.

Tsang, M. C. (2000). Education and National Development in China since 1949: Oscillating Policies and Enduring Dilemmas. *China Review*, 579-618.

Tsang, M. C., & Ding, Y. (2003). The challenges of compulsory education finance and education transfer in China. *Peking University Education Review*, (01), 84-94.

Tsang, M. C., & Ding, Y. (2005). Resource utilization and disparities in compulsory education in China. *China Review*, 1-31.

Wang, J., & Chang, B. (2008). The effectiveness, problems and countermeasures of implementing the "new mechanism" for compulsory education in western rural areas. *Education and Economics*, (02), 1-5.

Wang, R. (2003). A study on the equity of compulsory education investment in China. *Economics (Quarterly), 2* (2), 1-17.

Wang, R. (2008). Reform of the rural compulsory education assured funding mechanism: Policy design perspective. *Chinese Education & Society*, *41*(1), 9-16.

Wei, H., & Yang, D. (1997). Local decentralization and regional educational disparities in China. *China Social Science*, (01), 98-113.

Woessmann, L. (2016). The importance of school systems: Evidence from international differences in student achievement. *Journal of Economic Perspectives*, *30*(3), 3-32.

Xiao, Y., Li, L., & Zhao, L. (2017). Education on the cheap: The long-run effects of a free compulsory education reform in rural china. *Journal of Comparative Economics*, *45*(3), 544-562.

Xue, H., & Ding, Y. (2009). The effectiveness, problems and countermeasures of the reform of China's rural compulsory education funding guarantee mechanism. *Education Science*, *25*(04), 6-14.

Yang, J., & Ha, W. (2017). A study on the impact of new mechanism reform on the level of compulsory education expenditure and its structure-an estimation based on short panel data at county level in central and western China. *Educational Development Research, 37*(08), 46-55.

Yang, J., Ha, W., & Wu, Y. (2017). The impact of financial transfers on county-level compulsory education expenditures--analysis based on western county-level data. *Educational Academic Monthly*, (07), 13-22.

Zhang, L., & Li, K. (2008). Research on the policy of rural compulsory education funding guarantee mechanism. *Educational Development Research*, (09), 1-6.

Zhang, T., & Zou, H. F. (1998). Fiscal decentralization, public spending, and economic growth in China. *Journal of Public Economics*, *67*(2), 221-240.

Zhao, L. (2009). Between local community and central state: Financing basic education in China. *International Journal of Educational Development*, *29*(4), 366-373.

Zhou, F. (2004). Who pays for rural education? Tax reform and “county-based” education system reform. *Beijing University Education Review*, (03), 46-52.

We thank the editors, Thomas Downes and Kieran Killeen, one expert referee, colleagues in this volume, Xiaoyu Chen, Xiaohao Ding, Yanqing Ding, Susan Dynarski, Brian Jacob, Fengming Lu, Scott Rozelle, Rong Wang, Yinduo Wu, Jin Yang, and seminar participants at AEFP, Peking University, Stanford University, University of Michigan for their insightful comments. The education finance data were provided by the Ministry of Education of China through the Institute of Economics of Education at Peking University. We also thank the National Bureau of Statistics of China for providing access to the census data. This research also uses data from the China Health and Nutrition Survey (CHNS). We thank the National Institute of Nutrition and Food Safety, China Center for Disease Control and Prevention; the Carolina Population Center, University of North Carolina at Chapel Hill; the NIH; the Fogarty International Center, NIH, for financial support for the CHNS data collection and analysis files from 2006 to 2011 and future surveys; and the China–Japan Friendship Hospital, Ministry of Health, for support for CHNS 2009. Wei Ha acknowledges financial support from the National Natural Science Foundation of China (71473006, 71613013). Equal authorship applies. All errors and omissions are our own.

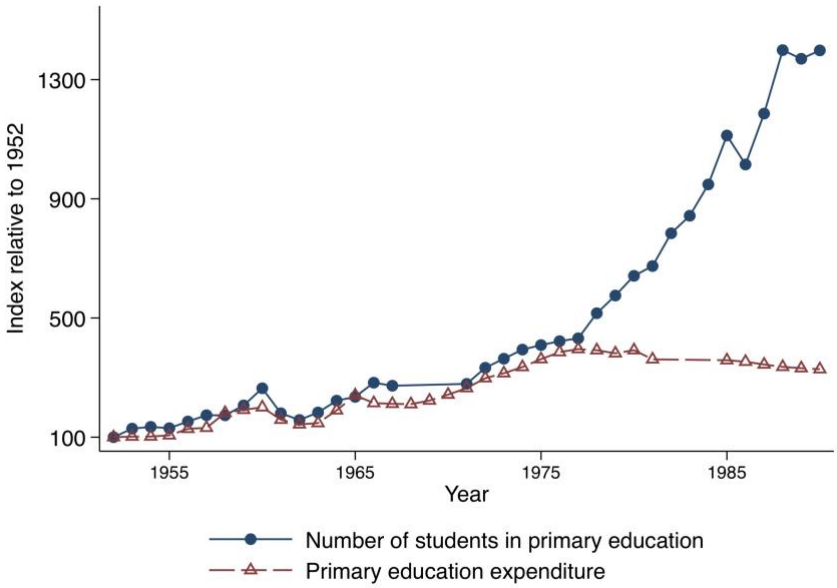


Figure 6.1. Enrollment and expenditure in primary education (1952-1990)

Notes: Data are from Department of Finance and National Education Commission: Basic Data Analysis of China's Education Expenditure 1978-1990.

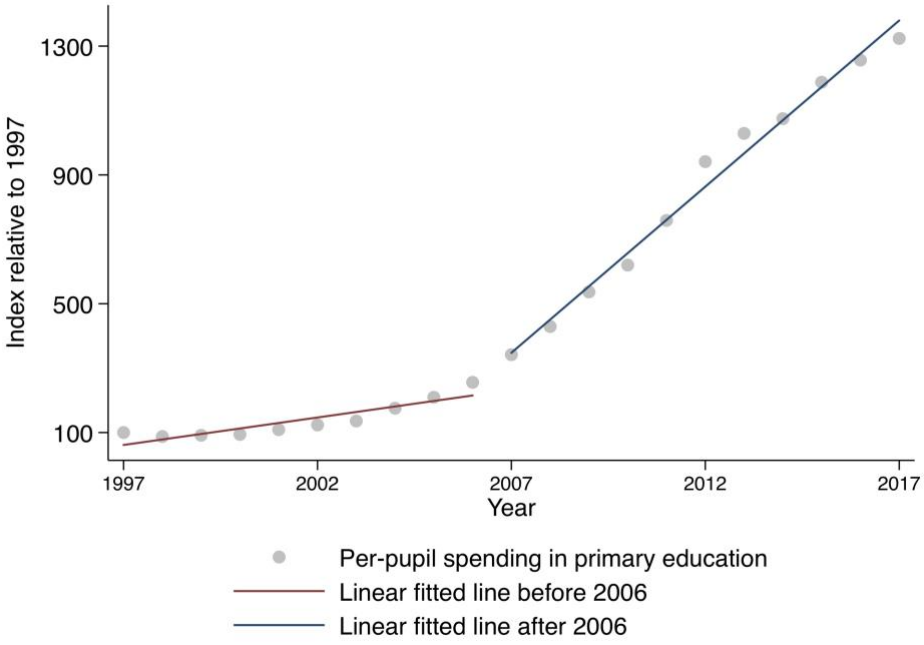


Figure 6.2. Expenditure in primary education (1997-2017)

Notes: Data are from China Education Finance Statistical Yearbook. The enrollment rate in primary education remained close to 100% since late 1990s.

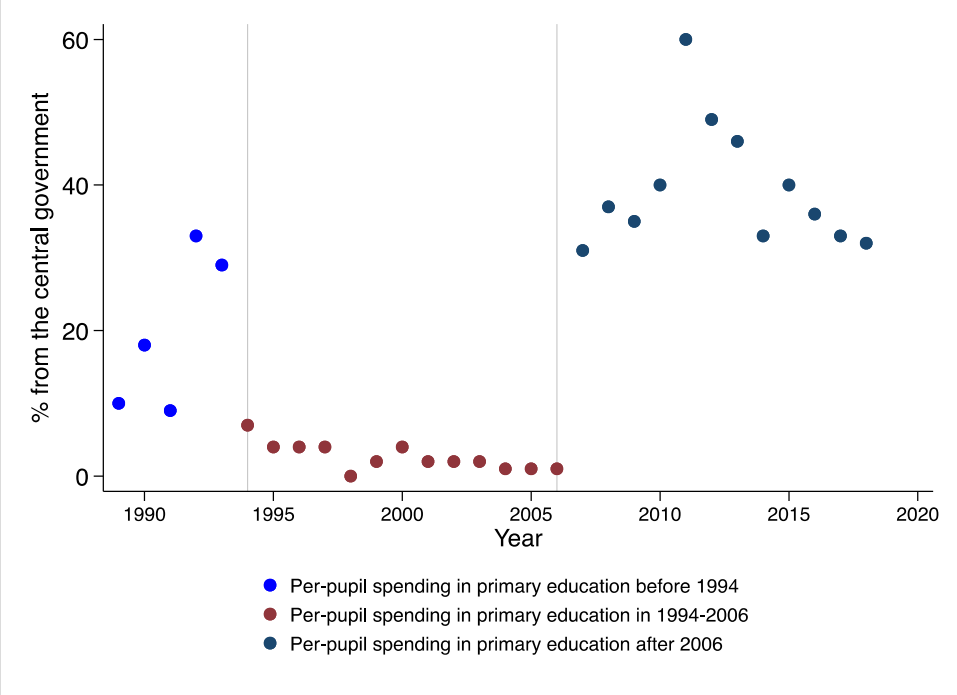


Figure 6.3. Share of primary education expenditure from the central government (1989-2018

Notes: Data are from China Education Finance Statistical Yearbook. The two vertical gray lines indicate the two major reforms: the 1994 Tax Sharing Reform and the 2006 Chinese Education Finance Reform.

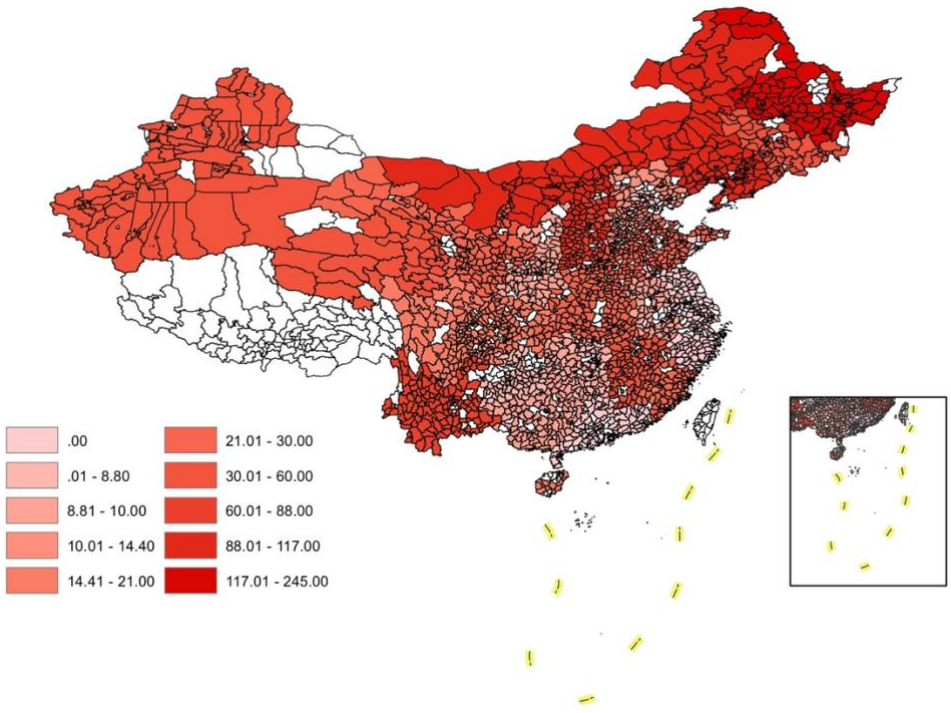
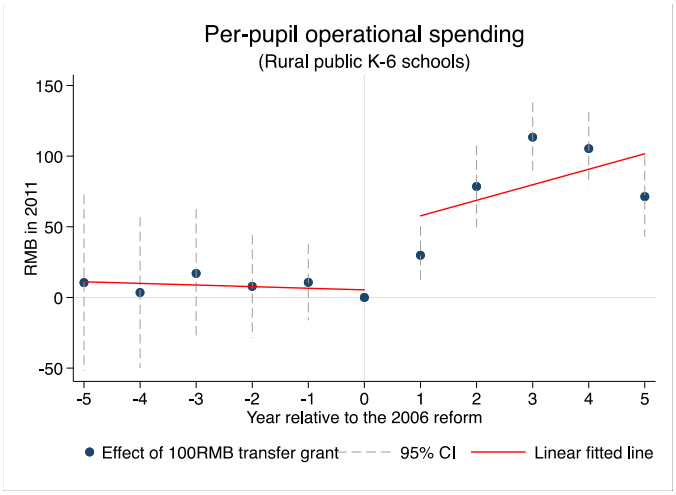
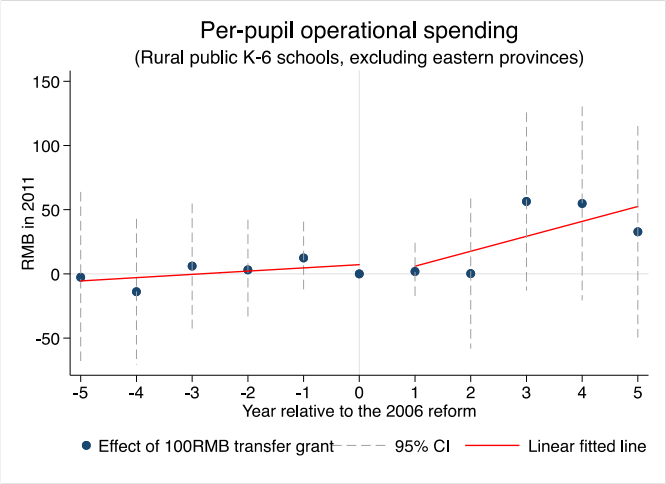


Figure 6.4. Distribution of the estimated transfer grant each county received from upper-level governments

Notes: We caclucate the the estimated transfer grant each county received from upper-level governments from the subsidy rate and desginated primary school operational expenditure benchmark data. Expenditure benchmark data are in 2007 price (CNY). Blank counties in the map have missing values.



A. Full sample



B. Excluding eastern provinces

Figure 6.5. Effects of transfer grant on school operational expenditure

Notes: These two figures show estimates of the effects of 100 CNY desginated transfer grant. Coefficients and standard errors are estimated from an event study regression by comparing the yearly difference in per-pupil operational spending between counties that would have received 100 CNY transfer grant and counties that would have received 0 transfer grant (weighted from real transfer grant amount). The difference in the year before the reform (2006 or 2007) is normalized as zero. Sample includes data from years 2000–2011. Expenditure data are adjusted to the 2011 price. All other regression specifications are the same as in column 3 of Table 6.1.

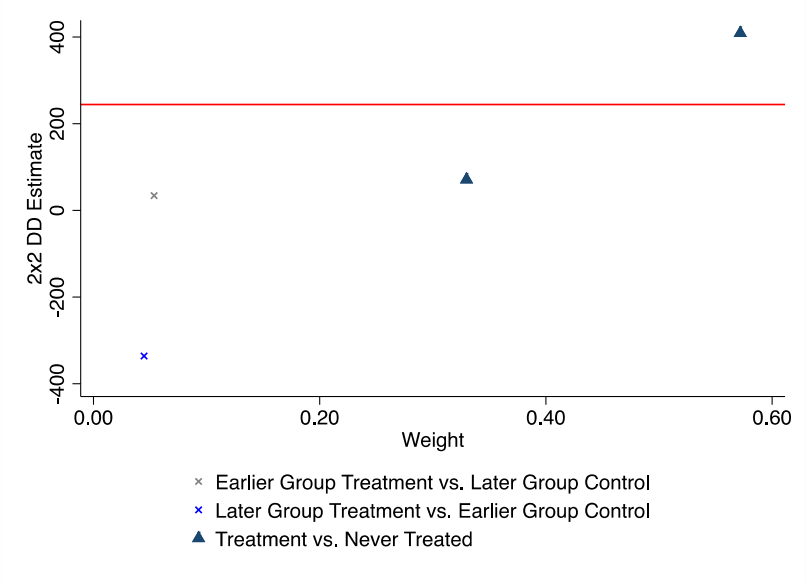


Figure 6.6. Difference-in-differences decompostion for transfer grant effects on school operational expenditure

Notes: This figure plots the 2x2 DID components from the Bacon decomposition (Goodman-Bacon, 2018) against their weights for the transfer grant effects. Regressions are based on the model specification of column 6 of Table 6.1 but without weighting and covariates. The average DID estimate is 244.114. The average DID estimate for "Earlier T vs. Later C" is 34.184 (weight=0.054). The average DID estimate for "Later T vs. Earlier C" is -335.963 (weight=0.045). The average DID estimate for "T vs. Never treated" is 285.347 (weight=0.902).

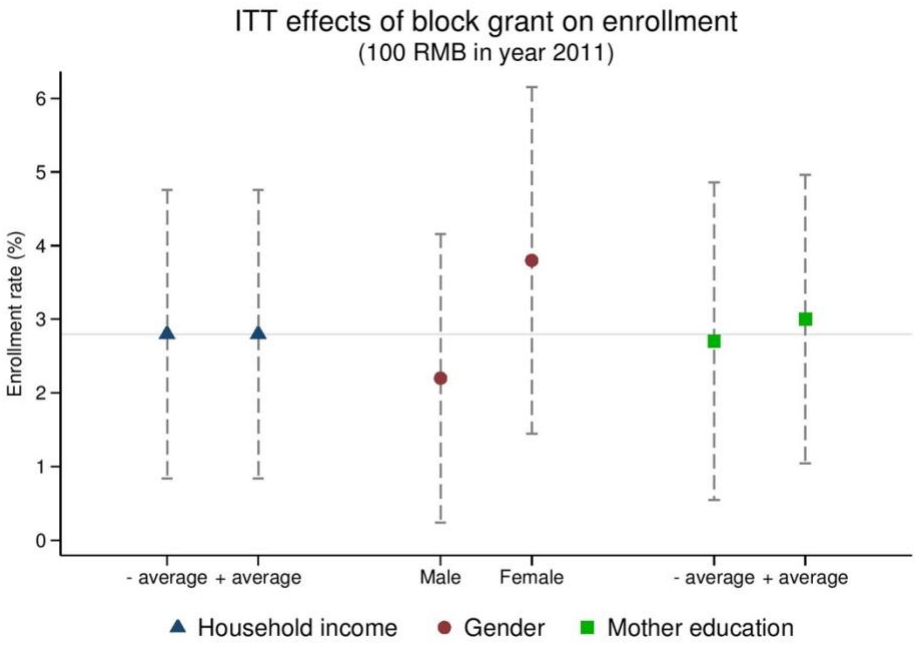
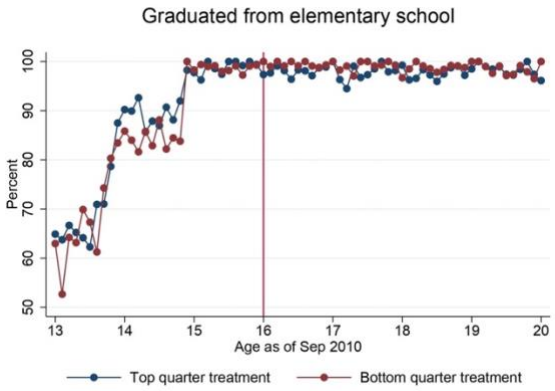
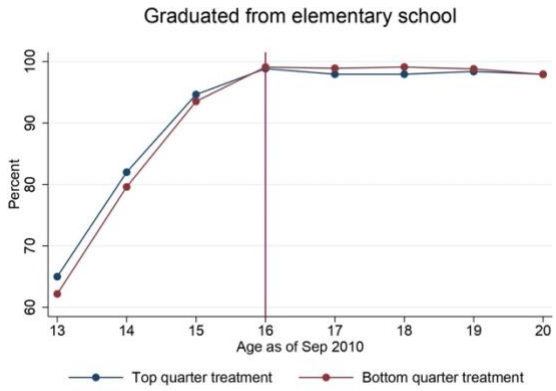


Figure 6.7. Heterogeneity in the ITT effects of transfer grant on K-6 enrollment

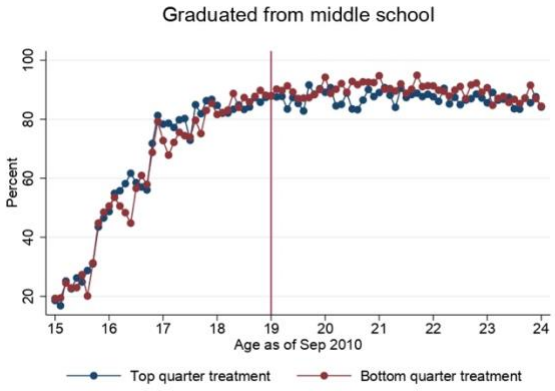
Notes: This figure plots the heterogeneous ITT effects of 100 RM transfer grant on K-6 school enrollment. The uniform effect indicated by the gray horizon line (0.028) corresponds to column 1 in Table 6.3. The estimated ITT effect for female students is 0.038, and that for male students is 0.022; the difference is statistically significant at 0.10 level. The vertical dash lines are 95% confidence interval.



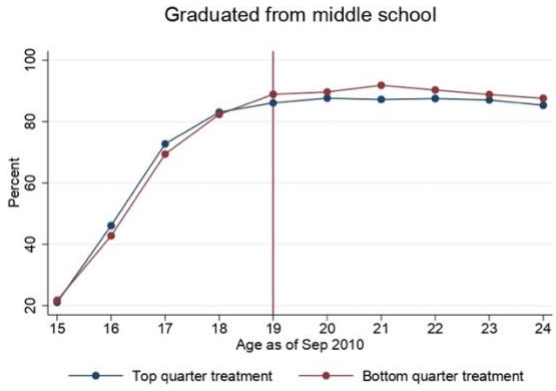
A. Average graduate rate (primary, by birth month)



B. Average graduate rate (primary, by birth year)



C. Average graduate rate (middle, by birth month)



D. Average graduate rate (middle, by birth year)

Figure 6.8. Average graduation rate in primary school and middle school by birth cohort

Notes: These figures plot the average graduation rate by birth cohort in primary school and middle school, respectively. Panel A and C plots by birth month and Panel B and D plots by birth year. Navy lines indicate the average graduation rate in counties ranked in top quarter of receiving the transfer grant and maroon lines indicate that in counties ranked the bottom quarter. The vertical red lines indicate the age cutoffs of students who should not have been exposed to the 2006 Chinese Education Finance Reform. Data are from the 1% sample of the 2010 Chinese Census (N=67,996 for the primary school sample and N=83,206 for the middle school sample). The corresponding DID estimate for the primary school sample is 0.008 (s.e.=0.002). Subsample DID estimates are 0.008 (s.e.=0.003) for female, 0.007 (s.e.=0.002) for male, 0.003 (s.e.=0.003) for students with home piped water, and 0.009 (s.e.=0.003) for students without home piped water.

Table 6.1 Effects of transfer grant on school expenditure (county-level analysis)

	(1)	(2)	(3)	(4)	(5)	(6)
	Treatment = Transfer grant (100 CNY)			Treatment = 1{Transfer grant>=median}		
A. Operating expenditure						
Treatment*Post	96.748***	83.756***	80.085***	95.059***	93.511***	98.362***
	(15.602)	(13.226)	(12.496)	(21.363)	(18.197)	(15.545)
Control mean		415			476	
R-squared	0.52	0.53	0.57	0.51	0.53	0.56
B. Personnel expenditure						
Treatment*Post	-74.673*	-107.917***	-113.451***	-233.396***	-215.929***	-117.440***
	(39.841)	(30.491)	(25.003)	(52.272)	(42.502)	(38.929)
Control mean		1,461			1,620	
R-squared	0.60	0.62	0.67	0.60	0.62	0.67
C. Capital expenditure						
Treatment*Post	17.874***	13.475***	16.665***	16.226***	8.454	-3.885
	(4.473)	(4.645)	(4.532)	(5.843)	(5.624)	(5.254)
Control mean		48			48	
R-squared	0.13	0.14	0.17	0.13	0.14	0.17
D. Total expenditure						
Treatment*Post	48.438	-5.462	-11.213	-85.135	-80.697	-15.403
	(54.758)	(42.419)	(33.652)	(71.119)	(56.380)	(49.650)
Control mean		1,945			2,160	
R-squared	0.60	0.61	0.66	0.60	0.61	0.66
Covariates	No	Yes	Yes	No	Yes	Yes
Trends	No	No	Yes	No	No	Yes

Notes: This table estimates the effects of the transfer grant from the upper-level governments (central, provincial and prefectural) after the 2006 Chinese Education Finance Reform on county-level school expenditures. The sample includes 22,116 county-year observations of 1,843 counties in 2000-2011. The first treatment (measured in 100 CNY) is the estimated grant amount from the central, provincial, and prefectural governments to the rural schools of each county. The second treatment equals one for counties having transfer grant greater than the national median, the mean amount of which is 150 CNY. All of the difference-in-differences regressions control for county and year fixed effects, and possibly additional time-varying controls and province-year trends. Time-varying controls include number of schools, population, share of rural population, number of townships, GDP per capita, ratio of local fiscal revenue and expenditure, ratio of fiscal revenue and GDP. All regressions are weighted by numbers of students. All the outcome measures are adjusted to the 2011 price and winsorized at the 5% and 95% values. The itemized expenditures do not add up to the total expenditure due to winsorization. Robust standard errors, reported in parentheses, are clustered by province. *** p<0.01, ** p<0.05, * p<0.1.

Table 6.2 Effects of transfer grant on total school expenditure in grades 1-6 and student educational attainment

	(1)	(2)	(3)	(4)
Outcomes in Panels B-D	Graduated from primary school		Years of schooling	
Sample mean in 2006	0.79		6.88	
A. First stage results - Outcome: Total per-pupil school expenditure during grades 1-6 (100 CNY)				
Grant*Treated cohorts	6.508***		6.508***	
	(2.062)		(2.062)	
Grant*Treated cohorts*Trend		1.064**		1.064**
		(0.514)		(0.514)
F-stat	*9.945*	*4.287*	*9.945*	*4.287*
F-stat (cluster by county-birth cohort)	*13.670*	*10.325*	*13.670*	*10.325*
B. ITT results				
Grant*Treated cohorts	0.148***		0.245***	
	(0.032)		(0.072)	
Grant*Treated cohorts*Trend		0.042***		0.060***
		(0.006)		(0.017)
C. OLS results				
Total expenditure in grades 1-6	-0.001	-0.001	-0.003	-0.003
	(0.001)	(0.001)	(0.003)	(0.003)
D. 2SLS results				
Total expenditure in grades 1-6	0.024**	0.040*	0.046**	0.073*
	(0.010)	(0.021)	(0.021)	(0.043)

Notes: The sample includes all village students who were born in 1990-1999 and were at least 11 years old in the CHNS survey in central and western provinces (N=861). All the regressions include individual covariates (age, gender, race, parental education, household size and socioeconomic status), community covariates (number of households, number of schools, average wage, labor market participation, health insurance coverage), survey year fixed effects, community fixed effects, and birth year fixed effects. The treatment variable "Grant" (measured in 100 CNY) is the estimated grant amount from the central, provincial, and

prefectural governments to the rural schools of the county where a student lived in. Students are defined as in the treatment cohorts when they were born in and after 1995 (1996) and were in schools receiving central grant starting in 2006 (2007). Older cohorts are defined as the control cohorts. Standard errors in parentheses are clustered at the county-year level. *** p<0.01, ** p<0.05, * p<0.1.

Table 6.3 Effects of transfer grant on yearly school expenditure and student enrollment

Outcomes in Panels B-D	(1)	(2)	(3)	(4)	(5)	(6)
	K-9 school enrollment during ages 6-16					
	Main specification		Misspecification 1 (Dichotomous treatment)		Misspecification 2 (Western region as treatment)	
A. First stage results - Outcome: Yearly per-pupil school expenditure (100 CNY)						
Grant*Post	1.641**		8.486***		-5.240***	
	(0.683)		(1.697)		(1.670)	
Grant*Post*Trend		1.476***		2.306***		-0.692
		(0.303)		(0.394)		(0.447)
B. ITT results						
Grant*Post	0.028***		0.074***		0.023	
	(0.010)		(0.022)		(0.025)	
Grant*Post*Trend		0.017***		0.018***		-0.005
		(0.004)		(0.005)		(0.005)
C. OLS results						
Yearly school expenditure	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
D. 2SLS results						
Yearly school expenditure	0.017*	0.011***	0.009***	0.008***	-0.004	0.007
	(0.009)	(0.004)	(0.003)	(0.003)	(0.005)	(0.010)

Notes: The sample includes all village students aged 6-16 in the CHNS survey years 2000-2011 in central and western provinces (N=2,669). The sample mean of school enrollment rate in 2006 is 0.94. All the regressions include individual covariates (age, gender, race, parental education, household size and socioeconomic status), community covariates (number of households, number of schools, average wage, labor market participation, health insurance coverage), survey year fixed effects, and community fixed effects. The treatment variable "Grant" (measured in 100 CNY) in the main specification is the estimated grant amount from the central, provincial, and prefectural governments to the rural schools of the county where a student lived in. We also use grant*post*linear year trend as the alternative treatment variable to capture the possible heterogeneous yearly increase in the block grant treatments in terms of amount and central and provincial governments'

share. In misspecification 1, we aggregate the continuous variation in grant level and sharing ratio (used to construct the estimated block grant) to a dummy indicator that is equal to one when estimated grant>248 CNY (sample mean). In misspecification 2, we define western provinces as the treatment group as rural schools in western provinces receive 80% of expenditure subsidies from the central government, while central provinces and some eastern provinces receive 60% from the central government. School expenditure is adjusted to the 2011 price. Standard errors in parentheses are clustered at the county-year level. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table 6.1 Summary statistics on selected variables (CHNS)

			Rural village		
Survey year	2000	2004	2006	2009	2011
A. Enrollment and attainment					
Enrollment	89.36%	96.52%	94.44%	96.10%	92.92%
Enrollment on time	84.83%	93.96%	90.91%	94.58%	91.35%
Primary school enrollment	93.92%	100.00%	95.19%	96.52%	91.15%
Middle school enrollment	84.21%	91.16%	92.11%	94.59%	96.27%
Female enrollment	88.89%	95.65%	93.02%	97.51%	96.17%
Male enrollment	89.77%	97.27%	95.57%	95.00%	90.12%
Completed years	5.01	4.58	4.13	4.38	3.98
B. Demographics					
Age	11.36	10.96	10.48	10.53	10.28
Female	45.99%	46.34%	44.24%	43.60%	46.24%
Minority	15.19%	20.15%	21.60%	22.34%	25.66%
Living with parents	92.27%	75.64%	73.46%	67.90%	57.08%
Father's education	5.84	5.19	4.58	4.62	3.93
Mother's education	4.81	4.91	4.99	4.81	4.00
Having refrigerator	11.74%	15.02%	22.84%	41.43%	59.07%
Household size	4.55	4.51	4.77	4.93	4.93
Household income per capita	3.23	3.91	4.40	7.03	7.18
C. Community					
Primary school in community	84.53%	80.77%	80.66%	65.51%	66.81%
D. School					
School expenditure per student	10.00	15.41	20.11	35.14	44.66
Number of counties	23	24	24	24	24
Number of communities	68	72	69	67	70
Observations	724	546	486	461	452

Notes: This table shows the means of main variables included in analysis using CHNS data from 2000-2011. The sample includes all village students aged 6-16 in the survey year in central and western provinces. Enrollment is defined as a student reported to be attending primary or middle school when surveyed. On time enrollment is defined as a student starts grade 1 at age 6 and proceeds to the subsequent grade after each 1 year. Household incomes are deflated in 1000 CNY in year 2011. School expenditures are deflated in 100 CNY in year 2011. All statistics are not sample weighted. Other community covariates are omitted.

Appendix Table 6.2 DID estimates of the intention-to-treat effects of block grant on educational attainment using various birth year spans

	Graduated from primary school			Schooling years completed		
Birth year span	1997	1998	1999	1997	1998	1999
1990	0.056**	0.120***	0.140***	0.178**	0.210***	0.234***
	(0.022)	(0.028)	(0.032)	(0.084)	(0.070)	(0.074)
1991	0.067***	0.128***	0.148***	0.201**	0.222***	0.245***
	(0.022)	(0.028)	(0.032)	(0.086)	(0.067)	(0.072)
1992	0.066***	0.131***	0.154***	0.239**	0.243***	0.261***
	(0.023)	(0.027)	(0.032)	(0.099)	(0.076)	(0.080)
1993	0.071***	0.138***	0.159***	0.252**	0.227**	0.238**
	(0.024)	(0.026)	(0.032)	(0.115)	(0.087)	(0.091)
1994	0.070**	0.147***	0.163***	0.307**	0.282**	0.276**
	(0.029)	(0.027)	(0.033)	(0.139)	(0.105)	(0.104)

Notes: This table reports DID estimates of the intention-to-treat effects of the block grant on educational attainment using different birth year spans. Each pair of cells reports the coefficient and county-year clustered standard errors using different birth year spans as listed in the table. Students aged 11-16 in each survey year are included. The results for 1991-1999 birth years are identical to those of columns (3) and (8) in Table 5. See additional notes to Table 5. Standard errors in parentheses are clustered at the county-year level. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table 6.3 Placebo tests (educational attainment)

	Graduated from primary school			Schooling years completed		
	(1)	(2)	(3)	(4)	(5)	(6)
Survey waves	2009, 2011	2000, 2004, 2006	2006	2009, 2011	2000, 2004, 2006	2006
Observations	475	390	212	474	388	210
A. ITT						
Grant*treated cohorts	0.187***	-0.030	-0.070	0.367***	-0.034	-0.006
	(0.033)	(0.096)	(0.098)	(0.073)	(0.156)	(0.159)
B. IV-2SLS						
Second stage						
School expenditure	0.045**	-0.011	-0.036	0.091*	-0.013	-0.003
	(0.021)	(0.052)	(0.123)	(0.047)	(0.075)	(0.087)
First stage						
Grant*treated cohorts	4.132**	2.635	1.932	4.025**	2.684	1.946
	(1.805)	(4.744)	(4.635)	(1.820)	(4.777)	(4.667)

Notes: This table reports placebo tests of the effects of block grant on educational attainment using various survey waves. The sample restriction and the DID and IV-2SLS model specifications are identical to Table 5 and Table 7b. Standard errors in parentheses are clustered at the county-year level. *** p<0.01, ** p<0.05, * p<0.1.