Transparent Authoritarianism?

An analysis of political and economic barriers to greater government transparency in China

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Abstract: In recent years, the Chinese Communist Party has experimented with a variety of mechanisms designed to improve bottom-up accountability and information flow within a fundamentally authoritarian single-party system. These include the institution of village elections, the relaxation of restrictions on journalists, and a more tolerant attitude toward small-scale protests, among other developments. The most recent such innovation has been the introduction of national regulations mandating the increased sharing of government-collected information. We exploit a newly released index of environmental transparency in Chinese cities to understand what political and economic barriers may inhibit or encourage a shift toward this new model of authoritarian rule. This exercise generates two key results. First, the financial strength of a city's government is a crucial determinant of transparency. Establishing the institutions to collect, organize, and disseminate information is costly and remains a low priority for cash-strapped local governments. Secondly, the legacies of the planned economy still have a major influence over what municipal governments are willing or (politically) able to do. Cities whose economies are relatively dependent on a single industrial firm tend to resist implementing transparency requirements when compared to those dealing with a less concentrated industrial base.

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Introduction

Transparent governance, the open sharing of information with citizens, is increasingly recognized as a crucial element of well-functioning democracy. 86 countries had instituted some form of freedom of information regulations by 2008, but the vast majority of these were democracies (Vleugels, 2008). Authoritarian regimes, by contrast, have generally tried to restrict their citizens' access to information, attempting to conceal catastrophic failures (as in the Chernobyl incident in the USSR) but also making secrecy the default even when the information in question might seem innocuous or even beneficial to the functioning of the regime, such as the content of economic regulations.

It is surprising, then, that in recent years China's government has taken significant steps to increase the access of ordinary people to government-collected information. Some of these efforts can be traced back to commitments to the international community, such as those involved in accession to the World Trade Organization in 2001 (Horsley, 2007). But even beyond initiatives targeting the openness of economic and trade regulations, the central government has taken significant steps toward increasing openness and facilitating more-responsive government at many levels. Muckraking journalists have substantial room to work as long as they do not aim too high in the hierarchy, some public protests are treated with a more gentle hand rather than an iron fist, and many NGOs can operate openly. Perhaps most remarkably, in 2007 the State Council introduced a new set of Open Government Information Regulations (OGI Regulations), which mandate disclosure of a wide array of information to ordinary citizens, either routinely or in response to requests. To be sure, these regulations are more restrictive than analogous freedom of information laws in democratic countries. Nevertheless, the new OGI regulations constitute an important incremental shift in China's approach to governance. Among other motivations, they were adopted in an effort to make it more difficult for lower-level arms of government to engage in corruption or less-extreme forms of poor governance unbeknownst to the center (Horsley, 2007). As with the (relatively) greater freedoms accorded to journalists, protesters, and NGOs, these regulations take advantage of the coincidence of interests between the central government and ordinary citizens in reducing corruption and ensuring compliance with some central mandates (Lorentzen, 2008a, 2008b).

This paper will focus on the implementation of these regulations in the context of environmental disclosure. The Ministry of Environmental Protection (MEP) was the most eager of all the national ministries to push for greater transparency, issuing its own implementing measures even before the State Council's overarching OGI Regulations were formally released (Ma, 2008). This was likely a

consequence of the persistent challenges it has faced in getting compliance from local governments, which have tended to favor economic growth over environmental goals (Economy, 2004, 2009). By routinizing the release of information on environmental quality and recruiting citizens as its allies, the Ministry may hope to exert greater pressure on local officials not to short-change the environment.

Yet the degree to which these new rules were implemented varies enormously from place to place. This is not inherently surprising given that China's complex bureaucratic system is characterized by a large degree of decentralization (Falkenheim 1980; Oksenberg & Tung, 1991; Park et. al. 1996; Solinger 1996; Jin et. al. 2005; Landry, 2008). Whatever their motivations, the expectations of central leaders are not always met, as local officials must constantly respond to a multi-dimensional array of sometimes contradictory demands from above. Taking advantage of transparency ratings compiled by two NGOs for 113 major Chinese cities, we will examine what factors may have contributed to greater or lesser compliance with these new regulations at the municipal level. Because most cities are for the most part two steps below the direct political control of central authorities, analyzing municipal institutions provides insight into the barriers facing the central government's attempt to introduce a 'democratic' practice in a non-democratic setting.

Two findings stand out. First of all, money matters. The wealthier a city is and the more stable the finances of its government, the more transparent it will be. This suggests that a major barrier to transparency is simply cost—collecting, vetting, and disseminating environmental information takes resources that many cities are hard-pressed to assemble. Rather than being unwilling to disseminate information more freely, some cities may simply be unable to afford the necessary institutional infrastructure. However, our second finding indicates that there is more going on than simple financial constraints. We find that the dominance of a single industrial enterprise in a city's economy is a remarkably robust negative predictor of transparency. Specifically, we demonstrate that the larger the enterprise relative to the city's size, the less transparent the city's environmental governance will be. This suggests that local governments favor economic development over the environment not just because they face conflicting mandates from the center, but also because they are influenced by powerful local economic interests. Cities whose economies comprise a number of small firms will be more willing to impose onerous disclosure requirements than ones in which one large firm is particularly influential.

We also examine the effects of leaders' personal characteristics. We find some indication that a mayor's past training in law is associated with higher levels of transparency, and that experience

studying or working abroad is (surprisingly) associated with lower levels of transparency. The most robust finding, however, is that the longer the mayor has been in office, the higher the city's transparency rating. This has two possible explanations. The first explanation links to the financial story above—because environmental transparency is a low priority, new mayors tend to allocate their time to other, more pressing matters. The second explanation links to the political economy of the city—the longer a mayor has been in office, the more able he is to push through transparency regulation in the face of opposition from entrenched economic interests.

This paper proceeds as follows. The next section provides more detail on the steps China has taken in recent years towards greater government transparency in general and on environmental transparency more specifically. We then discuss in detail the development and characteristics of our dependent variable, the Pollution Information Transparency Index (PITI) score. After this, we present the findings of our empirical analysis, looking first at potential explanations in the economy or political economy of the cities, then exploring the possible influence of the personal characteristics of mayors. Lastly, we address issues of selection bias and reverse causality before offering some concluding observations.

China's New Government Transparency Regulations

The State Council promulgated the Regulations on Open Government Information (OGI Regulations) on April 2007, to take effect a year later on May 1st, 2008. The regulations state that government departments should disseminate certain kinds of information routinely "on their own initiative" within 20 business days of its generation or updating, while other information should be disclosed upon request to citizens or organizations within 30 business days at most. All government departments at the county level and above are instructed to establish an Open Government Information office which among other responsibilities would manage the information gathered, determine what information should be disclosed, compile a catalogue of such information, and provide a guide for the use of those who would like to access or request information. In addition to providing general principles for determining what information should be released, the regulations specifically mention that government departments at the county level and above should "emphasize disclosure" of several specific kinds of information, including "…information on the supervision and inspection of environmental protection." Fees may only be collected for costs of "retrieval, duplication, postage and the like," and can be reduced or eliminated in cases of financial hardship (State Council, 2007).

The State Environmental Protection Administration (SEPA) issued its own Measures on Open Environmental Information (OEI Measures) in 2007, which provide more detailed instructions for implementation of the national regulations for its subordinate bodies.[2] In addition to reiterating the key points of the OGI regulations as they apply to environmental bureaus, it specifies sixteen specific types of information that should be disclosed automatically. These include environmental "laws, rules, regulations, standards, and other regulatory documents," information on the allocation of emissions quotas and permits to enterprises, the amounts of pollution fees or penalties collected and any exemptions, reductions, or postponements granted, the results of the investigation of public complaints, names of firms in violation of environmental regulations, and so forth. The measures also impose specific obligations on enterprises to disclose information about their environmental protection efforts and pollution emissions, specifically ruling out the excuse that these kinds of information constitute "trade secrets" (SEPA, 2007). SEPA Vice-Minister Pan Yue noted at the time of the release of the Measures that this stipulation was made explicitly to eliminate a common justification for non-disclosure (CECC, 2008).

Analysts immediately noted a number of limitations in these new policies. Rather than following the "global ideal" in which there is a "clear presumption of disclosure with narrowly drawn exceptions to that principle," the OGI regulations instead take a more cautious approach in which government agencies must take into account a number of considerations before releasing information (Horsley, 2007: 3-4). In particular, they include the important restriction that the information to be disclosed "may not endanger state security, public security, economic security and social stability" (State Council: Article 8). This echoes the expansive phrasing of the 1988 Law on Safeguarding State Secrets, which as a law takes precedence over the OGI Regulations. Since clear criteria have never been put forth as to what is or is not a state secret, this leaves government agencies a great deal of flexibility in determining what information they wish to release (Ding, 2009: 39, CECC, 2008). In addition, the continued subordination of the judiciary to the CCP means that attempts to use the legal system to compel disclosure face significant challenges (Ding, 2009). As a consequence, while some called the regulations a "turning point" (Horsley, 2007), others remained unimpressed (e.g. Ding, 2009).

[2] The State Environmental Protection Administration was elevated by the National People's Congress to become the Ministry of Environmental Protection in March 2008. (Xinhua, March 11, 2008) http://news.xinhuanet.com/english/2008-03/11/content_7766369.htm)

Dependent Variable: The Pollution Information Transparency Index

In an attempt to evaluate the success of these new regulations and to encourage compliance, China's non-governmental Institute for Public and Environmental Affairs (IPE) and the Natural Resources Defense Council--an American NGO--jointly created a Pollution Information Transparency Index (PITI). This index assigns 113 Chinese cities scores on eight different dimensions, for a total of 100 points possible. These dimensions are as follows:

1. Routine disclosure of firms that violate pollution standards (28 Points)
2. Reports of cleanup efforts by polluters (8 Points)
3. Disclosure of government audits of industries (8 Points)
4. Firm environmental behavior assessment reports (8 Points)
5. Provision of results of petitions and suits brought against polluters (18 Points)
6. Provision of reports on environmental impact assessments (8 Points)
7. Provision of lists of fines exacted on polluters (4 Points)
8. Compliance with requests for information requests (18 Points)

Within each dimension, cities were given points depending on assessments of to what degree the information provision was systematic, timely, complete, and user-friendly. Compliance with requests for information disclosure (Item 8) was assessed through letters and telephone calls by IPE and NRDC staff members (PITI, 2010). Some points were assigned for behaviors clearly mandated by the law, but additional points were assigned for other activities and disclosures that would be useful to the public. The index compilers estimate that basic compliance with the law would earn a score of approximately 63 points (Wang, 2009).

The first PITI index was released in June 2009, assessing performance as of one year after the regulations took effect. As would be expected given the loopholes in the formulation of these regulations, their novelty, and the typical challenges of implementing policy in China's nested bureaucratic system, implementation was far from perfect. The mean score was 31.06, the median was 26.6, and the lowest score (earned by the cities of Jilin and Xining) was only 10.2. Only three municipalities (Ningbo, Hefei, and Fuzhou) passed the 63-point level that could be attained through minimum compliance with the laws, with Ningbo earning the highest score in the sample, 72.9. The variation in scores was quite substantial, ranging from 10.2 to 72.9, as noted, with a standard deviation of 14.8.

The list of 113 cities was adapted from an earlier list of key environmental protection cities put out by the State Environmental Protection Administration.[3] 45 cities were included on that list because they were provincial-level municipalities, provincial capitals, open coastal cities, or SEZs (SEPA, 2002). The remaining cities appear to have been included based on their importance for tourism, their population, and their GDP, as well as the desire to include additional cities from western regions. While this cannot be considered a random sample of China's cities at or above the prefecture-level, there is no *prima facie* source of bias. Our econometric analysis below verifies that selection effects have no major influence on a city's PITI score.

Sources of Variation in Environmental Transparency

What might explain the extraordinary extent of variation in environmental transparency across these cities, despite the fact that each has the same formal obligation to carry out the central regulations? We can roughly split the explanations into two categories: ability and willingness. Ability has to do with the economic and budgetary constraints affecting cities. Providing transparent, routine, timely disclosure of environmental information is costly: training and paying staff responsible for managing this data and deciding what can or should be disclosed is expensive; websites take time and money to set up and maintain; responding to citizen's requests for information is time-consuming. A survey of Chinese officials studying abroad found that 30% of respondents felt they did not have adequate financial resources or staff to fulfill information requests, while 64% reported that inadequate records systems prevented them from handling requests (Piotrowski et al., 2009). Chinese cities vary a great deal in the quality of their finances. The central government has mandated that local government pay for crucial social services such as education, healthcare, and social welfare, while providing no guarantee that funds would be made available for localities that lack the resources to do so, leaving many local governments in very poor financial shape (Wong 1995, 2002, 2009; Wong & Bird 2005). Thus, cities that have fewer resources or substantial other demands on their staff and finances may have found it difficult to implement the regulations within a year.

[3] Three cities from the government's list (Haikou, Lhasa, and Sanya) were dropped by the PITI index compilers because they have low levels of industrialization. They were replaced by three other cities the compilers felt were important industrial cities in their regions (Dongguan, Erdos, and Yancheng) (Personal communication with NRDC).

Willingness, on the other hand, has to do with the values of citizens and officials, officials' incentives, and the political power of different groups in a city with respect to environmental disclosure. In a rough parallel to the Lipset (1960) modernization hypothesis that suggests that economic development may promote democracy, one might expect that wealthier citizens would be more likely to agitate for greater openness from their government, even in a non-democratic system. In a related but distinct theory, Inglehart argues that citizen values and expectations shift qualitatively towards "post-material" values when societies achieve a high level of economic development (Inglehart 1990, 1995, 1997). It is of course not the case that all of China can reasonably be qualified as a post-industrial or post-materialist society. Yet, given the high degree of social and economic inequality that divide urban and rural China as well as vast regional disparities (Wang & Hu 2001, Davis & Wang, 2009), it is reasonable to postulate that in cities where average standards of living are rapidly approaching the levels of developed industrial societies (at least for registered residents),people may be more demanding of their local governments about environmental issues than are residents of poorer cities whose social and economic conditions are much closer to those observed in less-developed societies (Tong 2005).

The political economy of cities may also have an effect on the willingness of city leaders to promote environmental transparency. Cities highly dependent on heavy industry or resource extraction may want to avoid damaging their major sources of city revenue, employment, and economic growth. Imposing onerous environmental disclosure requirements on enterprises might compel them to cut back on some profitable but polluting activities, or move these activities to other cities. Indeed, even collecting and disclosing city-level information could make it harder to turn a blind eye to major pollution sources. By contrast, cities primarily engaged in "clean" production activities might be more willing to exert pressure on remaining polluting industries by improving disclosure, and those hoping to develop tourism might actively desire to demonstrate their clean, green credentials.

In addition to the importance of different kinds of economic activity in a city, however, the size and scale of the enterprises engaging in it may also matter. If one or a few large firms plays a crucial role in a city's economy, their leaders may be able to exert greater leverage on city officials than would an equal number of smaller polluting enterprises, even if their economic importance is similar. They would face less of a challenge in coordinating to oppose moves to greater transparency, and are themselves likely to be important players in the local Communist Party. Thus, we might expect to see less transparency in cities dominated by large, well-established industrial firms.

We now explore these possibilities by examining the association of the PITI score with a number of demographic, economic, political and environmental variables. **Figure 1** presents some of the correlations between PITI scores and the key independent variables that we discuss in greater detail below and summary statistics are provided in the appendix.

We begin our analysis with a set of OLS estimates that regress municipal PITI scores against basic economic variables, measured in 2007 (the year the regulations were publicized). In **Table 1**, the first column shows that a city's GDP has a strong statistical association with the transparency score. Substantively, the coefficient implies that a doubling of GDP will result in a PITI score 5.67 points higher. This might seem a small effect but note that the GDP of the cities in our sample ranges from 8 billion to 1.21 trillion RMB, a factor of 151. Another way to think about this is that a jump from the 25th to 75th percentile of GDP in this sample would be associated with an increase of about 12 PITI points.

While statistically strong, this result is not very informative about the mechanisms that lead some cities to be more transparent than others. As discussed above, a more-prosperous city may be more easily able to afford putting in place the institutions required to support a high level of transparency. However, it could also be that richer cities have richer citizens who take a greater interest in the quality of their environment and exert pressure on the city government to protect it. A third possibility is that the economic structure of rich cities may be qualitatively different from that of others. Economic development tends to be associated with growth in the service sector and the replacement of extraction and heavy manufacturing with cleaner industries. For instance, Guangdong's leadership has recently explicitly advocated a development plan akin to the "flying geese" strategy that explicitly calls for the relocation of polluting and low-value added industries to interior provinces, while the province would shift in turn to technologically and human-capital intensive sectors (Bo, 2008).

To address this, we break GDP down into GDP per capita and population in column 2. If population has a strong effect, controlling for GDP per capita, that would support the idea that there are certain fixed costs to collecting and providing environmental information that are more easily born by large cities. If a modernization or post-materialism hypothesis held, we would expect GDP per capita to contain two effects: a direct effect through GDP, the same as that of population, and an indirect effect reflecting a change in values. Together these factors should lead GDP per capita to have much larger coefficient than population (when both are on a log scale). In this specification, the coefficients of the two are quite close. This suggests that the ability to pay for transparency is really what matters. Regardless of whether it has more funds because the number of citizens is larger or because they have

higher incomes, more prosperous municipal governments tend to provide better environmental information to their citizens.

To further dig into the mechanisms by which a city's prosperity may influence its ability to provide environmental information, in column 3 we directly consider the impact of the city's budget revenue. Including this variable essentially eliminates any effect from population or per capita GDP. That is, it is not the wealth of the city as a whole that matters, but specifically the wealth of the city's government. A city with twice the budget revenues of an otherwise similar city would be expected to have a PITI score of about 5 points higher. This further reinforces the idea that ability to pay is a more important determinant of transparency levels than any value shift.

In column 4 we consider an additional dimension of the city's finances—the ratio of the city government's expenditures to its revenues. While one might expect that these would be tightly linked, they have in fact become increasingly decoupled, due to the center's re-centralizing of revenues and the large number of unfunded mandates imposed on localities, as discussed above. This is very apparent in our data, with 99 of the 113 cities in our sample having expenditures greater than their revenues. Interestingly, we find this variable to be an even better predictor of PITI scores than budget revenues. This suggests that investments in environmental transparency are treated as a low priority, as they are more likely to be made by cities that have a budget surplus (or at least a relatively smaller shortfall). Substantively, the coefficient of -20.32 implies that a move from the 25th percentile of this variable (with revenues covering 92% of expenditures) to the 75th percentile (with revenues covering only 60% of expenditures) should be associated with an 8.75 point decrease in the PITI score.

Surprisingly, the specification in column 4 reduced the estimated coefficient of budget revenue and caused its statistical significance to drop below conventional levels. However, a problem here is that population, per capita GDP, and budget revenue are highly collinear—measuring the level of municipal development in different ways, which tends to attenuate the estimated effects of all three variables. Therefore, we drop population and per capita GDP from the specification in column 5, and see that indeed the estimated effect of budget revenue again becomes large and statistically significant.

Column 6 introduces a key political economy variable that may affect a city government's willingness to promote transparency. This variable, **Single-Firm Dependence**, is the percentage of the population employed by the largest industrial enterprise in the city in 1999.[4] The coefficient of 2.999 is highly

[4] In order to use logged values, we assigned cities with no firms listed in our source the same employment level as the smallest firm in our sample. Any resultant bias would work against the results found here. We found very

statistically significant, and implies that an increase from the 25th percentile of this measure (0.5% of the population employed by one firm) to the 75th percentile (3.2% of the population employed by one firm) should be associated with a 5.4 point decrease in the PITI score. We believe that this relationship highlights the importance of the local political economy in urban politics and the legacy of the planned economy. A city's government might otherwise be willing to increase its level of environmental disclosure, despite the impact on narrowly-defined economic growth, but it will be unable or unwilling to do so when economic power is concentrated in one or a small number of industrial firms.

In column 7, we include a number of controls for other factors that might be expected to affect a city's degree of environmental transparency. While budget revenue again becomes insignificant due to the inclusion of population and per capita GDP, the estimated effects of the expense ratio and single-firm dependence only increase. The other controls do not generally have significant coefficients. SO_2 is included as a measure of pollution, as it is one of the major pollutants targeted in the current five-year plan. [5] We included the ratio of FDI to GDP to see whether there is any evidence of a "race to the bottom" in which cities lower their environmental standards or reduce transparency in order to please highly mobile foreign investments. If anything, we see evidence of the opposite effect, a beneficial influence from foreign investment, with FDI having a slight positive association with transparency. In order to allow for the possibility that the importance of a large industrial firm has to do with the city's overall industrial structure, rather than the size of the firm per se, we control for the proportion of the city's GDP produced by the tertiary (service) sector and therefore not by the primary (agriculture and natural resources) or secondary (industrial) sectors. We find no such effect, reinforcing our belief that the effect of single-firm dependence is indeed working through the dynamic we described above.[6]

China's coastal cities, especially in the south and east, are widely considered to be more developed and modern both in their economies and politics. Surprisingly, however, we find a weakly significant result that being located in a coastal province has a negative effect, leading to a PITI score six points lower than it might otherwise be expected to be.[7] Of course, the key thing to remember is that the

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similar results when we use alternative measures, such as the registered capital of the firm or its sales revenues, each considered as a fraction of 1999 GDP.

[5] A variety of other measures of pollution were also used in place of SO_2 in order to test the robustness of the finding. None had statistically significant effects when controlling for the other variables here.

[6] Substituting the ratio of secondary industry or primary industry also did not lead to significant results.

[7] Cities are defined as "coastal" if they belong to one of the coastal provinces between Shandong and Guangdong, or if they are categorized as SEZs or coastal open cities.

significantly greater wealth and therefore budget size of coastal cities leads them to have much higher transparency scores than inland cities overall. The point is that this difference results from their prosperity, not any other factor resulting from their coastal locations.

The government has designated a number of cities to be key points of tourism development, but we do not find this designation to be significantly associated with greater pollution transparency. This may be because the governments of such cities view the appearance of having a good environment to be more important than improving actual environmental conditions.

Our sample includes cities at four different political levels: centrally-administered municipalities, provincial capitals, prefecture-level cities, and cities under direct provincial administration. Because there are only four of the first and last categories in our sample, we group the central municipalities and provincial capitals together, but find that there is no significant association with administrative level and PITI score.

We control for the number of mobile phones per capita to allow for the possibility that greater telecommunications penetration facilitates citizen activism and encourages the government to behave in a more open fashion, but find no evidence of such an effect. Finally, we control for GDP growth over the previous ten years to see if cities that generally have more dynamic or effective governments might also be more easily able to implement the new transparency measures, but again this has no effect.

Effects of Leadership Characteristics

Although we find political economic factors compelling, they explain only part of the variation. Thus, we do not necessarily rule out other classes of political explanations of municipal behavior. As Bunce (1981) noted in her study of executive leadership, "leaders make a difference", and this may be true of Chinese local leaders as well. Building on Landry's 2008 dataset on municipal governance (and extending its coverage through the year 2008), we explored how the diversity of educational and professional experiences leading up to a leader's appointment as Mayor may shape his preferences for or against transparency, once in power. Having collected reasonably complete biographies for the mayors and Communist Party secretaries of all 287 prefecture-level cities, we coded systematically for a variety of background characteristics that may influence how current leaders weigh the importance of both the

environment and open-government initiatives, and thus explain the degree of transparency that was measured in 2008.[8]

What incentives do mayors face? The point systems used to evaluate municipal performance are inordinately biased toward growth performance, leaving only a small fraction of the index for greening (绿化), sewage discharge treatment, and other environment-related issues. Thus, explicit promotion incentives still overwhelmingly favor GDP growth over the environment (Landry 2008). Yet environmental issues are looming larger in policy debates. Students at the Central Party School (where many mayors and secretaries pass through for short-term training) witnessed first-hand the controversy (largely initiated by the Party School) about introducing green GDP accounting in national statistics.[9] The preparations for the 2008 Olympics games further highlighted the importance of reducing air pollution, not only in Beijing and but also in Northern China and beyond.

Furthermore, maintenance of social stability is also an important evaluation factor for leaders at all levels (Minzner, 2009). The occurrence of environment-related protests, such as that in 2007 in Xiamen over a proposed chemical plant (Jacobs, 2009) or that in Guangzhou in 2009 over a trash incineration facility (Moore, 2009) mean that even the most narrowly self-interested leaders cannot afford to entirely neglect environmental concerns. Thus there is a real possibility that different leaders may choose different strategies in their efforts to achieve growth with social stability, perhaps depending on their own personal experiences and strengths. We therefore examined the possibility that local leaders with certain kinds of experience may be more likely to preside over cities exhibiting greater environmental transparency.

Figure 2 summarizes the results of this coding exercise and displays the hypothesized impact that such experiences may have on a leader's willingness to push for greater transparency in his jurisdiction. In

[8] We only consider the individuals in power as of May 2008, when the regulations formally came into place and the beginning of the PITI evaluation period.

[9] See China MOE. 2004. 《国家环保总局副局长潘岳透露中国绿色 GDP 核算体系框架初步建立》2004-09-01 [http://panyue.mep.gov.cn/zyhd/200907/t20090708_154488.htm]; Green Chinese Government Official Web Portal: "GDP Accounting Study Report 2004 issued" [http://www.gov.cn/english/2006-09/11/content_384596.htm] ; Xinhuanet. 2006. 《环保总局统计局联合发布绿色国民经济核算研究成果》[2006-09-07];http://news.xinhuanet.com/environment/2006-09/07/content_5062140.htm; Xinhuanet. 2006. 《绿色 GDP："低人一等"反受厚爱》[2006-09-07] http://news.xinhuanet.com/fortune/2006-09/07/content_5059094.htm; China Daily. 2007. "Call for Return to Green Accounting" [2007-04-19] [http://www.chinadaily.com.cn/china/2007-04/19/content_853917.htm]

addition to law, experience in medicine or public health, environmental protection, or water conservancy seems likely to make a mayor more receptive to these initiatives. We also hypothesize that cadres who were trained or worked abroad, have worked on attracting international trade and investment or have worked as educators should also favor OGI measures that they may have encountered elsewhere or learned about throughout their studies. We also coded their biographies for factors that are conversely likely to push cadres away from transparency, namely experience in corporations or sectors of the economy (coal, oil and gas, power generation) that may be a marker of allegiance to business and bureaucratic interests that a often regarded as inimical to transparency and environmental protection.

The preliminary analysis of this data shows that only a few of these characteristics seem to impact PITI scores (see Table A1, in appendix). Even when grouping positive and negative traits into simple additive indices of pro- and anti-PITI respectively, we only detect weak significance ($p<.1$) for the positive effect of training in law (cols. 4 & 5) and (surprisingly) a negative impact for foreign experience. Yet, these effects are substantial: mayors trained in law are associated with a 7.16 point increase in their city's PITI scores, while those who are studied or were trained abroad are associated with a loss of 5.49 points. That said, we consistently find that that tenure in office seems to matter a great deal: longer-serving mayors are strongly associated with lower levels of transparency. There could be two reasons for this finding: one is that new mayors are sent to replace cadres who have performed poorly in a number of ways and need time to turn things around (since transparency would presumably not rank very highly on their lists of immediate concerns), leading to a low score early in their tenure. Another possibly is that new mayors who happen to be appointed to cities where the current Party secretary is the same city's previous mayor inherit policies of the party secretaries and are reluctant to challenge them. We rule this second possibility out in specifications 2, 5 and 7, where we also control for the incumbency of the CCP Secretary and the length of his tenure as Mayor in the same city.

These findings thus suggest that the division of authority and responsibility between mayors and secretaries is real and that it is mayors--and not secretaries--who have effective ownership of environmental and OGI issues. Our results indicate (as expected) that these issues are not a short-term priority, and that the specific background of mayors is of little significance. The latter finding may be both a blessing and a curse from the perspective of those hoping to encourage greater transparency. It is good news that there is no obvious group of mayors systematically standing in the way of greater transparency, but conversely it appears programs that seek to "train" or "expose" mayors to

international practices, or efforts to instill a greater respect for the rule of law by appointing ever more mayors formally trained in the law appear to have little reliable effect, at least in the short run.

Given these findings, we only include the salient leadership effects along with the core political-economy models that were discussed above. In **Table 2**, model 1 shows how both a mayor's tenure and foreign exposure seem to impact their city's PITI score negatively. The result is unchanged when Secretary-specific variables discussed above are included (model 2). However, both the magnitude and the level of significance drop markedly when political-economic factors are introduced, in any of the variants that we discussed above, leaving coefficients for **Budget Expenditure** and **Firm dominance** unaffected. A possible explanation for this drop is that cities with unstable budgets will tend to have newer mayors, perhaps because the previous mayors were transferred to new postings following a period of poor economic performance, but further analysis is needed to validate this conjecture. However, mayoral tenure remains significant at the 10% level. This has two possible explanations. It may simply be another indication that environmental transparency tends to take a low priority—a newer mayor can only address a limited number of issues and will leave transparency to later. Alternatively, it may be another reflection of political power dynamics within the city. New mayors are less well-established and therefore will have a more difficult time implementing transparency in the face of opposition by entrenched economic interests than will mayors who have served for a longer period.

Selection Effects

Since PITI scores are based on a subset of only 113 cities out of the total of 287 municipalities at the prefecture or provincial rank, we must ensure that our findings are not sensitive to selection bias, and if we detect evidence of selectivity, we must account for it explicitly. As discussed above, the list of cities was drawn up by the central government based on their political, economic, and environmental importance. At this stage, the index's compilers do not intend to extend the index to cover more cities, as their primary goal is to prod China's major cities into greater compliance with the transparency regulations, so we must simply make our best efforts given the available data.

We gathered detailed information about all 287 cities listed in the 2008 edition of the *China City Statistical Yearbook* (and other relevant sources) in order to compare the PITI sample to the entire set of Chinese municipalities. The map in Figure 3 offers a simple graphical representation of both sites included in PITI (red dots) and the municipalities that are excluded from the report (black dots). At first

glance, we do not detect evidence of severe geographical bias, though several major cities in Heilongjiang (upper right corner), much of Yunnan, Gansu, and Sichuan, the interior of Fujian, as well as all of Tibet (Lhasa) and Hainan (Haikou and Sanya) are missing.

We therefore create a selection model to explore statistically whether the differences between the sample and the complete set are consequential. We include **population** (logged), since smaller cities tend to be excluded. The average size of PITI cities was 2.08 million in 2007, against only 0.79 million for excluded cities. Although large cities are likely to be more polluted, they are also likely to benefit from larger fiscal revenue and thus be better able to fund environmental projects. We conjecture that the leadership of larger municipalities has an incentive to be more transparent than their counterparts in smaller cities. For similar reasons, we also account for **GDP per capita** in 2007, since selected cities enjoyed an average value of 43,304 Yuan per capita, against 21,929 for non-selected cities. Finally, we control for two sets of characteristics that the government used in the creation of their list: All **open coastal cities, special economic zones (SEZ) and provincial capitals** were purposively selected because of their administrative, economic, and political importance,[10] along with a large number of **designated tourist cities**.[11] As a precaution, we include both the **latitude** (because coal-burning cities north of the Yangzi River may be over-represented in the PITI report) and **longitude** (because of possible over-representation of eastern cities due to their economic importance) as additional control variables in the selection equation. Table Z provides descriptive statistics of the in- and out-of-sample cities.

Table 3 reports estimates based on a Heckman two equation systems (selection probit equation, bottom of the table) and "outcome" equations (where the dependent variable is the PITI score) that use the same variables as the regressions in **Tables 1 and 2**. Regardless of the specification of the main model, we find very that all the factors included in the selection equations (columns 1 though 5) are

[10] This includes Beijing, Tianjin, Shijiazhuang, Qinhuangdao, Taiyuan, Hohhot, Shenyang, Dalian, Changchun, Harbin, Shanghai, Nanjing, Nantong, Lianyungang, Hangzhou, Ningbo, Wenzhou, Hefei, Fuzhou, Xiamen, Nanchang, Jinan, Qingdao, Yantai, Zhengzhou, Wuhan, Changsha, Guangzhou, Shenzhen, Zhuhai, Shantou, Zhanjiang, Nanning, Beihai, Haikou, Sanya, Chongqing, Chengdu, Guiyang, Kunming, Lhasa, Xian, Lanzhou, Xining, Yinchuan, and Urumqi.

[11] With the exception of Haikou, Sanya and Lhasa, 43 open coastal cities, special economic zones (SEZ) and provincial capitals. An additional 34 key tourist cities are included in the PITI report. These are: Datong, Baotou, Anshan, Fushun, Benxi, Jilin, Daqing, Mudanjiang, Wuxi, Xuzhou, Changzhou, Suzhou, Yangzhou, Shaoxing, Wuhu, Maanshan, Quanzhou, Jiujiang, Zibo, Taian, Weihai, Kaifeng, Luoyang, Jingzhou, Yueyang, Changde, Zhangjiajie, Shaoguan, Foshan, Zhongshan, Liuzhou, Guilin, Baoji, Xianyang. On the other hand, 18 key tourist cities are excluded from the report: Chengde, Dandong, Zhenjiang, Jinhua, Anqing, Bozhou, Sanming, Yichun (Jiangxi), Puyang, Shiyan, Jiangmen, Zhaoqing, Huizhou, Yangjiang, Qingyuan, Wuzhou, Leshan, and Yulin (Shannxi).

strong predictors of inclusion on the PITI list. All else being equal, cities that have a large population, are wealthy, located in northern China, or are administrative centers are likely to have been designated as environmental protection key points and therefore to have received a PITI score. We also find that **longitude** has a negative coefficient, which suggests that western cities are overrepresented, likely in an attempt to achieve greater geographic diversity.

The good news is that the factors that explain why a city is included in the study do not seem to bias the estimates of our main equations of interest. We detect evidence of selection bias only in the simple models of leadership characteristics (Columns 1 & 2), where ρ—deduced from the anth(ρ) parameter estimate—is both positive and significant. However, once we introduce fiscal and political economy variables either by themselves (col. 3), or along with leadership variables (col. 4 and 5), the selection effect is no longer significant. By comparing coefficient estimates between the Heckman model (column 5) to the same set of predictors obtained by OLS with robust standard errors (column 6), we easily rule out selection bias. Finally, model 7 shows that with the exception of **Budgetary Revenue**, adding population and GDP as ordinary independent variables rather than specifying them as part of the selection equation, our key results about the impact of budgetary expenditures and the dominance of large industrial firm in the municipal economy are unaffected. We suspect that the smaller and insignificant coefficient for **Budgetary Revenue** is the result of multicollinearity between **Budgetary Revenue, GDP** and **Population**.[12]

Reverse Causality

With any simple cross-sectional analysis like this one, a major concern is the risk of reverse causality or omitted variable bias. Straightforward reverse causality would be a problem if the level of environmental transparency directly affected one of the explanatory variables, for instance if it tended to slow economic growth. This problem is mitigated somewhat because we measure GDP, population, and budgetary variables as of year 2007, a year before formal compliance with the transparency regulations was mandated. This is an imperfect correction, as some cities instituted their own open

[12] Pair-wise correlation matrix between population, GDP per capita and budgetary revenue (all logged):

	ln(pop)	ln(gdppc)	ln(budgetrev)
ln(pop)	1.0000		
ln(gdppc)	0.2251	1.0000	
ln(budgetrev)	0.6943	0.7575	1.0000

government legislation as early as 2002, and there has been movement toward more open government since as early as the 1990s (Horsley, 2007). However, recall that we found no evidence of an association between transparency and GDP growth, which we would expect if there were direct reverse causation. Single-firm dominance is less vulnerable to reverse causation, since we assessed it as of 1999. While it is theoretically possible that there is some unmeasured third factor influencing both the PITI score and our independent variables, we do not believe there are any highly plausible candidates for such a factor.

Conclusion

While the data we analyze only contain cross-sectional factors, these results provide some indications of the future trajectory of the Chinese government's transparency initiatives. First, the apparent importance of startup costs and the wealth of the city bode well as long as China's economy continues to grow. Expenses that appear unacceptably high to cash-strapped cities now will become more bearable with time. The political economy considerations captured by the single-firm dominance variable, however, inject a note of pessimism. China may be moving towards a corporatist economy in which a few large firms, tightly interlinked with the party-state that dominate the economy, rather than toward a robust market economy characterized by numerous small, competitive firms like those of Taiwan or Hong Kong. This might exacerbate the effect we find in this study. In China's case, single-firm dominance is magnified by the high degree of administrative decentralization that pushes a great deal of routine management to municipal and county governments. Even recent bouts of recentralization (such as the tax reforms of the 1990s) have happened in ways that may be highly inimical to transparency: these reforms allowed Beijing to capture the rewards of higher tax revenue, while keeping the pressure on local governments on the expenditure side and exacerbating the "unfunded mandate" problems of municipal and local governments (Wong, 2009). If this trend proves to be true, local governments may find themselves increasingly vulnerable to capture by large firms that comprise a significant proportion of the local economy, and therefore unable to enforce disclosure or compliance with other environmental regulations.

Addendum: Under- and over-performing cities

While these factors explain a great deal of the variation in transparency among Chinese cities, the relationships we describe here are by no means deterministic, as noted by the PITI's compilers (IPE & NRDC, 2010). It is informative and may serve as a guide to further qualitative and quantitative research to examine those cities that are notable under- or over-performers once the factors we have identified are controlled for. In order to take into account as many variables as possible without dropping observations, we examine the residual (un-predicted) variation in cities' PITI scores based on the model in Table 2, Column 5.

The ten cities that over-performed the most (had the largest positive residuals) are listed in Table 4a. It is interesting to note that it is not just a matter of some cities that would be expected to perform well, such as Ningbo, performing even better than expected, but also that cities like Mudanjiang, Jingzhou, and Jiaozhou that we would have predicted to be backwaters manage to rise to the middle of the pack. Similarly, underperforming cities included places like Tianjin and Nanchang, which fell on the bottom of the list for reasons unexplained by the model (Table 4b). The unexpectedly good or bad performance of these cities suggests that there are important further insights to be gained about the factors that help cities escape the clutches of the political and economic factors enumerated in our model, or that hold them back even more.[13] By contrast, while Shanghai ranked 7th on the PITI index and was highlighted as an "all-star" for its exemplary disclosure of records of pollution violations, this is almost precisely in line with the predictions of the model.[14] Thus while Shanghai may offer a useful reference point for other city governments aiming to implement greater transparency, examining it is unlikely to generate insights into the political question of *why* some cities are unusually willing or unwilling to enforce disclosure rules.

[13] Notably, Xiamen is one of the worse performers, suggesting that the 2007 mass protests against the building of a new paraxylene plant (Jacobs, 2009) convinced the city government of the need to restrict citizen access to information, or conversely that the protests were a consequence of a long-standing lack of transparency and resistance to citizen involvement.

[14] Shanghai's predicted PITI score was actually 2.6 points higher than what it achieved in reality.

MAIN DATA SOURCES

PITI data is based on the work of IPE & NRDC. 2009. 《境信息公开 艰难破冰-污染源监管信息公开指数（PITI）暨 2008 年度 113 个城市评价结果》 [http://www.ipe.org.cn/uploadFiles/2010-05/1274760282937.pdf]

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Municipal-level variables for 2007 are based on the China City Statistical Yearbook (中国城市统计年鉴) 2008, China Statistics Press. (Available electronically at www.infobank.cn)

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Description of variables and data sources

Variable	Source and Definition
Mayor appointment date	Date of mayor's appointment, encoded as date (year/month) in Stata Source: Author's Database
Mayor foreign experience	Dummy variable for mayors with foreign experience Source: Author's Database
CCP secretary appointment date	Date of CCP secretary appointment, encoded as date (year/month) in Stata Source: Author's Database
Tenure of CCP secretary as mayor	Tenure of CCP secretary as mayor in months Source: Author's Database
Budgetary revenue	2007 budgetary revenue in 10000s Source: China City Statistical Yearbook 2008
Budgetary expenditures	2007 budgetary expenditures in 10000s Source: China City Statistical Yearbook 2008
Single-firm Dominance	Percentage of 1999 population employed by the largest industrial enterprise of the city Source: China City Statistical Yearbook 2000, China Large Industry Development Report 2000
GDP per capita	2007 GDP/2007 population Source: China City Statistical Yearbook 2008
Latitude (decimal degree)	Latitude of the seat of the municipality in decimal degrees
Longitude (decimal degree)	Longitude of the seat of the municipality in decimal degrees
Designated Tourism City	Dummy variable for cities selected as "Tourism Cities" by the Central government Source: China National Tourism Agency Website
GDP growth 1997-2007	Percent change in GDP from 1997 to 2007 Source: China City Statistical Yearbook 1998 and 2008
Mobile phones per capita	Number of 2007 mobile phone accounts per capita Source: China City Statistical Yearbook 2008
Provincial Capital or Central Municipality	Dummy variable for cities that are provincial capitals or central municipalities
GDP	2007 GDP in 10000s Source: China City Statistical Yearbook 2008
Population	2007 population in 10000s Source: China Statistical Yearbook 2008
SO2 Emissions	2004 SO2 emissions in mg/m3 Source: Institute of Public and Environmental Affairs Website
FDI ratio	Ratio of FDI (in US dollars) to GDP (in RMB) for 2007 Source: China City Statistical Yearbook 2008
Ratio of Services in GDP	Ratio of service industry in GDP for 2007 Source: China City Statistical Yearbook 2008
Coastal Province	Located in a coastal province between Guangdong and Shandong, plus designated open coastal cities
Open coastal city, SEZ, Prov. Seat	Dummy variable for cities designated as "open coastal cities," "special economic zones," or provincial seats (selection criteria for list inclusion)

Table 1: Main model, OLS regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	piti	piti	piti	piti	piti	piti	piti
GDP (log)	8.182***						
	(8.81)						
Population (log)		8.373***	-0.208	4.508			5.645
		(6.24)	(-0.06)	(1.46)			(1.23)
GDP per capita		10.01***	0.868	-0.210			4.564
		(4.00)	(0.25)	(-0.06)			(1.02)
Budgetary revenue (log)			7.687**	2.500	5.632***	4.975***	0.0980
			(3.09)	(0.99)	(4.83)	(4.24)	(0.03)
Budgetary expenditure ratio (2007) (log)				-20.32**	-14.79*	-15.56**	-27.54***
				(-3.12)	(-2.48)	(-2.83)	(-3.47)
Single-firm dominance						-2.999***	-3.670***
						(-4.44)	(-3.66)
$S0_2$ Emissions (log)							-1.749
							(-0.73)
FDI ratio							1.623
							(1.60)
Ratio of services in GDP							-14.68
							(-1.15)
Coastal province							-6.214+
							(-1.71)
Designated Tourism City							2.000
							(0.89)
Prov. Capital or Central Mun.							-1.245
							(-0.26)
Mobile phones per capita							-0.0315
							(-0.03)
GDP growth 1997-2007							0.0171
							(0.14)
Constant	-96.86***	-116.5***	-77.25**	-15.52	-37.76*	-42.88**	-44.26
	(-6.72)	(-4.66)	(-3.04)	(-0.48)	(-2.31)	(-2.73)	(-1.08)
Observations	113	113	113	113	113	113	93
R^2	0.3305	0.3435	0.3869	0.4467	0.4326	0.4956	0.5942

t statistics in parentheses

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: Mayors, OLS regressions

	(1)	(2)	(3)	(4)	(5)
	piti	piti	piti	piti	piti
Mayor tenure (months)	0.318***	0.292***		0.118+	0.111+
	(4.94)	(4.49)		(1.91)	(1.82)
Mayor foreign experience	-6.734*	-6.641+		-3.169	-3.292
	(-2.04)	(-1.91)		(-1.10)	(-1.13)
CCP Sec. tenure (months)		0.0453			0.0199
		(0.72)			(0.51)
Tenure of CCP Sec. as Mayor		-0.0355			0.00407
		(-0.56)			(0.10)
Population (log)			4.333	3.887	4.056
			(1.46)	(1.34)	(1.39)
GDP per capita			2.789	2.562	2.655
			(0.84)	(0.76)	(0.78)
Budgetary revenue (log)			1.575	1.081	0.960
			(0.65)	(0.45)	(0.40)
Budgetary expenditure ratio (2007) (log)			-18.48**	-17.87**	-17.84**
			(-3.17)	(-3.04)	(-3.02)
Single-firm dominance			-2.975***	-2.945***	-2.947***
			(-4.09)	(-3.98)	(-3.94)
Constant	210.1***	221.2***	-48.64	29.04	35.52
	(5.78)	(4.80)	(-1.55)	(0.58)	(0.66)
Observations	113	113	113	113	113
R^2	0.1742	0.1805	0.5033	0.5238	0.5245

t statistics in parentheses

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Sample Selection Models

OUTCOME EQUATION DV=PITI	(1) piti	(2) piti	(3) piti	(4) piti	(5) piti	(6) piti	(7) piti
Mayor's tenure (months)	0.215***	0.212***		0.125*	0.117*	0.119+	0.111+
	(3.40)	(3.42)		(2.09)	(1.97)	(1.92)	(1.82)
Mayor foreign experience	-5.360+	-5.298+		-3.502	-3.569	-3.287	-3.292
	(-1.82)	(-1.76)		(-1.28)	(-1.29)	(-1.13)	(-1.13)
CCP Sec. tenure		0.00262			0.0171	0.0120	0.0199
		(0.05)			(0.44)	(0.30)	(0.51)
Tenure of CCP Sec. as Mayor		-0.0100			-0.00273	0.00401	0.00407
		(-0.19)			(-0.06)	(0.09)	(0.10)
Budgetary revenue (log)			6.543**	5.760**	5.791**	4.115***	0.960
			(2.95)	(2.61)	(2.58)	(3.46)	(0.40)
Budgetary expenditure ratio (2007) (log)			-15.29**	-14.85**	-14.74**	-15.21**	-17.84**
			(-2.77)	(-2.73)	(-2.72)	(-2.82)	(-3.02)
Single-firm dominance			-2.673***	-2.605**	-2.592**	-2.965***	-2.947***
			(-3.37)	(-3.25)	(-3.13)	(-4.15)	(-3.94)
Population (log)							4.056
							(1.39)
GDP per capita							2.655
							(0.78)
Constant	156.6***	156.7***	-64.01*	16.48	21.50	41.88	35.52
	(4.45)	(3.53)	(-2.17)	(0.33)	(0.40)	(0.86)	(0.66)

Table 3 (*Cont.*)

SELECTION EQUATION	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DV= included in PITI	piti	piti	piti	piti	piti	piti	piti
Population (log)	1.301***	1.305***	1.370***	1.351***	1.348***		
	(6.47)	(6.47)	(6.09)	(5.87)	(5.74)		
GDP per capita	1.427***	1.432***	1.522***	1.501***	1.498***		
	(6.19)	(6.20)	(5.85)	(5.85)	(5.82)		
Latitude (decimal degree)	0.0534**	0.0533**	0.0708***	0.0711***	0.0710***		
	(2.84)	(2.83)	(3.79)	(3.93)	(3.90)		
Longitude (decimal degree)	-0.0373+	-0.0375+	-0.0761***	-0.0769***	-0.0769***		
	(-1.83)	(-1.81)	(-4.38)	(-4.48)	(-4.50)		
Designated Tourism City	0.896***	0.897***	0.852**	0.858**	0.855**		
	(3.66)	(3.65)	(2.70)	(2.92)	(2.88)		
Open coastal city/SEZ/Prov. Seat	0.844*	0.837*	1.095*	1.111*	1.126*		
	(2.16)	(2.11)	(2.21)	(2.30)	(2.30)		
Constant	-18.47***	-18.51***	-15.89***	-15.52***	-15.47***		
	(-6.40)	(-6.35)	(-5.04)	(-4.79)	(-4.72)		
athrho	-0.989***	-0.985***	0.480	0.513	0.526		
	(-3.88)	(-3.66)	(0.93)	(1.10)	(1.06)		
lnsigma	2.628***	2.627***	2.372***	2.352***	2.353***		
	(40.31)	(40.01)	(27.26)	(27.18)	(26.48)		
Observations	285	285	285	285	285	113	113
R^2						0.5179	0.5245

t statistics in parentheses

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

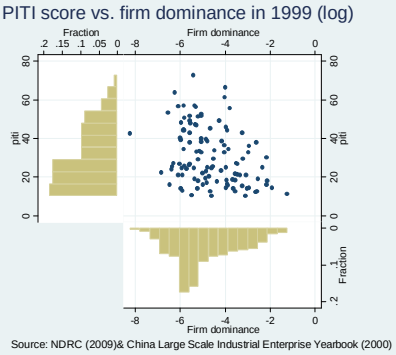
Table 4a: Over-performers

City	Actual PITI score	Predicted PITI score	Over-performance
Mudanjiang	38.8	11.3	27.5
Hefei	66.6	40.0	26.6
Wuhan	61.2	34.6	26.6
Ningbo	72.9	46.4	26.5
Taiyuan	55.4	28.9	26.5
Jingzhou	40.0	18.1	21.9
Changzhi	42.9	24.5	18.4
Jiaozuo	36.1	17.8	18.3
Weihai	45.4	28.0	17.4
Shaoxing	52.6	35.3	17.3

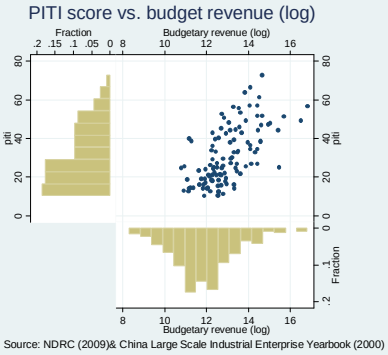
Table 4b: Laggards

City	Actual PITI score	Predicted PITI score	Under-performance
Tianjin	25.2	41.8	-16.6
Zhanjiang	10.6	26.4	-15.8
Xiamen	26.6	41.2	-14.6
Baotou	14.0	27.8	-13.8
Nanchang	23.2	36.8	-13.6
Lanzhou	16.6	29.9	-13.3
Karamay	11.2	24.5	-13.3
Xining	10.2	22.9	-12.7
Jining	17.8	30.4	-12.6
Ordos	18.2	30.1	-11.9

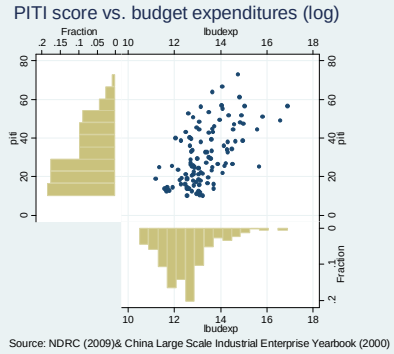
Figure 1: Correlations between PITI scores and key independent variables



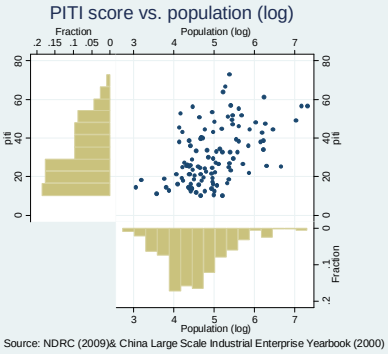
Source: NDRC (2009)& China Large Scale Industrial Enterprise Yearbook (2000)



Source: NDRC (2009)& China Large Scale Industrial Enterprise Yearbook (2000)



Source: NDRC (2009)& China Large Scale Industrial Enterprise Yearbook (2000)



Source: NDRC (2009)& China Large Scale Industrial Enterprise Yearbook (2000)

Figure 2: Educational and professional background of mayors and expected effect on support for transparency

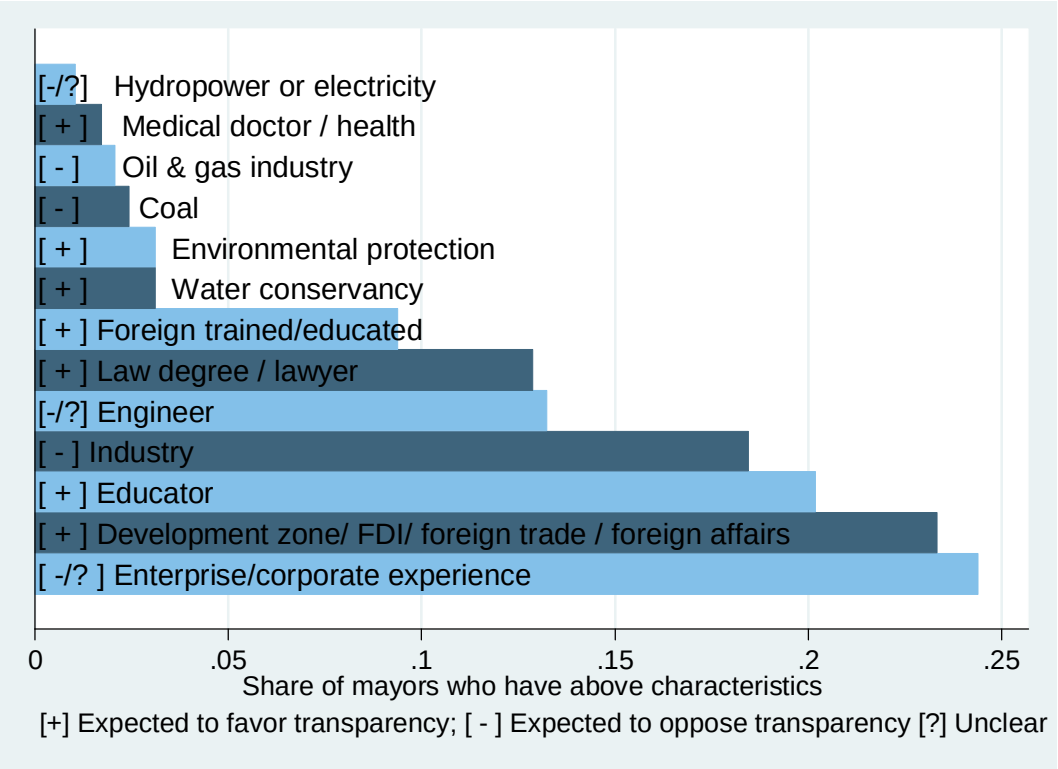
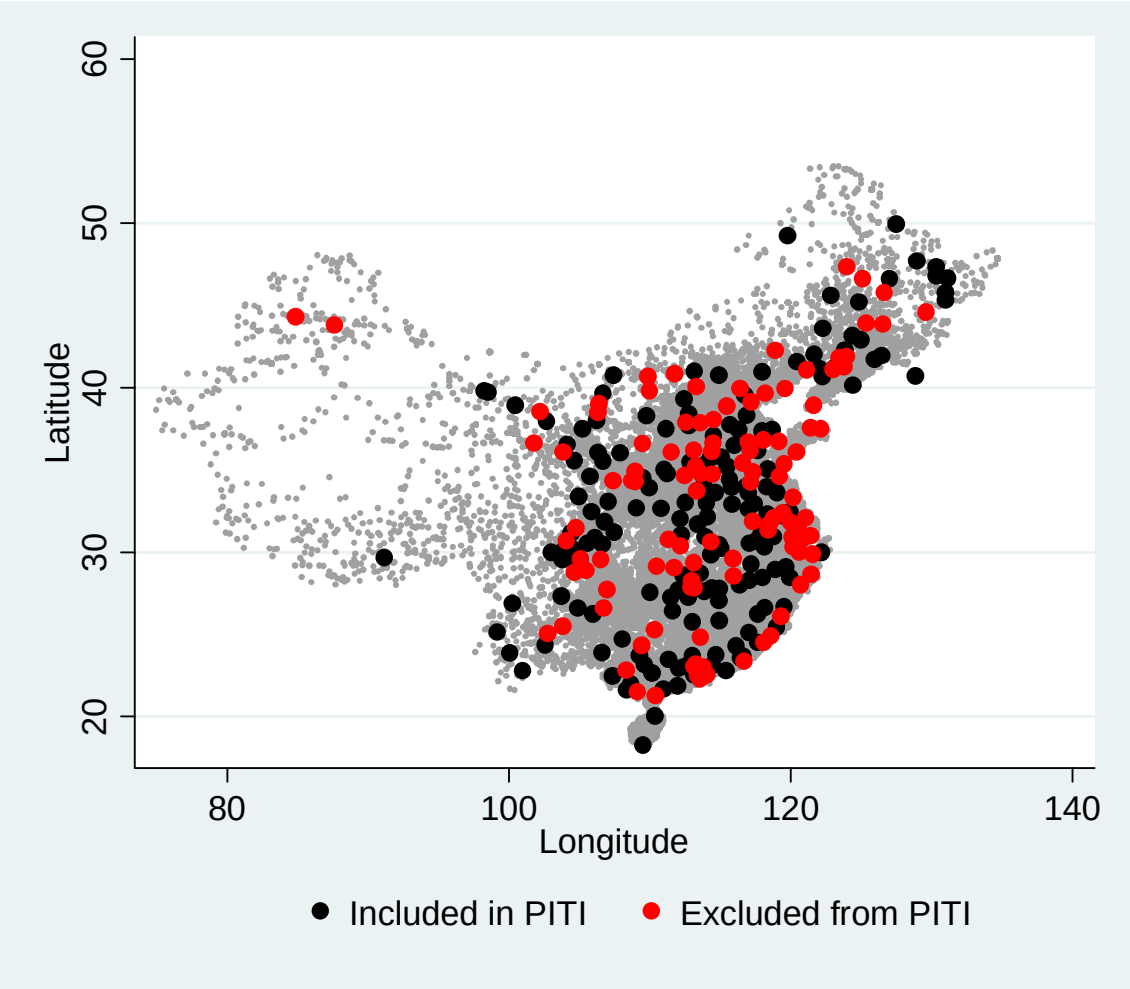
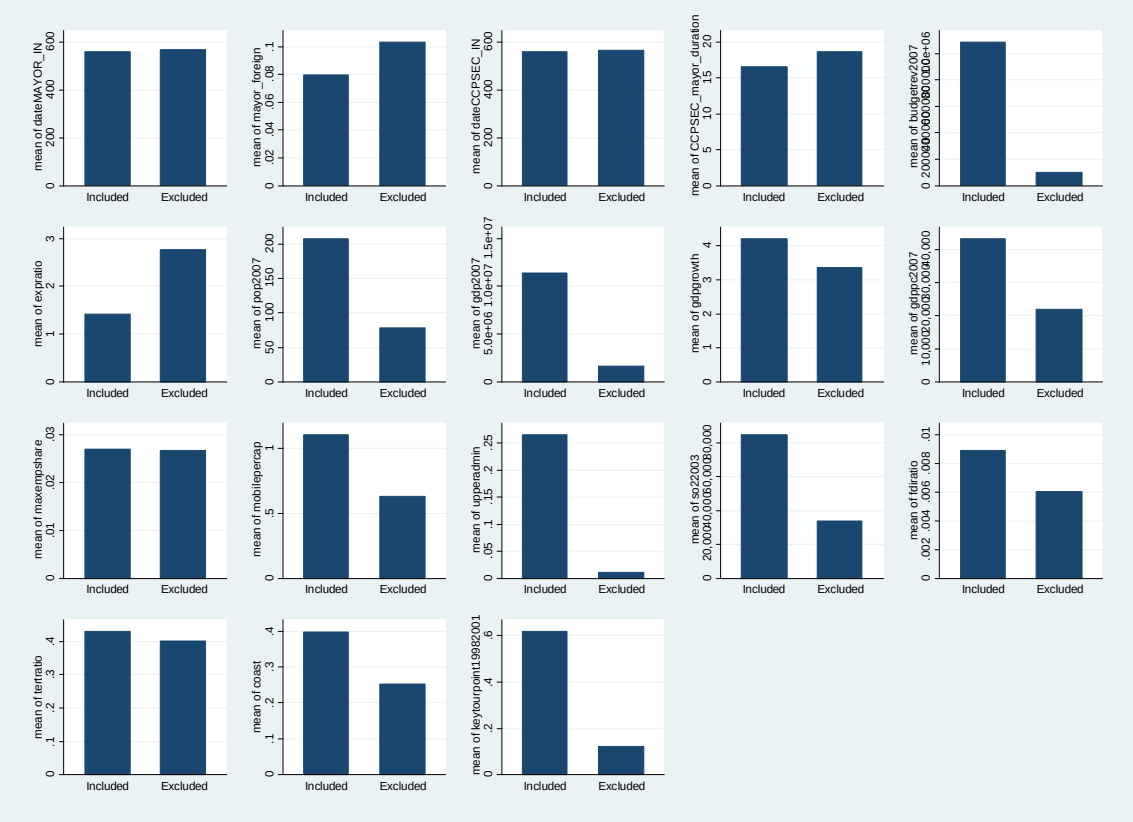


Figure 3: Map of cities included and excluded from the PITI index



Gray dots mark populated points

Figure 3: Main city characteristics (included in PITI versus excluded)



APPENDIX

Table A1 – Summary of key variables

	Obs	Mean	Std. Dev.	Min	Max
PITI score	113	31.065	14.823	10.2	72.9
Mayor tenure (months, as of 2008-12)	287	22.31707	16.88134	0	78
Mayor's date of birth	287	1959/05	49.5 months	1945/10	1968/10
Mayor foreign experience	287	0.094	0.292	0	1
CCP Secretary tenure (months, as of 2008-12)	287	24.11847	20.26641	0	104
Tenure of CCP Sec. as Mayor (0=never Mayor)	287	17.784	21.523	0	106
Budgetary revenue (2007)	286	491807.5	1643347	4078	2.06e+07
Budgetary expenditure ratio (2007)	286	2.230899	1.881525	.8029338	15.53188
Single-firm dominance (1999)	234	.0268408	.0455365	0	.3726322
GDP 2007 [Yuan]	285	5509943	1.20e+07	200977	1.21e+08
GDP 1997 [Yuan]	265	1246767	2294785	15121	2.70e+07
GDP growth 1998-2008 (%)	264	3.730	4.997	-0.307	55.589
GDP per capita (2007) [Yuan]	285	30403.88	20397.59	3836	135728
Ratio of services in GDP	285	0.414	0.107	0.086	0.724
Population (2007) [10,000]	286	129.9151	162.9603	15.3	1526.02
Population (1997) [10,000]	234	110.8885	134.7024	14.55	1127.22
$S0_2$ Emissions	286	977.8112	462.3282	101	2253
FDI ratio	257	-5.706	1.524	-11.038	-3.252
Mobile phones per capita	283	0.821	0.782	0.135	8.683
Coastal province	287	0.310	0.463	0	1
Open coastal city/SEZ/Provincial seat	287	0.160	0.368	0	1
Provincial Capital or Central Municipality	287	0.111	0.315	0	1
Designated Tourism City	287	0.317	0.466	0	1
Latitude (decimal degree)	287	32.898	6.658	18.279	49.967
Longitude (decimal degree)	287	114.023	7.189	84.850	131.132

Table A2: Impact of leadership-level variables on PITI

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	piti	piti	piti	piti	piti	piti	piti
Mayor's tenure (months)	0.322***	0.296***	0.309***	0.305***	0.287***	0.293***	0.278***
	(4.95)	(4.49)	(4.73)	(4.74)	(4.45)	(4.17)	(3.85)
CCP Sec. tenure (months)		0.0405			0.0256		0.0313
		(0.64)			(0.43)		(0.47)
Tenure of CCP Sec. as Mayor		-0.0434			-0.0393		-0.0133
		(-0.68)			(-0.60)		(-0.20)
Pro-PITI			1.807				
			(1.09)				
Anti-PITI			-0.329				
			(-0.23)				
Mayor experience in…							
_Law				7.160+	7.040+	6.795	6.563
				(1.81)	(1.78)	(1.59)	(1.53)
_Environmental protection				4.432	3.706	3.105	2.266
				(0.38)	(0.31)	(0.24)	(0.18)
_Foreign (train or study)				-5.647+	-5.479	-6.753+	-6.849+
				(-1.69)	(-1.56)	(-1.73)	(-1.67)
_Water conservancy						17.26	17.18
						(1.33)	(1.33)
_Medical / Health						-7.977	-8.366
						(-0.75)	(-0.77)
_FDI						2.684	2.613
						(0.74)	(0.71)
_Oil & gas						-14.14	-13.85
						(-1.47)	(-1.40)
_Hydropower/ electricity						5.072	5.557
						(0.80)	(0.81)
_Coal						4.520	4.545
						(0.48)	(0.49)
_Industry						3.226	3.292
						(0.92)	(0.93)
_Engineering						0.788	0.645
						(0.19)	(0.15)
_Corporate						-0.506	-0.406
						(-0.16)	(-0.12)
Constant	211.5***	220.4***	203.4***	201.8***	206.6***	193.6***	203.1***
	(5.76)	(4.77)	(5.47)	(5.53)	(4.46)	(4.83)	(4.08)
Observations	113	113	113	113	113	113	113
R^2	0.1590	0.1659	0.1693	0.2015	0.2059	0.2537	0.2557

t statistics in parentheses

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Resource Windfall and Corruption: Evidence from Peru

Stanislao Maldonado

University of California, Berkeley

Pacific Conference for Development Economics

UC Berkeley

March 12, 2011

1. Research Question

- Main research question:

  How corruption (approached by the demand of bribes by public officials) is affected by changes in local government revenues?

- Empirical problems:
  - **Omitted bias**: E.g. cultural and institutional differences across countries and regions (Fisman and Miguel 2007)
  - **Measurement error**: corruption measures based on opinion leaders surveys (Mauro 1995 and 93.7% of the current literature)
  - **Reverse causality**: feedback effects between corruption and local revenues

- This paper:
  - Controls for cultural and institutional differences by studying a country case.
  - Uses high quality data on a relevant dimension of corruption: payment of bribes to public officials by households.
  - Exploits an exogenous variation in local government revenues to study how corruption (measured by the demand of bribes by public officials) is affected by changes in local government revenues.

2. Research design

- Exploit an interaction between a fiscal rule (**Canon Law**) and a positive shock in international prices of the mineral resources:
  - ***Cross-sectional variation*:**

    Various minerals across districts (districts with and without minerals/districts with different minerals).
  - ***Time variation*:**

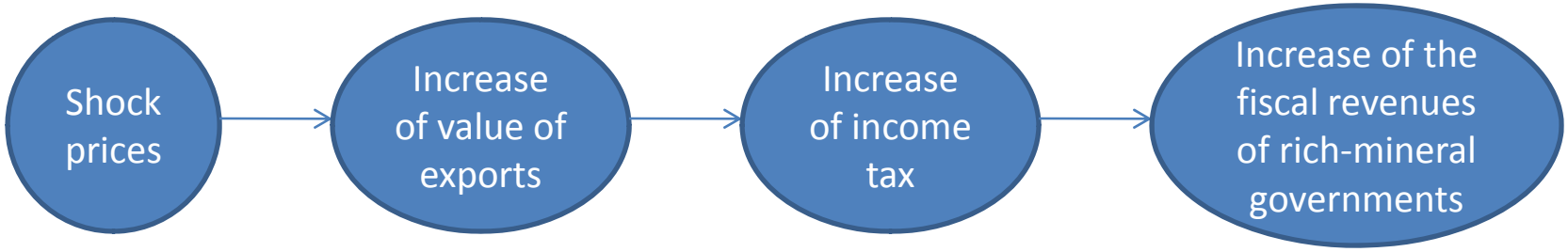
    Movement of international prices of different minerals over time.
- Identification:

  Compare the bribery behavior of public servants from mineral-rich and non mineral-rich local governments, before and after the rise of transfers

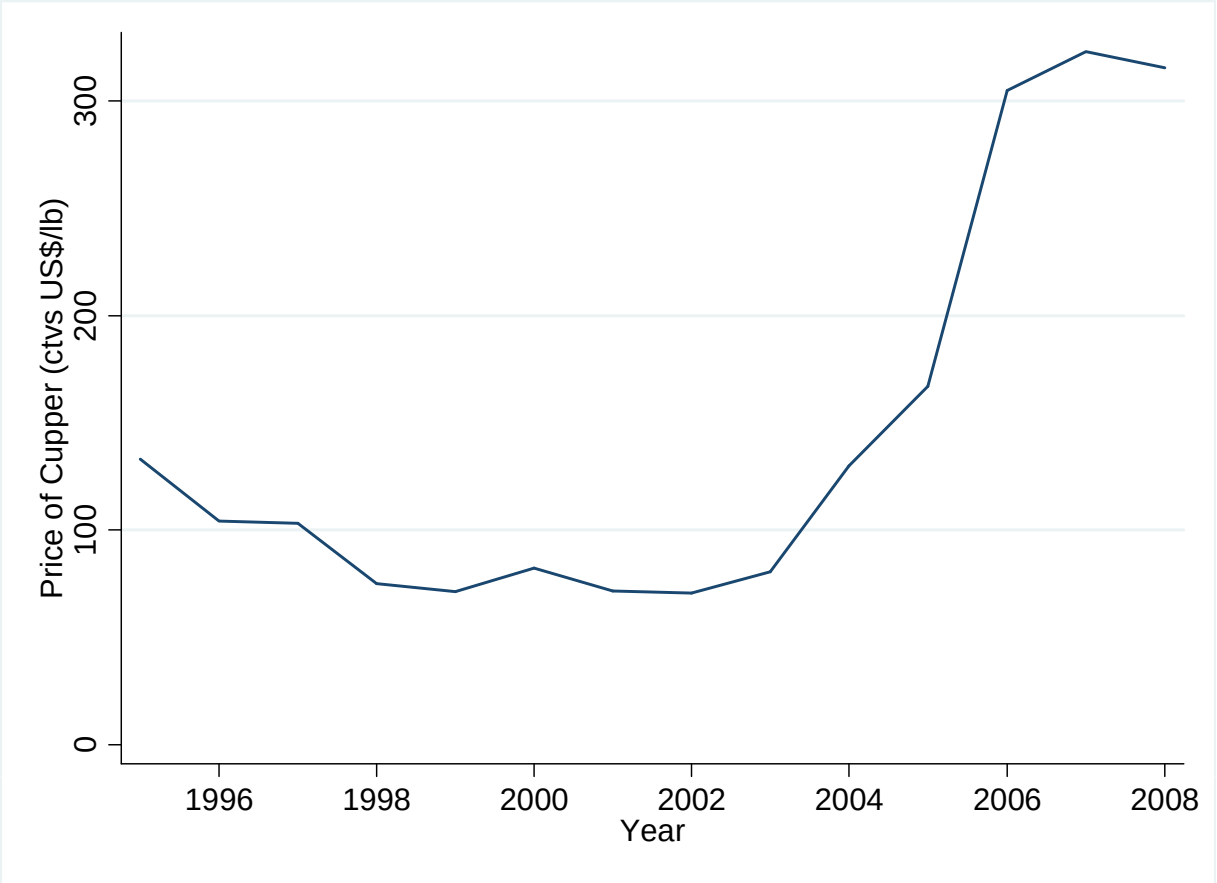
Mining Canon (Law 27506, 2001)

- States that the 50% of income tax paid by mining companies will be allocated to the regional and local governments located in the area where the minerals are extracted
- This amount is distributed between:
  - The regional government (20%)
  - The municipality of the district (10%)
  - The municipalities located in the province (25%)
  - The municipalities located in the region (40%)
  - In addition, a 5% is allocated to the public universities of the region

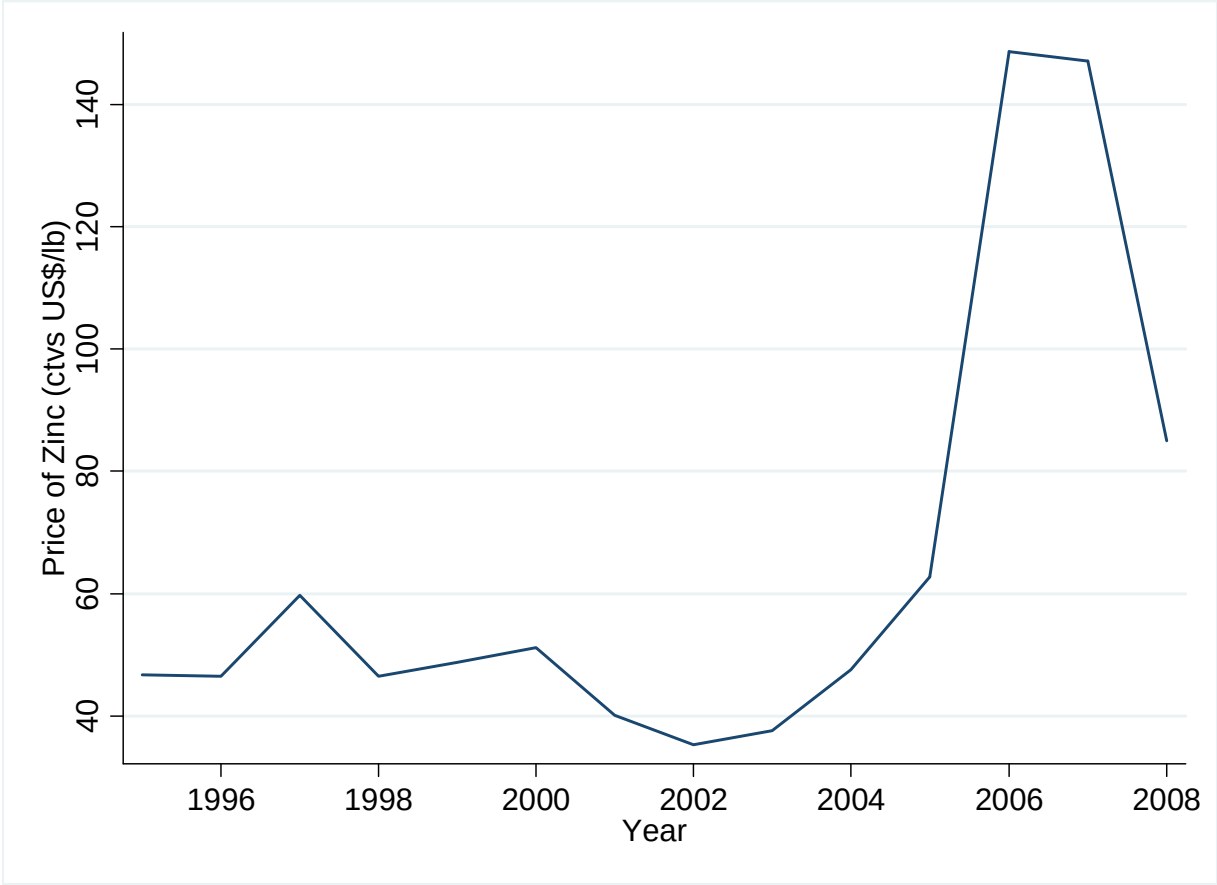
Research design



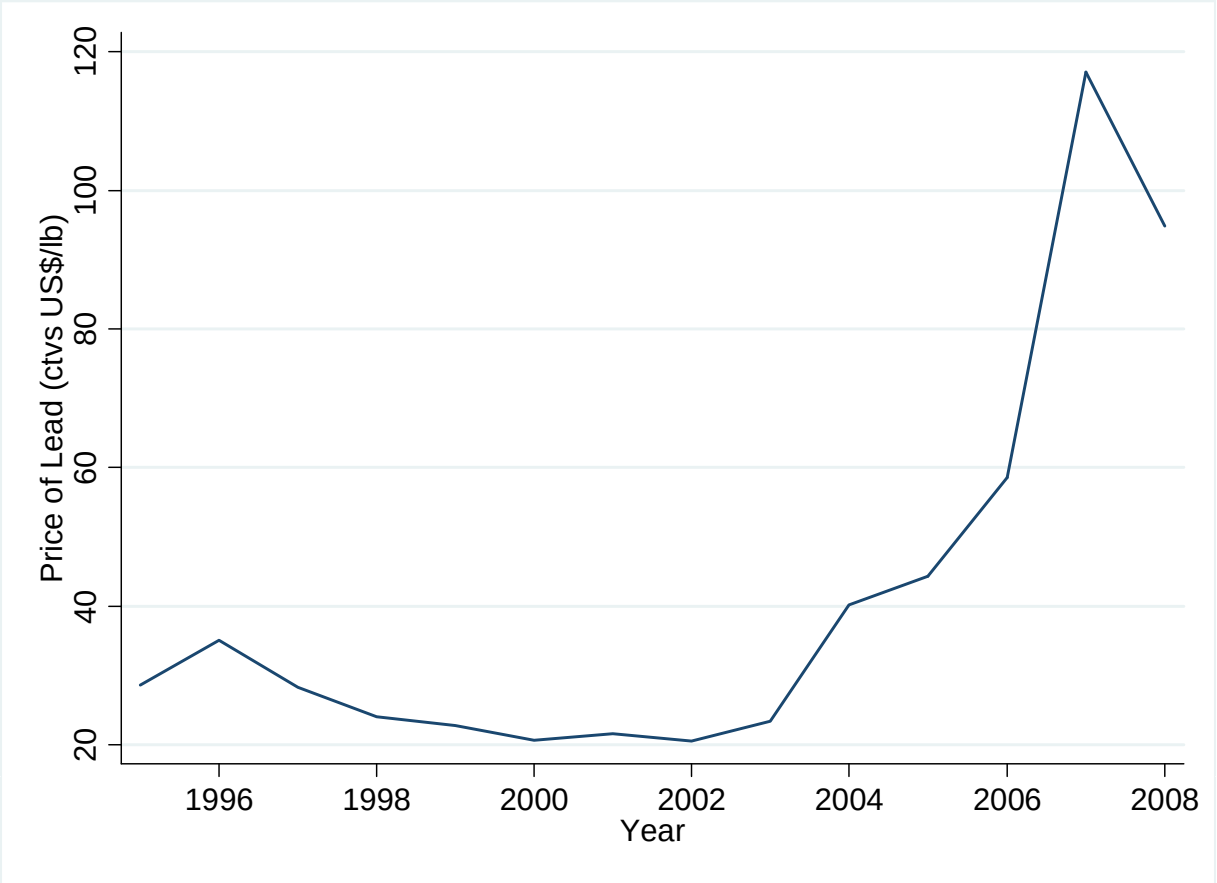
Evolution of international prices of mineral resources: Cupper



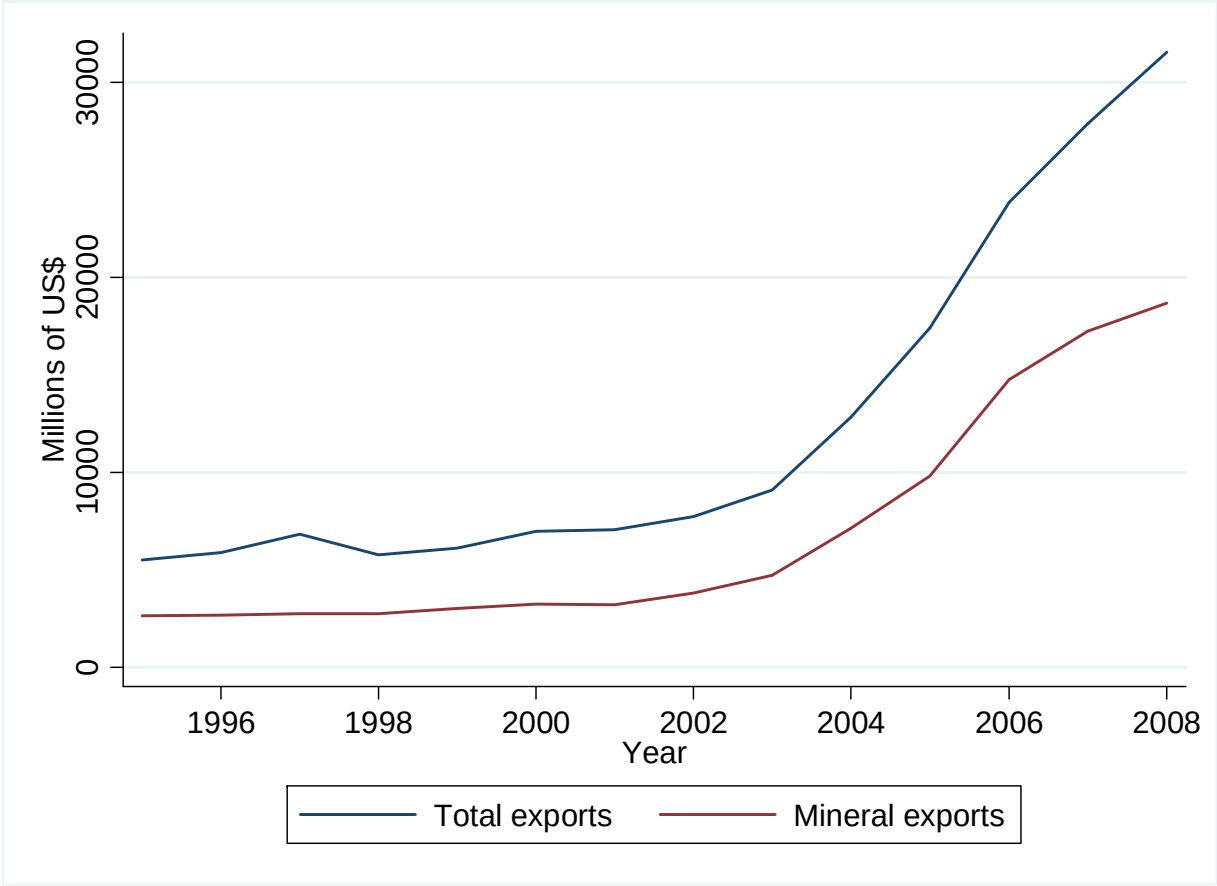
Evolution of international prices of mineral resources: Zinc



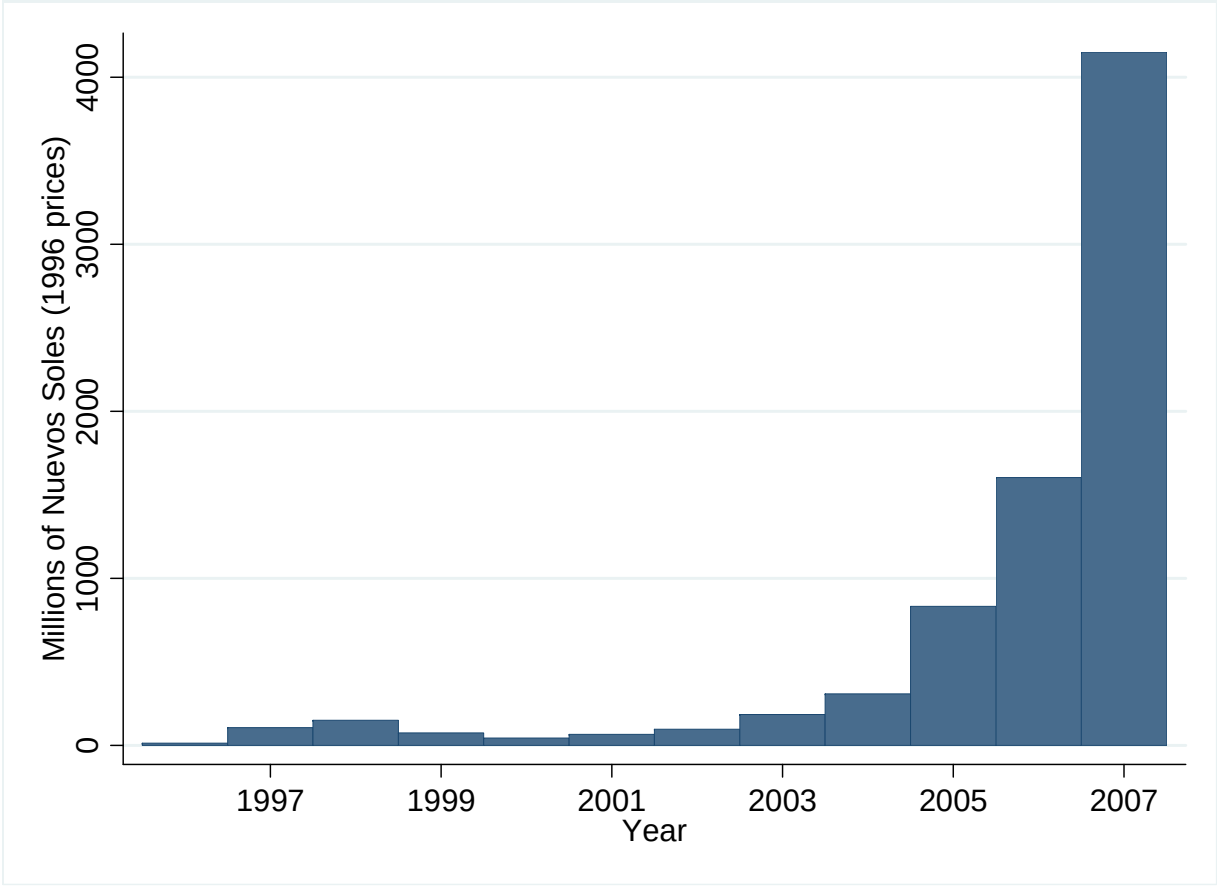
Evolution of international prices of mineral resources: Lead



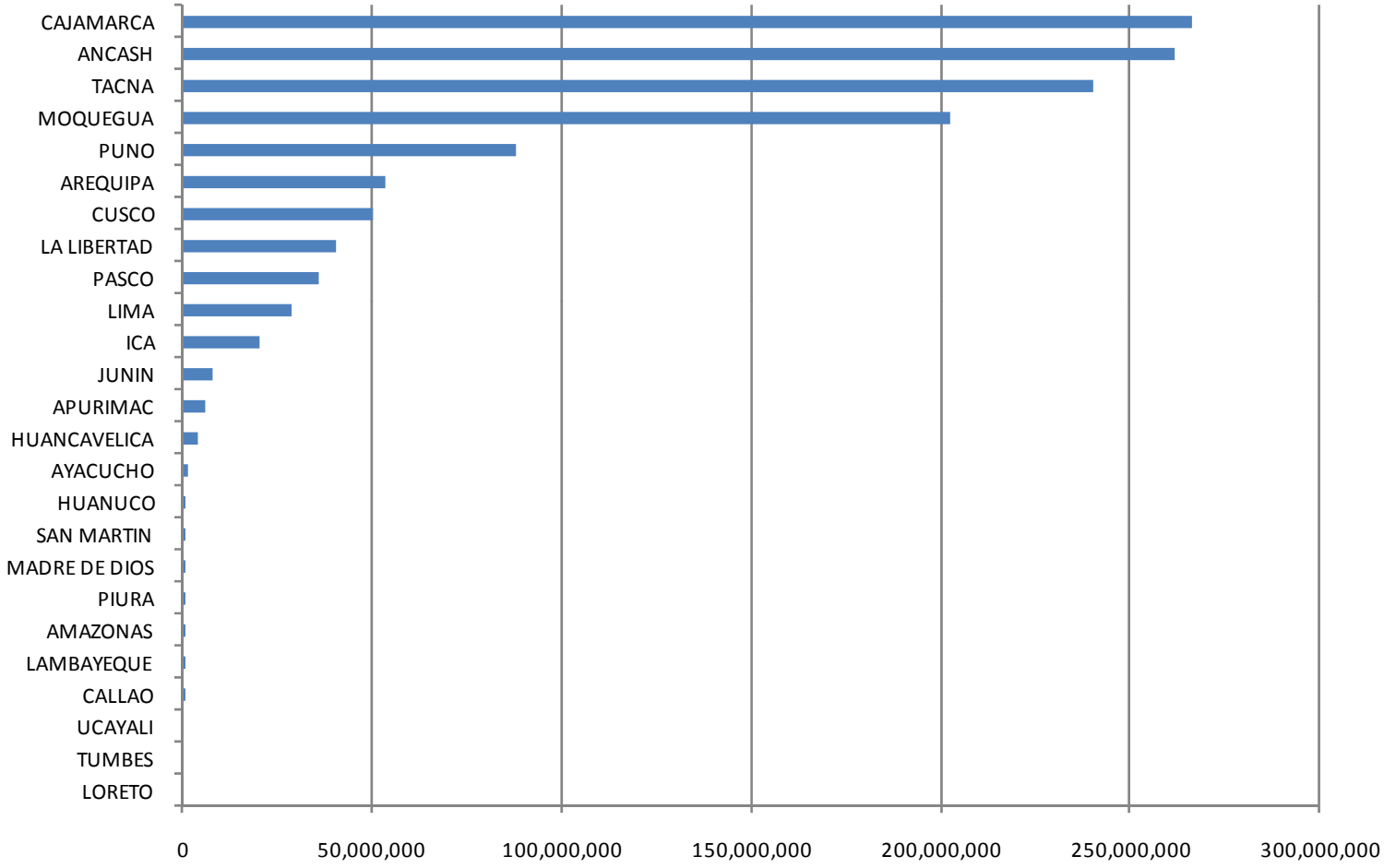
Evolution of total exports and mineral exports



Evolution of transfers to mineral-rich regional and local governments



Mining canon transfers allocation in 2006



Source: MEF

3. Data

- Annual repeated cross-section of household survey (The Encuesta Nacional de Hogares -ENAHO): 2002-2006.
  - Includes a detailed module on payment of bribes by households.
- Annual data about local revenues and transfers from central to local governments (Ministry of Finance): 1998-2006 .
- Annual data on mineral production and prices (Ministry of Energy and Mines): 1998-2008.

Table I: Summary Statistics

	Recipients	Producers	Non-recipients
Transfers			
Mining Canon	266,879	1,090,301	-
p10	432	11,788	-
p25	4,222	41,503	-
p50	34,078	182,260	-
p75	171,706	646,375	-
p90	567,559	1,348,306	-
p99	3,317,754	18,900,000	-
Municipality Revenues	3,502,600	4,066,107	6,387,575
Net Municipality Revenues	3,235,722	2,975,806	6,387,575
Share of Mining Canon	9.63	16.79	0.00
Other Canon Sources			
Oil Canon	65,826	0	894,368
Hydropower Canon	41,717	77,719	0
Forestal Canon	478	2,005	11,071
Fishing Canon	10,976	20,006	6,663
Gas Canon	75,984	13,256	1,613
FOCAM Canon	10,431	11,529	48,292
District Characteristics: Census 1993			
Population	12,339	10,788	22,618
% Rural Population	57.76	55.32	59.08
% Children (0-15 years old)	40.68	40.58	45.14
Malnutrition rates for Children	55.61	53.02	55.64
% Population without wastepipe-latrine	41.81	41.60	53.91
% Population without water	51.20	49.84	67.13
% Population without electricity	74.16	65.27	68.55
Female illiteracy rate	33.60	29.39	23.90
Altitude	2,326	2,720	498

4. Empirical model and results: Differences-in-differences

- The DD empirical specification:

$$y_{ijt} = \alpha_j + \lambda_t + \beta(Canon_{jt}.HighP_t) + X'_{ijt}\delta + \varepsilon_{ijt}$$

Where:

y_{ijt} : Outcome of interest for household i in district j.

$Canon_{jt}$: Treated districts (Mining Canon beneficiaries /Mineral Producers).

$HighP_t$: Dummy =1 for high mineral prices period.

X_{ijt} : Household and district level characteristics in period t.

- β recovers causal effect of interest under standard DD assumptions.

- Generalization of standard 2 periods-2 groups DD approach (see Bertrand et al 2004 and Hansen 2007)
- Two specifications of treatment variable:
  - Any HH located in a benefited districts (70%)
  - Any HH located in producer districts (15%)
- Standard errors were clustered at district level using the generalization of the White's robust covariance matrix developed by Liang and Zeager (1986)

- The extended DD empirical specification (heterogeneous effects):

$$y_{ijt} = \alpha_j + \lambda_t + \beta(Canon_{jt}.HighP_t) + \delta_1(Canon_{jt}.MostBen_j)$$
$$+\delta_2(MostBen_j.HighP) + \delta_3(Canon_{jt}.HighP.MostBen_j) + X'_{ijt}\gamma + \varepsilon_{ijt}$$

Where:

$MostBen_j$: Dummy =1 for most benefited areas (Ancash, Cajamarca, Moquegua and Tacna).

- δ_3 recovers causal effect for the most benefited areas.

Empirical Results: DD for Canon recipients

Table II: Impact of Mining Canon Transfers in the Probability of a Bribery Episode in Local Governments

	Difference in Differences Estimates				
	(1)	(2)	(3)	(4)	(5)
	Dependent variable: 1=If bribery episode in the municipal				
Treatment (1= Canon receiver after increase of prices)	-0.010	-0.015**	-0.015**	-0.013*	-0.014*
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Mineral producer					0.022
					(0.029)
Constant	0.065***	0.433***	0.430***	0.395**	0.400**
	(0.005)	(0.165)	(0.165)	(0.166)	(0.166)
Transfer controls	No	Yes	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	Yes
Household level controls	No	No	No	Yes	Yes
Mean dependent variable			0.03		
Observations	23,662	22,580	22,580	22,484	22,484
R-Squared	0.011	0.012	0.012	0.013	0.014

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district level.

Empirical results: DD Canon receivers

Table II: Impact of Mining Canon Transfers in the Probability of a Bribery Episode in Local Governments

	Difference in Differences Estimates				
	(1)	(2)	(3)	(4)	(5)
	Dependent variable: 1=If bribery episode in the municipal				
Treatment (1= Canon receiver after increase of prices)	-0.010	-0.015**	-0.015**	-0.013*	-0.014*
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Mineral producer					0.022
					(0.029)
Constant	0.065***	0.433***	0.430***	0.395**	0.400**
	(0.005)	(0.165)	(0.165)	(0.166)	(0.166)
Transfer controls	No	Yes	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	Yes
Household level controls	No	No	No	Yes	Yes
Mean dependent variable			0.03		
Observations	23,662	22,580	22,580	22,484	22,484
R-Squared	0.011	0.012	0.012	0.013	0.014

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district level.

Empirical Results: DD for mineral producers

Table III: Impact of Mining Canon Transfers in the Probability of a Bribery Episode in Local Governments (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If bribery episode in the municipal government							
Treatment (1= Producer district after increase of prices)	-0.020*	-0.020*	-0.020*	-0.020*	-0.027**	-0.028**	-0.027**	-0.027**
	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)
Mineral producer*Most Benefited Area					-0.002	-0.002	-0.002	-0.001
					(0.012)	(0.011)	(0.011)	(0.011)
After increase prices*Most Benefited Area					0.008*	0.012*	0.012*	0.013*
					(0.005)	(0.006)	(0.006)	(0.007)
Mineral producer*After increase prices*Most Benefited Area					0.047**	0.045***	0.045***	0.043**
					(0.019)	(0.017)	(0.017)	(0.017)
Constant	0.065***	0.414**	0.411**	0.380**	0.065***	0.384**	0.381**	0.350**
	(0.005)	(0.167)	(0.167)	(0.167)	(0.005)	(0.166)	(0.166)	(0.166)
Transfers controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.03							
Observations	23,662	22,580	22,580	22,484	22,484	22,580	22,580	22,484
R-Squared	0.011	0.012	0.012	0.013	0.014	0.012	0.012	0.014

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district.

Empirical results: DD mineral producers

Table III: Impact of Mining Canon Transfers in the Probability of a Bribery Episode in Local Governments (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If bribery episode in the municipal government							
Treatment (1= Producer district after increase of prices)	-0.020*	-0.020*	-0.020*	-0.020*	-0.027**	-0.028**	-0.027**	-0.027**
	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)
Mineral producer*Most Benefited Area					-0.002	-0.002	-0.002	-0.001
					(0.012)	(0.011)	(0.011)	(0.011)
After increase prices*Most Benefited Area					0.008*	0.012*	0.012*	0.013*
					(0.005)	(0.006)	(0.006)	(0.007)
Mineral producer*After increase prices*Most Benefited Area					0.047**	0.045***	0.045***	0.043**
					(0.019)	(0.017)	(0.017)	(0.017)
Constant	0.065***	0.414**	0.411**	0.380**	0.065***	0.384**	0.381**	0.350**
	(0.005)	(0.167)	(0.167)	(0.167)	(0.005)	(0.166)	(0.166)	(0.166)
Transfers controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.03							
Observations	23,662	22,580	22,580	22,484	22,484	22,580	22,580	22,484
R-Squared	0.011	0.012	0.012	0.013	0.014	0.012	0.012	0.014

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district.

Empirical results: DD mineral producers

Table III: Impact of Mining Canon Transfers in the Probability of a Bribery Episode in Local Governments (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If bribery episode in the municipal government							
Treatment (1= Producer district after increase of prices)	-0.020*	-0.020*	-0.020*	-0.020*	-0.027**	-0.028**	-0.027**	-0.027**
	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)
Mineral producer*Most Benefited Area					-0.002	-0.002	-0.002	-0.001
					(0.012)	(0.011)	(0.011)	(0.011)
After increase prices*Most Benefited Area					0.008*	0.012*	0.012*	0.013*
					(0.005)	(0.006)	(0.006)	(0.007)
Mineral producer*After increase prices*Most Benefited Area					0.047**	0.045***	0.045***	0.043**
					(0.019)	(0.017)	(0.017)	(0.017)
Constant	0.065***	0.414**	0.411**	0.380**	0.065***	0.384**	0.381**	0.350**
	(0.005)	(0.167)	(0.167)	(0.167)	(0.005)	(0.166)	(0.166)	(0.166)
Transfers controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.03							
Observations	23,662	22,580	22,580	22,484	22,484	22,580	22,580	22,484
R-Squared	0.011	0.012	0.012	0.013	0.014	0.012	0.012	0.014

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district.

Empirical model and results: Instrumental variables

- The empirical IV specification:

$$y_{ijt} = \alpha_j + \lambda_t + \beta R_{jt} + X'_{ijt}\delta + \varepsilon_{ijt}$$

Where:

y_{ijt} : outcome of interest for individual/household i in district j.

α_j : district fixed-effects.

λ_t : time fixed-effects.

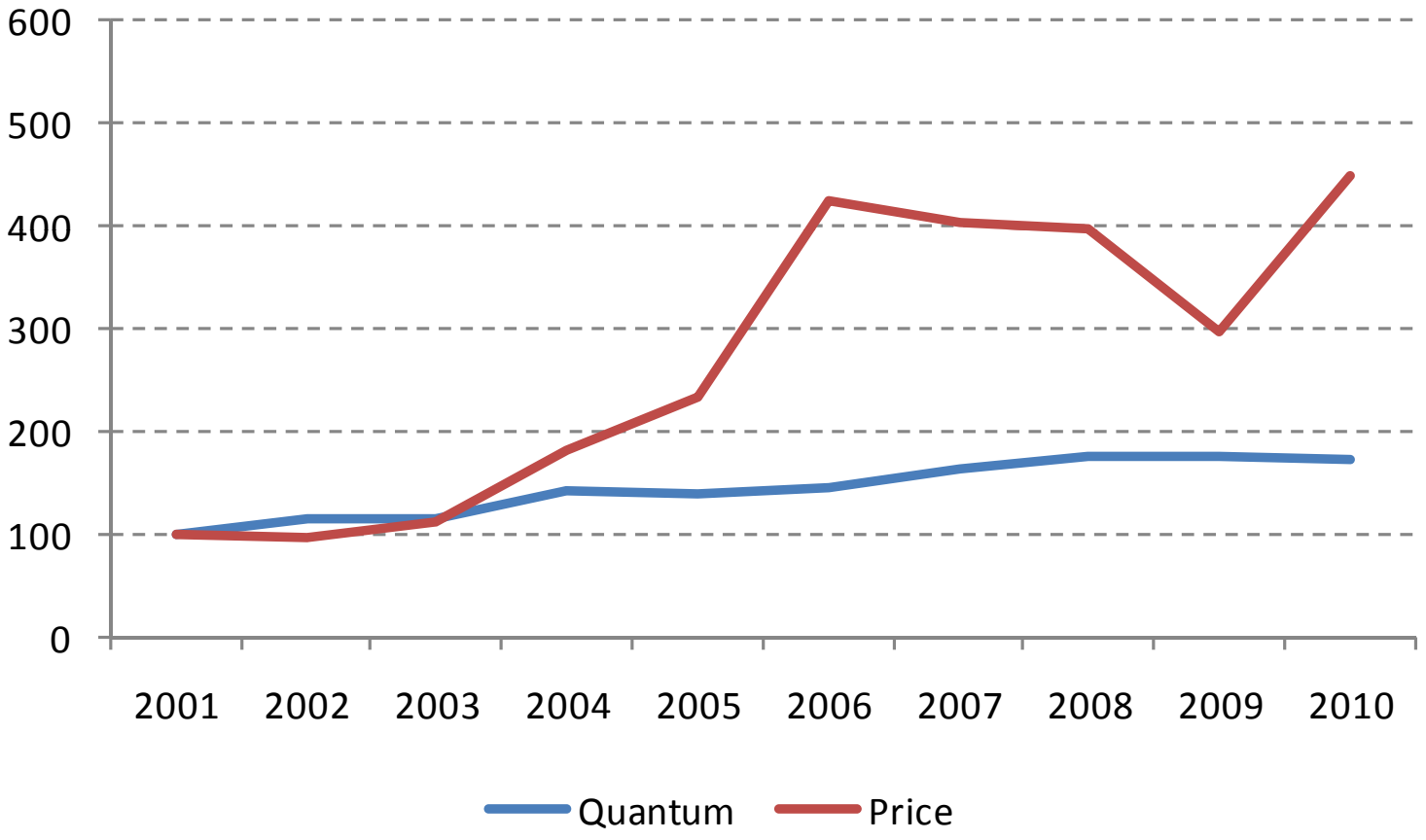
R_{jt} : measure of revenues allocated to the district j in period t.

X_{ijt} : individual/household and district level characteristics in period t.

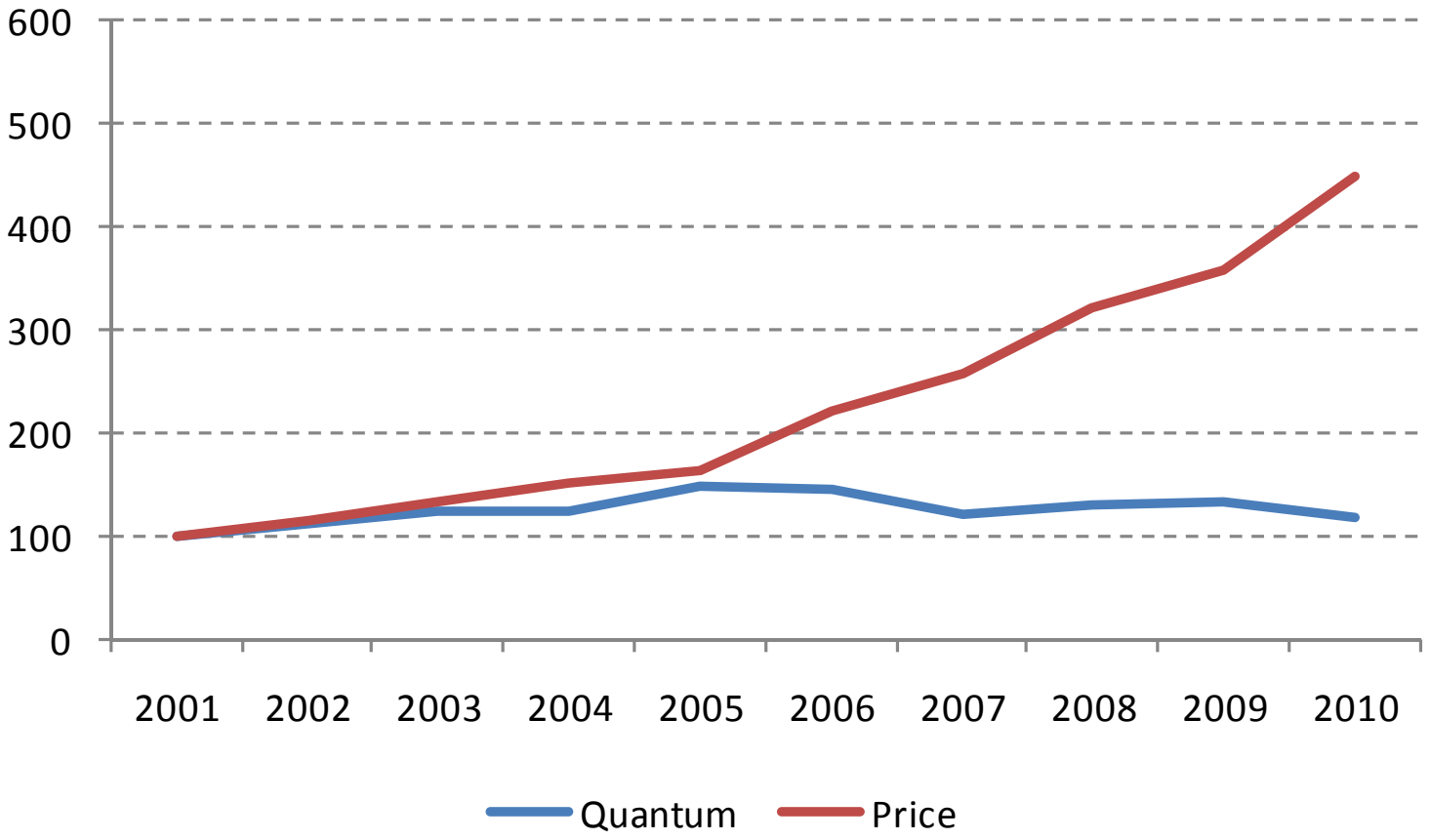
- IV approach: R_{jt} is instrumented with C_{jt}

- Validity of exclusion restriction:
  - Mining canon transfers only affect the corruption measure through its effect on local revenues.
  - The change of prices affected basically fiscal revenues and not production levels.
  - Mining lacks of linkages with other sectors of the economy and only employs 1% of the labor force.

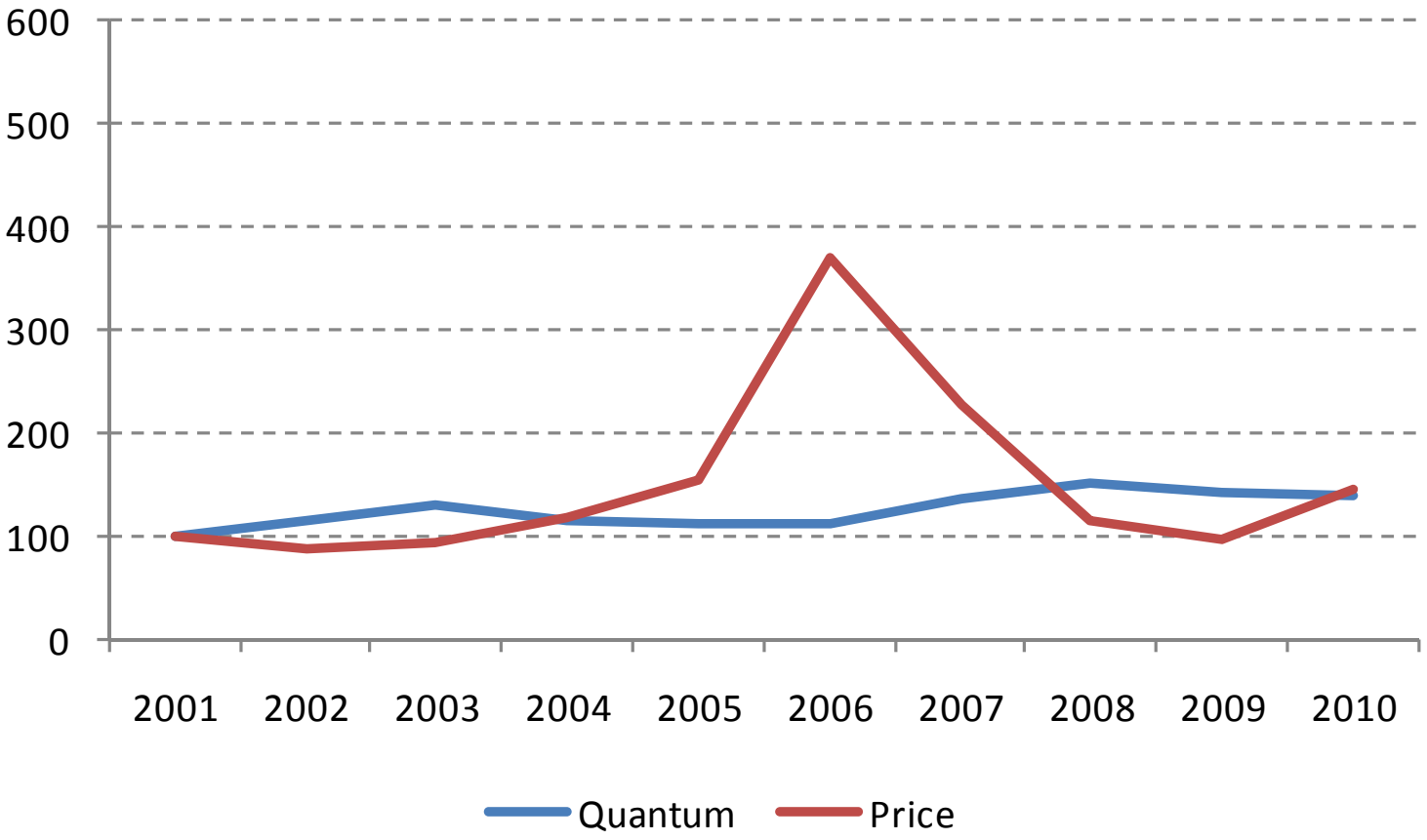
Evolution of quantum and prices of copper



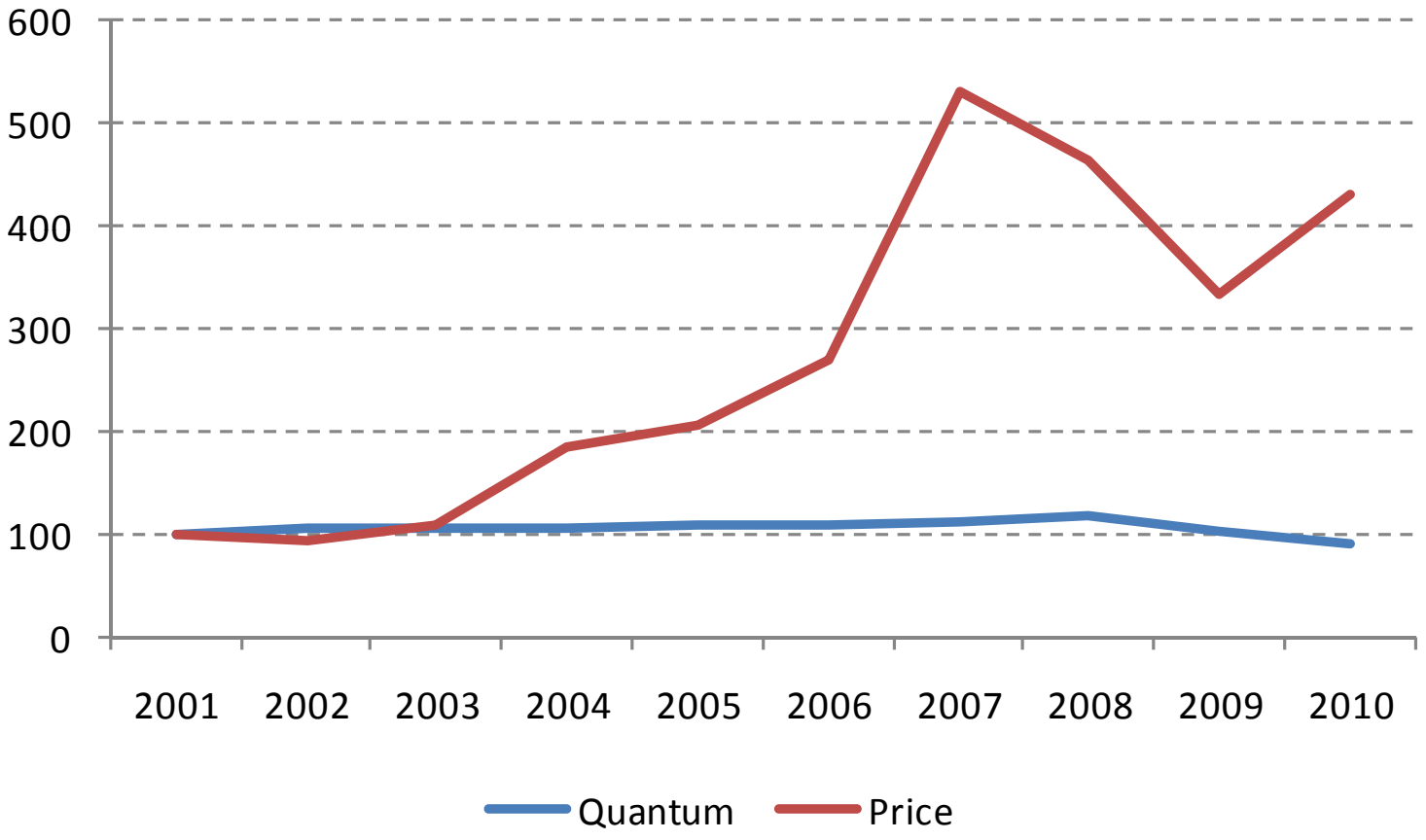
Evolution of quantum and prices of gold



Evolution of quantum and prices of zinc



Evolution of quantum and prices of lead



Empirical Results (IV: First Stage)

Table IV: The Impact of Mining Canon Transfers on Local Government Revenues

	First Stage				
	(1)	(2)	(3)	(4)	(5)
	Total Revenues (Million of New Soles)				
Mining Canon (Million of New Soles)	1.876***	1.868***	1.868***	1.867***	1.867***
	(0.078)	(0.076)	(0.076)	(0.077)	(0.077)
F-value	175.81	146.94	138.26	91.66	81.52
Transfers controls	No	Yes	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	Yes
Household level controls	No	No	No	Yes	Yes
Household's head controls	No	No	No	No	Yes
Observations	22546	22546	22546	22450	22425
R-Squared	0.532	0.542	0.542	0.541	0.541

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district.

Table IV: The Impact of Mining Canon Transfers on Local Government Revenues

	First Stage				
	(1)	(2)	(3)	(4)	(5)
	Total Revenues (Million of New Soles)				
Mining Canon (Million of New Soles)	1.876***	1.868***	1.868***	1.867***	1.867***
	(0.078)	(0.076)	(0.076)	(0.077)	(0.077)
F-value	175.81	146.94	138.26	91.66	81.52
Transfers controls	No	Yes	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	Yes
Household level controls	No	No	No	Yes	Yes
Household's head controls	No	No	No	No	Yes
Observations	22546	22546	22546	22450	22425
R-Squared	0.532	0.542	0.542	0.541	0.541

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district.

Table IV: The Impact of Mining Canon Transfers on Local Government Revenues

	First Stage				
	(1)	(2)	(3)	(4)	(5)
	Total Revenues (Million of New Soles)				
Mining Canon (Million of New Soles)	1.876***	1.868***	1.868***	1.867***	1.867***
	(0.078)	(0.076)	(0.076)	(0.077)	(0.077)
F-value	175.81	146.94	138.26	91.66	81.52
Transfers controls	No	Yes	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	Yes
Household level controls	No	No	No	Yes	Yes
Household's head controls	No	No	No	No	Yes
Observations	22546	22546	22546	22450	22425
R-Squared	0.532	0.542	0.542	0.541	0.541

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district.

Empirical Results (IV and Reduced Form)

Table V: The Impact of Local Government Revenues on Corruption

	IV-2SLS				Reduced Form			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Bribery episode in the municipal government				Bribery episode in the municipal government			
Total Revenues (Million of New Soles)	0.0003***	0.0003***	0.0003***	0.0003***				
	(0.0001)	(0.0001)	(0.0001)	(0.0001)				
Mining Canon (Million of New Soles)					0.001***	0.001***	0.001***	0.001***
					(0.0002)	(0.0002)	(0.0002)	(0.0002)
Constant					0.428**	0.424**	0.396**	0.408**
					(0.169)	(0.169)	(0.169)	(0.170)
Transfer controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Household level controls	No	No	Yes	Yes	No	No	Yes	Yes
Household's head controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.03							
Observations	22,546	22,546	22,450	22,425	22,580	22,580	22,484	22,459
R-Squared	0.012	0.012	0.013	0.015	0.012	0.012	0.013	0.015

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district.

Table V: The Impact of Local Government Revenues on Corruption

	IV-2SLS				Reduced Form			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Bribery episode in the municipal government				Bribery episode in the municipal government			
Total Revenues (Million of New Soles)	0.0003***	0.0003***	0.0003***	0.0003***				
	(0.0001)	(0.0001)	(0.0001)	(0.0001)				
Mining Canon (Million of New Soles)					0.001***	0.001***	0.001***	0.001***
					(0.0002)	(0.0002)	(0.0002)	(0.0002)
Constant					0.428**	0.424**	0.396**	0.408**
					(0.169)	(0.169)	(0.169)	(0.170)
Transfer controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Household level controls	No	No	Yes	Yes	No	No	Yes	Yes
Household's head controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.03							
Observations	22,546	22,546	22,450	22,425	22,580	22,580	22,484	22,459
R-Squared	0.012	0.012	0.013	0.015	0.012	0.012	0.013	0.015

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district.

Table V: The Impact of Local Government Revenues on Corruption

	IV-2SLS				Reduced Form			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Bribery episode in the municipal government				Bribery episode in the municipal government			
Total Revenues (Million of New Soles)	0.0003***	0.0003***	0.0003***	0.0003***				
	(0.0001)	(0.0001)	(0.0001)	(0.0001)				
Mining Canon (Million of New Soles)					0.001***	0.001***	0.001***	0.001***
					(0.0002)	(0.0002)	(0.0002)	(0.0002)
Constant					0.428**	0.424**	0.396**	0.408**
					(0.169)	(0.169)	(0.169)	(0.170)
Transfer controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Household level controls	No	No	Yes	Yes	No	No	Yes	Yes
Household's head controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.03							
Observations	22,546	22,546	22,450	22,425	22,580	22,580	22,484	22,459
R-Squared	0.012	0.012	0.013	0.015	0.012	0.012	0.013	0.015

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district.

5. Robustness

- Placebo tests:
  - Basic idea: only public officials working for the treated municipalities should be affected by the treatment
  - No effect on public officials whose wages are decided by central government (police, judiciary, teachers, etc) working in the treated areas should be expected.
- Validity of exclusion restriction:
  - Mining canon transfers should affect corruption only through its effect on local revenues
  - No direct effect of Mining canon transfers on incomes should be expected.

Placebo test: Judiciary workers

Table VI: Placebo Test

Impact of Mining Canon Transfers in the Probability of a Bribery Episode in the Judiciary (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If bribery episode in the Judiciary							
Treatment (1= Producer district after increase of prices)	-0.010	-0.005	-0.004	-0.007	-0.018	-0.007	-0.006	-0.010
	(0.053)	(0.054)	(0.055)	(0.055)	(0.060)	(0.062)	(0.063)	(0.063)
Mineral producer*Most Benefited Area					0.052	0.042	0.042	0.053
					(0.135)	(0.147)	(0.148)	(0.144)
After increase prices*Most Benefited Area					-0.063***	-0.063**	-0.062**	-0.063**
					(0.024)	(0.029)	(0.029)	(0.029)
Mineral producer*After increase prices*Most Benefited Area					0.024	0.010	0.008	0.008
					(0.145)	(0.157)	(0.158)	(0.156)
Constant	0.168***	0.535	0.567	0.506	0.168***	0.590	0.621	0.563
	(0.012)	(0.659)	(0.655)	(0.690)	(0.011)	(0.654)	(0.652)	(0.688)
Transfer controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.12							
Observations	3,322	3,215	3,215	3,198	3,322	3,215	3,215	3,198
R-Squared	0.021	0.024	0.025	0.027	0.022	0.025	0.026	0.028

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district level.

Table VI: Placebo Test

Impact of Mining Canon Transfers in the Probability of a Bribery Episode in the Judiciary (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If bribery episode in the Judiciary							
Treatment (1= Producer district after increase of prices)	-0.010	-0.005	-0.004	-0.007	-0.018	-0.007	-0.006	-0.010
	(0.053)	(0.054)	(0.055)	(0.055)	(0.060)	(0.062)	(0.063)	(0.063)
Mineral producer*Most Benefited Area					0.052	0.042	0.042	0.053
					(0.135)	(0.147)	(0.148)	(0.144)
After increase prices*Most Benefited Area					-0.063***	-0.063**	-0.062**	-0.063**
					(0.024)	(0.029)	(0.029)	(0.029)
Mineral producer*After increase prices*Most Benefited Area					0.024	0.010	0.008	0.008
					(0.145)	(0.157)	(0.158)	(0.156)
Constant	0.168***	0.535	0.567	0.506	0.168***	0.590	0.621	0.563
	(0.012)	(0.659)	(0.655)	(0.690)	(0.011)	(0.654)	(0.652)	(0.688)
Transfer controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.12							
Observations	3,322	3,215	3,215	3,198	3,322	3,215	3,215	3,198
R-Squared	0.021	0.024	0.025	0.027	0.022	0.025	0.026	0.028

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district level.

Table VI: Placebo Test

Impact of Mining Canon Transfers in the Probability of a Bribery Episode in the Judiciary (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If bribery episode in the Judiciary							
Treatment (1= Producer district after increase of prices)	-0.010	-0.005	-0.004	-0.007	-0.018	-0.007	-0.006	-0.010
	(0.053)	(0.054)	(0.055)	(0.055)	(0.060)	(0.062)	(0.063)	(0.063)
Mineral producer*Most Benefited Area					0.052	0.042	0.042	0.053
					(0.135)	(0.147)	(0.148)	(0.144)
After increase prices*Most Benefited Area					-0.063***	-0.063**	-0.062**	-0.063**
					(0.024)	(0.029)	(0.029)	(0.029)
Mineral producer*After increase prices*Most Benefited Area					0.024	0.010	0.008	0.008
					(0.145)	(0.157)	(0.158)	(0.156)
Constant	0.168***	0.535	0.567	0.506	0.168***	0.590	0.621	0.563
	(0.012)	(0.659)	(0.655)	(0.690)	(0.011)	(0.654)	(0.652)	(0.688)
Transfer controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.12							
Observations	3,322	3,215	3,215	3,198	3,322	3,215	3,215	3,198
R-Squared	0.021	0.024	0.025	0.027	0.022	0.025	0.026	0.028

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district level.

Placebo test: Police

Table VII: Placebo Test

Impact of Mining Canon Transfers in the Probability of a Bribery Episode in the Police Station (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If bribery episode in the Police Station							
Treatment (1= Producer district after increase of prices)	-0.011	0.000	0.000	0.003	-0.019	-0.010	-0.010	-0.005
	(0.045)	(0.044)	(0.044)	(0.046)	(0.051)	(0.052)	(0.052)	(0.054)
Mineral producer*Most Benefited Area					0.082	0.045	0.043	0.059
					(0.057)	(0.048)	(0.048)	(0.069)
After increase prices*Most Benefited Area					-0.046	-0.092*	-0.092*	-0.097**
					(0.064)	(0.052)	(0.052)	(0.049)
Mineral producer*After increase prices*Most Benefited Area					0.025	0.062	0.064	0.049
					(0.085)	(0.069)	(0.069)	(0.083)
Constant	0.320***	0.650	0.675	0.826	0.318***	0.743	0.765	0.919
	(0.016)	(0.994)	(0.992)	(0.999)	(0.016)	(0.986)	(0.984)	(0.989)
Transfer controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.34							
Observations	4,437	4,298	4,298	4,269	4,437	4,298	4,298	4,269
R-Squared	0.006	0.010	0.010	0.032	0.007	0.010	0.011	0.033

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district level.

Table VII: Placebo Test

Impact of Mining Canon Transfers in the Probability of a Bribery Episode in the Police Station (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If bribery episode in the Police Station							
Treatment (1= Producer district after increase of prices)	-0.011	0.000	0.000	0.003	-0.019	-0.010	-0.010	-0.005
	(0.045)	(0.044)	(0.044)	(0.046)	(0.051)	(0.052)	(0.052)	(0.054)
Mineral producer*Most Benefited Area					0.082	0.045	0.043	0.059
					(0.057)	(0.048)	(0.048)	(0.069)
After increase prices*Most Benefited Area					-0.046	-0.092*	-0.092*	-0.097**
					(0.064)	(0.052)	(0.052)	(0.049)
Mineral producer*After increase prices*Most Benefited Area					0.025	0.062	0.064	0.049
					(0.085)	(0.069)	(0.069)	(0.083)
Constant	0.320***	0.650	0.675	0.826	0.318***	0.743	0.765	0.919
	(0.016)	(0.994)	(0.992)	(0.999)	(0.016)	(0.986)	(0.984)	(0.989)
Transfer controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.34							
Observations	4,437	4,298	4,298	4,269	4,437	4,298	4,298	4,269
R-Squared	0.006	0.010	0.010	0.032	0.007	0.010	0.011	0.033

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district level.

Table VII: Placebo Test

Impact of Mining Canon Transfers in the Probability of a Bribery Episode in the Police Station (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If bribery episode in the Police Station							
Treatment (1= Producer district after increase of prices)	-0.011	0.000	0.000	0.003	-0.019	-0.010	-0.010	-0.005
	(0.045)	(0.044)	(0.044)	(0.046)	(0.051)	(0.052)	(0.052)	(0.054)
Mineral producer*Most Benefited Area					0.082	0.045	0.043	0.059
					(0.057)	(0.048)	(0.048)	(0.069)
After increase prices*Most Benefited Area					-0.046	-0.092*	-0.092*	-0.097**
					(0.064)	(0.052)	(0.052)	(0.049)
Mineral producer*After increase prices*Most Benefited Area					0.025	0.062	0.064	0.049
					(0.085)	(0.069)	(0.069)	(0.083)
Constant	0.320***	0.650	0.675	0.826	0.318***	0.743	0.765	0.919
	(0.016)	(0.994)	(0.992)	(0.999)	(0.016)	(0.986)	(0.984)	(0.989)
Transfer controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.34							
Observations	4,437	4,298	4,298	4,269	4,437	4,298	4,298	4,269
R-Squared	0.006	0.010	0.010	0.032	0.007	0.010	0.011	0.033

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district level.

Placebo test: Pre-trends assumption

Table VIII: Placebo Test

Impact of Mining Canon Transfers on the Probability of a Bribery Episode in Local Governments (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If bribery episode in the municipal government							
Placebo Treatment (1= Producer district after increase of prices)	0.016	0.013	0.013	0.013	0.002	-0.003	-0.003	-0.004
	(0.013)	(0.014)	(0.014)	(0.014)	(0.022)	(0.023)	(0.023)	(0.023)
Mineral producer*After increase prices*Most Benefited Area					0.012	0.013	0.013	0.017
					(0.025)	(0.027)	(0.027)	(0.026)
Constant	0.031***	0.847***	0.844***	0.855***	0.065***	0.413	0.413	0.370
	(0.001)	(0.139)	(0.140)	(0.139)	(0.005)	(0.367)	(0.367)	(0.362)
Transfers controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.04							
Observations	23,662	22,580	22,580	22,484	12,855	12,214	12,214	12,161
R-Squared	0.001	0.010	0.010	0.011	0.009	0.009	0.009	0.011

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district.

Table VIII: Placebo Test

Impact of Mining Canon Transfers on the Probability of a Bribery Episode in Local Governments (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If bribery episode in the municipal government							
Placebo Treatment (1= Producer district after increase of prices)	0.016	0.013	0.013	0.013	0.002	-0.003	-0.003	-0.004
	(0.013)	(0.014)	(0.014)	(0.014)	(0.022)	(0.023)	(0.023)	(0.023)
Mineral producer*After increase prices*Most Benefited Area					0.012	0.013	0.013	0.017
					(0.025)	(0.027)	(0.027)	(0.026)
Constant	0.031***	0.847***	0.844***	0.855***	0.065***	0.413	0.413	0.370
	(0.001)	(0.139)	(0.140)	(0.139)	(0.005)	(0.367)	(0.367)	(0.362)
Transfers controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
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	(0.013)	(0.014)	(0.014)	(0.014)	(0.022)	(0.023)	(0.023)	(0.023)
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					(0.025)	(0.027)	(0.027)	(0.026)
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	(0.001)	(0.139)	(0.140)	(0.139)	(0.005)	(0.367)	(0.367)	(0.362)
Transfers controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.04							
Observations	23,662	22,580	22,580	22,484	12,855	12,214	12,214	12,161
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Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district.

Exclusion restriction: Impact on incomes

Table IX: Validity of the Exclusion Restriction

Impact of Mining Canon Transfers in Household Per-capita Incomes (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: Household Per-capita Incomes							
Treatment (1= Producer district after increase of prices)	28.150	21.896	23.651	14.029	32.726	23.772	26.398	14.998
	(19.337)	(21.084)	(22.033)	(21.912)	(22.252)	(24.802)	(25.870)	(25.985)
Mineral producer*Most Benefited Area					-14.605	-29.608	-25.788	-20.041
					(38.781)	(39.995)	(39.918)	(39.020)
After increase prices*Most Benefited Area					37.090***	19.549*	18.118*	13.335
					(10.319)	(10.946)	(10.679)	(10.804)
Mineral producer*After increase prices*Most Benefited Area					-24.659	-6.684	-11.123	-3.099
					(53.120)	(53.038)	(54.453)	(55.316)
Constant	310.226***	113.521	-19.280	119.301	310.454***	87.489	-42.921	100.713
	(3.734)	(300.970)	(300.952)	(266.638)	(3.662)	(301.391)	(301.356)	(267.284)
Transfer controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
Household level controls	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	342.00							
Observations	91,150	86,539	86,539	84,534	91,150	86,539	86,539	84,534
R-Squared	0.008	0.008	0.013	0.065	0.008	0.008	0.013	0.065

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district level.

Table IX: Validity of the Exclusion Restriction

Impact of Mining Canon Transfers in Household Per-capita Incomes (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
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Treatment (1= Producer district after increase of prices)	28.150	21.896	23.651	14.029	32.726	23.772	26.398	14.998
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Transfer controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
District Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	No	No	Yes	Yes	No	No	Yes	Yes
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Table IX: Validity of the Exclusion Restriction

Impact of Mining Canon Transfers in Household Per-capita Incomes (Producer Districts)

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: Household Per-capita Incomes							
Treatment (1= Producer district after increase of prices)	28.150	21.896	23.651	14.029	32.726	23.772	26.398	14.998
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R-Squared	0.008	0.008	0.013	0.065	0.008	0.008	0.013	0.065

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors clustered at the district level.

6. Conclusion

- Significant positive effect of revenues on bribery-based corruption in Peru
- IV results consistent with DD approach.
- Results suggest that the transfers have differential effects depending on the magnitude of the shock.

Next steps

- Still a work in progress.
- Explore potential causal channels using alternative datasets.

Table 1.Distribution of the mining canon

June 2002-May 2004		July 2004-December 2004		From December 2004	
Receiver	%	Receiver	%	Receiver	%
Regional government [1]	**20**	Regional government + 5% for public universities in the region	**25**	Regional government + 5% for public universities in the region	**25**
Municipalities of the province where the mineral is extracted[2]	**20**	Distrital municipality where the mineral is extracted	**10**	Distrital municipality where the mineral is extracted	**10**
		Municipalities of the province where the mineral is extracted, excluding the producing district[3]	**25**	Municipalities of the province where the mineral is extracted, excluding the producing district[3]	**25**
Municipalities of the department where the mineral is extracted	**60**	Municipalities of the department where the mineral is extracted excluding the producing province[3]	**40**	Municipalities of the department where the mineral is extracted excluding the producing province[3]	**40**

(1) Ministerial Resolution N 261-202-EF/15, priority is given to rural population by weighting the rural district for two (2) and the urban population by one (1).

(2) Established by the Canon Law (Law No. 27,506), according to population density (Habitante/Km2)

(3) According to Population and Poverty linked to basic infrastructural needs.

Questions about bribes in the ENAHO survey

GOBERNABILIDAD (Persona de 18 años y más de edad)

6. En los últimos 12 meses, Ud. o algún miembro del hogar ha hecho uso de los servicios, tales como: (Si todas las alternativas tienen circulado el código 2 (NO) Pase a 15)			7. Encontró inmediata-mente al personal en la oficina de ...?		8. ¿Cuántas veces acudió para realizar el ...? (Pase al sgte. ítem)			9. Considera que el... ¿Le ocasionó pérdida de tiempo y/o gasto significativo en transporte u otros?		10. ¿Cómo calificaría el servicio de ...: Bueno? 1 Regular? 2 Malo? 3 NO SABE 4	11. ¿Le solicitaron, se sintió obligado o dio voluntariamente retribuciones como: regalos, propinas, sobornos, coimas, etc.? Sí, le solicitaron 1 Sí, se sintió obligado 2 Sí, dio voluntariamente 3 → Pase a 13 Le solicitaron y no dio 4 No 5 → Pase al sgte. ítem	12. ¿Cuánto fue el monto total gastado en regalos, propinas, sobornos, coimas, etc. en ...? (Productos en especie, valorice a precio de mercado minorista)	13. Cuando le solicitaron o dio voluntaria-mente los regalos, propinas, sobornos, coimas, etc. ¿Denunció ante las autoridades pertinentes?		14. ¿Por qué no denunció? Por temor a represalias 1 Porque las autoridades no hacen caso 2 Porque no tenía tiempo 3 Por no saber a donde ir 4 Por no saber los mecanismos para denunciar 5 Otro _____ 6 (Especifique)
Servicios	SI	NO	SI	NO	Nº Veces	¿Concluyó? SI	¿Concluyó? NO	SI	NO	CÓDIGO	CODIGO	MONTO S/.	SI	NO	CODIGO
1. ¿Trámites en la Municipalidad (Partida de nacimiento, apertura de establecimiento, licencia de construcción, etc.)?	1	2	1	2		1	2	1	2				1	2	
2. ¿Trámites en ESSALUD?	1	2	1	2		1	2	1	2				1	2	
3. ¿Trámites en bancos del estado (Banco de la Nación, Banco de Materiales, Banco Agrario)?	1	2	1	2		1	2	1	2				1	2	
4. ¿Trámites en el Poder Judicial (Juzgado de Paz)?	1	2	1	2		1	2	1	2				1	2	

[Resource windfall and corruption]

Inter-governamental transfers in Peru

- Some basic characteristics
  - Highly centralized country: 97% taxes collected by central government (Polastri and Rojas 2007)
  - Local government highly dependent from central government transfers: Transfers from central government represent 57% of total local government revenues
- Intergovernmental transfers system in Peru
  - Universal versus targeted transfers
    - Universal: FONCOMUN (56% of IGT) and Glass of Milk (10% of IGT)
    - Targeted: Canon (mining, oil, hydro power, fishing, forest and gas), Royalties, Camisea (FOCAM), etc.
  - Canon represents 91% of targeted transfers (Mining canon: 79% of canon transfers)

Table 1. Current revenue of local governments (In percent of GDP)

	2000	2001	2002	2003	2004	2005
Total	**1.95**	**1.96**	**2.07**	**2.19**	**2.29**	**2.53**
Tax Revenues	0.25	0.25	0.27	0.28	0.29	0.29
Other own income	0.59	0.63	0.69	0.67	0.69	0.67
Transfers from the Central Government	1.11	1.08	1.11	1.24	1.31	1.57
FONCOMUN	0.77	0.74	0.73	0.76	0.77	0.79
Canon	0.12	0.12	0.15	0.25	0.32	0.51
Other	0.22	0.23	0.23	0.23	0.23	0.27

Sources: BCRP and MEF

Table 2. Transfers to local governments, 2001-08 (In thousands of new soles)

	2001	2002	2003	2004	2005	2006	2007	2008
Municipal Compensation Fund	1 369 570	1 430 842	1 597 053	1 793 654	2 031 674	2 389 113	2 805 832	3 263 288
Mining Canon	81 279	116 270	228 661	346 167	666 105	1 309 784	3 867 751	3 326 756
Glass of milk	332 883	340 616	356 000	360 001	363 001	362 990	363 000	363 000
Customs Revenue	23 893	23 606	23 444	101 908	122 719	126 221	140 451	173 588
HydroPower Canon	0	41 117	67 469	83 921	84 464	95 723	156 785	109 737
Fishing Canon	-	0	14 182	30 127	21 773	37 139	35 250	52 603
Oil Canon and Sobrecanon	-	140 741	181 607	225 657	304 036	381 933	404 033	580 704
Forest Canon	-	424	778	658	668	3 792	5 473	3 709
Gas Field Canon	-	-	-	-	226 448	295 403	452 218	548 947
Camisea Development Fund	-	-	-	0	37 687	76 160	77 641	112 691
Mining royalties	-	-	-	-	167 343	309 124	403 299	399 487
Regular Resources	-	-	-	-	148 676	126 613	395 065	557 368
Total	**1 811 182**	**2 093 617**	**2 469 194**	**2 942 093**	**4 174 595**	**5 513 994**	**9 106 797**	**10 612 550**

Source: MEF.

Region Ancash

Total distributed in 2006:
S/.261,548,143

20 provinces

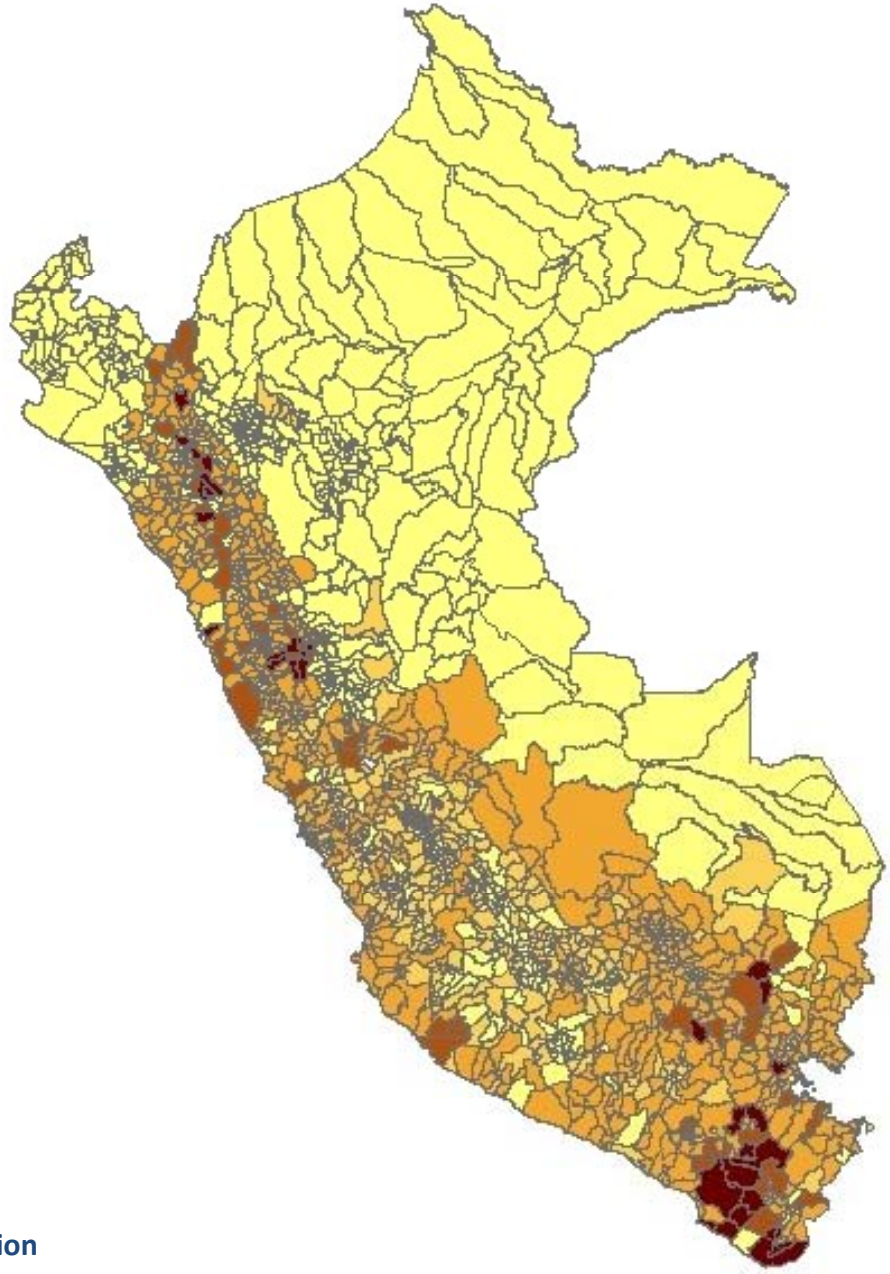
166 districts

San Marcos: Antamina

Distribution rule:

- San Marcos: S/.26,154,814
- A district of Huari (16): S/.4,086,689
- A district of Ancash: S/.630,236

Mining canon transfers allocation in 2006



Theoretical background

- Effects of an increase of local revenues on corruption is theoretically ambiguous
  - Becker and Stigler (1974):
    - Corruption=f(wage, probability of being audited)
    - Prediction: Higher salaries help to deter corruption

WHICH REGULATIONS REDUCE CORRUPTION? EVIDENCE FROM THE INTERNAL RECORDS OF A BRIBE-PAYING FIRM

December 8, 2010

ABSTRACT

This paper documents pervasive corruption in government procurement and evaluates the effect of auction regimes on kickbacks, using the internal records from an Asian trading firm. The average kickback was 14.7 percent of the product cost when auctions were not required. The government mandated *best-value auctions* in 2001, and strengthened them to *best-price auctions* in 2004. Exploiting a quasi-experimental design, I find that *best-price auctions* are much more effective than *best-value auctions* in reducing corruption. Moreover, these mandatory auctions decreased the efficiency of corruption, as they prevented some corrupt officials from running *secret auctions* to identify the largest bribe-giver.

Key words: Corruption, procurement, auction

JEL classification code: D73, K42, O12

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I. INTRODUCTION

Government procurement accounts for a substantial share of the world economy, typically 10-20 percent of GDP.[1] This procurement is vulnerable to corruption, as illustrated in a recent case involving billions of dollars paid by Siemens to bribe procurement officers around the world. The global volume of bribes is estimated at anywhere from U.S.$200 billion to one trillion per year.[2] To fight corruption, countries around the world are experimenting with a wide range of policies, including different procurement auction regimes. To date, there is almost no empirical evidence on the efficacy of such measures.

This paper studies the impact of *best-value* and *best-price* auctions on corruption - these are the two most important procurement auctions worldwide (World Bank 2006). The paper uses the internal bribery records made available for research by a trading firm from an Asian country. These records show that corruption was widespread before 2001 when auctions were not required. To fight corruption, the government mandated best-value auctions in 2001, and changed them to more transparent best-price auctions in 2004 for procurement above a certain value threshold. Exploiting this design, I find that best-value auctions did not reduce corruption and even increased it in some cases. In contrast, best-price auctions decreased corruption significantly, as they limited officials' discretion in evaluating bids.

Further, this paper also exposes the *secret auction* practice employed by corrupt officials to identify willingness to bribe. When formal auctions became mandatory, highly corrupt officials strategically discontinued secret auctions, thereby giving contracts to less efficient firms. Overall,

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[1] Global Trade Negotiations Home Page, Harvard University, accessed February 7, 2010.
[2] World Bank (2005, 2007) and Transparency International (2005)

these results indicate that open and non-discretionary auctions can significantly reduce corruption, but at some cost to allocative efficiency.

Bribe-paying firms often maintain a 'double-book' accounting system that consists of an official book for tax reporting as well as an internal book for keeping track of bribes and real financial transactions.[3] This is paper the first output of a research program aiming to collect and analyze the 'double-book' practice of firms, as presented in Cole and Tran (forthcoming). For this study, an Asian trading firm agreed to be interviewed and provided access to its internal book containing detailed data of the firm's procurement contracts and bribes, under the condition that the firm, country, and industry not be identified.[4]. Using this unique dataset, I provide a detailed account of corruption in procurement, including how rent is shared between the firm and corrupt officials. I estimate the effect of different auction designs on the firm's bribe payments and profits, and expose the widespread practice of secret auctions and its central role in determining allocative efficiency.

The trading firm imports a specific type of electrical equipment and sells it domestically to mainly government buyers. It operates in an Asian developing country, characterized by high economic growth and rampant corruption. The dataset contains 562 contracts between the firm and its government buyers for the period 1997-2006; all but three of which involve a bribe. These records include information detailing contract values, associated cash bribes, the firm's profits, and buyers' characteristics.

Prior to 2000, the country did not require auctions for government procurement. Data from this pre-period, 1997 to 2000, indicates that the firm's bribe and profit per contract averaged 14.7

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[3] Siemens' Chief Financial Officer also described his double-book accounting in an interview with Frontline (Schubert and Miller 2008).

[4] The firm has discussed the associated risks with Harvard Institutional Review Board (by phone.) The firm also worked with Richard Zeckhauser (Harvard University) and me on a separate project on the game-theoretical aspect of corruption.

and 16.1 percent of equipment cost, respectively. As efforts to reduce corruption in procurement developed, the government mandated best-value auctions in 2001 and strengthened them to more transparent, best-price auctions in 2004 to control corruption (See Figure I).

Under the *best-value* regime begun in 2001, firms submitted bids that included technical specifications and a price. These bids were evaluated in a single step, using a metric that compared the weighted sums of judged scores of their quality, maintenance and price. Procurement officials had significant discretion in judging scores for technical dimensions such as quality and maintenance.

A second feature of these auctions, which aids greatly in identification, is that different rules were applied to contracts of different sizes. High-value contracts (above US$14,540) required *open* auctions; medium-value contracts (US$7,270-14,540) required only *restricted* auctions; small-value contracts (under US$7,270) did not require auctions. Open auctions mandated that buyers advertise tenders and accept bids from all eligible vendors. Restricted auctions allowed buyers to solicit bids from vendors of their choice.

Following this first reform, the government recognized that it still allowed considerable scope for misbehavior. In particular, the procuring organizations could bias bids' scores by arbitrarily increasing the technical score in favor of the bids from the firms of their choosing. In 2004, auction methods were changed again, this time to the *best-price* method that consists of two steps: in the first (technical) step, bids are evaluated only on a pass/fail basis; in the second (commercial) step, all bids that passed the first step compete primarily on price. The pass/fail basis in this regime significantly reduced officials' discretion in evaluating bids.

Best-value and best-price auctions are the main auction regimes in procurement worldwide. The merits of these regimes have, however, been debated. Best-value auctions have been argued to

be optimal because they increase the number of bidders and therefore promote competition. Best-price auctions have also been described as a better regime because product quality may not be easily incorporated in the best-value scoring rule (Che 1993). Thus far, no empirical study has evaluated these propositions.

To estimate the efficacy of these auction regimes, I adopt a difference-in-difference approach, exploiting the above mentioned thresholds (US$7,270 and 14,540). A simple difference-in-difference analysis may be invalid if procuring officials reduce contract values to below the mandated thresholds to avoid auctions. To account for this possibility, I use the level of electrical power of the equipment to instrument for its value group. Power is a good instrument because it is difficult to manipulate: it depends on size of the building. In contrast, bidders can manipulate other contract features, such as the brand of the product, additional options, and service contracts, which affect the contract value without affecting power.

I find that the 2001 best-value method was not effective in curbing corruption. The best-value open auction requirement did not significantly affect the firm's bribery and profit margins. More surprisingly, the best-value restricted auction requirement increased the firm's bribes and profits by 9.2 and 7.0 percentage points (of equipment cost) respectively. This is because restricted auctions allowed corrupt officials and firms to restrict competition to fake bidders, increase auditors' reference price and therefore enlarge the scope for corruption.

The effect of the 2004 best-price method sheds light on another loophole of the 2001 best-value method. I find that the best-price method decreased the firm's bribes and profits by 4.2 and 5.9 percentage points for open auction contracts respectively and by 5.7 and 5.9 percentage points for restricted auction contracts respectively, relative to the 2001-2003 period. These effects indicate that official discretion was a key source for corruption in the best-value method. Overall, the 2001

and 2004 laws combined decreased bribes and profits by 4.2 and 6.4 percentage points for open auction contracts, but increased them by 3.5 and 1.1 percentage points for restricted auction contracts respectively, relative to the pre-2001 period. On the whole, these results demonstrate that auctions can be an effective tool against corruption only when they are open and limit discretion.

The firm's records reveal the important practice of *secret auctions*, not yet studied in the literature. Corrupt officials frequently ran a secret auction before the (formal) mandatory auction to identify the firm that can pay the largest bribe. Identifying the bribe-giving firm in advance allows corrupt officials to design tender requirements that specifically suit a firm and therefore increase the scope for corruption. Secret auctions lead to more efficient allocation of contracts as the largest bribe-payer, ceteris paribus, is the most efficient among the bidding firms.

The vast majority of its buyers conducted secret auctions before 2001. After formal auctions became mandatory in 2001, while 79 percent of state-owed enterprises (SOEs) continued this practice, 91 percent of government agencies (GAs) avoided it. This is because secret auctions also incur a cost to corrupt officials: participating in a secret auction gives firms sufficient information and preparation time to participate in the formal auction; and, competition in the formal auction drives the winning price down, narrowing the scope for corruption. Compared to SOEs, GAs care less about the return on procurement, take higher bribes, worry more about competition in formal auctions and therefore forego secret auctions to be able to manipulate auction prices. In fact, the records show that secret auctions are associated with lower bribes among GAs, but higher bribes among SOEs. This incentive difference made GAs drop secret auctions and allocate contracts to less efficient firms.

This paper contributes to three central questions in the corruption literature. First, it provides an accurate measure of corruption by making use of a new data source, the systematic

internal records of a firm paying bribes. Until now, only a few studies have offered creative ways to measure corruption. For instance, comparing procurement prices before and after a corruption crackdown (Di Tella and Schargrodsky 2003), finding inconsistency in official records (Fisman and Wei 2004), comparing reported costs with independent audit estimates (Olken 2007), using auditing data to estimate the percentage of public resources misused (Ferraz and Finan, forthcoming), conducting bribe-payers surveys (Svensson 2003), beneficiaries surveys (Reinikka and Svensson 2004), and expert evaluation surveys (Banerjee and Pande 2007).[5] This paper's approach using business internal records provides a direct measure of corruption and shows the rent distribution between bribe-payers and receivers, which has not been previously possible.

Second, this paper provides direct evidence of how corruption distorts behavior. Theorists have proposed that corruption occurs because of bidders' collusion (Graham and Marshall 1987), bid rigging (Compte et al 2000), and distortion of bid evaluation (Burget and Che 2004). While all of these reasons are plausible, this paper provides direct empirical evidence of distortions in bid evaluation. It shows that corruption decreases considerably when officials' ability to distort this evaluation is limited. The paper also presents empirical evidence in favor of the use of mechanism design as an anti-corruption effort (Laffont and Tirole 2001), comparing the effect of different auction regimes on corruption.

Third, this paper reveals the practice of secret auctions and their critical role in determining whether corruption leads to inefficient allocation of procurement contracts. The issue of efficiency has triggered considerable debate in the corruption literature. For example, Leff (1964) and Beck and Maher (1986) argue that corruption enhances efficiency because it greases bureaucratic processes and increases competition. Against this argument, Rose-Ackerman (1975) and Shleifer and

[5] There is another strand of literature using subjective indicators for cross-country analyses. See Lambsdorff (2006) for an extensive review.

Vishny (1994) maintain that corruption is more likely to lead to high inefficiency because firms' bribing costs and connections with officials differ. This paper argues that allocative efficiency actually depends on whether corrupt officials conduct secret auctions to identify the largest bribe-payers. When formal auctions are not mandatory, corrupt officials usually run secret auctions to identify the most efficient firms. However, when formal auctions become mandatory, highly corrupt officials avoid secret auctions to prevent firms from preparing for formal auctions. This strategic behavior renders corruption distortionary. Although this type of secret auction is an important phenomenon in the practice of corruption, it has not been discussed in the literature.[6]

The remainder of the paper is organized as follows. Section II provides background information about the firm, including its corruption process and statistics describing its sales, bribes and profits. Section III discusses the 2001 and 2004 auction laws, and the firm and its buyers' strategies to circumvent them. Section IV presents the empirical strategy to estimate the effects of the auction regimes and reports the results. Section V describes the secret auctions, their role in determining efficiency, and presents preliminary evidence of corrupt officials' strategic behavior. The paper concludes with a discussion of implications, limitations and further research.

II. Corruption Process and Statistics

This paper studies procurement corruption in an environment where procurement is quite important. In the study country, GDP grew at a roughly 15 percent annual rate from 1997 to 2006, as did government expenditure on goods and services. In a 2006 national survey, about 70 percent

[6] A different type of secret auction is conducted secretly among members of a colluded bidding ring before they have won an item from a formal auction (see Asker [2008] for a fascinating discussion of this type of secret auction.)

of responding firms said that firms in their industry pay bribes. Transparency International ranks the country as more corrupt than the median countries among 180 countries ranked on its Corruption Perception Index.

II.1 Corruption process

The firm imports a specific type of equipment and sells it to both government and private organizations for installation in residential or commercial buildings. This is a growing but highly competitive industry; there is little barrier to entry and most firms have very similar cost levels. To win government contracts, the firm and its competitors usually pay cash bribes to procurement officials. Below is a qualitative description of the process of procurement and corruption, which can be divided into five stages:

Stage 1 – Contact initiation: the firm can initiate a contact with its buyers in two ways. First, it may contact procurement officials and submit a bid for the advertised tenders. This strategy rarely succeeds since officials have usually identified and colluded with a firm before advertising for procurement. The second and most common path to initiate a contact is for the firm to identify and approach an organization that plans construction projects and might need the firm's equipment. This is achieved through the firm's contacts in supervising or budget-approving agencies.

Stage 2 – Secret auction: when a firm approaches a potential purchaser, the procurement official gives one of two possible responses. If the official has already colluded with another firm, he will signal to the approaching firm that 'you have no hope' to discourage it from competing with the firm that he has already selected to collude with. If the official has not colluded with another firm, he often welcomes the inquiry and asks the firm to submit a written quote citing its price and quality, usually via fax. That signals the firm's invitation to the secret auction stage. In the quote, the firm always increases its price to cover the expected bribe. At the same time, the firm confidentially

indicates the bribe to be offered. The firm never quotes a low price without taking into account the expected bribe because this quote could later serve as evidence of corruption, if the firm wins with a higher price that includes a bribe. In this secret auction stage, the official takes quotes from three to four firms. The official may negotiate with each of the firms individually to increase the amount of his bribe. The secret auction and its negotiations allow the official to gain accurate information about each of the bidding firms' costs. The official will then select the most efficient firm and demand the largest possible bribe. Therefore, secret auctions play a central role in ensuring the efficient allocation of contracts.

Stage 3 – Formal auctions: Depending on the timing and size of the procurement, a formal auction may or may not be required. If a formal auction is not required, the official will sign a contract directly with the secretly selected firm. If an auction is required, the official often asks this firm to help design the call for tender, which ensures the firm's advantages in bidding. They often include and hide (in the small print) extremely specific requirements in the call for tenders to scare off or disqualify competing firms.[7] To make the auction appear competitive, the official's selected firm also prepares fake bids (often with similar quality but at a price 10-15 percent higher than its own price) and asks firms with which it colludes to submit them. This coordination creates an orchestrated 'bidding ring'.[8] Only winning bidder has to pay the bribe. Losing bidders do not have to make any illegal payments such as the informal auction entry fee. This plot succeeds most of the time, but occasionally fails due to an unexpectedly better bid from another firm. In the bribery business jargon, such a situation is called a "broken auction."

[7] For example, in one case the buyer requires that bidding firm must have at least 5 mechanical engineers. In another case, the buyer requires that maintenance must be for 19 months instead of the conventional 18 months.
[8] However, this type of bidding ring is different from the type of bidding ring in bidding collusion in developed countries as discussed by Porter and Zona (1992) and Asker (2008).

Stage 4 – Delivery and bribe: after signing the contract, the buyer often advances 30-40 percent of the payment as a deposit, and pays the balance after delivery. The bribe is always paid in cash, and in proportion to the actual contract payment received. This incentivizes the official to pay for the equipment promptly. The bribe thus helps overcome the usual contract issue of delayed payment and enhances efficiency. This is consistent with the 'grease the wheel' theory in the corruption literature (Leff 1964). Occasionally, however, there might be delays in payment if the buyer's organization has an internal conflict. For example, the official in charge of payment may think that she deserves a larger share of the bribe and therefore delays payment. In such cases, the firm may have to pay an extra 1-2 percent of the procurement cost to ensure timely payment.

Stage 5 - Audits: There are two types of audits. The first type audits buyers' organizations, reviews auctions and determines whether the winning bids are the best among all bids. The effectiveness of this type of audit depends on the auditors' ability to compare bids, which is often limited by complex technicalities and other criteria. The second type is an audit of the selling firm by tax auditors. In its accounting records, the selling firm must justify the bribe as a legitimate cost item. Otherwise it would appear as a profit and the firm would have to pay corporate income tax for it. The firm can cover up the bribe by inflating either a domestic cost (such as the costs for domestic parts, assembling or transporting) or the cost of imported equipment.[9] Auditors in this country are generally corrupt. If they find corruption by a firm, the firm usually has to pay a bribe in proportion of the corrupt amount to them. Even if no corruption is found, the firm usually pays a small amount of "speed money."

[9] It is tricky because OECD suppliers often do not risk inflating prices, probably because of the penalties stipulated in the OECD Convention on Combating Bribery of Foreign Public Officials (The Siemens and British Aerospace cases mentioned earlier are two examples of the effect of this Convention.) Therefore, transactions often need to be conducted through a third party based in a country that has not ratified this Convention that would be willing to inflate the imported price.

II.2 Descriptive statistics

This firm is among the top five largest firms in the industry, holding 5-6 percent of domestic market share[10] with annual sales revenue of approximately US$ 6M. The firm's sales revenues grew at an average annual growth rate of around 20 percent from 1997 to 2006. Given its market position and cost level, the firm believes that its profit margin and bribery levels are similar to those of its main competitors.

From 1997 to 2006, the firm had 562 sales contracts with government buyers for total revenue of US$ 22.4 M, made a net profit of US$2.60 M and paid total cash bribes of US$ 2.64 M. The vast majority of this firm's government contracts involve bribery. The average bribe is 15.4 percent of the equipment cost. The highest bribe was 95 percent of the equipment cost,[11] though 90 percent of the bribes lie between 5 and 30 percent. This large variation is due to various characteristics of buyers and contracts, and does not allow eyeballing easily the trend of corruption over time from the Figure II.

There is considerable variation in the amount of bribe paid. The average bribe paid to government agencies[12] is 23.8 percent, which is more than twice the average bribe to state-owned enterprises (SOEs), which is 10.9 percent. The likely cause of this disparity is that SOE face evaluation on the profitability of their business, while government agencies are not.

The firm's average net profit[13] is 15.4 percent of the equipment cost, a margin roughly equal to the average bribe. The profit correlates strongly with the bribe paid for each contract, implying that the profit from the deals with government agencies is twice as high as the profit from SOEs.

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[10] I computed this market share by comparing the firm's imports with the total imports of the same equipment by all firms, using data from the national customs office.
[11] In practice, bribes are commonly quoted as a percent of contract values. However, in this paper I measure bribes as percent of the equipment cost, to avoid simultaneity issue (contract value = equipment cost + firm's profit + bribe.)
[12] Government agencies include ministries, schools, universities and hospitals.
[13] The net profit is the net earnings of the firm after excluding all the costs of equipment, overhead and bribes.

Part IV in this paper explores the reasons for this difference. The profit as percent of contract cost has somewhat decreased over time, as contract values have increased. As the firm has built up its reputation, it has moved toward larger contracts, causing the firm's absolute profit to increase over time.

The average equipment cost per contract is $ 30,500 (in 1997 price) although the cost of multiple-equipment-unit contracts can go as high as hundreds of thousand dollars. However, the majority (60 percent) of contracts are for a single piece of equipment. This figure is the true cost to the firm, including the import price and local costs the firm pays to deliver the equipment, excluding the bribe and profit. As popularly believed, bribes (as percent of cost) tend to decrease in cost, but for this trading firm this trend is only moderate.

III. AUCTION REGIMES AND STRATEGIES TO CIRCUMVENT THEM

The government enacted two important procurement laws in 2001 and 2004; there are thus three different regulatory periods (see Figure I):

Period 1 – no auctions required (Prior to 2001): auctions are not required for government procurement.

Period 2 – Mandatory *best-value auctions* (January 2001 to January 2004): the law specifies a *low threshold* (equivalent to US$7,270) and a *high threshold* (equivalent to US$14,450). Government procurement contracts with budget values below the low threshold still do not require auctions. Contracts with values between the two thresholds require *restricted auctions*, i.e. the government buyers select the most appropriate vendors and invite them to submit bids. Contracts with values above the high threshold require *open auctions*, i.e. government buyers need to advertise the procurement and accept bids from all eligible vendors. Both types of auctions are conducted in the

best-value method, that is, bids are compared using a weighted sum of judged scores of their quality and commercial merits. The bid with the highest sum would win.

Period 3 – mandatory *best-price auctions* (after February 2004): while the second law keeps the thresholds intact, it changes the bid evaluation to the best-price method consisting of two steps. The first step is technical: each bid is evaluated against various technical requirements and the bids that meet these technical requirements are short-listed for the second stage. The second step is commercial: bids compete primarily on their prices. In essence, this second law significantly reduces officials' discretion in evaluating auction bids as they can no longer give bids arbitrary scores for dimensions such as quality or maintenance.

The above regimes are mandatory for all procurement with funding from the government budget (mainly by government agencies, ministries, schools or hospitals) and recommended for all procurement with funding from other sources (mainly by state-owned enterprises). In practice, most state-owned enterprises adhere to these laws closely to signal their proper procurement conduct.

In principle, the firm and its buyers might have come up with different strategies to circumvent these auction regimes. First, some of them might not comply with the regimes. Second, the firm might shift towards a particular group of buyers with whom it could more easily circumvent the auction rules. Third, some buyers might have anticipated the enactment dates of the laws and closed many contracts right before these dates. Finally, they might have chosen contract values just below the auction thresholds to avoid auctions. The rest of this section will discuss these possible strategies.

Compliance with auction regimes. Before 2001, some buyers had already conducted open and restricted auctions to make the procurement process appear more transparent. However, these auctions were usually ineffective because there were no clear and specified procedures, and the

buyers could exploit numerous loopholes. After 2001, the majority but not all of buyers conducted auctions for procurement with values above the auction threshold. This is because the laws are only recommended for SOEs and allow skipping auctions in special circumstances (such as national security or natural disaster.)

Client composition. I study this firm's client characteristics (government agency – SOEs, rural – urban, government funding – ODA, direct-contract – subcontract, strong –weak relationship, single – multiple decision-maker) during this 10-year period. Even though the firm had only 65 contracts per year, client composition varied little over time. The only exception is the firms' relationship with clients. There are three levels of relationship: i) no previous relationship with the client; ii) indirect relationship through an introducer; and iii) long-term relationship, i.e. the firm has previously had a contract with the client. The firm moved away from the no-relationship buyers toward long-term buyers. As mentioned in the previous section, to win a contract with a no-relationship buyer, the firm had to offer excellent quality and price in order to "break" the corrupt auctions, leaving the firm with little profit. This explains why the firm moved away from these buyers as its client base and reputation improved.

Ten years of data are insufficient to test for the composition change using the usual regression methods. I instead use a randomization inference test[14] to test whether client composition changes over time. To do so, I first select two years at random from the 10 years in my sample, and compute the joint F statistic for whether client composition changed during these two years. I do this joint F test 1000 times (drawing a different pair of years each iteration), which generates a distribution of F statistic. I then compare the F-statistic from the actual year in which reform was implemented. Results suggest that there was not a significant change in client composition around

[14] Bertrand, Duflo and Mullainathan (2004) shows that the randomization inference test works well irrespective of sample size in difference-in-difference analyses.

the time of the reforms: the F-statistic from the actual reforms is smaller than 17 percent of the F statistics from the simulated distribution. I therefore cannot reject the null hypothesis that there was no shift in the client composition. In principle, the client composition might have shifted in the characteristics that are not observable in the records. However, given that buyer characteristics tend to correlate with one another,[15] such a shift would be likely to be detected using the above observable characteristics.

Strategic selection of contract dates. These auction regimes were issued by the executive, not the legislative, branch of the government. The preparation for these reforms was confidential, and conducted without consultation of the public or businesses. Therefore, the timings of the laws were unexpected by the business community and the public. The data shows that the number of contracts signed in the month right before the laws' enactment dates is not different from other years, indicating that the clients did not wait for or try to avoid the laws. A Z test shows that the proportion of contracts signed one month before the enactment dates in 2001 and 2004 is not statistically different from this proportion signed in the same calendar month of other years.[16]

Strategic selection of contract values. Figure IIIa compares the distribution of contract values before and after January 2001. The two vertical lines indicate the thresholds for open and restricted auctions. It is clear that there is some value manipulation around the thresholds.

To test for the difference between the two distributions of values before and after the regulation, I use a Z-test to compare the proportions of contracts that fall into different bands around the thresholds. Panel A in Table II shows the results. The difference of the proportions in the range under the low threshold ($6,907-7,270) has a sign consistent with contract manipulation

[15] For example, ODA procurement tends to involve multiple decision makers, or the firm's tend to have long-term relationship with buyers in urban areas.
[16] The Z-statistics for 2001 and 2004 are -1.03 and -0.27, respectively.

but is statistically insignificant. This insignificance is not surprising because this is the threshold for restricted auctions, which many customers might have found ways to get around without having to change their procurement values.

However, the difference of the proportions in the range *under the high threshold* ($13,813-14,540) is highly significant. Moreover, the difference of the proportions in the range *above the high threshold* ($14,540-15,267) has a reversed sign and is also highly significant. This indicates that the firm and its customers indeed shifted some of the contracts from above the high threshold to under the threshold to avoid auctions. For this reason, I use equipment power as an instrument for auction regime - this is described in greater detail below.

IV. Effect of the Auctions Regimes on Corruption

The effect of these mandatory auction regimes on corruption is conceptually ambiguous. If an auction is properly implemented, it provides auditors with better information about competing bids, therefore preventing corrupt officials from letting a bid with poor quality and high price win, and thus reducing the scope for corruption. However, there are many loopholes that can prevent the proper implementation of an auction. Corrupt officials can avoid competition by announcing the tender very late, disqualifying good bids through narrow criteria, orchestrating a bidding ring, or using their discretion to bias bid evaluations. In such cases, auctions may not reduce corruption.

IV.1. Empirical strategy

The auction laws described in Section III are excellent sources of plausibly exogenous variation in auction regime. To estimate their effects on corruption, I employ a difference-in-difference approach using contracts below the lower auction threshold as the control group. There are two treatment groups: one includes the contracts above the high threshold (open auction regime)

and the other includes the contracts between the two thresholds (restricted auction regime). There are also two auction methods: the best-value method instituted between 2001 and 2004, and best-price method superseding it after 2004. This diff-in-diff should be able to separate out the effect of other factors and reforms that happen at the same time since such an effect should be absorbed in the trend of the control group.

This diff-in-diff approach can be implemented in a simple OLS strategy as follows:

$$\begin{aligned} Bribe_i = & + \beta_1 (Post2001_t * Big_{it}) + \beta_2 (Post2001_t * Med_{it}) \\ & + \beta_3 (Post2004_t * Big_{it}) + \beta_4 (Post2004_t * Med_{it}) \\ & + \beta_5 Post2001_t + \beta_6 Post2004_t + \beta_7 Big_{it} + \beta_8 Med_{it} + \omega X_{it} + \varepsilon_i \end{aligned} \quad (1)$$

Where i indexes contracts; t indexes periods; each observation is a procurement contract; $Post2001_t$, $Post2004_t$, are dummies indicating regulatory period of Contract i; Big_{it} and Med_{it} are dummies indicating the value category of Contract i; Vector X_{it} is a set of characteristics of the buyer and of Contract i, including equipment cost, buyers' organizational types, year and sub-region dummies.

The strategic selection of contract values to avoid auctions after 2001, shown in section III, provides a threat to OLS strategy because corrupt buyers would seek to move some contracts from bigger groups to smaller groups. According to the firm, its buyers can manipulate procurement values in two ways. First, when possible, they might divide the contracts into several smaller contracts so that their values fall below the thresholds. Second, customers might choose to remove expensive options or switch to a low-cost brand so that they do not have to go through the auction process. This would mix up the control and treatment groups in the difference-in-difference identification.

For the first possibility, it is often difficult to divide a contract since most of the contracts are for a single equipment unit. A practical choice is to separate the maintenance contract from the equipment contract so that their values remain under the thresholds. The maintenance part of the contract usually accounts for 10-15 percent of the total contract's value. Because the firm provides data about separated contracts, I am able to match contracts that are divided in this way, and in my analysis treat them as a single contract. To deal with the second possibility, I use an instrumental variable (IV) to predict the value of the contract, had the firm and its buyers not been gaming the system.

Instrumental variable strategy. I use the electrical power of the equipment to instrument for the contract value. Power is a good IV for two reasons. First, power correlates strongly with contract values, as more powerful equipment tend to be more expensive. Second, power is unlikely to be manipulated because it must meet the size requirement of the building that the equipment serves, and buyers can reduce the contract value to a large extent without having to reduce power. For this type of equipment, buyers can remove expensive options and switch to a lower-cost brand, and cut the equipment cost as much as 50 percent. Figure IIIb shows that there is no marked difference between the distribution of power equipment before and after 2001. The Z-test shown in Panel B of Table II indicates that the distribution of equipment power does not concentrate under thresholds after auctions were mandated (I use value thresholds to predict power thresholds, using only pre-2001 data.)

Note that we are concerned about endogeneity (i.e. the manipulation) of contract values. To deal with this, I use power to instrument for contract value. Technically, endogenous contract values also make group dummies (Bid and Med) in Equation (1) endogenous. To instrument for these three endogenous variables (Contract Value, Big and Med), I break the power continuum into 14 equal-

sized ranges, [17] plus one last range that includes all high power equipment. I create 14 dummy variables (omitting the smallest category) to indicate whether the required power falls into these ranges. I use the interactions of these 14 dummies with the dummies for Post 2001/2004 as instruments for the interactions of Big and Med with the dummies for Post 2001/2004.

The key exclusion restriction is that equipment power does not affect the contract's bribe or profit in any ways other than through contract values. This is likely to be true. Apparently, bribes and profits may changes as power increases. However, this relationship occurs because the contract's value increases, and not because of the power increase per se. In other words, power is correlated with bribe or profit only through contract value. One might argue that more powerful equipment are more uniquely designed, has less market price benchmark and therefore allows higher bribe and profit. While this might be true for extremely powerful equipment, this firm carries only equipment within popular ranges of power (see Figure IIIb), which have market price benchmark readily. There is also no evidence that any of the equipment types are more uniquely designed than the other. As a result, power is not likely to be manipulated and it is correlated with bribe and profit only though contract value. In this paper, let's call this simple IV specification IV1.

In this setting, one fortunate aspect is that we know exactly when contracts might be manipulated. Only after 2001, buyers had the incentive to manipulate the contract values to be below the thresholds. This allows us to improve the IV specification further by running the first stage estimation using only pre-2001 contracts to avoid any problems caused by manipulation, and then running the second stage estimation using all contracts. This improved IV specification is denoted IV2.

Formally, the first stage equation for both IV specifications is:

[17] These are 14 industry's standard ranges that are already used to measure the power of the equipment, such as 1-2, 2-3, 3-4 KVA etc.

$$Y_{it} = \alpha Power_{it} + \delta (Power_{it}*Post2001_t) + \lambda (Power_{it}*Post2004_t) + \mu Z_{it} + u_{it}$$

Where Y are the endogenous variables Big, Mid and their interactions with Post 2001/2004; $Power_{it}$ is the power range dummies vector and Z_i is the vector of the control variables in structural equation (1).

IV.2 Results

First stage. I use equipment power ranges to predict equipment cost and value groups of the contracts, and the interaction of power ranges to predict the interaction of value groups with indicators for auction regime. Table III reports the results of the IV2's first stage estimation, indicating that power ranges are strong predictors for equipment cost and value groups. The F statistics for log of equipment cost, Mid and Big are large and reported at the last row of the table.

Second stage. The second stage results are reported in Table IV. The effects of the auction regimes on corruption, estimated by OLS and IV methods, are qualitatively consistent, though they differ somewhat in magnitude and significance. These results are robust after clustering by year and subregion, or using Newey-West standard errors. Since this is a diff-in-diff identification, all of the effects of other factors and policies are reasonably assumed to be absorbed in the trend for the control group (including fixed effect for years). Therefore, the net effects of *best-value* and *best-price* auction regimes are represented by the coefficients of the interactions of their effective periods and the treatment group dummies. Below, I describe the IV2 results.

The enforcement of mandatory auctions in 2001 is ineffective in reducing bribes and profits. The coefficients for the effects of the open auction regime are negative but statistically insignificant. The estimated zero effect is relatively precise, as the 95-percent confidence interval rules out any effect larger than ±3.3 percent. This result indicates that the effect of open auctions is consistently

negligible across buyer groups. There are many loopholes that make open auctions ineffective. For example, corrupt officials can impose narrow or unexpected requirements to disqualify good bidders and give high scores to the arbitrary dimensions of the bid of their secretly selected firms (multidimensional quality is generally difficult to quantify and compare.)

Intriguingly, the restricted auction regime seems to increase bribes by 9.2 and profit by 7.0 percentage points of equipment cost. These increases are both strongly significant and economically large. There are several explanations. First, prior to the implementation of auctions, auditors usually used the market price as the reference to judge the procurement price. After restricted auctions were instituted, buyers could limit bids only to the firms of their choice. Corrupt officials and their selected firms usually asked friendly firms to submit fake bids with poorer quality and higher prices than the bid that is intended to win (higher prices are usually preferred because they send a more visible signal about the proper conduct of auctions.) Because auditors use these high prices as the reference to judge the procurement price, these auctions provide cover for large bribes. Second, there are administrative and time costs involved in organizing restricted auctions, and corrupt officials and firms require compensation to cover these costs. The increase in the distribution of contract values right under the restricted auction threshold (US$7,270) indicates that restricted auctions are avoided, suggesting evidence for the second explanation. However, both reasons may contribute to the increase in the firm's profits and bribes.

In contrast to the 2001 reform's disappointing results, the enforcement of the 2004 best-price method is effective in reducing bribes and profits. For open auction procurement, bribes and profits fell 4.2 and 5.9 percentage points, respectively. For restricted auction procurement, bribes and profits fell 5.7 and 5.9 percentage points, respectively. These results provide the evidence for two important effects of the best-price method. First, this method reduces officials' discretion in

evaluating bids by limiting their ability to let a poor bid win and therefore narrows the scope for bribes. Second, this method increases price competition and explains why the firm's profits fell considerably. The fact that profits fell significantly more than bribes did among open auction contracts indicates that the government gains more from promoting competition than from limiting bribery.

Other factors determining corruption. Table V reports the difference in the firm's profits and bribes across various buyer groups. Perhaps the most noticeable observation is that the profits and bribes move together closely. There might be two factors underlying this co-movement. First, when the firm has to pay a higher bribe, it must increase its price and is therefore at a higher risk of being caught. It increases the profit to cover this risk. Second, to avoid being discovered, large bribe-takers do not shop around to identify the most efficient firm. This behavior limits competition and allows the selected firm to earn higher profits.

The firm's average bribe and profit from its contracts with government agencies are higher than those with SOEs by 11.0 and 5.5 percentage points, respectively. These large differences can be attributed to the different spending incentives faced by government agencies and SOEs. I explore this difference in detail in the next section.

For rural buyers, the average bribe and profit earned are lower than those of urban buyers by 3.1 and 2.2 percentage points, respectively. However, the firm studied believes that rural buyers are generally more corrupt than urban buyers. The rural buyers that reach out to outside suppliers like this firm tend to be less corrupt than rural buyers in general. This highlights the caution that needs to be taken in interpreting the differences across buyer groups, given that the data are from only one firm.

The average bribe in Official Development Assistance (ODA) contracts is lower than in government-funded contracts by 7.4 percent. The profit is also lower but the difference is not statistically significant because there are only 31 ODA contracts in the dataset. ODA procurement tends to be less corrupt because there are more controls governing the auction process and the quality of the product. When there are multiple decision-makers at the buying organization, the firm earns a lower profit. When the firm is a subcontractor, it also pays a higher bribe and makes a lower profit. The market knowledge and power of the direct-contractors appear to reduce the rent of the subcontractors.

These results also indicate that corruption (as percentage of the contract cost) decreases as the contract cost increases. The estimation suggests that the average bribe and profit fall by 7.1 and 7.9 percentage points if equipment cost doubles.

Robustness. The above IV strategy seeks to address the possibility that buyers reduce their ideal contract values by cutting expensive options or switching to a lower-cost brand. Such manipulation should not affect the contract values that are far from the thresholds. Thus, as a robustness check, I run OLS regressions, excluding contracts with values around the auction thresholds (call this the exclusion method). A drawback of this method is the reduction of statistical power.

Table VI reports the results of the exclusion methods, excluding 10 percent below[18] and up to 50 percent above auction thresholds. In contrast to the IV results, the open auction regime from 2001 seems to reduce the total of bribes and profits by a small, statistically significant amount 3.8-4.5 percent. For effects of the remaining auction regimes, the exclusion method provides the estimates with the same direction but slightly smaller magnitude than those of IV. The restricted auction

[18] The firm believed that buyers never manipulated contract values to below 90% of the thresholds.

regime from 2001 increased the total of bribes and profits by 10.5-15.2 percent, respectively. The best-price method reduced this total by 6.7-6.8 percent in the open-auction group, and 5.6-10.9 percent in the restricted-auction group, relative to the 2001-2003 period.

V. SECRET AUCTIONS

Perhaps one of the most puzzling facts about corruption is that it seems to devastate some economies (e.g. Sub-Saharan Africa) but coexists with high growth in other economies (e.g. East Asia). This fact gives rise to the argument that under some conditions corruption results in severe misallocation of resources, while in other contexts it operates like an efficient tax on businesses (Nissanke and Aryeetey 2003).

The debate about the efficiency of procurement corruption stems from two different views about the method corrupt officials can manipulate auctions. In the first case, corrupt officials select a firm to collude with *before* the auction announcement (Laffont and Tirole 2001; Arozamena and Weinschelbaum 2009). This selection is based on connection, trust and other factors that minimize the risk of corruption discovery. Corrupt officials then design the tender requirement that favors their selected firm. In this case, corruption tends to be allocatively inefficient because contracts go to connected and not necessarily efficient firms.

In the second case, corrupt officials select the firm *after* the bids' submission and allow it to adjust its bid before the bids' opening (Menezes and Monteiro 2006; Lambert-Mogiliansky and Sonin 2006). They choose the firm with the best bid and allow it to submit a bid that is just better than the second best bid. The allocation of contracts in this case tends to be more efficient because contracts go to the lowest-cost provider among the bidders.

As auctions are monitored and audited, the firms that are not selected by officials usually bid with low prices and good qualities in hopes to break the collusion and win the contracts. As a result, if officials choose a connected firm before the auction, their bribe will depend on their ability to design the tender requirement in favor of their selected firm (Burguet and Perry 2009). If officials

choose the best bidder after the bids' submission, their bribe will depend on the cost difference between the best and second-best bidders. Conceptually, it is unclear which method maximizes the bribe, and therefore it is unclear whether corruption is efficient.

The records from this bribe-paying firms reveal a third as-yet undiscussed method: Corrupt officials usually run a *secret auction* before the formal auction to select the most efficient firm, and then design the tender requirement in favor of that firm, thus reaping benefits of both methods discussed in the literature. In this paper, I will describe this practice and show some preliminary evidence. More formal and rigorous analysis of the effect of secret auctions on allocative efficiency will be presented in an upcoming research.

The firm's internal records show that when auctions were not mandatory, the majority (88 percent) of corrupt buyers ran secret auctions, leading to allocative efficiency as a byproduct. However after auctions became mandatory in 2001, while 79 percent of state-owned enterprises (SOEs) continued this practice, 81 percent of government agencies (GAs) discontinued it, potentially rendering their corruption distortionary.

The reason for GAs to discontinue secret auctions is the following: once auctions become mandatory, if officials organize secret auctions they inevitably give firms more information and time to prepare for formal auctions. The firms that have participated but have not been selected in secret auctions are likely to participate again in formal auctions with a low bid and offer a zero (or small) bribe to the officials. They have a cost advantage over the firm secretly selected by the corrupt official because they do not have to pay a negotiated bribe. Their low auction prices would drive down the winning price of the selected firm, leaving less room for corruption.

The remaining question is thus why secret auctions are more disadvantageous for GAs than for SOEs. It turns out that the underlying reason for this difference is the following: SOEs care

more about profitability than GAs do. SOEs are evaluated by their financial performance while GAs are not. Procurement funding for SOEs often comes from bank loans approved by loan officers, who are concerned about repayment. Procurement funding for GAs often comes from the government budget and is approved by other officials whose performance is usually not linked to its cost-effectiveness. Given these different incentives, GAs tend to take higher bribes and therefore worry more about the competition in formal auctions that would drive winning prices down, narrowing the scope for corruption. In short, the difference in officials' concern for 'return on procurement' leads to strategically different modes of behavior and corrupt processes, ultimately rendering GAs' corruption more distortionary than that of SOEs.

Some evidence. To support the above discussion of officials' strategies, ideally we need evidence to show that after auctions became mandatory: i) GAs discontinued secret auctions relatively more than SOEs; and ii) secret auctions increase bribes to SOEs but decrease bribes to GAs.

To test (i) I estimate the following equation with contracts above the open auction threshold:

$$SecretAuction_i = \lambda_1 (Post2001_t * GA_{it}) + \lambda_2 Post2001_t + \lambda_3 GA_{it} + \omega X_{it} + v_{it}$$

To test (ii) I estimate the following equation with contracts after 2001 with values above the open auction threshold:

$$Bribe_i = \theta_1 SecretAuction_{it} + \omega X_{it} + \eta_{it}$$

Where each observation is a procurement contract; i indexes contracts; t indexes periods; $SecretAuction_{it}$ is the dummy indicating whether there is a secret auction; and X_{it} is a vector of characteristics of the buyer and of Contract i, including year and sub-region dummies.

Table VII reports the results of the first estimation with three different samples: all contracts, only big and direct-contracted[19] contracts, and big direct-contracted contracts with connected buyers. The last sample, though small, is the most appropriate for two reasons. First, subcontracts always involve secret auctions (because direct-contractors do not conduct formal auctions) and therefore do not aid the estimation. Second, secret auctions by unconnected buyers may be underreported because this firm might not have been invited to some secret auctions and therefore is unaware of their existence.

As reported in Table VII, the effect of GA*Post2001 is negative, indicating that GAs dropped the secret-auction practice relatively more than the reference group, which is SOEs. Specifically, the probability that GAs conduct secret auctions decreases by 52.2 percentage points, after 2001 relatively to SOEs. This strategic turn-around is strongly significant.

Table VIII reports the relationship between secret auctions and bribes/profits. Having conducted a secret auction is associated with an *increase* of 2.93 percentage points in the average bribe to SOEs but conversely with a *decrease* of 6.46 percent percentage points in the average bribe to GAs. This is consistent with the above description indicating that by conducting secret auctions: SOEs gain from identifying the most efficient firm, but GAs lose by increasing competition in formal auctions. Moreover, GAs' secret auctions are also associated with a 4.40 percentage point decrease in the firm's profit, consistent with the above discussion that secret auctions increase competition in formal auctions. However, we should treat this evidence as preliminary given the usual issues with OLS estimation.

[19] Having a direct-contracted contract means the firm sells directly to users of this equipment. Having a subcontracted contract means the firm sells to another firm that sells to users.

VI. CONCLUSION

This paper describes the corruption process in government procurement, as revealed through the internal records of and interviews with an Asian trading firm. It shows that mandatory auctions can be an effective tool to control corruption when they are open and limit discretion. Specifically, *best-price* and *open auctions* are far more effective than *best-value* and *restricted auctions* in reducing corruption. Further, the evidence suggests that if governments bind officials' performance evaluation with the return on procurement (as in SOEs), they can reduce corruption as well as its distortion.

The limitations of this study stem from the fact that it uses data drawn from only a single firm's winning contracts. A key concern is that the firm might have shifted its client composition, which would bias the difference-in-difference estimation. The randomization test presented in section III suggests no evidence for such a shift. However, using data from one firm still makes it difficult to generalize about corruption levels as well as the effects of regulations on other industries, or even on other firms in the same industry. What we know is that the firm is one of the leading firms in a highly competitive industry of a developing country with rampant corruption. Most of other firms are probably paying bribes in order to sell their products. Until now, this is also the first piece of evidence about the efficacy of these four most important auction regimes in procurement (best-value vs. best-price; open vs. restricted).

An important question that this paper does not answer is that why corruption still remain at a significant level even after procurement auctions are mandatory. Note that 'double-book' accounting is evidently practiced by many bribe-paying corporations, as discovered in the bribery cases of Siemens, British Aerospace, Schnitzer Steel Industries or the trading firm studied here. This practice implies that the level of corruption depends on the corporations' 'technologies' to fake or

inflate financial transactions. This technologies vary across industries (where inputs are different) and across countries (where tax auditing systems diverse). Future studies to understand these technologies would be important for identifying effective reforms to control corruption.

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Tables and Figures

Table I
Mean, Type and Description of Variables

Variable	Mean	Description
From the firm's internal records		
Cost	30.5 US$ thd. (1997)	The cost of the equipment to selling firm (in thousand 1997 US dollars)
Bribe	15.4%	Cash bribery given to the buying agent of the buyer organization (as % of true equipment cost.)
Profit margin	15.2%	The firm's net profit from each contract (as % of equipment cost)
Total Bribe and Profit	30.6%	Sum of Bribe and Profit margin (as % of true equipment cost)
Rural	0.416	This variable indicates whether the buyer from a rural area instead of an urban area
ODA	0.055	Indicates whether the contract is funded by official development assistance or otherwise government budget
G.Agency	0.351	Indicates whether the buyer is a government agency or otherwise a state-owned enterprise
Decision-Maker	0.781	Indicates whether the buying agent is the procurement decision maker in the buyer organization
Multiple Gate	5.2%	Indicates whether the selling firm has to deal with more than one person in the buyer organization
Secret auction	0.808	Indicates whether the corrupt procurement official conducts a secret auction before the formal auction
Multiple Equipment	0.301	Indicates whether this is the procurement contract for multiple or single equipment unit
Subcontract	0.128	Indicates whether the selling firm is a subcontractor or otherwise main contractor
From external sources		
Province Corruption Index	13.4%	Proportion of firms operating in the buyer's province say that they pay more than 10% of their revenue on bribery, according to a national survey in 2006.

Table II.
The Proportions of Contracts around the Thresholds

Band	Min value	Max value	Proportion before Jan 2001	Proportion after Jan 2001	Z-statistic
Panel A. The proportions of contracts in the 5% value bands around the thresholds					
5% under $7,270	6,907	7,270	1.5%	3.2%	0.949
5% above $7,270	7,270	7,634	0.8%	0.5%	-0.250
5% under $14,540	13,813	14,540	1.5%	8.1%	2.544
5% above $14,540	14,540	15,267	2.3%	0.0%	-2.074
Panel B. The proportions of contracts in the power range around the thresholds					
Just below the low threshold			7.5%	8.2%	-1.37807
Just above the low threshold			5.2%	7.7%	0.231991
Just below the high threshold			7.5%	4.6%	-1.09949
Just above the high threshold			3.7%	4.1%	0.160643

Table III.
First Stage's Results

	Log Equipment cost	Big	Mid
Power range 2	0.537***	-0.00910	0.124
	(0.204)	(0.0971)	(0.139)
Power range 3	0.684***	0.0276	0.0995
	(0.202)	(0.0822)	(0.155)
Power range 4	0.757***	-0.0547	0.290*
	(0.237)	(0.0781)	(0.165)
Power range 5	1.037***	0.00203	0.486**
	(0.189)	(0.106)	(0.228)
Power range 6	1.258***	0.127	0.571**
	(0.242)	(0.168)	(0.242)
Power range 7	1.233***	0.232	0.363*
	(0.224)	(0.179)	(0.218)
Power range 8	1.372***	0.380	0.489
	(0.200)	(0.340)	(0.357)
Power range 9	1.448***	0.310	0.574**
	(0.244)	(0.217)	(0.235)
Power range 10	1.782***	0.778***	0.108
	(0.193)	(0.157)	(0.175)
Power range 11	1.574***	0.225	0.695**
	(0.202)	(0.231)	(0.283)
Power range 12	1.487***	-0.0250	0.957***
	(0.225)	(0.116)	(0.160)
Power range 13	1.751***	0.775***	0.0622
	(0.202)	(0.190)	(0.210)
Power range 14	2.038***	1.012***	-0.176
	(0.206)	(0.130)	(0.173)
Power range 15	2.463***	1.000***	-0.129
	0.537***	(0.104)	(0.139)
Observations	144	144	144
F statistic	27.5	105.1	29.0

Notes: These first-stage models include interactions with periods, buyer and contract characteristics, year and sub-region fixed effect. Buyer and contract characteristics include government agency, rural, ODA, subcontract, log of cost, multi-gate and decision-maker. Standard errors are in parentheses. * indicates p-value<.10; ** indicates p-value<.05; *** indicates p-value<.01. The F statistics for IV1 are even higher.

Table IV
Effects of Auction Regimes on Bribes and Profits

	OLS			IV1			IV2		
	Bribe	Profit	Bribe & Profit	Bribe	Profit	Bribe & Profit	Bribe	Profit	Bribe & Profit
Big * Post-2001	-0.0218*	-0.0143	-0.0361*	-0.0130	-0.00454	-0.0175	0.0001	-0.00507	-0.00515
	(0.0127)	(0.0102)	(0.0211)	(0.0168)	(0.0134)	(0.0277)	(0.0166)	(0.0148)	(0.0297)
Med * Post-2001	0.0789***	0.0703***	0.149***	0.0882***	0.0782***	0.166***	0.0921***	0.0700**	0.162***
	(0.0177)	(0.0140)	(0.0290)	(0.0261)	(0.0195)	(0.0420)	(0.0322)	(0.0276)	(0.0570)
Big * Post-2004	-0.0286**	-0.0501***	-0.0787***	-0.0210	-0.0422***	-0.0632**	-0.0417**	-0.0592***	-0.101***
	(0.0125)	(0.0121)	(0.0231)	(0.0156)	(0.0147)	(0.0286)	(0.0178)	(0.0177)	(0.0328)
Med * Post-2004	-0.0426**	-0.0806***	-0.123***	-0.0257	-0.0666***	-0.0923**	-0.0567*	-0.0593**	-0.116**
	(0.0167)	(0.0150)	(0.0295)	(0.0219)	(0.0182)	(0.0373)	(0.0318)	(0.0281)	(0.0569)
Big (>$14,540)	0.00419	0.00685	0.0110	0.0384	0.0386	0.0770	0.164***	0.119***	0.282***
	(0.0250)	(0.0184)	(0.0426)	(0.0677)	(0.0500)	(0.115)	(0.0605)	(0.0436)	(0.0957)
Med ($7,270-14,540)	0.00658	0.00117	0.00774	0.00189	-0.00248	-0.000602	0.0847**	0.0590**	0.144***
	(0.0159)	(0.0113)	(0.0252)	(0.0375)	(0.0267)	(0.0621)	(0.0334)	(0.0246)	(0.0555)
Post-2001	0.000608	0.0229**	0.0235	-0.00736	0.0143	0.00693	0.0196	0.0423***	0.0619**
	(0.0125)	(0.0106)	(0.0188)	(0.0148)	(0.0161)	(0.0267)	(0.0213)	(0.0135)	(0.0312)
Post-2004	-0.0358*	-0.0176	-0.0534	-0.0406**	-0.0222	-0.0628	-0.0207	-0.00488	-0.0256
	(0.0197)	(0.0210)	(0.0396)	(0.0204)	(0.0217)	(0.0408)	(0.0273)	(0.0258)	(0.0487)
Log equipment cost	-0.00160	-0.0281***	-0.0297***	-0.0215	-0.0491***	-0.0706*	-0.0710***	-0.0791***	-0.150***
	-0.0218*	-0.0143	-0.0361*	-0.0130	-0.00454	-0.0175	(0.0253)	(0.0191)	(0.0418)
Buyer/contract characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year/subregion FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean	0.154	0.152	0.306	0.154	0.152	0.306	0.154	0.152	0.306
Observations	562	562	562	562	562	562	562	562	562
R-squared	0.685	0.767	0.721	0.673	0.752	0.706	0.646	0.711	0.675

Notes: Buyer and contract characteristics include government agency, rural, ODA, subcontract, log of cost, multi-gate and decision-maker. Standard errors are in parentheses. * indicates p-value<.10; ** indicates p-value<.05; *** indicates p-value<.01. Bootstrap standard errors are reported.

Table V
IV2 Estimates of the Effects of Auction Regimes on Bribes and Profits
(Detailed Report)

	Bribe	Profit	Bribe & Profit
Big * Post-2001	0.0001	-0.00507	-0.00515
	(0.0166)	(0.0148)	(0.0297)
Med * Post-2001	0.0921***	0.0700**	0.162***
	(0.0322)	(0.0276)	(0.0570)
Big * Post-2004	-0.0417**	-0.0592***	-0.101***
	(0.0178)	(0.0177)	(0.0328)
Med * Post-2004	-0.0567*	-0.0593**	-0.116**
	(0.0318)	(0.0281)	(0.0569)
Big (>$14,540)	0.164***	0.119***	0.282***
	(0.0605)	(0.0436)	(0.0957)
Med ($7,270-14,540)	0.0847**	0.0590**	0.144***
	(0.0334)	(0.0246)	(0.0555)
Post-2001	0.0196	0.0423***	0.0619**
	(0.0213)	(0.0135)	(0.0312)
Post-2004	-0.0207	-0.00488	-0.0256
	(0.0273)	(0.0258)	(0.0487)
Government agency	0.110***	0.0561***	0.166***
	(0.00595)	(0.00492)	(0.00993)
Rural	-0.0309***	-0.0221***	-0.0530***
	(0.00600)	(0.00493)	(0.0101)
ODA	-0.0737*	-0.0147	-0.0884
	(0.0428)	(0.0234)	(0.0618)
Agent is decision-maker	-0.0205	-0.0556***	-0.0761***
	(0.0128)	(0.0103)	(0.0223)
Multiple decision-makers	0.0290	-0.0506**	-0.0217
	(0.0419)	(0.0237)	(0.0604)
Subcontract	0.0223	-0.0223**	-5.92e-06
	(0.0139)	(0.00943)	(0.0211)
Province Corruption Index	0.000399	-0.00146*	-0.00106
	(0.000984)	(0.000781)	(0.00169)
Log equipment cost	-0.0710***	-0.0791***	-0.150***
	(0.0256)	(0.0193)	(0.0412)
Constant	0.188***	0.311***	0.499***
	(0.0341)	(0.0245)	(0.0568)
Year and subregion fixed effect	Yes	Yes	Yes
Observations	562	562	562
R-squared	0.646	0.711	0.675

Notes: Standard errors are in parentheses. * indicates p-value<.10; ** indicates p-value<.05; *** indicates p-value<.01. Bootstrap standard errors are reported.

Table VI
Effects of Auctions on the *Total of Bribe and Profit* (Exclusion Method)

	No exclusion	Exclude 10% below and				
		10% above	20% above	30% above	40% above	50% above
Big * Post-2001	-0.0361*	-0.0380*	-0.0399*	-0.0435*	-0.0441*	-0.0446**
	(0.0211)	(0.0218)	(0.0222)	(0.0222)	(0.0228)	(0.0226)
Med * Post-2001	0.149***	0.124***	0.133***	0.152***	0.122***	0.105**
	(0.0290)	(0.0342)	(0.0349)	(0.0380)	(0.0415)	(0.0419)
Big * Post-2004	-0.0787***	-0.0676***	-0.0681***	-0.0666***	-0.0650**	-0.0638**
	(0.0231)	(0.0252)	(0.0254)	(0.0256)	(0.0261)	(0.0263)
Med * Post-2004	-0.123***	-0.100***	-0.106***	-0.109***	-0.0765*	-0.0562
	(0.0295)	(0.0336)	(0.0365)	(0.0381)	(0.0394)	(0.0397)
Big (>$14,540)	0.0110	0.0168	0.0287	0.0565	0.0585	0.0729
	(0.0426)	(0.0503)	(0.0565)	(0.0612)	(0.0657)	(0.0714)
Med ($7,270-14,540)	0.00774	0.0181	0.0145	0.00946	0.0175	0.0301
	(0.0252)	(0.0301)	(0.0325)	(0.0362)	(0.0387)	(0.0430)
Post-2001	0.0235	0.0317	0.0353*	0.0384*	0.0376*	0.0389**
	(0.0188)	(0.0194)	(0.0195)	(0.0195)	(0.0201)	(0.0197)
Post-2004	-0.0534	-0.0591	-0.0571	-0.0646	-0.0666	-0.0668
	(0.0396)	(0.0408)	(0.0408)	(0.0406)	(0.0425)	(0.0430)
Buyer and contract characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year and subregion fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Mean	0.306	0.306	0.306	0.306	0.306	0.306
Observations	562	512	491	471	453	434
R-squared	0.721	0.709	0.707	0.715	0.710	0.708

Notes: Buyer and contract characteristics include government agency, rural, ODA, subcontract, log of cost, multi-gate and decision-maker. Standard errors are in parentheses. * indicates p-value<.10; ** indicates p-value<.05; *** indicates p-value<.01.

Table VII
The Choice of Conducting a Secret Auction after the 2001 Law

Dependent variable is a dummy indicating whether the buyer conducted a secret auction	All big transactions	Only big and direct-contracted transactions	Only big, direct-contracted transactions with connected buyers
Post 2001	-0.0854	-0.0444	-0.0753
	(0.0853)	(0.0909)	(0.105)
Gov. agency	-0.104	-0.136	-0.180
	(0.0815)	(0.0865)	(0.142)
Gov. agency * Post 2001	-0.457***	-0.513***	-0.522***
	(0.0924)	(0.0978)	(0.150)
Rural	0.0111	0.0131	-0.0778
	(0.0721)	(0.0800)	(0.154)
Rural * Post 2001	-0.504***	-0.551***	-0.526***
	(0.0782)	(0.0849)	(0.145)
ODA	-0.507**	-0.726***	-0.0224
	(0.201)	(0.187)	(0.0866)
ODA * Post 2001	-0.0951	0.103	0
	-0.0854	-0.0444	-0.0753
Year and subregion fixed effect	Yes	Yes	Yes
Observations	357	307	213
R-squared	0.572	0.596	0.695

Notes: Standard errors are in parentheses. * indicates p-value<.10; ** indicates p-value<.05; *** indicates p-value<.01.

Table VIII.
Relationship between Having a Secret Auction and Bribe & Profit
Government agencies vs. state-owned enterprises
(for only big, direct-contracted procurement after 2001)

	Government agencies		State-owned enterprises	
	Bribe	Profit	Bribe	Profit
Secret auction	-0.0646***	-0.0440**	0.0293***	0.00744
	(0.0201)	(0.0168)	(0.00850)	(0.00804)
Rural	-0.0563***	-0.0298**	6.89e-05	-0.0119
	(0.0128)	(0.0119)	(0.00934)	(0.00869)
ODA	-0.0587***	-0.0760***	-0.00858	0.0402***
	(0.0183)	(0.0162)	(0.0111)	(0.0106)
Buyer/contract characteristics	Yes	Yes	Yes	Yes
Year and subregion fixed effect	Yes	Yes	Yes	Yes
Observations	73	73	135	135
R-squared	0.568	0.639	0.389	0.587

Notes: Buyer and contract characteristics include subcontract, log of cost, multi-gate and decision-maker. Standard errors are in parentheses. * indicates p-value<.10; ** indicates p-value<.05; *** indicates p-value<.01.

Figure I. Auction regimes

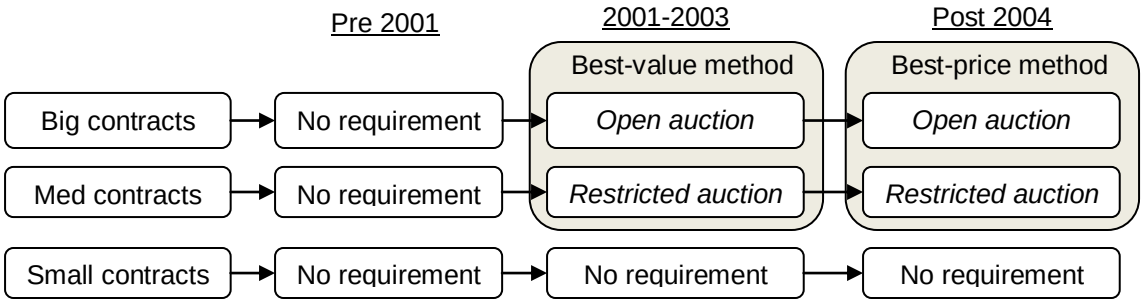
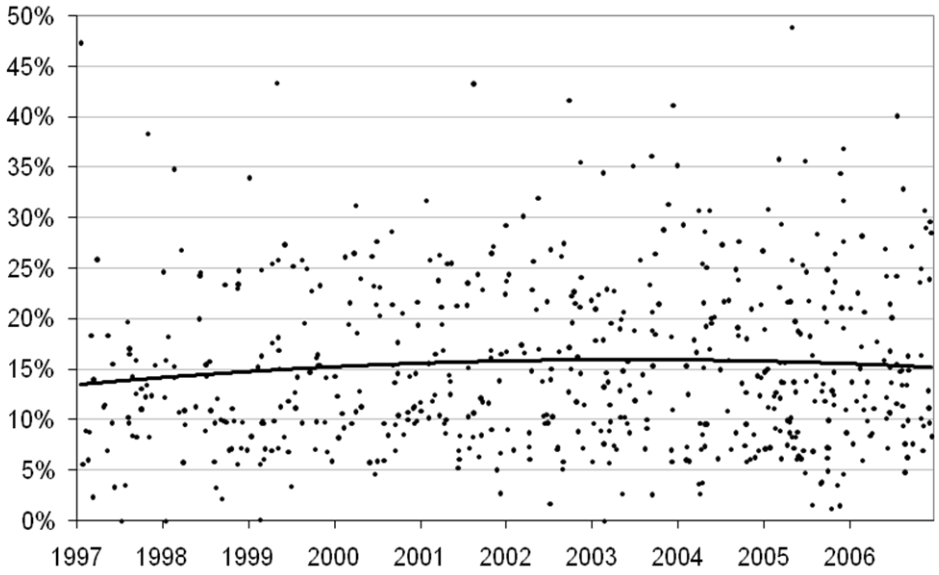


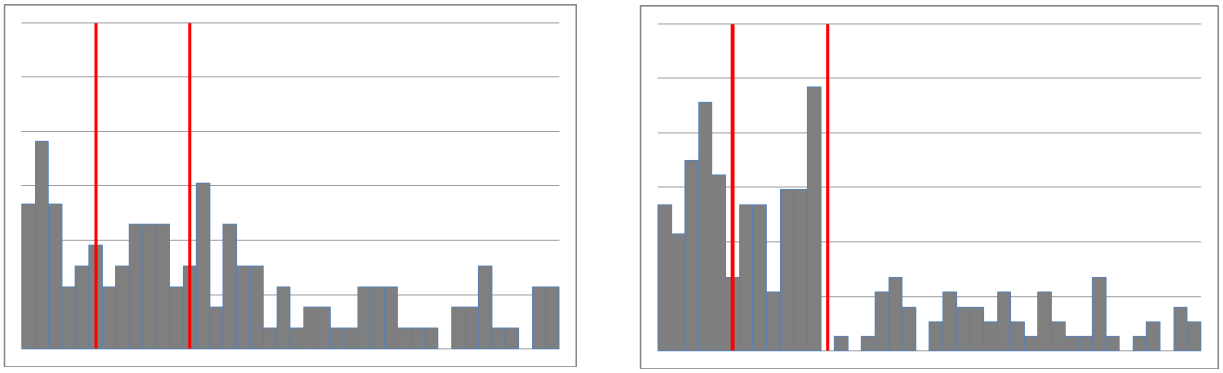
Figure II
Bribe (as Percentage of Equipment Cost) over Time



Notes: Each dot represents a contract. One contract with bribes greater than 50% of equipment cost is excluded. The trend-line is second-order polynomial.

Figure III

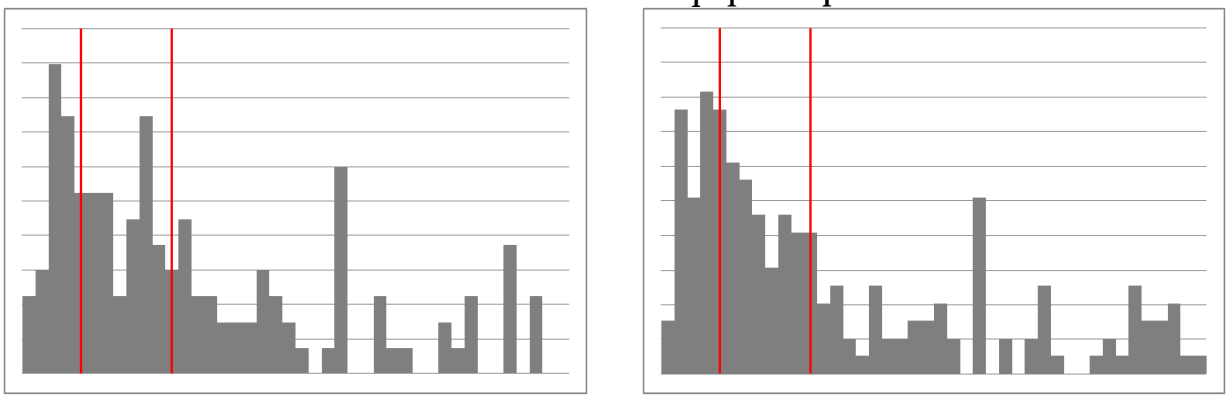
IIIa. The Distribution of Contract Values before and after 2001



Before January 2001 After January 2001

Notes: Two vertical lines indicate the auction thresholds mandated after 2001 ($7,270 for restricted auctions and $14,540 for open auctions.)

IIIb. The distribution of equipment power



Before January 2001 After January 2001

Notes: Two vertical lines indicate the equivalent power auction thresholds mandated after 2001 (These power thresholds are predicted using pre-2001 power-value relationship)