Resource Windfall and Corruption: Evidence from Peru*

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Abstract

The relationship between economic conditions and corruption has been subject of an intense discussion in the empirical literature due to the lack of good quality data on objective measures of corruption and the presence of omitted variables, measurement error and reverse causality problems. Using a rich and novel dataset that includes a complete set of bribery-related questions for the period 2002-2006, I exploit an exogenous variation in the economic conditions of a set of mineral-rich local governments in Peru which is due to an interaction between a fiscal rule that forces the central government to allocate 50% of the income taxes paid by mining companies to these governments and the extraordinary rise of the international prices of mineral resources observed since 2003. Using different empirical strategies, I find that, after the increase of prices of mineral resources, the predicted probability of being asked to pay a bribe by a local public official reduces by 1.5-1.8 percentage points in districts with access to this type of transfers, being the effect larger in mineral producer districts (2.7 percentage points). This represents a 52-62% reduction on the average probability. However, when focusing in areas most benefited from the positive shock of mineral prices, I find a positive effect on corruption with an increase in the former predicted probability of 4.3 percentage points. Taken together, these results suggest that the increase of transfers due to positive shocks in mineral prices have differential effects on corruption depending on the magnitude of the shock in local government revenues.

JEL: Q3, H3, C2

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1. Introduction

Corruption is one of the most pervasive problems in the developing world. This is particularly true in the case of Peru, where corruption is perceived as one of the most critical obstacles to economic development[1]. This perception was largely influenced by the enormous scale of grand corruption discovered during the last days of the autocratic regime led by the former president Alberto Fujimori[2]. It is estimated that 6 billion dollars were taken illegally from the Treasury during the Fujimori's term[3].

Despite its importance, very little is known about the causes and consequences of corruption, especially in the case of developing countries. In particular, there is little empirical evidence about its relationship with economic and political performance. The existing literature on the topic is mainly based on both macro-level data and subjective measures of corruption that, not surprisingly, has been largely criticized due to the presence of omitted variables, measurement error and reverse causality problems.

The nature and extent of these problems are much more acute than those found in other areas of the empirical political economy. For instance, omitted variable bias is a critical issue for most of those studies using macro and micro-level data since corrupt behavior is highly correlated with social norms and cultural values (see, for instance, Fisman and Miguel 2007), just to mention some of the dimensions we usually cannot control for in any empirical analysis. These problems are exacerbated due to the presence of measurement error in our measures of corruption, which is largely due to its very illicit and secretive nature, making people unwilling to report or talk about it[4]. Because of this, most of the empirical measures exploited in the literature are based on perceptions about corruption rather than actual measures of its multiple dimensions, which are particularly sensitive to measurement error

[1] According to the V National Corruption Survey carried by Apoyo Consultoria for the NGO Proetica in 2008, around 50% of the Peruvian population considers that corruption is the most important country's problem. See, http://www.proetica.org.pe/Descargas/V%20Encuesta%20Nacional%20%20-%202008.pdf

[2] At the end of 2000, a video in which Vladimiro Montesino, Fujimori's spy chief, appears bribing a member of the Congress was released to the press. This was the first of many videos showing Montesinos bribing politicians, judges, and broadcasters in order to control the Congress, the Judiciary and the media for a frustrated third term in office. See McMillan and Zoido (2004) for a discussion on Montesinos' bribing behavior.

[3] El Comercio, April 8, 2010. "Balance del Gobierno de Fujimori: desaparecieron 6 mil millones de dólares de las arcas del Estado". http://elcomercio.pe/noticia/458481/balance-gobierno-fujimori-desaparecieron-mil-millones-dolares-arcas-estado

[4] This problem is also exacerbated by the lack of a consistent definition of corruption. For a discussion about conceptual issues, see Shleifer and Vishny (1993), Bardhan (1997) and Banerjee, Hanna and Mullainathan (2009).

issues[5]. Finally, reverse causality is also an important concern since corruption affect incomes (at a micro-level) and economic performance (at a macro-level), but it also can be affected by these latter dimensions as well suggesting the presence of feedback effects that complicates any empirical attempt[6].

Recent empirical work on the topic has made some progress in terms of overcoming these limitations. Regarding the data problems, more studies based on high quality and objective data about corruption are available now. This recent emphasis on measurement issues is critical given the inherently complex nature of this phenomenon. More papers are now using innovative approaches in terms of developing consistent measures on the extent of corruption at a micro-level, whether by using micro-data collected at household/firm level (Abdallah et al 2009 and Gamboa-Cavazos et al 2007) or by constructing specific measures of corruption dimensions like, for instance, those based on missing expenditures (Olken 2007) or in audit reports (Ferraz and Finan 2008). Regarding the issues about causality, although there is some incipient progress on addressing the endogeneity of corruption to economic and political outcomes, there is still a lot of work to do in terms of understanding the causes and consequences of corruption at a micro-level.

Despite this progress, there are still some important issues that need to be addressed in order to overcome the empirical problems that characterize the current literature. Although the use of better quality data is certainly improving our understanding about the causes and the impact of corruption, most of the recent papers are based on data with low statistical power due to small samples sizes which raises issues about external validity of their results. Likewise, the emphasis has been put on understanding the effects of corruption, leaving the important issue about how corruption reacts to changes in economic conditions aside.

In this paper, I try to overcome some of these issues by using a credible approach for estimating the causal effect of economic performance on corruption. In particular, the focus of the paper is to

[5] As has been pointed out for several authors (for instance, Banerjee, Hanna and Mullainathan 2009), the problem with these measures is that it is not really clear what they actually mean. Surveyed people have different things in mind when answering questions about their perception of corruption. Also, perceptions may tell us very little about the actual level of corruption. For instance, Olken (2009) shows –comparing data about perceptions of corruption in a road project in Indonesia with data about missing expenditures-that perceptions are weakly correlated with objective measures of corruption and that they are biased given individual characteristics such as ethnicity and trust.

[6] This clear, for instance, in most of the empirical cross-country studies about the impact of corruption on economic growth (see, for instance, Mauro 1995). While it is clear that corruption can cause lower growth rates and poverty, it is also possible that poor economic performance and poverty can cause corruption. At a micro-level, low wages can induce public officials to become corrupt but it also possible that corruption affects the ability of the bureaucracy to pay higher wages (Di Tella and Schargrodsky 2003).

analyze how changes in local economic conditions affect the bribery-behavior of public officials in their interaction with citizens. In that regard, I will try to make progress in addressing the endogeneity of economic variables to corruption and the data quality problems that characterizes the existing literature. For overcoming the data problems, I will take advantage of a rich and novel dataset, the Encuesta Nacional de Hogares (ENAHO), collected by the Peru's statistical agency which includes a complete set of bribery-related questions for the period 2002-2006. An important advantage of this dataset is that collects information about the interaction of household members with public officials as well as the request of bribes by the latter ones[7]. In contrast to previous empirical attempts, this survey is representative at national level, being less sensitive to external validity problems.

For addressing the endogeneity of economic variables, I exploit an exogenous variation in the economic conditions of a sub-set of mineral-rich regional and local governments. This exogenous variation is due to the interaction of a rule of the fiscal system in Peru, known as *Mining Canon*[8], that forces the central government to allocate 50% of the income taxes paid by mining companies to the regional and local governments where the resources are extracted, with an extraordinary rise of the international prices of these resources observed during the past years. As a result, these mineral-rich regional and local governments experienced a large increase of their fiscal revenues compared to those districts without access to these resources. By comparing the bribery-behavior of public officials from local governments with and without mineral resources, this paper will shed light on the causal effect of an exogenous increase of local revenues on bribery-based corruption.

I will argue that the patterns of economic growth and the characteristics of the fiscal system in Peru provide a credible exogenous source of variation for studying the causal effect of economic performance on corruption. As many Latin American countries, Peru is an exporter of mineral resources, which accounts for more than 50% of the country's exports. Mineral resources are also one of the most important sources of fiscal resources (25% of total fiscal revenues in 2008), an important fraction of which are allocated by law to the regional and local governments where the minerals are extracted.

[7] This data collection effort was part of a program led by DIAL, a research French institution, in several African and Latin American countries. Similar modules about governance issues in household surveys are available for Bolivia, Colombia and Ecuador as well as for many African countries. For a description, see Herrera, Razafindrakoto and Roubaud (2005).

[8] According to the current legal framework, *Canon* is a participation of the regional and local governments located in natural resource-rich areas in the rents obtained by the State from the exploitation of these resources. There are several sources of canon, usually related with a particular resource. This idiosyncratic name is not the same as royalty, which is a different concept in the Peruvian fiscal system. While canon is a fraction of income tax paid by producer companies, a royalty is a percentage of the value of minerals according to international prices.

Because of these two basic characteristics, the fiscal resources of the mineral-rich regional and local governments are more sensitive to fluctuations of the (arguably exogenous) international prices of mineral resources. My research strategy takes advantage of this fact and exploits variation across local governments and over time for exploring the causal effect of an exogenous increase in local government revenues on a particular form of corruption (unofficial payments to public officials).

The main empirical findings are as follows. Using a differences-in-differences approach, I find that, after the increase of prices of mineral resources, the predicted probability of being asked to provide a bribe by public officials from local governments located in mineral-rich areas reduces by 1.5-1.8 percentage points. This suggests a large effect of 52-62% on the average probability of being asked to pay a bribe. This effect is larger in mineral producer districts (2.7 percentage points). However, when adding interactions to the differences-in-differences design for capturing differential effects in those areas most benefited from the positive shock of mineral prices, I find a positive effect on corruption with an increase in the former predicted probability of 0.43. Taken together, these results suggest that the transfers have differential effects depending on the magnitude of the shock.

Using an instrumental variable approach that captures the local effect of the transfers on mineral-rich areas, confirms these results. An increase in one unit in the log of revenues increases the probability of being required to pay a bribe by 2.4 percentage points. This represents an increase of 80% on the average probability of being asked to pay a bribe.

I believe this paper contributes to the empirical literature on corruption by providing a clean identification of the effect of an exogenous increase in revenues on bribe-based corruption levels of local governments affected by this shock. Despite this fact, several mechanisms or causal path-ways can be used at explaining the sign and magnitude of the causal relationship. This is expected since an exogenous increase in revenues can affect bribery-based corruption in different ways[9]. Future research along the lines of this paper will provide evidence about alternative causal path-ways to the reduced-form results discussed here[10].

[9] For instance, an increase in revenues may lead to an increase of wages of public officials and therefore reduce their demand for bribes. This result would be consistent with the Becker and Stigler (1974) model. Likewise, more resources may help to implement better monitoring technologies.

[10] In order to explore alternative causal path-ways, I will rely on an additional dataset which contains detailed information about human resources, budgeting and public goods provision issues at a municipality level. By using this data, I expect to provide some evidence about potential explanations for the paper's results, although my identification strategy will not allow me to isolate the role played by any specific factor in that regard. In addition, my research strategy will not allow me to rule out the effect of revenues shocks on other forms of corruption. For

The rest of the paper is organized as follows. In section II, I provide an overview of the existing literature. Section III discusses some theoretical issues related with the empirical design while Section IV discusses the data and provide descriptive statistics. Section V presents the research design and Section VI presents the empirical results. Section VII discusses robustness checks and Section VIII presents conclusions.

2. Literature Review[11]

This paper is related to a growing empirical literature on corruption and unofficial payments at a micro-level. One of the first attempts in that direction was the Sevensson's (2003) article on payment of bribes which uses a cross-section of firms in Uganda. He finds that firms on which public officials has more control are more likely to pay bribes whereas those firms with a higher ability to pay and lower refusal power have to pay more. A similar study using firm level-data for the Mexican case was carried by Gamboa-Cavazos et al (2007). Taking advantage of variation in gubernatorial office terms and in market structure across Mexican states, the authors find that the market structure and the characteristics of the political system matter at explaining the extent of corruption.

Bribe payments based on individual data have also received some attention in the empirical literature. For instance, Olken and Barron (2007) use data on truck drivers in Indonesia to explore how a large decrease in the number of police check post affects the market power of corrupt officials. They find that the average bribe increased in respond to this change and also that the pattern of bribes paid by drivers is consistent with the predictions of standard models of price discrimination. Bertrand et al (2007) use an experiment on the allocation of driver's license in India to test whether corruption represents redistribution between public officials and citizens or represents distortions in the allocation of public services. They find that unofficial payments occur through private agents (not directly to public officials) and that these payments have distortionary effects. Banerjee et al (2004), Hunt (2007) and

instance, if public servants allocate time and other resources between different types of corruption activities, an exogenous increase in the municipalities' revenues may lead to substituting low profitable corruption activities (like requesting bribes for licenses) for more profitable ones (like illegal procurement practices or over-invoicing of goods and services). The overall effect of a revenue shock can be an increase of corruption even if a reduction in the levels of bribes that people paid in the course of daily life is observed at the same time. Therefore, it is important to keep in mind that my results will only make sense for a specific type of corruption practice.

[11] Since the focus of this paper is on bribes and unofficial payments, I restrict my attention to papers related to these issues from an empirical point of view at a micro level. For that reason, the literature based on country-level and subjective measures of corruption is not part of what follows. A short review of that literature suggest that corruption is associated with lack of political freedom (Treisman 2000, Graef and Mehlkop 2003), lower growth (Mauro 1995), lower freedom of press (Brunetti and Weder 2003), more decentralization (Fisman and Gatti 2002), more ethno-linguistic fractionalization (Triesman 2000) and lower foreign competition (Ades and Di Tella 1999).

Abdallah et al (2009) find evidence of unofficial payments in health sector in rural India, Uganda and Bangladesh respectively. These papers provide evidence which suggest that richer patients are more likely to bribe for health care services and that they pay more than other patients. They also find that patients having more relation-specific investments (such as transport cost and travel time) pay higher unofficial payments[12].

The Peruvian case has been of interest of many researchers in this area. Of direct interest for the purposes of this research is a set of papers based in the same dataset as the one used in this paper (Hunt and Laszlo 2005, Hunt 2005, Hunt 2007a, Hunt 2007b and Hunt and Laszlo 2007), but only for years 2002 and 2003. In all the cases, the authors are basically interested in the determinants and the pay-off of bribery without claiming causality for any of their results due to the lack of an instrument or any other credible source of exogeneity in their analysis. For example, Hunt and Laszlo (2005, 2007) propose a simple model of the interaction between public officials and citizens to test who pay bribes and what the pay-off are. They find that the incidence of bribery and its size is increasing in household income and that those citizens who refuse to pay the bribe are penalized with 20% lower probability of completing their business. Furthermore, the authors do not find changes in the service quality associated with the bribe payment compared to those citizens who faced an honest public official. In a related paper, Hunt (2007a) finds similar results for the case of public officials in the health sector. Finally, Hunt (2007b) shows that people victim of misfortune are more likely to pay bribes to public officials, especially the police or the judiciary, and that in such situation the frequency of bribery is also higher. He suggests that this may be due to the fact that victims are more vulnerable or desperate for public services[13].

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[12] A similar set of studies uses household survey data for capturing bribe payments. For instance, Gorodnichenko and Sabirianova (2007) measure bribes indirectly by estimating the size of the unobserved compensation of public employees using micro-level data on earnings, household spending and assets holdings for Ukraine. They attribute the observed wage gap between public and private workers (24 to 32% after controlling for worker characteristics) to bribery under the argument that despite workers from both sectors are comparable in observable characteristics; no movement from public to private sector is observed during the period under analysis.

[13] Other interesting study is McMillan and Zoido (2004). They use bribe receipts and recorded videotapes of the former secret police chief, Vladimiro Montesinos, to study the breakdowns of checks and balances in the political system. In particular, they use the bribe size to infer the Montesinos's willingness to pay to buy-off those who could have potentially checked his power, finding that television is the most important mechanism in that regard. Other ttudies based on micro-data are also available. For instance, Kaufmann et al (2005) study how bribery affects the delivery of public services using both household and public officials' level data. They find that bribes work as taxes that affect more to the poorest and that low income users are discouraged to seek for basic services than high income ones. They also find that the service delivery is greatly affected by corruption and that older and more educated people are less likely to seek for these services.

To summarize, it should be clear from this short review that –despite the enormous progress during the last years- the current literature is still in the initial steps of providing a more credible evidence of the causes and effects of corruption. This study will make some progress in filling out the gap of the previous empirical literature in this regard.

3. Theoretical Background and Preliminary Hypotheses

This section will discuss some theoretical issues to motivate the empirical exercise. Theoretical models of corruption are often based in simple demand-supply framework (See Shleifer and Vishny 1993 among others). In this framework, one may think that there is an upward sloping supply curve for corruption prospects driven by public officials and a downward sloping demand curve driven by citizens. For simplicity, I will focus in a single good which is monopolically provided by a public official (like a license). Also, I will focus on the supply side of the analysis since no significant change on the demand happened in the districts affected by the shock in mineral prices during the period under analysis[14].

Assuming that demand remains unchanged, what matters is to understand how public officials react to changes in the environment of the local governments where they work. In the context of this study, I am interested in an exogenous change in the municipality revenues. The theoretical literature has stressed several factors that can explain that. In the model developed by Becker and Stigler (1974), the decision of a public official to become corrupt depends basically on her wage and the probability of being audited. Therefore, if the increase of revenues is associated with higher wages and the adoption of more effective audit technologies, this will imply lower supply of corruption opportunities from public officials.

Besides these economic factors, political factors may also play a role at explaining the corruption supply. Of particular interest is the expected permanency of public officials in the office, which in turns depends on the characteristics of the political system. On the one hand, if these

[14] As I will argue later, the rise of international prices did not affect the labor market and thus incomes of the inhabitants of the rich mineral areas affected by the exogenous increase in their revenues. I exploit this characteristic of the Mining activity to isolate the supply side of the market for corruption opportunities in the analysis. This does not mean that incomes in these areas did not grow during the period. In fact, mean incomes were increasing. A Kolmogorov-Smirnov test of equality of income per-capita distribution between 2002 and 2006 rejects the null of equality of distributions (results not shown). A similar analysis performed for rich-mineral districts also rejects the null of equality of distributions. Although an increase of incomes is observed in the treated areas, this increase was modest related to the observed increase of incomes in non-mineral rich areas (results not shown due to space constraints, available upon request). This suggests that perhaps other factors are behind the increase of incomes in these areas.

characteristics enables medium to longer terms in the office, then the incentives to extract rents from citizens will be lower. On the other hand, shorter horizons will work in the opposite direction. Therefore, several characteristics of the political system may affect in both directions permanency in the office. In particular, a large increase of local government's revenues may cause more political competition. This may lead to lower likelihood of keeping the office, providing more incentives to ask for bribes. This is especially important in the case of less institutionalized bureaucracies as is the case in this context[15]. Some anecdotal evidence is providing some support to this belief (Arellano 2008), but neither analytical nor econometric treatment of this hypothesis is yet available[16]. However, it is beyond the aim of this paper to provide an answer to this question[17].

The basic point of this section is that the net effect of the revenue shock is theoretically ambiguous and depends on the industrial organization in the supply side. Therefore, the sign of the relation between revenues and corruption is an open empirical question.

4. Data and Descriptive Statistics

4.1 The ENAHO survey

The main data source for this research is the Encuesta Nacional de Hogares (ENAHO), carried out yearly by Peru's national statistical agency. Starting in 2002, the statistical agency included a module on governance in which one randomly selected household member over 18 is asked several questions about her interaction with 21 different types of public officials. Those surveyed who respond positively about the use of a public official in the past 12 months are then asked a set of questions about whether a bribe was requested by the official, whether the surveyed felt obligated to or voluntarily give a bribe, whether she refuses to provide such payment, and what the amount of the payment was are included.

[15] One critical characteristic of the public service in Peru is the fact that a significant part of the public employment is temporal. This is particular true for the case of municipality workers. However, there is a lot of variation within the public sector in terms of the type of contracts public officials have. In fact, I will exploit this fact and compare -in a set of placebo tests- the bribery behavior of public officials not affected by the shock that work in sectors where contracts are longer such as the police and the judiciary.

[16] This relationship merits a more careful treatment and will be the outcome of a related research project.

[17] So far, I was interested in a single good provided by a public official with monopoly power in its provision. Notice that, if one admits more than one good supplied by a public official and allow for a less simple market structure at the municipality level, then a more complex set of empirical propositions can be developed. For instance, assuming that public officials have to devote some time for delivering the good in exchange for the bribe, then the optimal response will be to allocate more time in delivering the more bribe-profitable good. Therefore, an exogenous increase in revenues that may cause an increase in the supply for corruption opportunities for one good may potentially lead to the reduction in the supply of the other one. If public officials find more profitable to over-invoice good and services than asking for bribes, then a reduction in bribery should be observed.

In this paper, I use the surveys over the period 2002-2006. About 19,000 respondents of the governance module are available for each year. This period cover years where the international prices of mineral resources were stable (2002 and 2003) and years were these prices experienced an extraordinary rise (from 2004 to 2006) as shown in Graph 1[18].

In Panel I, II and III of Table I, I report summary statistics for the respondents to the Governance module of the ENAHO survey. The full sample contains 91,150 observations for the period under analysis. 27.11% of respondents reported using a local public official in the past 12 months. For comparison purposes, I also include the use of civil servants from the judiciary and members of the police, which have levels of use of 3.8% and 5.4% respectively. The use of municipal workers is very similar both in mining and non-mining districts (27.2% versus 27.7% respectively), as well as in the case of districts receiving Mining Canon transfers and those who do not receive such transfers[19]. Finally, the percentage of citizens interacting with public officials remains stable in the period, with the exception of municipal servants whose use increased over the period (from 22% in 2002 to 30% in 2006).

The main dependent variable for the empirical analysis is an indicator of episode of bribe for households in a given district and period. All the households reporting at least one member involved in a bribe episode are coded as ones, and recorded as zeros in other cases. The mean of bribery episodes in the sample for local public officials is 2.8% (Column A). This is remarkably low compared to public servants in the judiciary (11.6%) and the police (33.6%), and similar between mineral-rich and non-mineral-rich districts (Column B and C). However, when looking at its evolution over time, this number has been falling over the period studied, going from 5.87% in 2002 to 1.53% in 2006 (Column D). This trend is also observed in the case of judicial workers (from 15% to 7%) but not for the police (from 30% to 33%).

Descriptive statistics for a set of control variables for household characteristics and characteristics of the household head are also available (results not shown). In the first case, I include a set of dummies for capturing the possession of assets as well as the (log) of consumption, the number of

[18] Starting 2007, the detailed questions related with bribery were dropped from the ENAHO and replaced with a single question about the payment of bribe in case a household member was asked to do it by a public official. Since no information about the type of public official is provided, I cannot fully exploit the 2007 survey in my research design. This in unfortunate since 2007 is the year where the rise of revenues is more pronounced, as it is shown in Graph 2.

[19] This distinction is important since the transfers of Mining Canon are allocated to all districts located in the regions where minerals are extracted. From now on, we differentiate districts receiving Mining Canon transfers from those who are mineral producers, where the latter are a subset of the former.

wage earners and whether the household obtained its dwelling through an invasion. In most cases, these characteristics are similar between mineral/non-mineral as well as between Mining Canon/non-Mining Canon districts. In addition, no significant changes are observed over time. The same applies in the case of the variables related to household head's characteristics, which includes age, gender, marital status and a set of educational dummies.

One potential concern with the data is the presence of non-response and/or underreporting in the bribery-related questions. Individuals may feel stigma or shame of recognizing the payment of a bribe. However, this issue seems to be irrelevant in the Peruvian case where bribery is largely perceived as a failure of the system (Hunt 2007). In fact, Herrera et al (2005) show that the non-response rate of the governance module is significantly lower than the overall survey non-response rate (3-4% versus 5-6% respectively) for the years 2003 and 2004, providing evidence that these problems might be not important. In addition, the fear of prosecution is also low given the fact that the amount of this kind of payments is also low.

4.2 Revenues, production and inter-governmental transfers data

Data on revenues and transfers from the central government at district level over the period 1998-2008 was collected from the Ministry of Economy and Finance. This includes detailed information from all type of transfers received by local governments as well as information about other regular sources of incomes (taxes, contributions, fees for services, among others). In this analysis, I will focus on the period 2001-2006.

Panel IV of Table I presents descriptive statistics for the transfers dataset. This includes the value of the most relevant transfers from the central government such as the Fondo de Compensacion Municipal FONCOMUN (Municipal Compensation Fund) and the Minning Canon. In addition, a set of dummies for controlling for other type of canon and royalties received by local governments are included[20]. The data suggest an important increase in all the types of transfers over the period (column D), which is consistent with the increase of price of international commodities and the start of important investments in the country in a context of high economic growth.

[20] This includes transfers (mainly canon and royalties) due to oil, forestry, hydro-energetic, natural gas and fishing activities. FOCAM stands for Camisea Socioeconomic Development Fund, which is a transfer allocated to districts under the area of influence of the Camisea project.

The information of prices and production covers the period 1998-2007. This information is mainly used to identify the mineral producer districts in the empirical analysis.

5. Identification strategy

As stated in the introduction, the existing literature on corruption does not adequately address the endogeneity of economic variables to corruption and thus does not convincingly establish a causal relationship. My identification strategy will allow me to overcome some of the problems mentioned above by exploiting an exogenous variation in the economic conditions of a subset of Peruvian local governments which were benefited by a spectacular increase of their fiscal revenues. This rise was due to favorable fluctuations of the international prices of mineral resources produced in their territory. By comparing the bribery behavior of public servants of these local governments against the behavior of public officials from municipalities without mineral resources; before and after the rise of the international prices of these resources, I expect to uncover the causal effect of a positive shock on local revenues on bribery-based corruption forms.

5.1 International commodity prices as a source of exogeneity

The justification for using movements of international prices of mineral resources as a valid source of exogeneity in my empirical strategy is provided by some basic characteristics of the Peruvian economy. Historically, Peru has been a small and open economy highly dependent on the exports of primary products, characteristic that was reinforced by the liberal reforms based on the Washington Consensus during early 90s. For this reason, the country is basically a price-taker in the international markets of its most important exports and consequently highly sensitive to external shocks. In fact, some researchers (see, for instance, Dancourt 1999) have suggested that almost all the economic crises faced by the country since 1950 have been related with external shocks such as a fall in the terms of trade.

In this paper, I take advantage of a positive shock due to an extraordinary increase in the prices of the most important mineral resources produced by the country. Graph 1 presents the evolution of the international prices of the 8 most important mineral resources produced by the country[21] during the period of reference. As shown in the graph, these prices were quite stable from 1995 to 2003 and then

[21] These minerals are copper, zinc, lead, tin, gold, silver, iron and molybdenum.

underwent an extraordinary rise until 2008. In almost all the cases the prices were multiplied by two or three times in relation to the average prices before 2003[22].

As a result of this exogenous rise of minerals prices, the country's exports experienced an extraordinary increase. Graph 2 shows the evolution of the country's total exports as well as its mineral resources exports. It is clear from the graph that there is a significant change in the value of Peruvian exports after 2003, which was mainly driven by the increase of mineral resources' exports. Since it is arguably that the rise of prices may have affected the production decisions in unobservable ways that may be potentially correlated with the treatment of interest (for instance, local government taking aggressive decisions for preventing corruption with the expectation of favoring local production and consequently obtaining more revenues), then concerns about the endogeneity of fiscal revenues may cast doubts about the credibility of my identification strategy. Nonetheless, there no reasons to believe that such potential source of endogeneity of fiscal revenues may have played an important role during the period under analysis. The data shows that the production of minerals did not suffer a significant change during the period compared with the price changes. This fact allow me to argue that the increase of mineral exports, and consequently the fiscal revenues related with them, are mainly driven by an exogenous price shock and are not due to a changes in production levels.

5.2 Fiscal revenues shocks

Having discussed about the exogeneity of the shock, the next step consists in understanding the connection between this shock and the increase of fiscal revenues of the local governments. My research strategy takes advantage of a differential increase of revenues among local governments due to a set of laws that allow local and regional governments where mineral resources are extracted to have the right of a differential access to the income taxes paid by mining companies to the central government[23]. Given the high growth rates experienced in the period, all instances of government faced

[22] One potential concern with my identification strategy is the fact that the country is one of the most important producers of minerals in the world. Currently, Peru is the second producer of silver; third of zinc, copper and tin; fourth of lead and molybdenum and firth of gold. It may be argued that past corruption and/or other events during the period may have affected the country's production levels and consequently the international prices. Nevertheless, there is no evidence that such internal factors have played an important role at explaining the recent rise of commodity prices. Experts have suggested that the recent rise of commodities prices is largely explained by the China's rapid industrialization process (Roubini 2006) as well as by the fall of interest rates (Frenkel 2008).

[23] The most important law is the Law 27506 (known as the Canon Law), enacted in 2001,which 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%), and the municipalities located in

an important increase in their budgets, but local governments in mineral areas faced an extraordinary increase in their budgets as it is showed in Graph 2, which presents the amount of transfers received by local and regional governments from these areas during the period under analysis. As it should be clear from the graph, the amount of transfers due to royalties and Mining Canon were relatively low (roughly 67 and 95 millions of nuevos soles) during 2001 and 2002, having a spectacular increase since then reaching the extraordinary number of 4.15 billion in 2007[24].

This shock was heterogeneously distributed across the regions in the country. Since the distribution of mineral resources depends on the geographic characteristics, we should observe that some areas are more suitable for the extraction of minerals. As a consequence, different areas are affected by different prices and then are benefited by the shock in revenues in different ways. The evolution of transfers from Mining Canon shows two basic patterns are shown by this table: a) there are huge differences in terms of Mining Canon transfers among the departments, and b) there are disparities in terms of the evolution overtime of Mining Canon transfers across departments (not shown). This suggests that the effects of the shocks may be heterogeneous.

This is clearer in Map 1. This shows that only 4 regions (Ancash, Cajamarca, Moquegua and Tacna) got a disproportionate access to Mining Canon transfers in 2006. Districts from these regions obtained 75% of the Mining Canon transfers distributed that year meanwhile the remaining districts only got modest transfers. This suggests that few districts get a lot of resources and that a differential effect of the Mining Canon transfers is expected.

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6. Empirical model and results

My empirical strategy takes advantage of the differential effect of the price shocks on local governments' revenues for estimating the causal effect of a positive shock on local revenues on corruption. Specifically, I compare the corruption faced by individuals who live in local governments benefited from this exogenous rise of revenues with those who live in non-benefited areas, before and after the increase of the prices of mineral resources.

As mentioned above, I approximate corruption by a set of bribery-based measures developed from the ENAHO survey. The main outcome of interest is the probability of a bribery experience.

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the region where the resource is exploited (40%). In addition, a 5% is allocated to the public universities of the region.

[24] For reference, the current exchange rate is 2.85 nuevos soles per US dollar.

Consistent with my identification strategy, I will focus only on payments of bribes to public officials working for local governments. Since the shock due to the increase of transfers occurred at local level, it is expected that these public officials would be more sensitive to this source of exogenous variation. Other public officials should not react in the same way, fact that I will exploit for performing robustness checks in the next section.

6.1 Differences-in-Differences

I use two different econometric approaches. As a first approximation, a difference-in-difference strategy (DD) is implemented. This strategy is motivated by the pattern of mineral prices over the period, in which those were quite stable from 1996 to 2003 and then experienced a huge increase. The basic specification is as follows:

$$y_{ijt} = \alpha_j + \lambda_t + \beta(Canon_{jt}.HighP_t) + X_{ijt}^{'}\delta + \varepsilon_{ijt} \quad (1)$$

Where y_{ijt} is the outcome of interest for household i who lives in the district j in period t. α_j and λ_t are respectively district and years fixed effects. $Canon_{jt}.HighP$ is a dummy variable for observations after the rise of international prices, which in this case takes the value of one for years 2005 and 2006[25], in treatment districts. $X_{ijt}^{'}\delta$ includes household characteristics as well as some district level characteristics and ε_{ijt} is an error term. The parameter of interest is β which recovers the causal effect of interest and it is estimated using a linear probability model.

This specification is a generalization of the standard two period-two groups DD approach (see, for instance, Bertrand, Duflo and Mullainathan 2004 and Hansen 2007). The time fixed-effects accounts for the time-series changes in my measures of corruption. The district fixed-effects controls for time-invariant characteristics at district level and the interaction $Canon_{jt}.HighP$ accounts for changes in dependent variable in treated districts after the increase of prices of mineral resources. Identification in this setting requires controlling for any systematic shock to the corruption measures of the districts

[25] I take account of the fact that there is lag between the occurrence of this increase of mineral prices and the moment in which taxes collected from mining companies are allocated to districts benefited from Mining Canon.

affected by the increase of prices of mineral resources that are potentially correlated with, but not a consequence of, the revenues shock[26].

As pointed out by several authors (Moulton 1986), inference without accounting for within-group dependence can severely underestimate standard errors. This is what Angrist and Pischke (2009) call the "Moulton problem". In addition, and particularly relevant for DD estimation, there is a potential serial correlation problem, as highlighted by Bertrand, Duflo and Mullainathan (2004)[27]. To deal with both issues, I cluster the standard errors at district level using the generalization of the White (1980) robust covariance matrix developed by Liang and Zeger (1986). This solution controls for clustering and heteroskedasticity, and it is valid as long as a large number of clusters is available; which is the case in the context of this paper[28].

I use two different ways to specify the treatment variable. In the first place, I consider as a treated observation to any household located in a district benefited from Mining Canon transfers. One disadvantage of this approach is that around 70% of districts in the country get these transfers even in modest magnitudes[29]. Since it is arguably that such as a low level of transfers should have not any effect on corruption, consider districts like this as treated units may lead to incorrectly underestimate the effect of revenues on corruption.

This calls for an alternative way to define the treated districts in the analysis. Since a significant part of the transfers are allocated to the mineral producer districts, it is expected that the effect of transfers should be important in these areas. Using mineral producer districts as treated units has the advantage of providing a clear connection between the shock in prices and its impact on local revenues. However, any estimate for this group should be consider as a lower bound of the effect of the revenues shock on corruption since districts in the province where the mineral producer is located are also

[26] Formally, this is known as the common trends assumption. In terms of counterfactuals, this implies an additive structure for the potential outcomes for the untreated districts (without considering covariates) as follows: $E(y_{ijt} / j,t) = \alpha_j + \lambda_t$. For a discussion, see Angrist and Pischke (2009), chapter 6.

[27] According to these authors, this is due to the following reasons: a) usually estimates are based long time series, b) the dependent variable is usually highly positively serially correlated, and c) the treatment variable changes very little within the treatment unit over time. In the context of this paper, a) is not a big issue since only 5 years are available. The other two issues will be controlled for in the empirical analysis.

[28] For a discussion for the case of a small number of clusters, see Angrist and Pischke (2009). Cameron, Gelbach and Miller (2007) propose bootstrap-based solutions. Particularly, the wild cluster bootstrap appears to perform well in a set of simulations studied by the authors.

[29] For instance, the Municipality of Vista Alegre in the region of Amazonas received 3.61 Nuevos Soles (about 1 U.S. dollar) as Mining Canon transfers in 2006 while the Municipality of Ilabaya in the region of Moquegua received about 59 millions of Nuevos Soles (21 million U.S. dollar) for the same reason.

affected by the shock in revenues[30]. Therefore, using these districts as counterfactuals for mineral producers leads to an underestimation of the effect of revenues on corruption.

As mentioned before, only four regions concentrate 75% of Mining Canon transfers allocations. These regions have experienced a huge increase in their local revenues and therefore may have reacted to this increase in a different way than the rest of regions. In order to explore potential heterogeneous effects, I included to the previous specification interactions between the treatment and being an observation located in one of the regions extraordinarily benefited from the increases of Mining Canon transfers. I am interested in exploring whether a different behavioral response among public officials in these areas is observed. The basic empirical specification is as follows:

$$y_{ijt} = \alpha_j + \lambda_t + \beta(Canon_{jt}.HighP_t) + \delta_1(Canon_{jt}.MostBen_j) + \delta_2(MostBen_j.HighP) + \delta_3(Canon_{jt}.HighP.MostBen_j) + X'_{ijt}\gamma + \varepsilon_{ijt} \quad (2)$$

This is an extended version of (1) in which a new variable, $MostBen_j$, which is equal to one for households located in districts with access to Mining Canon transfers that belongs to one of the four most benefited regions, and interactions with the treatment and post-treatment period, have been added. The triple interaction captures the parameter of interest δ_3 for the most benefited areas from canon transfers. The second level interactions accounts for changes in treatment districts in the most benefited areas (δ_1), and changes in the most benefited areas after the increase of prices (δ_2). In all the specifications the standard errors are clustered at the district level[31].

The key assumption for my identification strategy is that, in the absence of the positive shock in local revenues, there are no differential changes in corruption correlated with initial levels of local revenues. For instance, if the increase of local revenues due to Mining Canon was concentrated in areas that were expected to reduce their corruption levels, then this assumption would be violated. Later, I will provide reasons for what this is not the case. Using placebo tests, I will show that the results of the paper are robust to a set of alternative specifications.

[30] As mentioned before, districts in the province where the mineral producer district is located share 25% of the total transfers due to Mining Canon. This implies that the increase in their revenues over the period must also be substantial.

[31] Notice that this specification is not the same as a standard differences-in-differences-in-differences (DDD). A standard DDD exploits variation within the treated areas while I am interested in the variation in a subset of treated districts. Gruber (1994) is the basic reference for DDD.

I first estimate (1) without controls (Column 1 in Table II) taking as a treatment variable being in a district benefited from canon transfers. The coefficient associated to the interaction is negative but not significant. This is not unexpected since receiving Mining Canon transfers is not the only source of variation in local government revenues. After adding a set of controls for the most important sources of revenues (see Appendix 1 for details), the coefficient associated to the interaction is still negative and becomes significant at 5% confidence level (column 2) with a magnitude of -0.015 (standard error 0.007). This implies that after the increase of mineral prices, the probability of being asked to pay a bribe by a local public official lowers by 1.5 percentage points. This effect is large and represents a 52% reduction in the average probability of being asked to pay a bribe. The inclusion of controls for urbanization (column 3), household wealth (column 4) and a dummy for mineral producer districts (column 5) do not affect either the magnitude or the sign of the estimated relationship.

These results are consistent to a change in the definition of treatment area. Table III presents the DD results for a set of regressions in which the treatment area is restricted to be only mineral producer districts. The coefficient associated to the interaction between treatment and the dummy for years with high mineral prices is negative and significant in the simplest specification (column 1). This result is robust in magnitude and statistical significance after controlling for other type of transfers (column 2), urbanization (column 3) and household wealth (column 4). These coefficients are larger than those estimated above (nearly 33% higher) and suggest that transfers are having a stronger effect in districts where the minerals are extracted, which is expected since these districts receive –by law- more transfers from the central government than no producers located in a region benefited by Mining Canon. Nevertheless, the relationship is imprecisely estimated, casting doubts about its importance.

In order to obtain additional evidence in this regard, I run the extended DD described in equation (2) using the same treatment definition as before. Results are reported in columns 5 to 8 of Table III. Without controls, the estimated coefficient for the original DD interaction is similar in sign as the previous results, but higher in magnitude and statistical significance (column 5). The coefficient associated to the triple interaction, which captures differences between mineral producer districts in the most benefited areas and mineral districts in areas modestly benefited from the large increase in revenues due to Mining Canon transfers, is around 0.047 and significant at 5% confidence level.

It is important to contrasts these results to those obtained in column 1 as well as for the uncontrolled specifications in Table II. In all these cases, the simplest specification either lacks of

statistical significance or it is weakly significant, which it may be related to not taking into account this differential effect of the treatment in the most benefited areas.

As in previous specifications, including controls for the other transfers strengthens my results (column 6). This specification yields a point estimate of -0.028 (standard error 0.011) for the DD interaction between treatment and post-treatment period, which is significant at 5%. The coefficient associated to the triple interaction remains positive and with the same magnitude (0.045) but significant at 1%. These estimates are robust to adding controls for urbanization (column 7) and household wealth (column 8).

The estimates suggest that this effect of the variation in revenues due to the increase in prices of mineral resources on corruption is negative for the treated areas (a point estimate of -0.027). This effect is captured by the interaction between being a mineral producer district (and consequently getting a privileged access to rents generated by Mining) and being in a period characterized by extraordinary high prices of mineral resources. But the overall effect works in the opposite direction in the case of mineral producers located in the most benefited areas as it is captured by the higher point estimate of the triple interaction.

Together, these results suggest differential impacts of canon transfers in my measure of corruption depending on the magnitude of the shock of mineral prices. For those places with moderate increase of transfers, the evidence suggests that corruption is affected negatively. However, in areas where the magnitude of the shock was large, corruption seems to be affected in a positive way.

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6.2 Instrumental variables

The second empirical approach I use in this paper is based on an instrumental variables method[32], which is motivated by the presence of a credible source of exogeneity in revenues due to fluctuations in international prices. The basic motivation for IV in the context of this paper is to provide an estimate for a more general parameter than the one recover in the previous section as well as to control for potential sources of endogeneity if the assumptions of the DD analysis do not hold. The previous DD analysis basically studies the impact of a particular event (a shock in transfers due to international prices of mineral resources) on corruption. However, a more interesting question is to

[32] See Imbens and Angrist (1994), Angrist, Imbens and Rubin (1996), Heckman (1997), among others. For an overview, see Wooldridge (2001), Imbens and Wooldridge (2009), Cameron and Trivedi (2005), Lee (2005), and Angrist and Pischke (2009). See also Abadie (2003) for non-linear treatment response models.

analyze whether and how local revenues are related to corruption. Obviously, local revenues are endogenous but the shock in transfers induced by the increase of mineral resources prices provides an exogenous source of variation in revenues that can be exploited for recovering a causal relationship between this latter variable and corruption.

Several specifications can be used in order to capture the source of variation in revenues available in the data. In this paper, I use the (log) of Mining Canon transfers as an instrument for local government revenues taking into account my previous results for the DD and the extended DD designs[33]. The estimated effect is a generalized local average treatment effect (LATE). Angrist and Imbens (1995) show that the standard LATE framework can be extended to accommodate models with variable treatment intensity in which the Wald estimator is a weighted average of the unit causal response. Identification under this design requires the instrument being independent of all potential outcomes and treatment intensities implying that the Mining Canon transfers have no effect on corruption other than through its effect on local revenues. I will show later that there is no evidence against this assumption in the context of this paper.

The first stage estimates the impact of this interaction on fiscal revenues and can be written as follows:

$$\log R_{jt} = \alpha_j + \lambda_t + b \log Canon_{jt} + X_{ijt}^{'}\gamma + v_{ijt} \qquad (3)$$

The term $\log R_{jt}$ is a measure (in logs) of per-capita revenues transferred to district j in period t. α_j and λ_t are respectively district and time fixed effects while $\log Canon_{jt}$ is a per-capita measure (in logs) of mining canon transfer for district j in period t. $X_{ijt}^{'}\gamma$ includes household and district level characteristics and v_{ijt} is an error term. The standard errors are clustered at district level.

The first stage estimates suggest that the relationship between the log of mining canon transfers and the log of revenues is strongly positive (Table IV). The estimated coefficient is 1.205 (standard error 0.026) and it is statistically significant at 1% confidence level (column 1). The interpretation of the coefficients is straightforward and represents the elasticity mining canon transfers-local revenues. The

[33] Dube and Vargas (2008) use an interaction between the price of oil and a measure of oil production in their analysis of the impact of commodity price shocks on civil conflict in Colombia. I prefer to use an actual measure of transfers instead of an interaction between the mineral prices and some measure of mining potential in the mineral-rich areas because the Mining Canon transfers depend on actual production.

instrument has an important predictive power on the endogenous variable (F statistic is 579.35 in specification 1), suggesting that my design is less sensitive to weak instruments issues. These results are robust to the inclusion of controls for urbanization (column 2), household wealth (column 3) and household's head characteristics (column 4). In particular, the F-statistic of the most complete specification is 155.98.

The reduced form is presented in Table V. The (log) of mining canon transfers is associated positively with corruption with a point estimate of 0.028 (standard error 0.011). This result is robust to the inclusion of controls for urbanization (column 6), household wealth (column 7) and household's head characteristics (column 8).

The second stage estimates the impact of revenues on corruption. The basic specification is as follows:

$$y_{ijt} = \alpha_j + \lambda_t + \beta \log R_{jt} + X_{ijt}^{'}\delta + \varepsilon_{ijt} \quad (4)$$

Where y_{ijt} is the outcome of interest for individual i who lives in the district j in period t. α_j and λ_t are respectively district and time fixed effects. $X_{ijt}^{'}\delta$ includes household and district level characteristics and ε_{ijt} is an error term. The parameter of interest is β which recovers the causal effect of interest.

Table V presents the results for IV-2SL estimation of equation (4). This procedure is preferred given the dichotomous nature of the dependent variable (Wooldridge 2001). The results suggest that revenues are positive associated with the measure of corruption used in this paper after controlling for other transfers (column 1). The estimated coefficient is 0.023 (standard error 0.009), suggesting that a unit change in the log of local revenues increases the probability of being asked to pay a bribe by 2.4 percentage points. The effect is large, representing an increase of 80% in the average probability of being required to make an unofficial payment to local public servant. This result is still robust after controlling for urbanization (column 2), household wealth (column 3) and household's head characteristics (column 4). In all the cases, the coefficient is the same with a level of statistical significance of 1%.

It is important to keep in mind that in the IV design I am allowing the magnitude of transfers to play a role at explaining the results. In the DD design, the emphasis is on whether being a recipient of

mining canon transfers matters. The fact that a positive sign is found in the IV analysis is consistent with the previous finding of a positive effect of transfers in areas in which a large increase of transfers is observed. The fact that the results of the reduced form are similar to the IV ones is consistent

6.3 Discussion about channels

So far, the empirical results suggest that differential effects of transfers on corruption are present in the data. While in general it seems to be the case that mining canon transfers are inducing a reduction in corruption as suggested by the DD analysis, this effect is countered by the positive effect of transfers on corruption in areas that were extraordinarily benefited from the boom of prices in mineral resources. The results for the IV approach, which estimates a local average treatment effect, are consistent with the findings of the DD analysis providing evidence of a positive impact of local revenues on corruption from the large increase of mining canon transfers due to the positive shock of the increase in mineral prices. This requires a more detailed analysis of the causal channels that explain these results.

One potential explanation is that public officials of these most benefited areas realize the temporary nature of the shock and want to take advantage of the boom by increasing their demand (and possibly prices) of bribes. Therefore, even in the case that their salaries were increasing over the period, they have incentives for requesting more bribes. This merits further analysis in the future.

An alternative explanation is provided by a recent sociological paper by Arellano (2011). Based on field work in a set of mineral rich districts, the author finds that there is an increase in labor-based conflicts related to the use of resources by local politicians for hiring low-skilled workers with higher salaries compared to existing wage levels for civil servants in the areas. This increase in wage inequality is consistent with an increase in the demand of bribes since public officials may have reacted to the relative decrease of their wages by increasing their demand of bribes. A more sophisticated econometric analysis is in progress.

7. Robustness checks

7.1 Placebo tests

As discussed above, my identification strategy relies in the fact that behavior of public officials in the Peruvian local governments must be sensitive to the revenues shock, or more generally, to changes in economic conditions of the local governments they work for. In contrast, public officials working in

the same areas whose wages are related to decisions taken for the central government, should not be affected by the revenue shock. I use this intuition and run a robustness check doing the analysis performed before for other public officials. My story will be consistent if not effect of Mining Canon transfers is found for these officials.

Table VI presents the result of DD and the extended DD analysis for the case of judiciary workers. The coefficients associated to the double and triple interactions are not significant. However, I do find a negative effect of the increase of prices in the most benefited areas. The results for the IV approach are also consistent and no effect of transfers is found (results not shown, available upon request). The results of the analysis for the police are also similar, as it is shown in Table VII.

An alternative placebo test to check the validity of my research design takes advantage of the assumptions implied in the DD model. If the absence of pre-trends assumption is valid, then it must be the case that during the years in which mineral prices were stable no difference between treated and control areas should be observed. Therefore, I create a placebo analysis by dropping observations for years in which prices showed an important increase (2005-2006) and re-defining the treatment variable as a dummy equal to one for treated districts (mineral producers in this case) after the placebo increase of prices (year 2004) and zero otherwise. Since in 2004 the increase of prices could have no affected the level of mining canon transfers, we should expect no change in level of corruption associated to this placebo increase. This is exactly what I have found. Results reported in Table VIII show that, before the actual increase in prices, no difference in corruption is observed between treated and non-treated areas. This suggests that no evidence against the identification assumptions is available so far.

7.2 Potential violations of the exclusion restriction

The validity of the exclusion restriction is supported by the fact that the change of prices affected basically fiscal revenues and not production levels. This fact is largely explained by the characteristic of the mining activity, which lack of linkages with other sectors of the economy and only employs 1% of the labor force. Thus, it is arguably that the exclusion restriction holds in this context, since the international price of minerals only affect my corruption measure through its effect on fiscal revenues.

Graph 3 shows evidence on this regard. It is clear from the graph that most of the variation in mining canon transfers is associated to the increase of mineral prices rather than endogenous

production responses. Of course, in many cases production rose over the period, but any increase in production is not necessarily endogenous. Given the expansion of the mining sector over the period under analysis, part of the observed growth in mining production is related to already planned investment. Computation of growth rates for the periods before (2001-2003) and after (2004-2006) the increase of mineral prices suggests that the pre-increase of prices period rates are in fact lower than the post-increase ones (except for the case of molybdenum), suggesting that the endogenous response issue is less important than expected[34]. This is not surprising since reacting to the new prices is not an automatic process for a sector that was working at its maximum capacity during the period.

In order to provide econometric evidence in that regard, I estimate the same extended DD model for household incomes. If the exclusion restriction is invalid, we should observe that transfers have a direct effect on household incomes and therefore it would be difficult to isolate the demand and supply of corruption in my design. Results for this analysis are presented in Table IX. I find no evidence of changes in household incomes due to the treatment. This is also valid for the case of the most benefited areas. Although this does not excluded other potential sources of violation to the exclusion restriction, at least provides some evidence in favor of the validity of my research design.

Even if endogenous production responses are not present in the data, the increase in production may affect citizens' demand for corruption opportunities. As a robustness check, I run the same DD specification excluding minerals that have shown a significant production increase over the period. Table X presents the evidence about the robustness of the basic results when copper production is excluded. The results are similar to those presented in Table III. Similar results are available for alternative robustness checks in which different mineral producers are dropped from the data.

8. Conclusions

This paper studies the impact of local revenues, a proxy of the local governments' economic conditions, upon corruption at local level, measured as the extent of the demand of unofficial payments by local civil servants. In order to address the endogeneity of corruption to economic conditions, I exploit a natural experiment in which a large increase in local revenues is observed due to the interaction of a rule of the fiscal system in Peru that forces the central government to allocate 50% of

[34] The growth rates for the pre and post increase of prices periods are the following for each mineral: 8% and 0.3% for copper, 11% and 8% for gold, 14% and 0.23% for zinc, 6.6% and 6.5% for silver, 3.4% and 1.2% for lead, 7% and 6% for iron, 2.6% and -3.8% for tin, and 0.4% and 9.9% for molybdenum. The results don't change when molybdenum producers are dropped from the sample (results not shown, available upon request).

the income taxes paid by mining companies to the regional and local governments where these resources are extracted, with an extraordinary rise of the international prices of these resources experienced during the past years. Because of this, these mineral-rich local governments experienced a large increase of their fiscal revenues compared to those local governments without mineral resources. Therefore, by comparing the bribery-behavior of public officials from local governments with and without mineral resources, before and after the shock, I shed light on the causal effect of local revenues on bribery-based corruption.

I find a significant effect of revenues on bribery-based corruption in Peru. Using a DD approach, I find that after the increase of prices of mineral resources the predicted probability of being asked to provide a bribe by public officials in local governments benefited with Mining Canon transfers reduces by 1.5-1.8 percentage points. This effect is large since represents a reduction in the average probability of being required to pay a bribe by local civil servant of 52%. This effect is larger in producer districts (a reduction of 2.0-2.7 percentage points).

However, when using an extended DD for capturing differential effects in those areas most benefited from the positive shock of mineral prices, I find a positive effect on corruption with an increase in the former predicted probability of 0.043. Taken together, these results suggest that the transfers have differential effects depending on the magnitude of the shock. The IV results are consistent with the DD and the extended DD analysis. I find that an increase of one unit in the log of local revenues increases the probability of being required to pay a bribe by 2.4 percentage points. This effect is large and represents an increase of 80% in the average probability of being asked to pay a bribe.

These results leave a number of open questions related to the mechanisms behind this differential effect of transfers. More research is needed in this area in order to shed light on these questions.

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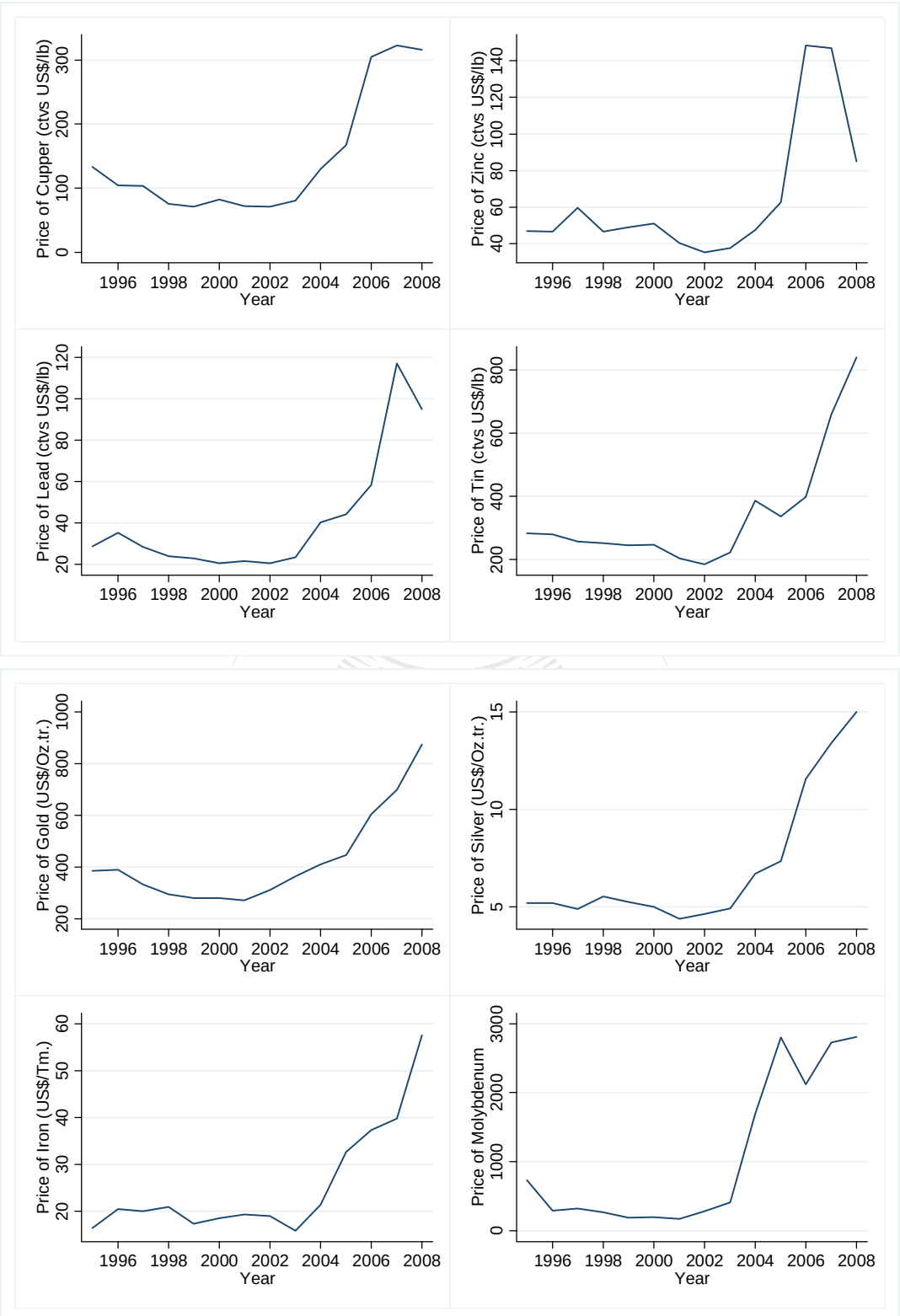
Appendix 1: Variable Definitions

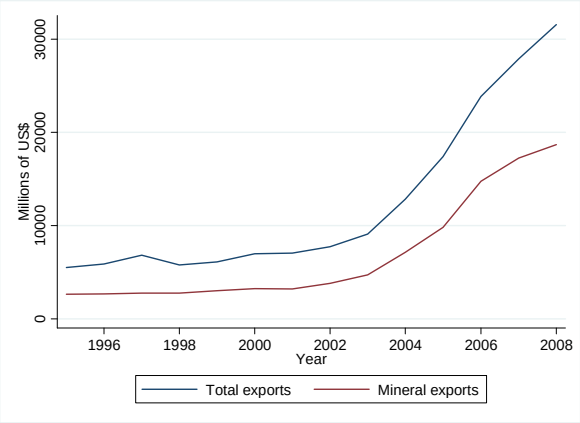
Variable	Description
Most benefited area	1 if the district belongs to the 4 major benefited regions of Mining Canon transfers (Ancash, Cajamarca, Moquegua and Tacna)
Mineral producer	1 if the district produces some type of mineral
Total revenues	District`s total revenues (Millions of Soles)
Total transfers of canon	District`s total canon transfers (Millions of Soles)
Receiver of Mining Canon	1 if the district receives transfers from Mining Canon
Bribery episode in:	
The municipal government	1 if household has experienced an episode of bribery in the municipality
The judicial system	1 if household has experienced an episode of bribery in the judicial system
The PNP police station	1 if household has experienced an episode of bribery in a PNP police station
Urban	1 if geographical coverage is urban
Own bike	1 if the household has a bike
Own car/van	1 if the household has a car/van
Own tricycle	1 if the household has a tricycle
Own motorbike	1 if the household has a motorbike
Own truck	1 if the household has a truck
Own mototaxi	1 if the household has a mototaxi
Log (1+Consumption)	Logarithm of the monthly household consumption
Number of earners	Number of earners at the household
Own residence through occupation	1 if the residence was obtained by occupation
Age	Age (in years) of household head
Gender (Male=1)	1 if the gender of the household head is male
Marital status (Married=1)	1 if the marital status of the household head is married or cohabitant
Elementary school (incomplete)	1 if the highest education level is elementary school (incomplete)
Elementary school (complete)	1 if the highest education level is elementary school (complete)
High school (incomplete)	1 if the highest education level is high school (incomplete)
High school (complete)	1 if the highest education level is high school (complete)
University (incomplete)	1 if the highest education level is University (incomplete)
University (complete)	1 if the highest education level is University (complete)
Log (1+Municipal Compensation Fund)	Logarithm of the Municipal Compensation Fund
Receipt of transfers from:	
Oil canon	1 if the district receives transfers of Oil canon
Mining Canon	1 if the district receives transfers of Mining Canon
Hydropower canon	1 if the district receives transfers of Hydropower canon
Forest canon	1 if the district receives transfers of Forest canon
Royalties	1 if the district receives transfers of Royalties
Canon gas field	1 if the district receives transfers of Canon gas field
Fishing canon	1 if the district receives transfers of Fishing canon
Mining royalties	1 if the district receives transfers of Mining royalties
FOCAM royalties	1 if the district receives transfers of FOCAM royalties

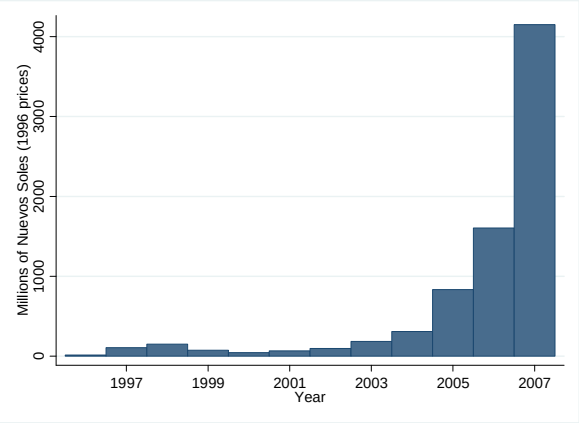
Graph 1: Evolution of commodity prices



Source: Ministry of Energy and Mines.

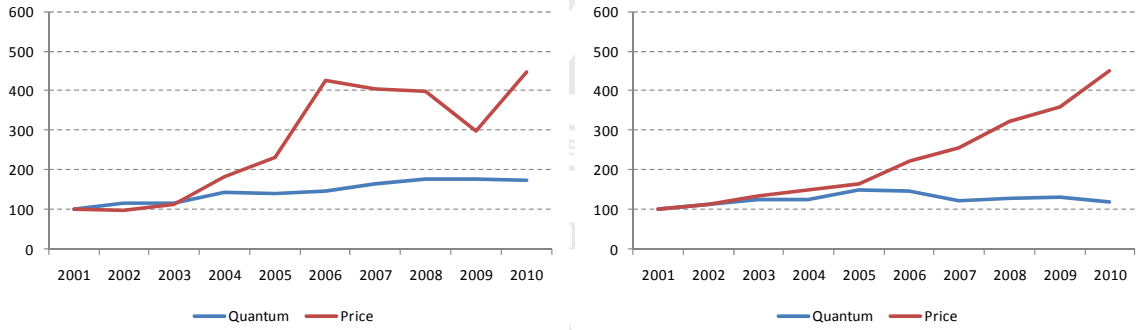
Graph 2: Evolution of total exports, mineral exports and mining canon transfers





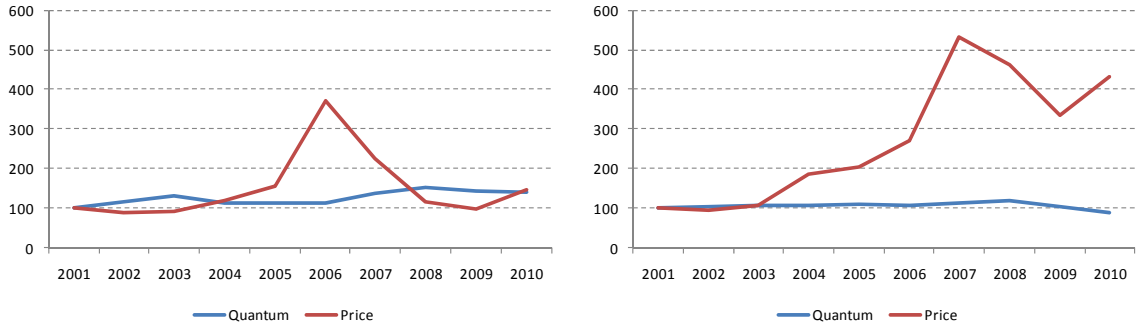
Source: Ministry of Economic and Finance.

Graph 3: Evolution of mineral production and prices



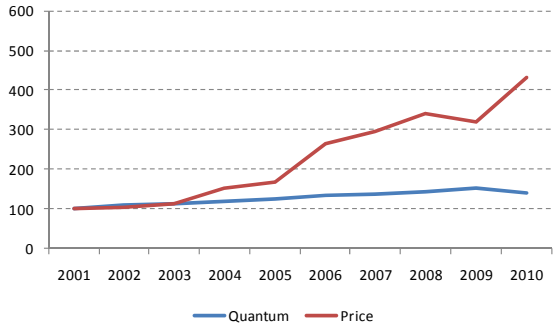
1. Copper

2.Gold

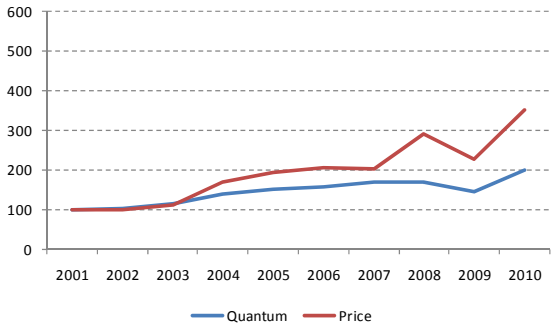


3. Zinc

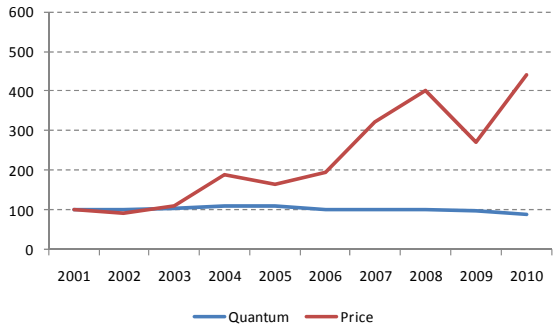
4.Lead



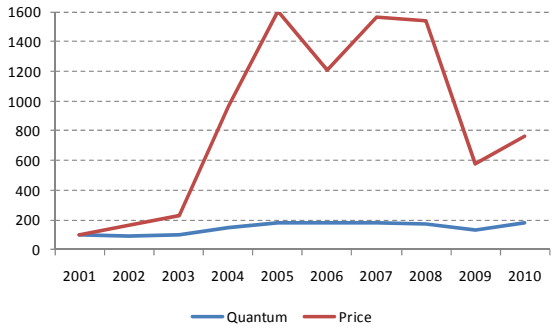
5. Silver



6.Iron



7. Tin



8.Molymbdenum

Source: Ministry of Energy and Mines.

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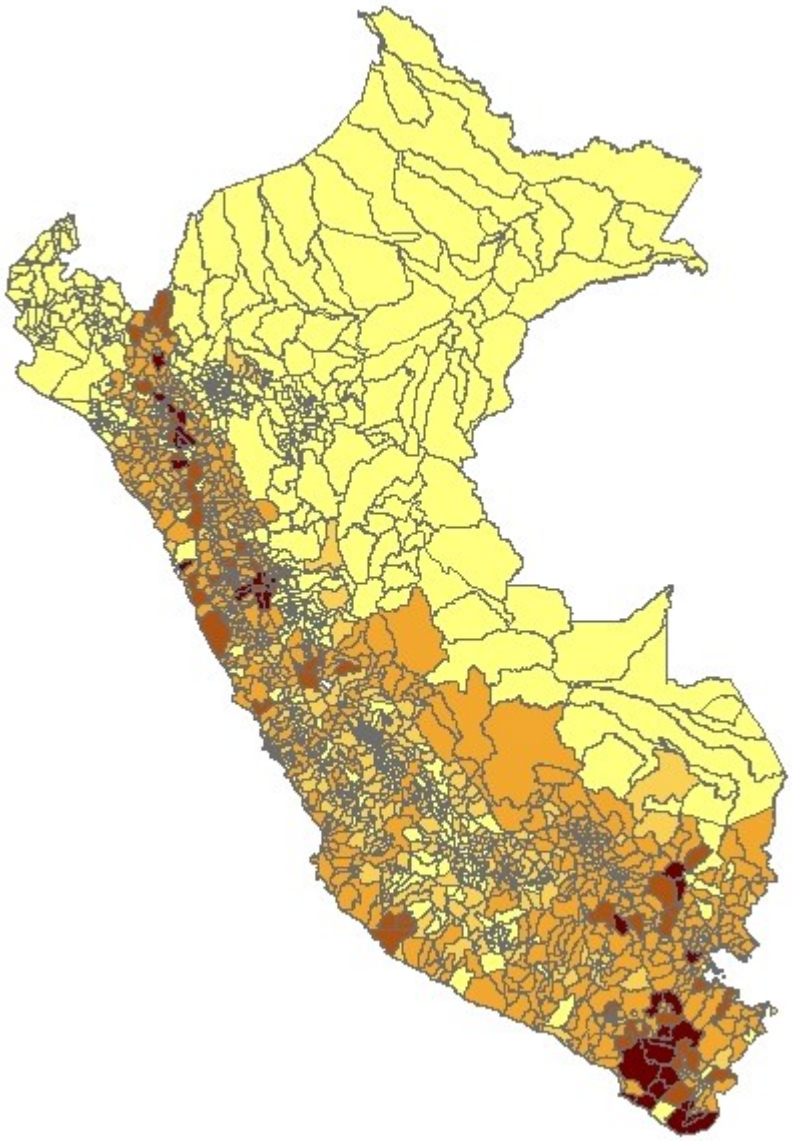
Map 1: District Allocation of Mining Canon Transfers, 2006



Source: Own elaboration using data from the Ministry of Economic and Finance.

Table I: Descriptive Statistics

Variable		I. Full Sample		II.Receiver of mining canon				III.Mineral producer				IV.Year									
				No		Yes		No		Yes		2002		2003		2004		2005		2006	
	Obs.	Mean	S.d.	Mean	S.d.	Mean	S.d.	Mean	S.d.	Mean	S.d.	Mean	S.d.	Mean	S.d.	Mean	S.d.	Mean	S.d.	Mean	S.d.
I.Revenues and transfers																					
Total Revenues	86539	28.9	78.3	22.5	29.8	30.2	84.4	29.4	79.8	17.6	26.4	21.8	54.9	22.1	56.7	30.2	80.6	33.5	91.2	33.6	89.7
Total Tranfers of canon	86539	2.1	7.4	2.4	4.7	2.0	7.8	1.8	6.1	7.9	19.8	0.5	1.3	0.8	1.7	1.3	2.3	2.6	6.9	4.4	13.3
II.Corruption measures																					
Used an official of :																					
The municipal government	85907	0.27	0.44	0.28	0.45	0.27	0.45	0.27	0.44	0.27	0.45	0.22	0.41	0.25	0.44	0.28	0.45	0.30	0.46	0.30	0.46
The judicial system	85911	0.04	0.19	0.03	0.18	0.04	0.20	0.04	0.19	0.03	0.18	0.04	0.20	0.04	0.19	0.04	0.18	0.04	0.19	0.04	0.19
The PNP police station	85911	0.05	0.23	0.04	0.20	0.06	0.23	0.05	0.23	0.06	0.24	0.06	0.23	0.06	0.23	0.06	0.23	0.05	0.21	0.05	0.23
Bribery episode in:																					
The municipal government	23662	0.03	0.17	0.03	0.18	0.03	0.16	0.03	0.17	0.02	0.14	0.06	0.24	0.04	0.19	0.02	0.14	0.02	0.14	0.02	0.12
The judicial system	3322	0.12	0.32	0.14	0.35	0.11	0.31	0.12	0.32	0.11	0.31	0.15	0.36	0.19	0.39	0.09	0.28	0.09	0.29	0.07	0.26
The PNP police station	4437	0.34	0.47	0.27	0.45	0.35	0.48	0.33	0.47	0.45	0.50	0.30	0.46	0.43	0.49	0.32	0.47	0.32	0.47	0.34	0.47
III.Regional controls																					
Geographical coverage (urban = 1)	91150	0.65	0.48	0.63	0.48	0.67	0.47	0.65	0.48	0.62	0.48	0.65	0.48	0.65	0.48	0.65	0.48	0.65	0.48	0.65	0.48
IV.Household characteristics																					
Own bike	89139	0.29	0.45	0.27	0.44	0.30	0.46	0.29	0.45	0.29	0.45	0.27	0.44	0.29	0.45	0.29	0.46	0.29	0.46	0.30	0.46
Own car/van	89139	0.08	0.28	0.04	0.20	0.10	0.29	0.08	0.28	0.10	0.31	0.09	0.28	0.09	0.29	0.09	0.28	0.08	0.27	0.08	0.27
Own tricycle	89140	0.04	0.19	0.02	0.15	0.04	0.19	0.04	0.19	0.04	0.19	0.04	0.20	0.04	0.19	0.04	0.19	0.03	0.18	0.03	0.18
Own motorbike	89136	0.02	0.14	0.04	0.19	0.02	0.13	0.02	0.14	0.03	0.17	0.02	0.13	0.02	0.13	0.02	0.14	0.02	0.15	0.03	0.16
Own truck	89139	0.01	0.08	0.01	0.08	0.01	0.08	0.01	0.08	0.01	0.09	0.01	0.08	0.01	0.08	0.01	0.08	0.01	0.09	0.01	0.07
Own mototaxi	89139	0.01	0.12	0.03	0.16	0.01	0.11	0.01	0.12	0.01	0.11	0.01	0.10	0.01	0.10	0.01	0.12	0.02	0.12	0.02	0.13
Log Consumption	91150	7.96	1.02	7.87	0.97	8.01	1.02	7.96	1.03	7.98	0.96	6.78	0.85	8.21	0.81	8.25	0.81	8.25	0.82	8.33	0.83
Number of earners	91150	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1
Own residence through invasion	91148	0.04	0.20	0.07	0.25	0.04	0.20	0.04	0.21	0.01	0.11	0.06	0.24	0.04	0.19	0.03	0.18	0.04	0.19	0.04	0.20
V.Individual characteristics (household head)																					
Age	91150	49	16	48	15	50	16	49	16	48	15	48	16	49	16	49	16	50	16	50	16
Gender (Male=1)	91150	0.78	0.41	0.80	0.40	0.78	0.41	0.78	0.41	0.83	0.37	0.80	0.40	0.79	0.41	0.79	0.41	0.77	0.42	0.78	0.42
Marital status (Married=1)	91134	0.72	0.45	0.74	0.44	0.71	0.45	0.72	0.45	0.76	0.43	0.73	0.45	0.73	0.45	0.72	0.45	0.71	0.45	0.71	0.45
Elementary school (incomplete)	90846	0.29	0.46	0.31	0.46	0.28	0.45	0.29	0.45	0.31	0.46	0.31	0.46	0.30	0.46	0.29	0.45	0.30	0.46	0.28	0.45
Elementary school (complete)	90846	0.17	0.38	0.19	0.39	0.17	0.37	0.17	0.38	0.15	0.36	0.17	0.37	0.18	0.38	0.18	0.38	0.17	0.38	0.18	0.38
High school (incomplete)	90846	0.13	0.34	0.15	0.35	0.13	0.34	0.13	0.34	0.14	0.35	0.14	0.35	0.13	0.34	0.13	0.34	0.13	0.34	0.13	0.34
High school (complete)	90846	0.21	0.41	0.20	0.40	0.21	0.41	0.21	0.41	0.21	0.41	0.20	0.40	0.21	0.41	0.20	0.40	0.21	0.41	0.21	0.41
University (incomplete)	90846	0.05	0.22	0.04	0.20	0.05	0.22	0.05	0.22	0.04	0.21	0.05	0.22	0.04	0.20	0.05	0.21	0.05	0.22	0.05	0.22
University (complete)	90846	0.14	0.35	0.11	0.32	0.15	0.36	0.14	0.35	0.14	0.34	0.13	0.34	0.14	0.35	0.15	0.36	0.14	0.35	0.15	0.36

VI.Municipal Characteristics																				
Log (1+municipal compensation fund)	91085	14.80	1.36	14.94	1.34	14.77	1.36	14.81	1.36	14.56	1.24	14.56	1.29	14.57	1.28	14.77	1.33	14.89	1.37	15.07	1.40
Receipt of transfers from:																					
Oil canon	91085	0.08	0.28	0.30	0.46	0.04	0.20	0.09	0.28	0.00	0.00	0.09	0.28	0.09	0.28	0.09	0.28	0.08	0.27	0.08	0.27
Mining canon	91085	0.84	0.37	-		-		0.83	0.37	0.96	0.19	0.82	0.38	0.82	0.38	0.76	0.43	0.86	0.34	0.92	0.27
Hydropower canon	91085	0.56	0.50	0.07	0.26	0.65	0.48	0.55	0.50	0.68	0.47	0.45	0.50	0.51	0.50	0.56	0.50	0.61	0.49	0.61	0.49
Forest canon	91085	0.71	0.45	0.68	0.46	0.72	0.45	0.71	0.46	0.81	0.39	0.40	0.49	0.81	0.39	0.75	0.43	0.70	0.46	0.90	0.30
Royalties	91085	0.01	0.08	0.00	0.04	0.01	0.09	0.01	0.08	0.00	0.00	-		-		-		0.03	0.16	0.00	0.02
Canon gas field	91085	0.04	0.18	0.07	0.25	0.03	0.17	0.03	0.18	0.04	0.19	-		-		0.05	0.22	0.06	0.23	0.05	0.22
Fishing canon	91085	0.33	0.47	0.20	0.40	0.35	0.48	0.33	0.47	0.33	0.47	-		0.55	0.50	0.54	0.50	0.31	0.46	0.30	0.46
Mining royalties	91085	0.32	0.47	0.03	0.16	0.38	0.48	0.32	0.47	0.32	0.47	-		-		-		0.61	0.49	0.81	0.39
FOCAM royalties	91085	0.05	0.22	0.02	0.15	0.05	0.23	0.05	0.21	0.08	0.27	-		-		-		0.11	0.32	0.11	0.31

Note: The unit of observation is the household.

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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 government				
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%. Huber-White standard errors clustered at the district level. Controls includes a dummy for whether the household is an urban area, assets possession (car, bike, etc.), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. See Appendix 1 for details.

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*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%. Huber-White standard errors clustered at the district level. Controls includes a dummy for whether the household is an urban area, assets possession (car, bike, etc.), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. See Appendix 1 for details.

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

	First Stage				
	(1)	(2)	(3)	(4)	(5)
	Log of Total Revenues per-capita (Thousand of New Soles)				
Log of Mining Canon per-capita (Thousand of New Soles)	1.205***	1.224***	1.224***	1.224***	1.224***
	(0.026)	(0.025)	(0.025)	(0.025)	(0.025)
F-value	579.35	251.63	238.48	170.43	155.98
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	22,526	22,526	22,546	22,430	22,405
R-Squared	0.851	0.865	0.865	0.865	0.865

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. Controls includes a dummy for whether the household is an urban area, assets possession (car, bike, etc.), household consumption, number of earners, a dummy for whether the dwelling was obtained through occupation, and characteristics of the household head (age, gender, education and civil status). See Appendix 1 for details.

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			
Log of Total revenues per-capita (Thousand of New Soles)	0.023***	0.023***	0.023***	0.024***				
	(0.009)	(0.009)	(0.009)	(0.009)				
Log of Mining Canon per-capita (Thousand of New Soles)					0.028***	0.028***	0.029***	0.030***
					(0.011)	(0.011)	(0.011)	(0.011)
Constant					0.389**	0.386**	0.355**	0.366**
					(0.168)	(0.168)	(0.169)	(0.169)
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	22,526	22,526	22,430	22,405	22,560	22,560	22,464	22,439
R-Squared	0.012	0.012	0.013	0.015	0.011	0.012	0.013	0.015

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. Controls includes a dummy for whether the household is an urban area, assets possession (car, bike, etc.), household consumption, number of earners, a dummy for whether the dwelling was obtained through occupation, and characteristics of the household head (age, gender, education and civil status). See Appendix 1 for details.

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*After increase prices*Most Benefited Area					0.024	0.010	0.008	0.008
					(0.145)	(0.157)	(0.158)	(0.156)
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%. Huber-White standard errors clustered at the district level. Controls includes a dummy for whether the household is an urban area, assets possession (car, bike, etc.), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. See Appendix 1 for details.

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*After increase prices*Most Benefited Area					0.025	0.062	0.064	0.049
					(0.085)	(0.069)	(0.069)	(0.083)
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%. Huber-White standard errors clustered at the district level. Controls includes a dummy for whether the household is an urban area, assets possession (car, bike, etc.), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. See Appendix 1 for details.

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)
Placebo (Mineral producer*After increase prices*Most Benefited Area)					0.012	0.013	0.013	0.017
					(0.025)	(0.027)	(0.027)	(0.026)
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%. Huber-White standard errors clustered at the district level. Controls includes a dummy for whether the household is an urban area, assets possession (car, bike, etc.), number of earners, and a dummy for whether the dwelling was obtained through occupation. See Appendix 1 for details.

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*After increase prices*Most Benefited Area					-24.659	-6.684	-11.123	-3.099
					(53.120)	(53.038)	(54.453)	(55.316)
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%. Huber-White standard errors clustered at the district level. Controls includes a dummy for whether the household is an urban area, assets possession (car, bike, etc.), number of earners, and a dummy for whether the dwelling was obtained through occupation. See Appendix 1 for details.

Table X: Impact of Mining Canon Transfers in the Probability of a Bribery Episode in Local Governments (Excluding Copper 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)	-0.026**	-0.023*	-0.023*	-0.024*	-0.032***	-0.030**	-0.030**	-0.030***
	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Mineral producer*After increase prices*Most Benefited Area					0.036***	0.036***	0.036***	0.034***
					(0.014)	(0.013)	(0.013)	(0.013)
Constant	0.066***	0.338**	0.335**	0.305*	0.066***	0.323*	0.320*	0.289*
	(0.005)	(0.170)	(0.171)	(0.170)	(0.005)	(0.171)	(0.171)	(0.170)
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	23,072	22,015	22,015	21,919	23,072	22,015	22,015	21,919
R-Squared	0.011	0.012	0.012	0.014	0.012	0.012	0.012	0.014

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. Controls includes a dummy for whether the household is an urban area, assets possession (car, bike, etc.), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. See Appendix 1 for details.

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