Local Government Response to Fiscal Squeeze: Evidence from a Targeted Tax Reduction

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Abstract

A rich literature examining the effects of intergovernmental grants to local governments has documented evidence of the "flypaper effect" in terms of overall and categorical expenditures. This paper considers this phenomena in the context of a budget shortfall generated by a targeted tax reduction that benefits a subset of the population. Specifically, we examine whether local government increases tax revenue from other sources to offset the shortfall, reduces expenditures that benefit the targeted group, and consider the net impact of these local responses on income and economic productivity. Identification comes from a ban on all agricultural taxes in China combined with differential revenue replacement levels determined by a national formula at the province level. Comparing nearly identical counties in adjacent provinces reveals that large differences in revenue shortfall are not offset by increased taxes on other subgroups, consistent with a strong flypaper effect. However, local government expenditure on agriculture is disproportionately reduced, attenuating the benefits to the targeted group. Further analysis reveals that farmers in counties that experienced larger revenue shortfalls suffered a loss of net income. These results shed light on how local governments respond to fiscal shortfall stemming from a targeted tax reduction, and how these responses may offset the intended benefits.

Keywords: flypaper effect; fiscal squeeze; local government; agricultural tax.

JEL classification: H71, H72, Q18.

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1 Introduction

The flypaper effect suggests that government responds differently to local income and intergovernmental subsidies, and is one of the most widely-documented anomalies in public finance (Henderson, 1968; Courant et al., 1978). Counter to traditional economic models which predict an equivalent response to local income and intergovernmental transfers, subsidies tend to generate a greater increase in government expenditure (Courant et al., 1978; Hines and Thaler, 1995). While a large literature has studied the effects of grant and income shocks from various sources, there is less research on the effects of shortfalls stemming from a targeted tax reduction, and little consensus about the magnitude and mechanisms of the flypaper effect and consequent economic impacts. This study considers these questions by examining the impact of an agricultural tax reduction on county-level government revenue, expenditure, and agricultural production and income. Specifically, we estimate how counties with fiscal shortfall adjust other sources of revenue, alter spending across categories, and examine how these responses impact agricultural output and farmers' net income. Understanding how local governments respond to fiscal shortfalls and alter expenditures will shed light the optimal budget policy.

The flypaper effect, originally noted by Henderson (1968) and Courant et al. (1978), describes the differential reaction of local government to income from citizens relative to an intergovernmental subsidy. Government expenditure may exhibit a high correlation with the source of revenue, even if local government could allocate it elsewhere. Early studies investigated the overall expenditure change and found a crowd-in effect for intergovernmental subsidies, that is, local governments increase spending rather than reducing taxes. While a number of studies find evidence of a strong flypaper effect (Dahlberg et al., 2008; Allers and Geertsema, 2016; Suárez Serrato and Wingender, 2016; Kakamu et al., 2014), others find weak or mixed evidence (Becker, 1996; Knight, 2002; Darby et al., 2005; Brunner and Schwegman, 2017). Recent studies refine money stickiness to examine whether subsidies for specific budget categories generate disproportionate spending increases in those areas, and find evidence that revenues earmarked for health (Levaggi and Zanola, 2003), road work (Leduc and Wilson, 2017), and administration (Berg and Rattsø, 2007) tend to boost corresponding expenditure. However, Knight (2002) and Gordon (2004) find crowd-out effects on local infrastructure and education spending, respectively. The anomaly of the flypaper effect may be explained by collective decisions (Roemer and Silvestre, 2002), fiscal illusion (Turnbull, 1992), behavioral responses (Hines and Thaler, 1995), risk aversion and insurance (Vegh and Vuletin, 2015),

or unobserved political preferences (Knight, 2002, 2004; Inman, 2008). Few studies have focused on the social and economic impact of the flypaper effect (Leduc and Wilson, 2017). In this study, we examine the overall and categorical flypaper effects driven by a policy-induced fiscal shortfall from a targeted agricultural tax break, and evaluate the consequent economic impact on agricultural production and farmer income.

There are a number of challenges in identifying the effect of an intergovernmental subsidy on local spending and economic outcomes. First, it is difficult to find truly exogenous shocks to local revenue, as the amount of intergovernmental subsidy is usually not randomly determined, and is likely to correlate with unobservables at the local level (Knight, 2002; Inman, 2008). Previous studies address this issue by using various identification strategies such as regression discontinuity based on a grant formula (Dahlberg et al., 2008), political power of congressional delegations as an instrumental variable (Knight, 2002), and census calibration changes (Gordon, 2004; Suárez Serrato and Wingender, 2016). Second, local governments are inherently heterogeneous in terms of their population characteristics, natural endowments, and socioeconomic conditions, hence it is difficult to find similar local governments to use as a counterfactual. In order to generate an unbiased estimate of the impact of a specific policy, we need an observable, exogenous shock that is imposed on otherwise similar local governments.

This paper examines the effect of fiscal squeeze caused by a targeted tax reduction. In 2004, the central government of China passed a law to abolish all agricultural taxes in order to benefit the country's 900 million farmers and promote agricultural production. This tax reduction prohibits county governments from collecting agricultural taxes as one of their sources of income. As compensation, county governments were subsidized by a designated transfer from the central government, and the amount of the subsidy was determined at the province level: depending on whether a province is coastal and a major-grain producer, they receive either 0%, 50%, 80% or 100% replacement of pre-policy agricultural tax revenue. Thus, we are able to compare very similar counties that are adjacent to each other geographically but received substantially different replacement subsidies. We consider local government response in terms of revenue, expenditure, and agricultural outcomes using a difference-in-differences design.

To allow for heterogeneous effects, we differentiate by per-capita gross product, agricultural dependence, and the political experience of county governors. To conduct the analysis, we create a merged data set from The County Public Finance Statistics Yearbook of China, China Regional Eco-

nomic Statistics Yearbook, China County Social and Economic Statistical Yearbook, and a manually collected county politician profile data set that includes county governors' age, tenure, and level of education.

We find that counties on both sides of the province border follow a similar government budget trajectory prior to the agricultural tax cancellation in 2004. However, after policy implementation, when counties can no longer collect agricultural taxes, those receiving incomplete subsidies experienced a significant reduction of 45 yuan per capita, which is an 81 percent reduction in agricultural revenue, or a 10 percent reduction in overall local government revenue. In the years following policy implementation, we find that tax revenues from other sources (such as sales tax and value-added tax) and intergovernmental subsidies remain unchanged in shortfall counties relative to their neighbors. This finding is consistent with Dye and McGuire (1997), Darby et al. (2005), Bradbury and Case (2001), and Jonas (2012), each of whom find that local government does not alter taxes when there is a fiscal surplus or shortfall. Given the balanced budget requirement, the significant reduction confirms a clear first stage on revenue shortfall, and exhibits a nearly perfect overall flypaper effect.

The consequent change in government expenditure may reflect the flypaper effect in terms of categorical stickiness. Specifically, we find that the per-capita agricultural spending of counties without full revenue replacement is reduced by 18 yuan, or 36 percent, which is much larger than the reductions in other categories (6 percent on average). This is not consistent with the predictions of traditional models, which suggest for proportional reductions. (Henderson, 1968; Hines and Thaler, 1995). This large reduction on local agricultural expenditure shows that, at the category level, local governments reduce the extent to which the benefits of the tax reduction accrue to the targeted group. However, the fact that agricultural expenditure reduction is less than revenue reduction still implies partial stickiness of the targeted money, which is consistent with Leduc and Wilson (2017) and Levaggi and Zanola (2003). In addition to examining the effect on agriculture, this natural experiment allows us to consider which other categories of spending are most affected by a shortfall. Apart from the agricultural spending reduction, we find significant reductions in social security spending (11.4 percent), short-run liquidity reserves (12.5 percent), and a catch-all category comprised of non-profitable public sector subsidies including designated pension and relief fees.

We examine the consequent effects of agricultural expenditure reduction on agricultural production and farmers' income. While government spending on agriculture is mostly used for fixed investment and technology promotion, the reduction on spending may also have a negative impact on agricultural

production, but examining the relative changes in agricultural factor inputs (cultivated land area, agricultural labor force, and its share among population) and agricultural outputs (output of grain crops, oiling crops, and meat product) reveals no significant changes in agricultural production when counties receive incomplete subsidies. However, we find that farmers' net income in less-subsidized counties is significantly less than that of fully subsidized counties after the agricultural tax cancellation. Net income refers to revenue from agricultural production less the costs of production minus taxes and fees. Given similar levels of agricultural tax relief, similar levels of agricultural output, and no de facto tax increase from other sources, the explanation for the income decline may be that individual agricultural producers face increased costs of production. Thus, the effect of reduced government agricultural expenditure reduction may result in higher costs of production and lower net income.

This paper contributes to the literature in several ways. First, we address the effect of a fiscal shortfall driven by a policy change instead of changes in local income or wealth (Darby et al., 2005; Dye and McGuire, 1997; Jonas, 2012). Second, as the fiscal shock is due to a targeted tax break in agriculture, we can investigate the categorical flypaper effect for the agricultural sector, enriching the existing literature by considering the extent to which local government redistributes away from the intended beneficiaries (Levaggi and Zanola, 2003; Leduc and Wilson, 2017; Berg and Rattsø, 2007). Finally, by examining the impacts on agricultural outcomes and farmers' net income, we are able to estimate the impact of local government responses on the targeted group.

The paper is organized as follows. Section 2 presents background information about the revenue and expenditure system in China, the agricultural tax, and its cancellation. Section 3 describes the construction of the data set on local revenue, expenditure, agricultural outcomes, and other local economic variables. Section 4 presents the empirical strategy and methods of testing its validity. Section 5 and 6 present the results of local government revenue and expenditure changes, showing the overall and categorical flypaper effects. Section 7 shows the consequent effects on the inputs and outputs in agricultural production, and farmer net income. Section 8 shows the heterogeneous effects, and Section 9 concludes.

2 Background

2.1 Revenue and Expenditure System

China, one of the largest countries in the world, has 34 provinces, 333 prefectures, and 2,862 counties.[1] County government is the lowest level of government that has independent authority, above which there are prefecture, provincial, and central governments.[2]

Tax revenue and other government income are shared between central and local (including county, prefecture, and provincial) governments by methods detailed in the Tax Sharing System (TSS). This system classifies three types of taxes: central taxes, local taxes, and shared taxes. Examples of each type of tax can be found in Table 1.[3] While part of central government tax revenue is distributed as subsidies for local governments, all revenue from local personal income, land use, property, and agricultural taxes, goes directly to the local budget. In 2000, local revenue accounted for half of the local budget, while the rest came from central subsidies.[4] In less developed areas, central subsidies account for an even higher fraction of revenue. For example, in our sample, which does not include wealthy coastal cities, intergovernmental transfers finance about two-thirds of local budgets.

In conjunction with revenue sharing between central and local governments, public expenditure in China is also shared. Local governments have high levels of expenditure responsibility that exceed those in most countries. In most countries, it is the central government's responsibility to provide social security and welfare, while education and health are often shared between state/provincial and central governments. In China, county and township governments provide the majority of public services, including 70 percent of budgetary expenditures for education, and 60 percent of those for health (Bank, 2002). As of 2006, China did not have national social security legislation. At that time, most social security revenue (pensions and medical insurance, etc.) was also administrated at the county level.[5] Appendix Table A2 shows the assignments of expenditure responsibilities between

[1] Data comes from the China government website in 2014. The numbers include equivalent administrative divisions, for example, the number of provinces includes number of autonomous regions and municipalities.

[2] There are also 44,741 township-level governments below the counties, however, due to their dependency on county government, few fiscal studies had focused on township government behavior.

[3] The detailed tax sharing is listed in Appendix Table A1.

[4] Including the local share from shared tax revenue.

[5] The central government, for instance, the Ministry of Labor and Social Security, may provide general guidance and ensure that local regulations follow central government guidelines. Provincial or city/county social insurance agencies administrate their respective social security pools and individual accounts. Provincial labor and social security authorities are responsible for regulatory funds to which locally pooled funds in the jurisdiction must pay a percentage of their revenue. Notably, all revenues and expenditures of social security are managed under a specific account called "Social Security Fund", and the fund has an independent budget which is separately prepared from the general budget. Moreover, governments always subsidize the funds with general public budget to make ends meet.

central and local governments from 2003 to 2006. It shows that local governments have primary responsibility for most public services, including agriculture, education, and public health.

2.2 Agricultural Tax

China has long been an agricultural nation, and agricultural taxes have existed for over 2,600 years. All individuals and organizations who receive revenue from certain agricultural products are required to pay the tax. The agricultural tax is a proportional tax on perennial production under normal climate, soil, and cultivating conditions. Therefore, by definition, it is a lump-sum tax based on past production levels instead of current revenue (Wang and Shen, 2014). Counties are the smallest administrative division in China that has authority to determine the agricultural tax rate and collect agricultural taxes. The statutory highest agricultural tax rate by the central government is 15.5% , but the average tax rate in practice is 8.4%.[6] As all agricultural taxes go to county governments, in this paper, we study the policy effects on county-level governments.

In the 1950s, when the People's Republic of China was newly founded, agricultural taxes accounted for more than 40% of total government revenue. While the importance of agricultural tax revenue has been decreasing during recent decades, it still accounts for 30% of local revenue for counties and 10% of total revenue. Nevertheless, the implementation of agricultural taxes has potentially harmful implications. First, agricultural taxes may discourage agricultural production. Second, the burden of the agricultural producer may be high: in some provinces, aggregate tax burdens on farmers are as high as 30 percent, which is higher than for the nation's highest earners (Chen, 2003). Third, agricultural taxes collected in less-developed areas will aggravate spatial inequality, which is a critical issue in China, and accelerate conflicts between farmers and local governments (Bernstein and Lü, 2000; Lin et al., 2007).

In 2004, in order to encourage agricultural production, reduce farmers' economic burdens, and narrow spatial development gaps, China's central government decided to abolish agricultural taxes.[7] The nationwide agricultural taxes were immediately reduced.[8] In 2006, all local governments had fully stopped collecting agricultural taxes. This policy affected 900 million Chinese farmers, exempt-

[6]The statutory tax rate is based on the historical production level, while the practical rate is calculated on the actual production level.

[7]The agricultural taxes being canceled included three types of taxes: *Agricultural Tax*, *Agricultural Specialty Tax* and *Livestock Tax*. Other relevant taxes, including *Land Occupation Tax*, *Tobacco Product Tax* and *Deed Tax*, even if accounted under the category of "Agricultural Taxes", are still in effect. Therefore, the value of revenue categorized as "agricultural tax" does not fall to zero after the abolishment.

[8]In the beginning of 2004, the agricultural specialty tax was immediately canceled, and the tax rate of agricultural tax was reduced by three percentage points for MGP provinces and one percentage point for non-MGP provinces.

ing them from over 100 billion yuan in agricultural taxes. Previous studies on the abolishment of China's agricultural taxes focus on agricultural productivity and the economic outcomes for farmers (Xu and Wang, 2009; Wang and Shen, 2014), but find little effects.

As agricultural tax was one of the major sources of local government revenue in China, and all revenue from it went to local governments, the abolishment could lead to large local deficits, especially for agriculture-dependent counties. In order to offset this deficit, China's central government offered a permanent, annual lump-sum grant called "Subsidy for Agricultural Tax Cancellation" to local governments. This grant is differentiated by province so that counties in some provinces got full offset while others did not. The amount of central government subsidy is determined by each county's 2002 agricultural tax revenue, but varies in compensation rate. The subsidy rate from the central government was set as: a) 100% for major-grain producing (MGP) provinces in central and western regions, b) 80% for non-MGPs in central and western regions, c) 50% for MGPs in eastern (coastal) regions, and d) 0% for non-MGPs in eastern (coastal) regions.[9] We acquire the level of total offsetting subsidies from both central and provincial governments, and categorize provinces by whether this total subsidy is equal to or less than the baseline level. Figure 1 shows the geographical distribution of provinces with balanced revenue and with net revenue loss due to the abolishment.[10] As the figure shows, there is a clear border, meandering from the Southwest to East Coastal Area, that separates areas that got full compensations and those that did not.

3 Data

The data used in this study comes from multiple sources. The primary data is converted from The County Public Finance Statistics Yearbook of China. Two more data sets, the China Regional Economic Statistics Yearbook and the China County Social and Economic Statistical Yearbook, provide county-level economic variables. In addition, we manually collect a data set of the background and careers of counties' local governors.

[9]However, provincial governments may also provide subsidies to county-level governments. This happens in areas with incomplete subsidies, and thus reduces the policy differences induced by central policy. When we define less-subsidized counties, we focus on the 50% and 0% cases since there are no de facto first stage differences between 100% and 80% provinces.

[10]Precisely speaking, given the increasing trend in agriculture tax revenue, counties getting full subsidies of 2002 agricultural tax revenue will still expect relative fiscal losses after 2004. We focus on the loss of insufficient baseline subsidy, i.e., the missing part in 2002 baseline subsidy, assuming that counties in different provinces had same trajectories of agricultural tax revenue if the agricultural taxes were not canceled.

The primary data set used for analysis is The County Public Finance Statistics Yearbook of China, for the years 2001 to 2006. This yearbook includes government revenues and expenditures at the county level. The data set is available in the form of print books through Department of Budget, Ministry of Finance of China. We manually digitized the yearbooks from 2001 to 2006 by scanning each page and then using Optical Character Recognition (OCR) software to convert scanned images to spreadsheets. We exploit the balancedness of the budget to manually check for and correct errors that occurred during data conversion.[11]

The resulting data reveal revenue sources: agricultural revenue (including agricultural tax revenue and the subsidy for agricultural tax cancellation after 2004), other non-agricultural revenue (including revenue from value-added taxes, sales taxes, city maintenance taxes, local personal income taxes, firm taxes, and other non-tax local revenue such as fees), and subsidies (including all intergovernmental subsidies, except for the agricultural subsidy mentioned above). Importantly, the yearbooks also include expenditures, including: agriculture (forestry, livestock and fishing are included), infrastructure, education, governmental administration, social security, public safety, miscellaneous, and changes in reserves. A detailed description of expenditures can be found in Section 6.

To study the effects of the cancellation of agricultural tax on outcomes such as agricultural production and farmers' income, we also use data from the China Regional Economic Statistics Yearbook. This book is available in electronic form, and we extract variables that capture agricultural inputs and outputs, such as agricultural labor force, area of cultivated land, farmers' income, and the amount of agricultural production (grain crops, oil crops, and meat product). The third data set used in this study is the China County Social and Economic Statistical Yearbook. This data set is also in electronic form, and provides information on both the production and welfare sectors, such as by-sector gross regional product for each county.

Furthermore, to study how local governors may impact the revenue and expenditure changes when the agricultural taxes are canceled, we manually collect information for county-level officials. We focus on the top local governor (County Party Secretary, i.e., Xian Wei Shu Ji) for counties located on province borders in 2004, and collect their age, education level, the time when they started to serve as County Party Secretary, and whether they were promoted afterwards.[12] This information

[11] A technical notes regarding error fixing in OCR can be found in Appendix Section A. There are other studies, such as Yin and Zhu (2012), using the same data set with a shorter year span from The County Public Finance Statistics Yearbook, however, the quality of data is limited and thus is not adopted by our study.

[12] The border counties will be discussed in Section 4.

was collected from the Baidu Encyclopedia, which is a commonly used website that contains profiles for noteworthy individuals. For officials not included in the Baidu Encyclopedia, we searched county newspapers, and made phone calls to county governments. Our data is new, as there are no existing data sets on county-level governors. Existing data sets, such as Jiang (2018), are focused on profiles of prefecture or higher level governors.[13]

We capture per-capita values by dividing each county's revenue and expenditure by its population in the corresponding year. The variable "Other Income" is the summation of per-capita local revenues except for revenue from agricultural taxes. We also keep track of its sub item, value added tax and sales tax, in order to compare with previous studies that find income substitution from sales and value-added taxes (Burge et al., 2012; Zhao and Hou, 2008; Chen, 2017). The variable "Other Intergovernmental Subsidy" is the summation of per-capita subsidies. We do not provide the sub-items, as their categories are changing over time during the sample period.

4 Empirical Framework

In this section, we detail the empirical strategy used to estimate the effect of the targeted agricultural tax cancellation and incomplete subsidy on county fiscal outcomes on revenue and expenditure. We introduce a baseline difference-in-difference design first, discuss the shortcomings of this approach, and then develop a border design and present evidence of its validity.

4.1 Baseline Difference-in-Difference Design

The endogeneity of grant levels is a common issue in the literature, and it is resolved in different ways, such as using power of congressional delegations or census calibration changes as instruments (Knight, 2002; Gordon, 2004; Suárez Serrato and Wingender, 2016), or exploiting discontinuities in grant determination (Dahlberg et al., 2008). This paper exploits an exogenous policy difference in compensation rates across provinces. A baseline version of the specification can be written as follows:

$$Outcome_{i,t} = \beta_0 + \beta_1 Post04_t + \beta_2 Incomplete_i + \beta_3 Post04_t \times Incomplete_i + \vec{\eta}\vec{X}_{i,t} + \varepsilon_{i,t} \quad (1)$$

[13] In China, officials in prefecture or higher level are counted as high-level officials. Their profiles are managed and supervised by the central government, so access to these profiles is readily available. However, county-level officials are counted as low-level officials, and their profiles are not uniformly managed.

where the subscript i and t denote county and year respectively. The *Outcome* represents a county's revenue from agricultural tax and subsidy, revenue from other local sources, intergovernmental subsidies, and expenditure on agriculture, infrastructure, education, social security, administration, public safety, and change in financial resources from special government funds. $Post04$ is a dummy variable that takes value 1 if the year is equal to or after 2004 when the policy shock occurred, and *Incomplete* equals to 1 if the county is in treatment group, i.e., in those provinces that are expected to have insufficient subsidy due to the policy. We also add other county-level control variables $\vec{X}$, including county population, and the per-capita regional domestic product in each sector. The coefficient β_1 captures the changes in the outcome between the pre period (2001–2003) and the post period (2004–2006). β_2 captures the initial difference between county governments on each side of the treatment border. Our interest is in the coefficient β_3, which reveals the effect of an incomplete subsidy.

However, simply using a difference-in-difference design that includes all counties in all provinces of China may generate biased estimates. As shown in Figure 1, provinces that receive insufficient subsidies are, by design, located in coastal areas, with high levels of regional development. Wealthier counties may have fundamentally different trends in revenue, expenditure, farmer's income, and other, unobserved factors over time than the poorer, more agricultural counties. To generate more credible estimates, we implement a border design.

4.2 Border Design

China has more than 2,000 counties with diverse geographic and socioeconomic conditions. We strengthen our design by restricting the sample to adjacent counties on either side of provincial borders. The border design has been implemented in various studies, such as Card and Krueger (2000); Dube and Reich (2010); Duranton et al. (2011); Thompson and Rohlin (2012); Turner and Blagg (2017). Counties on the border of adjacent provinces are likely to be similar in terms of natural and socioeconomic conditions, such as population density, geographical endowment, road system, economic development, etc. They may also experience similar shocks to weather and economic conditions. The identification strategy is valid under the assumption that the pre-post change on each side of the border would be similar in the absence of the change in tax law. This assumption would be violated if any other policy changes are implemented at the same time and introduce asymmetric effects across the border, or if there exists different trends in outcome variables for treated and control counties. This results in a sample of 1,002 observations from 168 counties over

6 year.

As an alternative design, we extend the definition of "border counties" to include counties that are contiguous to border counties. This extended sample includes 1,855 observations from 311 counties. Using the extended sample helps control for geographic trend. Further discussion about this extended sample and matching results can be found in Section 5.3.

We estimate the following equation using restricted border contiguous sample and extended border sample, respectively:

$$Outcome_{i,t} = \delta_i + \gamma_t BorderSegment_i + \beta_3 Post04_t \times Incomplete_i + \vec{\eta}\vec{X}_{i,t} + \varepsilon_{i,t} \tag{2}$$

Pre-existing county differences are absorbed by county fixed effects. We include year-by-segment fixed effect as suggested in Dube and Reich (2010). As the province border extend across all of Southern China Mainland, the differences between the east and west counties can be large. Having year-by-segment fixed effects allow for locally varied year effects, reducing the potential for bias, and generating greater precision in estimation. A segment is defined as a section of border that separates two distinct provinces. There are 15 segments along the border. Counties are clustered into segments exclusively. At the junction area of multiple provinces, if a county is contiguous to more than one province, it is clustered to whichever is closer to the county administrative center. The standard errors are clustered on province level, assuming error independence across provinces. (Cameron and Miller, 2015).

We further estimate the year-by-year specification using restricted border contiguous sample:

$$Outcome_{i,t} = \delta_i + \gamma_t BorderSegment_i + \sum_{k=2004}^{2006} \beta_k \mathbf{1}(Year = k) Post04_t \times Incomplete_i + \vec{\eta}\vec{X}_{i,t} + \varepsilon_{i,t} \tag{3}$$

This alternative specification may show the partial implementation of the policy, and capture any effects faded or increased over time.

4.3 Design Validity

We define counties as treated if they are located in provinces that, by national law, are set to receive less than a full offsetting subsidy, and counties as part of the control group if they are in

provinces that re provided with full compensation. Identification is based on contiguous counties that are on opposite sides of the provincial borders, as shown in Figure 1.[14] This results in a sample with 86 counties in 8 provinces as the control group and 82 counties in 7 provinces as the treatment group. Table 2 shows that counties on either side of the border are quite similar in terms of population and gross regional product in each sector before the agricultural tax abolishment (2001—2003).[15] The overall fiscal structures for treated and control counties are also similar: while the majority revenue (70 percent of total revenue) comes from intergovernmental subsidies, agricultural tax income accounts for about 7 percent of total revenue. The shares of other income and expenditure are similar as well.[16] Appendix Figure A1 and A2 show the distribution of key variables. These figures show that counties in the border sample are more similar than those in full sample.

To confirm that contiguous counties on opposite sides of the border follow the same trajectories prior to the policy, we implement a series of timing placebo tests by estimating Equation 3 using observations in pre- and post-treatment periods, but a false treatment time dummy one year before and two years after the actual year of agricultural tax abolishment. Likewise, we implement a geographical placebo test using the true timing of the policy, but false borders within provinces with and without full subsidy replacement. These placebo tests help to rule out the cases that the effect comes from a time or geographical trend.

5 The Effect of a Subsidy Shortfall on Local Revenue

The agricultural tax cancellation along with different fiscal subsidy creates an exogenous shock to county government budget. In this section, we first discuss how agricultural revenue is changed due to the agricultural tax cancellation, then show the effect on net revenue change, and provide robustness tests in the end.

5.1 Agricultural Revenue

We first investigate the effect of the cancellation of the agricultural tax and incomplete replacement subsidies on local government revenue. Figure 3 shows the population-weighted trends of agricultural

[14]The distribution of counties inn the extended sample is shown in Figure 2. In China, county-level administration unit includes *district*, *county-level city*, and *county*. A *district* is part of a city which is most developed, and a *county-level city* is smaller and less industrialized than a city, but larger and developed than a typical county. We exclude these two and only study *counties*.

[15]For comparison, in Appendix Table A3 we present the summary statistics for all sample.

[16]The share of intergovernmental subsidy is large in our sample, mainly as a consequence of the fact that most of border counties are relatively poor and less developed.

revenues per-capita: counties on both sides of the border have similar trends in agricultural tax income prior to the policy change. After the abolishment of agricultural taxes, counties in provinces with incomplete replacement experience significant revenue losses compared with counties in the control group. Specifically, in 2001, 2002 and 2003, counties on each side of the border have nearly identical per-capita agricultural tax revenue. In 2004, revenue in treated counties drops to about 10 yuan per capita, while control counties remain closer to 40 yuan. This gap grows even larger in 2005 and 2006.

To examine whether these differences are driven by trends around the border, we examine how the effects vary with distance from the border. Figure 4 plots the average differences in agriculture revenue against the distance from the the province border.[17] Counties on the treated side are assigned positive distances, while control group counties are assigned negative distances. This reveals a strong first stage in agricultural revenue income difference across the border.[18] The graph shows that there is no noticable geographical trend, so the results appear to stem from the policy shock.

Table 3 presents the estimates of the policy effects on local government revenue. Column (1) shows that treated counties get an agricultural tax subsidy of 32.47 yuan per capita less than control counties on average due to the policy.[19] Consequently, in column (2) we find that net agricultural revenue for local governments is reduced by 34.79 yuan per capita.[20] Taking into account that the agricultural revenue has been cut by more than 80 percent, and that the aggregate effect is a reduction of about 17 million yuan per county (which is equivalent to 2.5 million USD), the first-stage effect is strong in both economic magnitude and statistical significance.

While the first two columns in Table 3 show average changes in agricultural tax revenue before and after policy implementation, columns (1) and (2) in Table 4 examine how these subsidy gaps vary by year. The agricultural subsidy for treatment counties is partially reduced in 2004 (21.72 yuan per capita, a 47.2 percent change), which is consistent with the fact that the policy of agricultural tax cancellation was partially implemented in that year. In 2005 and 2006, treated counties experienced

[17]The distance is measured from the county administrative center, which is defined by the location of the county government building, to the nearest province border.

[18]Note that, this is exhibition similar to, but not a regression discontinuity design, in that we do not regard distance from the border as a running variable to explain the differences in fiscal outcome.

[19]Based on the fact that both treated and control counties get no agricultural tax subsidy prior to the agricultural tax cancellation.

[20]The agricultural revenue for local governments is defined by adding agricultural subsidy to agricultural tax revenue. Despite that most agricultural taxes are canceled, there are some taxes in effect post to the policy, such as land use tax and tobacco tax. This explains why the difference in agricultural revenue is slightly different from that of agricultural subsidy.

a full reduction in agricultural revenue, totaling 40.58 and 42.43 yuan per capita, respectively, or a roughly 100 percent change, indicating full policy compliance.

5.2 Net Local Revenue

Given the fiscal shortfall caused by the loss of agricultural revenue, and the balanced budget requirement, local government must either increase revenue from other sources, reduce expenditures, or use reserve funds.[21] The overall flypaper effect would suggest that the expenditure will decrease. While most studies investigate the income and expenditure effects of increased fiscal income and find positive net revenue effects (Sjoquist et al., 2005; Allers and Geertsema, 2016; Dahlberg et al., 2008; Brunner and Schwegman, 2017), there is little consensus about the revenue response when government faces a fiscal squeeze. Jonas (2012) shows that local governments in the U.S. simultaneously increased their income from other sources and decreased local government expenditure after the 2008 economic recession. Other studies find that local governments tend to maintain their levels of expenditure by raising money from other sources Lago-Penas (2008); Melo (2002); Gamkhar and Oates (1996). The practice of revenue raising differs by the institutional context. In countries where local governments have the authority to determine tax rates, they can simply increase the tax rate, while in countries where local governments do not have the authority to change tax rates freely, this tax revenue increase can be done by strengthening tax enforcement.[22] In China, local governments have limited authority to change tax rates, but they have the freedom to change the extent of tax enforcement.[23]

In Table 3, column (3), we find no evidence that local governments facing fiscal squeeze increase revenue from other sources, which exhibits perfect overall money stickiness. Lost the other potential sources, column (4) shows no difference in other intergovernmental subsidies, which rules out the case that treatment counties get insufficient agricultural subsidies but are compensated through other intergovernmental transfers. Therefore, as shown in column (5), the aggregate effect on net revenue change is about -44.87 yuan per capita, corresponding to an average reduction of about 9.6 percentage in total local revenue.

[21] Yu suan fa [Budget Law] (promulgated by the National People's Congress, Aug. 31, 2014) art. 12, 28 (P.R.C.) The reserve funds come from the general local reserve, and the surplus in special government funds.

[22] In developing countries, the tax enforcement level is usually low, leaving enough room for revenue raising Khan et al. (2016).

[23] Chen (2017) finds that local governments increased income from value-added and sales taxes by imposing higher de facto tax rates. Notably, Chen (2017) exploits the same shock but uses a difference-in-differences design to compare counties within the same prefecture.

Column (3) to (5) in Table 4 shows the net revenue effects by year. As shown in column (3), the percentage changes of other sources of local revenue are insignificant and negligible, while the changes, if anything, are negligible in 2005 and 2006. Column (4) shows that in neither post-treated year local governments with incomplete replacement got abnormal subsidies from other sources. The aggregated changes in government revenue are shown in column (5), revealing that the per-capita revenue reduction in 2004 is half as large as in the following two years.[24]

5.3 Robustness Tests

In this section we present the results of various robustness tests, including using the extended sample, and using a sample matched on county characteristics.

The goal of the border design is to find the counterfactual that is the most similar to treated counties. However, in the border design, the sample size is limited, so we use an enlarged sample as a robustness test. Besides border-contiguous counties, we also include counties that are adjacent to border-contiguous counties, i.e., the closest off-border counties. Therefore, the sample size is roughly doubled. Another advantage of using the extended border sample is that it allows us to control for geographical trends that may otherwise contaminate the estimates.

By including additional county observations, we replicate our primary estimates on agricultural revenue and net revenue change. Table 5 shows the effects on local revenues for the extended sample. Compared with the main results on local revenue (Table 3), we find that the effects are slightly smaller, and the precision is slightly greater, but there is no statistical difference between the results using the extended sample and those using the border county-only sample. This suggests that the results are robust to the selection of counterfactual counties and that the border design is likely to be valid.

While the border design assumes that contiguous counties along the border are similar, we cannot rule out the possibility that non-adjacent counties may be a better counterfactual. Specifically, using matched, non-adjancent counties eliminates concerns about potential spillover effects. Therefore, as an alternative approach, we implement propensity score matching (PSM) as a method of choosing counterfactual counties that are most likely to experience similar outcomes. Propensity score matching is used to estimate an ex-ante probability of being treated, i.e., the propensity score,

[24]The fact that local governments did not raise revenue from other sources may be explained by the institutional context in China. Local government officials are often appointed by higher levels government, so there is no voting pressure for local government to maintain expenditure level.

and to use counties with a similar propensity score as the counterfactual.(Rosenbaum and Rubin, 1983; Imbens, 2000; Gelman and Imbens, 2014) This strategy is commonly used to select a control group when a subset of individuals are affected by an exogenous shock in a panel data context. Counties in fully and less subsidized provinces are matched by population, the share of revenue from intergovernmental subsidies (a proxy for the dependence on central government), and the share of agricultural tax income in local revenue (a proxy for agricultural dependence).[25] These two variables are crucial in determining how a county will be affected by the policy. Appendix Figure A3 shows the density of propensity scores, revealing that the propensity scores in provinces with and without full compensation are distributed differently. We use propensity score matching to compare the sample from the common support of distributions using caliper matching, as there are often multiple potential control counties with similar propensity scores.

Table A4 presents the changes in revenue estimated with the propensity score matched sample. Compared with main result in Table 3 and the extended sample in Table 5, we find the net effect on agricultural revenue reduction (-19.96 yuan per capita, 38.8 percent) is smaller and imprecisely measured, while the effects on outcomes in natural logs are larger. Overall, the similarity in magnitude and percentage change shows that the treatment effects are robust to the selection of counterfactual, and also indicates that the cross-border spill-over effect of public spending is not a major concern that might dampen the estimate.

5.4 Placebo Tests

One may argue that the estimated treatment effect may come from not the policy but predetermined differences between opposite sides of the province border, or geographical or time-related confounding treatments. In order to rule out these cases, we conduct a series of placebo tests in both time and space. Four different tests are implemented, in which we a) let the year 2003, one year prior to the actual cancellation of agricultural tax be the treatment time, and only use observation from 2002 to 2003, i.e., use 2002 observations as pre-treat and 2003 observations as post-treated; b) let year 2006, i.e., two years after the agricultural tax cancellation, be the treatment time, and only use observation from 2005 to 2006; c) fabricate a border by using the original treated counties as the control group, while using border contiguous counties also on the treated side as the treatment group, i.e., move the whole policy border to the south by one county so that we are comparing within provinces with insufficient subsidy; d) fabricate a border by using the original control group

[25] We use fiscal data from County-level Public Finance Statistics Yearbook of 2002.

counties as the treatment group, while using border contiguous counties as the new control group, i.e., move the border to the north by one county, and thus compare within provinces with full revenue replacement.[26]

Table A5 shows the revenue effects for each of these placebo tests. The results of the tests are shown in Panel A to D, respectively. We find no significant changes in any sources of local government revenues in any test, which strongly suggests that pre-existing differences and post-treatment trends and confounders are not driving the results.

6 The Effect of a Subsidy Shortfall on Expenditure

Given the significant reduction in agricultural revenue and the lack of increased revenue from other sources, the agricultural tax cancellation provides an opportunity to examine how local governments adjust their expenditure. Specifically, we examine how agricultural expenditure and other categories of expenditure are affected by the fiscal shortfall.

6.1 Agricultural Expenditure

For the expenditure effects, first and foremost, we are interested in the consequent change in agricultural spending. The literature examining how an increase in governmental subsidy changes local spending reveals mixed evidence. Levaggi and Zanola (2003), Berg and Rattsø (2007) and Leduc and Wilson (2017) find that intergovernmental subsidies targeted to a specific sector boosts the spending in that sector. However, crowd-out effects are found in Knight (2002) and Gordon (2004), that is, federal funds for a specific category of expenditure will reduce the spending of local government on that category. In our case, agriculture is the targeted benefited sector. If the reduction of local government spending on agriculture is proportional to overall revenue reduction, it implies perfect categorical money stickiness. On the contrary, if the reduction of local government spending on agriculture is as much as overall revenue reduction, it implies that local governments fully offset the targeted policy intended by the central government.

Table 6 shows the policy effects on local government expenditure on agriculture. Column (1) shows that the per-capita agricultural expenditure is reduced by 17.61 yuan, which is 35.6 percent

[26] In test b), the reason for not using one year post to actual treatment time is that year of 2004 is partially treated. If we use the faked treatment time which is one year after the true time, it will capture the partial implementation of policy.

of agricultural spending. Recall that in Table 3 we find an 81 percent reduction in agricultural revenue, this implies an elasticity of 0.44, implying a partial categorical flypaper effect. When the negative income shock stems from the agricultural sector, the expenditure on agriculture is significantly reduced, yet the multiplier effect is limited compared to other studies, indicating that local governments partly reduce the extent to which the benefits of the tax reduction accrue to the targeted group.

In column (1) of Table 7 we present the expenditure effects over time. The pattern of changes is interesting. Unlike the revenue effect, that is, partial reduction in 2004 and full effect in 2005 and thereafter, agricultural spending in counties with incomplete subsidy is reduced immediately in 2004, the first year of the policy change. Per-capita agricultural spending is reduced by 22.75 yuan, which is a 44.6 percent decline. The reductions in 2005 and 2006 are 27.1 and 32.9 percent, respectively.

6.2 Other Expenditures

In addition to expenditure on agriculture, we are interested in how expenditure in other categories responds to fiscal squeeze. Previous theoretical studies claim that a neutral government may adjust its expenditure proportionally (Barro, 1990; Yin and Zhu, 2012).[27] Mahdavi (2004) compares the elasticity of expenditure in different categories and finds that spending on luxury goods (such as park and recreation) is more volatile than that on necessity goods (such as public safety).

Table 6 shows the effect of each category of expenditure. In general, different categories of spending are not proportionally changed. Specifically, column (7) shows that one of the most significantly reduced categories of spending is for a broad, catch-all category consisting of hospitals and libraries, designated pensions and relief fees for veterans, science and technology expenditure, public health and medic expenditure, general government fund expenditure, cultural and sports undertakings, militia and military reserve expenditure, lottery and community fund operation cost, and government donation and humanitarian assistance.[28] Treated counties have experienced a per-capita reduction of 21.23 yuan in miscellaneous spending, which is a 12.5 percent reduction. Local governments

[27] While previous studies do not differentiate the sources of money and merely focus on revenue from local taxation, in Appendix Section B we present a simplified model, which particularly shows how productive spending and welfare-related expenditure are proportionally adjusted in response to change in intergovernmental subsidy.

[28] Each of the sector accounts for a small share in the category of miscellaneous spending, however, we are unable to decompose and estimate sector-by-sector changes from the data.

also reduce payments into liquid reserves.[29] Column (3) shows that Social security spending is also reduced by 2.96 yuan per capita. Despite the fact that the magnitude is relatively small compared with agricultural spending, this reduction accounts for 11 percent of social security spending. Other categories of expenditure, such as infrastructure, education and public policy, do not respond significantly to the reduction in revenue.[30]

The pattern of changes in expenditure indicates that reduction in agricultural expenditure accounts for about half of the revenue change in magnitude. Apart from that, the miscellaneous spending and social security expenditure are vulnerable to fiscal deficit. However, spending on infrastructure, education and public safety are less elastic, perhaps because they are more likely to be guided and supervised by the higher-level governments.

Table 7 shows the effect over time. Contrary to agricultural spending, which shows a stable reduction, treated counties are more inclined to decrease their miscellaneous expenditure and reserves from special government funds in 2005 and 2006: the reduction in miscellaneous spending and special government funds reserves are around 30 and 20 yuan per capita, respectively, much larger than the effects in 2004 (7.95 and 12.71 yuan per capita). The shift in expenditure reduction from agricultural spending to miscellaneous spending and special government funds reserve indicates that the expenditure pattern changes are different in short- and long-run: most of the short-run effect comes from the agricultural sector, which means local governments partially offset the targeted policy by the central government. However, as time goes by, the long-run effect is more likely to be determined by expenditure elasticity, as miscellaneous expenditure seems to be the most elastic among all expenditure categories. We also observe a persistent reduction in social security spending.

6.3 Robustness Tests

Similar to Section 5.3, we examine the robustness of estimates to using an extended border sample and a propensity score matched sample. Table 8 shows the expenditure effects estimated with the extended sample. Agricultural expenditure is decreased by 18.08 yuan per capita (38.0 percent) for less-subsidized counties. Miscellaneous spending and social security spending are reduced by 7.0 and

[29] In China, there are general government budget and special government funds. The former can be freely allocated by the local government, but the latter is for specific use, and is controlled or guided by central government. When there is a surplus in government funds, it is allowed to use them to fill the deficit gap of general spending, but it is not allowed to move the money in the opposite direction. Therefore, apart from the general liquidity reserve fund (which is included in miscellaneous spending), the government funds serve as another source of local government reserve.

[30] The administration expenditure is rather increased by 4.08 yuan per capita in counties that got insufficient subsidies. However, considering that the base level of administrative spending is large, this increase accounts for a negligible percentage change.

12.0 percent, respectively. Apart from a 5.7 percent reduction in public safety spending (though the magnitude effect is subtle), these results are similar to the primary estimates.

Table A6 presents the expenditure effects estimated with the propensity score matched sample. Column (1) shows that the agricultural expenditure is reduced by 16.61 yuan per capita, which is 37.2 percent of agricultural expenditure. In column (3) and (7), we find that the relative reduction of miscellaneous expenditure is about 10.9 percent, and the percentage reduction of social security spending is 15.9 percent. These results are similar to the main regression results, but are less precisely estimated.

7 Agricultural Production and Farmers' Income

Now that we have observed the categorical flypaper effect in agricultural spending, an important concern is that what will be the resulting impact of lost expenditure on agricultural production and farmer income. Previous literature has shown that government spending plays a crucial role in agricultural production Griliches (1964); Chavas (2001). In China, Zhou and Chen (2005) finds that farmers' income is significantly increased by benefiting policies, such as tax-for-fee reform. Wang and Shen (2014) studies how does agricultural tax cancellation affect farmers, but finds little effects on agricultural inputs, outputs, or farmer income. We re-examine these effect under a difference-in-differences framework on border counties.

For agricultural production, we measure factor inputs in three dimensions: the area of cultivated land, local agricultural labor force, and the share of agricultural workforce among total labor force.[31] Table 9 shows the policy effects on factor inputs in agricultural production. Column (1) to (3) shows the average treatment effect, while column (4) to (6) shows the effect by year. Despite the fact that the cultivated land size in counties with insufficient budget replacement tends to be lower, no significant results in terms of magnitude or percentage change are found in either dimension, indicating that there is no factor input difference between counties getting full subsidies or not. For agricultural output, as we have found no notable changes in agricultural inputs, we would expect no output change as well. Table 10 shows the changes in agricultural outputs, measured in the grain crops yield, oil crops yield, and meat production.[32] We find the grain crops yield and per-capita

[31] Some provinces provide additional county-level data on agricultural production, such as electricity used in agricultural production and number of registered agricultural machinery. However, the sample size is too limited to draw any informative result.

[32] Grain crops include rice, wheat, cereal, corns, etc. Oil crops include beans, peanuts, sunflower seeds, rape seeds, etc. Meat product includes pork, beef, chicken, lamb, etc. Note that beans are usually accounted as oil crops in

production are slightly reduced in 2005 and 2006, but other agricultural production outputs are unaffected.

Table 11 shows the effect of agricultural tax cancellation on farmer net income. The net income is defined as revenues minus costs minus government transfers, which, precisely speaking, is the summation of wages, productive income, and business income, minus expenditure and depreciation in family production and business, minus taxes and other fees. Column (1) in Panel A implies that farmers' average net income in counties with insufficient subsidy is 86.24 yuan less than that in counties with full replacement. This accounts for 2.5 percent of farmer's total income, which is both economically and statistically significant, indicating that farmers are worse off when their local government receives incomplete subsidy replacement. Column (2) shows the decomposed income effects by year: in 2005 when the policy is fully implemented, farmers in counties with insufficient subsidy earn around 100 yuan less than those in control counties; while in 2004 when the policy is partially implemented, the income effect is also in proportion. Panel B shows the resulting income effect in natural logarithm: the income difference accounts for about three percentage in farmers' total income. This pattern is similar to the revenue change of local government.

The effects on farmers' net incomes are unexpected but interesting. After agricultural tax cancellation, no matter how the government subsidizes local governments, farmers are directly better off, and thus farmers' income is expected to rise. The significant results and consistent pattern in our estimation indicate that counties with deficit pass their fiscal shortfall to farmers, from whom they previously collected agricultural taxes. Recall that the net income is determined by revenues, costs, and transfers, and the revenue effect is supposed to be the same across the border since there are no significant differences in levels of agricultural outputs, and the agricultural product purchase price is set by the central government thus there is no price effect across the border. The taxes and fees should also be the same, in that agricultural taxes for farmers in treatment and control counties are equally exempted, and that in Table 3 we do not observe governments on either side exhibiting abnormal revenue increases, which rules out the case of transferring tax burden to farmers by collecting from other sources. Therefore, the only possible change must come from costs.

The treatment effects on farmer's net income and agricultural outcomes reveal that when local governments reduce their expenditure on agriculture, the actual agricultural production is not significantly affected. However, farmer's net income is reduced in counties with insufficient tax

China, which is different from American and European practice.

compensation, roughly equal to the agricultural revenue change. One explanation for this is a transferring effect: when local governments spend less on agricultural expenditure that may promote agricultural productivity, the responsibility falls to farmers and thus they, as individual producers, spend more on production materials (such as fertilizer, agricultural machine, technology investment, etc.)

8 Heterogeneous Effects

In the previous sections, we have shown the pattern of local government revenue and expenditure in response to the loss of an agricultural subsidy. We further our study by examining the effects for different types of counties, as average effects may obscure interesting heterogeneity. Specifically, we examine how local government revenues and expenditures are affected by the tenure of the local governor, as well as by the level of of county agricultural dependence and wealth.

First, we are interested in how a county's local governor affects its fiscal behavior. On one hand, as discussed in Li and Zhou (2005), central government uses personnel control to induce desired local economic performance, thus local governors have an incentive to generate economic growth in order to get a promotion. On the other hand, extensive existing evidence about political connections (Faccio, 2006; Li et al., 2008; Fisman and Wang, 2015) indicates that local governors may build stronger connections if he or she stay in the office for longer time. Therefore, we are testing whether counties with newly-appointed governors and with experienced governors implement a similar response when facing fiscal deficit.

Table 12 presents the revenue effects. We categorize counties by whether their top local governor (County Party Secretary) was appointed within the last two years or not.[33] When counties have fiscal deficit due to insufficient revenue replacement, columns (1) and (2) show that treated counties are exposed to similar fiscal shocks, regardless of the tenure of of local governors. However, column (3) and (5) show a large (but less precisely estimated) difference, where new governors accept the revenue shortfall, while longer-tenured governors tend to collect revenue from other sources. The decomposed effects are fuzzy, but in aggregate, counties with new governors exhibit larger average

[33]In China, each county has its own election period, however, the time is correlated, in that county-level election and governor appointment are usually right after the election of higher level government. In our sample, governors of nearly two thirds of counties are categorized as "newly-appointed", while the longer-tenured accounts for just 30 percent. Particularly, to make this variation exogenous, we exclude those who are on their second term, i.e., have served more than five years. Thus, all politicians in our sample are on their first term, and thus the variation of politician tenure is exogenous.

deficits. This finding is consistent with previous literature, as politicians with longer tenure are more likely to increase revenue from other sources (Li and Zhou, 2005).

Table 13 presents the expenditure effects. We find that new governors tend to reduce local expenditure, especially reducing agricultural and miscellaneous spending. On the contrary, the expenditure reduction in counties with experienced governors is subtle: they even increase their administration and public safety spending. Instead, their major adjustments come from using reserves. These results, to some extent, indicate that experienced governors are more likely to use their fiscal sources when facing an unexpected deficit, including raising additional revenue and using government funds, while newly-appointed governors reduce local spending.

Additionally, we examine heterogeneous effects by the agricultural tax dependence of each county. Agricultural tax dependence is measured by the share of agricultural tax income among local government's total revenue prior to the cancellation of the agricultural tax. We separate counties into two groups based on the median level. In the high-dependency group, agricultural taxes accounted for 37.7 percent of local tax revenue on average, while in the low-dependence group, this number is 17.3 percent. When the agricultural tax is abolished, agriculture dependent counties will be affected more than counties that are less dependent on such tax revenue. Appendix Table A7 shows the revenue effects by agricultural tax dependence. In column (1), we see that agricultural tax-dependent counties lose relatively more subsidy from tax cancellation compared to those counties also receiving an incomplete subsidy but that are less dependent on agricultural taxes. However, in column (2), we find that high-dependence counties, apart from the loss due to the incomplete subsidy, lose even more in their revenue from land use taxes, tobacco taxes and deed taxes (which are categorized as "agricultural income" but not canceled by the policy). The percentage of agricultural revenue reduction for agriculture-dependent counties is about 100 percent, while this number for less agriculture-dependent counties is 24.1 percent. For the expenditure effects, Appendix Table A8 column (1) shows that, both agricultural dependent and independent counties experience similar reduction in agricultural spending in terms of magnitude and percentage change. Other expenditure effects are less precisely estimated.

We also study how the local government behavior varies by local wealth, i.e., gross regional product per capita. Similar to the heterogeneity tests for agricultural dependence, we split based on the median level and separate counties into rich and poor counties. Rich counties have average per-capita gross product of 5,866.24 yuan, while poor counties have 2,828.67 yuan. Appendix Table A9

shows the heterogeneous effects in local revenue changes. Column (1) and (2) show that treated counties with lower per-capita GDP experience a bit more loss in agricultural revenue than treated but rich counties. The correlation to the previous result shown in Appendix Table A7 is intuitive, as rich counties usually have more development in industry and business sector, but poor counties are usually agricultural-based. The net revenue change in column (7) also reflects such differences. However, given the difference in net revenue shortfall, when we turn to the expenditure effects, Appendix Table A10 shows that rich and poor counties exhibit similar reduction in agricultural spending.

The heterogeneous effects by agricultural dependence and wealth indicate that, despite the flypaper effect, i.e., reduction in government agricultural spending, the magnitude and percentage change is not highly sensitive to how much it decreased the total revenue of the county. A potential explanation is that county governments perform revenue and expenditure accounting at the sector level, providing additional insight into the presence of a categorical flypaper effect.

9 Conclusion

In 2004, China's central government abolished agricultural taxes and provided annual subsidies to offset local budget losses. However, the amount of the subsidy varied by province, and otherwise similar counties on opposite sides of provincial borders experienced significantly different revenue shocks. Using a merged data set from the County Public Finance Statistics Yearbook of China, the China Regional Economic Statistics Yearbook, the China County Social and Economic Statistical Yearbook, and a manually collected county politician profile data set, a difference-in-difference design on border counties shows that agricultural tax revenue was reduced by 81 percent when counties received no subsidy replacement, accounting for a 10 percent reduction in total local revenue. We find no evidence that local governments offset the loss by increasing taxes on other sectors on the economy. Instead, we find that local agricultural spending is reduced by 36 percent. Social security and other expenditures were also reduced, while expenditures on infrastructure, administration, and education experienced little or no change. We further find that agricultural factor inputs and production were not significantly affected, but the net income of farmers in less-subsidized counties decreased, suggesting that the cost pressure of public goods supply reduction is transferred to agriculture producers.

This study contribute to the literature in several ways. First, it addresses the effect of fiscal squeeze driven by a policy change and finds no crowd-in effect from other sources of local income, which exhibits the flypaper effect in terms of overall revenue. Second, it supplements the existing categorical flypaper effect literature by examining the consequent effects for the agricultural sector, revealing that local government reduces expenditures that benefit farmers. Specifically, we find that government spending is reduced for farmers, and farmers' net income declines in less-subsidized counties due to the increased cost. Our findings imply that local government is reluctant to shift the tax burden to other residents, and partially offsets the benefits intended for the group receiving the tax reduction through reduced expenditure. This highlights the potentially unintended consequences of a targeted tax reduction imposed by the central government when expenditures are determined at the local level.

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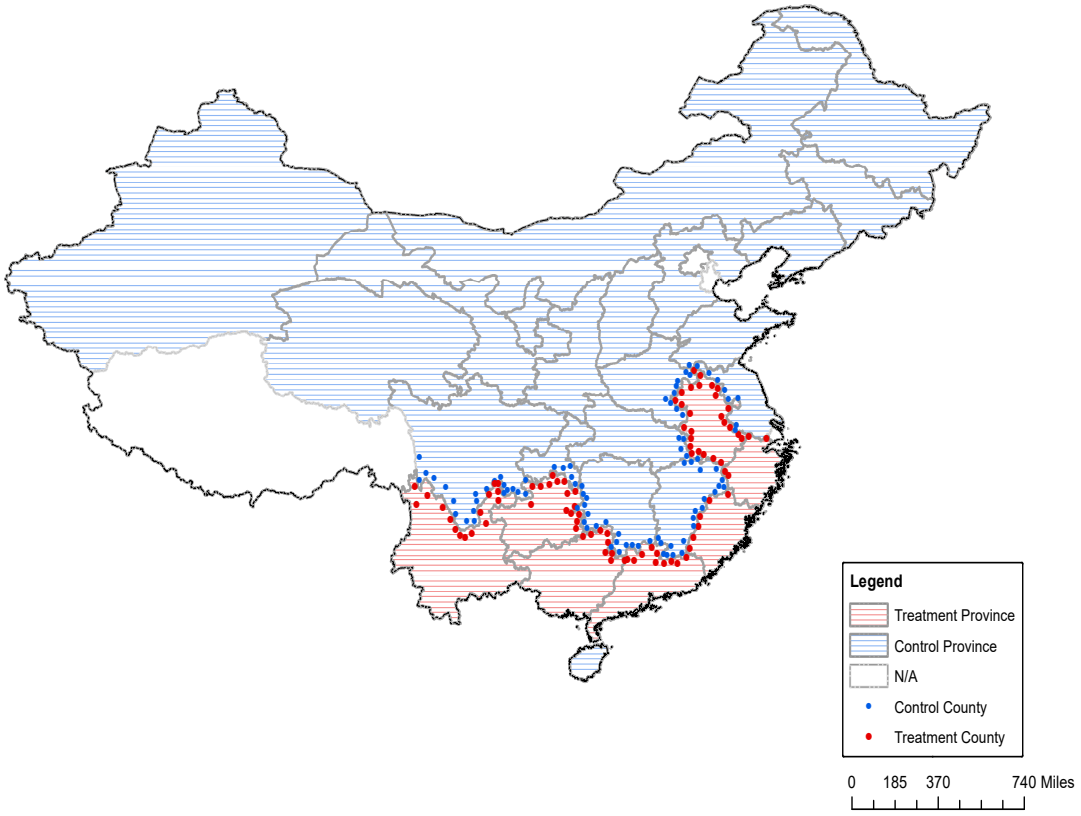
List of Figures

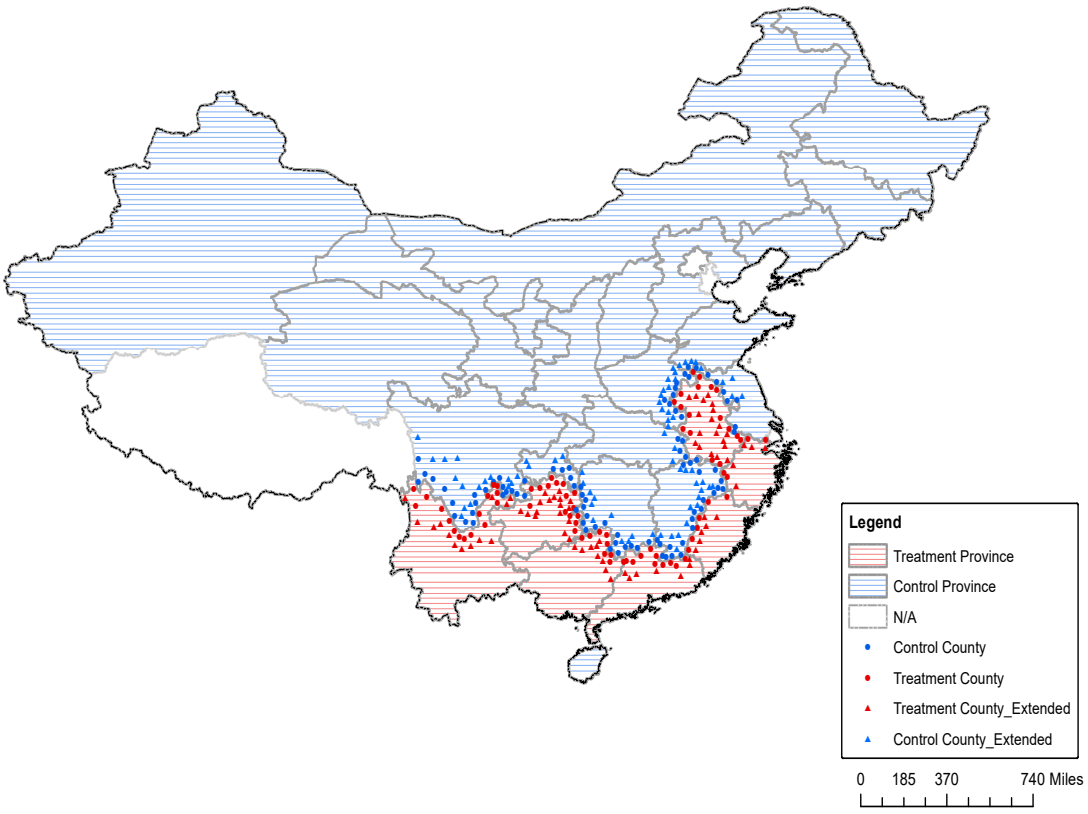
List of Tables

Figure 1: Geographical Distributions of Policy Effects: Border Sample



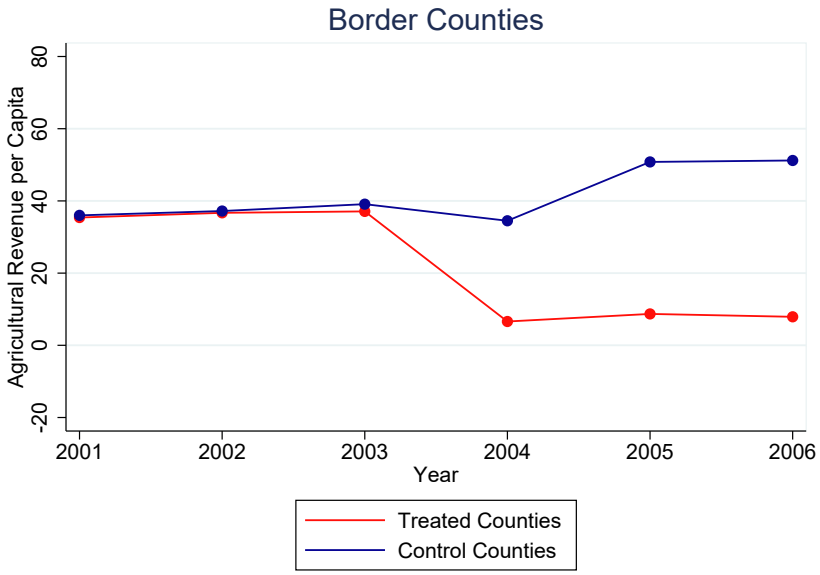
This figure shows geographical distribution of China Mainland provinces with different policy effects. Counties in blue-colored provinces (Sichuan, Chongqing, Hunan, Jiangxi, Hubei, Henan, Shandong, Jiangsu, and other northern provinces which are not included in the sample) get full amount of baseline subsidy, and counties in provinces in red (Yunnan, Guizhou, Guangxi, Guangdong, Fujian, Zhejiang and Anhui) get insufficient level compared to baseline. We exclude Municipal Cities (Beijing, Tianjin and Shanghai), Special Autonomous Regions (Hong Kong, Macau and Taiwan), and Tibet (where there is agricultural tax exemption since 1950). All the counties labeled on map are adjacent to the border. There are 90 counties in control group (blue) and 87 in treatment group (red).

Figure 2: Geographical Distributions of Policy Effects: Extended Sample



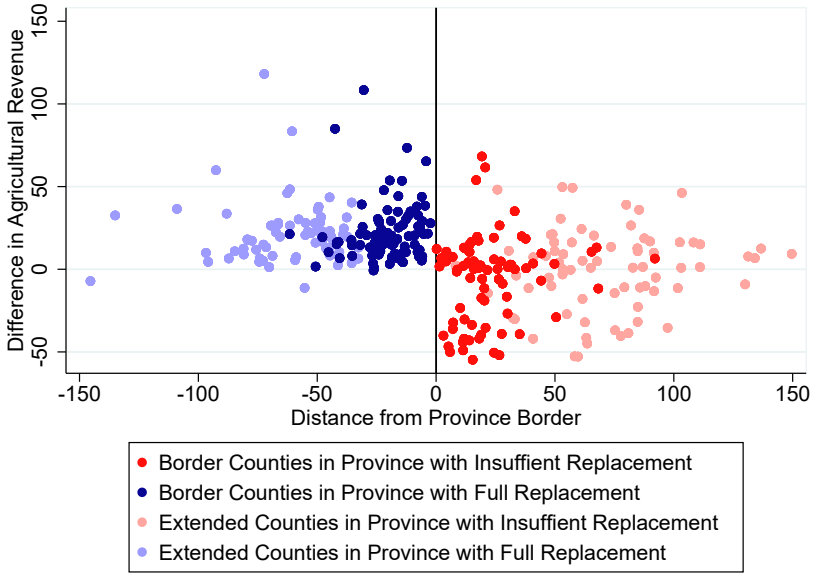
This figure shows geographical distribution of China Mainland provinces with different policy effects. Counties in blue-colored provinces (Sichuan, Chongqing, Hunan, Jiangxi, Hubei, Henan, Shandong, Jiangsu, and other northern provinces which are not included in the sample) get full amount of baseline subsidy, and counties in provinces in red (Yunnan, Guizhou, Guangxi, Guangdong, Fujian, Zhejiang and Anhui) get insufficient level compared to baseline. We exclude Municipal Cities (Beijing, Tianjin and Shanghai), Special Autonomous Regions (Hong Kong, Macau and Taiwan), and Tibet (where there is agricultural tax exemption since 1950). By including off-border counties to the original sample, the extended sample includes 1,978 observations in total, with 164 counties in control group (blue) and 166 in treatment group (red).

Figure 3: Policy Effects on Agriculture Revenues by Year



This figure shows the population-weighted trends of local government's agricultural revenue (tax+subsidy), adjusted for agricultural importance (using share of agricultural tax income) as covariates. Their pre-treatment trend looks matched after the adjustment. Agricultural revenue includes agricultural tax (Agricultural Tax, Agricultural Specialty Tax and Livestock Tax) income and specific subsidies from central government.

Figure 4: Policy Effects on Agriculture Revenues by Distance From Border



This scatter plot shows spatial distribution of changes in agriculture revenue after the agricultural tax abolishment. Distance is measured from county administrative center (i.e., the location of county government) to the nearest border and is in unit of kilometer. Positive distance represents counties in provinces with full subsidy, and negative distance represents counties in provinces with incomplete replacement.

Table 1: Revenue Sharing between the Central and Local Governments

I. Taxes exclusively assigned to the Central and Provincial Governments
1. Excise taxes
II. Taxes shared between the central and local governments
1. Value-added tax
2. Enterprise income tax
3. Natural resource tax
4. Construction tax
5. Industrial and commercial tax
III. Taxes exclusively assigned to local governments
1. Agricultural tax
2. Personal income tax
3. Land use tax
4. Property tax

Notes: For a detailed description of Revenue Sharing System, please refer to Appendix Table A1.

Table 2: Descriptive Statistics for the Border Sample

Unit: RMB per capita

	Control Group		Treatment Group	
	Mean	Std.dev.	Mean	Std.dev.
Total Revenue	532.99	215.51	661.09	387.93
Local Revenue	182.02	99.74	174.15	98.00
Agricultural Tax	44.42	22.58	41.37	21.74
Value Added Tax	19.59	19.44	26.09	31.13
Personal Income Tax	7.91	5.62	9.87	10.95
Sales Tax	32.17	26.88	32.63	27.44
Other Income	137.60	88.18	132.78	97.00
Intergovernmental Subsidy	350.97	189.21	486.95	351.78
Total Expenditure	501.48	192.45	615.99	370.53
Agriculture	46.94	33.69	73.78	76.56
Infrastructure	33.95	58.60	21.15	44.28
Education	120.99	36.82	159.45	65.09
Administration	72.91	38.15	90.00	54.81
Social Security	18.17	12.56	14.72	14.71
Public Safety	29.77	13.92	33.32	19.56
Miscellaneous	170.84	68.39	211.91	139.48
Gross Regional Product in				
Primary Sector	1,444.30	464.20	1,537.08	643.07
Secondary Sector	1,484.04	1,271.77	1,239.29	928.95
Tertiary Sector	1,630.06	4,405.61	1,378.58	816.82
Population	561,261	362,629	492,549	354,556
Number of Counties	86		82	
Number of Observations	257		244	

Notes: This table shows the pre-treatment descriptive statistics of counties in treatment group and control group, restricted to border sample. Revenue, expenditure and gross regional product are in unit of RMB per capita (2004 real price).

Table 3: Policy Effects on Local Government Revenue

Unit: RMB per capita

Outcome Variable	(1) Agr. Subsidy	(2) Agr. Revenue (Tax+Subsidy)	(3) Other Local Revenues	(4) Other Central Subsidies	(5) Net Revenue Change
Panel A: Reduced form, OLS estimate					
Post04×Incomplete	-32.468***	-34.788***	-8.934**	-1.151	-44.873***
	(4.948)	(8.293)	(4.049)	(16.469)	(9.774)
Mean Dep.Var.	12.365	46.870	135.390	406.007	588.267
Observations	1,002	1,002	1,002	1,002	1,002
R-squared	0.826	0.556	0.718	0.865	0.878
Number of Counties	168	168	168	168	168
Panel B: Natural-logs Reduced form, GLM estimate					
Post04×Incomplete		-0.810***	-0.023	-0.056	-0.096***
		(0.229)	(0.031)	(0.050)	(0.022)
Observations		1,002	1,002	1,002	1,002
Number of Counties		168	168	168	168

Agricultural revenues include agricultural tax revenues and agricultural subsidy revenues (which only exists after 2004).
All regressions are weighted by 2005 county-level population.
All regressions are controlled with county fixed effects, year-by-segment fixed effects, and covariates of population and per-capita GDP in each sector.
Standard errors in parentheses are clustered at province-border level.
*** p<0.01, ** p<0.05, * p<0.1.

Table 4: Policy Effects on Local Government Revenue by Year

Unit: RMB per capita

Outcome Variable	(1) Agr. Subsidy	(2) Agr. Revenue (Tax+Subsidy)	(3) Other Local Revenues	(4) Other Central Subsidies	(5) Net Revenue Change
Panel A: Reduced form, OLS estimates					
Post04×Incomplete×Year=04	-21.939***	-21.722***	-1.938	-2.116	-25.776*
	(2.626)	(5.235)	(3.684)	(18.509)	(13.952)
Post04×Incomplete×Year=05	-38.455***	-40.580***	-11.988**	-0.927	-53.496***
	(6.385)	(9.863)	(4.127)	(18.569)	(12.617)
Post04×Incomplete×Year=06	-37.335***	-42.432***	-13.072*	-0.386	-55.891***
	(6.383)	(10.187)	(6.995)	(14.310)	(9.751)
Mean Dep.Var.	12.365	46.870	135.390	406.007	588.267
Observations	1,002	1,002	1,002	1,002	1,002
R-squared	0.848	0.591	0.719	0.865	0.879
Number of Counties	168	168	168	168	168
Panel B: Natural-logs Reduced form, GLM estimates					
Post04×Incomplete×Year=04		-0.472***	-0.024	-0.042	-0.072***
		(0.103)	(0.028)	(0.050)	(0.024)
Post04×Incomplete×Year=05		-0.986***	-0.027	-0.048	-0.102***
		(0.353)	(0.032)	(0.054)	(0.027)
Post04×Incomplete×Year=06		-1.042***	-0.019	-0.073	-0.110***
		(0.339)	(0.041)	(0.049)	(0.020)
Observations		1,002	1,002	1,002	1,002
Number of Counties		168	168	168	168

Agricultural revenues include agricultural tax revenues and agricultural subsidy revenues (which only exists after 2004).

All regressions are weighted by 2005 county-level population.

All regressions are controlled with county fixed effects, year-by-border-segment fixed effects, and covariates of per-capita GDP in each sector and share of elementary school/middle school students in all population.

Standard errors in parentheses are clustered at province level.

*** p<0.01, ** p<0.05, * p<0.1.

Table 5: Policy Effects on Local Government Revenue: Extended Sample

Unit: RMB per capita

Outcome Variable	(1) Agr. Subsidy	(2) Agr. Revenue (Tax+Subsidy)	(3) Other Local Revenues	(4) Other Central Subsidies	(5) Net Revenue Change
Panel A: Reduced form, OLS estimates					
Post04×Incomplete	-31.291***	-32.150***	-4.734	0.231	-36.654***
	(5.412)	(7.744)	(3.754)	(19.568)	(11.026)
Mean Dep.Var.	12.553	47.651	139.239	398.354	585.244
Observations	1,855	1,855	1,855	1,855	1,855
R-squared	0.822	0.564	0.690	0.832	0.853
Number of Counties	311	311	311	311	311
Panel B: Natural-logs Reduced form, GLM estimates					
Post04×Incomplete		-0.760***	-0.021	-0.042	-0.084***
		(0.216)	(0.030)	(0.059)	(0.026)
Observations		1,855	1,855	1,855	1,855
Number of Counties		311	311	311	311

Agricultural revenues include agricultural tax revenues and agricultural subsidy revenues (which only exists after 2004).

All regressions are weighted by 2005 county-level population.

All regressions are controlled with county fixed effects,year fixed effects× border-segment fixed effects, and fraction of agriculture tax revenue in local total revenue(subsidy not included, proxy for importance of agricultural tax to local economy).

Those counties not on the province border is clustered into the same border segment as its closest neighbor county, where the distance is calculated using county seat-to-county seat straight distance.

Standard errors in parentheses are clustered at province level.

*** p<0.01, ** p<0.05, * p<0.1.

Table 6: Policy Effects on Local Government Expenditures

Unit: RMB per capita

Outcome Variable	(1) Agriculture	(2) Infrastructure	(3) Social Security	(4) Administration	(5) Education	(6) Public Safety	(7) Miscellaneous	(8) Total	(9) Reserves
Panel A: Reduced Form, OLS estimate									
Post04×Incomplete	-17.608***	4.623	-2.963**	4.083***	3.839	-0.611	-21.231***	-25.836**	-19.037***
	(5.545)	(7.644)	(1.209)	(1.189)	(3.203)	(1.106)	(4.380)	(10.873)	(4.942)
Mean Dep.Var.	53.636	24.683	17.422	72.443	141.253	29.763	188.395	545.768	42.499
Observations	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002
R-squared	0.913	0.680	0.807	0.950	0.932	0.924	0.939	0.963	0.815
Number of Counties	168	168	168	168	168	168	168	168	168
Panel B: Natural-logs Reduced Form, GLM estimate									
After×Treatment	-0.356***	-0.000	-0.114**	0.015	-0.016	-0.026	-0.125***	-0.064**	-0.216
	(0.062)	(0.432)	(0.057)	(0.026)	(0.013)	(0.018)	(0.019)	(0.027)	(0.133)
Observations	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002
Number of Counties	168	168	168	168	168	168	168	168	168

All regressions are weighted by 2005 county-level population

All regressions are controlled with county fixed effects, year-by-border-segment fixed effects, and covariates of per-capita GDP in each sector and share of elementary school/middle school students in all population.

Standard errors in parentheses are clustered at province level.

*** p<0.01, ** p<0.05, * p<0.1.

Table 7: Policy Effects on Local Government Expenditures by Year

Unit: RMB per capita

Outcome Variable	(1) Agriculture	(2) Infrastructure	(3) Social Security	(4) Administration	(5) Education	(6) Public Safety	(7) Miscellaneous	(8) Total	(9) Reserves
Panel A: Reduced Form, OLS estimate									
Post04×Incomplete ×Year=04	-22.754**	3.309	-3.304**	2.896**	10.977***	0.083	-7.946**	-13.070	-12.706*
	(8.658)	(5.819)	(1.254)	(1.336)	(1.857)	(0.756)	(3.678)	(10.331)	(6.476)
Post04×Incomplete ×Year=05	-12.000***	3.649	-1.979	3.066**	0.879	-1.971*	-29.525***	-34.317**	-19.178***
	(3.550)	(7.829)	(1.126)	(1.405)	(4.530)	(1.094)	(4.536)	(12.301)	(4.763)
Post04×Incomplete ×Year=06	-17.861***	6.919	-3.581*	6.291***	-0.537	0.015	-26.646***	-30.537**	-25.354**
	(3.581)	(8.710)	(1.971)	(1.360)	(4.163)	(1.530)	(5.967)	(11.211)	(9.282)
Mean Dep.Var.	53.636	24.683	17.422	72.443	141.253	29.763	188.395	545.768	42.499
Observations	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002
R-squared	0.634	0.217	0.454	0.727	0.810	0.689	0.809	0.879	0.431
Number of Counties	168	168	168	168	168	168	168	168	168
Panel B: Natural-logs Reduced form, GLS estimate									
Post04×Incomplete ×Year=04	-0.446***	-0.213	-0.139***	0.015	0.055***	-0.014	-0.068***	-0.042*	-0.244*
	(0.102)	(0.352)	(0.046)	(0.020)	(0.014)	(0.022)	(0.017)	(0.023)	(0.126)
Post04×Incomplete ×Year=05	-0.271***	0.035	-0.082	0.009	-0.019	-0.062**	-0.151***	-0.064**	-0.213
	(0.049)	(0.438)	(0.065)	(0.028)	(0.023)	(0.026)	(0.024)	(0.028)	(0.189)
Post04×Incomplete ×Year=06	-0.329***	0.195	-0.121	0.034	-0.056***	-0.011	-0.140***	-0.069**	-0.245
	(0.047)	(0.485)	(0.102)	(0.031)	(0.013)	(0.020)	(0.021)	(0.031)	(0.168)
Observations	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002
Number of Counties	168	168	168	168	168	168	168	168	168

All regressions are weighted by 2005 county-level population.
All regressions are controlled with county fixed effects, year-by-border-segment fixed effects, and covariates of per-capita GDP in each sector and share of elementary school/middle school students in all population.
Standard errors in parentheses are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1.

Table 8: Policy Effects on Local Government Expenditures: Extended Sample

Unit: RMB per capita

Outcome Variable	(1) Agriculture	(2) Infrastructure	(3) Social Security	(4) Administration	(5) Education	(6) Public Safety	(7) Miscellaneous	(7) Total	(8) Reserves
Panel A: Reduced Form, OLS estimate									
Post04×Incomplete	-18.038***	4.806	-3.105**	3.750**	3.738*	-1.232	-10.449***	-16.770	-19.884***
	(5.083)	(6.789)	(1.287)	(1.276)	(1.812)	(0.754)	(3.472)	(13.599)	(6.276)
Mean Dep.Var.	55.168	23.253	16.574	77.250	139.786	31.718	202.530	564.756	54.431
Observations	1,855	1,855	1,855	1,855	1,855	1,855	1,855	1,855	1,855
R-squared	0.896	0.672	0.770	0.934	0.908	0.922	0.924	0.956	0.731
Number of Counties	311	311	311	311	311	311	311	311	311
Panel B: Natural-logs Reduced Form, GLM estimate									
Post04×Incomplete	-0.380***	0.056	-0.120**	0.014	-0.017	-0.057***	-0.070***	-0.047	-0.437*
	(0.059)	(0.402)	(0.049)	(0.029)	(0.024)	(0.009)	(0.023)	(0.032)	(0.231)
Observations	1,855	1,855	1,855	1,855	1,855	1,855	1,855	1,855	1,855
Number of Counties	311	311	311	311	311	311	311	311	311

All regressions are weighted by 2005 county-level population.
All regressions are controlled with county fixed effects, year-by-border-segment fixed effects, and covariates of per-capita GDP in each sector and share of elementary school/middle school students in all population.
Standard errors in parentheses are clustered at province-border level.
*** p<0.01, ** p<0.05, * p<0.1.

Table 9: Policy Effects on Factor Inputs in Agricultural Production

Outcome Variable	(1) Actual Cultivated Area Size	(2) Agricultural Laborforce	(3) Share of Agr. Laborforce	(4) Actual Cultivated Area Size	(5) Agricultural Laborforce	(6) Share of Agr. Laborforce
Unit	Km^2 (100 Hectare)	1,000 Person	% (in total population)	Km^2 (100 Hectare)	1,000 Person	% (in total population)
Panel A: Reduced Form						
After×Treat	-3.125	-0.337	0.005			
	(7.875)	(5.207)	(0.006)			
After×Treat×Year==2004				11.623	-5.699	-0.001
				(14.174)	(5.190)	(0.006)
After×Treat×Year==2005				-13.582	3.995	0.009
				(14.782)	(7.227)	(0.009)
After×Treat×Year==2006				-10.956	1.841	0.011
				(14.413)	(6.784)	(0.008)
Mean Dep.Var.	527.82	365.29	0.48	527.82	365.29	0.48
Observations	888	859	859	888	859	859
R-squared	0.111	0.282	0.191	0.115	0.284	0.194
Number of n_county	168	168	168	168	168	168

All regressions are weighted by 2005 county-level population.
All regressions are controlled with county fixed effects, year-by-border-segment fixed effects, and covariates of per-capita GDP in each sector and share of elementary school/middle school students in all population.
Standard errors in parentheses are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1.

Table 10: Policy Effects on Gross and Per-capita Agricultural Production

Outcome Variable	(1) Grain Crops	(2) Oil Crops	(3) Meat Product	(1) Grain Crops	(2) Oil Crops	(3) Meat Product
Panel A: Gross Product						
						Unit: 1,000 ton
After×Treat	-3.366	-0.548	-3.441*			
	(7.386)	(2.796)	(1.881)			
After×Treat×Year==2004				8.089	-0.930	-4.427**
				(7.892)	(1.932)	(1.645)
After×Treat×Year==2005				-15.149*	-0.134	-2.407
				(7.725)	(5.477)	(2.123)
After×Treat×Year==2006				-0.009	-0.558	-3.502
				(7.792)	(1.529)	(3.092)
Mean Dep.Var.	323.63	24.648	53.908	323.63	24.648	53.908
Observations	903	816	840	903	816	840
R-squared	0.601	0.349	0.506	0.605	0.349	0.507
Number of n_county	168	145	151	168	145	151
Panel B: Per-Capita Product						
						Unit: Kg per capita
After×Treat	-14.826	3.150	-2.734			
	(10.412)	(3.904)	(3.103)			
After×Treat×Year==2004				0.327	0.656	-3.370*
				(8.256)	(1.805)	(1.735)
After×Treat×Year==2005				-26.523**	8.195	-1.611
				(11.508)	(9.693)	(3.537)
After×Treat×Year==2006				-17.150	-1.743	-3.842
				(11.954)	(2.162)	(6.088)
Mean Dep.Var.	431.758	30.467	72.688	431.758	30.467	72.688
Observations	903	816	840	903	816	840
R-squared	0.495	0.230	0.519	0.500	0.235	0.520
Number of n_county	168	145	151	168	145	151

All regressions are weighted by 2005 county-level population.
All regressions are controlled with county fixed effects, year-by-border-segment fixed effects, and covariates of per-capita GDP in each sector and share of elementary school/middle school students in all population.
Standard errors in parentheses are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1.

Table 11: Policy Effects on Farmers' Income

Unit: RMB per capita

	(1)	(2)
Outcome Variable	Farmer's Income	Farmer's Income
Panel A: Change in Magnitude		
After×Treat	-86.237***	
	(26.046)	
After×Treat×Year=2004		-54.287
		(36.759)
After×Treat×Year=2005		-97.054***
		(26.408)
After×Treat×Year=2006		-106.319***
		(27.827)
Mean Dep.Var.	2424.153	2424.153
Observations	1,770	1,770
R-squared	0.674	0.675
Number of n_county	311	311
Panel B: Change in Natural-logs		
After×Treat	-0.025*	
	(0.012)	
After×Treat×Year=2004		-0.017
		(0.012)
After×Treat×Year=2005		-0.030**
		(0.013)
After×Treat×Year=2006		-0.028
		(0.016)
Mean Dep.Var.	7.721	7.721
Observations	1,770	1,770
R-squared	0.646	0.647
Number of n_county	311	311

All regressions are weighted by 2005 county-level population.
All regressions are controlled with county fixed effects, year-by-border-segment fixed effects, and covariates of per-capita GDP in each sector and share of elementary school/middle school students in all population.
Standard errors in parentheses are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1.

Table 12: Policy Effects on Local Government Revenue by Tenure of Politicians

Unit: RMB per capita

Outcome Variable	(1) Agr. Subsidy	(2) Agr. Revenue (Tax+Subsidy)	(3) Other Local Revenues	(4) Other Central Subsidies	(5) Net Revenue Change
Panel A: Reduced form, OLS estimate					
Post04×Incomplete×NewGovernor=0	-36.163***	-41.148**	12.107	1.381	-27.660
	(5.952)	(15.322)	(16.198)	(26.123)	(30.426)
Post04×Incomplete×NewGovernor=1	-30.726***	-34.271**	-6.378	-0.038	-40.688***
	(4.580)	(12.021)	(8.139)	(17.977)	(10.153)
Observations	856	856	856	856	856
R-squared	0.800	0.412	0.681	0.841	0.852
Number of Counties	143	143	143	143	143
Panel B: Natural-logs Reduced form, GLM estimate					
Post04×Incomplete×NewGovernor=0		-0.853**	0.034	-0.049	-0.085
		(0.372)	(0.137)	(0.108)	(0.060)
Post04×Incomplete×NewGovernor=1		-0.806**	-0.028	-0.088	-0.112***
		(0.345)	(0.058)	(0.097)	(0.039)
Observations	856	856	856	856	856
Number of Counties	143	143	143	143	143

All regressions are weighted by 2005 county-level population.
All regressions are controlled with county fixed effects,year fixed effects× border-segment fixed effects, and fraction of agriculture tax revenue in local total revenue(subsidy not included, proxy for importance of agricultural tax to local economy).
Those counties not on the province border is clustered into the same border segment as its closest neighbor county, where the distance is calculated using county seat-to-county seat straight distance.
Standard errors in parentheses are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1.

Table 13: Policy Effects on Local Government Expenditures by Tenure of Politicians

Unit: RMB per capita

Outcome Variable	(1) Agriculture	(2) Infrastructure	(3) Social Security	(4) Administration	(5) Education	(6) Public Safety	(7) Miscellaneous	(8) Total	(9) Reserves
Panel A: Reduced Form, OLS estimate									
Post04×Incomplete×NewGovernor=0	-12.901	1.322	0.063	10.227***	2.260	4.139	-12.876	-0.942	-26.717**
	(11.762)	(10.932)	(2.735)	(3.074)	(3.408)	(2.666)	(11.645)	(27.560)	(10.332)
Post04×Incomplete×NewGovernor=1	-16.602**	6.863	-3.360	1.734	3.501	-1.391	-18.602***	-23.405*	-17.283
	(6.100)	(9.837)	(2.189)	(5.410)	(4.871)	(1.666)	(5.476)	(11.167)	(10.564)
Observations	856	856	856	856	856	856	856	856	856
R-squared	0.507	0.132	0.309	0.652	0.785	0.630	0.787	0.855	0.186
Number of Counties	143	143	143	143	143	143	143	143	143
Panel B: Natural-logs Reduced Form, GLM estimate									
Post04×Incomplete×NewGovernor=0	-0.284**	0.573	0.040	0.111*	-0.028	0.120*	-0.104*	-0.023	-0.649***
	(0.119)	(0.416)	(0.183)	(0.062)	(0.058)	(0.063)	(0.061)	(0.065)	(0.190)
Post04×Incomplete×NewGovernor=1	-0.389***	0.495	-0.091	-0.015	-0.031	-0.062	-0.134***	-0.082**	-0.236
	(0.082)	(0.665)	(0.093)	(0.040)	(0.029)	(0.041)	(0.025)	(0.035)	(0.191)
Observations	856	856	856	856	856	856	856	856	856
Number of Counties	143	143	143	143	143	143	143	143	143

All regressions are weighted by 2005 county-level population.
All regressions are controlled with county fixed effects, year-by-border-segment fixed effects, and covariates of per-capita GDP in each sector and share of elementary school/middle school students in all population.
Standard errors in parentheses are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1.

Appendix

A Notes on Economic Data Converting with OCR

Optical Character Recognition (OCR) is the technology that converts images of typed, handwritten or printed text into machine-encoded text in designated forms. With the development of digital image scanning and processing technology, using OCR software becomes a common method for converting spreadsheet in printed materials (such as books, archives, and reports) to data set that can be directly used in economic research and analysis. A printed spreadsheet consists of the contents (most are numbers), the horizontally and vertically aligned structure, and the frame lines that separate cells. Therefore, apart from the general converting errors, the structure of spreadsheets may introduce specific errors. In this part, we briefly discuss three types of conversion errors in the environment of digitizing spreadsheets, the consequent effects on data quality in terms of measurement errors in estimating average treatment effect, and some ways to fix them.

The first type of error comes from single characters. In most cases OCR works and provides accurate results. However, when the condition of source materials is poor, a single character can be wrongly read. For example, number "0" with a black stain on its bottom right could be read as letter "Q", and number "1" with a horizontal, dirty crease could be read as number "4". Since this type of error occurs randomly, it introduces same bias to data of treatment and control groups, and thus statistically only reduce the precision of estimates.

The second type of error is due to the poor quality of scanning. This is more likely to happen at certain position of pages, even if we place and scan the material in the correct way. For example, when we scan the County Public Finance Statistics Yearbook of China, which is a book of 1,500 pages, the quality of contents near the hinge is poor, because it is hard to flatten that part of a thick book on a book scanner. The impact of this type of error depends on how the spreadsheet is ordered. If variables are listed in columns, scanned variables close to the hinge may have larger measurement errors. On the contrary, if variables are listed in rows but observations are in columns, such measurement errors may fall to certain observations, and we need to test whether it is correlated with treatment assignment.

The last but most critical type of error comes from the frame line. If the numbers are too close to the frame line, the vertical frame line could be converted as part of numbers, leading to an additional digit "1" at the beginning or the end of the original number. For example, a right-aligned number "23456" can be converted to "234561". The lead "1" changes the value by adding 10^N where N

is the number of digits in original value, while the lag "1" changes the value by multiplying the original value by 10. This type of error, if not being corrected, usually leads to asymmetric changes in variable distribution of treatment and control group.

Besides manual proofreading, we exploit the balancedness of the budget balance sheet to check for and correct errors. As all tables of revenue, expenditure and subsidy have their total and sub items, we simply check whether the summation of sub items equals to total item. This implementation can rule out most errors listed above. The only remains are those with two same errors in one observation, but such cases are very rare.

B Government Spending and Political Incentives

B.1 Baseline Model

In this part we set up a model for local government behavior in response to the changes in intergovernmental subsidy. Using this model, we are able to develop some testable hypotheses in local government behavior.

Consider a two-period economy with a representative agent and a (local) government. At the very beginning, the government allocates its revenue on public expenditures. Following Alesina and Rodrik (1994), Barro (1990), Devarajan et al. (1996) and Yin and Zhu (2012), we assume that there are two different sector of spending: production-related expenditure (g_1) and welfare-related expenditure (g_2). In order to focus on the role of intergovernmental transfer, different from previous studies, we assume that the government collects no local taxes and the only source of revenue comes from an exogenous transfer, G_0, and the government's budget balance condition is therefore:

$$g_1 + g_2 = G_0$$

In the first period, the representative agent allocate her endowment k_0 onto consumption c_1 and capital stock k, and in the second period, the agent consumes c_2, which comes from the production of capital. Assume that labor supply is fixed, and further assume that the production function is given by:

$$y = \tilde{A}k^{\gamma}(g_1\bar{l})^{1-\gamma} = Ak^{\gamma}g_1^{1-\gamma}$$

Assume that the agent has intertemporal discount factor β, and in each period she utilizes consumption and government's *durable* welfare goods, assume that the utility function is given by:

$$u_i(c_i, g_2) = \ln c_i + \alpha \ln g_2$$

Therefore, given government expenditures, the agent chooses each period's consumption c_1, c_2, and the capital stock k to maximize:

$$\max_{c_1, c_2, k} U^C = u_1 + \beta u_2 = \ln c_1 + \beta \ln c_2 + (1+\beta)\alpha \ln g_2$$

subject to

$$c_1 + k = k_0$$

and

$$c_2 = A k^{\gamma} g_1^{1-\gamma}$$

we can solve for the equilibrium

$$c_1^* = \frac{1}{1+\beta\gamma} k_0$$

$$k^* = \frac{\beta\gamma}{1+\beta\gamma} k_0$$

$$c_2^* = A g_1^{1-\gamma} (\beta\gamma)^{\gamma} \frac{k_0^{\gamma}}{(1+\beta\gamma)^{\gamma}}$$

Now, given the representative agent's response function, the government allocates g_1 and g_2 to maximize its utility function. We assume that the government is neutral and benevolent, i.e., maximizes the consumer's utility:

$$\max_{g_1, g_2} U^G = u_1^* + \beta u_2^* = \ln c_1^* + \beta \ln c_2^* + (1+\beta)\alpha \ln g_2$$

subject to

$$g_1 + g_2 = G_0$$

First-order condition implies that

$$\beta \left(\frac{1-\gamma}{g_1} \right) + (1+\beta)\alpha \left(\frac{1}{g_1 - G_0} \right) = 0$$

which solves the optimal share of production-related expenditure

$$\frac{g_1}{G_0} = \frac{1}{1 + \frac{\alpha}{1-\gamma}\left(1 + \frac{1}{\beta}\right)}$$

alternatively,

$$\frac{dg_1}{dG_0} = \frac{1}{1 + \frac{\alpha}{1-\gamma}\left(1 + \frac{1}{\beta}\right)}$$

or

$$\frac{d\ln g_1}{d\ln G_0} = \frac{1}{1 + \frac{\alpha}{1-\gamma}\left(1 + \frac{1}{\beta}\right)}\frac{G_0}{g_1}$$

The derivation implies that, when there is an exogenous change in intergovernmental transfer, local governments are expected to reduce productive expenditure and welfare-related expenditure proportionally, keeping their relative sizes unchanged. It is expected to see identical percentage changes.

Note that, with constant elasticity of substitution (CES) production function and utility function, the results may apply to general cases with multiple sectors. Therefore, if we compare the percentage changes of different categories of expenditure, without flypaper concern and political incentive concern, those estimates are expected to be the same.

B.2 Generalized Case with Political Incentive Concern

One strong assumption in the baseline model is that, the decision maker, i.e., local politician, are neutral and benevolent to maximize local representative agent's utility. In reality, this assumption is usually violated. Existing literature has found empirical evidence that governments' expenditure composition can reflect their ideology. Budge and Hofferbert (1990) examines the relation between U.S. party programs and federal government expenditures, and concludes that parties do stick to policies on which they are elected. Bräuninger (2005) finds that higher weight on social welfare spending in a party's policy agendas does lead to a significant increase in social security spending. Moreover, a variety of studies discuss about how political incentives or career concerns affect expenditure composition. Drazen and Eslava (2010) finds that under the competitive election system in Colombia, voter-targeted spending rises in election years relative to other categories of spending. Similar results are also discovered by Khemani (2000) for a study in India and Gonzalez (2002) in Mexico.

Different from most republic countries, China's county-level governors are usually appointed or dismissed by upper government. Therefore, for the local governors, they consider about their evaluation from higher level government. Li and Zhou (2005) and Yin and Zhu (2012) find that under the central appointment system in China, local officials put higher priorities on production related spending (for example, agricultural and infrastructure expenditure) over welfare expenditure as their turnovers are largely based on the economic performance (mainly GDP) of their regions. However, this concern, if exists, should apply to counties on both sides of province border. Therefore, in a triple-differences design, it is expected to see no difference in percentage changes between groups.

Appendix Figures and Tables

Table A1: Revenue Sharing between the Central and Local Governments, Detailed

I.Taxes exclusively assigned to the Central and Provincial Governments

1. Excise taxes
2. Income tax of all central government enterprises
3. Taxes collected from the Ministry of Railroads and from the headquarters of banks and insurance companies
4. Income taxes, sales taxes and royalties from offshore oil activities of foreign companies and joint ventures
5. Energy and transportation fund contribution
6. Seventy percent of the three sales taxes collected from enterprises owned by the Ministry of Industry, the Ministry of Power, SINOPEC (petrochemicals), and the China nonferrous metals companies.
7. All customs duty, VAT and excise taxes on imports
8. Enterprise income tax collected from banks and other financial institutions.

II. Taxes shared between the central and local governments

1. Value-added tax (75 percent central, 25 percent provincial)
2. Natural resource taxes (coal, gas, and other minerals if the enterprises are fully State-owned.)
3. Construction tax on the cost of construction of buildings that are outside the plan and financed from retained earnings
4. Salt tax
5. Security and exchange tax (50 percent central, 50 percent provincial)
6. Industrial and commercial tax, and income tax levied on foreign and joint venture enterprises.

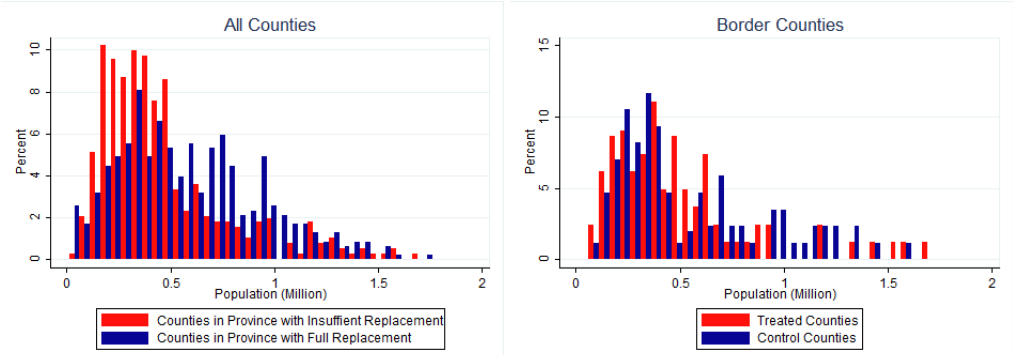
III.Taxes exclusively assigned to local governments

1. Income tax and adjustment tax of locally owned state enterprises, collectives, and private enterprises (including agricultural tax)
2. Business (gross receipts) tax falling on sectors not covered by VAT (transportation and communications, construction, finance and insurance, post and telecommunications, culture and sports, entertainment, hotels and restaurants, and other)
3. Rural market (stall rental) trading tax
4. Urban maintenance and construction tax (a surcharge on the tax liability of enterprises for business tax, consumption tax, and VAT)
5. The urban land use tax
6. Vehicle and vessel utilization tax
7. Thirty percent of the product and VAT revenues collected from enterprises owned by the Ministry of Industry, Ministry of Power, SINOPEC, and the China nonferrous metals companies
8. Individual income tax
9. Value-added tax on land
10. Education surtax
11. Entertainment and slaughter taxes
12. Property tax
13. Surtax on collective enterprises
14. Resources tax
15. Fixed asset investment tax (discontinued in 1999)
16. Fines for delinquent taxes.

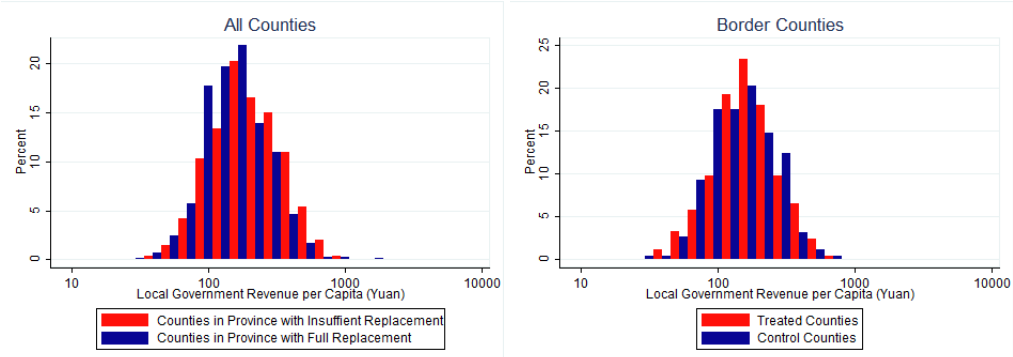
Source: Bahl (1999).

Figure A1: Variable Distribution

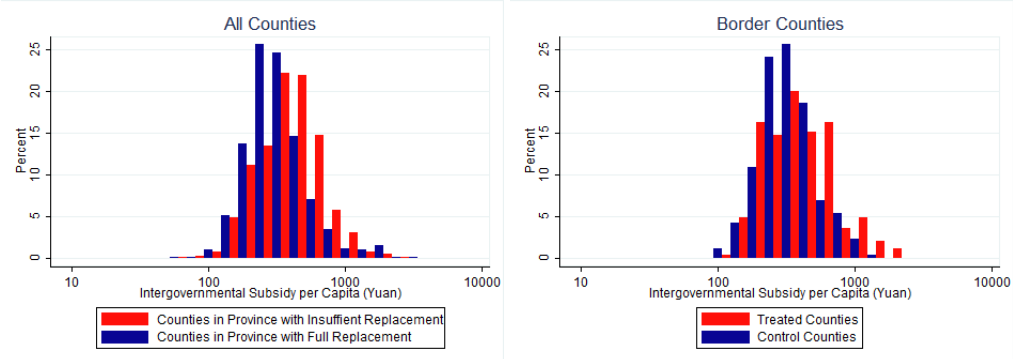
(a) Population



(b) Local Revenue



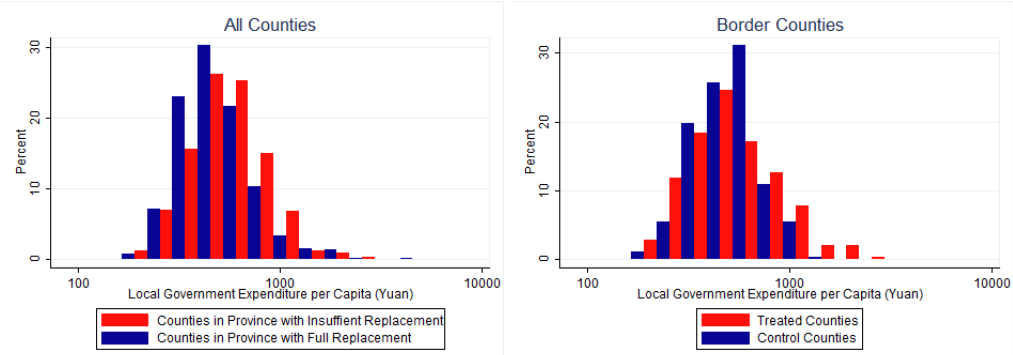
(c) Intergovernmental Subsidy



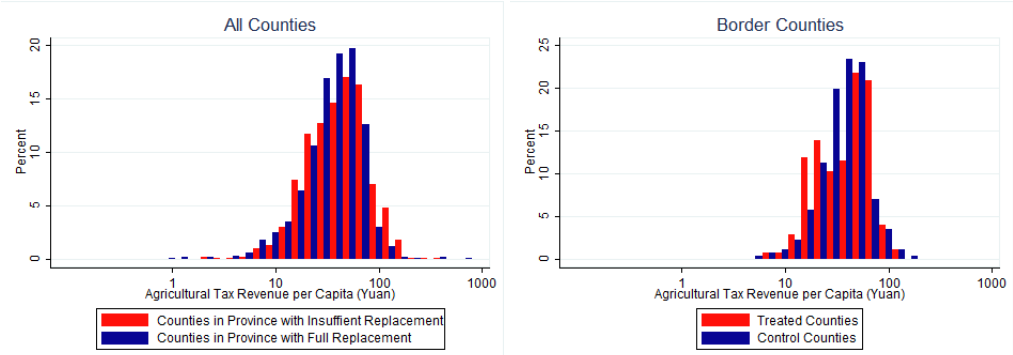
These figures show the distribution of key variables (population, local revenue, and intergovernmental subsidy) on average before 2004 for counties in province with full and incomplete subsidy replacement. By comparing the distributions, it shows that treatment and control counties in border sample are more similarly distributed than those of full sample.

Figure A2: Variable Distribution, Continued

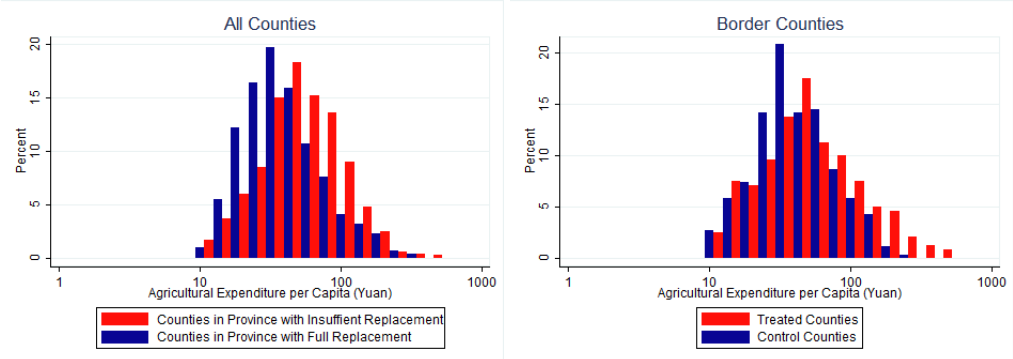
(a) Local Expenditure



(b) Agricultural Tax Income

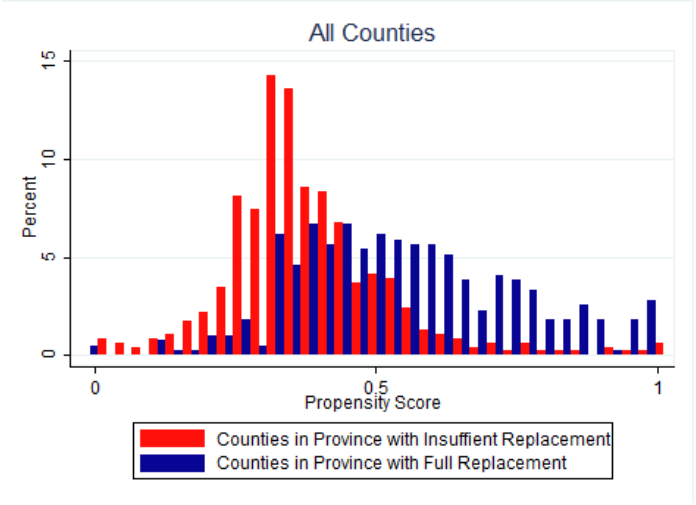


(c) Agricultural Expenditure



These figures show the distribution of key variables (local expenditure, agricultural tax income, and government expenditure on agriculture) on average before 2004 for counties in province with full and incomplete subsidy replacement. By comparing the distributions, it shows that treatment and control counties in border sample are more similarly distributed than those of full sample.

Figure A3: Propensity Score Distribution



This figure shows the distribution of propensity score of treatment and control group counties. Counties in treated and control provinces are matched by population, share of intergovernmental subsidy, and share of agricultural tax income in local revenue. The figure shows unbalanced distributions, which implies the importance of matching to find a comparable counterfactual.

Table A2: Expenditure responsibilities between Central and Local Governments, 2003-2006

	Central Exp/Sub-Item Exp	Local Exp/Sub-Item Exp	Central Exp/Central Total Exp	Local Exp/Local Total Exp
Agriculture	9.4%	90.6%	1.93%	6.60%
Infrastructure	38.8%	62.2%	17.79%	10.26%
Education	7.8%	93.2%	3.11%	15.05%
Health	2.3%	97.7%	0.28%	4.17%
Social Security	12.2%	87.8%	2.55%	6.33%
Pension	0.9%	99.1%	0.07%	2.85%
Administration	16.7%	83.3%	5.44%	9.60%
Public Defense	98.8%	1.2%	29.43%	0.12%

Notes:This table shows partial expenditure responsibilities between central and local government in China. The first two columns represents the percentages in terms of a specific sub item expenditure, while the last two columns show the percentages of total expenditure for that level of government. All the percentages are averaged between 2003-2006. A complete table can be found from Tan (2010).

Table A3: Descriptive Statistics of All Sample

Unit: RMB per capita

	Control Group		Treatment Group	
	Mean	Std.dev.	Mean	Std.dev.
Total Revenue	549.01	323.72	679.70	323.09
Local Revenue	189.70	118.50	215.25	131.16
Agricultural Tax	45.21	35.08	47.33	33.00
Value Added Tax	22.59	22.64	34.38	37.22
Personal Income Tax	8.90	8.47	13.37	18.20
Sales Tax	30.88	26.52	41.97	36.48
Other Income	144.48	100.74	167.91	123.13
Intergovernmental Subsidy	359.32	280.88	464.46	277.62
Total Expenditure	507.19	290.04	625.72	305.78
Agriculture	46.90	41.49	68.22	55.51
Infrastructure	30.39	69.14	23.17	41.36
Education	120.89	52.11	164.13	59.17
Administration	76.95	63.51	92.82	50.49
Social Security	16.67	14.44	12.29	12.17
Public Safety	28.52	17.17	34.96	19.85
Miscellaneous	178.63	103.22	218.30	114.80
Gross Regional Product in				
Primary Sector	1,615.24	968.35	1,634.12	843.9669
Secondary Sector	1,961.14	1,630.95	1,660.58	1,766.45
Tertiary Sector	1,645.70	2,144.5	1,280.19	1,148.22
Population	607,388	341,593	454,708	313,375
Number of Counties	470		391	
Number of Observations	1,409		1,174	

Notes: This table shows the pre-treatment descriptive statistics of counties in treatment group and control group. Revenue, expenditure and gross regional product are in unit of RMB per capita (2004 real price).

Table A4: Policy Effects on Local Government Revenues: Matching

Unit: RMB per capita

Outcome Variable	(1) Agr. Subsidy	(2) Agr. Revenue (Tax+Subsidy)	(3) Other Local Revenues	(4) Other Central Subsidies	(5) Net Revenue Change
Panel A: Reduced form, OLS estimate					
Post04×Incomplete	-28.323***	-19.960**	5.002	-11.599	-26.557
	(5.064)	(8.312)	(12.938)	(20.692)	(24.055)
Mean Dep.Var.	13.996	49.295	164.313	415.435	629.043
Observations	4,321	4,321	4,321	4,321	4,321
R-squared	0.761	0.321	0.613	0.698	0.763
Number of Counties	730	730	730	730	730
Panel B: Natural-logs Reduced form, GLM estimate					
After×Treatment		-0.388**	-0.123**	-0.092	-0.120***
		(0.197)	(0.054)	(0.059)	(0.030)
Observations		4,321	4,321	4,321	4,321
Number of Counties		730	730	730	730

Agricultural revenues include agricultural tax revenues and agricultural subsidy revenues (which only exists after 2004).
All regressions are compounded-weighted by 2005 county-level population and caliper matching weights.
All regressions are controlled with county fixed effects, year fixed effects, and fraction of agriculture tax revenue in local total revenue(subsidy not included, proxy for importance of agricultural tax to local economy).
Standard errors in parentheses are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1.

Table A5: Placebo Test: Policy Effect on Local Government Revenues

Unit: RMB per capita

Outcome Variable	(1) Agr. Revenue (Tax+Subsidy)	(2) Other Local Revenues	(3) Other Central Subsidies	(4) Net Revenue Change
Panel A: Fake Treatment Time: 1 year before				
Post03×Incomplete	-1.6317	-5.0401**	12.7681	6.0963
	(1.3570)	(2.2005)	(7.3006)	(8.7913)
Mean Dep.Var.	47.831	109.461	336.766	494.058
Observations	335	335	335	335
R-squared	0.327	0.367	0.509	0.585
Panel B: Fake Treatment Time: 2 year after				
Post06×Incomplete	-3.0386*	-5.2265	-7.5228	-15.7878
	(1.685)	(7.393)	(14.066)	(17.421)
Mean Dep.Var.	48.735	174.799	542.473	766.006
Observations	335	335	335	335
R^2	0.984	0.987	0.986	0.988
Panel C: Fake Border of Treatment: Within Treatment Group				
Post04×FakeBorder(T)	4.7991*	7.4672	-14.1102*	-1.8438
	(1.9664)	(3.9921)	(6.7973)	(7.3537)
Mean Dep.Var.	39.671	141.283	427.873	608.827
Observations	934	934	934	934
R^2	0.661	0.924	0.958	0.960
Panel D: Fake Border of Treatment: Within Control Group				
Post04×FakeBorder(C)	3.2584	7.6816	15.3143	26.2543
	(2.6468)	(6.7471)	(14.0052)	(19.0888)
Mean Dep.Var.	54.631	137.451	372.534	564.617
Observations	923	923	923	923
R^2	0.845	0.913	0.916	0.923

Agricultural revenues include agricultural tax revenues and agricultural subsidy revenues (which only exists after 2004).
All regressions are weighted by 2005 county-level population.
All regressions are controlled for county fixed effects, year fixed effects, border-specific trends, and fraction of agriculture tax revenue of local total revenue(subsidy not included, proxy for importance of agricultural tax to local economy).
Standard errors in parentheses are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1.

Table A6: Policy Effects on Local Government Expenditures: Matching

Unit: RMB per capita

Outcome Variable	(1) Agriculture	(2) Infrastructure	(3) Social Security	(4) Administration	(5) Education	(6) Public Safety	(7) Miscellaneous	(8) Total	(9) Reserves
Panel A: Reduced Form, OLS estimate									
Post04×Incomplete	-16.606*	0.668	-3.870	1.798	1.167	0.291	-5.408	-16.783	-9.774
	(8.820)	(8.426)	(2.982)	(3.513)	(4.517)	(2.487)	(10.155)	(20.670)	(12.702)
Mean Dep.Var.	55.992	25.235	16.046	79.627	144.256	32.453	202.646	575.569	53.475
Observations	4,321	4,321	4,321	4,321	4,321	4,321	4,321	4,321	4,321
R-squared	0.426	0.062	0.266	0.591	0.599	0.521	0.725	0.770	0.205
Number of Counties	730	730	730	730	730	730	730	730	730
Panel B: Natural-logs Reduced Form, GLM estimate									
Post04×Incomplete	-0.372***	0.167	-0.159	-0.035	-0.057	-0.070*	-0.109***	-0.098***	-0.137
	(0.076)	(0.392)	(0.138)	(0.023)	(0.036)	(0.042)	(0.042)	(0.034)	(0.091)
Observations	4,321	4,321	4,321	4,321	4,321	4,321	4,321	4,321	4,321
Number of Counties	730	730	730	730	730	730	730	730	730

Agricultural revenues include agricultural tax revenues and agricultural subsidy revenues (which only exists after 2004).
All regressions are compounded-weighted by 2005 county-level population and caliper matching weights.
All regressions are controlled with county fixed effects, year fixed effects, and fraction of agriculture tax revenue in local total revenue(subsidy not included, proxy for importance of agricultural tax to local economy).
Standard errors in parentheses are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1.

Table A7: Policy Effects on Local Government Revenue by Level of Agricultural Dependence

Unit: RMB per capita

Outcome Variable	(1) Agr. Subsidy	(2) Agr. Revenue (Tax+Subsidy)	(3) Other Local Revenues	(4) Other Central Subsidies	(5) Net Revenue Change
Panel A: Reduced form, OLS estimate					
Post04×Incomplete×DepHigh=0	-28.182***	-16.737***	-1.064	-13.376	-31.177
	(3.432)	(4.367)	(15.825)	(24.130)	(29.949)
Post04×Incomplete×DepHigh=1	-35.168***	-45.432***	-10.225	8.750	-46.906***
	(4.695)	(12.500)	(7.809)	(14.761)	(13.354)
Observations	1,002	1,002	1,002	1,002	1,002
R-squared	0.804	0.461	0.645	0.836	0.847
Number of Counties	168	168	168	168	168
Panel B: Natural-logs Reduced form, GLM estimate					
Post04×Incomplete×DepHigh=0		-0.241*	-0.040	-0.181***	-0.147***
		(0.132)	(0.066)	(0.065)	(0.041)
Post04×Incomplete×DepHigh=1		-1.039***	-0.023	0.031	-0.059*
		(0.349)	(0.062)	(0.095)	(0.032)
Observations		1,002	1,002	1,002	1,002
Number of Counties		168	168	168	168

Agricultural Dependence is measured by share of agricultural tax income (pre-treatment) among total local income. Low and high group have mean of 0.171 and 0.376, respectively.
All regressions are weighted by 2005 county-level population.
All regressions are controlled with county fixed effects,year fixed effects× border-segment fixed effects, and fraction of agriculture tax revenue in local total revenue(subsidy not included, proxy for importance of agricultural tax to local economy).
Those counties not on the province border is clustered into the same border segment as its closest neighbor county, where the distance is calculated using county seat-to-county seat straight distance.
Standard errors in parentheses are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1.

Table A8: Policy Effects on Local Government Expenditures by Level of Agricultural Dependence

Unit: RMB per capita

Outcome Variable	(1) Agriculture	(2) Infrastructure	(3) Social Security	(4) Administration	(5) Education	(6) Public Safety	(7) Miscellaneous	(8) Total	(9) Reserves
Panel A: Reduced Form, OLS estimate									
Post04×Incomplete×DepHigh=0	-12.479	1.930	-3.855	6.416	8.192	2.685	-19.672*	-5.489	-25.687
	(8.292)	(10.354)	(3.584)	(4.871)	(5.557)	(2.265)	(10.692)	(29.269)	(17.086)
Post04×Incomplete×DepHigh=1	-18.621**	8.531	-2.233	2.512	2.333	-2.105	-19.644***	-28.966*	-17.940*
	(8.243)	(9.151)	(1.858)	(4.732)	(3.999)	(1.438)	(4.787)	(15.532)	(8.599)
Observations	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002
R-squared	0.494	0.093	0.312	0.648	0.780	0.633	0.770	0.848	0.194
Number of Counties	168	168	168	168	168	168	168	168	168
Panel B: Natural-logs Reduced Form, GLM estimate									
Post04×Incomplete×DepHigh=0	-0.393***	0.198	-0.220	-0.035	-0.056	-0.025	-0.164***	-0.114***	-0.435
	(0.089)	(0.446)	(0.143)	(0.030)	(0.037)	(0.046)	(0.028)	(0.038)	(0.292)
Post04×Incomplete×DepHigh=1	-0.324***	0.861	0.051	0.059**	0.007	-0.031	-0.086***	-0.019	-0.299*
	(0.082)	(0.586)	(0.095)	(0.029)	(0.025)	(0.029)	(0.028)	(0.032)	(0.164)
Observations	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002
Number of Counties	168	168	168	168	168	168	168	168	168

All regressions are weighted by 2005 county-level population.

All regressions are controlled with county fixed effects, year-by-border-segment fixed effects, and covariates of per-capita GDP in each sector and share of elementary school/middle school students in all population.

Standard errors in parentheses are clustered at province-border level.

*** p<0.01, ** p<0.05, * p<0.1.

Table A9: Policy Effects on Local Government Revenue by Level of Wealth

Unit: RMB per capita

Outcome Variable	(1) Agr. Subsidy	(2) Agr. Revenue (Tax+Subsidy)	(3) Other Local Revenues	(4) Other Central Subsidies	(5) Net Revenue Change
Panel A: Reduced form					
Post04×Incomplete×Rich=0	-33.398***	-38.478**	-9.758	1.131	-47.105***
	(4.971)	(13.460)	(8.983)	(15.250)	(13.514)
Post04×Incomplete×Rich=1	-31.409***	-29.379**	-1.692	0.763	-30.309
	(5.113)	(12.555)	(17.686)	(30.355)	(33.124)
Observations	1,002	1,002	1,002	1,002	1,002
R-squared	0.801	0.403	0.645	0.835	0.847
Number of Counties	168	168	168	168	168
Panel B: Natural-logs Reduced form, GLM estimates					
Post04×Incomplete×Rich=0		-0.948**	-0.018	-0.030	-0.078**
		(0.408)	(0.079)	(0.100)	(0.037)
Post04×Incomplete×Rich=1		-0.550*	-0.045	-0.120	-0.129**
		(0.288)	(0.069)	(0.094)	(0.052)
Observations		1,002	1,002	1,002	1,002
Number of Counties		168	168	168	168

Richness is measured by county GDP.
All regressions are weighted by 2005 county-level population.
All regressions are controlled with county fixed effects,year fixed effects× border-segment fixed effects, and fraction of agriculture tax revenue in local total revenue(subsidy not included, proxy for importance of agricultural tax to local economy).
Those counties not on the province border is clustered into the same border segment as its closest neighbor county, where the distance is calculated using county seat-to-county seat straight distance.
Standard errors in parentheses are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1.

Table A10: Policy Effects on Local Government Expenditures by Level of Wealth

Unit: RMB per capita

Outcome Variable	(1) Agriculture	(2) Infrastructure	(3) Social Security	(4) Administration	(5) Education	(6) Public Safety	(7) Miscellaneous	(8) Total	(9) Reserves
Panel A: Reduced Form, OLS estimate									
Post04×Incomplete×Rich=0	-16.811*	3.826	-2.519	3.185	6.784	-1.683	-18.915***	-24.577	-22.528**
	(8.463)	(9.850)	(1.919)	(6.027)	(5.541)	(1.737)	(4.457)	(18.025)	(9.090)
Post04×Incomplete×Rich=1	-15.812*	10.876	-3.348	5.228	-0.282	2.011	-21.090*	-13.305	-17.004
	(8.425)	(11.406)	(3.844)	(5.230)	(4.421)	(2.150)	(10.374)	(31.667)	(13.695)
Observations	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002
R-squared	0.492	0.093	0.311	0.647	0.780	0.630	0.770	0.847	0.193
Number of Counties	168	168	168	168	168	168	168	168	168
Panel B: Natural-logs Reduced Form, GLM estimate									
Post04×Incomplete×Rich=0	-0.328***	0.617	0.013	0.037	0.023	-0.026	-0.103***	-0.035	-0.376**
	(0.088)	(0.766)	(0.094)	(0.028)	(0.032)	(0.039)	(0.031)	(0.037)	(0.175)
Post04×Incomplete×Rich=1	-0.399***	0.464	-0.188	-0.018	-0.085**	-0.030	-0.151***	-0.102*	-0.329
	(0.088)	(0.419)	(0.147)	(0.057)	(0.037)	(0.050)	(0.039)	(0.053)	(0.210)
Observations	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002	1,002
Number of Counties	168	168	168	168	168	168	168	168	168

Richness is measured by county GDP.
All regressions are weighted by 2005 county-level population.
All regressions are controlled with county fixed effects, year-by-border-segment fixed effects, and covariates of per-capita GDP in each sector and share of elementary school/middle school students in all population.
Standard errors in parentheses are clustered at province level.
*** p<0.01, ** p<0.05, * p<0.1.