What Makes Local Governments More Accountable? Evidence from a Website Reform*

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Abstract

There is evidence that local governments around the world collect bribes and make inefficient investments. What can influence local governments to reduce corruption and to invest responsibly? Ferraz and Finan (2012) show that local governments in Brazil are less corrupt when their mayors can stand for re-election and when a radio station and/or newspaper monitors them. In China, however, local (county-level) leaders are not elected and the state tightly controls the media. Nevertheless, using a large-scale reform in which some counties were required to post their data and to setup communication links for their constituents on their websites, we find that corruption fell substantially and public investments sharply increased in treated versus control counties. We interpret these findings using a model where county leaders benefit from being promoted and from collecting rents and, higher-level governments use postings from private citizens on social media to monitor country governments under their jurisdiction. Consistent with this mechanism, we find that following the enactment of the reform citizens in treated versus control counties massively increased their blogging on the social media using words related to government corruption and public investments. Satellite light data and sentiment tests suggest the reform led to an improvement in the quality of public investments in treated versus control counties.

Keywords: Corruption, transparency, public iinvestments, selection bias, decentralization, social media

JEL Classification: H41, D73, P26.

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1 Introduction

In decentralized economies local governments are responsible for public investments including schools, roads, ports, transport and health services. There is evidence, however, that some local governments collect bribes and invest in inefficient public projects (see Olken and Pande, 2012, for a survey). How corrupt are local governments? And, what influences them to reduce corruption and to make better public investments? In a study of Brazil, Ferraz and Finan (2012) use a randomized survey of local governments (municipalities) and document widespread corruption. They find that politically inclusive institutions, including voting and a free media, play an important role because municipal governments are less corrupt when the mayor can stand for re-election and when newspapers and/or radio stations actively monitor the municipal government. However, there are few evidence based studies of conditions under which local governments reduce corruption and improve public investments in systems where political institutions are exclusive.[1]

This paper studies a large scale policy reform in China that was designed to understand to reduce corruption and improve public governments in local (county) governments. Like Brazil, China is a decentralized system where county governments are responsible for providing a broad set of public goods and services (Qian, Roland and Xu, 2016; Xu, 2011). And, like Brazil, local government corruption is endemic: most notably, there is evidence that local government officials collect enormous rents from illegal land deals (see Ang, 2016; Cai et al, 2011; Chen and Kung, 2016 and 2019). However, in contrast to Brazil, in China local governments leaders are not elected and the state closely controls the media.

The reform required one hundred counties to post their data and to set up communication links on their county websites. In China there are roughly 2800 counties located in 31 provinces that are under jurisdiction of the central government; and each county is under the jurisdiction of a province. During 2011, the central government ordered each province to have two to four of its counties post their data for taxes, regulations, investments etc on a unified government e-platform. These treated counties were also required to install communication links on their website enabling their constituents to send inquires and to file grievances and to receive responses from their county government in a timely fashion. According to our reading of the reform implementation,

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[1]The classification of political institutions into those that are exclusive (or sometimes called extractive) and inclusive is developed in Acemoglu and Robinson (2012).

all treated counties set up online forums and some also set up a link to the popular social media outlet Sina-Weibo.

Drawing lessons from this reform about how local governments can become less corrupt and invest more effectively is challenging for several reasons. First, treatment was not randomly assigned because the central government required the provinces to use several criteria for selecting counties for treatment including, for example, the quality of the counties' websites, the stability of their public finances, etc. However, drawing on methods in Gentzkow (2006) we show that the assignment of treatment is as good as random once we control for these criteria.

Another challenge is finding credible measures of county-level corruption. Our baseline measure is the overall value of mismanagement in the state sector taken from annual county audits. These data are arguably reliable because the county auditors work under the supervision of auditing agencies in the higher level (prefectural) governments and, thus, have strong incentives to obtain reliable information. Because of the potential concern that county auditors mighy persuade the agencies in their prefecture to under-report corruption after the reform is enacted, we consider three alternative corruption measures. Following Cai et al (2011) we use business entertainment spending in state, private and foreign firms as a measure of bribes paid to the government: this data comes from an annual survey that Ministry of Finance and the State Administration of Taxation oversee, and regional tax authorities implement the collection.[2] Importantly, while there may be systematic mis-reporting, there is no reason to believe the misreporting changes post-treatment and in treated counties. Because there is evidence that counties under-price sales and use non-transparent methods for selling land to collect bribes (see Cai et al, 2013), we also use land sale prices and shares of sales sold in open forums including tenders, auction and bids. Because land sale prices in open forums include bids, tenders and auctions and are straightforward to collect; and just whether or not a sale is open or negotiated is straightforward, we are confident these data are reliable.

Another challenge is showing that public investments promote social welfare. We measure public investment using county level administrative data for fixed asset investments (FAI) per capita [3]

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[2]See Giannetti et al (2017, p.5) for a detailed description of the data and its reliability. They note that the "survey is conducted in a specific time in each year and is based on a uniform, comprehensive survey system. Survey answers are collected and subsequently verified by local tax authorities. Information is subsequently further verified using technical algorithms to minimize potential reporting errors. A special tax force of the local tax authorities also audits survey respondents."

[3]Components of FAI include include capital construction, renewal and transformation, real estate development

A large component of FAI in China includes infrastructure investment, which has been shown to promote growth in China.[4] However, Chen and Kung (2016) show that when corrupt county leaders receive windfalls from land revenues, they pick public image investments that do not social welfare, for example, ostentatious parks that promote their self-image.[5] After summarizing our empirical findings, we will then discuss we discuss how to test for whether public investment is related to social welfare.

Using a difference-in-difference estimation setup, we find that our baseline measure of corruption declined by more than one-sixth of its sample standard deviation in treated versus control counties. These results are robust to pre-trends and corrections for selection. In addition, these results still hold, though are smaller in magnitude, when we use business entertainment expenses and shares of land sales to measure corruption.[6] We also find that in treated versus control counties public investment increased by about two ninths of its sample standard deviation and county leaders' probability of being promoted increased by more than seven-percentage points. Because the reform was followed by a drop in corruption, and more promotions of leaders in treated versus control counties, this suggests that an increase in the quantity of public investments in treated versus control counties likely increases social welfare. However, to address Chen and Kungs' concern that additional public investments might fund inefficient "public image investments," we check the social media postings for key words related to public image investments. We find that there is very little discussion of public investments pre-treatment and that such discussion fell negligibly post-treatment in treated versus control counties. Evidence that public investment increased social welfare is that economic activity measured using night lights from satellites increased in treated versus control counties post-treatment. Finally, public sentiment tests from social media that are discussed in more detail in the text suggest that welfare in treated versus control counties improved post-treatment.

In order to interpret these findings, we use a monitoring model in the spirit of Becker (1968) where county-leaders gain utility from being promoted within the government/party hierarchy and

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investment, other state-owned fixed assets investment, urban collective fixed asset investment, rural collective fixed asset investment, private housing investment in urban and it is a general term for the amount industrial and mining areas, rural individual fixed assets investment.

[4]See DeMurger, (2001); Fleisher et al (2010); and, Banarjee et al (2012).

[5]Chen and Kung (2016) collect disaggregated county-level that could be used to test whether governments chose particular investment categories that are a priori productive or not. However, their investment data does not cover the period when the website reform is enacted.

[6]We cannot draw any conclusions using land-sale prices because they exhibit a trend before the reform was enacted.

also from collecting rents. Rent-seeking reduces utility through two channels: first, the probability of being "caught" and, thus, having to pay a monetary fine increases; and, second, being caught lowers the probability of promotion.[7] In addition, rent-seeking may increase or decrease the county leader's utility. County leaders' promotion prospects strongly improve when their counties achieve strong economic output (e.g., see Li and Zhou, 2006; and, Manion, 1985).[8] However, just whether corruption "greases the wheels" and increases economic output is controversial (see Bardhan, 1997; and, Aidt, 2009). If corruption does not grease the wheels, leaders trade off the private benefits of rent-seeking against the costs associated with lower promotion prospects. However, if it greases the wheels, officials enjoy both the private benefits of rents and better promotion prospects. Our empirical findings are consistent with the view that rent seeking does not grease the wheels.

In the model county-leaders know that its overseeing government selects and promotes them based on the county's economic output and their rent-seeking. In addition, county leaders know that their overseeing government observes the economic output in their county and their rent-seeking activity with probability less than one. County leaders expect that once the reform has been enacted, their overseeing government will more closely monitor their performance and their rent-seeking activity for two reasons. First, county leaders understand that their overseeing government would naturally increase the intensity of its traditional monitoring methods during a reform.[9] Second, using the data posted and the information links on the county websites, constituents can easily send inquires and complaints via the website; and they can become more informed when the county government responds to their concerns using the website. And, as argued by King et al (2013) and Qin et al (2017), citizen communications on websites and the social media in general provides additional information to the governments overseeing county governments.

While we do not have direct evidence that the overseeing governments increased their traditional monitoring activities, it seems self-evident that they would do so during a reform. And, we find evidence consistent with the interpretation that county governments reduced corruption and increased the quantity and effectiveness of public investments because their constituents were more informed and were monitoring them more closely. First, compared to control counties, treated

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[7]Demotions in the current position could be also be incorporated. However, because demotions are rare events, for simplicity, we keep them out of the model.

[8]More recently, promotions also depend upon social harmony and, our, model could be interpreted to include this.

[9]Traditional methods include having lower level government and party officials collect data more carefully or collect more kinds of data.

counties increased the links and images on their websites by twenty-two percent or more than one-quarter of a sample standard deviation. Taking links and images as a proxy for information and communication capacity on a county webpage, this finding suggests that reform made it easier for constituents in treated counties to gather information and to communicate with their governments. We find more direct evidence of this in our case study of the Shunde county in the Guangdong province in the next section. Finally, using private postings on the Chinese social media (Sina Weibo), we document that there was a virtual tweet storm for keywords related to transparency, corruption and public public investment following the enactment in treated versus control counties. This suggests the citizens in treated versus control counties provided information via inquiries and grievances about the performance of their county governments that higher level overseeing governments could use to better monitor the counties under their jurisdiction.

Because upgrading their websites forced county governments to operate more transparently, our study contributes to several micro-econometric studies that identify the impact of government transparency. Renikka and Svensson (2005) find when newspapers in Uganda increased government transparency and provided information about a national educational grant program, corrupt leakage of the grant fell, local spending on education increased and student attendance and learning outcomes improved. Freedom of information acts (FIOAs) increase transparency because they require governments to provide information about their activities in a timely fashion. Peisakhin (2012) finds citizens in India who are given an FIOA can register to vote in roughly the same amount of time as a control group that had to pay bribes. Pan (2017) analyzes how the Chinese government since 1999 uses online transparency initiatives in an effort to limit local corruption. In a random sample of almost two-million county government webpages, Pan shows how local-level officials use the internet to "construct their self-image" and, thus, empower themselves. The reform studied in this is not included in Pan's study and, it has different provisions.

At a broader level just whether transparency can make governments more effective is unclear. Olken and Pande (2012, p.31) argue more transparency can discourage talented individuals from working in the public sector and Mas (2017) shows that public pay disclosure requirement in California has led to an increase in the quit rate of high-level city managers. However, in a cross-country study that uses public perception data, Djankov et al (2010) show that the public disclosure of pay to politicians is associated with less corruption and better quality government. Our study

indicates that more transparency in systems with politically exclusive institutions improves local government accountabilty.

Chen and Kungs' (2016) study of county-level corruption in China considers the period (1999-2008) and finds that the "windfalls" from land sales going to county governments made the promotion system based less on economic performance (i.e. GDP growth) and, based more on political connections. Our study covers a later period and shows how leaders of treated counties, who reduced corruption and increased public investments, were more likely to be promoted. During the period of the Chen and Kung study only 6.4% of county leaders were promoted; in our study promotions were more common and applied to more than 12% of county leaders.

This paper builds on the Ferraz and Finan (2011) study of Brazil. Using audit data, they carefully identify that second term mayors (who are not eligible for re-election) steal on average $55,000 more than first term mayors (who are eligible for re-election). They find that the presence of a local newspaper and/or radio state that can actively monitor the municipal government eliminates the corruption of second term versus first term mayors. In contrast to municipalities in Brazil where mayors are elected, high-level Government and Party leaders appoint and promote county-leaders in China; and, in China the state more carefully controls the media.

During the past two decades, authoritarian regimes have been building internet platforms where citizens can post grievances. Authoritarian leaders may use citizens' grievances about lower level officials' conduct to punish these officials (Dmitrov 2014; Qin et al, 2017). However, because autocrats may post false and self-serving information on these platforms (Earl and Kimport, 2011; Guriev and Treisman, 2015; Kalathil and Boas, 2010; MacKinnon, 2012). This is not a concern in our study because the data on county websites does not include information about central leaders. A potential concern is that bureaucracies located between the counties and the central government that aggregate grievances might strategically manipulate the upward flow of information. Pan and Chen (2018) show in a case study of a Chinese province that, while such administrative organs strategically omit data, they do not grossly misrepresent or falsify grievances and inquiries.

The next section contains an overview of the website reform. Section three develops a model that guides our empirical work. Section four describes our data, section five describes our estimation framework and robustness checks, section six contains our empirical results and section seven concludes.

2 Institutional Background

In an effort to reduce local corruption, since 1999 the national leaders in China have been requiring its local level governments to post information on the internet (Pan, 2017, on-line Appendix pp.1-3). For example, there is a general understanding that county governments collect unreported side-payments and bribes in negotiated land transactions with developers. In effort to reduce potential corruption, as of August 31 2004 county governments were required to post information about their commercial land sales on publicly accessible websites (Cai et al, 2013).

We focus on an initiative for county governments enacted January 4, 2012 that has different provisions than previous transparency initiatives discussed in Pan (2017). In early 2011 the Central Government issued a document entitled, the "Opinions on Deepening the Disclosure of Government Affairs and Strengthening Administrative Services." Then, in September of 2011, the General Office of the State Council issued "Opinions of the National Government Affairs Openness Leading Group on Implementing the Electronic Platform to Strengthen the Openness of County Government Affairs and the Pilot Work of Administrative Services." According to these documents, each province was required to select two to four counties that would participate in establishing a unified electronic government platform that would disclose data about the county's activities and performance and would also include a link that would enable the county residents and the county government to communicate with each other. In each province, the government affairs openness leadership team, the departments in charge of information disclosure and government websites, and the industrial and information departments were charged with selecting counties for this initiative that already had strong web-based information disclosure systems and government services in place. Figures 1 illustrates the spatial distribution of treated counties.

The idea was that public disclosure would encourage county governments and parties to reduce corruption and to serve their constituents more efficiently. In preparation for the reform, treated counties were required to comprehensively sort out, clean up and strictly regulate the items that they were required to post on the e-platform. The government platform was comprised of the electronic government network, government websites, business management systems, data service centers and information security systems. Thus, information on government affairs and the government services directory in pilot counties was released through an electronic government platform that was easily accessible by the entire Chinese society.

The county's data in the Basic Directory has three sections. The first section has sixty-five items including key policies, regulations, special funds, and government administrative powers. The second has 295 items related to administrative matters including development, reform, education, police civil administration, judicial administration, public finance, land resources, the environment, housing and urban construction, etc. The final part has twenty five items related to government services including marriage and unemployment registries and health insurance applications, etc.

Links on county website typically named something like "interactions between citizens and government" allow county constituents to post inquiries and grievances which the county typically posts on the on the website along the government responses. For example, Figure A1 in the Appendix illustrates the home page for Shunde county's website about a year after the enactment (December 21, 2012).[10] Going from left to right on the top line, the home page contains the government transparency link, the on-line service link, the interaction between government and citizens link, and additional links containing general information about Shunde county, directions for conducting searches, etc. Figure A2 shows the transparency link and sub-links that direct users to all of Shunde county's data including a regulations catalog, a description of the scope of government activities, transaction data for collective assets, auditing information, etc. Figure A3 is the on-line services link where county constituents make inquiries and complaints and where the relevant government agencies respond. Sub-links include government registration and inspection services, a personal link where one can review results of an application, etc. Figure A4 is the interaction link for the government and citizens. Sub-links include a mailbox to the county leader, a forum of government business, Sina Weibo posts, and a survey about public opinion and grievances.

We have read the Shunde website and found that after the reform was enacted the county made its data available and its constituents made many inquires and received responses from the government.[11] The interaction between constituents grew over time. In 2012, the first year of the reform, in the online forum there were 5,166 posts (blogs) and 19,668 followed posts. The government responded to 80-percent (4,410) of the posts. By 2013 the number of posts on the online more than tripled 18,229 and the followed posts more than quadrupled to 86,363. While the overall number of government responses almost doubled to 7,964, the response rate fell to 44 percent.

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[10]Shunde is a well-off county with population of roughly 1.2 million; it is located in Guangdong, which is one of the richest provinces in China.

[11]Our source can be found through the link: http://zwgk.shunde.gov.cn/ind.php?UnitID=10gknb=1

Reporting corruption is a sensitive issue in China, and a citizen that reports that somebody is corrupt must also submit supporting documentation. Nevertheless, in 2013 the Procurate received 517 accusations of corruption with documentation, and handled all of them.

By 2014 in Shunde, the website contained rich data and there was an active interaction between the county constituents and the government. For example, the Land and Urban Construction Bureau of Shunde had set up a "micro interview" platform through the social media link (Sina-Weibo) where it could easily receive inquiries and complaints from constituents and respond. This is significant, in particular, because this bureau is involved in land deals and, thus, is likely to be suspected of being corrupt. Nevertheless, in 2014 this bureau made all 133,760 of it files open to the public and received 87,182 inquires about these files.

There is evidence that, similar to the county government in Shunde, many treated county governments made their data available to their constituents. For example, in the Yongkong county in Zhejiang Province, the government installed a channel on the local cable TV that frequently reports their data.[12] We do not have similar examples of how, similar to Shunde, treated county governments facilitated effective communication with their constituents. However, later in the paper we will document that during the reform constituents in treated counties significantly increased their communication on social media (Sina-Weibo) about corruption, government transparency and public investments. While it is possible that some treated counties may have set up communication links that did not facilitate communication, this evidence indicates that the reform at least energized constituents to engage in a discussion of issues that the reform addressed. Moreover, as the work on social media in China (King et al, 2013; Pan, 2017; and Qin et al, 2017) and in autocracies in general (Dmitrov, 2014) suggests county leaders understood that their overseeing governments who evaluated their performance, were paying attention to this increased social media activity.

3   Theoretical Considerations

In the model there is a representative county leader who lives for two periods. In the first period, he/she collect rents, R, and supplies public investments, G, that enhance county-level growth and

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[12]See http://new.ifeng.com/shendu/lwxwzk/detail_2013_12/09/31919857_0.shtml. Additional evidence is available on websites from Changsha County in Hunan Province, Anming in Yunan and Meilan in Hainan and that can be accessed from the previously cited website. Evidence for Yuexiu in Guangdong can be found at www.gz.gov.cn/GZ00/qxnb/201403/2633545.shtml

promote social harmony. In the second period, the government overseeing the county either promotes or does not promote the county leader. In China there are thirty one provincial governments under jurisdiction of the central government. Each provincial government has multiple prefectures under its jurisdiction that, in turn, have many counties under their jurisdiction. However, the provincial government oversees the counties because it determines the selection and promotion of county leaders based on information that it collects from its agencies and also on the basis of suggestions and grievances from the general public posted on the county website and social media outlets such as Sina-Weibo.[13]

The website reform was enacted with the understanding that rent-seeking detracts from growth and welfare. However, Ang (2016) argues rent seeking in China has "greased the wheels" of economic activity because it gives county officials strong incentives to push forward growth promoting projects such as the construction of roads and railroads and schools. To incorporate this, public investments are assumed to be concave in rent seeking:

$$G = G\{R, .\}, \ and \ G^{''}\{R\} < 0, G\{0\} >> 0 \tag{1}$$

where rent-seeking greases the wheels when $G^{'} > 0$ and does not when $G^{'} \leq 0$.

A county leader's promotion prospects improve when he/she makes more public investments (which increase economic output and social harmony) and reduces his/her rent-seeking. Thus, county leader's expected promotion prospects are assumed to be increasing and concave in public investments that the provincial government detects:

$$\pi_{mg}\pi_P\{G\} = \pi_{mg}\pi_P\{G(R)\} : \pi_P^{'} > 0, \pi_P^{''} \leq 0 \tag{2}$$

where $\pi_P\{G)$ is the probability of promotion when public investments are perfectly observed and π_{mg} is the probability of detection. Moreover, the absolute decline in the probability of being promoted is increasing and convex in detected rent seeking activity:

$$\pi_{mr}\pi_d\{R\} : \pi_d^{'} > 0, \pi_d^{''} \geq 0 \tag{3}$$

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[13]See the regulation "Several Provisions on Strengthening the Construction of the County-Party Leader's Committee," issues on April 12, 2009.

where $\pi_d\{G\}$ is the absolute value of the decline in the probability of demotion if the provincial government perfectly observes rents and π_{mr} denotes the probability of detection. The overall probability of promotion, PP, is then

$$PP\{\pi_{mg}, \pi_{mr}, R\} = \pi_{mg}\pi_P\{G\{R\}\} - \pi_{mr}\pi_d\{R\} \tag{4}$$

and expected period two utility is $PP\{\pi_{mg}, \pi_{mr}, R\}(U^P - U^L) + U^L$ where U^P and U^L denote period two continuation payoffs when a county leader is and is not promoted: $U^P > U^L$, where $U^L = 0$ with no loss of generality.

Because promotions are highly competitive, they are uncertain even when R=0: $PP\{\pi_{mg}, \pi_{mr}, 0\} = \pi_{mg}\pi_P\{G((0\} - \pi_{mr}\pi_d\{0\} << 1$. Consistent with our understanding that the reform was designed to reduce rent-seeking, we assume $PP\{\pi_{mg}, \pi_{mr}, R\}$ is non-increasing in R:

$$\partial PP/\partial R = \pi_{mg}\pi_P'G' - \pi_{mr}\pi_d' \leq 0 \tag{5}$$

Moreover, if monitoring is ineffective, the county leader keeps his/her rents; otherwise, he/she pays $\chi > 0$.[14]

Period 1 expected private benefits of rent-seeking are $(1 - \pi_{mr}\chi)R$:

$$1 - \pi_{mr}\chi > 0 \tag{6}$$

The county leader chooses R* in order maximize rents net of expected fines in period one plus expected utility in period two:

$$Choose\ R^* > 0 : Maximize\ L = (1 - \pi_{mr}\chi)R + PP\{\pi_{mg}, \pi_{mr}, R\}U^P \tag{7}$$

Differentiating equation (7), the first order and second order conditions are

$$\partial L/\partial R^* = 1 - \pi_{mr}\chi + \partial PP/\partial R * U^P = 0 \tag{8}$$

$$\partial^2 L/\partial R^*\partial R^* = \partial^2 PP/\partial R\partial R * U^P = (\pi_{mg}\pi_P''(G')^2 + \pi_{mg}\pi_P'G'' - \pi_{mr}\pi_d'')U^P < 0 \tag{9}$$

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[14]And, $\chi \geq 1$ when the county-leader returns all rents and pays an additional fine.

The first order condition shows the marginal benefit of an additional unit of rents equals marginal cost which includes the period one marginal expected penalty, $\pi_{mr}\chi$, and the period two marginal expected loss in utility, $-\partial PP/\partial R * U^P$, because rent seeking lowers the expected utility from being promoted.[15] By inspection of equation (9), the second order condition is negative and R^* is a maximizer.

Differentiating the first order condition with respect to π_{mr}, then

$$-\partial^2 L/\partial R^* \partial \pi_{mr} = (\chi + \pi_d' U^P) > 0 \qquad (10)$$

which is the impact of the an improvement of monitoring rents, π_{mr}, on marginal costs. Since $\partial R^*/\partial \pi_{mr} = -\partial^2 L/\partial R^* \partial \pi_{mr}/\partial^2 L/\partial R^* \partial R^*$, equations (9) and (10) imply rent seeking is decreasing in π_{mr}. This is a standard moral hazard result. And, because $\partial G/\partial \pi_{mr} = \partial R^*/\partial \pi_{mr} G'$, public investments are increasing when $G' < 0$ (no greasing the wheel) and decreasing when $G' > 0$ (greasing the wheel).

Differentiating the first order condition with respect to π_{mg}, then

$$-\partial^2 L/\partial R^* \partial \pi_{mg} = \pi_P' G' U^P \qquad (11)$$

which is the impact of improving the monitoring of public investments, π_{mg}, on marginal costs. Since $\partial R^*/\partial \pi_{mg} = -\partial^2 L/\partial R^* \partial \pi_{mg}/\partial^2 L/\partial R^* \partial R^*$ and $\partial G/\partial \pi_{mg} = \partial R^*/\partial \pi_{mg} * G,'$ an increase in π_{mg} causes rent seeking to fall, and public investments to increase when $G' < 0$. However, when $G' > 0$, rent seeking and public investments increase.

Our reading of the reform is that it led county leaders to believe that their overseeing government would monitor their outcomes and rent-seeking activity more intensely for two reasons. The first reason, which seems self-evident, is that an overseeing government would monitor its treated counties more intensely during an anti-corruption reform. The second reason is that citizens living in treated counties have more information and this enables them to post more informed grievances and inquiries on social media which the overseeing government can use for evaluating and making promotion decisions for the leaders of the the county government under its jurisdiction.

Thus we can derive have two testable hypotheses about the impact of the reform:

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[15]This inequality holds by by assumption (5).

H1: If rent seeking does not grease the wheels, the website reform causes rent-seeking to decline and public investments to increase.

H2: If rent seeking greases the wheels, the impact of the website reform on rent-seeking and public investments is ambiguous. If the reform more strongly improves monitoring of rents, then rent seeking and public investments decline. However, if the reform more strongly improves monitoring of public investments, then rent seeking, and public investments increase.

In our empirical sections, we will document that corruption declines and public investments increase, indicating that rent seeking does not grease the wheels. In this case, leaders in treated counties should in general have a better chance of promotion because they are less corrupt and they supply more public investments:

H3. If rent seeking does not grease the wheels, then under general conditions the website reform causes a treated county-leader's probability of being promoted to increase (see the Appendix for a proof).

We can also make predictions about the differential impact of the reform in counties that are close and distant from their overseeing governments. Du, Lu and Tao (2014) and Huang et al (2017) document that it cheaper for overseeing governments in China to monitor business activities and the activities of state owned enterprises in locations that are closer. In this case, the probability of detecting rents and public investments is increasing in a county's closeness to its overseeing government:

$$\pi_{mr} = \pi_{mr}(c); \pi_{mg} = \pi_{mg}(c) : \pi'_{mr} < 0, \ \pi'_{mg} < 0 \tag{12}$$

where c denotes closeness.

In the Appendix, we show the positive impact of an improvement in π_{mr} on marginal costs in equation (11) is weaker for closer counties under very general conditions. And, the positive impact of an improvement in π_{mg} on marginal costs in equation (11) is also weaker for closer counties. Thus, we would expect the treatment effect of improving the monitoring of rents and also public investments is stronger in more distant counties. An overly strong sufficient condition for this to hold is an improvement in π_{mr} and π_{mg} each make the second order conditions in equation (9) even more concave. However, in the Appendix we show that under a robust set of parameters rent seeking is decreasing and convex in both π_{mr} and π_{mg}.

This implies the following testable hypotheses.

H4: If rent seeking does not grease the wheels, then, under general conditions, the reduction rents is more profound in distant counties.

H5: If rent seeking does not grease the wheels, then, under general conditions, the increase in public investments is more profound in distant counties.

4 Data

The data for this study are collected from various official statistical publications and public databases. China contains thirty-one provinces of which four, Beijing,Tianjin, Shanghai and Chongqing, are centrally administrated municipalities. Because these operate quite differently than the remaining twenty-seven provinces they are excluded from the sample. The province Tibet is excluded because its data coverage is incomplete. Thus, using twenty-six of the thirty-one provinces we compile a dataset including 2144 unbalanced counties in China covering, at most, the period 2005-2014, where 2005-2011 and the 2012-2104 are the pre-treatment and post-treatment periods. Selected summary statistics are presented in Table 1.

Corruption and public investment

We use the value of mismanagement to measure corruption from the China Audit Yearbook, 2006-2015. In order to compare corruption between counties, we divide the value of mismanagement in state sector by the general budget income of county. Mismanagement covers five broad items including: the implementation of the state budget and public finances; party and government officials' wasteful activities; specific projects such as poverty alleviation and affordable housing, social security, education, environmental remediation; fixed investment projects such as construction; and, activities of state owned enterprises with special attention paid to their loans.

As discussed in the introduction, because there are potential concerns about under-reporting of our baseline corruption measure in treated counties during the reform (post-treatment), we use several alternative corruption measures. A corruption measure developed by Cai et al (2011) is business entertainment expenses in state, private and foreign firms in a county divided by sales. This data comes from the Annual Tax Survey database 2007-2014, which the Ministry of Finance and the State Administration of Taxation of China reports annually. We can trace the location of each firm using its tax ID and 6-digit location code. The survey includes firms in agricultural, manufacturing

and service sectors. We exclude firms in the financial industry, nonprofit organizations and social groups. The firms with missing information in key variables are also excluded as are firms whose numbers of employees, sales, asset are negative. Since this an indirect measure of corruption, there is perhaps less concern that there will be strategic under-reporting in treated counties during the reform (i.e., post-treatment) than with more direct data from the National Audit Office.

Finally, there is evidence that county governments under-price industrial land sales in order to collect rents (Cai et al., 2013). Thus, we use land sale prices and transactions as a proxy for corruption. Parcel-level data on land transaction are collected from the official websites of China's Ministry of Land and Resources (http://landchina.mlr.gov.cn) and this records most land transactions from 2007 to 2014. Each land parcel transaction includes the transacted price, hectares of the land, location of the land, how the land is used, and what types of land are transacted.

The enactment of the website reform precedes that widespread and well known anti-corruption reform under Xi Jinpeng by less than a year, and, the two reforms overlap during 2013 and 2014. Thus, to tease out the impact of the website reform, we use the categorical variable, "inspection," which denotes whether or not the Central Commission for Discipline Inspection conducted inspections for the anti-corruption reforms in a province during a particular year.

We use public investment expenditures normalized by population (10,000 RMB per capita) to measure public investments. The source for public investment spending is the National County (Prefectural) Social Economic Statistical Yearbook 2006-2015.

Quality of County Websites

Data from the Internet Archive during 2008-2010 (https://archive.org/) is used to measure the quality of county websites pre-treatment. Using the front page of a county website, we count the number of characters, the number of images and the number of links. If more than one web page was stored in the internet archive, we use the front page of the most recent website.

County-Level Economic Conditions

The China County Statistical Yearbook covering the years 2006-2015 is a source for general budgetary income and contains the list of counties classified as mountainous and impoverished. County level financial information including income, expenditures, transfers, the number of government employees, etc. comes from the National Prefecture and County Finance Statistics 2009.

The distance between each county and the capital city of its overseeing provincial government is

calculated using the longitude and latitude of each county, which can be obtained from a Baidu map (http://map.baidu.com). To address county-level administrative changes during the period of 2005 to 2014, we use the 2005 boundary classifications, and this can be accessed from the website of Ministry of Civil Affairs of the People's Republic of China (http://www.mca.gov.cn/article/sj/tjbz/a/201713/201708220

County Economic Leaders

Formally, the party secretary and the head of government (the mayor) are the joint political leaders in a county. However, because, the party secretary, de facto, is in charge (for example, see Chen and Kung, 2016) we collect data for party secretaries from the official website of each county and the Provincial Yearbook. We then search the Baidu Encyclopedia (Baidu Baike) for their gender, age, year of education, duration of their tenure as party secretary and when (if ever) they were promoted.

Constituents' Use of Social Media

In order to proxy for county-constituents' reaction to the reform, during 2009-2014 we scrape the county-level websites for Sina-Weibo, which is the major blogging and social media network in China. We focus on citizens' reactions and thus, exclude the blogging activity of government and party entities. In order to measure how the reform affects constituent interest in government corruption, accountability and transparency, we count how many times a year the following twenty-four key words have been mentioned: "E-government," "Government affairs openness," "Government service," "Government service pilot reform," "E-platform," "Government convenience services," "Government website," "Corruption," "Anti-corruption," "Supervision," "Government openness," "Transparency," "Monitoring," "Clean government," "Administrative function," "Government affairs platform," "Administrative system," "Service-oriented government," "Administration by law," "Open," "Transparency," "Information sharing," "Government information," and "Government Network." To measure how the reform affects constituents' interest in public investments we count the postings o the following twenty-six key words: "public investment," "Public transportation," "Highway," "Railway," "Airport," "Light Rail Train," "Subway," "Port," "Telecommunications," "Power grid," "Water supply," "Electricity supply," "Hydraulic project," "Public service," "Aviation," "Communication," "Garden," "Greening," "Garbage removal," "Sewage treatment," "Electricity power," "Gas," "Tap water," "Environmental protection," "Environmental sanitation," and "Ecosystem."

Quality of Investment

We use several variables in order to gauge whether increases in fixed investment promoted social welfare. First, we scrape the county-level websites in order to count how many times a year several words capturing public image investments including "image projects," "principle project," "white elephant project," and the sum of these three words. In order to check whether investment gains are associated with additional economic activity, we use satellite imagery of nighttime luminosity at the county level (Henderson et al., 2012; Donaldson and Storeygard, 2016, pp.183-184). [16] Finally, we use public opinion about the county government and their investments and conduct a sentiment analysis on Sina-Weibo for relevant words including "Government service," "Transparency," "Corruption, anti-corruption and collusion" and "Fixed investments." We firstly download all the posts including these keywords from Sina-Weibo, then use the sentiment test tools provided by Baidu to do sentiment test for each keyword (Amaas et al, 2011). [17]The sentiment test is classified into three types, 0 is negative, 1 is neutral, and 2 is positive. The sentiment test is measured by the number of post with sentiment test score equal to 2, normalize by the total number of posts for each keyword.

5   Empirical Framework

To test our predictions about the impact of the reform, we compare corruption, public investment and party secretary promotions before and after the reform for treated counties versus non-treated counties. The baseline DID framework is:

$$Outcome_{ct} = \alpha_c + \beta Treatment_c \times post_t + \gamma_t + e_{ct} \tag{13}$$

where c and t represent county and year. The dependent variable $Outcome_{ct}$ can be corruption, public investment, promotions, websites and use of social media in each county in a particular year; α_c and γ_t represent county and year fixed effects; and, e_{ct} is the error term.

The identifying assumption for differences-in-differences estimation is that the treated counties would have followed the same time trends as non-treated counties if the reform was not enacted

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[16]Our source for the original satellite can be found through the link: https://ngdc.noaa.gov/eog/download.html

[17]The website for Baidu sentiment test tool can be found through the link: https://ai.baidu.com

as of January 4, 2012. A challenge to this assumption is that treated counties are not randomly selected, and the divergence between treated and non-treated counties is generated from pre-existing differences between them. To deal with this, we use the approach of Gentzkow (2006): we first identify the selection criteria for the treated counties; and, then we control for the different trends between treated and non-treated counties post-treatment.

According to our reading of the reform documents, the central government required the provincial governments to select counties that had good operating e-government capacity and that operated openly and provided adequate services. To measure county e-government capacity, we control for the page size, the number of images and links on the front page of their websites pre-treatment (2008-2010). In addition, according to our reading of reform documents, provincial governments selected counties for treatment on the basis of its geography (remoteness and prefectural status) and the quality of its public finances. We proxy for geography using dummy variables including whether the county is mountainous and whether the county is the capital within its prefecture. And, for public finances, we control for county employees as a share of the total budgetary income in 2009 and also use a dummy variable for whether or not a county is impoverished as set at the national level.

Table 2 Panel A reports balance checks for the selection variables. On average, the treated counties have better e-government capacity because they have 84.5-percent more words on their web pages, with 42-percent more images and 47-percent more links. Public finances, measured by the number of government employees divided by total government total income, is 2.7-percentage points smaller in the treated counties, suggesting that their governments are more efficient. Treated counties appear to be more open (less isolated) since 27.7% of them are mountainous versus 39.3% of non-treated counties. These patterns suggest treated counties are in a better position to provide services since a smaller share are categorized as impoverished and mountainous, and a higher share are provincial capital cities.

Panel B compares treatment and control counties by various economic development indicators including the average urban wage, financial transfers from the central government to the county governments, financial deficits, land transactions and the performance of the county's firms. The treated counties have higher urban wages, and, their firms have larger assets, outputs, profits and employment levels. However, in which is critical for our identification strategy, once the seven

selection variables for treatment are controlled for, the control and treated counties are balanced.

Another potential concern is that treated counties are selected on the basis of their leadership.[18] For example, provincial leaders might select counties that have young and well educated leaders who would try to push through reforms in order to get promoted. Or, counties might be selected where it is easy to replace incumbent leaders with new leaders who would tend to have stronger incentives to push through reforms. To address these concerns, Panel C compares the average age and average years of education of the party secretary and also average number of new party secretaries in treated versus control counties. In all cases, we fail to reject the nulls that there is no unconditional and no conditional difference between treated and untreated counties pre-treatment.

Panel D tests for whether key outcomes variable are conditionally balanced pre-treatment. We fail to reject the null for all outcomes except for the share of of open land sales, which is 8.9-percentage points higher in the treated counties in 2009.

To control for trends in corruption generated by the selection variables over time, following Gentzkow (2006), (we interact them with a third-order polynomial function of time, $X_c \times f(t)$. The new specification, thus, allows for the possibility that that the relationship between the dependent variable and the control variables change non-linearly in the post-treatment period:

$$Corruption_{ct} = \alpha_c + \beta Treatment_c \times post_t + \gamma_t + X_c \times f(t) + e_{ct} \qquad (14)$$

As a further check of our identifying assumption, we conduct several robustness checks, including a graphic verification of whether treated counties and non-treated counties have similar trends in corruption before treatment, placebo tests that have random assignment of treatment status and a falsified timing for the implementation of the reform.

6 Empirical results

6.1 Corruption

Columns (1) and (2) of Table 3 report results for our baseline measure of corruption. Column (1) presents estimates that control only for county and year fixed effects. The treatment effect variable, $Treatment_c \times post_t$, shows corruption fell by almost 12-percentage points, which is more

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[18]We thank Jennifer Pan for this suggestion.

than one-sixth of its sample standard deviation and, this effect is significant at the 1-percent level. To address the concern that the result in column (1) is biased due to the non-random selection of treated counties, in column (2) we include the interaction between the seven treatment selection variables and a third order polynomial function of time. We continue to find a negative and significant coefficient of $Treatment_c \times post_t$ with only a negligible reduction in its magnitude.

6.2 Robustness checks

The empirical results in Table 3 rely on the assumption that, *conditional on the selection variables for treatment*, the government does not select treated counties on the remaining factors. A necessary condition for the identifying assumption is treated and non-treated counties have similar time trends in corruption pre-treatment. If the time trends are roughly parallel pre-treatment, and change post-treatment, we can be confident that the website reform caused these changes. In Figure 2, we plot the time trends of differences in corruption from 2005 to 2014 where we include, as in Table 2 Column (2), county and year fixed effects, and controls interacted with a third order polynomial of time. The small circles in figure 2 depict coefficients for treatment versus control counties interacted with year dummies, and the whiskers on the lines containing these circles are the upper and lower bounds of their 95-percent confidence intervals. The year just prior to treatment, 2011, is the baseline for comparison. Simple inspection indicates the parallel trends assumption holds: pre-treatment (2005-2010) there are never significant differences in corruption in treated versus control counties (compared to the baseline year of 2011) and the point estimates are tightly centered around zero. There is no significant decline in corruption in the first year of the reform (2012); however, this difference becomes significant and strong in 2013 and 2014.

Table 4 contains several robustness checks. The website reform was enacted in early January of 2012 and, in mid-December of 2012 the Central Commission for Discipline began to conduct inspections in the provinces for the Party's widespread anti-corruption campaign. Figure A5 in the Appendix depicts the spatial distribution of inspections across China's provinces in 2013 and 2014. In order to control for the potential confounding effect of the anti-corruption campaign, Column (1) includes the dummy variable "inspection" which indicates whether or not an inspection was conducted in a county's province during a particular year. While inspections, as expected, significantly reduce corruption, the impact of the web-site reform also remains statistically significant

and its quantitative impact is still roughly one-sixth of a sample standard deviation.

The mild downward spike in Figure 2 in 2009 raises a potential concern that something unobserved occurred in 2009 indicating a pre-trend. In fact, in November 2008, the central government announced an economic stimulus package of four trillion RMB (equivalent to 586 billion USD) to minimize the influence of the global financial crisis and enacted this program primarily during 2009-2010. To account for this, in Column (2), we add the dummy variable $Treatment_c \times year_{20092010}$ which equals one in 2009 and 2010, and zero otherwise. The treatment effect coefficient remains significant and becomes somewhat stronger, suggesting that our results are not contaminated by pre-trends. Finally, in column (3) we replace the selection control interacted with a third degree polynomial in years with the same controls interacted with a year dummy variables and, find that our results are robust.

We also report a placebo test that randomly assigns treatment status to counties in the county. Specifically, we randomly select 80 of the 2,144 counties in the sample for treatment, and also randomly assign the timing of adoption of the transparency reform. If our identifying assumption is satisfied, the coefficient of $Treatment_c^{false} \times post_t^{false}$ should be zero. To have sufficient power to reject the null that $Treatment_c^{false} \times post_t^{false}$ is zero, we repeat this test 1000 times. In Figure 3, the distribution of the coefficients for $Treatment_c^{false} \times post_t^{false}$ is plotted. By inspection, it is clear that it is centered around zero, indicating there is no substantial omitted variables in the specification.

When corruption does not grease the wheels, our theory predicts that the impact of reform on corruption is, under general conditions, stronger in counties more distant from their provincial (overseeing) government. Table 5 reports results for a regression where we add the triple difference-in-difference term to the baseline specification (Table 3 Column (2)) $Treatment_c \times post_t \times distance_c$. Results indicate that an additional 100 kms between the provincial and county capital lowers corruption by 0.050 points. Thus, a one-standard deviation increase in distance (1.843 x 100 kms) is associated with a -0.092 point drop in corruption or roughly one seventh of its sample standard deviation.

Alternative measures of corruption.

This section considers several alternative measures of corruption. Table 6 reports results for business entertainment expenses. Column (1) includes controls only for firm and year fixed effects;

and, the coefficient $Treatment_c \times post_t$ is statistically significant and business entertainment expenses fall by 0.07-percentage points, or 3% of its sample standard deviation. To address concerns about the non-random selection of treated counties, Column (2) includes the interactions between the seven selection variables and a third order polynomial function of time. Results indicate that $Treatment_c \times post_t$ remains statistically significant and its magnitude changes only negligibly. Results are very similar in Column (3), which controls for inspections.

To check for the validity of our identification strategy, Figure 4 plots the coefficients and ninety-five percent confidence intervals for the treatment*Year Dummies, where 2011 is the baseline and controls from Column (2) in Table 6 are included. Pre-treatment (2007-2011), all the coefficients are, in the statistical sense, indistinguishable from zero, suggesting that there are no pre-trends. The average treatment effect of the reform during 2012-2014 is roughly -0.7 percentage points and significant at the 5-percent level (see Table 6). However, the event study in Figure 3 indicates the reform only has an impact in 2014 which is stronger (corruption falls by 0.1 percentage points) and somewhat noisier (significant at the 10-percent level).

Before 2002, county governments conducted land sales primarily using private negotiations in which the transacted price was much lower than the market price (Cai et al, 2013). In 2004, county governments were required to conduct all state owned urban (commercial) land sales using open transactions including auctions, listings and tenders. However, county governments could still use private negotiations for industrial land transactions.

The corruption model of Shleifer and Vishny (1993) predicts government officials can set prices artificially low and withhold sales in order to collect bribes. Thus, if the reform reduced corruption, we would expect land prices rise and the share of transactions conducted openly would increase. To test these predictions, we collect parcel level land transaction data during 2007-2014 from the website of China's Ministry of Land and Resources. The results in Table 7 are consistent with these expectations: industrial land prices in treated counties increased by about 14-percent or roughly 8-percent of a sample standard deviation; and, the probability that industrial land transactions were open (versus negotiated) increased by almost 8 percentage points. These findings include controls for selection, county and year fixed effects.

Figures A6 and A7 in the Appendix illustrate the coefficients and 95-percent confidence intervals for Treatment*Year Dummies for industrial land prices and open land transactions. In the case

of industrial land prices, Figure A6 shows that in each pre-treatment (2007-2011) year, we fail to reject the null that each Treatment*Year interaction variable is zero, suggesting there are no pre-trends. However, the very low point estimate of Treatment*Year in 2007 and the subsequent increase in point estimates for this interaction variable during 2008,-2010 raises concerns of potential pre-trends. In the case of open land transactions, Figure A7 shows, again, that we fail to reject the null that Treatment*Year is zero each year pre-treatment. And, by inspection, there is less concern about pre-trends. Moreover, post-treatment, there is an immediate and statistically significant (always at the 10-percent level) increase in the share of open land transactions.

Using our baseline audit measure, business entertainment expenses and open land transactions, we find that the reform causes corruption to fall. However, we cannot test for the impact of the reform using industrial land prices, because pre-trends are a concern.

6.3   Public Investment

Table 8 examines the reform's impact on public investment. Whether or not we use the inspections dummy variable to control for Xi Jinpeng's anti-corruption reform, the website reform's impact is substantial, roughly two-ninths of its sample standard deviation, and significant at the 10-percent level. Put in different terms, the point estimates indicates that public investment per capita increased by roughly 4,400 RMBS or roughly 710 US dollars per capita per year! Figure A8 in the Appendix shows that time trends are all statistically indistinguishable from zero for each year pre-treatment (2007-2011). While there is a mild uptick in the point estimates for time trends during 2010-2011, post-treatment increases in time trends are more pronounced. Moreover, time-trends post treatment are statistically significant at the 10-percent level which is consistent with the estimated average treatment effects in Table 8. Thus, we are confident that the reform caused investments in public investment to increase in treated versus control counties. A concern is that the additional investments could be largely comprised of inefficient white elephant and public image investments. A priori, this seems unlikely because the reform successfully reduced corruption in treated versus control counties. However, later in the section additional evidence is presented suggesting that the increase in the quantity of fixed investments is associated with gains in social welfare.

Table 9 tests for the heterogeneous effect of distance on public investment. Under general

conditions, our theory predicts the impact of the reform on public investment should be stronger for more distant counties. The estimate for the triple difference in difference estimator, Treatment x post x public investment, indicates that adding 100 kilometers between the county and the provincial capital increases public investment by roughly 3,680 RMB per capita or, almost 600 US dollars. However, this effect is noisy and has p-value that is not significant even at the 20-percent level.

6.4 Promotions

Our model also predicts that if rent-seeking does not grease the wheels, then the reform would increase the probability that county-leaders in treated versus control counties are promoted. The results in Table 10 are consistent with this prediction. Here we add an additional post-treatment year, 2015, so that there is more time for the overseeing government to evaluate a county-leader's performance. Controlling for selection, county and year fixed effects, the probability of promotion increases by 7.4-percentage points This result is is precisely estimated and, is quantitatively significant: accounting for roughly 22-percent of the sample standard deviation. Put in different terms, the promotion rate for the sample is roughly 12%, so treatment increase promotion prospects by more than 50%.

Figure A9 in the Appendix shows that each year pre-treatment (2002-2011) time trends are all statistically insignificant at 5-percent level. However, a concern is there is a large increase in time trends between 2007 and 2008; and, the point estimate for 2008 is large (more than 10-percent) and significant at the 10-percent level. Nevertheless, during the pre-treatment period (2002-2011) time trends are generally zero; while jump are in the range of 5-percent to 12-percent during 2002, 2008 and 2010, in the following year these time trends drop and are close to zero. Post-treatment, these time trends also exhibit a zig-zagging pattern. In 2012 and 2015 promotion probabilities exceed 10-percent and are significant at the 5-percent level. During the 2013 and 2014, they are less than 5-percent and statistically insignificant. This suggests that pre-trends are not an issue and our estimates are credible.

6.5   Citizen Monitoring

Our proposed underlying mechanism is that leaders in treated counties believed that, post-treatment, their overseeing (provincial) government would monitor their outcomes and rent-seeking more closely: thus, they reduced corruption and increased public investment post-treatment. As previously argued, it is almost self-evident that the provincial governments would increase its traditional methods of monitoring treated counties during a period of reform. However, if citizens in treated counties gained more access to their government's data and could more easily communicate with their government, then comments from these citizens about their governments on the county website or the general social media could be used by an overseeing (provincial) government to better monitor its treated county governments.

Results in Table 12 uses the log of the number of links and images on a county website as a proxy for its availability of data and communication links. Estimation results indicate that there was a 22% increase in links and image on county websites in treated versus control counties post-treatment. While the estimates are noisy, i.e., significant at the 10-percent level, their quantitative impact is large and accounts for roughly two-ninths of the sample standard deviation of website links and images. This suggests that citizens in treated counties gained more access to their county government's data.

Table 13 and Table A1 in the Appendix provide evidence that constituents in treated counties communicated much about government corruption, government accountability and transparency in public forums post-treatment. Table 13 contains fourteen relevant words scraped from Sina-Weibo websites, and Table A1 contains ten additional words. The results indicate that the reform unleashed the Chinese equivalent of a "tweet storm." Twenty out of twenty-four word increases are significant at the 5% level including "Government service" (19.5% increase); "Corruption" (12% increase); "Govt openness" (28% increase); "Transparency" (14% increase); "Monitoring" (22% increase). In addition, Tables 14 and A2, provides evidence of a massive increase of words related to public investment, for example, "Highway" (25.6% increase); "Airport" (35.6%); "Railway" (15%); and, "Subway" (15%).

6.6 Quality of Public Investment

As previously noted, a concern with our results is that the increase in public investments in treated counties post-treatment may have been primarily white elephant or public image projects that did not contribute to social welfare.

In order to estimate whether the reform led to more citizen awareness of inefficient public investments in treated versus control counties, we conduct key searches on three relevant words on Sina-Weibo: "image projects," "principle projects" and "white elephant investments" and the sum of these words. Table 14 summarizes our findings Surprisingly, over the entire period of 2009-2014, there is very little communication using these words (see section "Social Media Words Related to Image Projects" in Table 1). Moreover, communications using these keywords in treated versus control counties fell negligibly following the reform. One interpretation of these findings is that county constituents in treated versus control counties did not observe new inefficient investments. Another interpretation is constituents are hesitant to use their words on social media. However, this latter interpretation seems unlikely since citizens freely communicate using words related to corruption (see tables 1 and 12).

If public investments improved welfare, then we would expect that economic activity would improve. Table 15 measures economic activity using night lights (the log of average light per square kilometer) as measured with satellites (see Henerson et al, 2012; and, Donaldson and Storeygaard, 2016). While it is possible that there are bad public investments which would increase the use of electricity, we would expect good investments to dominate them in terms of electrical usage. Table 15 show that in treated versus control counties night lights increase by 4.8 percent when we control for county and year fixed effects and by 3.7 percent when we interact the variables that control for selection with a third order polynomial of time.

Finally, in Table 16 we measure consumer sentiment for various words related to quality of investment communicated on Sina-Weibo. The dependent variable is the number of posts with a positive attitude for a particular key word as a share of total posts. If government service and investments post-treatment improve welfare, then we would expect to observe an increase in positive sentiments about the government, as measured by key words including "Government service," "Transparency," "Corruption, anti-corruption and collusion," would improve. We also measure directly sentiments about public investments for the key word "fixed investment." In all

the differences and differences estimates, we control for county and year fixed effects and we also interact the selection control variables with a third order polynomial of time. Results for increase in positive sentiment for "Government service" and "Transparency" are significant at the 5-percent level and have very strong quantitative significance. Positive sentiment for "Government service" and "Transparency" by 0.33 and 0.67 share points, which accounts for 73-percent and 145-percent of the respective sample standard deviations. The increase in positive public sentiment about "Corruption, anti-corruption and collusion" in the government is significant at the 10-percent level and accounts for almost 30-percent of the sample standard deviation. The increase in positive sentiment about "Fixed investment" is both statistically and quantitatively insignificant. However, given the strong increase in positive sentiment about the government, then it seems implausible that governments in treated counties are making investments that do not improve social welfare.

7   Conclusion

How can local governments be encouraged to be less corrupt and to provide more productive public investments when political institutions are exclusive? Using the case of China, we show that a website reform encouraged county governments to reduce corruption and to increase public investments. Moreover, leaders in the treated counties had higher promotion rates following the enactment of this reform.

In order to interpret our findings, we have developed a model in the spirit of Becker (1968) where county leaders trade off the personal benefits of rent seeking against its costs in terms of expected penalties and reduced promotion prospects. Because the reform causes corruption to fall and public investments to increase, our model indicates corruption does not grease the wheels of growth. The model also suggests that county leaders reduce corruption because they expect that their outcomes (public investments) and rent-seeking will be more closely monitored for two reasons. First, their overseeing government is likely to increase the intensity of its traditional monitoring methods during a reform. And, secondly, the reform gives citizens more information which they can use to make more informed grievances and inquires that the overseeing government uses to evaluate the county leaders. While it is almost self-evident that overseeing governments increase the intensity of their traditional monitoring practices during reforms, we also find evidence from Sina-Weibo suggesting that citizens in treated counties used information on the e-platform to make

more informed grievances and inquiries.

In their study of municipal governments in Brazil, Ferraz and Finan (2010) show that that electoral incentives and media are effective tools for fighting corruption. In China, however, county officials compete for promotions and, thus, are concerned with just how their overseeing government will evaluate them and, do not stand for popular elections. Moreover, the local media in China provides less information than in Brazil. Thus, our study suggests that broad public disclosure on publicly accessible e-platforms in combination with promotion incentives is a strategy for improving local government accountability when political institutions are exclusive.

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Figure 1. Spatial Distribution of Treated Counties

- treatment county

0   250 500   1,000 Kilometers

Figure 2 Estimated Coefficients for the Baseline Measure of Corruption – Mismanagement as a Share General Budgetary Income
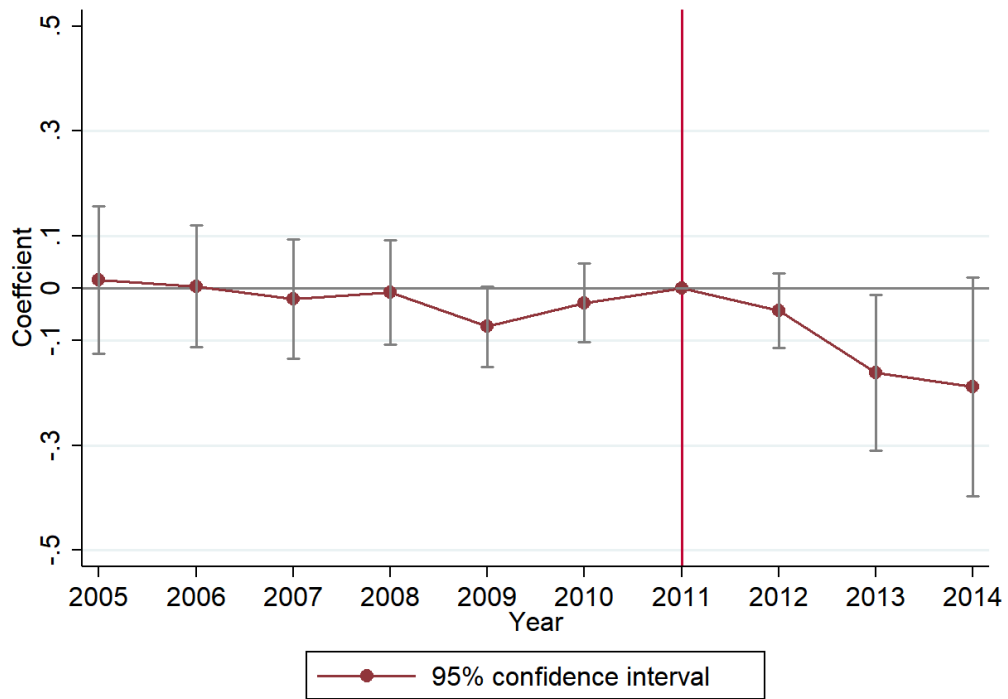
Notes: The circles represent coefficients of treatment interacted with year dummy variables; and, the surrounding whiskers are the 95-percent confidence intervals. The default year is 2011. The dependent variable is the value of mismanagement as a share of general budgetary income.

Figure 3. Placebo Test
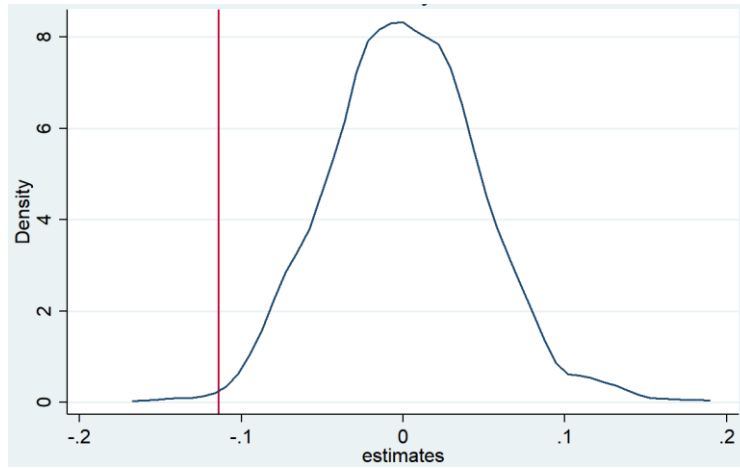
Notes：The figure shows the kernel density of the estimated coefficients from 1000 simulations randomly assigning treatment status to counties. The vertical line represents the point estimate of the treatment effect result in column 2 in Table 3.

Figure 4. Estimated Coefficients for Corruption – Business Entertainment Expenses
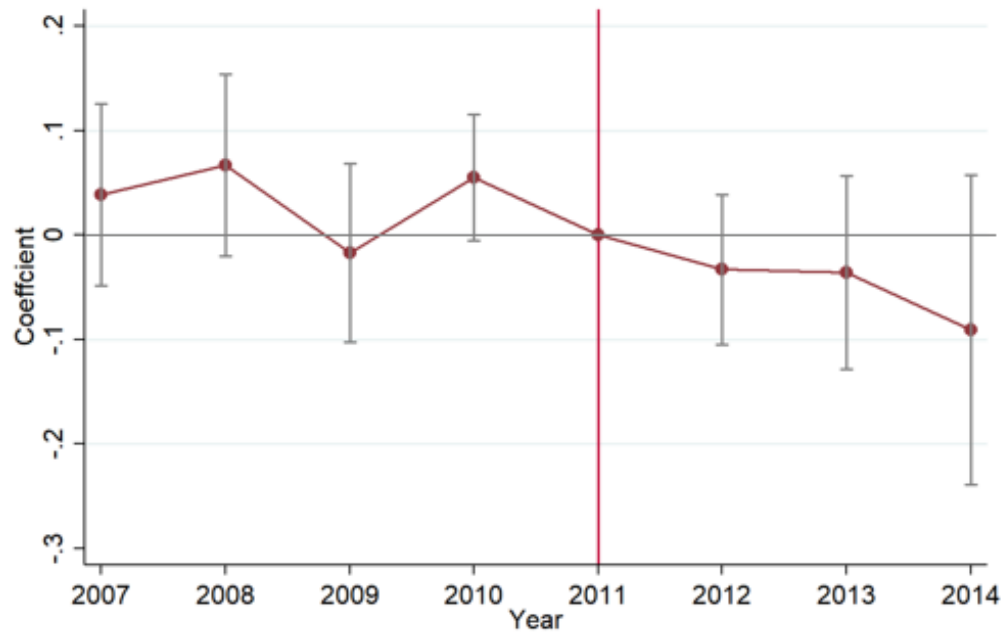

Notes: The circles represent coefficients of treatment interacted with year dummy variables; and, the surrounding whiskers are the 95-percent confidence intervals. The baseline year is 2011.The dependent variable is spending on business entertainment as a percentage of sales.

Table 1. Summary statistics

Variables	Definition	Mean	S.D	Data coverage
County variable				
Treatment	=1 for trtated counties, and 0 otherwise	0.041	0.197	2005-2014
Post	=1 for year>=2012, and 0 otherwise	0.296	0.457	2005-2014
Corruption and Fixed				
Investment				
Mismanagement	Overall value of mismanagement (millions of yuan)	141.066	584.259	2005-2014
Budgetary income	General budgetary income (millions of yuan)	661.335	1301.515	2005-2014
Corruption	Mismanagement as a share of general budgetary income	0.287	0.656	205-2014
EE	Business entertainment expenses (1000 yuan)	268.880	3084.859	2007-2014
Sales	Sales (100 million)	5443.546	5372909	2007-2014
EE_sales	Business entertainment spending as a percentage of sales	0.836%	2.383%	2007-2014
Land price	Total price of an industrial land parcel (log)	5.711	1.690	2007-2014
Land allocation	=1 if an industrial land was sold by open transaction, 0 otherwise	0.584	0.492	2007-2014
Inspection	Dummy for inspections of provincial governments by the Central Commission for Discipline Inspection: = 1 if province was inspected, and 0 otherwise	0.133	0.340	2005-2014
Fixed investment	Fixed investment normalized by population (10,000 yuan per capita)	1.430	2.063	2005-2014
Satellite light	The average light per square kilometer (log)	1.739	1.181	2005-2013
Quality of County Websites				
Page size	Number of words on the front page of county website (log)	9.241	4.426	2008-2010
Images	Number of images on the front page of county website (log)	3.294	2.063	2008-2010
Links	Number of links on the front page of county website (log)	4.031	2.416	2008-2010
Website construction	Total number of links and images (log) on the front page	5.760	0.813	2008-2014
County-level Economic				
Conditions				
Public finance	Number of government employees as a share of total government income	0.118	0.088	2009
Mountain	=1 for mountainous county, and 0 otherwise	0.385	0.487	2009
Poverty	=1 for national poverty county, and 0 otherwise	0.267	0.442	2009
Provincial capital	=1 for a county located within a provincial capital city, and 0 otherwise	0.086	0.281	2009
Distance	Distance to the seat of province (100 km)	2.289	1.843	2009
County Leaders Characteristics				
Promotion	=1 for when a county party secretary has been promoted to a higher-level position, and 0 otherwise	0.122	0.328	2002-2015
Gender	= 1 for male, and = 0 for female	0.964	0.187	2002-2015
Duration	The number of years serving as county party secretary	5.274	1.740	2002-2015
Age	Age of the county party secretary	47.316	3.951	2002-2015
Education	Years of education of the county party secretary	17.623	1.658	2002-2015
Social Media Words related to				
Government				
Accountability and Corruption				
E-government	Number in Sina Weibo (log)	0.018	0.129	2009-2014

Government affairs openness	Number in Sina Weibo (log)	0.028	0.173	2009-2014
Government service	Number in Sina Weibo (log)	0.112	0.334	2009-2014
Government service pilot reform	Number in Sina Weibo (log)	0.005	0.062	2009-2014
E-platform	Number in Sina Weibo (log)	0.006	0.075	2009-2014
Government convenience services	Number in Sina Weibo (log)	0.094	0.299	2009-2014
Government website	Number in Sina Weibo (log)	0.104	0.345	2009-2014
Corruption	Number in Sina Weibo (log)	0.396	0.577	2009-2014
Anti-corruption	Number in Sina Weibo (log)	0.140	0.360	2009-2014
Supervision	Number in Sina Weibo (log)	0.535	0.682	2009-2014
Government openness	Number in Sina Weibo (log)	0.804	0.822	2009-2014
Transparency	Number in Sina Weibo (log)	0.128	0.354	2009-2014
Monitoring	Number in Sina Weibo (log)	0.287	0.513	2009-2014
Clean government	Number in Sina Weibo (log)	0.181	0.402	2009-2014
Administrative function	Number in Sina Weibo (log)	0.009	0.097	2009-2014
Government affairs platform	Number in Sina Weibo (log)	0.021	0.140	2009-2014
Administrative system	Number in Sina Weibo (log)	0.012	0.109	2009-2014
Service-oriented government	Number in Sina Weibo (log)	0.006	0.071	2009-2014
Administration by law	Number in Sina Weibo (log)	0.095	0.304	2009-2014
Open	Number in Sina Weibo (log)	0.000	0.007	2009-2014
Transparency	Number in Sina Weibo (log)	0.805	0.822	2009-2014
Information sharing	Number in Sina Weibo (log)	0.128	0.354	2009-2014
Government information	Number in Sina Weibo (log)	0.020	0.131	2009-2014
Government Network	Number in Sina Weibo (log)	0.070	0.283	2009-2014
Social Media Words Related to				
Fixed Investment				
Infrastructure	Number in Sina Weibo (log)	0.214	0.445	2009-2014
Public transportation	Number in Sina Weibo (log)	0.055	0.268	2009-2014
Highway	Number in Sina Weibo (log)	1.006	0.982	2009-2014
Railway	Number in Sina Weibo (log)	0.441	0.690	2009-2014
Airport	Number in Sina Weibo (log)	0.318	0.637	2009-2014
Light Rail Train	Number in Sina Weibo (log)	0.032	0.227	2009-2014
Subway	Number in Sina Weibo (log)	0.123	0.418	2009-2014
Port	Number in Sina Weibo (log)	0.081	0.326	2009-2014
Telecommunications	Number in Sina Weibo (log)	0.321	0.585	2009-2014
Power grid	Number in Sina Weibo (log)	0.169	0.411	2009-2014
Water supply	Number in Sina Weibo (log)	0.161	0.433	2009-2014
Electricity supply	Number in Sina Weibo (log)	0.341	0.606	2009-2014
Hydraulic project	Number in Sina Weibo (log)	0.344	0.567	2009-2014
Public service	Number in Sina Weibo (log)	0.078	0.285	2009-2014
Aviation	Number in Sina Weibo (log)	0.161	0.456	2009-2014
Communication	Number in Sina Weibo (log)	0.151	0.408	2009-2014
Garden	Number in Sina Weibo (log)	0.251	0.530	2009-2014
Greening	Number in Sina Weibo (log)	0.304	0.557	2009-2014
Garbage removal	Number in Sina Weibo (log)	0.011	0.102	2009-2014
Sewage treatment	Number in Sina Weibo (log)	0.072	0.261	2009-2014

Electricity power	Number in Sina Weibo (log)	0.312	0.556	2009-2014
Gas	Number in Sina Weibo (log)	0.112	0.371	2009-2014
Tap water	Number in Sina Weibo (log)	0.265	0.563	2009-2014
Environmental protection	Number in Sina Weibo (log)	0.575	0.795	2009-2014
Environmental sanitation	Number in Sina Weibo (log)	0.215	0.505	2009-2014
Ecosystem	Number in Sina Weibo (log)	0.661	0.795	2009-2014
Social Media Words Related to Image Projects				
Image projects	Number in Sina Weibo (log)	0.001	0.033	2009-2014
Principle project	Number in Sina Weibo (log)	0.000	0.013	2009-2014
White elephant project	Number in Sina Weibo (log)	0.000	0.017	2009-2014
Sum of the three projects	Number in Sina Weibo (log)	0.001	0.040	2009-2014
Ecosystem	Number in Sina Weibo (log)	0.661	0.795	2009-2014
Sentiment tests using keywords on Sina Weibo				
Government service	Number of posts with positive attitudes as a share of the total posts on Sina Weibo for Government Service	0.610	0.447	2010-2016
Transparency	Number of posts with positive attitudes as a share of the total posts on Sina Weibo for Transparency	0.635	0.464	2010-2016
Corruption, Anti-corruption & Collusion	Number of posts with positive attitudes as a share of the total posts on Sina Weibo for Corruption, Anti-Corruption & Collusion	0.395	0.438	2009-2016
Fixed Investment	Number of posts with positive attitudes as a share of the total posts on Sina Weibo for Fixed Investment	0.785	0.375	2010-2016

Table 2. Balance Tests

Variable	Treatment	Control	Unconditional Difference	Conditional difference
Panel A: Selection variables				
Page size (log)	9.977	9.132	0.845**	
	(3.704)	(4.508)	(0.417)	
Images (log)	3.678	3.257	0.420**	
	(1.899)	(2.080)	(0.212)	
Links (log)	4.460	3.986	0.474**	
	(2.131)	(2.442)	(0.239)	
Public finance	0.093	0.120	-0.027***	
	(0.036)	(0.087)	(0.004)	
Mountainous county	0.277	0.393	-0.116**	
	(0.450)	(0.489)	(0.050)	
Poverty county	0.145	0.274	-0.129***	
	(0.354)	(0.446)	(0.040)	
Provincial capital	0.181	0.085	0.096**	
	(0.387)	(0.279)	(0.043)	
Panel B: Other characteristics				
Agricultural grain output 2010 (log)	12.234	11.991	0.243	0.184
	(1.313)	(1.201)	(0.161)	(0.149)
Government transferred funds 2009 (log)	3.177	2.752	0.425	0.206
	(3.603)	(3.383)	(0.413)	(0.407)
Average urban wage 2010 (log)	10.361	10.254	0.107*	0.086
	(0.471)	(0.359)	(0.060)	(0.059)
Financial deficit divided by total public income in 2009	0.672	0.059	0.008	0.004
	(0.073)	(0.074)	(0.008)	(0.008)
Average hectares of land transaction 2010 (log)	9.892	9.872	0.020	-0.145
	(1.220)	(1.202)	(0.144)	(0.132)
Average firm's assets, 2010 (millions of yuan)	131.757	114.609	17.147***	2.858
	(718.629)	(968.646)	(6.442)	(7.048)
Average firm's output 2010 (millions of yuan)	119.547	98.144	21.403***	8.388
	(756.140)	(796.856)	(6.708)	(6.941)
Average firm's net profit 2010 (millions of yuan)	6.964	5.191	1.773**	1.064
	(101.243)	(116.215)	(0.888)	(0.907)
Total number of firm employees 2010	181.409	167.770	13.639**	5.144
	(698.92)	(646.550)	(5.925)	(6.057)
Panel C: County leader characteristics				
Average birth year in 2010	1964.438	1964.390	0.048	0.450
	(1.991)	(3.475)	(0.538)	(0.506)
Average education in 2010	18.078	18.132	-0.055	0.115
	(1.891)	(1.711)	(0.519)	(0.541)
Number of new county leaders in 2010	1.500	1.400	0.100	0.080
	(0.516)	(0.512)	(0.129)	(0.119)

Panel D: Dependent variables

Corruption in 2010	0.104	0.162	-0.058**	-0.031
	(0.207)	(0.356)	(0.024)	(0.024)
Fixed investment in 2010	1.632	1.359	0.273**	0.090
	(1.065)	(1.752)	(0.136)	(0.136)
Land prices in 2009	4.904	5.068	0.164***	-0.035
	(0.846)	(0.947)	(0.033)	(0.034)
Share of open land transactions in 2009	0.738	0.679	-0.059***	-0.089***
	(0.40)	(0.467)	(0.016)	(0.016)
EE_sales in 2010	0.718	0.720	-0.002	0.021
	(2.040)	(1.927)	(0.018)	(0.177)
Web construction in 2010	5.707	5.753	-0.046	-0.099
	(0.975)	(0.836)	(0.139)	(0.078)
Share of promotions in 2010	0.175	0.138	0.037	0.035
	(0.382)	(0.345)	(0.043)	(0.043)

Table 3. Baseline Results for Corruption

	(1)	(2)
Dependent variable Value of mismanagement as a share of general budgetary income		
Treatment×post	-0.118***	-0.114***
	(0.039)	(0.040)
County fixed effects	YES	YES
Year fixed effects	YES	YES
Control ×T		YES
Control ×T2		YES
Control ×T3		YES
Year coverage	2005-2014	2005-2014
Observations	20,359	20,359
R-squared	0.336	0.338
Number of clusters	2165	2165

Notes: Robust standard errors, clustered at the county level, are in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All observations are at the county-year level. The variables "Control" denotes the key criteria the province used in selecting the treatment counties. Control variables are interacted with a third order polynomial function of time.

Table 4. Robust Checks for the Effect of Treatment on Corruption

	(1)	(2)	(3)
Dependent variable Value of mismanagement as a share of general budgetary income			
Treatment×post	-0.110***	-0.128***	-0.116***
	(0.039)	(0.040)	(0.042)
Inspection	-0.286***		
	(0.038)		
Treatment×year_2009_2010		-0.049	
		(0.033)	
County fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES
Control ×T	YES	YES	
Control ×T2	YES	YES	
Control ×T3	YES	YES	
Control×year dummy			YES
Year coverage	2005-2014	2005-2014	2005-2014
Observations	20,359	20,359	20,359
R-squared	0.342	0.338	0.339
Number of clusters	2165	2165	2165

Notes: Robust standard errors, clustered at the county level, are in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All observations are at the county-year level. The variables "Control" denotes the key criteria the province used in selecting the treatment counties. "Inspection" is the dummy for inspections of provincial governments by the Central Commission for Discipline Inspection. "year_2009_2010" is one if year is 2009 or 2010, zero otherwise. Control variables are interacted with a third order polynomial function of time. Control variables are interacted with the year dummy variables which more flexibly control for the time effects of control variables on outcome variables in Column (3).

Table 5. Triple Difference Effects of Treatment on Corruption

	(1)
Dependent variable Value of mismanagement as a share of general budgetary income.	
Treatment$\times$post$\times$distance	-0.050**
	(0.022)
Treatment$\times$post	YES
post$\times$distance	YES
Treatment$\times$distance	YES
County fixed effects	YES
Year fixed effects	YES
Control $\times$T	YES
Control $\times$T2	YES
Control $\times$T3	YES
Year coverage	2005-2014
Observations	20333
R-squared	0.337
Number of clusters	2143

Note: Robust standard errors, clustered at the county level, are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. In column (1) and (2), all observations are at the county-year level. The variables "Control" denotes seven key criteria the province used in selecting the treatment counties. Interactions of the seven selection variables with a third-order polynomial function of time are included.

Table 6. The Effect of Treatment on Firm Business Entertainment Expenses

	(1)	(2)	(3)
Dependent variable Business entertainment expenses as a percentage of sales			
Treatment $\times$ post	-0.074**	-0.072**	-0.074**
	(0.029)	(0.030)	(0.031)
Inspection			0.058*
			(0.035)
Firm fixed effect	YES	YES	YES
Year fixed effects	YES	YES	YES
Control $\times$ T		YES	YES
Control $\times$ T2		YES	YES
Control $\times$ T3		YES	YES
Year coverage	2007-2014	2007-2014	2007-2014
Observations	694,210	694,210	694,210
R-squared	0.508	0.508	0.508
Number of clusters	2063	2063	2063

Notes: The dependent variable is business entertainment as a percentage of sales. Robust standard errors, clustered at the county level, are in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All observations are at the firm-county-year level. The variables "Control" denotes key criteria the province used in selecting the treatment counties. Interactions of the selection variables with a third-order polynomial function of time are included in column (2). "Inspection" is the dummy for inspections of provincial governments by the Central Commission for Discipline Inspection.

Table 7. The Effect of Treatment on Industrial Land Transactions

	(1)	(2)	(3)	(4)
Dependent variables	Industrial land price (log)	Open land transactions (indicator)	Industrial land price (log)	Open land transactions (indicator)
Treatment×post	0.138**	0.078**	0.140**	0.077**
	(0.066)	(0.032)	(0.066)	(0.032)
Inspection			-0.030*	0.009
			(0.017)	(0.010)
County fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Control ×T	YES	YES	YES	YES
Control ×T2	YES	YES	YES	YES
Control ×T3	YES	YES	YES	YES
Year coverage	2007-2014	2007-2014	2007-2014	2007-2014
Observations	135,791	137,246	135,791	137,246
R-squared	0.688	0.493	0.688	0.493
Number of clusters	2000	2002	2000	2002

Notes: Robust standard errors, clustered at the county level, are in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All observations are at the land parcel-county-year level. The variables "Control" denotes the key criteria the province used in selecting the treatment counties. In column (1) and (3), the dependent variable is the log of the industrial land price. In column (2) and (4), the dependent variable is an indicator for whether the land was transacted in an open transaction, such as a tender, auction or bid. All regressions control for Year fixed effects, County fixed effects, and interactions of the selection variables with a third-order polynomial function of time. "Inspection" is a dummy variable indicating whether or not the Central Commission for Discipline Inspection conducted an inspection of a provincial government.

Table 8. The Effect of Treatment on Fixed Investment

	(1)	(2)
Dependent variable		
Fixed Investment		
Treatment×post	0.444*	0.445*
	(0.250)	(0.250)
Inspection		-0.064
		(0.076)
County fixed effects	YES	YES
Year fixed effects	YES	YES
Control ×T	YES	YES
Control ×T2	YES	YES
Control ×T3	YES	YES
Year coverage	2005-2014	2005-2014
Observations	18,590	18,590
R-squared	0.741	0.741
Number of clusters	1936	1936

Notes: Robust standard errors, clustered at the county level, are in parentheses: *** p<0.01, ** p<0.05, * p<0.1. All observations are at the county-year level. The variables "Control" denotes the key criteria the province used in selecting the treatment counties. Control variables are also interacted with the year dummy variables which more flexibly control for the time effects of control variables on outcome variables. "Inspection" is a dummy variable indicating whether or not the Central Commission for Discipline Inspection conducted an inspection of a provincial government.

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Table 9. Triple Difference Effects of Treatment on Fixed Investment

Dependent variable	
Fixed Investment	
Treatment $\times$ post $\times$ distance	0.368
	(0.382)
Treatment $\times$ post	YES
post $\times$ distance	YES
Treatment $\times$ distance	YES
County fixed effects	YES
Year fixed effects	YES
Control $\times$ T	YES
Control $\times$ T2	YES
Control $\times$ T3	YES
Year coverage	2005-2014
Observations	18,586
R-squared	0.743
Number of clusters	1936

Note: Robust standard errors, clustered at the county level, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All observations are at the county-year level. The variables "Control" denotes seven key criteria the province used in selecting the treatment counties. Interactions of the seven selection variables with a third-order polynomial function of time are included.

Table 10. Effect of Treatment on the Promotion of County Party Secretaries

| Dependent variable | |
Vertical Promotion indicator	
Treatment×post	0.074**
	(0.035)
County fixed effects	YES
Year fixed effects	YES
Control ×T	YES
Control ×T2	YES
Control ×T3	YES
Treatment trend	YES
Total work time of party secretary	YES
Year coverage	2002-2015
Observations	21,399
R-squared	0.111
Number of clusters	1970

Notes: Robust standard errors, clustered at the county level, are in parentheses: *** p<0.01, ** p<0.05, * p<0.1. All observations are at the county-year level. The variables "Control" denotes the key criteria the province used in selecting the treatment counties. Promotion is 1 if the county party secretary has a vertical promotion, and 0 otherwise. The county party secretary is defined to be promoted if he or she was promoted to a higher level which includes a party secretary at the prefectural level, vice party secretary at the prefectural level, mayor, vice mayor, assistant mayor, acting mayor, standing committee member of a city, or general secretary of a prefecture. Treatment-specific linear time trends are included to control for the differences in time trends between the treatment and control groups. Total working time as the party secretary is also controlled for.

Table 11. Effect of Treatment on Website Construction

Dependent variable

Number of links on the front page of county

website(log)

Treatment $\times$ post	0.218*
	(0.129)
County fixed effects	YES
Year fixed effects	YES
Control $\times$ T	YES
Control $\times$ T2	YES
Control $\times$ T3	YES
Year coverage	2008-2014
Observations	8,584
R-squared	0.615
Number of clusters	1693

Notes: Robust standard errors, clustered at the county level, are in parentheses: *** p<0.01, ** p<0.05, * p<0.1. All observations are at the county-year level. The dependent variable is measured by total number of links and images (log) in the front page of the website of each county. The variables "Control" denotes the key criteria the province used in selecting the treatment counties.

Table 12. Effects of Treatment on Key Words Related to Quality of Government from Sina Weibo

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	E-government	Government Affairs Openness	Government service	Government service pilot reform	E-platform	Government Convenience services	Government website
Treatment×post	0.086***	0.138***	0.195***	0.108***	0.099***	0.070**	0.103**
	(0.024)	(0.026)	(0.039)	(0.020)	(0.022)	(0.034)	(0.043)
County fixed effects	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES
Control ×T	YES	YES	YES	YES	YES	YES	YES
Control ×T2	YES	YES	YES	YES	YES	YES	YES
Control ×T3	YES	YES	YES	YES	YES	YES	YES
Year coverage	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014
Observations	10,712	10,712	10,712	10,712	10,712	10,712	10,712
R-squared	0.261	0.240	0.340	0.261	0.232	0.321	0.284
Number of clusters	1822	1822	1822	1822	1822	1822	1822

	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Corruption	Anti-corruption	Supervision	Government Openness	Transparency	Monitoring	Monitoring
Treatment×post	0.120**	0.107**	0.186***	0.280***	0.142***	0.216***	0.058
	(0.057)	(0.043)	(0.068)	(0.072)	(0.041)	(0.051)	(0.041)
County fixed effects	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES
Control ×T	YES	YES	YES	YES	YES	YES	YES
Control ×T2	YES	YES	YES	YES	YES	YES	YES
Control ×T3	YES	YES	YES	YES	YES	YES	YES
Year coverage	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014
Observations	10,712	10,712	10,712	10,712	10,712	10,712	10,712
R-squared	0.436	0.308	0.511	0.625	0.373	0.376	0.332
Number of clusters	1822	1822	1822	1822	1822	1822	1822

Notes: Robust standard errors, clustered at county level are in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All observations are at the county-year level. The variables "Control" denotes the key criteria the province used in selecting the treatment counties. Government communications on Sina Weibo are excluded.

Table 13. Effects of Treatment on Key Words Related to Fixed Investment from Sina Weibo

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Infrastructure	Public transportation	Highway	Railway	Airport	Light Rail Train	Subway
Treatment×post	0.137**	0.121***	0.256***	0.150**	0.366***	0.106**	0.151**
	(0.055)	(0.042)	(0.077)	(0.067)	(0.095)	(0.045)	(0.073)
County fixed effects	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES
Control ×T	YES	YES	YES	YES	YES	YES	YES
Control ×T2	YES	YES	YES	YES	YES	YES	YES
Control ×T3	YES	YES	YES	YES	YES	YES	YES
Year coverage	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014
Observations	10,706	10,706	10,706	10,706	10,706	10,706	10,706
R-squared	0.394	0.458	0.690	0.515	0.547	0.508	0.538
Number of clusters	1821	1821	1821	1821	1821	1821	1821

	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Port	Telecommunications	Power grid	Water supply	Electricity supply	Hydraulic project	Public service
Treatment×post	0.110**	0.230***	0.120**	0.167***	0.198***	0.140**	0.146***
	(0.055)	(0.062)	(0.051)	(0.061)	(0.063)	(0.057)	(0.047)
County fixed effects	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES
Control ×T	YES	YES	YES	YES	YES	YES	YES
Control ×T2	YES	YES	YES	YES	YES	YES	YES
Control ×T3	YES	YES	YES	YES	YES	YES	YES
Year coverage	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014
Observations	10,706	10,706	10,706	10,706	10,706	10,706	10,706
R-squared	0.499	0.469	0.358	0.396	0.477	0.435	0.369
Number of clusters	1821	1821	1821	1821	1821	1821	1821

Notes: Robust standard errors, clustered at county level are in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All observations are at the county-year level. The variables "Control" denotes the key criteria the province used in selecting the treatment counties. Government communications on Sina Weibo are excluded.

Table 14. Effects of Treatment on Key Words Related to "Image Projects" from Sina Weibo

	(1)	(2)	(3)	(4)
	Image projects	Principle project	White elephant project	Sum of the Three Groups
Treatment×post	-0.004	-0.000	-0.000	-0.005
	(0.003)	(0.000)	(0.000)	(0.003)
County fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Control ×T	YES	YES	YES	YES
Control ×T2	YES	YES	YES	YES
Control ×T3	YES	YES	YES	YES
Year coverage	2009-2014	2009-2014	2009-2014	2009-2014
Observations	10,712	10,712	10,712	10,712
R-squared	0.169	0.167	0.168	0.169
Number of clusters	1822	1822	1822	1822

Notes: Robust standard errors, clustered at county level are in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The dependent variable is the log number of keywords on Sina Weibo. All observations are at the county-year level. The variables "Control" denotes the key criteria the province used in selecting the treatment counties. Government communications on Sina Weibo are excluded.

Table 15. Effects of Treatment on Satellite Lights

Dependent variable	(1) Satellite Lights	(2) Satellite Lights
Treatment $\times$ post	0.048***	0.037**
	(0.018)	(0.018)
County fixed effects	YES	YES
Year fixed effects	YES	YES
Control $\times$ T		YES
Control $\times$ T2		YES
Control $\times$ T3		YES
Year coverage	2005-2013	2005-2013
Observations	18,329	18,329
R-squared	0.983	0.984
Number of clusters	2140	2140

Notes: Robust standard errors, clustered at the county level, are in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All observations are at the county-year level. The variables "Control" denotes the key criteria the province used in selecting the treatment counties. Control variables are interacted with a third order polynomial function of time. The dependent variable is the average light per square kilometer (log).

Table 16. Effects of Treatment on Public Sentiment from Sina Weibo

	(1)	(2)	(3)	(4)
	Government service	Transparency	Corruption, anti-corruption& collusion	Fixed investment
Treatment×post	0.327**	0.673***	0.129*	0.024
	(0.139)	(0.150)	(0.072)	(0.096)
County fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Control ×T	YES	YES	YES	YES
Control ×T2	YES	YES	YES	YES
Control ×T3	YES	YES	YES	YES
Year coverage	2010-2016	2010-2016	2009-2016	2010-2016
Observations	906	456	5,944	3,643
R-squared	0.436	0.577	0.294	0.352
Number of clusters	342	190	1502	1142

Notes: Robust standard errors, cluster at county level are in parentheses: *** p<0.01, ** p<0.05, * p<0.1. The dependent variable is the ratio for the number of posts with positive attitude to the total number of posts related with the keywords on Sina Weibo. The first keywords is government service, the second keyword is transparency, the third one includes corruption, anti-corruption and collusion between government and business, and the fourth variable is fixed investment. There are some missing information for some keywords so that the year coverage is not the same. All observations are at the county-year level. The variables "Control" denotes the key criteria the province used in selecting the treatment counties. Government communications on Sina Weibo are excluded.

Appendix Figure A1. The front webpage of Shunde in Foshan in Guangdong Province on 21 Dec 2012

Source: https://web.archive.org/web/20121221103048/http://www.shunde.gov.cn/

Appendix Figure A2. The transparency link in the front webpage of Shunde in Foshan in Guangdong Province on 21 Dec 2012

Source: https://web.archive.org/web/20121221103048/http://www.shunde.gov.cn/

Appendix Figure A3. The online service link in the front webpage of Shunde in Foshan in Guangdong Province on 21 Dec 2012

Source: https://web.archive.org/web/20121221103048/http://www.shunde.gov.cn/
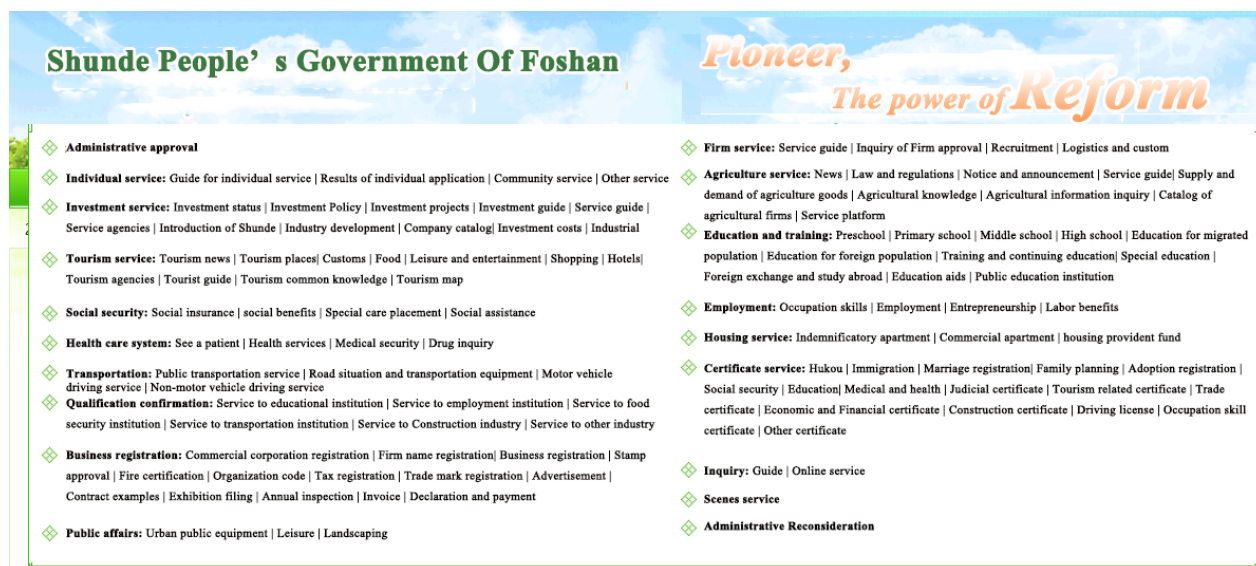
Appendix Figure A4. The interaction between government and citizens in the front webpage of Shunde in Foshan in Guangdong Province on 21 Dec 2012

Source: https://web.archive.org/web/20121221103048/http://www.shunde.gov.cn/

Figure A5. The anti-corruption inspection across the country


Source: http://www.ccdi.gov.cn/special/zyxszt/index.html
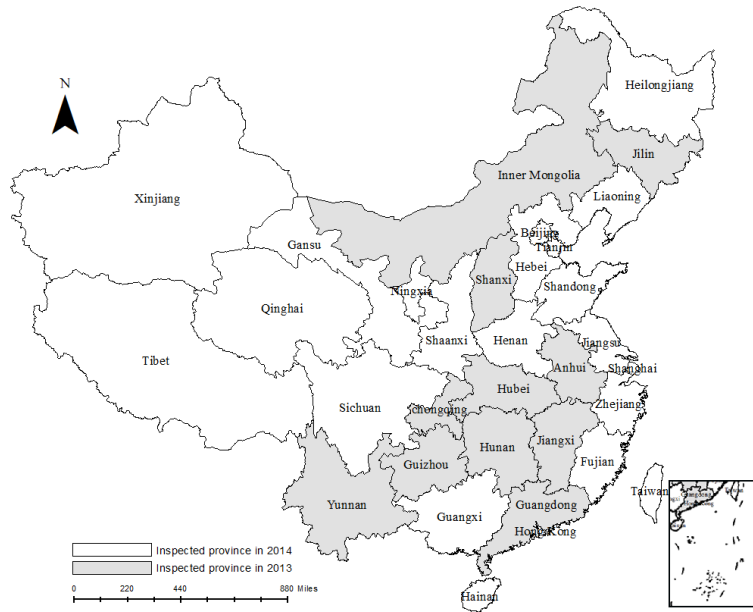
Figure A6. Estimated Coefficients for Industrial Land Prices
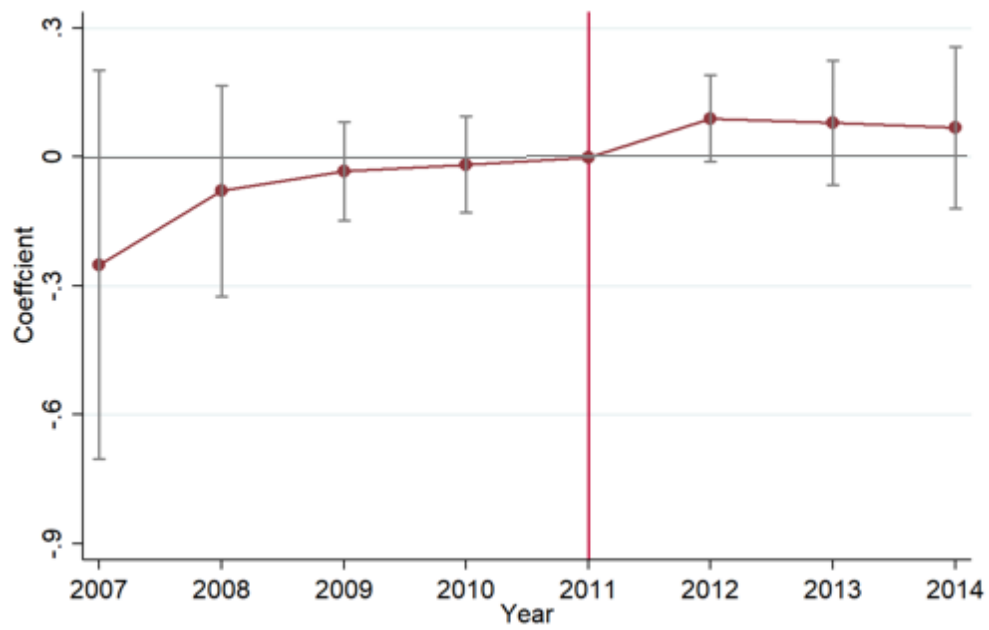
Notes: The circles represent coefficients of treatment interacted with Year dummy variables; and, the surrounding whiskers are the 95-percent confidence intervals. The baseline year is 2011. The dependent variable is Industrial Land Prices.

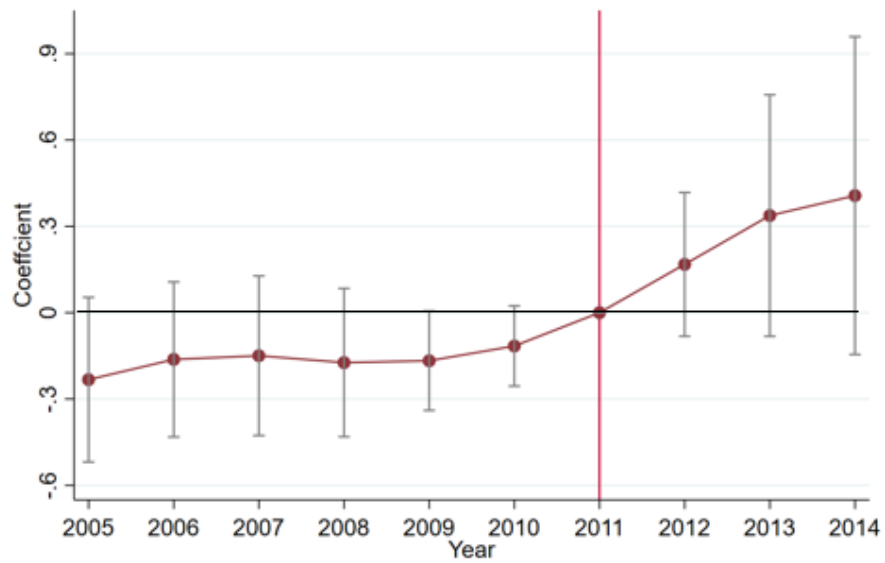Figure A7. Estimated Coefficient for Open Land Transactions
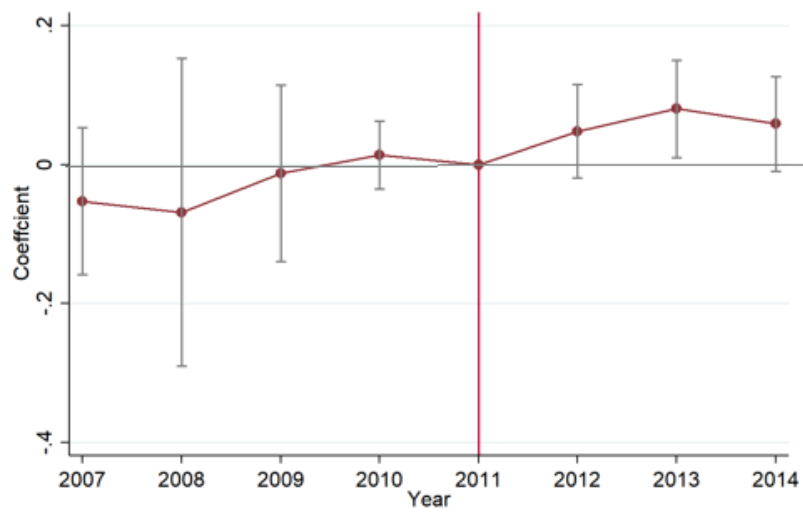
Notes: The circles represent coefficients of treatment interacted with Year dummy variables; and, the surrounding whiskers are the 95-percent confidence intervals. The baseline year is 2011. The dependent dummy variable is Open Land Transactions.

Figure A8. Estimated Coefficients for Fixed Investment

Notes: The circles represent coefficients of treatment interacted with Year dummy variables; and, the surrounding whiskers are the 95-percent confidence intervals. The baseline year is 2011. The dependent variable is fixed investment. The confidence interval is much larger in 2014 because, in that year, roughly 120 counties do not report their fixed investments.

Figure A9. Estimated Coefficients for the Promotion of County Party Secretaries
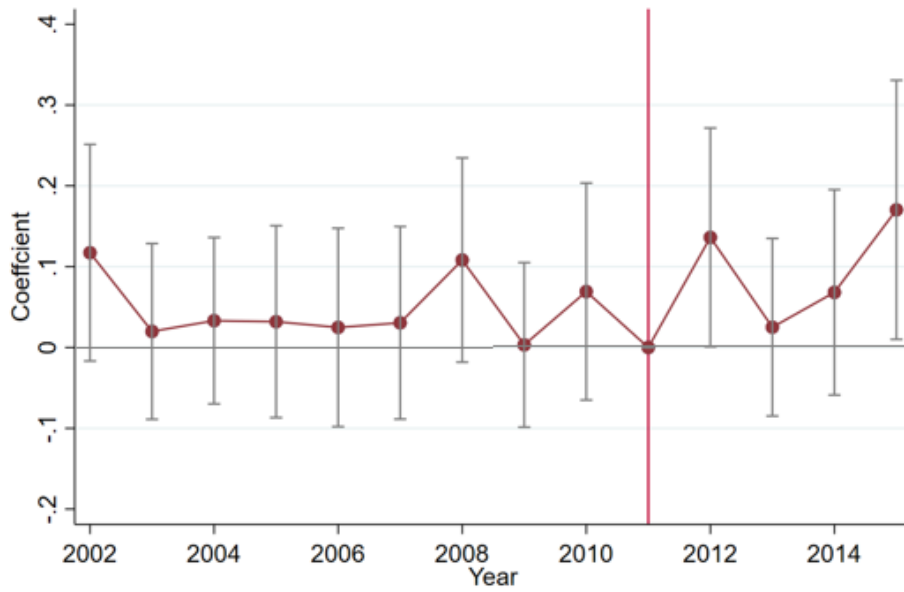

Notes: The circles represent coefficients of treatment interacted with Year dummy variables; and, the surrounding whiskers are the 95-percent confidence intervals. The baseline year is 2011. The dependent variable is whether or not the county party secretary has been vertically promoted or still works in the county. Treatment-specific linear time trends are included to control for selection into treated counties of party secretaries.

Table A1. Effects of Treatment on Additional Key Words Related to Quality of Government from Sina Weibo

	(1) Administrative function	(2) Government affairs platform	(3) Administrative system	(4) Service-oriented government	(5) Administration by Law	(6) Open	(7) Transparency	(8) Information Sharing	(9) Government information	(10) Government network
Treatment×post	0.035***	0.108***	0.005	0.001	0.070**	0.304***	0.142***	0.004	0.120***	0.036*
	(0.013)	(0.027)	(0.012)	(0.008)	(0.029)	(0.067)	(0.041)	(0.016)	(0.033)	(0.022)
County fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Control ×T	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Control ×T2	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Control ×T3	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year coverage	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014
Observations	10,712	10,712	10,712	10,712	10,712	10,712	10,712	10,712	10,712	10,712
R-squared	0.188	0.268	0.245	0.204	0.260	0.625	0.373	0.247	0.270	0.248
Number of clusters	1822	1822	1822	1822	1822	1822	1822	1822	1822	1822

Notes: Robust standard errors, clustered at the county level, are in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All observations are at the county-year level. The variables "Control" denotes the key criteria the province used in selecting the treatment counties. Government communications on Sina Weibo are excluded.

Table A2. Effects of Treatment on Additional Key Words to Fixed Investments from Sina Weibo

	(1)	(2)	(3)	(4)	(5)	(6)
	Aviation	Communication	Garden	Greening	Garbage removal	Sewage treatment
Treatment×post	0.191***	0.105**	0.306***	0.294***	0.034**	0.073**
	(0.065)	(0.042)	(0.080)	(0.073)	(0.013)	(0.034)
County fixed effects	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES
Control ×T	YES	YES	YES	YES	YES	YES
Control ×T2	YES	YES	YES	YES	YES	YES
Control ×T3	YES	YES	YES	YES	YES	YES
Year coverage	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014
Observations	10,706	10,706	10,706	10,706	10,706	10,706
R-squared	0.436	0.345	0.492	0.516	0.236	0.311
Number of clusters	1821	1821	1821	1821	1821	1821

	(7)	(8)	(9)	(10)	(11)	(12)
	Electric power	Gas	Tap water	Environmental protection	Environmental sanitation	Ecosystem
Treatment×post	0.169***	0.123**	0.157**	0.175**	0.310***	0.248***
	(0.055)	(0.049)	(0.065)	(0.081)	(0.076)	(0.065)
County fixed effects	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES
Control ×T	YES	YES	YES	YES	YES	YES
Control ×T2	YES	YES	YES	YES	YES	YES
Control ×T3	YES	YES	YES	YES	YES	YES
Year coverage	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014	2009-2014
Observations	10,706	10,706	10,706	10,706	10,706	10,706
R-squared	0.409	0.386	0.442	0.578	0.479	0.631
Number of clusters	1821	1821	1821	1821	1821	1821

Notes: Robust standard errors, cluster at county level are in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All observations are at the county-year level. The variables "Control" denotes the key criteria the province used in selecting the treatment counties. Government communications on Sina Weibo are excluded.