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Essays in the Political Economy of Natural Resource Booms

By

Stanislao Humberto Maldonado Zambrano

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

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in the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Elisabeth Sadoulet

Professor Jeremy R. Madruger

Professor Edward Miguel

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Abstract

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Doctor of Philosophy in Agricultural and Resource Economics

University of California, Berkeley

Professor Elisabeth Sadoulet, Chair

I study the political effects of resource booms on the behavior of politicians, citizens and government and discuss why the existing literature provide unsatisfactory answers to understand the complex nature of resource booms. In the first chapter, I explore how resource booms affect the incentives of politicians and how this is related to the contested issue of the impact of natural resources on living standards. Then, in the second chapter, I analyze how resource booms can affect the citizens' beliefs about the performance of democracy and its implications in terms of quality of the democratic regime. Finally, in the third chapter, I study how resource booms affect the performance of local government in terms of delivering public goods in an efficient manner. Together, these chapters offer a complete understanding of some of the most relevant issues highlighted by the theoretical and empirical literatures of the so-called resource curse.

Are resource booms beneficial or detrimental for citizens? What is the role of politicians' incentives in this regard? In the first chapter "The Political Effects of Resource Booms: Political Outcomes, Clientelism and Public Goods Provision in Peru" I exploit variation in natural resource rents and mineral production among Peruvian municipalities to analyze the impact of resource booms on local politicians' behavior and citizens' well-being. Although this topic has recently attracted the attention of several scholars, the existing empirical evidence remains inconclusive regarding whether resource booms are beneficial or detrimental to citizens via their effects on public good provision and welfare outcomes. I argue that, despite the fact that many of the existing theoretical models allow for the possibility of non-monotonic responses, the empirical literature has mostly approached this phenomena using linear models, failing to correctly understand the nature of resource booms. Exploiting the recent extraordinary increase in mineral prices along with a set of rules for the distribution of natural resource rents in Peru, I show that the effects of resource booms in reelection outcomes, political competition, and public goods provision are function of the size of the rents in a non-monotonic fashion. For municipalities that experienced a modest increase in rents, the evidence suggests that the boom is associated with increases in public good provision and living standards, whereas the opposite occurs for the case of extremely rich municipalities in terms of mining rents. These results are robust to endogenous production responses and are consistent with a simple model of electoral competition in a resource rich economy.

In the second chapter "Resource Booms and Political Support: Evidence from Peru", I use the same identification strategy as in Chapter 1 in order to study how resource booms can affect the performance of democracy in resource-rich areas. I motivate this chapter by noticing that resource abundance has been usually associated with poor democratic performance. Particularly, some scholars suggest that in resource-rich countries democracy faces constraints to consolidate and survive. Interestingly, current theoretical explanations emphasize the role of politicians and elites in this regard implicitly assuming that citizens are always pro-democracy. However, historical and empirical evidence suggest that, in countries where democracy is new or unconsolidated, citizens are critical about its performance and willing to replace it with an authoritarian regime if they perceive this regime is better for delivering the policy outcomes they care about. In this chapter, I study this issue exploiting sub-national exogenous variation across mineral-rich local governments in Peru related to the allocation of mineral resource rents during a recent boom in mineral prices. Using a difference in difference approach, I estimate a non-monotonic effect of natural resource rents on the perception about the effectiveness of democracy. For modest increases in rents a positive impact on citizens' support for democracy is observed whereas the opposite occurs in districts that experienced large transfers. These results are consistent with a model on citizen's learning about the effectiveness of democracy during a resource boom.

Finally, in the third chapter "Natural Resource Windfalls and Efficiency of Local Government Expenditures: Evidence from Peru" I analyze the role of natural resource windfalls in explaining the efficiency of public expenditures. Using a rich dataset of expenditures and public good provision for 1,836 municipalities in Peru for period 2001-2010, I estimate a non-monotonic relationship between the efficiency of public good provision and the level of natural resource transfers. Local governments that were extremely favored by the boom of mineral prices were more efficient in using fiscal windfalls whereas those benefited with modest transfers were more inefficient. These results can be explained by the increase in political competition associated with the boom, as it was found in Chapter 1. However, the fact that increases in efficiency were related to reductions in public good provision casts doubts about the beneficial effects of political competition in promoting efficiency.

These chapters provide different and more complex views than the existing literature. They emphasize the existence of non-monotonic patterns in the relationship between resource booms and political and economic outcomes that were not previously addressed empirically exploiting subnational variation to uncover causality. This approach allows us to understand the previously inconsistent findings in the literature with respect to the lack of impacts on living standards despite the large increase in rents experienced by resource-rich areas.

To my mothers, Flor de Maria and Maria Isabel, for all their love and sacrifice and for keeping me alive

To my dad Humberto, for believing in me since I was a kid

To my family, for all their love and unconditional support

To Maria Jose, for being with me in my battle against a Brain Arteriovenous Malformation, for her love and friendship during these difficult times

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It was a long trip to get here. In a way, it was a noisy trip. When I left Peru to go to Argentina for my master studies I was expecting to come back a year after but life took me to a different path. Today I am graduating from one of the best universities in the world. It is impossible to repay the debt that I owe to all of those who helped me in the process in these paragraphs. I will do all my best to accomplish that in the future.

Berkeley, May 2015

Chapter 1

The Political Effects of Resource Booms: Political Outcomes, Clientelism and Public Goods Provision in Peru*

* A preliminary version circulated under the title "The Political Effects of Resource Abundance: Evidence from Peru". I appreciate the advice of Elisabeth Sadoulet during the development of this project and comments by Micheal Anderson, Lee Behman, David Collier, Ruth Collier, Alain de Janvry, Larry Karp, Fred Finan, Ethan Ligon, Jeremy Madruger, Ted Miguel, John Nye, Mary Shirley, Alberto Simpser, Jas Sekhon, Colin Xu and seminar participants at the Ronald Coase Institute institutional workshop at University of Chicago, Development Workshop and Environment and Resource Economics seminar at UC Berkeley. Tania Lozano, Sarita Ore and Victor Huamani provided excellent research assistance. I am grateful for a research grant from ACDI/IDRC-Economic and Social Research Consortium. All remaining error is my responsibility.

1.1. Introduction

The abundance of natural resources has been usually linked to poor economic and political performance. Anecdotal evidence and some previous cross-national research suggest that natural resource rich countries are not only failing in terms of transforming their natural wealth in well-being for their citizens but they are also more vulnerable to a set of economic and political pathologies that are impoverishing them[1]. This has led to some scholars to describe this phenomenon as a "resource curse" (Sachs and Warner 1995, Karl 1997 and Ross 1999, among others). Despite the significant theoretical work in this area (Tornell and Lane 1999, Mehlum et al 2006, Robinson et al 2006, Torvik 2002, among others), our knowledge about this phenomenon remains limited from an empirical point of view.

This seems to be specially the case of the political dimensions of the resource curse[2]. Some scholars have suggested that resource abundance can weaken the levels of governance and the quality of democracy in resource-rich areas (Watchenkon 2002, Jensen and Watchenkon 2004, Morrison 2007 and 2009, Robinson et al 2006, among others) but the empirical evidence is not conclusive and even contradictory[3]. Although there are differences in terms of the proposed mechanisms, there exist a consensus among researchers that what matters in order to understand this relationship is the behavior of politicians and political elites. For instance, Jensen and Wantchekon (2004) suggests that the key mechanism to explain the poor institutional and democratic performance in resource-rich areas is the *"…incumbent's discretion over the distribution of natural resource rents*".

In this paper, we shed light on these issues by studying how a mineral resource boom affects the electoral behavior of politicians and its consequences in terms of citizens' well-being. Specifically, we are interested in understanding how mineral resource booms affect reelection outcomes and political competition paying attention to the instruments politicians use in order to affect these outcomes such as public good provision and public employment. We then analyze how these dimensions are related to citizens' well-being.

To do so, we use variation in mineral resource rents and mineral production across Peruvian municipalities and over time. This variation is due to a set of rules about the allocation of mining tranfers to resource-rich areas along with the extraordinary increase in the prices of the most important minerals produced by the country over the past years. This set of rules establish that a fraction of the taxes paid by mining companies and a percentage of their revenues have to be allocated to areas where these resources are extracted. This is the key element of our research design because allows us to take advantage of variation across local governments with and without access to these transfers, before and after the recent increase of the prices of mineral resources, in order to explore the causal effect of an increase of natural resource rents on the set of political and economic outcomes described above.

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[1] Resource abundance has been related to macroeconomic pathologies such as "Dutch disease" (exchange rate appreciation that contracts the trade sector), poor levels of economic growth, high unemployment, low savings, high external indebtedness, export earnings instability and lack of export diversification. See Frenkel (2010) and van der Ploeg (2011) for an overview of these issues.

[2] See Deacon (2011) and Rosser (2006) for an overview.

[3] This is particular the case for the impact of resource abundance on democracy. Ross (2001) is the first of a large collection of studies that find a negative association between natural resource and democracy. More recently, Haber and Menaldo (2011) have found evidence questioning this relationship. These authors find that, in fact, natural resources are linked to better democratic outcomes.

Peru offers an ideal setting to explore the impact of resource abundance on the behavior of local politicians. In the first place, the country is one of the most important mineral producers of the world. Currently, Peru is the 2nd producer of copper and silver, the 3rd of zinc and tin, the 4th in lead and molybdenum, and 6th in gold[4]. More importantly, there is a significant spatial variation within the country in terms of the type of mineral products exploited in each region which facilitates the empirical analysis. A third reason relates to the characteristics of the recent mining boom experienced by the country. Mineral production has been multiplied by more than 5 (from 1.35 to 7.05 US billions) and rents distributed to producer regions increased by 118-fold (from 7 to 827 US millions) from 1996 to 2010, including a peak in 2007 where mining rents reach the record of 1.317 US billions. This extraordinary increase in a very short-period have created few rich municipalities that have experienced a dramatic increase in their budgets creating an ideal scenario to study the impact of natural resource windfalls on the electoral incentives of politicians. A fourth reason is the set of rules for the allocation of mining rents across Peruvian municipalities. The current legal framework establish a distribution rule that not only grants a significant fraction of the mining royalties and taxes paid by mining companies to mineral producer districts but that also allocates part of these transfers to non-producer districts located in neighboring areas. This fact allows us to distinguish between the impacts of a resource boom related to the increase of mining rents (something we can call a "rent effect") from the impacts related to changes in the local economy associated to increases in mineral production (or "production effect")[5]. A final reason, it is the nature of the local political arena in the country, characterized by its high level of fragmentation and weekly connection with national political parties, making the Peruvian case less sensitive to strategic interactions between local politicians and national political parties that may affect the rules of mining rents distribution.

In order to understand the connection between resource abundance and political outcomes, it is critical to study how natural resource rents affect the electoral behavior of politicians. This calls for a theoretical framework. In this paper, we adapt a basic model of electoral competition in the presence of exogenous rents developed by Caselli (2006). In this simple two-period model, an incumbent politician decides the present value of his consumption by allocating the local government budget between political rents and public goods. He faces the potential competition of an entrepreneur who has to decide whether to work in the industrial sector or to become a challenger for the incumbent. Production of industrial goods depends on the level of public goods like roads or physical infrastructure. Therefore, the incumbent can avoid political competition by providing more public goods to citizens in the face of a resource boom, making the opportunity cost of becoming a political challenger high. However, this boom also makes more profitable for the entrepreneur to become a challenger since the value of holding power is higher as well. Hence, there is a threshold value of natural resource rents after which it is optimal for the incumbent underinvest in public goods. This is due to the fact that, from the point of view of the entrepreneur, the potential rents of controlling office are higher than the level of profits he would make given the provision of public goods. Then, the incumbent cannot prevent entry and therefore he

[4] See MINEM (2012) for details.

[5] Conceptually, we can think that an exogenous rise of mineral prices can lead to an increase in mining transfers due to a pure price effect without changes in the actual production levels. In this case, the behavior of politicians will be affected only through the increase in local government budgets. However, higher prices can also be associated to an increase in production levels, and these changes in production can lead to the emergence of public "bads" such as environmental degradation, crime, prostitution, etc.; that can negatively affect citizens' welfare and influence both the incumbent and citizens' political behavior.

maximizes the present value of his consumption by underinvesting in public goods. As a result, the model predicts a non-monotonic relationship between the level of natural resource rents and the level of political competition which is a consequence of a non-monotonic relationship between these rents and public goods provision.

In this basic model, if the mayor prevents competition, he also gets reelected. A more realistic approach is to model reelection as an interaction between the mayor and citizens along the interaction between the mayor and other politicians. In this extension of the model, the incumbent politician can also use natural resource rents for buying-off the electorate and affect in this alternative way the entry decision of the entrepreneur. His ability to do so will depend on how effective political patronage is in deterring competition and obtaining electoral support from citizens. This effectiveness can be thought as a function of local state capacity. When this capacity is low, then patronage is basically ineffective in getting citizens' electoral support, so it is not optimal for the incumbent invest in it. As a consequence, the results are essentially the same as previously described with the difference that the mayor is not reelected. On the other hand, when this capacity is high, then the incumbent can use patronage in an effective manner to obtain electoral support, being always able to prevent competition and to get reelected. When local capacity is intermediate, then a non-monotonic pattern between natural resource rents and reelection outcomes emerge, having this relationship a U-shaped form.

We take to the implications of this model to the empirical test using a unique dataset of mineral production, transfers from central government, electoral outcomes, public good provision, electoral conflict and local government characteristics for the period 1996-2010. We use detailed knowledge about the institutional setting to link the theoretical framework with the empirical test. In particular, we assume that the levels of institutional capacity are intermediate, so non-monotonic patterns between natural rents and economic and political outcomes are expected. In order to claim causality, our identification strategy exploits the increase of international prices of mineral resources and changes in the distribution rule of mining rents. Using variation in mining rents induced by these two factors, we compare the political and economic outcomes of districts that differ in the level of mining rents they receive from the central government. We implement this design using two empirical approaches. In the first case, we use a difference in difference (DD) strategy in which mining rents are defined as a continuous treatment. Using mining rents as treatment would be problematic if rents are also a result of endogenous changes in production levels induced by the boom of mineral prices. This is the justification for our second approach based on an instrumental variable (IV) design. We use mining Canon revenues –a subset of mining rents- as an instrument since it is less sensitive to changes in production than other transfers related to natural resource exploitation. Mining canon depends on the taxes paid by mining companies and are distributed to different level of subnational governments following a set of fixed rules as we will explain later. We recognize that this is an imperfect instrument since the exclusion restriction might not hold[6]. To address this issue, we implement the sensitivity analysis developed by Nevo and Rosen (2012) and derive one-side bounds for the treatment effect under study. We

[6] Ideally, the identification of a causal effect in this setting would require that mining rents were exogenous. This may be the case if the variation in rents were exclusively explained by changes in the international prices of mineral resources. However, mining companies may have reacted to the new prices by expanding the level of mineral production or by starting new operations in ways that can affect the local economy and citizens' political behavior. Therefore, mining rents would be endogenous. We argue in this paper that, even if these factors may have played a role, the most important driver of the increase in natural rents were movements in international prices. We provide evidence that shows that this is actually the case and use a set of robustness checks to provide evidence in that regard.

offer evidence that endogenous responses related to production are not present in the context of this paper and that –even if we allow for a significant departure from the validity of the exclusion restriction- the main results of the paper are largely unaffected.

We find evidence of a non-monotonic patterns consistent with this theoretical framework. For municipalities with average mining transfers (130 nuevos soles per-capita), we estimate a reduction of 38% in mayors' reelection probability for each 1,000 nuevos soles of mining transfers. However, for districts with extraordinarily high levels of mining transfers (above 4,800 nuevos soles per-capita) a positive relationship is observed. A similar pattern is observed for the case of political competition. We estimate a negative impact of 4.9% in terms of our measure of political competition for the average municipality with a turning point above of 11,000 nuevos soles per-capita after which the effect becomes positive. These results are robust to controlling for mineral production and remain essentially the same for several sub-samples. When the Nevo and Rosen's (2012) bounds are estimated, the results are basically unchanged even for the case in which significant departures of the exclusion restriction are allowed.

We also find patterns consistent with a non-monotonic effect for the case of public good provision, the construction of local infrastructure, investment in roads and public employment. This also applies to the case of household income as a measure of welfare, but no evidence is found for household consumption. We interpret this result as evidence of short-term impacts of the mineral resource boom on citizens' welfare.

Taking these results together, we believe that we have enough evidence to argue that the existing literature is failing in correctly understand the nature of resource booms. It is interesting to note that, although the theoretical literature has long recognized the existence of non-monotonic patterns, the empirical literature have privileged linear approximations. To best of our knowledge, this is one of the first papers on addressing these non-monotonic patterns in response to natural resource booms exploiting sub-national variation.

In addition, this paper contributes to the empirical literature of the economic and political effects of natural resources in several ways. First, unlike most of the recent empirical literature, we treat resource booms as complex phenomena associated to shocks in production and natural resource rents. Whereas most of the recent contributions analyze only the role of natural resource rents (Brollo et al 2013, Caselli et al 2013, and Monteiro et al 2012), this paper also studies the contribution of production changes in political outcomes which represents a step forward in understanding resource booms in an empirical manner. Second, instead of defending the validity of the exclusion restriction based on informal arguments, we provide a formal sensitivity analysis to evaluate how empirical results might be affected by departures from the condition of the strict exogeneity in our IV design. Given the complexity of the topic, it would be a good practice for researchers to routinely report bounds on treatment effects to boosts the credibility of their estimates. Third, our design is able to solve the puzzle in the existing literature regarding the no impact of natural resource rents on public services and well-being despite significant increases in public budgets (Caselli and Micheals 2013, Monteiro and Ferraz 2012). Whereas political corruption is certainly a factor that explains the lack of impact, it is hard to believe that local politicians are able to steal the whole budget in order to observe no impact at all. By using a novel empirical approach for dealing with non-monotonic responses, we show that the effects of mining rents on public good provision and well-being are conditional to the size of the rents. Finally, we exploit the fact that mining sector in the country is controlled by several private-owned companies, most of them international, which makes no room for endogenous production and rent responses related to the political cycle as it might be the case with state-owned companies. Along the recent

literature, we control for differences in economic and political institutions by exploiting subnational variation across local governments as well as a high degree of variation in natural resource rents and level of production across subnational governments that can be accommodated with panel data techniques using fixed effects.

This paper also contributes to an old debate regarding the political consequences of resource abundance and its links with citizens' welfare. Particularly, this paper relates to a growing literature that explores the effects of resource booms using sub-national variation. Scholars have studied the effect of resource booms on civil conflict (Angrist and Klueger 2008, Dube and Vargas 2013, and Arellano 2011a), corruption (Brollo et al 2013, Maldonado 2011 and Vicente 2010), and citizens' confidence in political institutions and democracy (Maldonado 2012), and local government efficiency (Ardanaz 2013, Ardanaz and Maldonado 2014). Other scholars have explored the impact of resource booms on citizens' well-being via public good provision (Caselli and Micheals 2013, Monteiro and Ferraz 2012) and demand of local inputs (Aragon and Ruud 2013).

The closest antecedents to this paper are Brollo et al (2013) and Monteiro et al (2012). In the first case, the authors study the impact of a fiscall windfall on political corruption and selection of politicians exploiting exogenous variation in federal transfers to local governments given by discontinuities induced by population thresholds established in the Brazilian constitution. They find that larger transfers increase political corruption and lower the quality of politicians. The second paper uses variation in oil royalties induced by a geographical rule to explore the impact of resource booms on local elections. The authors find the boom creates a large incumbency advantage but this effect disappears in the short-run.

This paper differs from Brollo et al (2013) and Monteiro et al (2012) in terms of the analysis of the non-monotonic nature of resource booms recognized by the theoretical literature but that has been largely neglected in the empirical literature. It also differs in terms of the role played by production levels in the empirical analysis. Compared to Brollo et al (2013), this paper exploits a source of variation in transfers that is related to natural resources instead of a generic inter-governmental transfer or fiscal windfall. Since some cross-country evidence shows that their political properties might be different (Dalgaard and Olsson 2008), we believe our approach is more suitable to capture the nature of the political resource curse[7].

The rest of the paper is organized as follows. Section 1.2 provides some basic details about the institutional setting. Section 1.3 introduces a basic theoretical framework whereas Section 1.4 presents the empirical strategy. Section 1.5 describes the data and section 1.6 presents the empirical results. Section 1.7 concludes the chapter.

1.2. Institutional background

1.2.1. Local Politics.

[7] Dalgaard and Olsson (2008) show that windfalls associated with influx of foreign aid has a negative impact on corruption whereas natural resource rents are positively related to corruption. This suggests that fiscal windfalls may have different political properties depending on the set of institutional rules attached to them. Unfortunately, there is no strong causal evidence to evaluate the validity of this argument since most of it comes from cross-country studies. This constitutes a relevant topic for future research.

Local governments as independent political units are relatively new in Peru[8]. The Constitution of 1979 is the first one recognizing their political autonomy[9]. The current legal framework established that municipalities are governed by the mayor and a council. Electoral rules allow the mayor a great discretionary power in municipal government decisions. No matter the electoral results, mayors are granted 50% plus 1 seats in the council implying a limited ability of political accountability by local political parties from the opposition.

Elections for mayor and members of local council are held each four years[10]. There are not term limits but local authorities can be subject to impeachment due to a set of direct democracy mechanisms introduced in the Constitution of 1993. This element can play an important role in shaping politicians' incentives since it reduces their political horizons.

Due to the collapse of the national party system, national political parties play a minor role in local elections. In a survey collected as part of a study for the World Bank (World Bank 2001), interviewed local politicians indicated that no funding from national parties was received by them. Also, evidence of party loyalty is absent. Many mayors were re-elected under different political brands over the past years. Along the same lines, local politics became increasingly fragmented due to the rise of provincial and local political movements with weak links with national political parties[11]. As a consequence, local politics is highly personalistic and increasingly disconnected of national politics.

Although electoral rules allow local politicians a high degree of freedom, the weak institutional capacity of local governments works as an important constraint for their political behavior. To illustrate this point, we can approximate institutional capacity using some dimensions related to low capacity such as the presence of local management instruments. Using the Registro Nacional de Municipalidades (RENAMU) from 2011, we have estimated that only 14% of local governments had urban planning plans and 20% had local development plans. On the other hand, only 29% had cadastral information systems. Along the same lines, most local governments in the country lack of stable and qualified public servants. Using the RENAMU again, we have estimated that only 21% of the local public servants have permanent contracts whereas 50% have temporary ones. More importantly, only 19% of local public servants have professional degrees. Not surprisingly, investment capacity is low.

According to the current legal framework, local governments' responsibilities can be classified in two: exclusive and shared. Exclusive functions include urban and rural development, regulation and management of local public goods, local government organization, local development planning, and execution and monitoring of local public infrastructure (World Bank 2010a: 37). On the other hand, shared functions require coordination with other government levels

[8] Local governments are the smallest autonomous political and administrative units in the country. There are about 1645 local governments, 1840 including the provincial governments that also play the role of local governments in the provincial capitals (195 in total). These provinces are organized in turn in 25 regions besides the province of Lima that has a special status for being the nation's capital.

[9] The local elections by direct universal suffrage were first introduced in 1963 during the first government of Fernando Belaunde Terry. With the overthrow of Belaunde and came to power by military coup of General Juan Velasco Alvarado in October 1968, municipal elections were suspended. Between 1968 and 1980 when civilians return to power, mayors were appointed by the executive branch, particularly the Ministry of Interior. For more details, see Bensa (2002).

[10] Law 27734 which amends various articles of the Municipal Elections Act (Law 26864), given on May of 2002. Before the publication of this norm, municipal elections were convened every 3 years.

[11] According to ONPE (2010b), 72% of candidates in the municipal elections of 2002 belonged to this type of political organizations.

(either provincial, regional or central government) and include participation in management of school services, public health, culture, sports and recreation, citizen security, transport, housing, and social programs and waste management. In practice, this overlap of functions has shown to be problematic since it has caused coordination problems among different levels of governments, affecting the performance of economic development and social programs.

1.2.2. Local public finance

Peru is a very centralized country. From a fiscal perspective, 97% of taxes are collected by the central government (Polastri and Rojas 2007). Local governments' ability to establish taxes and its marginal rates is very limited. Property taxes (vehicles, real estate and real estate transfer) are the main source of local tax revenues for Peruvian municipalities (90% in 2007), playing production and consumption taxes a marginal role. However, it is important to note that revenues from these taxes are low and represent at most 13% of local governments' current incomes (World Bank 2010a and Canavire-Bacarreza et al 2012).

Consequently, local governments are highly dependent from central government transfers. On average, transfers from central government represent 75% of local governments' budget for 2008 (Canavire-Bacarreza et al 2012). A significant part of transfers from central governments are allocated in the form of the Fondo de Compensación Municipal (FONCOMUN), which represents a 33% of all intergovernmental transfers. This transfer is universally distributed among local governments. The rest is allocated as targeted transfers. From these targeted transfers, canon transfers (including all sources of canon such as oil, hydropower, forest and gas canon) represent a 91% of the total targeted transfers, being the mining canon and the mining royalty the most important ones, representing 72% of all canon transfers and 29% of local governments' budgets (Canavire-Bacarreza et al 2012:16). Therefore, mining canon and mining royalties represent a significant fraction of local governments' budget in mineral-rich areas, close to 70% of municipal budgets in some producer districts.

1.2.3. Mining legal framework

Mining is an activity with long tradition in Peru since colonial times. Historically, it has been associated to exploitation[12] and environmental degradation, which explains the negative perception that this activity has in areas where is performed (World Bank 2005). During the 20th century the most important mines of the country were in foreign hands[13]. The limited regulatory state capacity and the unequal access to key resources like water and land were critical factors in shaping a historical conflictive relationship between mining interest and local communities located in mineral rich areas. In this scenario, the Peruvian state was regularly perceived as a biased actor in favor of mining companies (Gil 2009:31) which can be explained by the fact that the mining sector has been historically the most important source of fiscal revenues (Arellano 2011a:620).

During the 90s, mining experienced a significant expansion because of a set of laws and regulations oriented to promote foreign direct investment in the sector as part of the market reforms

[12] The best example of this is the mining Mita, a labor-forced system implemented by the Spanish Crown during colonial times. See Dell (2010) for an evaluation of its impact of long-term economic development.

[13] The exception was the period 1968-1980 under the military government, in which there was a process of nationalization of the mining industry. Originally the military tried to expand production through the exploitation of new deposits (Cerro Verde, Santa Rosa, Tintaya, Antamina, Bambas Quellaveco, to name a few) for which the country took loans. The absence of adequate cost planning caused the process to fail and just a couple of mining projects (Tintaya and Cerro Verde) were finally implemented.

introduced under the rule of Alberto Fujimori. These new regulations granted a set of advantages to investors such as legal and tax stability, tax reductions in exchange of infrastructure, freedom of profit remittances, and free availability of foreign currency (Glave y Kuramoto 2002, Dammert and Molinelli 2007, and Gil 2009). In addition, the new legal framework guaranteed the same treatment for foreign and national investors, and property rights restrictions to foreign citizens were removed. Environmental regulations were relaxed and land expropriation was allowed in favor of mining investors when original land owners were no willing to sell their properties after negotiation[14]. Along the same lines, restrictions to sell communal lands were eliminated[15].

Due to this new regulatory framework, mining investment experienced an important increase. For example, by 1996, US$ 387 million were invested in the sector (MEM 2005), while in 2001 this figure reached US$ 1.595 billion (MEM 2012). As a consequence, mineral production grew at an average rate of 7.2% between 1992 and 2000 while the average GDP did so at a rate of 4.8%. This growth was mainly driven by the start of new large scale operations in copper, gold and silver production. A larger fraction of the territory of the country has been devoted to the mining activity, from 2'258,000 hectares in 1991 (Glave and Kuramoto 2002: 532) to 14'418,227 hectares in 2011 (MEM 2012: 10). Today, mining covers 13.6% of the country and Peru is one of the most important producers of minerals in the world.

Along with the legal framework for promotion of mining activity, in 1992 the Central Government passed the first Mining Canon Law (DS 014-92 EM) which stated that a 20% of income tax should be allocated to the areas in which the profits were generated. This law has as a historical antecedent the Oil Canon, which was established in 1976 during the military government through Decree-Law 21678 after the discovery of oilfields in the jungle. In 2001, as part of the decentralization process, this law was modified to increase the participation of mineral rich areas. The most important law is the Law 27506 (known as the Canon Law),which states that the 50% of income tax paid by mining companies should be allocated to the regional and local governments located in the areas where the minerals are extracted. After several amendments to this law, it was established that this amount should be distributed between the regional government (20%), the municipality of the district (10%), the municipalities located in the province (25%), and the municipalities located in the region where the resource is exploited (40%). In addition, a 5% is allocated to the public universities of the region (see Appendix 1.1 for details). The changes to the distribution rule were designed to precise the criteria used to allocate the transfers among the local governments located in the same province and region of the mineral producer districts[16].

[14] In 1995, Article 7 of the Land Law (Law 26505) was amended to facilitate the acquisition of land to holders of mining concessions. The law states that the land owner will receive compensation to be determined by the experts of the Ministry of Energy and Mines and, if there is no agreement between the parties, it would be enough that the holder of the mining concession pays the amount in the Bank of the Nation. This has generated a lot of protest among peasant communities who feel that their property rights are threatened. Therefore, this mechanism has not been used in practice by mining companies since they fear that this may affect the sustainability of their projects although it seems to have worked as a bargaining tool (Szablowski 2002). See Glave and Kuramoto (2002: 547) for details.

[15] Since the Constitution of 1920, the territories of the rural communities were protected by explicit prohibitions on the sale and/or lease of land. Article 11 of Law 26505 eliminated this restriction if two thirds of all community members were in agreement in the case of the communities located in the sierra and jungle, and 50% for each case those located in the coast.

[16] In its original version, the Law 27506 considered a distribution rule which allocated 20% of the mining canon rents to the municipalities of the province where the resource is exploited, 20% to the regional government and 60% to the provincial and district municipalities of the region where the mineral resource is extracted. The distribution among municipalities in the province and the region depended in turn on population density. This rule ended up benefiting the most densely populated areas to the detriment of communities where mining takes place, so that was severely

Two important characteristics about mining Canon are important to mention here. Firstly, there is a lag between the generation of the transfer and the moment in which is distributed to the regional and local governments. Mining companies paid taxes in March for the previous fiscal year and mining canon is distributed in the mid of the year[17]. Secondly, mining Canon transfers can be used only for investment, which means that they have to be used as public investment projects that should follow the rules of the Public Investment National System (SNIP in Spanish)[18]. Current expenses are prohibited by law, including payroll expenses[19].

The mining royalty follows a similar allocation rule, although it has a different tax base[20]. In this case, it is a percentage of the value of mineral production using the international price as a reference. If the output value is less than 60 US$ million, the rate is 1%. For production values between 60 and 120 US$ million, the percentage is 2% while for values above 120 million the percentage is 3%. Appendix I summarizes the legal framework behind the collection and distribution of mining royalties.

1.2.4. Fiscal windfall and the boom of mineral resources

As discussed above, the production of mineral resources experienced a significant increase as a consequence of the policies implemented to attract foreign investment in the mining sector. Figure 1.1 presents the evaluation of the real value of mineral production for period 1996-2010. After 2000, mineral production experienced an extraordinary increase of about 200%. It is interesting to note that the most important variation occurred before the increase in prices of natural resources in 2003, which suggests that most of the observed variation should be a consequence of the new regulatory framework in the mining sector implemented during the market reforms based on the Washington Consensus.

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questioned. Law 28077 of 2003 fixed this by focusing mining canon rents on producing localities, but only partially since it excluded producing districts of the distribution of mining canon rents at the province and region levels, which in practice received less resources than those districts without mining located in the same province and/or region. This situation was corrected in 2004 with Law 28332. These changes reflected a tension between two goals that gained prominence at different times. Initially, the mining Canon was perceived as an instrument of redistribution of resources which is reflected in the use of population density as a criterion for assignment. Later, with increasing resistance to the expansion of the mining activity (for example, in Tambogrande, Quellaveco and Quilish), the Canon took a more definite compensatory criterion. For a discussion of changes in the rules of the Canon, see Barrantes et al (2010) and Arellano (2011b).

[17] The way in which mining Canon rents were distributed also varied during the analysis period. Between 1998 and 2006, it was generally distributed in 12 installments starting in June following the fiscal year. Since 2007, it was distributed in one installment in the month of July of the following fiscal year. Between 1992 and 1997, mining Canon was distributed following ad-hoc rules using specific supreme decrees.

[18] The SNIP was designed with the aim of improving the quality of public investment. To be approved, all public investment projects must show that are a profitable use from an economic and social perspective of scarce resources. These projects were evaluated by the staff of MEF in Lima until 2007 when the system was decentralized. This decision coincided with the fiscal bonanza, after which subnational governments began to develop a greater number of projects and the SNIP started to show troubles handling this increase. It also started to show limitations to take into account local realities (Arellano 2011b).

[19] During the second government of Alan Garcia (2006-2011), this rule was relaxed by amendments to the annual state budget law. It was established that up to 5% of mining Canon rents can be used to finance the design of public investment projects and up to 20% of these rents can be used for maintenance of public infrastructure.

[20] Mining royalty was regulated in December 2004 by Supreme Decree 157-2004-EF. The royalty is understood as compensation to the State for the use of extracted natural resources (Arellano 2011b) and applies only to those mining operations that began in 2005 since all those producers that started before were protected by tax stability agreements.

Although the increase in production played an important role in the recent mineral boom, more relevant was the increase of mineral prices. Figure 1.2 presents the evolution of the international prices of the eight most important mineral resources produced by the country during the period of reference. As shown in the figure, these prices were quite stable from 1995 to 2003 and then underwent an extraordinary rise until 2010. In almost all the cases the prices were multiplied by two or three times in relation to the average prices before 2003.

Figure 1.3 shows that were changes in prices that explain most of the variation observed in mining rents. As seen, the prices and quantities evolve similarly to 2003 and after that experienced different patterns, with prices that showed a change up to 4 times their original value (15 times in the case of molybdenum). Moreover, changes in the levels of production were much more modest seldom above 100% during the period under review. This suggests that were changes in prices the main factor to explain variation in mining rents levels. Although the variation in average price levels is more important than the variation in production levels, it is important to note that the latter are not negligible and could play a role in explaining the phenomenon of interest. We will return to this point later.

As a consequence of the combined increase in prices and quantities, mining transfers experienced an extraordinary increase. This was also accompanied by a change in the rule of allocation of mining canon transfers that increased the participation of regional and local governments from the areas where mineral resources are extracted from 20% to 50%. Figure 1.4 describes that evolution. 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 million of nuevos soles) during 2001 and 2002, having a spectacular increase since then reaching the extraordinary number of 4.15 billion in 2007[21]. Towards 2010, this amount was about 2.5 billion nuevos soles. This windfall was particularly beneficial for mineral producer districts. Figure 1.5 shows the evolution of average mining transfers according to whether the district is producer or only recipient of mining transfers. Starting 2005, producer districts began to concentrate a significant fraction of mining transfers.

To illustrate the magnitude of this concentration, Figure 1.6 presents the Lorenz curve for the average mining transfers for period 1996-2010. Few districts were benefited with extraordinarily high levels of mining canon transfers, something reflected in a Gini coefficient of 0.8. This is a critical element since previous evidence for the Peruvian case suggests that the behavior of municipalities with extraordinary high levels of transfers is generally different than the average mining transfer recipient[22].

This is also reflected geographically. Since the distribution of mineral resources depends on 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 mining revenues in different ways. The evolution of transfers from mining transfers shows two basic patterns: a) there are huge differences in terms of mining rents across districts, and b) there are disparities in terms of the evolution overtime of mining rents across districs. This suggests that the effects of the shocks may be heterogeneous, as it should be clear from Map 1.1. This map shows the allocation of average mining rents for period 1996-2010. We observe a clear pattern with concentration of mineral rents-rich districts in the south (Tacna,

[21] For reference, the current exchange rate is 2.85 nuevos soles per US dollar.
[22] See, for instance, Maldonado (2012).

Moquegua and Cusco), center coast (Ancash) and north (Cajamarca). The jungle and the coast close to the frontier with Ecuador are the areas in which mineral rents-poor districts are located.

1.3. Analytical framework

This paper's contribution is empirical since the existing literature on the political resource curse is already rich in theoretical contributions highlighting a set of potential channels that can explain the relationship between resource abundance and political outcomes. However, we consider the following simple model adapted from Caselli (2006) and Caselli and Cunningham (2009) to motivate the empirical exercise. The details are covered in the Appendix 1.2.

1.3.1. Sketch of the Model

We consider a very simple two-period local economy with a large number of unskilled workers and two talented agents, one of them being the current incumbent. In the first period, this economy is composed by two sectors: the natural resource and subsistence sectors. The mineral resource sector is assumed to provide an exogenous flow of rents to the local government. This way to model a resource boom basically considers the "rent effect" discussed above. Modelling the "production effect" is harder since both positive and negative externalities can be result of changes in the level of mineral output. We leave aside these issues here since, as mentioned in the introduction, there is no evidence of the impact of mineral production on political outcomes.

It is assumed that production in this economy depends on the provision of public goods by the local government. A typical public good would be roads or any other type of basic infrastructure. Therefore, the incumbent politician can influence the level of output in this economy according to the level of public goods he decides to provide.

The talented agent has managerial skills that can be used either in the industrial sector or politics. The talented agent problem is to decide whether to become an industrialist in the second period or a challenger to the incumbent politician. She compares the net benefit of becoming a politician against her opportunity cost in the industrial sector. If she becomes a politician, she would face the result of an election in which she has some positive (exogenous) probability of winning. If she wins, she can extract rents from the municipality otherwise she would need to face the cost of losing the election. If she becomes an industrialist, she would hire unskilled workers to produce an industrial good that also depends on the stock of public goods.

Therefore, the incumbent politician problem is to maximize the net present value of his consumption taking into account the impact of his behavior on the decision of the talented agent of becoming an electoral challenger. A high level of consumption associated to a low provision of public goods reduces the opportunity cost for the talented agent of becoming a politician and increases the chance for the incumbent to face a competitor. The opposite is also true.

The game follows the next structure. During period 1, a level of mineral rents and public goods are given exogenously. The mayor is also exogenously determined in the first period. At the end of the first period the mayor decides his level of consumption with respect to public good provision for period 2. Once this level of public good is realized, the talented agent chooses whether to become an industrialist or a competitor for the incumbent. At the end of the second period there is an election.

The solution of this model delivers a non-monotonic pattern between mineral resource rents and political competition. In the presence of an increase in mineral resource rents per-capita, the value of holding power increases, making politics more attractive for the talented agent

(reflected in an increase of the opportunity cost of involving in industrial production). Nevertheless, the mayor also has access to more mineral rents he can use to provide more public goods to reduce the opportunity cost of becoming an industrialist. This implies that, for low levels of mineral rents, the mayor can successfully prevent the entry of the talented agent into politics. However, this strategy would become useless for very high levels of mineral rents associated to a mineral resource boom since the value of holding power would be higher than the level of profits the talented agent can obtain in the industrial sector. Hence, there exist a threshold value of per-capita mineral rents (c^*) after which it is no longer optimal for the incumbent to invest in public goods. Therefore, the mayor cannot prevent the entry of the talented agent into politics. As a consequence, the mayor reduces his level of investment in public goods since his probability of reelection has been reduced.

This basic model predicts a non-monotonic relationship between per-capita mineral rents and political competition. Since more political competition is associated in this framework with lower probability of reelection, then the inverse result is valid for reelection outcomes. However, explaining reelection solely in terms of the interaction between the mayor and the potential challenger is limited since the former has in practice more instruments to influence electoral outcomes. The mayor can use mineral resource rents not only to influence the decision of the talented agent but also for buying off the electorate in exchange of electoral support via the distribution of public and private goods as well as public employment.

This fact can be accommodated in an extension to the basic model. Clientelism can be modeled as a factor affecting the probability of winning the election of the competitor. The more the mayor invests in clientelistic expenditures, the less chance of winning the election for the competitor. Of course, we need to take into account the effectiveness of these clientelistic practices to influence the electoral outcomes. Caselli (2006) models this by using an elasticity for the relationship between clientelistic expenditures and the probability of winning the election for the talented agent (γ in Appendix 1.2). He shows that the basic results differ for different levels of this elasticity. When this elasticity is low, then the results are similar to the previous basic model since the clientelistic expenditure is basically ineffective. If this expenditure is somewhat effective, then a more complex non-monotonic pattern can emerge. For low levels of mineral rents a positive relationship with public good investment is observed but then a reduction is expected as the value of holding office dominates over potential profits in the industrial sector for the talented agent. However, when the levels of rents are very high, it is possible for the incumbent to prevent entry because the clientelistic expenditures are high enough to buy electoral support, reducing the incentives of the talented agent to run for election. Finally, when the elasticity is high, clientelistic expenditures are very effective to prevent entry.

In terms of reelection outcomes, a low elasticity between clientelistic expenditures and the probability of election of the competitor basic implies that the relationship between mineral rents per-capita and reelection is negative. Mayor cannot prevent entry because clientelistic expenditures are basically ineffective. The opposite is true for a high elasticity being the mayor always able to prevent competition. The middle case is more interesting. We find a non-monotonic relationship between mineral rents and the probability of reelection for the mayor. Given that mining rents are somewhat effective, there is a reduction in the probability of keeping office for the mayor for relatively low levels of rents. However, when these rents are higher, the mayor is able to retain office because he can influence the electoral outcome -even if clientelistic expenditures are just somewhat effective- due to the amount of rents he is able to control.

1.3.2. Link with the Empirical Test

The values of some parameters need to be fixed before taking the model to the empirical test. For instance, in the model γ is an exogenous parameter. This parameter can be interpreted as a measure of the institutional capacity of local governments. High levels reflect a greater ability of local government to transform the public budget on goods and services for citizens. In the context of this paper, the assumption that the level of γ for the average local government is intermediate is maintained[23].

We also need to consider the initial level of political competition. As seen in Section 2, the local political arena is fragmented due to the existence of many political parties and local political movements competing at the local level. The model simplifies this by assuming only one potential competitor. When many parties are present at baseline, then it is possible that each local politician faces her own value of $c*$. We discuss below the empirical consequences of relaxing this assumption.

Using this conceptual framework (see Appendix 1.2 for details), the following testable predictions are derived:

Hypothesis 1: *Political competition is non-increasing in mining rents per-capita for* $c < c^*$ *and non-decreasing for* $c > c^*$.

A similar hypothesis can be derived for the case of reelection outcomes:

Hypothesis 2: *Incumbent reelection is non-increasing in mining rents per-capita for* $c < c^*$ *and non-decreasing for* $c > c^*$ *for an intermediate value of* γ.

To explore the role of public good provision and clientelism as mechanisms to explain political outcomes, we consider the following testable predictions:

Hypothesis 3: *Public goods provision is non-decreasing in mining rents per-capita for* $c < c^*$ *and non-increasing for* $c > c^*$ *for an intermediate value of* γ.

H3 is a more generic hypothesis and applies not only to the provision of public goods, but it will be also used to understand the expansion in local infrastructure, in terms of physical units and investment.

Hypothesis 4: *Clientelistic spending is non-decreasing in mining rents per-capita for* $c < c^*$ *and non-increasing for* $c > c^*$ *for an intermediate value of* γ.

We link the clientelistic spending to the provision of private benefits to citizens. This takes the form of specific transfers or public employment funded with mining transfers. This latter form of empirically approaching clientelism has antecedents in the theoretical literature. Robinson et al (2006) model clientelism as a job offer in the public sector. This offer has the advantage over other forms of redistribution since it provides a credible commitment device to support elector exchanges between politicians and voters. That credibility comes from the fact that this type of job offer based on commitment is difficult to reverse.

One limitation of the theoretical model is that it only predicts aggregate expenditure patterns in public goods and clientelism without specifying how local politicians allocate natural

[23] Peruvian local governments certainly have less institutional capacity than local governments in developed countries but they do not suffer the limitations that are observed in local governments in poor African countries. Thus, an intermediate level is assumed.

resource rents between different types of public goods or forms of clientelism. In the case of clientelism, the theoretical literature suggests that public employment is the most common form and it has the advantage of working as a credible, selective and reversible mechanism to ensure electoral support (Robinson and Verdier 2013). In the case of the provision of public goods, it is possible to propose a similar intuition where the type of public good to be provided by the local government depends on the political properties of its production function. Thus, a public good whose production function is intensive in unskilled labor provides a greater electoral return for incumbent mayor than a public good whose production function requires skilled labor and physical capital. Therefore, it is more likely that the first to be built[24]. Similar reasoning helps to understand the construction of "white elephants", since they are buildings that, despite having marginal social benefits, are intensive in unskilled labor force and it is highly profitable from an electoral point of view[25].

To summarize this conceptual section, it is important to keep in mind the non-monotonic patterns that emerge between mineral resource rents and electoral outcomes. Since incumbents use the provision of public goods and clientelistic expenditures as the mechanisms to influence these outcomes, it is also expected that the relationship of these variables with natural resource rents is also non-monotonic. We take the implications of this conceptual framework to the empirical test in the rest of the paper.

1.4. Empirical Strategy

1.4.1. Identification

The goal of this paper is to estimate the impact of a mineral resource boom on reelection and political competition via the analysis of how politicians use public good provision and clientelism to influence the electoral outcomes. We use changes in international prices of mineral resources produced by the country and a set of rules regarding distribution of mineral rents to subnational governments as sources of variation to claim causality.

A mining boom is defined in this paper as an increase in the levels of mineral production and mining rents associated with an exogenous variation in the levels of mineral prices. The exogeneity in the variation in mineral prices is relatively simple to justify as will be seen later. It is a bit trickier to differentiate between changes in levels of production and mining rents levels as a result of changes in international prices. This difficulty arises from the fact that both changes (levels of production and mining rents) are associated and the impact of each of them on the election results will not necessarily go in the same direction[26].

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[24] A clear example would be the decision to build a school versus a hospital. The infrastructure in the first case is relatively basic and it can be built by staff with little human capital as opposed to a hospital that requires a specialized infrastructure, not to mention the stock of tools and machinery that are needed to make it operate. For a school to work, it is required to train teachers. Those are trained in teacher training centers that are relatively abundant in the country. By contrast, health personnel requires specialized training, so relatively few are able to received compared to teachers. Thus, the production function of a school offers greater returns and less complexity than in the case of a hospital, which would explain why politicians favor their construction.

[25] Robinson and Torvik (2005) present a formal model that suggests that "white elephants" are an inefficient redistribution mechanism in order to influence election results.

[26] In producing districts, the increase in international prices leads to increase of mining royalties which may cause an increase in the provision of public goods, which in turn can positively influence the mayor's ability of staying in power. On the other hand, if the increase in international prices is associated with an expansion of mineral production levels in the district, this could be accompanied by an increase in pollution and local levels of unrest, which could

We argue that mineral prices are exogenous to local politics in mineral rich districts. The basic reason has to do with the pattern of insertion of the Peruvian economy in the global economy as a price-taker of international prices of its more important commodities and recent changes in the international context, particularly the expansion experienced by the Chinese economy as a result of its industrialization process[27]. This is critical since Peru is one of the most important producers of minerals in the world, which implies that the country can potentially influence international prices, affecting in this way the validity of our research design[28]. There are many reasons why this is not the case. Firstly, there is not a single state-owned producer company in the country as it is common in many developing countries. Many private companies operate in the country[29], so it is very hard for an individual company to influence international prices. Secondly, there is a consensus among the experts about the role of China in the boom of international prices. According to a World Bank study (Winters and Yusuf 2007), China has become the largest consumer of minerals in the world (24% of total world production) after the increase of its demand since 1999. From 1999 to 2005, China consumed two thirds of the growth of world metal production, which made it the most important factor in explaining the growth in metal prices observed in the period under analysis. Finally, the fall of the interest rates is another explanation for the increase of commodity prices (Frenkel 2008).

Another concern with our research design is the endogeneity of production levels. Local governments may influence production decisions by investing in ways to attract mining companies. It is also possible that already operating mining companies react to higher prices by expanding the levels of production and starting new production units. We believe these factors are not relevant although we cannot completely rule out their role. On the one hand, local governments play no role in the process of granting mining rights. All required permits are granted by different units of the executive branch (mostly the Ministry of Energy and Mines, Ministry of Environment and Ministry of Culture). On the other hand, starting a new exploitation requires 7 years on average, so it is hardly the case that any response like this can be relevant in our setting since any new exploitation started as a consequence of the boom of prices in 2003 would appear at the end or beyond the period under analysis (1996-2010). We cannot rule out any endogenous increase of production in already existing exploitations, although we do know that most of the variation comes from the shock in prices as discussed in Section 1.2.4. Changes in production may have impacts on political outcomes indirectly due to its impact in mining rents allocated to local governments or directly due to its impact in the local economy. We will control for this in the empirical model and use additional robustness checks to evaluate the validity of the empirical results.

One final concern is that mining rents were endogenous. Mining rents can be endogenous due to endogeneity in prices and quantities as well as an endogenous placement of the distribution rule. We already discuss the role of prices and quantities. Regarding the distribution rule, a serious

adversely affect the reelection of the mayor. The net effect is thus ambiguous, since there is no perfect way to isolate the role of these two factors on the election results. We will address these issues later.

[27] Historically, Peru has been a small open economy heavily dependent on exports of primary products, a feature that was reinforced by liberal reforms based on the Washington Consensus during the 90. For this reason, the country is basically a price taker in international markets of its major exports and, therefore, very sensitive to external shocks. In fact, some researchers (see, for example, Dancourt 1999) have suggested that most of the economic crisis experienced the country since 1950 have been linked to external shocks such as a fall in the terms of trade.

[28] Today, Peru is the second largest producer of silver, third in zinc, copper and tin, fourth in lead and molybdenum and fifth in gold. See MINEM (2011) for details.

[29] For instance, in 2013, there were 2,052 units under exploitation by 854 mining companies, including small producers. When small producers are excluded, there are 637 mining companies. See MINEM (2014).

concern would be that changes in distribution rules of mining rents were the result of an active role of the political authorities of local governments in anticipation of the price boom. For instance, the mining Canon was originally funded with the 20% of taxes paid by mining companies and this rate was raised to 50% in 2001. The allocation criteria was further modified to assign more rents to mineral producer districts. If these changes were concessions to local interest, the mining rents were endogenous. However, the political system is fragmented and national political parties have very weak connections with local politicians, so this is hardly the case. In fact, Barrantes et al (2010) show that changes in the mining Canon law were the product of circumstantial alliances between congressmen from mineral rich regions and not the result of pressure from regional and local actors or the executive power, ruling out this possible source of endogeneity. The only reason why we should be worried about the endogeneity of rents is due to the potential source of endogeneity of mineral production discussed above. We address these issues in the next section.

1.4.2. Empirical Model

The empirical model followed in this paper is based on two different econometric approaches. We first use a difference-in-difference strategy (DD) exploiting the pattern of mineral prices over the period. We directly use mining transfers as a treatment variable in a DD design with continuous treatment. We also include a measure of mineral production to account for changes in the political environment of local governments associated to changes in production levels. The basic specification is as follows:

$$(1.1)\quad y_{ijt} = \alpha_j + \lambda_t + \beta f(MR_{jt}) + \gamma Q_{jt} + X'_{ijt}\delta + \varepsilon_{ijt}$$

where y_{ijt} is the outcome of interest for the observation i in district j and period t. α_j and λ_t are respectively district and years fixed effects. MR_{it} and Q_{it} are respectively measures of mining transfers per-capita and real value of mineral output for district j in period t. $X'_{ijt}\delta$ includes individual/household and district level characteristics whereas ε_{ijt} is an error term. The parameter of interest is β which recovers the causal effect of interest.

It is important to note that the function $f(MR_{jt})$ is used in order to indicate the use of a non-monotonic specification for the case of mining rents. This includes a specification in levels as well as a quadratic specification in accordance with the theoretical framework. In addition, although most of the outcomes to be analyzed are defined at district level, we consider the individual/household level since welfare outcomes are defined at these levels. Finally, the variable Q_{jt} is used as a control variable, so it removes any variation in political variables associated with endogenous changes in mining revenues levels that are due to changes in the level of mineral production. It is important to remember that control variables need not to be orthogonal to unobservables contained in the error term; it is only required that their inclusion in the econometric specification allows us to remove any remaining selection bias[30].

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 political outcomes. The district fixed-effects controls for time-invariant characteristics at district level and the MR_{jt} accounts for changes in

[30] See Stock and Watson (2006) for a discussion about the role of control variables.

dependent variable in treated districts associated to the movement of mining revenues after the increase of prices of mineral resources. Identification in this setting requires controlling for any systematic shock to political outcomes of districts affected by the increase of prices of mineral resources that are potentially correlated with, but not a consequence of, the revenues shock[31].

In the previous section, we discussed the importance of controlling for endogenous changes in production levels. Although evidence suggests that endogenous changes in production levels are at best marginal, it is important to take seriously this issue in the empirical analysis. One way to do this is to evaluate if the basic results of the study are maintained when sub-samples of interest are analyzed. In particular, an interesting example is the sample composed by mining rents recipient districts in which there is no production. In this case, there are no problems associated with endogenous production as discussed above. In this case, the specification (1.1) will also be used but only for the sub-group of districts that receives transfers but that are not producers. Alternative specifications for different groups will be discussed below.

The use of this continuous treatment variable is problematic since does not control for the fact that there may exist endogenous responses in production even after controlling for mineral production. One way to address this issue consists in constructing a measure of predicted mining transfers taking the pre-period district production levels as fixed and only allowing changes in prices to explain the variation in mining revenues, but this alternative does not work due to lack of information[32]. Although these are relevant issues from a conceptual point of view, we believe the practical evidence is less compelling. The evidence discussed in section 2.4 suggests that a significant fraction of the variation in mining rents is related to the increase of mineral prices rather than a consequence of changes in mineral production which did not experience a significant variation over the period under analysis. Although we believe that including a measure of mineral production should be enough to account for any potential endogenous response related to changes in production, we take this concern seriously. This leads to our alternative research design based on an instrumental variable approach.

The use of an instrumental variables (IV) method in this context is motivated by the presence of a credible source of exogeneity in mining revenues due to fluctuations in international prices. Despite this, isolating the role of prices is hard due to the informational constraints about taxes and profits discussed above. Therefore, we propose the use of mining Canon transfers, a subset of mining revenues as an instrument for total mining revenues. We proceed in this way since mining Canon revenues is less sensitive to endogenous responses to production among the set of rents distributed to local governments. Mining Canon basically depends on the rules of allocation established by Law that contains fixed rates for each level of government and the variation of prices. Despite the weak evidence regarding endogenous production responses, we

[31] 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.

[32] There are many reasons why this alternative is difficult to implement: a) mining transfers depends on revenues and taxes paid by mining companies. Although information about revenues is not hard to find, it is difficult to estimate the taxes paid by mining companies since they are a function of profits. In the case in which a mining company operates in more than a district or has more than one exploitation, it is hard to assign what fraction of the paid taxes are attributable to a given district. In addition, the information about mining companies' profits for computing the amount of mining rents to be distributed is considered a secret by tax authorities; b) the transfers allocated to non-mineral producer districts are less transparent and depend on a formula developed by the Ministry of Economics and Finance based on poverty measures and population size.

recognize that this is an imperfect instrument in the sense suggested by Nevo and Rosen (2012) and proceed accordingly by incorporating a sensitive analysis in our design based on Nevo and Rosen's work on identification with imperfect instruments, as it is going to be discussed below.

Leaving aside the imperfect instrument issue for a moment, we believe that mining Canon recovers relevant variation to identify the causal effect of interest. The estimated effect represents a generalized local average treatment effect (LATE) [33]. 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 mining Canon transfers should have no effect on political outcomes other than through its effect on mining transfers. We will argue that, even if we allow for a significant departure from the validity of the exclusion restriction, the basic results of this paper would not be significantly affected.

The first stage estimates the impact of mining Canon on mining transfers and can be written as follows:

$$(1.2)\quad MR_{jt} = a_j + d_t + bf(MC_{jt}) + cQ_{jt} + X'_{jt}\gamma + v_{jt}.$$

The term MR_{jt} is a measure of per-capita mining rents allocated to the district j in period t. a_j and d_t are respectively district and time fixed effects while MC_{it} is the level of per-capita Mining Canon transfers for district j in period t. X_{jt} includes district level characteristics and v_{jt} is an error term.

The second stage estimates the impact of mining transfers on political and economic outcomes. The basic specification is as follows:

$$(1.3)\quad y_{ijt} = \alpha_j + \lambda_t + \beta f\left(\overline{MR_{jt}}\right) + \gamma Q_{jt} + X'_{ijt}\delta + \varepsilon_{ijt};$$

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

The validity of the exclusion restriction is likely to hold with the proposed instrument. As previously show, the change of prices basically affected fiscal revenues and not significantly production levels[34]. 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. The business cycle is also relevant since a new mining project takes about 6-7 years to start operations, which implies that even if mining companies react by expanding operations as a consequence of

[33] See Imbens and Angrist (1994), and Angrist, Imbens and Rubin (1996) for the LATE parameter and its estimation using IV. Heckman (1997) provides a critique to this approach.

[34] Notice that not necessarily all production change is endogenous. Recall from Section 2 that the period under analysis is characterized by important efforts by the Peruvian government to attract foreign investment. This happened well before the increase in prices in 2003. Despite that, it is true that part of the changes after 2005 can be a response to changes in prices. However, according to experts in the Ministry of Energy and Mines, typically mining companies appear to react to the new high prices period by expanding their activities to new mining projects rather than expanding production because the maturation process is long.

the shock in prices, it is hard that would be relevant for this paper since any new operation would be largely excluded from the period under analysis.

To analyze how sensitive are the IV results to potential violations of the exclusion restriction, we implement the sensitivity analysis proposed by Nevo and Rosen (2012). This approach is based on the idea that the validity of the exclusion restriction is always hard to defend with only informal arguments and a more formal argument is required to evaluate the consequences of departures from the standard assumption regarding the exogeneity of the instrument. Their approach is based on the construction of a weighted combination between the imperfect instrument and the endogenous variable that is shown to be uncorrelated with the error term under a set of plausible assumptions; in particular, a) same direction of correlation between the endogenous regressor and the imperfect instrument with the error term, b) the instrument is less endogenous than the original endogenous variable. They start by defining the ratio between the correlations between the instrument and the endogenous regressor with the error term as follows:

(1.4) $\lambda_j^* = \rho_{MC,\mu} / \rho_{MR,\mu}$;

where $\rho_{MC,\mu}$ and $\rho_{MR,\mu}$ are respectively the correlation coefficient between Mining Canon and the error term and Mining transfers and the error term. Nevo and Rosen show that, under the above assumptions, the following condition is true:

(1.5) $E\left[\left(\sigma_{MR} MC_{it} - \lambda_j^* \sigma_{MC} MR_{it}\right)\mu\right] = \sigma_{MR}\sigma_{MC,\mu} - \lambda_j^* \sigma_{MC}\sigma_{MR,\mu} = 0.$

Where σ_{MR} and σ_{MC} are the standard deviations for mining transfers and mining Canon respectively. Therefore, if the value of λ_j^* were known, using the expression $\sigma_{MR} MC_{it} - \lambda_j^* \sigma_{MC} MR_{it}$ instead of the imperfect instrument would provide a valid instrument to identify the causal effect of interest. The problem is that λ_j^* is unknown. However, Nevo and Rosen show that under the assumptions above the value of λ_j^* is bounded between [0,1]. Then, a function $V(\lambda_j)$ can be estimated for different values of λ_j as follows:

(1.6) $V(\lambda_j) \equiv \sigma_{MR} MC_{it} - \lambda \sigma_{MC} MR_{it}.$

Using $V(\lambda_j)$ it is possible to bound the treatment effect using different values for λ_j. In the empirical application we use values from 0.1 to 0.9 to assess the impact of different levels of violation of the exclusion restriction. One limitation of the Nevo and Rosen approach is that the identification of two sides bound requires a negative correlation between the instrument and the endogenous variable with the error term. This does not seem to be the case in the context of this paper. Since the error term basically recovers non-observable production responses to the boom of mineral prices, one should expect a positive correlation between these variables and the error term. In this scenario, the authors show that only a one-side bound can be identified.

We conclude this section with some details about inference. Since Moulton (1986), it is recognized that inference without accounting for within-group dependence can severely underestimate standard errors. In addition, there is a potential serial correlation problem, as

highlighted by Bertrand, Duflo and Mullainathan (2004)[35]. To deal with both issues, we 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 are available; which is the case in our setting[36].

1.5. Data

1.5.1. Data sources

The empirical analysis is based on a unique dataset comprising information on electoral outcomes, intergovernmental transfers, public good provision, local government characteristics and living standard measures for the period 1996-2010. Data on electoral outcomes were collected from the Oficina Nacional de Procesos Electorales (ONPE), the Peruvian electoral office. We assemble a panel dataset for local elections for years 1998, 2002, 2006 and 2010 to construct measures of reelection and political competition, the main outcomes of this study. This covers years in which mineral prices were stable (1998 and 2002) and years after a significant increase (2006 and 2010).

Data on municipalities' revenues and mineral transfers from the central government over the period 2001-2010 were 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). The sample is composed by about 1,830 districts. These data are used to explore how politicians use local government budget. We complement this dataset with information about mining Canon transfers from 1996 to 2000 obtained from the Ministry of Energy and Mines.

A panel dataset about local governments' characteristics was constructed from the Registro Nacional de Municipalidades (RENAMU). This source is a census of municipalities carried out by the National Statistical Institute (INEI) yearly since 2002. It includes information about human resources, assets, public good provision and budget of local governments as well as data about socioeconomic characteristics of the district itself. Information for the period 2002-2010 is exploited in this paper.

The information about mineral prices and mineral production was collected from the Ministry of Energy and Mines and covers the period 1996-2010. This information is used to construct a measure of real value of mineral production (using prices of 2001 as reference) for each district over the period under analysis.

Another piece of information is the Encuesta Nacional de Hogares (ENAHO), carried out yearly by Peru's national statistical agency. The ENAHO is a national representative survey with detailed information about living conditions at household level. The sample size is about 19,000 households for each year. In this study, we use a repeated cross-section for period 1998-2010 to explore the impact of the natural resource boom on living conditions.

[35] 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. Since all these factors may play a role in our setting, we proceed in this way.

[36] 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.

Finally, data from the 1993 Census of Population and Housing are used in order to evaluate district pre-treatment characteristics according to the levels of mineral production and mining transfers.

Several adjustments were made to the original data to account for inflation and the creation of new districts in the period of the study. The details are discussed in Online Appendix I. In the first case, all nominal variables were converted to real terms using the price index based on December 2001. Using a special deflator, real values were expressed in prices of metropolitan Lima for the same year. In the case of the creation of new districts, homogeneous geographical identifiers were constructed for the period 1993-2010.

1.5.2. Main variables

The basic dependent variables are constructed from ONPE's electoral data. Following the theoretical framework, the two basic political outcomes are a measure of incumbency advantage and one of political competition. In the first case, we simply construct a dummy variable equal to 1 if the mayor was re-elected. It is important to emphasize that this is a measure of individual reelection. As discussed in section 2, the electoral arena is highly fragmented and political parties are weak. Therefore, a measure of party reelection would not be consistent with the basic workings of the political game in Peru since it is common to observe politicians migrating from one political movement to another.

Constructing reelection outcomes at individual level was straightforward for the electoral cycles 2002-2006 and 2006 and 2010. We use the number of the national document of identity (DNI) and match the numbers within each cycle. Since the DNI is unique for each individual, we are confident in the quality of the match. For the cycle 1998-2002, we had no information about DNI for observations from 1998. So we matched observations using first and last names and controlling for information about age and district from a third source (INFOGOB, an online platform with information about politicians) to make sure that the match was done correctly.

Measuring political competition is more complicated[37]. We proceed by computing a basic measure of political competition based on the Herfindahl-Hirschman index (H). We define political competition (PC) following Skilling and Zeckhauser (2002) as follows:

$$(1.7)\quad PC = 1 - H.$$

Notice that $H = \sum s_i^2$ is computed using the square of the share of votes s obtained for each candidate. Values of PC closer to one will reflect higher levels of political competition.

The treatment variable is a real measure of mining transfers. This variable is the sum of all transfers related to exploitation of mineral resources being the most important categories mining Canon and mining royalties. This measure is expressed in real terms using prices of Lima for 2001 as reference. For the regression analysis, we convert this measure in 1,000 of nuevos soles per-capita.

The rest of outcomes related to public good provision, public employment, local governments' budget and living conditions will be discussed later. Online Appendix I presents the details of the definition and construction of each variable as well as the methodological decisions behind them.

[37] See Bardhan and Yang (2004) for a conceptual discussion regarding different possible interpretations of the variable political competition.

1.5.3. Summary statistics

Table 1.1 presents basic summary statistics of the mining transfers. We distinguish between three types of districts: producers, mining transfer recipients (excluding producers) and non-mining transfers recipients. Regarding political variables, reelection levels are relatively low (panel I of Table 1.1). In the case of districts that do not receive transfers, levels of reelection in the period of analysis is 11%. Reelection levels for the case of producer districts is 19% whereas in the case of recipient districts this value is 18%. In the case of the measure of political competition the results go in the opposite direction since they suggest a high level of competition. For the case of recipient districts, the average value is 0.81 (for an indicator that varies 0 and 1) while in the case of producer districts the indicator is 0.84. For mining transfers recipient districts, the indicator is 0.82.

Regarding mining tranfers, mineral producer districts received 475 nuevos soles per-capita during the period under analysis (Panel II of Table 1.1). This amount represents a 25% of the average monthly income per-capita in these areas. Canon recipient districts (excluding producers) receive 92 soles on average. These numbers do not take into account the extremes inequalities in the distribution of mining canon transfers. For instance, whereas the percentile 90 of mineral producers gets 877 nuevos soles per-capita, the percentile 99 obtains 9,479 soles. This is evidence that, whereas a large number of districts receive this transfer, only few of them get it in large magnitudes. Consequently, there are significant differences in relation to the public budget across districts. While the public budget is 347 nuevos soles per capita for non-recipient districts, it is 1,496 nuevos soles per-capita in case of producer districts and 568 soles for recipient districts.

Panel III of Table 1.1 presents the average real value of mining production by district and by type of mineral for the period 1996-2010. The average value of real output to 2001 prices equals more than $ 2 million. Copper is the most important mineral in relation to its production value, followed by zinc and gold. The minor is molybdenum with an average value of $ 17,000 in the period.

Panel IV of Table 1.1 presents also descriptive statistics for a set of socio-economic characteristics for districts using Census 1993 data. The evidence suggests important differences among districts regarding population size, percentage of rural population and basic needs. The existence of these pre-treatment differences highlight the issue of research strategies based on the comparison of cross-section data as they may be associated with unobservable factors.

1.6. Empirical Results

1.6.1. Reelection Outcomes

Table 1.2 explores the impact of mining transfers on mayor's reelection in the case of the DD design. In the top panel, we use as a treatment variable the average per-capita mining transfer (measured in thousands of Nuevos Soles in Lima 2001 prices) for the period that includes the election cycles 1998-2002, 2002-2006 and 2006-2010. The lower panel considers only mining transfers in the election year (2002, 2006 and 2010)[38]. The dependent variable of interest is a dummy variable equal to one if the mayor is reelected.

[38] We opt for both specifications in order to evaluate whether the results are sensitive to political transfers during elections in line with the literature of "political budget cycle" (Nordhaus 1975) or respond to the average over the term in office of a mayor.

Column 1 presents the results for the specification in levels. A negative impact of average mining transfers on the probability of reelection is estimated. The point estimate is -2.5 percentage points with a statistical significance level of 1%. Considering an average reelection level of 17 %, the previous estimate represents a reduction of 14.7 % for every thousand soles per capita distributed as mining transfer. In the case of mining transfers in the election year, there is no effect on mayors' reelection.

Column 2 includes the quadratic specification, consistent with the theoretical framework of this study. For the average mining transfers, the coefficients for the level and the square of transfers are not significant. The opposite occurs in the case of mining transfers for the election year. In this case, from being no statistically significant in column 1, the coefficients for the level and the square of the transfers are now significant at 1% significance level. Consistent with the theoretical framework, the coefficient for the level is negative (-0.066) while the case of the coefficient for the square is positive (0.007). Given the non-monotonic nature of the impact of transfers, the effect of transfers on the election results in a given district depends on the level of mining transfers received. We return to this point later.

Column 3 includes the logarithm of the real value of mineral production in the district as a variable that captures the impact of changes in production levels on the electoral results. In both cases, the coefficients are not statistically significant, suggesting that changes in production levels have no impact on mayors' reelection. These results are in line with the evidence previously presented that suggests that the recent Peruvian mining boom is basically due to a price effect of the external boom in demand for minerals rather than due to changes in production levels . From the point of view of identifying the interest causal effect, this suggests that the boom only affected the income levels obtained by local governments, and these income levels explain the election results rather than changes in the local economy associated with changes in production levels that could have affected the election results. In this scenario, it is possible to rule out alternative stories related to the production effect that explain the reduced-form results presented here[39].

Columns 4, 5 and 6 present the basic results obtained in column 3 for a set of sub-samples. First, column 4 excludes observations from Lima. Since Lima concentrates more than half the country's GDP, it is important to evaluate whether the study results are robust to the exclusion of districts located in this region. As implied by the size and signs of the coefficients, excluding the districts of Lima has a marginal impact on the basic results. The coefficient associated with the level of mining transfers in the election year is now -0.062 while in the case of the square is 0.007. The same happens for the case of the average mining transfers, although the coefficients are not statistically significant.

Column 5 shows the results of a specification that excludes observations from non-producing regions. The intuition of this specification relates to the definition of the relevant counterfactual scenario. Non-producing regions differ in several ways from producing regions so the use of the former ones as part of the counterfactual scenario could be problematic. Excluding non-producing regions from the sample restricts the comparison between mining rent recipient districts that differ in terms of the magnitude of the transfers they receive. In this scenario, the emphasis is on the intensity in which districts are treated. The econometric results suggest that this

[39] It is important to note that these results do not imply that production levels do not exert any role in the economic and social dynamics of the producer districts. It just indicates that on the political dimensions analyzed, they do not play a relevant role.

concern is not relevant in the context of this paper. The coefficients for the level and the square are not substantially modified in terms of magnitude and level of statistical significance.

Column 6 follows the same logic as the previous exercise but this time only excludes from the sample non-producing provinces. Again, the main results are robust to the exclusion of these provinces in terms of the coefficient's magnitude and in relation to their levels of statistical significance.

It is interesting to contrast the results for the case of the average transfers for the electoral cycle versus the results for the case of mining transfers in the election year. While results for the latter one are robust to various specifications, the results for the former are only significant for the simple specification in levels. This is consistent with the international evidence that suggests that transfers are more sensitive to electoral periods[40]. In that sense, it is expected that mining transfers in election years have a greater impact on the probability of mayors' reelection.

In order to interpret the results of the empirical exercise, it is necessary to compute the total marginal effects according to mining transfer levels. This step is important since there is a high level of inequality in the levels of per capita transfers distributed to municipalities, as it was discussed above. Figure 1.8 presents the calculation of the marginal effects according to the level of mining transfers. As discussed above, the average district receives 130 soles per capita. With that level of transfers, the total marginal effect is -0.0652, a reduction of 38 % compared to the average rate of reduction in the sample of districts. The effect of mining transfers on mayors' reelection is negative for most districts except for those which receive very high levels of transfers. The turning point occurs in districts with levels of per-capita real transfers above 4,800 soles annually. For districts with these levels, mining transfers have a positive impact on the probability of mayors' reelection.

The results in Table 1.2 are in line with the theoretical framework of this study. They suggest that empirical approaches that are prevalent in the literature may fail to capture the dynamics of mining booms since they are not adequately approximating the non-monotonic nature of the phenomenon under analysis. These results contrast with the evidence in the case of the re-election of political authorities in other countries. For example, Monteiro and Ferraz (2012) find a positive impact of oil royalties on short-term reelection of mayors in Brazilian municipalities (an increase of 32% relative to the mean). This effect disappears in the medium term, which is interpreted by the authors as evidence for the existence of a surprise effect of an increase of oil royalties. Interestingly, when all elections are analyzed as a whole as done in our study, the authors did not find any effect of oil royalties on the re-election of mayors, similar to that obtained in the linear specification in column 1 of Table 1.2 in this paper. Furthermore, Brollo et al (2013) find a positive impact (about 7%) of intergovernmental transfers on the re-election of mayors, also for

[40] Several studies in the case of Latin America provide evidence in this direction. Drazen and Eslava (2010) found increases in pre-election periods in spending associated with infrastructure projects for municipalities in Colombia. In the case of Mexico, Gonzalez (2002) finds increases in public investment in the pre-election periods and transfers in the year of the election. Sakurai and Menezes-Filho (2008) find that capital expenditures in the years prior to the election and current spending in the election year have positive impact on the probability of reelection of mayors in Brazil. Evidence exists in the same direction in the case of other countries such as Russia (Akhmedov and Zhuravskaya 2004) and Portugal (Veiga and Veiga 2007). Jones et al (2012) found positive effects of spending increases for the case of the provinces of Argentina, but they did not find that spending on election years play a special role. The evidence for the case of developed countries tends to suggest that the increase in spending or fiscal deficit prior to an election has no impact on the election or even that impact is negative. For an overview of the literature, see Eslava (2006).

the case Brazilian. However, since this study does not study variation associated with the exploitation of natural resources, it is hard to compare it with our results[41].

1.6.2. Political Competition

Table 1.3 presents the results for political competition. The same specifications shown in Table 1.2 are used here. The dependent variable is the measure of political competition suggested by Skilling and Zeckhauser (2002). The upper panel shows the results for the DD model for the average mining transfers.

The results of the empirical exercise are in line with the findings from the previous section. In the first specification (column 1), there is not a relationship between the average mining transfer levels and the indicator of political competition. However, when the square of mining transfers (column 2) is included, both coefficients become statistically significant, suggesting that the linear approximation is not consistent with the empirical evidence. The coefficient associated with the transfer level is negative (-0.836), while the square is positive (0.036). The results are not altered when the logarithm of the real value of mineral production in the district is included (column 3), which suggests that changes in production levels associated with the mining boom have no impact on political competition.

Given the non-monotonic nature of the phenomenon under study, the interpretation of the results requires a similar calculation as the one performed previously for the case of reelection. In this case, for a district with a level of per-capita mining transfers similar to the average (130 soles per year), the total marginal effect is -0.8266. In relation to the average of the measure of political competition, the size of the effect is very small, about 1%. This is because levels of political competition in Peru are very high due to political fragmentation (average of 83.15 for a measure of political competition whose maximum value is 100). An alternative interpretation would be to take the inverse of this measure; this is what it would take to reach the perfect level of political competition (an indicator of 100 points). In that case, the size of the effect related to the average transfer would be 4.9%.

As in the case of reelection, the impact of transfers is negative for most of the districts except those with very high levels of per-capita mining transfers. In particular, for districts with levels of per-capita mining transfers over 11,700 annual soles, there is a change in the sign of the effect. These districts are in the top 1% of the mining transfer distribution.

Columns 4, 5 and 6 present the analysis for the sub-samples analyzed in the previous section. In all cases, the coefficients and levels of statistical significance for the case of the level and the square of mining transfers do not change substantially. Also, in all cases the logarithm of

[41] How to interpret the results of our paper in relation to the previously discussed studies? In both cases, there is a positive impact. According to our theoretical framework, a positive relationship exists when the elasticity between patronage spending and the probability of election for the competitor is high. We have suggested that this elasticity may depend on local government institutions. In Peru, these institutions are relatively new and there is consensus regarding institutional weakness (World Bank 2001 and Aragon et al 2008). In contrast, the Brazilian case is often used as an example of vibrant local institutions which play an important role in terms of the provision of public goods. Thus, the Brazilian case would be one in which the elasticity of patronage spending and the probability of election for the competitor is high and therefore the relationship between mining rents and reelection is positive. On the other hand, the Peruvian case is one where this elasticity has an intermediate value, and therefore the non-monotonic relationship would be expected. Of course, this explanation is just a possible one among many other ones. However, the fact that the results of our study are similar to those of Monteiro and Ferraz (2012) when a similar specification is used is very suggestive.

the real value of mineral production is not statistically significant, confirming that changes in mineral production have no impact on political competition.

In the lower panel of Table 1.3, the results for the case of mining transfers in the election year are presented. In this case, the results are not statistically significant in any of the specifications used. This result contrasts with those found in the previous section for the case of reelection. This difference in results may be explained by the different incentives faced by political agents. On the one hand, mayors have incentives to spend more during election periods in order to influence voter's choices, which would explain why mining transfers in the election year are more sensitive to explain reelection. Moreover, political competition is more related to the incentives of local politicians, which usually have better information regarding the fiscal situation of local governments. In that sense, it is expected that the relevant information to the local politicians in terms of the decision to contest in elections is more related to the average level of transfers received by a local government during the years prior to the election than in the election year.

The results of this section are consistent with our theoretical framework and show the limitations of using monotonic approximations to account for the phenomenon of interest. The results are also robust to the inclusion of mining production levels, suggesting that the effects of the mining boom are essentially due to the change in the level of mining revenues received by local governments and not associated with the levels of mineral production, which-as previously stated-it rule out sources of bias in estimating the causal effect of interest associated with changes in production.

Our results differ from those found by Monteiro and Ferraz (2012), the only other study that examines this issue of which we are aware. In this case, the authors find a negative impact on various measures of political competition in the short term, but this effect disappears in the medium term. Although in the case of the average district our results are similar, we found a non-monotonic pattern consistent with the theoretical literature, having districts with very high levels of mining rents more political competition[42].

1.6.3. Robustness Analysis for Reelection Outcomes and Political Competition

In the previous sections the basic results for the case of the central variables of interest have been presented. In this section, we explore the robustness of the results to alternative specifications. In particular, we are interested in evaluating whether the central results of the previous section change when districts from producer regions are excluded. The idea is to deepen the analysis of the differences regarding the role of mining transfers (or rent effect) and levels of production (or production effect) on the levels of political competition and reelection. In the previous section, we have found that the levels of production did not play a role in explaining the impact of the mining boom, suggesting that this impact was due primarily to the rent effect. In this section, by excluding producer regions from the analysis, we eliminate any potential effect of

[42] The authors do not discuss the implications of this result and they only use it as evidence that are changes induced by the boom on the behavior of mayors (and not in the other local politicians) what explain the results of their work. Our work differs in that it provides a mechanism for understanding the behavior of local politicians based on a theoretical model that models the interaction between the incumbent mayor and potential competitors. In our paper, for low levels of mining rents, mayors have the ability to prevent entry because mining rents are not high enough to compensate for the opportunity cost of potential competitors. Only when mining rents are very high mining, the benefits of controlling the municipality outweigh the opportunity cost of competing in elections, leading to a positive impact of mining rents on political competition.

changes in production levels, making it possible to identify the causal effect of interest more precisely.

Table 1.4 presents the results of robustness checks. The results for the case of the average mining transfers are presented in the upper panel while in the lower panel considers transfers during the election year. In addition, columns 1-4 present results for the case of mayors' reelection while columns 5-8 do the same for the case of indicators of political competition.

Column 1 replicates the results from column 3 from the previous section for comparative purposes. Column 2 presents the results for a specification in which all producers districts are excluded from the sample. As it can be seen, for the case of average transfers, the results are significant for the level once the producer districts are excluded from the sample. Interestingly, the results for the square are not significant[43].

A different scenario occurs in the case of transfers in the election year. Compared to the basic specification of column 1, the exclusion of the producing districts makes stronger the relationship between mining transfers and mayors' reelection. The coefficients for the level and the square of the transfers are now two times the original ones (from -0.067 to -0.113 in case the level and from 0.007 to 0.015 in the case of the square). Statistical significance levels are maintained.

Column 3 presents the results of a specification in which producer districts are excluded and the analysis has been restricted to the producer regions. The analysis does not consider the non-producing regions to construct the counterfactual. The results are not substantially modified in terms of magnitude of the coefficients as well as levels of statistical significance. The same occurs in column 4, where the analysis focuses on the producer provinces. In this case, the analysis is refined to exclude provinces that do not have producer districts. The results are maintained.

As previously indicated, the results in the case of transfers in the election year are more sensitive to explain changes in the probability of mayors' reelection. The evidence in this section suggests that these results are robust to the exclusion of the producer districts. In the case of average transfers, the previous section found that these transfers had no impact on reelection, but in this section we find that there is a negative linear relationship, although the statistical significance is weakened in the specification that excludes producer districts in producer provinces.

Columns 5, 6, 7 and 8 present the results of the analysis for the case of the political competition indicator. Overall, the results are weaker than in the case of reelection. For example, the results of the column 6 for the case of the average transfer are essentially the same for the case of the level of the transfer (coefficient of -0.922, significant at 10% confidence), but is not the same for the square. When producer districts are excluded, the relationship is no longer significant, although when the analysis focuses on the producer provinces (column 8) the coefficient associated with the level of transfer is again significant (coefficient -1.250, significant at the confidence level of 5%). The results for the case of transfers during the election year are not statistically significant in any of the employed specifications.

1.6.4. Instrumental Variables Results for Reelection Outcomes

In this section we discuss the results of the IV approach. As mentioned above, there is a concern regarding the fact that some of the variability in mining transfers may be endogenous. The

[43] Since producer districts receive on average higher levels of mining transfers, it is not surprising that their exclusion explain the loss of significance of the coefficient associated to the square of the transfers.

source of exogenous variation in this study is the movement of international prices of mineral resources along the set of rules for mining transfer allocation across local governments. This variation in prices explains the variability in mining transfers and therefore can be exploited to identify the causal effect of interest. However, it is possible that the variation in prices has also affected the levels of production of mining companies and therefore it might have influenced by other mechanisms -besides mining rents- the political outcomes of interest. In previous sections we have found that production levels do not directly impact the electoral results. Furthermore, it has been found that the results are not substantially altered when producer districts are excluded from the analysis, which reinforces the idea that changes in production levels have a marginal role in explaining the political variables under study. In this section, we use the IV technique in order to provide additional evidence on the robustness of the basic results of this paper.

Mining transfers may be endogenous for the reasons indicated in the previous paragraph, although the evidence we have found so far suggests that endogeneity problems -if they exist- should play a marginal role in this setting. The solution would be to use an instrument; that is, a source of exogenous variation that explain mining transfers but not correlated with unobservable factors in the original equation. In the context of this study, it has not been possible to identify a source of variation of that nature but it is possible to use mining Canon transfers as an imperfect instrument, as discussed in Section 5. Then, using the Nevo and Rosen's (2012) proposal, we evaluate the sensitivity of our results.

Table 1.5 presents the results of analysis. Column 1 in the upper panel shows the results of the preferred specification as reference. Column 2 presents the results of IV using mining canon transfers as instrument. As it is shown, the results are essentially similar to the DD specification in terms of magnitude and statistical significance (coefficient of -0.076, significant at a confidence level of 1%). If this were a perfect instrument, this result would suggest that the bias of the DD design is marginal[44].

To assess the sensitivity of this result, we implement the methodology developed by Nevo and Rosen (2012). Columns 3-7 present the results for different values of the parameter λ. This parameter allows a level of association between imperfect instrument and the unobservables from the main equation. Given the evidence discussed previously, it is expected that the estimated coefficients do not vary substantially because production levels do not exert a role in explaining the political outcomes. The results are in line with these expectations. For example, if we assume a low level of correlation between unobservables and the imperfect instrument ($\lambda = 1$ in column 3), it is found that the results do not vary substantially from those presented in column 2 (-0.077 for the level and 0.008 for the square of mining transfers, both significant at a confidence level of 1%). It is important to note that, even in the case of high levels of correlation such as 0.5 and 0.7, the resulting coefficients do not change substantively. For example, for a level of $\lambda = 0.7$, the coefficient for the level is -0.093 while for the square is 0.011, both significant at 1 % and not so different in magnitude to the estimated coefficients in column 2 for the imperfect instrument.

These results suggest that the IV design using mining Canon as an imperfect instrument is quite robust since the estimated coefficients are not substantially modified when high levels of correlation between this imperfect instrument and unobservables in the main equation are allowed. As already noted, this correlation -if it exists- should not be so high, so despite assuming high levels of correlation we still obtain small changes in the estimated coefficients. These results speak

[44] It is important to remember that, under a design difference in difference, it is assumed that mining transfers are exogenous.

about the robustness of the econometric exercise in this section. It is also important to note that in all specifications used, the relationship between production levels and the mayors' reelection is not statistically significant.

The lower panels of Table 1.5 present the first stage for the level and the square of the mining Canon instrument. Column 2 presents the results for the imperfect instrument. The association between imperfect instrument (mining Canon) and the endogenous variable (mining transfers) is very strong in the case of the variable in levels, as evidenced by the levels of statistical significance of the coefficient associated with the instrument (statistically significant at 1 %) and the F test for the first stage (F = 1.644), which is well above the empirical value usually used in the literature (F = 10)[45]. This result rules out the existence of a weak instruments problem. The same applies for the case of the square of mining Canon (F = 64.83).

Columns 3 to 7 of the lower panels show the first stage to the function $V(\lambda)$ and its square for each value of λ used. The patterns are in line with the estimate in column 3. There is no evidence for weak instruments for the relevant values of λ.

The results for the case of political competition are essentially the same. For this reason, they are not discussed here.

1.6.5. Provision of Public Goods

In previous sections, the impact of mining transfers on political competition and reelection of local authorities were discussed. The evidence is in line with the theoretical framework which suggests that the relationship between mining transfers and political outcomes is non-monotonic. In this section, we study how mining transfers affect mayors' incentives to provide public goods. Table 1.6 presents the results of the empirical exercise.

Each column represents a public good using the preferred specification that includes the level and square of transfers as well as the real value of mineral production (in logs). The upper panel shows the results of the DD design while the lower one the IV estimates. Since in terms of magnitude and statistical significance, the results of both econometric techniques are essentially the same, we only discuss the estimates for the DD model.

The evidence is consistent with our previous findings, with some exceptions. For example, we estimate a non-monotonic relationship between access to public lighting, garbage collection and access to security services. Although the sign of the coefficients for the case of contracted security personnel and number of police stations per 1,000 inhabitants is in line with expectations, they lack of statistical significance, suggesting that for these variables the relationship is essentially linear. We did not find any relationship between mining transfers and access to potable water or access to libraries[46].

In line with previous evidence, we find that the level of mineral production have no direct impact on the provision of public goods, with the exception of access to libraries (coefficient of

[45] This empirical rule was proposed by Stock, Wright and Yogo (2002). Murray (2010) discusses the strategies available to deal with weak instruments.

[46] In the case of access to potable water, it is important to note that qualitative evidence indicates that this is a priority by the population (Arellano 2011b). The absence of an impact in this direction could be explained by the technical complexity of these projects and the rules of the system of public investment that requires the formulation of public investment projects that are technically and financially viable. In smaller towns, these conditions are hardly met. In addition, as discussed below, the political cycle matters since these are projects which longer horizons and thus are not electorally profitable for mayors.

0.004 and standard error of 0.002). This result can be explained as a result of the "Mining Program of Solidarity with the People" implemented during the second government of Alan García (2006-2011). The construction and implementation of libraries was one of the investments that mining companies privileged during this period (2006-2010)[47].

Our results contrast with the existing literature. Caselli and Micheals (2013) study the impact of oil royalties on the provision of housing, urban services, infrastructure as well as educational and health inputs. The authors found no impact, except for some educational dimensions, although these results were not robust in most cases. Monteiro and Ferraz (2012) found similar results using a different dataset and research design. Arellano (2011b) presents previous evidence for Peru going in the same direction. Using census data from 1993 and 2007, the author studies the impact of mining Canon on changes in the percentage of people between 15 and 24 who finish high school, the percentage of households with sanitary facilities, potable water and electricity supply using propensity-score matching. In all the above indicators, except in case of electricity supply, there is no impact.

While in previous work, the lack of impact was considered a "puzzle", in our work these results are consistent with our theoretical framework. Although it is hard to make a comparative analysis in this regard[48], our results call into question the common sense that had been established regarding the lack of impact of natural resource booms on the provision of public goods. Despite this, it is true that the impacts, when they exist, are relatively modest in relation to the magnitude of the expansion of fiscal resources associated with the mining boom. We return to this point later.

In short, the provision of public goods experienced a non-monotonic dynamics. For most districts, there was an increase in the provision of local public goods but for those with extraordinary levels of mining revenues the impact was moderated if no zero. This result is consistent and it is in line with the theoretical framework of this study.

1.6.6. Local Infrastructure

In this section we study the relationship between the mining boom and local infrastructure. Given data limitations, in this section we focus on infrastructure related to health, sports and transportation. Tables 1.7 and 1.8 summarize the findings. Similarly to the previous section, we discuss only the results of the DD design given the similarity of the results with those obtained by the IV design.

Columns 1-4 present the results for the case of health infrastructure. We do not find evidence that the mining boom has any connection with the construction of hospitals, health centers and polyclinics. We do find a nonlinear relationship between mining transfers and the availability of basic health infrastructure, although the impact is very modest in absolute terms (0.007 units per thousand inhabitants for the district with average level of mining transfers).

These results contrast with the case of the sports infrastructure (columns 5-8). The mining boom is associated in a non-monotonic way with a greater availability of stadiums, multipurpose,

[47] For example, Yanacocha invested in implementing libraries in 184 educational institutions between 2007 and 2008 Cajamarca. See SASE (2012).

[48] Countries differ in terms of public goods that are under the responsibility of local governments. In the Peruvian case, there is also a set of public goods whose provision is shared by various levels of government. While in some countries like Brazil the provision of education and health services are the responsibility of local governments, in the case of Peru such provision is shared, playing the central government a more important role in this regard.

soccer and basketball fields. No evidence is found in terms of a relationship between the mining boom and the availability of gyms and volleyball fields.

Why mayors seem to favor sports infrastructure over health infrastructure? There are several ways to answer the previous question. On the one hand, one could argue that the decisions of mayors in relation to the type of infrastructure to build simply reflect voter preferences. However, qualitative evidence indicates that the inhabitants of these areas have more preferences for health infrastructure as evidenced by the results of participatory budgeting[49]. A more complex explanation would emphasize the nature of the production function of public goods. Since mayors have reelection incentives and voters favor private over public goods, mayors have a basic preference for the construction of infrastructure that is intensive unskilled work. In that sense, it is more profitable from an electoral point of view to build sport fields against hospitals, which will require more skilled labor and special equipment[50].

Table 1.8 presents the results for the case of the mining boom impact on road construction in terms of cost and quantity. Columns 1-6 show the results for the case of the amount built. There is only evidence of an increase in per-capita square meters of constructed roads, although the relationship is only linear. All other variables that recover the construction of roads, sidewalks and rural roads do not show a statistically significant relationship with mining transfers.

Columns 7-12 show increases in costs assumed by local governments for the construction and repair of roads, sidewalks and rural roads. In this case, we found a nonlinear relationship between mining transfers and the construction and repair of roads, and a linear effect in the case of rural roads built and sidewalks repaired. The case of the cost of rural roads constructed is interesting since the results for the level are not statistically significant even when the square it is. However, the results of the IV design show the expected signs, suggesting that it was just a marginally non-significant result.

1.6.7. Clientelism

In the previous section, we studied the relationship between mining transfers and the provision of public goods and local infrastructure. An alternative strategy used by local politicians to influence the election results is through the use of public employment. This mechanism has been emphasized in the literature by works such as Robinson et al (2006) and Robinson and Verdier (2013). In this section we analyze the impact of mining transfers on public employment by contract type (Table 1.9) and human capital level (Table 1.10).

Table 1.9 considers three types of public officials according to the type of contracts they have: Appointees; those who have some type of medium-term contract; and temporary employees, are considered[51]. This last category adds different types of temporary contracts established by the

[49] Qualitative evidence on this issue has been collected by several studies. See for example, Gil (2009) and Arellano (2011b).

[50] For example, in 2010 a survey conducted by the project "Improving Municipal Investment" in the district of San Marcos (where Antamina, one of the largest mines in the country, operates) showed that 60% of the population identified access to safe drinking water as the main problem of the community followed by health (10%). However, that same year the local government of San Marcos invested only 13% of its budget on sanitation and only 1.3% in health. The main investment in that year was the construction of community centers. For details, see MIM (2011).

[51] The legal framework distinguishes between municipal officials and employees, which are governed by the Basic Law on the Civil Service and Public Sector Remuneration (Legislative Decree 276) - and blue collar workers are in the private sector labor regime under Law of Productivity and Competitiveness (Legislative Decree 728). Municipal officials include elected officials and managers or trusted personnel. The appointed public servants are part of the civil service of the state and have a set of rights that include training, job stability and job progression. Public servants with

Peruvian government, such as non-personal services (SNP) and administrative service contracts (CAS), during the reference period of the study, although they differ in terms of social rights granted to workers[52]. Also, we focus on three econometric specifications. First, we include the specification in levels without including controls for the level of mining production in the district. The second specification includes the quadratic component and production levels to finally add a specification that excludes producer districts.

Evidence suggests that the number of employees per 1,000 inhabitants increased with the level of mining transfers. This applies to both hired and appointed officials as well as the case of temporary workers, although the percentual change differs. Specifically, there was an increase of 0.10 appointees per 1,000 residents per 1,000 nuevos soles from per-capita transfer (Column 1, Table 1.9). This increase is 2.56 for the case of employees with contracts (column 4, Table 1.9) and 0.63 in the case of temporary employees (column 7, Table 1.9). This increase is 2.56 for the case of employees with contracts (column 4, Table 1.9) and 0.63 in the case of temporary employees (column 7, Table 1.9).

Unlike the previous sections, the evidence of non-monotonic effects is weaker. In the case of appointed officials, the coefficient associated to the square of the transfers is negative but not statistically significant. The coefficient for the level is still significant but only for a confidence level of 90% (Column 2, Table 1.9). For employees with contracts, the quadratic model is not significant (column 5, Table 1.9). Only in the case of temporary employees the non-monotonic relationship is consistent with previous results (column 8, Table 1.9). This result is interesting, since it is acknowledged that temporary jobs are more sensitive to the political cycle and they are a typical instrument used by politicians to influence the outcome of election. For this reason, the statistical evidence on the nonlinear relationship between mining transfers and temporary employment suggests that the existing political dynamics in regions rich in minerals is consistent with our theoretical framework.

Results vary slightly when producer regions are excluded from the analysis. No effects are found for the case of appointed officials (Column 3, Table 1.9), but the non-monotonic relationship is present in the case of employees with contract (Column 6, Table 1.9). Finally, we find that the levels of transfers affect the level of temporary employment, although this is not confirmed in the case of the square.

Table 1.10 presents the results for the case of an analysis by type of employees. Five types of employees are considered: Municipal officials, professionals, technicians, security workers and porters. For each of them we consider two specifications. The first considers the quadratic model including the actual level of mineral production measured in logarithms while the second excludes the mineral producer districts.

The results for the first specification are consistent with previous findings regarding the relevance of the quadratic specification. For all types of employees except for technical workers, a non-monotonic relationship is observed between mining transfers and employment of municipality workers. For example, there is a net increase of 0.22 officers per 1,000 inhabitants

contracts do not have the rights associated with administrative career. For a detailed discussion on the subject, see Castro Pozo (2012).

[52] Temporary contracts in the public sector evolved during the period under study. From 1996 to 2008, SNP contracts prevailed, which did not guarantee any rights to workers. In 2008, the CAS contract was introduced in order to formalize the staff hired by the state under temporal modalities and to ensure a set of basic rights. Since our analysis period ends in 2010, it has little relevance in terms of the results of the study to make a distinction between temporary contracts. Therefore, we add all temporary workers into one category.

per 1,000 per -capita soles of mining transfers for the case of districts with average levels of per-capita transfer (Column 1, Table 1.10). Since the number of officers per 1,000 inhabitants is 0.59, this effect is important. For the case of technicians, the coefficients of the quadratic specification are both positive. This is consistent with an increased demand for technicians in regions with high levels of mining transfers, a fact associated with some institutional constraints that requires local governments to formulate public investment projects in order to use mining transfer funds. Moreover, the results for the specification that excludes producer districts are essentially the same in terms of statistical significance and sign of the coefficients as in the previous case, except for professionals and technicians.

These results provide substantial evidence regarding the political dynamics in regions benefited from mining transfers with respect to the use of public employment for electoral purposes[53]. On the one hand, it is evident that the greater variability is caused by the use of temporary workers. On the other hand, the non-monotonic pattern suggested by the theoretical framework is confirmed. This result is consistent for different types of workers.

Our results contrasts with the ones by Monteiro and Ferraz (2012). These authors estimate an increase of 7 employees per 1,000 inhabitants for the Brazilian case. They do not find evidence that the oil boom has increased the proportion of public employees with higher education or contract. Our econometric results suggest a more complex panorama. Thus, an increase in public employment for recipient districts is observed, but this effect is attenuated and even goes in the opposite direction in the case of districts with very high levels of mineral rents. This pattern is consistent with our theoretical framework. It also provides evidence consistent with the emphasis made by Robinson et al (2006) regarding the use of public employment as the main tool used by politicians to gain electoral support, with the difference that the relationship is not monotonic rather than linear.

1.6.8. Local Government Expenditures

In this section, we analyze the impact of mining transfers on local government expenditures. The goal is to understand how local governments spend mining rents using different spending categories. The results for the preferred specification for eight different spending categories (including payroll, pensions, goods and services, other current expenditure, investment financing, other capital expenditures and debt) are presented in Table 1.11.

We find the proposed non-monotonic relationship between mining rents and three types of expenditures: goods and services, investment and other capital expenditures. Since mining rents are required by law to be used as public investment, these results are not surprising. In the case of investment, the effect is an increase of 845 nuevos soles in investment for each 1,000 soles of mining transfers for the case of the average district in the sample. This amount is 109 and 9 nuevos soles for the case of goods and services and other capital expenditures respectively.

[53] Although the current legal framework prohibits the use of Canon and mining royalties for hiring workers, anecdotal evidence suggests that local authorities have been using a number of mechanisms to use these fiscal resources in current expenditures without violating restrictions imposed by law. Using qualitative methods (interviews and field visits), specialists in the field of sociology have documented the increased of temporary public employment and wages in districts that experienced a substantial increase in their budgets due to the mineral price boom (Arellano 2008 2011b). For example, Arellano (2011b) finds that several mineral-rich municipalities diverted resources from investment projects financed by the mining Canon to pay salaries of municipal officials using a spending category called "institutional strengthening".

Table 1.12 presents results of the impact of mining transfers on functional expenditures. We consider the nine most important functions of local government in Peru. We find a pattern consistent with the non-monotonic relationship suggested by the theoretical framework. All the coefficients for the level and the square of mining transfers are strongly statistically significant for almost all the expenditures categories studied with the exception of "Health and sanitation" in which case the coefficient for the square is not statistically significant.

The type of expenditure most affected by mining transfers is "Transport", which is again consistent with the current legal framework that favors investment in infrastructure. This type of expenditure has also other economic and political properties that convert it in one of the most attractive use of mining revenues. It is usually associated to construction and maintenance of roads and sidewalks, which is highly intensive in low-skilled labor, being a common way politicians use in order to get political support from citizens. It also has the advantage of serving as a signal for politicians to show citizens their quality[54].

To gauge an idea about the net effect of mining transfers on transport expenditures, we proceed in the same way as above. The average municipality experienced an increase of about 250 nuevos soles in transport expenditures for each 1,000 nuevos soles of mining transfers. Besides "Transport", "Planning" and "Agriculture" are the expenditures categories more benefited from the resource windfall. According to Arellano (2011), the increase in "Agriculture" can be explained by the interest of local politicians to compensate citizens from rural areas for the potential negative effects of mining activity. It usually takes the form of irrigation projects, seed distribution or similar programs.

1.6.9. Welfare Outcomes

We have studied the impact of a mineral resource boom on politician behavior and the use of public good provision and public employment as instruments to influence electoral outcomes. We now turn to the issue of the welfare effects of the mineral resource boom.

Table 1.13 analyzes the impact of the natural resource boom on income and consumption per-capita. We consider the basic specifications of Table 1.2. The upper panel presents the IV results for the case of monthly household income per-capita whereas the lower panel the evidence for the case of monthly household consumption per-capita. Both measures are expressed in real terms using prices of Lima in 2001. We consider these two measures together since they are supposed to recover different aspects of welfare. In particular, consumption is believed to provide a better measure of long-term well-being whereas income is better measure of short-term changes in welfare. Since most of the impact of the recent mineral boom can be assessed only in the short-term, income seems to be a good candidate in the context of this paper but it is important to note that there is an old debate regarding whether income or consumption is the best measure of welfare (see, for instance, Hentschel and Lanjouw 1996, Blundell and Presston 1998 and Deaton 1997 for a discussion).

We start by discussing the results about household income. Column 1 of Table 1.13 reports the results in levels. We estimate an average increase of 32 nuevos soles per-capita for each 1,000

[54] The clearest example of this was the implementation of the "Pilot Plan for Maintenance of Public Infrastructure" in the district of San Marcos (Ancash), in the area of influence of the Antamina mine. According to Salas (2010), thanks to this program, "... the municipality has employed virtually all San Marcos residents in working age." The program set a higher wage almost 4 times the agricultural wage (10 soles) in exchange for maintenance of basic infrastructure such as roads cleaning, maintenance of unpaved roads, construction of retaining walls, among others. According to Salas, the implementation of this program was effective to avoid the impeachment of the mayor.

nuevos soles of mining transfers per-capita. This effect is stronger in magnitude when the square of mining transfers is added to the specification (Column 2). For the average municipality, this implies an average increase of 95 nuevos soles for each 1,000 nuevos soles. The results are consistent with our theoretical framework in terms of the non-monotonic pattern between mining rents and economic outcomes.

Column 3 adds the log of the real value of mineral production to control for the impact of changes in mineral production on household per-capita real income. The basic results are robust to the inclusion of mineral production. More importantly, the coefficient for mineral production is not statistically significant. This result is consistent with our previous results regarding the lack of impact of mineral production. These results remain essentially unchanged when districts from Lima (Column 4), non-producer regions (Column 5) and non-producer provinces (Column 6) are excluded from the sample.

The lower panel presents the results for the case of consumption. The evidence suggests that consumption has not been affected by the mineral boom, with the exception for the specification in which non-producer regions are excluded. Since consumption is a measure of long-term welfare, it is not surprising that we find no effect in this case. Taking together, these results suggest that there is a positive short-term effect of the mineral resource boom on well-being in the Peruvian case.

Our results contrast with those of the existing literature. For the Brazilian case, Caselli and Micheals (2013) do not find impact of the oil boom on per-capita household income, although some very weak evidence of impacts in the bottom quintile of the income distribution (10 per cent real per-capita). For the Peruvian case, Loayza et al (2013) find positive impacts of mining on household welfare but these are not explained by the mining transfers but by mineral production[55]. This result is also found by Aragon and Rud (2013) for the case of Cajamarca, a northern Peruvian region. They found in a robustness test that mining Canon has no explanatory role in the increases in real income for households located close to the Yanacocha mine[56].

1.6.10. Electoral Conflict

[55] There are many reasons why our results differ from those obtained by Loayza et al (2013). The first has to do with the identification strategy. These authors use different counterfactuals to evaluate the impact of the mining boom. While their identification strategy is based on the comparison between producers and non-producers districts with cross-sectional data (supplemented with a set of identification tests based on the assessment of differences in pre-boom socio-economic characteristics between producers and non-producers), our empirical strategy uses panel data, which has the advantage of controlling for all economic and institutional factors that do not vary over time and that are unique to each district. The authors also instrumented mining Canon with mineral production, which are potentially endogenous to price changes, which calls into question their causal interpretation for exogeneity in the econometric analysis. Additionally, the sample in our study covers the period 1998-2010 while Loayza et al (2013) studied the period 2002-2006, relatively short to find impacts of mining transfers on welfare. Finally, there are differences in terms of the type of information used in the analysis. While Loayza et al (2013) combine census data with household surveys to impute expenditure at the district level, this paper uses data from a pseudo-panel of households built from the ENAHO for the period under analysis. The use of imputation techniques, developed by experts from the World Bank, has been widely criticized by experts like Angus Deaton (see Banerjee et al 2006 for criticism and Lanjouw and Ravallion 2006 for a defense).

[56] The basic difference of this paper with our paper has to do with the scope of the study. The authors use a (somewhat) similar empirical approach but their study is limited to neighboring provinces of the Yanacocha mine in Cajamarca. Their period of analysis covers years 1997-2006, which could underestimate the impact of mining Canon since this started to grow exponentially from 2004-2005.

We conclude this section analyzing the impact of the resource boom on electoral conflict. So far, we have paid attention to political impacts that are mediated by the electoral rules and political institutions. However, it is common in developing countries that formal democratic rules are challenged when electoral results are not in line with the interest of *de facto* political powers. Political conflict is the natural consequence in a weakly institutionalized political environment[57].

Table 1.14 presents the results. The dependent variable is a dummy equal to one if the district experienced at least some conflict during an electoral period. These activities typically include destruction of property, assaults on ONPE's staff and board members, invasion and/or destruction of polling stations, destruction of electoral materials, among others. We concentrate on the electoral conflict because of its political nature, which is distinguished from the socio-environmental conflicts related to mining which have been widely studied by other authors and that have regularly captured the attention of the media and public opinion. The advantage of this approach is that it allows to evaluate the conflict directly associated with the control of mining revenues which has received less attention from the empirical literature.

The results in Table 1.14 follows the same format as those presented in Table 1.2. Column 1 of the top panel of Table 1.14 presents the results in levels for the case of the DD design. As noted, there is not an impact of mining transfers on electoral conflict. However, when the quadratic specification is considered, both the coefficients for the level to the square of mining transfers become statistically significant (Column 2). The coefficient is positive for the level and negative in the case of the square of transfers which suggests that mining rents are positively associated with electoral conflict, except in the case of districts with unusually high levels of mining transfers. The results did not change when controlling for levels of mineral production (Column 3). In line with the previous evidence, production levels have no direct influence on the electoral conflict, which is consistent with the political nature of this type of phenomenon and confirms the soundness of our research strategy.

The results reported in columns (4), (5) and (6) provide additional evidence of the robustness of the empirical exercise. The coefficients of our preferred specification (3) are robust to the exclusion of Lima, non-producer regions and non-producer provinces. Also, mineral production levels are not significant in any of the above specifications. The results using instrumental variables are essentially the same as in the case of DD, which are not discussed in detail here.

The above results suggest that the political conflict follows the same non-monotonic pattern found in the previous sections. For low levels of mining rents, there is a positive relationship between conflict and mining transfers. The relationship changes direction only for the case of districts with unusually high levels of mining transfers. For the average mining district in terms of mining rents, the effect is positive.

The conflict associated with the electoral process can be interpreted as a form of non-institutionalized competition for power. For the average district, higher levels of mining revenues are associated with the use of this type of violence. Local politicians are less willing to peacefully accept the election results when there are higher levels of mining rents for the case of the average district. The use of violence implies an important deterioration in the acceptance of the institutional rules governing the transfer of political power.

[57] Theoretical models that analyze the choice between democratic rules and political violence are scarce. To the best of our knowledge, Aslaksen and Torvik (2006) is the only one that explores the issue for resource-rich countries.

1.7. Discussion of Results

The recent literature that analyzes the role of natural resources on development using econometric strategies that provide a credible identification of the causal effect of interest is relatively new and small, and is therefore relatively little is known about the phenomenon of interest. Recent evidence has exploited natural resource booms associated with oil exploitation (Caselli and Micheals 2013, Monteiro and Ferraz 2012, Dube and Vargas 2013, and Vicente 2010), mining (Maldonado 2011, Aragon and Rud 2013, Arellano 2011b and Loayza et al 2013) and the cultivation of the coca leaf (Angrist and Krueger 2008, Dube and Vargas 2013). Other authors have studied the impact of unexpected increases in fiscal resources (Brollo et al 2013).

Although there is no systematic evidence about it, there are reasons to believe that the impact of natural resources on development depends on the type of resource. In line with the results of Dube and Vargas (2013), one should expect different impacts depending on whether the resource exploitation is intensive in labor or capital. In the case of mining production, this has always been characterized as capital intensive, so any potential impact on welfare should be more linked to the mining rent. An exception would be the artisanal gold production in parts of the Peruvian jungle, which is characterized by labor-intensive and therefore capable of directly impact on household welfare through market mechanisms. The dramatic decline in poverty levels in this region may be associated with this characteristic[58].

Similarly with the case of coca, whose cultivation is labor intensive. The expansion of the production of coca leaf in Colombia –due to air interdiction activities in Peru and Bolivia- led to an increase in self-employment income and the probability of employment in rural areas of Colombia, as documented Angrist and Kluger (2008). Moreover, the authors also document an expansion of male youth labor supply.

It is much more difficult to interpret the results of Brollo et al (2013) if we consider this perspective. The economic properties of natural resources with respect to the use of labor or capital factors are in turn linked to their political properties related to rent appropriation and its use by politicians to gain or remain in power. From this depends, in our view, that the exploitation of natural resources can be beneficial or detrimental to the citizens. In the case of Brollo et al (2013), there is a dramatic increase in transfers to local governments without these are associated with the exploitation of any natural resource. Hence, it is difficult to interpret this source of variation as a case of "resource curse".

Finally, it is important to note that although we have found increases in the provision of public goods and gains in living standards, these changes are relatively modest compared to the magnitude of the boom. This leads to ask the question about the use of mining transfers. We have documented increases in public employment and the expansion of local infrastructure based on unskilled labor, which constitute an unproductive use of mining transfers but with high political returns[59]. Additionally, we should consider the corruption of political authorities and local officials

[58] The best example is the Madre de Dios region. Between 2001 and 2010, the poverty rate of this region, characterized by informal gold-production, showed a significant reduction (from 36.7% to 8.7%), much higher than the decline experienced for national average (54.8% to 31.3%). For a detailed discussion, see INEI (2011).

[59] The press has emphasized the misuse of mining transfers showing the proliferation of white elephants and magnificent buildings in mineral-rich regions. Thus, for example, it has been documented the construction of stadiums with capacity greater than the population of the district (in Yarabamba, Arequipa, three stadiums were built, the largest with capacity of 3,000 for a population of 1,200 habitants), construction/repair of main squares, and construction of exotic monuments honoring the soccer referee in Tumbes, the maca in Junin, the hat in Cajamarca, the lizard in Tumbes, just to mention some examples. Beyond the eccentricity of the buildings, the fact is that the use of mining

as suggested by Maldonado (2011), which has been widely documented by the local press[60]. The combination of perverse political incentives with low local institutional capacity would allow us to understand why the impacts of the mining boom are modest relative to the magnitude of the increase observed mining rents in the last decade.

1.8. Concluding Remarks

In this paper we have studied the way in which a mineral resources boom has affected the incentives of local politicians as well as their implications in terms of provision of public goods, clientelism and welfare of citizens. Despite the recent emphasis given by the some new scholarship about the resource curse on novel identification strategies to estimate the impact of resource booms on political and economic outcomes, there is still a lot of work to do in terms of providing credible causal estimates about this relationship. More importantly, it is little what we know regarding the mechanisms that explain it. In particular, there is an empirical puzzle in the current literature related to the impact of resource booms on citizen's well-being. Most of the existing papers fail to detect impacts on household welfare and public good provision. This is hard to believe given the large amounts of rents created due to the spectacular rise of international prices. This empirical failure may be just reflecting our poor understanding of the phenomenon.

An adaptation model of Caselli (2006) provides –in our view- a simple framework for understanding this phenomenon. This theoretical framework studies the interaction between incumbent mayor and a potential competitor to decide whether to engage in industrial production or political activity competing in elections. In the presence of a resource boom, the mayor has more fiscal resources to provide more public goods or larger spending on patronage. However, he also faces more competition because the value of being mayor is higher. The mayor can expand the provision of public goods and patronage spending to prevent the entry of competitors and increase its electoral support, but it is limited by the institutional capacity of local government. If mining rents levels are too high, the mayor may not provide a level of public goods and patronage spending to discourage entry into electoral competition by the potential competitor. As a result, his optimal response is to underinvest in public goods. Thus, the model highlights the non-monotonic responses associated to a resource boom.

We found a reduction in the probability of re-election (38% for each 1,000 nuevos soles per-capita mining transfers) and the level of political competition (4.9% for each 1,000 nuevos soles per-capita mining transfers) for districts with average levels of mining transfers, but positive effects for the case of extremely rich in mineral resources districts (over 5,000 nuevos soles per capita). These results are robust to the inclusion of mining production and maintained for different sub-samples. Also, when producer districts are excluded from the sample, the results do not change substantially. To assess the validity of the exclusion restriction of the instrumental variables

transfers in this way has a high political returns as it allows to redistribute resources through public employment for electoral purposes in public investment projects based on unskilled labor, which it is perfectly rational from the perspective of the mayors.

[60] The press has documented many cases of district and provincial mayors with serious allegations of corruption in mineral-rich regions. For example, the districts of San Marcos and Chavin in Ancash have their mayors investigated about misappropriation of public funds by the Comptroller General of the Republic (CGR). Recently, the Minister of Economics and Finance has restricted the access to public funds to several municipalities in the region of Ancash, Cajamarca, Tumbes, Pasco and Puno. According to the CGR, more than 3,000 public officials have been accused of corruption since 2009.

design, Nevo and Rosen's (2012) bounds were estimated and it was found that-even if significant deviations from the exclusion restriction are allowed- the basic results of the study are not altered.

These effects are explained by the strategic behavior of local politicians facing the resource boom, which in turn affects the provision of public goods and welfare of the citizens. We found an increase in provision of public goods, public employment and short-term increases in household welfare (proxied by household income) for the average municipality, although these effects are relatively modest compared with the large influx of fiscal resources distributed as mining Canon and mining royalties to local governments in resource-rich regions. In line with the theoretical framework, the relationship between public goods, welfare and electoral conflict with mineral rents is also non-monotonic, with a distinct pattern for districts with very high levels of mining transfers.

These results suggest the need of a more careful approach to study the impact of resource abundance since we show that the use of linear approximations can seriously underestimate its true impact on the political and economic dimensions usually discussed in the literature. Even worse, it can be even possible to be unable to detect any impact, as we have shown for several of the dimensions analyzed. We believe this is one of the most important contributions of this paper.

These results are also relevant for policy makers interested in the design of intergovernmental transfer schemes. The large influx of transfers associated with unexpected movements in international prices can create perverse incentives among local politicians. The increase in temporary public employment as an electoral strategy has been widely documented in qualitative research from case studies (Arellano Salas 2011b and 2010) and confirmed in our quantitative analysis, taking into account the already noted differences. This creates concern about the ability of municipalities in mineral-rich areas to respond to citizen demands.

Despite these factors, the evidence presented in this paper contradicts the negative opinion regarding the role of natural resources in economic development. We show that, for most local governments in Peru, natural resources appear to be more a blessing than a curse, but a blessing relatively modest in relation to the magnitude of the boom. This is true even in a context where institutions are weak, which also contradicts the cross-sectional literature that argues that natural resources are a blessing only in the presence of good institutions. We believe this is an issue that requires further future research.

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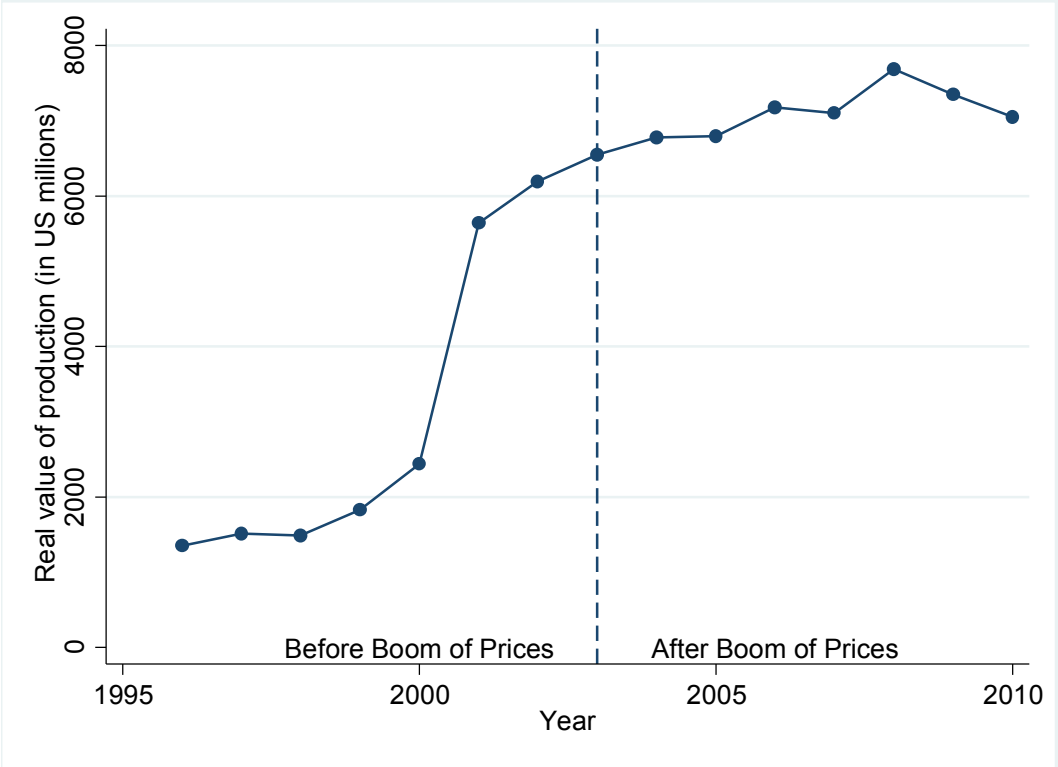
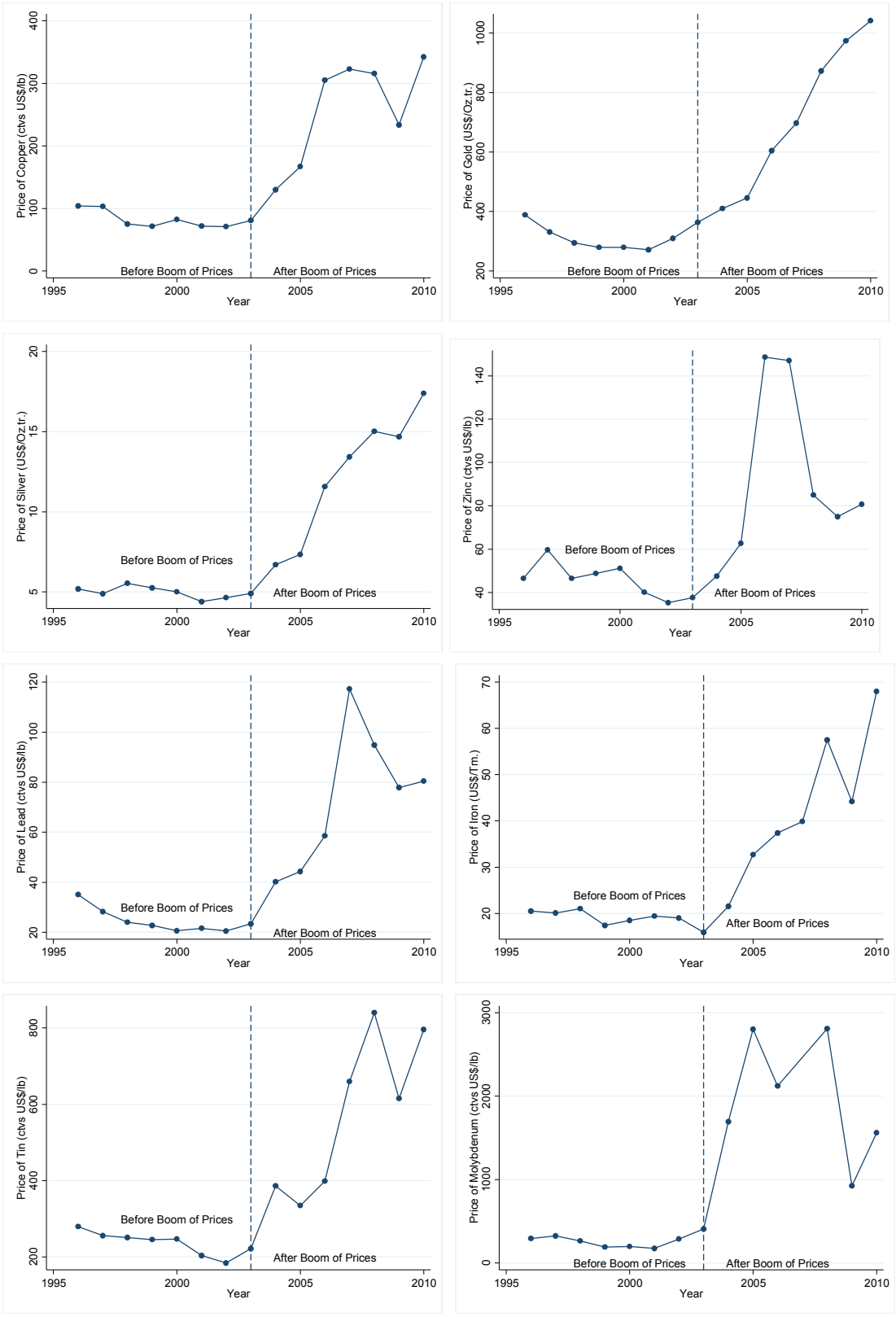
Figure 1.1: Evolution of Mineral Production



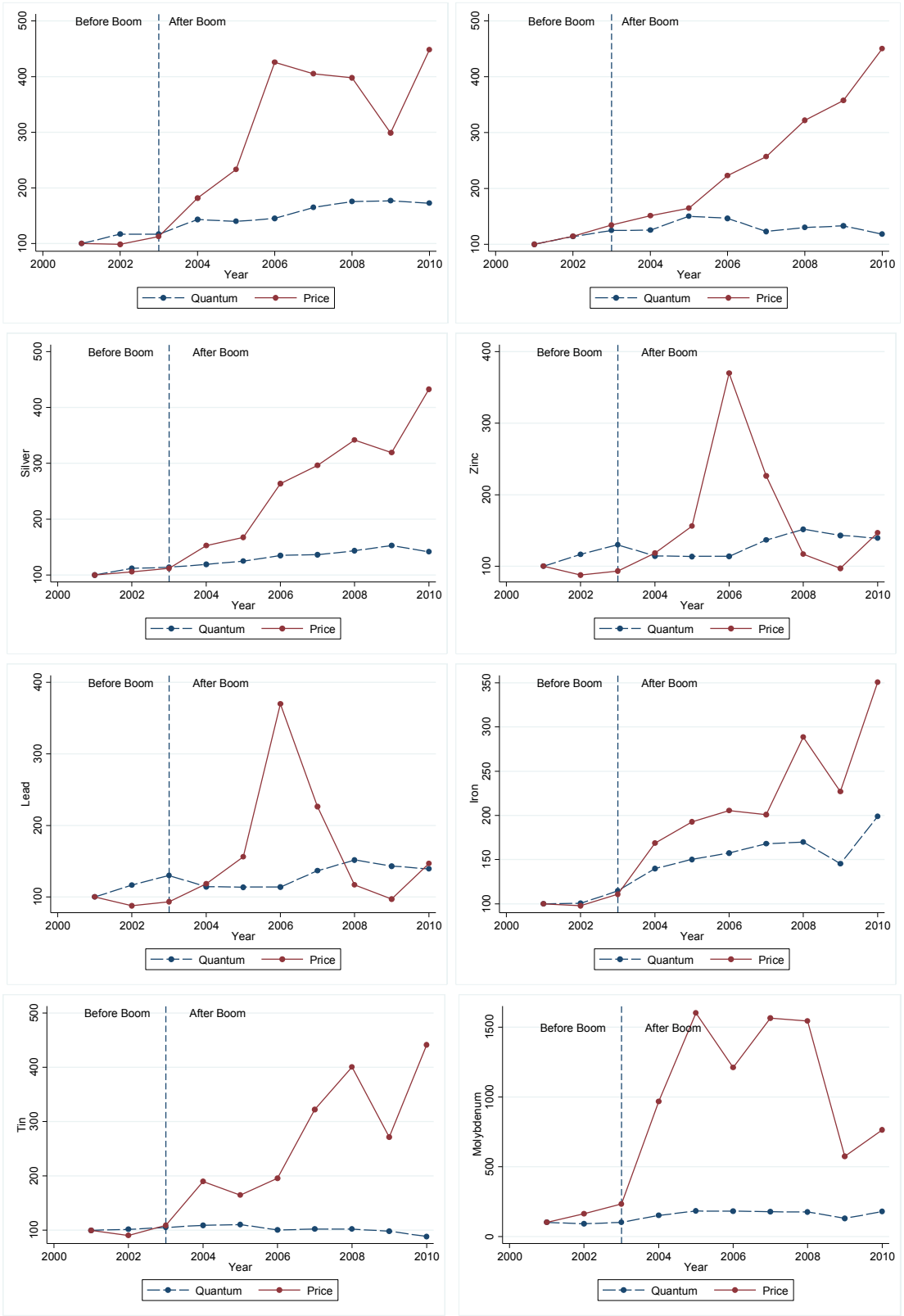
Source: Own from data from Ministry of Energy and Mines.

Figure 1.2: Evolution of Mineral Prices



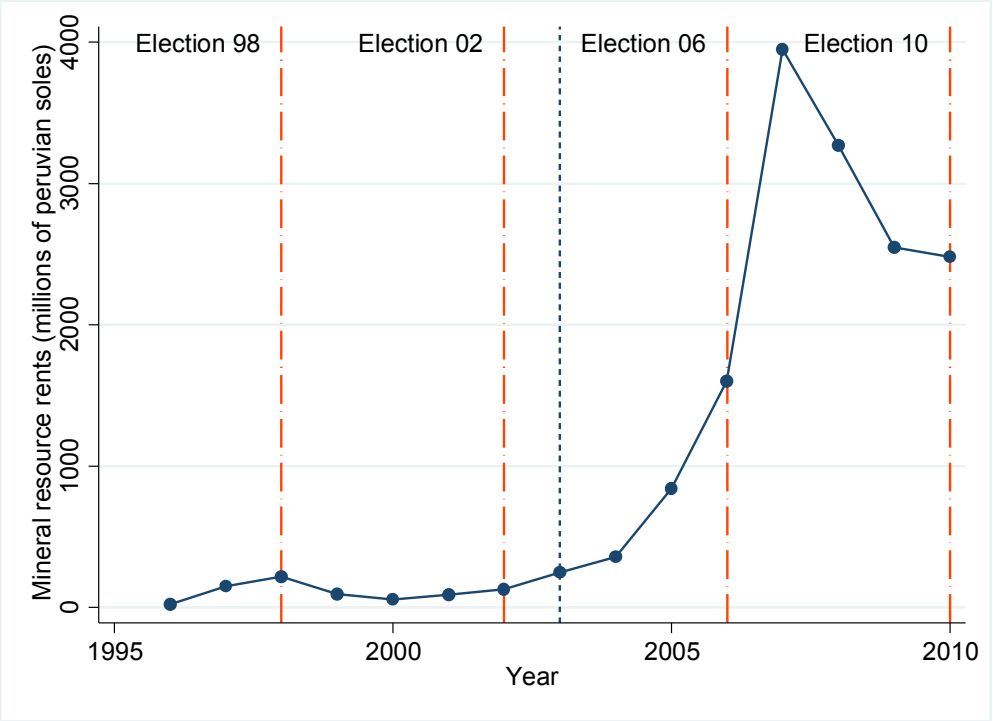
Source: Own from data of Ministry of Energy and Mines.

Figure 1.3: Evolution of quantum and prices of mineral exports (2001-2010)



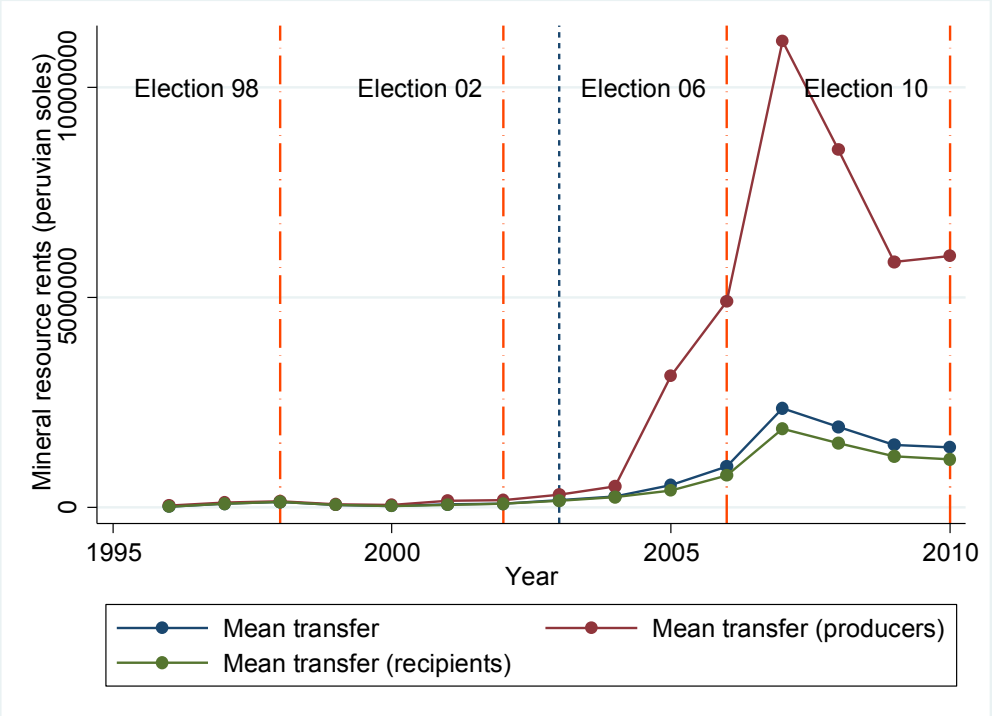
Source: Own from data of Ministry of Energy and Mines.

Figure 1.4: Evolution of mining rents distributed to local governments (1996-2010)



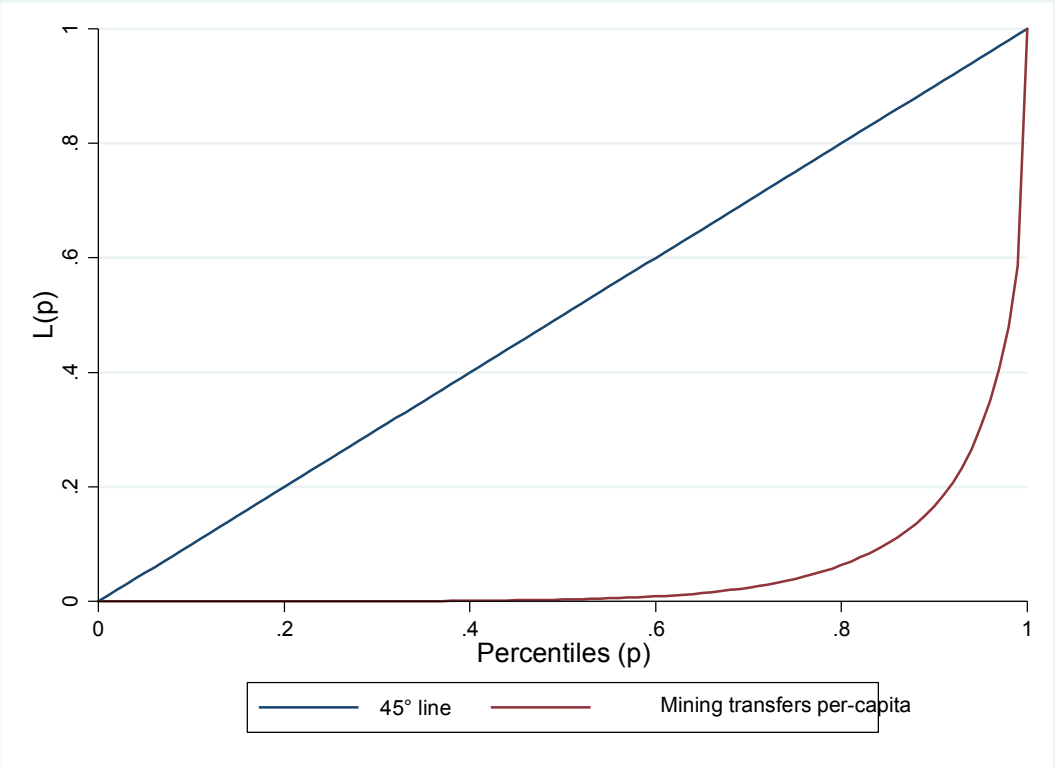
Source: Own from data of Ministry of Energy and Mines and Ministry of Economics and Finance.

Figure 1.5: Evolution of mining rents by type of district



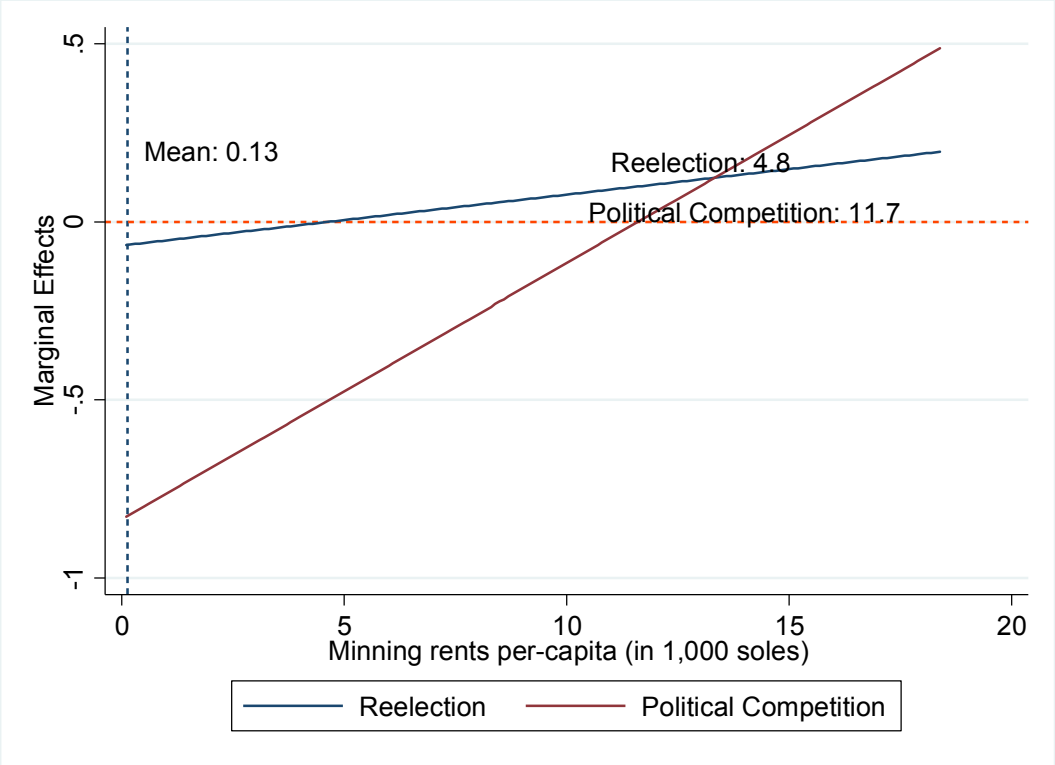
Source: Own from data of Ministry of Energy and Mines and Ministry of Economics and Finance.

Figure 1.6: Lorenz curve for average mining transfers (1996-2010)



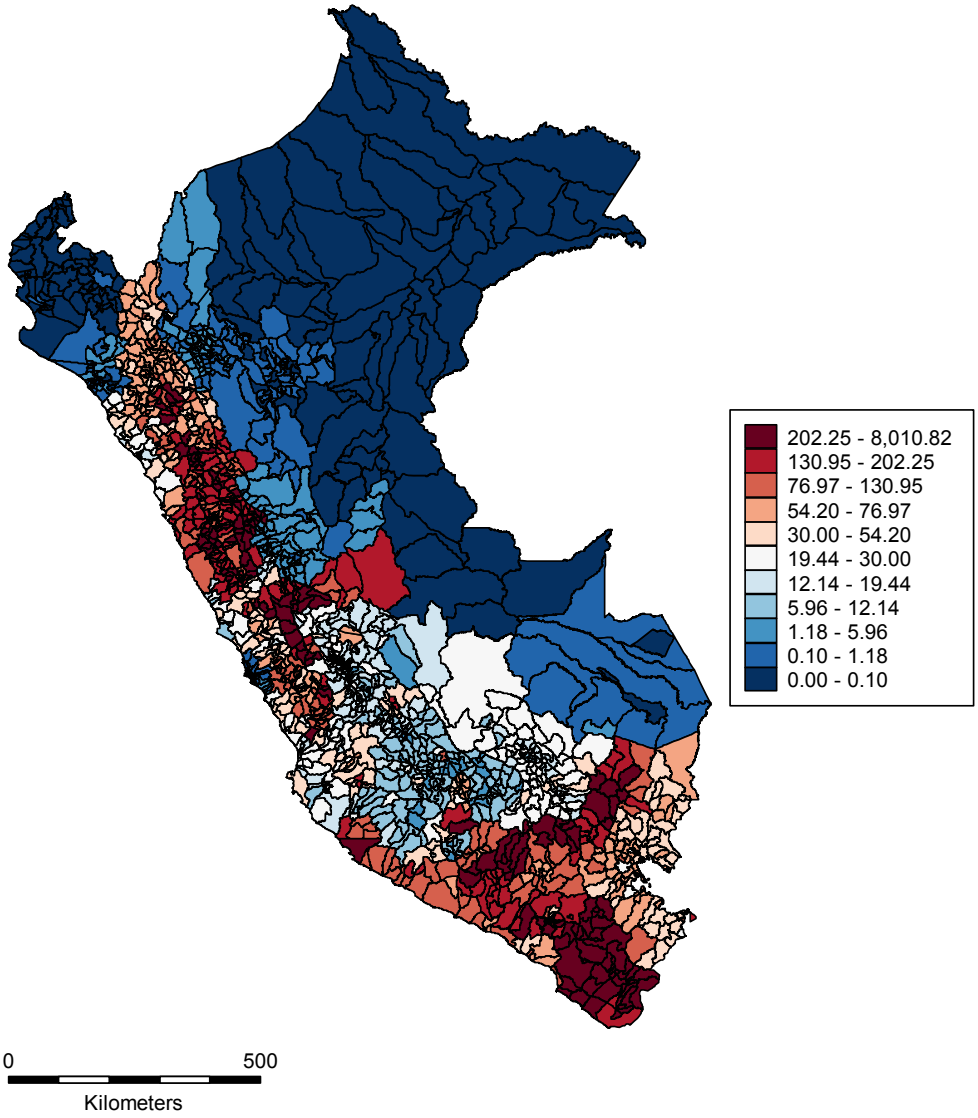
Source: Own.

Figure 1.7: Marginal effects of the impact of mining transfers on reelection and political competition



Source: Own.

Map 1.1: District allocation of average mining transfers (1996-2010)



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

Table 1.1: Summary Statistics

	Recipients	Producers	Non-recipients
I. Political Outcomes			
Reelection	0.18	0.19	0.11
Political Competition	0.82	0.84	0.81
II. Transfers			
Mining Transfers (per-capita)	92.32	474.47	-
p10	0.09	0.39	-
p25	0.70	2.64	-
p50	4.92	27.75	-
p75	44.04	281.85	-
p90	179.31	877.38	-
p99	1,272.58	9,479.57	-
Municipality Budget (per-capita)	568.03	1,496.52	347.17
III. Mineral Production			
Real Value of Mineral Production (US$ in 2001)	-	2,324,875	-
Copper	-	898,122	-
Zinc	-	490,013	-
Lead	-	69,880	-
Tin	-	134,851	-
Molybdenum	-	17,171	-
Silver	-	219,311	-
Gold	-	466,456	-
Iron	-	29,070	-
IV. District Characteristics: Census 1993			
Population	12,339	10,788	22,618
% Rural Population	57.76	55.32	59.08
% Children (0-15 years old)	40.68	40.58	45.14
Malnutrition rates for Children	55.61	53.02	55.64
% Population without wastepipe-latrine	41.81	41.60	53.91
% Population without water	51.20	49.84	67.13
% Population without electricity	74.16	65.27	68.55
Female illiteracy rate	33.60	29.39	23.90
Altitude	2,326	2,720	498

Source: Own.

Table 1.2: Impact of Natural Resource Booms on Reelection

	Difference in Differences Estimates					
	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: 1=Mayor is reelected.					
Average Transfers for Electoral Cycle						
Mining Transfers per-capita	-0.025***	-0.034	-0.034	-0.028	-0.031	-0.024
	(0.010)	(0.026)	(0.026)	(0.026)	(0.026)	(0.028)
Mining Transfers per-capita^2		0.001	0.001	0.000	0.000	0.000
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of (1+Real Value of Production)			0.001	0.002	0.001	0.000
			(0.004)	(0.005)	(0.004)	(0.004)
Year of Election						
Mining Transfers per-capita	0.007	-0.066***	-0.067***	-0.062**	-0.061**	-0.071***
	(0.018)	(0.024)	(0.024)	(0.024)	(0.025)	(0.025)
Mining Transfers per-capita^2		0.007***	0.007***	0.007***	0.007***	0.008***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Log of (1+Real Value of Production)			0.001	0.002	0.001	0.001
			(0.004)	(0.004)	(0.004)	(0.004)
Excluding Lima	No	No	No	Yes	No	No
Excluding Non-producer Regions	No	No	No	No	Yes	No
Excluding Non-producer Provinces	No	No	No	No	No	Yes
Mean dependent variable	0.17	0.17	0.17	0.16	0.17	0.18
Number of observations	4,582	4,582	4,582	4,128	3,734	2,346
R2	0.014	0.016	0.016	0.018	0.014	0.016

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001.

Table 1.3: Impact of Natural Resource Booms on Political Competition

	Difference in Differences Estimates					
	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: (1-Herfindahl Index)*100					
Average Transfers for Electoral Cycle						
Mining Transfers per-capita	-0.310	-0.836**	-0.830**	-0.825**	-0.752*	-0.899**
	(0.217)	(0.402)	(0.402)	(0.405)	(0.406)	(0.439)
Mining Transfers per-capita^2		0.036**	0.036**	0.037**	0.033**	0.040**
		(0.016)	(0.016)	(0.016)	(0.016)	(0.017)
Log of (1+Real Value of Production)			-0.021	-0.016	-0.019	-0.015
			(0.057)	(0.061)	(0.057)	(0.057)
Year of Election						
Mining Transfers per-capita	-0.280	-0.307	-0.307	-0.283	-0.251	-0.371
	(0.193)	(0.391)	(0.394)	(0.396)	(0.394)	(0.421)
Mining Transfers per-capita^2		0.003	0.003	0.001	-0.001	0.007
		(0.022)	(0.022)	(0.022)	(0.022)	(0.023)
Log of (1+Real Value of Production)			0.000	0.004	0.001	0.006
			(0.052)	(0.055)	(0.052)	(0.052)
Excluding Lima	No	No	No	Yes	No	No
Excluding Non-producer Regions	No	No	No	No	Yes	No
Excluding Non-producer Provinces	No	No	No	No	No	Yes
Mean dependent variable	83.15	83.15	83.15	83.15	83.15	83.15
Number of observations	4,581	4,581	4,581	4,127	3,734	2,346
R2	0.132	0.132	0.132	0.139	0.139	0.156

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001.

Table 1.4: Robustness Checks for Impact of Natural Resource Rents on Reelection and Political Competition

	Impact of Mining Transfers on Reelection				Impact of Mining Transfers on Political Competition			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Average Transfers for Electoral Cycle								
Mining Transfers per-capita	-0.034	-0.079**	-0.075**	-0.067*	-0.830**	-0.922*	-0.854	-1.250**
	(0.026)	(0.033)	(0.033)	(0.036)	(0.402)	(0.513)	(0.523)	(0.565)
Mining Transfers per-capita^2	0.001	0.003	0.002	0.002	0.036**	0.016	0.012	0.036
	(0.001)	(0.002)	(0.002)	(0.002)	(0.016)	(0.029)	(0.030)	(0.030)
Log of (1+Real Value of Production)	0.001				-0.021			
	(0.004)				(0.057)			
Year of Election								
Mining Transfers per-capita	-0.067***	-0.113**	-0.103**	-0.130**	-0.307	-0.158	-0.097	-0.554
	(0.024)	(0.046)	(0.047)	(0.052)	(0.394)	(0.644)	(0.649)	(0.721)
Mining Transfers per-capita^2	0.007***	0.015***	0.014***	0.017***	0.003	-0.076	-0.083	-0.035
	(0.002)	(0.005)	(0.005)	(0.005)	(0.022)	(0.063)	(0.063)	(0.067)
Log of (1+Real Value of Production)	0.001				0.000			
	(0.004)				(0.052)			
Excluding Producer Districts	No	Yes	No	No	No	Yes	No	No
Excluding Producer Districts in Producing Regions	No	No	Yes	No	No	No	Yes	No
Excluding Producer Districts in Producing Provinces	No	No	No	Yes	No	No	No	Yes
Mean dependent variable	0.17				83.15			
Number of observations	4,582	4,316	3,468	2,080	4,581	4,315	3,468	2,080
R2	0.016	0.014	0.011	0.012	0.132	0.127	0.132	0.146

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001.

Table 1.5: Instrumental Variable for Reelection Outcomes

		Instrumental Variables					
	DID	Imperfect IV	Nevo and Rosen (2012) One-sided Bounds				
			(λ=0.1)	(λ=0.3)	(λ=0.5)	(λ=0.7)	(λ=0.9)
Mining Transfers per-capita	-0.067***	-0.076***	-0.077***	-0.079***	-0.084***	-0.093**	-0.126**
	(0.024)	(0.027)	(0.028)	(0.029)	(0.031)	(0.037)	(0.057)
Mining Transfers per-capita^2	0.007***	0.008***	0.009***	0.009***	0.010***	0.011***	0.016***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.006)
Log of (1+Real Value of Production)	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
	First Stage for Level of Transfers						
Mining Canon		1.231***					
		(0.063)					
Mining Canon^2		0.005					
		(0.004)					
Log of (1+Real Value of Production)		0.000	0.000	0.000	0.001	0.002	0.005
		(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)
V(0.1)			2.275***				
			(0.125)				
V(0.1)^2			0.001				
			(0.001)				
V(0.3)				2.718***			
				(0.178)			
V(0.3)^2				0.001			
				(0.001)			
V(0.5)					3.322***		
					(0.275)		
V(0.5)^2					0.002		
					(0.001)		
V(0.7)						4.039***	
						(0.510)	
V(0.7)^2						0.005*	
						(0.003)	
V(0.9)							3.815***
							(1.305)
V(0.9)^2							0.014
							(0.009)
Number of observations		5,141	5,141	5,141	5,141	5,141	5,141
R2		0.961	0.954	0.930	0.885	0.785	0.529
F test		1,644.01	1,339.42	804.94	384.58	124.88	59.86

	First Stage for the Square of Transfers					
Mining Canon	-0.621					
	(0.897)					
Mining Canon^2	1.788***					
	(0.139)					
Log of (1+Real Value of Production)	-0.010	-0.011	-0.013	-0.016	-0.019	-0.014
	(0.014)	(0.015)	(0.018)	(0.022)	(0.028)	(0.031)
V(0.1)		-1.210				
		(1.753)				
V(0.1)^2		0.262***				
		(0.022)				
V(0.3)			-1.628			
			(2.366)			
V(0.3)^2			0.315***			
			(0.029)			
V(0.5)				-2.328		
				(3.400)		
V(0.5)^2				0.390***		
				(0.042)		
V(0.7)					-3.944	
					(6.087)	
V(0.7)^2					0.497***	
					(0.066)	
V(0.9)						-11.860
						(17.237)
V(0.9)^2						0.624***
						(0.176)
Number of observations	5,141	5,141	5,141	5,141	5,141	5,141
R2	0.954	0.945	0.919	0.869	0.764	0.514
F test	64.83	57.77	47.76	45.79	35.97	5.34

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001.

Table 1.6 : Impact of Natural Resource Booms on Public Goods Provision

	DID Estimates							
	Access to Water Network	Acess to Public Light	Garbage Collection		Security Services			Access to Library
			In Capital	Rest	Access	Perssonel	Stations	
Mining Transfers per-capita	0.007	0.027**	0.054*	0.103***	0.052***	0.154***	0.093***	-0.015
	(0.010)	(0.011)	(0.028)	(0.035)	(0.013)	(0.056)	(0.035)	(0.011)
Mining Transfers per-capita^2	0.000	-0.001**	-0.002**	-0.004***	-0.001***	-0.004	-0.002	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.003)	(0.002)	(0.000)
Log of (1+Real Value of Production)	-0.001	0.002	-0.003	0.003	-0.001	0.003	0.000	0.004*
	(0.003)	(0.001)	(0.004)	(0.006)	(0.002)	(0.009)	(0.001)	(0.002)
	IV Estimates							
Mining Transfers per-capita	0.005	0.032***	0.056*	0.096***	0.054***	0.151***	0.084**	-0.016
	(0.010)	(0.011)	(0.030)	(0.037)	(0.013)	(0.054)	(0.034)	(0.010)
Mining Transfers per-capita^2	0.000	-0.001***	-0.002**	-0.004***	-0.001***	-0.003	-0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.003)	(0.002)	(0.000)
Log of (1+Real Value of Production)	-0.001	0.002	-0.003	0.003	-0.001	0.003	0.000	0.004*
	(0.003)	(0.001)	(0.004)	(0.006)	(0.002)	(0.009)	(0.001)	(0.002)
Mean dependent variable	0.76	0.88	0.94	0.55	0.15	6.1	1.3	0.41
Number of observations	5,566	8,644	9,014	8,781	14,117	12,825	10,026	14,237
R2	0.242	0.264	0.017	0.113	0.115	0.242	0.078	0.013

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. Perssonel and stations are measured in units per 1,000 habitants. All other variables are dummy variables of whether the district has access to a particular public good.

Table 1.7: Impact of Natural Resource Booms on Local Infrastructure

	DID Estimates									
	Health Infrastructure				Sport Infrastructure					
	Hospital	**Health Center**	**Polyclinic**	**Odontological/Basic Medical Services**	**Stadiums**	**Multipurpose Fields**	**Soccer Fields**	**Basquetball Fields**	**Volleyball Fields**	**Gymnasiums**
Mining Transfers per-capita	0.000	-0.003	0.006	0.007**	0.029***	0.048**	0.042*	0.007**	-0.000	0.001
	(0.000)	(0.002)	(0.004)	(0.003)	(0.011)	(0.022)	(0.024)	(0.003)	(0.007)	(0.001)
Mining Transfers per-capita^2	-0.000	0.000	-0.000	-0.000**	-0.001**	-0.001	-0.002*	-0.000*	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Log of (1+Real Value of Production)	-0.000	0.000	0.001**	0.000	0.002	0.005	-0.000	-0.001*	-0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.002)	(0.004)	(0.004)	(0.001)	(0.001)	(0.000)
	IV Estimates									
Mining Transfers per-capita	0.000	-0.003	0.007	0.007**	0.027**	0.041*	0.030*	0.007**	0.000	0.002
	(0.000)	(0.002)	(0.004)	(0.003)	(0.011)	(0.022)	(0.017)	(0.004)	(0.007)	(0.001)
Mining Transfers per-capita^2	-0.000	0.000	-0.000	-0.000**	-0.001*	-0.001	-0.001*	-0.000*	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Log of (1+Real Value of Production)	-0.000	0.000	0.001**	0.000	0.002	0.005	-0.000	-0.001*	-0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.002)	(0.004)	(0.004)	(0.001)	(0.001)	(0.000)
Mean dependent variable	0.01	0.01	0.02	0.01	0.26	0.31	0.18	0.02	0.03	0.01
Number of observations	12,947	14,233	14,233	14,233	12,663	12,663	12,663	12,663	12,663	12,663
R2	0.002	0.004	0.013	0.004	0.004	0.006	0.005	0.004	0.003	0.012

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. Dependent variables are measured in units per 1,000 habitants.

Table 1.8: Impact of Natural Resource Booms on Roads Construction and Investment

	DID Estimates							
	Quantity				Cost			
	Roads Repaired (m2)	Roads Constructed (m2)	Rural Roads Repaired (Km)	Rural Roads Constructed (Km)	Roads Repaired	Roads Constructed	Rural Roads Repaired	Rural Roads Constructed
Mining Transfers per-capita	0.040	0.211**	-0.090	0.071	5.393**	36.305***	26.989**	4.716
	(0.050)	(0.105)	(0.328)	(0.067)	(2.408)	(13.317)	(12.686)	(2.869)
Mining Transfers per-capita^2	-0.003	0.003	0.002	-0.002	-0.289*	-0.786**	-0.035	-0.153*
	(0.003)	(0.003)	(0.009)	(0.002)	(0.158)	(0.384)	(0.391)	(0.086)
Log of (1+Real Value of Production)	0.003	0.034	-0.008	0.001	-0.015	11.629	-0.109	-0.453**
	(0.003)	(0.031)	(0.019)	(0.002)	(0.186)	(9.707)	(0.479)	(0.184)
	IV Estimates							
Mining Transfers per-capita	0.047	0.233**	-0.066	0.069	5.393*	39.909**	29.439*	5.248*
	(0.063)	(0.111)	(0.323)	(0.066)	(3.008)	(15.701)	(16.443)	(2.964)
Mining Transfers per-capita^2	-0.003	0.000	0.002	-0.001	-0.302*	-1.060**	-0.129	-0.172*
	(0.004)	(0.003)	(0.009)	(0.002)	(0.183)	(0.474)	(0.552)	(0.090)
Log of (1+Real Value of Production)	0.003	0.033	-0.008	0.001	-0.015	11.597	-0.135	-0.458**
	(0.003)	(0.031)	(0.019)	(0.002)	(0.186)	(9.675)	(0.497)	(0.184)
Mean dependent variable	0.06	0.19	0.41	0.13	2.63	15.90	16.29	11.97
Number of observations	12,831	12,831	11,954	13,235	12,831	12,831	11,954	13,235
R2	0.002	0.010	0.003	0.002	0.015	0.005	0.006	0.004

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. Dependent variables are measured in per-capita terms.

Table 1.9: Impact of Natural Resource Booms on Public Employment by Type of Contract

	DID Estimates								
	Appointed Staff			Contracted Employees			Temporary Employees		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Mining Transfers per-capita	0.104**	0.189*	0.262	2.555*	1.916	0.686***	0.630**	1.076***	1.106*
	(0.053)	(0.108)	(0.165)	(1.307)	(1.337)	(0.256)	(0.300)	(0.335)	(0.567)
Mining Transfers per-capita^2		-0.004	-0.007		0.032	-0.026***		-0.022*	0.003
		(0.003)	(0.006)		(0.026)	(0.009)		(0.014)	(0.038)
Log of (1+Real Value of Production)		-0.000			-0.018			-0.033*	
		(0.007)			(0.018)			(0.019)	
	IV Estimates								
Mining Transfers per-capita	0.103*	0.181	0.244	2.192*	1.755	0.647***	0.601**	0.956***	1.050*
	(0.056)	(0.118)	(0.173)	(1.223)	(1.152)	(0.239)	(0.286)	(0.345)	(0.560)
Mining Transfers per-capita^2		-0.004	-0.006		0.022	-0.026***		-0.018	0.003
		(0.004)	(0.006)		(0.025)	(0.008)		(0.015)	(0.039)
Log of (1+Real Value of Production)		0.000			-0.017			-0.032	
		(0.007)			(0.016)			(0.020)	
Mean dependent variable		0.93			1.34			2.73	
Excluding Producer Districts	No	No	Yes	No	No	Yes	No	No	Yes
Number of observations	15,523	15,523	14,801	15,523	15,523	14,801	15,523	15,523	14,801
R2	0.161	0.162	0.166	0.125	0.128	0.060	0.106	0.109	0.114

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. Dependent variables are measured in number of employees per 1,000 habitants.

Table 1.10: Impact of Resource Booms on Public Employment by Type of Employment

	DID Estimates									
	Officials		**Professionals**		**Technicians**		**Security Workers**		**Janitors**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mining Transfers per-capita	0.222***	0.300**	0.710***	0.603***	0.349*	0.275**	0.198***	0.239***	0.209***	0.204***
	(0.082)	(0.126)	(0.172)	(0.112)	(0.208)	(0.136)	(0.065)	(0.089)	(0.071)	(0.073)
Mining Transfers per-capita^2	-0.006**	-0.010**	-0.011**	-0.014	0.016***	0.003	-0.007**	-0.012***	-0.007***	-0.008***
	(0.003)	(0.004)	(0.005)	(0.009)	(0.006)	(0.017)	(0.003)	(0.004)	(0.002)	(0.002)
Log of (1+Real Value of Production)	-0.007		-0.012		-0.002		-0.006*		-0.005	
	(0.005)		(0.008)		(0.006)		(0.003)		(0.006)	
	IV Estimates									
Mining Transfers per-capita	0.223**	0.291**	0.615***	0.550***	0.305	0.244*	0.199***	0.234***	0.200***	0.187***
	(0.091)	(0.135)	(0.132)	(0.104)	(0.190)	(0.132)	(0.064)	(0.079)	(0.073)	(0.070)
Mining Transfers per-capita^2	-0.006**	-0.009**	-0.010**	-0.013	0.016**	0.004	-0.007**	-0.012***	-0.007***	-0.008***
	(0.003)	(0.004)	(0.004)	(0.009)	(0.007)	(0.017)	(0.003)	(0.004)	(0.002)	(0.002)
Log of (1+Real Value of Production)	-0.007		-0.011		-0.002		-0.006*		-0.005	
	(0.005)		(0.007)		(0.006)		(0.003)		(0.006)	
Excluding Producer Districts	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Mean dependent variable	0.59	0.59	0.91	0.91	1.24	1.24	0.24	0.24	0.67	0.67
Number of observations	15,523	14,801	15,523	14,801	15,523	14,801	15,523	14,801	15,523	14,801
R2	0.135	0.135	0.127	0.122	0.173	0.121	0.048	0.046	0.048	0.046

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. Dependent variables are measured in number of employees per 1,000 habitants.

Table 1.11: Impact of Natural Resource Booms on Local Government Expenditures

	DID Estimates							
	Payroll	**Pensions**	**Goods and Services**	**Other Current Expenses**	**Investment**	**Finance Investment**	**Other Capital Expenditures**	**Debt**
Mining Transfers per-capita	54.628*	0.292	109.853***	-0.222	850.268***	-0.028*	9.245**	-0.202
	(29.997)	(0.195)	(27.127)	(0.432)	(59.741)	(0.017)	(4.413)	(0.797)
Mining Transfers per-capita^2	-1.375	-0.014**	-2.404***	0.023	-20.394***	0.001	-0.370**	0.069
	(0.917)	(0.006)	(0.880)	(0.017)	(2.101)	(0.000)	(0.184)	(0.056)
Log of (1+Real Value of Production)	-0.698*	-0.005	-0.909	-0.072	2.066	-0.003	0.073	0.218
	(0.396)	(0.053)	(0.614)	(0.060)	(3.582)	(0.003)	(0.177)	(0.161)
	IV Estimates							
Mining Transfers per-capita	48.258*	0.270	106.301***	-0.125	833.864***	-0.027	8.100**	-0.178
	(26.902)	(0.184)	(25.128)	(0.390)	(53.951)	(0.017)	(3.620)	(0.800)
Mining Transfers per-capita^2	-1.226	-0.014**	-2.299***	0.019	-20.397***	0.001	-0.347**	0.067
	(0.845)	(0.006)	(0.865)	(0.016)	(1.915)	(0.000)	(0.171)	(0.061)
Log of (1+Real Value of Production)	-0.641*	-0.005	-0.877	-0.073	2.221	-0.003	0.084	0.217
	(0.363)	(0.053)	(0.598)	(0.060)	(3.570)	(0.003)	(0.175)	(0.161)
Mean dependent variable	34.13	5.21	96.89	14.17	313.66	0.01	4.43	16.58
Number of observations	17,317	17,317	17,317	17,317	17,317	17,317	17,317	17,317
R2	0.119	0.721	0.249	0.043	0.517	0.002	0.022	0.083

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. Dependent variables are measured in per-capita terms.

Table 1.12: Impact of Natural Resource Booms on Local Government Expenditures

	DID Estimates								
	Planning	**Agriculture**	**Social Assistance**	**Education and Culture**	**Energy and Natural Resources**	**Industry, Trade and Services**	**Health and Sanitation**	**Transport**	**Housing and Urban Development**
Mining Transfers per-capita	251.621***	167.233***	30.352***	155.660***	15.064***	25.808***	90.828***	252.922***	34.642***
	(46.664)	(28.607)	(3.036)	(14.942)	(3.394)	(4.886)	(21.678)	(55.535)	(4.938)
Mining Transfers per-capita^2	-6.203***	-3.852***	-0.276**	-4.581***	-0.460***	-0.813***	-1.123	-7.572***	-1.024***
	(1.456)	(0.844)	(0.112)	(0.734)	(0.106)	(0.128)	(1.367)	(1.303)	(0.204)
Log of (1+Real Value of Production)	-1.838*	-0.100	0.115	1.775	-0.390	-0.218	1.048	-1.039	0.262
	(1.026)	(0.840)	(0.365)	(1.662)	(0.312)	(0.287)	(1.188)	(1.423)	(0.340)
	IV Estimates								
Mining Transfers per-capita	239.767***	153.721***	30.971***	158.298***	13.295***	23.141***	96.984***	248.192***	34.273***
	(41.698)	(25.128)	(3.262)	(15.298)	(2.051)	(4.106)	(19.611)	(49.358)	(4.881)
Mining Transfers per-capita^2	-5.814***	-3.634***	-0.315**	-4.696***	-0.425***	-0.771***	-1.433	-7.596***	-1.029***
	(1.330)	(0.752)	(0.134)	(0.781)	(0.073)	(0.110)	(1.304)	(1.144)	(0.211)
Log of (1+Real Value of Production)	-1.733*	0.023	0.110	1.752	-0.374	-0.194	0.996	-0.994	0.265
	(0.991)	(0.820)	(0.364)	(1.661)	(0.303)	(0.288)	(1.187)	(1.397)	(0.342)
Mean dependent variable	164.89	38.46	42.95	57.99	13.80	9.25	66.66	68.29	20.24
Number of observations	17,317	17,317	17,317	17,317	17,317	17,317	17,317	17,317	17,317
R2	0.318	0.167	0.119	0.259	0.034	0.068	0.232	0.233	0.053

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. Dependent variables are measured in per-capita terms.

Table 1.13: Impact of Natural Resource Booms on Household Well-being

Instrumental Variables Estimates

	Income per-capita					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Mining Transfers per-capita	32.171***	96.399***	96.307***	97.452***	98.367***	105.063***
	(10.772)	(37.319)	(37.367)	(37.454)	(37.576)	(39.110)
Mining Transfers per-capita^2		-2.151**	-2.149**	-2.179**	-2.200***	-2.379***
		(0.845)	(0.847)	(0.847)	(0.849)	(0.885)
Log of (1+Real Value of Production)			1.634	1.589	1.746	1.773
			(1.878)	(1.906)	(1.898)	(1.927)
	Consumption per-capita					
Mining Transfers per-capita	0.641	8.437	8.398	8.575	9.883*	9.179
	(1.695)	(5.894)	(5.909)	(5.944)	(5.723)	(6.282)
Mining Transfers per-capita^2		-0.261*	-0.260*	-0.267*	-0.298**	-0.275*
		(0.142)	(0.142)	(0.143)	(0.136)	(0.151)
Log of (1+Real Value of Production)			0.695	0.499	0.861	0.997
			(0.864)	(0.853)	(0.900)	(0.917)
Excluding Lima	No	No	No	Yes	No	No
Excluding Non-producer Regions	No	No	No	No	Yes	No
Excluding Non-producer Provinces	No	No	No	No	No	Yes
Mean dependent variable: income	400.56					
Mean dependent variable: consumption	334.8					
Number of observations	200,861	200,861	200,861	171,002	145,565	87,843
R2	0.011	0.012	0.012	0.015	0.012	0.012

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. The analysis covers period 1998-2010.

Table 1.14: Impact of Natural Resource Booms on Electoral Conflict

	Dependent variable: =1 if at least one incident of electoral conflict was reported					
	(1)	(2)	(3)	(4)	(5)	(6)
			Differences in Differences			
Mining Transfers per-capita	0.016	0.042**	0.043**	0.044**	0.047***	0.050***
	(0.012)	(0.017)	(0.017)	(0.017)	(0.017)	(0.018)
Mining Transfers per-capita^2		-0.002***	-0.002***	-0.002***	-0.002***	-0.003***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of (1+Real Value of Production)			-0.002	-0.001	-0.002	-0.002
			(0.002)	(0.002)	(0.002)	(0.002)
			Instrumental Variables			
Mining Transfers per-capita	0.020	0.048***	0.050***	0.051***	0.054***	0.056***
	(0.013)	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)
Mining Transfers per-capita^2		-0.002***	-0.002***	-0.003***	-0.003***	-0.003***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log of (1+Real Value of Production)			-0.002	-0.001	-0.002	-0.002
			(0.002)	(0.002)	(0.002)	(0.002)
Excluding Lima	No	No	No	Yes	No	No
Excluding Non-producer Regions	No	No	No	No	Yes	No
Excluding Non-producer Provinces	No	No	No	No	No	Yes
Mean dependent variable	0.06	0.06	0.06	0.06	0.06	0.06
Number of observations	5,138	5,138	5,138	4,651	4,174	2,572
R2	0.034	0.034	0.035	0.039	0.031	0.030

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001.

Appendix 1.1: Rules for mining Canon and mining royalty distribution

Transfer	Use / Destination	Constitution base	Form of allocation of the resources	Legal base
(1) Canon 1 /	Public Investment 2 /	* 50% Income Tax 3/	* 10% to the municipalities in the district where the natural resource is located. * 25% to the municipalities of the province where the natural resource is located. * 40% to municipalities in the region where the natural resource is located. * 40% to municipalities in the region where the natural resource is located. * 25% to regional government (80% CR and 20% for regional universities).	* Constitution of Peru (Article 77) assigns to districts a share of income received by the State due to the exploitation of natural resources. * Law 27,506, Canon Law (July 10, 2001) establishes the allocation rule to local and regional governments. * Supreme Decree 005-2002-EF, regulation of Canon. * Law 28,077 (September 26, 2003) and Law 28,322 (August 10, 2004) amended several articles of the Canon Law. These modification were regulated by Supreme Decree 029-2004-EF and EF-187-2004, respectively.
(2) Mining Royalty	Public Investment	* % on the value of minerals (or its equivalent) sold according to international prices.	* 20% to the local municipality where the mining concession is located. * 20% to the municipalities of the province where the mining concession is located. * 40% to the municipalities of the region where the mining concession is located. * 15% to the Regional Government. * 5% to the universities.	* Law 28258, Law of Mining Royalty (June 24, 2004), that establishes the mining royalties, its constitution, determination, administration, distribution and use. * Law 28323, Law that modifies the Law of Mining Royalty (August 10, 2004). * Supreme decree 157-2004-EF, Regulation of the Law of Mining Royalties (November 15, 2004). * Supreme decree 018-2005-EF, which dictates complementary norms of the regulation of the Law of Mining Royalties (January 29, 2004). * Ministerial resolution 163-2006-EF-15, which establishes the exchange rate and rank for the payment of mining royalties (March 22, 2006).

1. It includes mining, oil, hydropower, fishing, forest and gas Canon.
2. Valid for all Canon except the oil Canon, in which case the assignment rule is the following: in Loreto, Ucayali and Huánuco until a 20% can be used for current expenditures. In Piura and Tumbes, 100% has to be used for public investment.
3. Some variants for the cases of the oil, gas and fishing Canon exist. For the case of oil Canon, it is constituted on 12.5% of the Value of the Production. Details for other forms of Canon are discussed on www.mef.gob.pe.

Appendix 1.2: Model[61]

Consider a simple two-period local economy composed by $N+2$ citizens. In the first period, this economy has two sectors: a) a natural resource sector and b) a subsistence sector. The natural resource sector produces a per-period flow rent C which is assumed to be exogenous and it is completely appropriated by the local government (controlled by the incumbent mayor)[62].

In the first period, each agent in this economy can produce in the subsistence sector. The output x_t depends on the stock of a public good g_t provided by the local government following a linear production function, $x_t = \rho_x g_t$, where ρ_x is an exogenous technological parameter. In the second period, it is possible to produce in the industrial sector, which is assumed to be more efficient but requires managerial skills. A talented agent can hire l_t workers and produce an output $y_t = \rho_y g_t l_t$. It is assumed that $\rho_x < \rho_y$, so producing industrial goods is more efficient.

Local government revenues depends on C and taxes collected from the subsistence and industrial sector, $\tau(x_t + y_t)$, with t exogenous with $t < 1$. These revenues are used to produce public goods g_t and to finance incumbent's consumption. In an extension of this basic model revenues are also used to fund patronage b_t . The amount of public goods g_t is exogenous in period 1 but endogenous in period 2. We assume that $g_2 = g_1 + I$ where I represents the investment in expanding the stock of public goods.

The incumbent mayor seeks to maximize the present value of his own consumption. In the first period the mayor in power is exogenously given. For simplicity, it is assumed that there is just one talented agent to avoid strategic interactions. The talented agent can choose between producing in the subsistence sector; becoming an entrepreneur and hiring workers for producing in the industrial sector; or becoming a challenger to the incumbent mayor and running for office. The talented agent problem is to choose between politics and industrial production. It is assumed that the skills needed for being an entrepreneur are the same for engaging in politics. If the talented agent runs for election he wins office with (exogenous) probability γ. With probability $(1-\gamma)$ he losses the election and has to incur in a cost D . The incumbent politician stays in office if the talented agent decides not to run for office or if he loses the election. The untalented agents can work either in the subsistence sector or be employed as workers for talented individuals. All agents are assumed to be risk-neutral.

The timing of the game is as follows:

[61] We closely follow the exposition in Caselli (2006).

[62] This assumption is consistent with the setting of this study in which mineral production is performed by mining companies whose economic decisions are weakly connected with local politics and local government are recipients of mining transfers.

i. Incumbent, the initial level of public goods and mining canon rents are exogenously given in period 1.
ii. Incumbent maximizes the present value of his consumption with respect to the level of investment in public goods for period 2.
iii. At the beginning of period 2, the talented agent decides to become an entrepreneur or to become a challenger to the incumbent mayor.
iv. At the end of period 2 an election takes place. If the talented agent decides not to become a challenger, or if he loses the election, the period-1 mayor continues in office. Otherwise, the talented agent becomes the new mayor.

A.1.2.1 Analysis

a) Talented agent's decision

The talented agent basically compares the cost and benefit of running for election. In particular, he will run for election if the utility of being the mayor is higher than the profits of being an industrialist:

(A.1.2.1) $\gamma\left[C+\tau\rho_x g_2 N\right]-(1-\gamma)D>(1-\tau)\rho g_2 N,$

The left-hand side term is composed by two expressions. The first one is the local government revenue for period 2 weighted by the probability of winning the election. The second term represents the expected cost of losing the election. The right-hand term is the level of profits after tax of becoming an entrepreneur in the industrial sector where $\rho=\rho_y-\rho_x$. After rearranging these expressions we find that the talented agent will run for election if and only if:

(A.1.2.2) $\gamma c-[(1-\tau)\rho-\gamma\tau\rho_x]g_2>(1-\gamma)d,$

where $c = C/N$ is Mining canon revenues per-capita and $d = D/N$. It is clear that the role of public goods depends on the level of tax, the probability of winning the election and the productivity parameters. The second term in the left-side hand of equation 2 recovers the difference between the opportunity cost (profits) and the return from running for election. To solve this problem we need the following assumption:

Assumption 1: $(1-\tau)\rho>\gamma\tau\rho_x.$

This assumption implies that local economic development reduces political competition which seems plausible. We use this assumption to establish the following lemma:

Lemma 1: *the talented agent will run for election if* $g_2<g^*$*, where*

(A.1.2.3) $g^*=\dfrac{\gamma c-(1-\gamma)d}{(1-\tau)\rho-\gamma\tau\rho_x}$

This solution shows that the incumbent politician has incentive to invest in public goods since by this mean the opportunity cost of the talented agent can be increased. As a consequence, he will be more likely to be reelected in period 2. On the other hand, Lemma 1 also suggest that the required level of public good is increasing in c. This implies that larger levels of c make more likely that the incumbent mayor will face more political competition and, as a consequence, he will need to invest more in g to prevent political competition by making the opportunity cost of the talented agent higher.

b) Incumbent politician's decision problem

The incumbent politician's problem is to maximize the present value of consumption with respect to public good investment I. Therefore, his objective function is the following:

(A.1.2.4) $c+\tau\rho_x g_1+Z(c+\tau\rho_y g_2)+(1-Z)(1-\gamma)(c+\tau\rho_x g_2)-I,$

where

$$Z=\begin{cases}1 \text{ if } g_2 \geq g^* \\ 0 \text{ if } g_2 < g^*\end{cases}$$

subject to

$g_2 = g_1 + I$

$I \leq \tau\rho_x g_1 + c$

g_1, c given.

The first two elements are the (exogenous) local government's revenues for period 1. The third and fourth terms are the second-period revenues which depend on whether the talented agent runs for election (recovered by the indicator function Z) and his probability of winning it. The first constraint is the production function for the public good which is assumed to be linear. The second constraint is the budget constraint for period 1.

In period 1 the incumbent politician solves this problem by comparing the costs and benefits of investing in public good g . Notice that if the incumbent expect the talented agent to become a challenger, then one unit of resources invested in providing the public good yield a return of $(1-\gamma)\tau\rho_x$. On the other hand, when no challenger is expected, this return will be equal to $\tau\rho_y$. We impose two additional parametric assumptions:

Assumption 2: $\tau\rho_y > 1$ which basically means that the return of investing in g is higher than its opportunity cost, and

Assumption 3: $(1-\gamma)\tau\rho_x < 1$, which essentially implies that if the incumbent politician does not expect to be able to prevent a challenger then he does not invest in public goods at all.

Using these two assumptions, we can solve this problem[63]. Hence, we have the following lemma:

Lemma 2: *Whenever* $g^h \geq g^*$ *the incumbent politician uses all its resources in period 1 to provide public goods and there are no incentives for the talented agent to become a challenger in period 2. When* $g^h < g^*$ *the incumbent politician makes no investment in public goods in period 1 and the talented agent becomes a challenger in period 2.*

This result is related to the level of public goods. To connect the level of natural resource rents per-capita c with policies pursued by the incumbent, we need the following parametric assumption:

Assumption 4: $\gamma/[(1-\tau)\rho - \gamma\tau\rho_x] > 1$

This assumption says that the challenger's probability of winning the election is sufficiently large relative to the returns of investing in public goods. Using A4 and the definitions for g^* and g^h we can state the following proposition:

Proposition: *If* $c > \dfrac{(1-\gamma)d + g_1(1+\tau\rho_x)[(1-\tau)\rho - \gamma\tau\rho_x]}{\gamma - (1-\tau)\rho + \gamma\tau\rho_x} \equiv c^*$, *then the incumbent makes no investment in public goods in period 1 and faces a challenger in period 2. Otherwise, the incumbent uses all his resources in period 1 to provide public goods and the talented agent does not choose to become a challenger in period 2.*

This constitutes the basic result of this simple model.

A.1.2.2 Extension: Endogenous challenger's probability of election

Consider the case in which the incumbent can use spending on patronage B to influence the challenger's probability of election. For simplicity, we assume that patronage is produced using a simple linear technology:

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[63] To see this, consider the case in which the incumbent pursues a policy such that $g_2 \geq g^*$. Under A2, the optimal incumbent's response is to use his entire first-period budget in expanding the stock of public good ($I = \tau\rho_x g_1 + c$). Then, the new stock of public good in period 2 will be $g_2 = g_1(1+\tau\rho_x) + c \equiv g^h$. This represents the maximum level of public good in period 2 given the available budget in period 1. This policy is feasible if this level is good enough to prevent political competition ($g^h \geq g^*$). Now let's consider the case in which the incumbent pursues a policy such that $g^h < g^*$. Given A3, the incumbent will no invest in public goods ($I = 0$). As a consequence, $g_2 = g_1$, which is always a feasible policy. Therefore, if $g^h < g^*$, the incumbent faces a challenger in the second period.

(A.1.2.5) $\gamma(B) = \max[\gamma_0 - \delta B, 0]$

In this scenario, the incumbent's optimization problem becomes:

(A.1.2.6) $c + \tau\rho_x g_1 + Z(c + \tau\rho_y g_2) + (1-Z)(1-\gamma)(c + \tau\rho_x g_2) - I - B,$

where:

$$Z = \begin{cases} 1 \text{ if } g_2 \geq g^*(\gamma) \\ 1\text{-}\gamma \text{ if } g_2 < g^*(\gamma) \end{cases}$$

subject to:

$g_2 = g_1 + I$
$\gamma = \min[\gamma_0 - \delta B, 0]$
$I + B \leq \tau\rho_x g_1 + c$
g_1, c given.

The solution of this problem is complicated because changes in B have ambiguous effects on the challenger's probability of election and the return to investment in public goods. On the one hand, patronage spending increases the incumbent's re-election probability but also reduces the investment in public goods, reducing the challenger's opportunity cost. On the other hand, this reduction in public good investment also reduces the total output affecting the tax base over which the incumbent can extract rents. Therefore, there is no a simple solution for this problem since many scenarios, most of them with no empirical relevance, are possible.

To avoid a complex classification exercise, Caselli (2006) presents a set of numerical exercises to evaluate the behavior of the main variables of the model. What is important in this scenario is the behavior of the parameter γ that reflects the elasticity between patronage spending and the probability of election of the talented agent.

Figure A.1.2.1 shows the relationship between the levels of mining transfers per capita and levels of investment in public goods to different values of γ parameter. We consider a low value, one intermediate and one high in the previous parameter. As seen in the figure, when the parameter is low, the results are essentially the same as those of the basic model. That is, when the mayor is not effective in using mining revenues to affect the competitor's probability of election by mean of patronage spending, the previously discussed non-monotonic pattern is maintained. Investment in public goods is positive up to a point, after which decreases.

When γ has an intermediate value, the pattern is more complex. In this case, there are two thresholds per-capita rents. The first is similar to above, showing a positive relationship between mining rents and investment in public goods in a first section and then show a negative relationship. Then, for a very high level of mining rents, the relationship is again positive. The intuition behind this change is that, when the mayor has huge amount of mining rents, is always

possible to prevent entry of competitors and is therefore profitable for the mayor to invest in public goods. Finally, when γ is high, then it is always possible for the incumbent mayor prevent the entry of potential competitors and therefore it is profitable to invest in public goods.

A similar analysis is possible for the case of the relationship between spending on patronage and levels of per-capita rents. Figure A.1.2.2 presents the results of the exercise. When γ is low, the incumbent mayor does not invest in patronage spending since its ineffectiveness makes it a bad investment. For intermediate levels of γ, only high levels of per-capita rents are associated with increased levels of spending on patronage. For high levels of γ, the relationship between mining transfers and patronage spending is positive.

Figure A.1.2.3 presents the case of the relationship between per-capita mining rents and the probability of reelection. When γ is too low, the mayor cannot be reelected for any income level. The opposite occurs when γ is very high: the mayor always gets reelected. The most interesting case is for an intermediate value of γ. In this case the relationship looks like an inverse U; that is, negative for the first tranche (more mining transfers are associated with a lower probability of re-election) and positive after a mining rents threshold.

Figure A.1.2.1: Investment in Public Goods

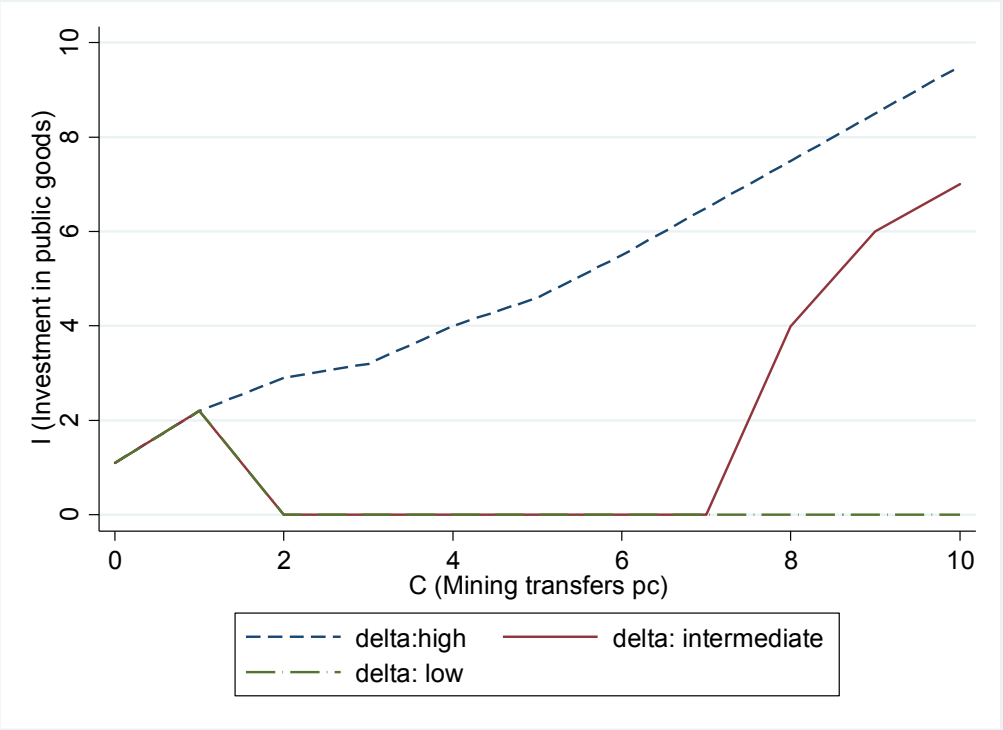


Figure A.1.2.2: Investment in Patronage Spending

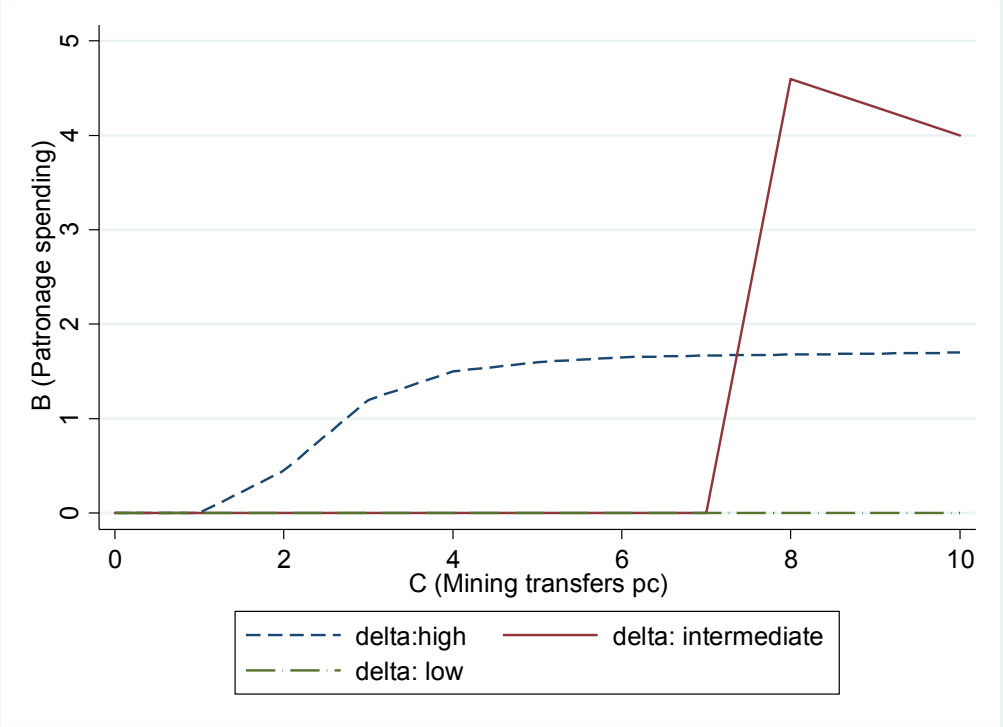
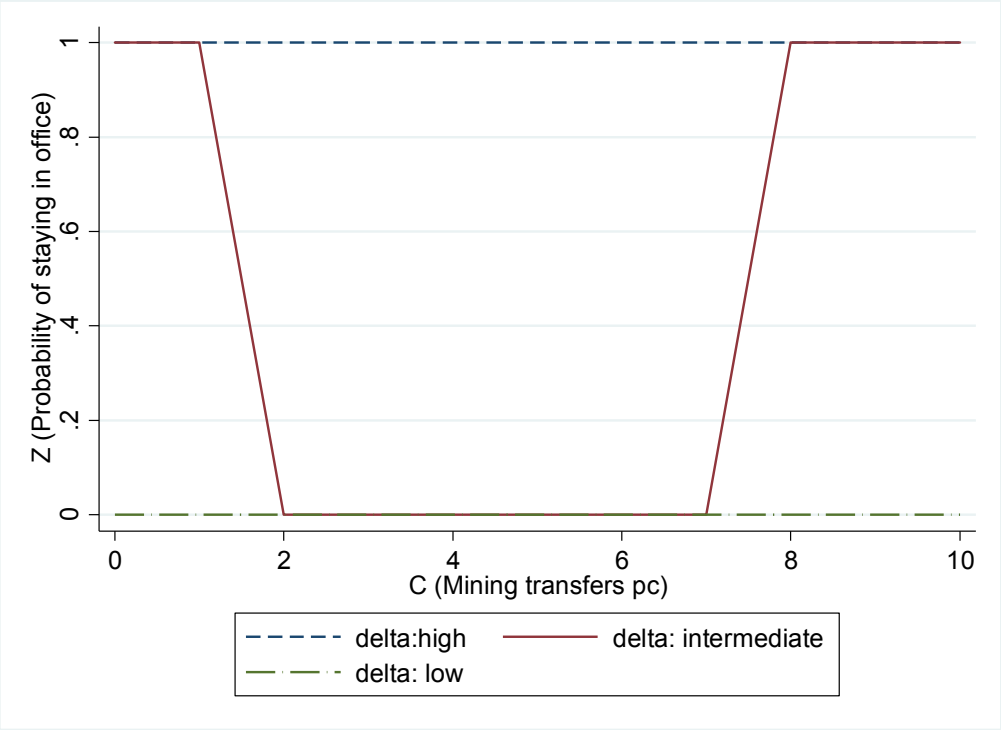


Figure A.1.2.3: Probability of Reelection



Chapter 2

Resource Booms and Political Support: Evidence from Peru*

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2.1. Introduction

The relationship between resource abundance and democratic performance has been subject of significant debate in the literature over the past years. Since the seminal contribution of Ross (2001), there was a consensus among scholars and policy-makers around the idea that resource wealth hinders democracy (Watchenkon 2002, Jensen and Watchenkon 2004, Morrison 2007 and 2009), giving origin to a large literature on the political resource curse. Recent scholarship has questioned this consensus, either by showing that this relationship does not exist after all (Haber and Menaldo 2011) or by indicating that –under certain conditions- it can has the opposite sign (Dunning 2008 and 2009 for Latin America), although more sophisticated evidence is also available in support for the original thesis or some modified version of it (Aslaksen 2010, Ross 2009 and Tsui 2011). Consistent with some work in other areas of political economy (Acemoglu, Johnson and Robinson 2001, Easterly and Levine 2002), some scholars have suggested that these apparent contradictory results can be explained if countries' institutional framework are taken into account, being the political resource curse conditional to the quality of economic and political institutions (Robinson et al 2006, Mehlun et al 2006, Wantchekon 2002, Battacharyya and Hodler 2009)[64].

A critical element in this debate is the idea that resource abundance may have a negative impact on the consolidation of democracy[65]. Some scholars suggest that resource abundance can weaken the democratic regime by leaving the door open for authoritarian regimes in case it collapses or by retarding its consolidation (Watchenkon 2002, Jensen and Watchenkon 2004, Morrison 2007 and 2009, Epstein et al 2006, Goldberg et al 2009, Gassebner et al 2008 and Ulfelder 2007). Although there are differences in terms of the proposed mechanisms, there exist a consensus that what matters in order to understand this relationship is the behavior of politicians and political elites[66]. For instance, Jensen and Wantchekon (2004) suggests that the key mechanism to explain the resource wealth-democracy relationship is the "…incumbent's discretion over the distribution of natural resource rents". Consequently, it is not surprising that the vast majority of theoretical models developed in this literature implicitly assume that citizens are always pro-democracy, as is the case of recent contributions based on the work by Acemoglu and Robinson (2006) such as Robinson et al (2006), Aslaksen and Torvik (2006), Robinson and Torvik (2005), Dunning (2008) and Morrison (2007). In these works, it is only the elite's behavior what explains, for instance, the probability of a coup or, more generally, the prevalence of non-democratic regimes.

Although I agree on the critical role played by politicians and elites in any explanation of the political resource curse, it is a stinking fact that citizens' attitudes towards democracy play no role in the standard theoretical explanations of this phenomenon. Political scientists have long recognized the importance of having high levels of political support for a political system,

[64] A different view is provided by Dunning (2008), who suggests that a positive relationship between resource abundance can be found even in places with weak institutions such as Venezuela. The argument is that resource abundance can foster democracy in places with high level of inequality because the access to rents reduces the redistributive pressures on the elites. As a consequence, the elites have fewer incentives to overthrow democracy.

[65] According to Ulfelder (2007) and Ross (2009), the standard literature of the effect of resource abundance on democracy conflates two distinct issues: the survival of authoritarianism and the survival of democracies. The latter issue is the focus of this paper.

[66] In his seminal contribution, Ross (2001) suggests three channels, from which the first two fall in this category: a) a "rentier effect", due to the use of patronage and low taxes as mechanisms to lower citizens' accountability; b) a "repression effect", expressed in the use of resources to increase internal security spending; and, c) a "modernization effect", that suggest that resource wealth retards the adoption of social and cultural changes related to democracy.

particularly the democratic regime, to function in a satisfactory way (Easton 1965, Linz and Stepan 1978)[67]. A political system with low levels of support is believed to be more unstable and less legitimate, and consequently prone to suffer governance crises, especially in countries with weak democratic institutions (Norris 2011 and Levi and Stoker 2000). Therefore, for democracy to survive, it must be the case that citizens' political support for this system must be high. On the other hand, when support for democracy is low, citizens are more willing to support autocratic regimes[68].

The evidence seems to be consistent with this claim: in countries in which support for democracy is low citizens are more willing to replace it with an authoritarian regime. Figure 1 uses country-level data from the Latin American Public Opinion Polls project to illustrate this point by showing a negative relationship between satisfaction with democracy and support for a coup d'état. This empirical fact is a puzzle for standard political economy models of democracy in general, and for political economy models of the resource curse in particular, since they assume that democracy is unambiguously preferred by citizens whereas evidence seems to suggest that this preference is conditional on citizens' satisfaction with the way democracy is "working" for them. This opens the door for, rather than alternative, complementary explanations of the political resource curse that take into account the role of citizens' views about the democratic system in explaining weak democratic governance and political instability; factors which can lead to the breakdown of democracy and the rise of authoritarian regimes often observed in these countries. If citizens in resource-rich countries are discontent with the ability of their democratic regimes for delivering the policy outcomes they care about, then this lack of support makes democracy highly vulnerable to non-democratic elites that can take advantage of this situation to overthrow it. Therefore, if political support has critical implications for the survival of democracy and its consolidation, then it is important to understand whether resource abundance is linked with lack of support for democracy and their political institutions[69].

In this paper, I study the impact of resource abundance on political support for democracy. In doing that I take advantage of a simple theoretical framework based on the work by Brender and Drazen (2007 and 2009) and Caselli (2006) to explain this relationship by analyzing how an exogenous increase in natural resource rents affects the behavior of citizens and politicians in this regard. In this model, citizens face an inference problem about the effectiveness of democracy which depends on the policy outcomes they observe. Citizens also have limited information about

[67] The concept of "political support" is highly contested among political scientists (Levi and Stoker 2000). For the rest of this paper, I will take the definition of political support provided by Norris (2011). This definition takes into account the following dimensions: a) Attitudes towards nation-state (national pride, patriotism, and identity); b) Agreement with core principles and values of political regime; c) Evaluation of overall regime performance; d) Confidence in regime institutions, and; e) Approval of incumbent office holders. The emphasis in this project will be in dimensions b), c) and d) of the Norris' definition.

[68] One may argue that a reduction in political support is not necessarily associated to a regime failure. Citizens may feel unsatisfied with the performance of democracy but still believe that is the best regime. This is certainly true for the case of societies in which democracy is consolidated. However, in countries in which the democratic regime is not fully consolidated, this is not necessarily true. In words of Norris (2011): "In regimes which are classified as electoral autocracies or electoral democracies, which have not yet fully consolidated the transition from absolute autocracy, a serious and enduring lack of democratic legitimacy can be expected to have more serious consequences for political instability". Bermeo (2003) presents historical evidence and country-cases analysis for several Latin American countries analyzing the role of changes in citizens' perceptions and behavior in the breakdown of democracy.

[69] This argument is also consistent with the fact that the poorest tend to be more critical of democracy and more willing to accept authoritarian regimes compared to other groups in society as it happens for the Peruvian case (Carrion and Vera 2010). I can argue that, the poorer the median voter, the more relevant my argument is.

the type of politicians under the democratic regime. In this context, politicians can influence citizens' beliefs about the effectiveness of democracy by providing public goods to citizens, allowing them to learn that "democracy works". However, politicians need to optimally decide the allocation of the budget between the public goods required for citizens to learn about the effectiveness of democracy and the rents they care about. Following some scholarship in political economy and political science, I argue that this investment will depend on the expectations politicians have regarding their ability of keeping power rather than an interest of contributing to citizens' learning about the effectiveness of democracy. They will provide public goods as long as they are not challenged by potential competitors. This is explained by the nature of democracy for local politicians, which is basically perceived as a public good in this setting, lacking these politicians of incentives to contribute to citizens' belief about democracy. Therefore, the results would depend on how natural resource booms affect the electoral incentives of politicians.

I link this model with existing theoretical results from previous research regarding the impact of resource booms on the ability of incumbent politicians to keep power. In a companion paper (Maldonado 2014), I have shown theoretically and empirically that the relationship between resource booms and public good provision is non-monotonic. For low levels of rents, incumbents do not face substantial political competition, so they expand the provision of public goods to prevent entry of potential competitors. On the other hand, for high levels of rents, incumbents are not able to prevent competition due to the high value of holding office, having the incumbents the incentive of reducing public good provision. Since the provision of public goods is key to influence citizens' beliefs regarding whether "democracy works", it should be expected that natural resource booms are non-monotonically related to political support for democracy following the pattern in public good provision[70].

This framework is taken to the data using district-level variation in Peru. Specifically, I exploit an exogenous variation in fiscal revenues of a set of mineral-rich local governments in order to claim causality. This exogenous variation is due to the interaction between the mining Canon rule, and the extraordinary rise of the international prices of mineral resources observed during the past years. This rule states that 50% of the income taxes paid by mining companies have to be allocated to the regional and local governments where mineral resources were extracted. As a result, these mineral-rich municipalities experienced a large increase of their fiscal revenues compared to those districts without these resources. By comparing the levels of confidence about the performance of different levels of government and the evaluation of performance of democracy by citizens from local governments with and without mineral resources, before and after the increase of the prices of these resources, this paper shed light on the causal effect of an exogenous increase of local government revenues on citizens' political support for democracy[71].

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[70] A key element of my theoretical framework is the idea that citizens learn about the effectiveness of democracy by observing policy outcomes (i.e. public goods). A large body of empirical evidence supports this claim. Since the seminal contributions of Kramer (1971) and Fair (1978), there is a well-established empirical fact in economics and political science about the effect of macroeconomic conditions on incumbent's re-election success. Recent contributions suggest that local and personal (or household) economic conditions matter for political support (Manacorda et al 2010, Elinder et al 2008 and Pop-Eleches and Pop-Eleches 2009). Consequently, to test the validity of the channels implied by the model I will use measures of personal and local welfare such as public goods distribution and household incomes. Evidence of (lack of) a positive effect of the resource boom on personal/familiar (e.g. household income) and local economic conditions (e.g. public goods) would be consistent with the model.

[71] Since the same (reduced-form) predictions can be obtained from different models, I provide additional evidence in order to reject alternative causal channels. In particular, a version of the "grievance" channel implied in the literature about conflict and resource abundance can be consistent with the empirical results (Collier and Hoeffler 2004, Gurr 1970). According to this literature, natural resource abundance can foster civil conflict by exacerbating the grievances

Using district-level data to study these issues have both advantages and disadvantages. The most important advantage of this design is its ability to control for institutional characteristics that may cofound resource abundance and political support, making endogeneity a less contentious issue. A second advantage of this study over the previous literature is the use of variation in local revenues that depends on the movement of international prices of mineral resources, which are essentially exogenous to municipalities, avoiding any potential endogeneity concern. These advantages come with some costs: since I exploit within-country variation, some of the dimensions about the relationship between democracy and resource abundance cannot be addressed. Although this study is motivated by this relationship, its central goal consists in analyzing the effect of resource abundance on political support, which it is believed to have important implications for democratic consolidation in countries with weak democratic institutions.

Establishing a precise relation between natural resource abundance and political support has important theoretical and policy implications. As mentioned before, most of the current literature on the political economy of the resource curse has played attention to the "supply side" of the political markets by exploring the effects of resource abundance on the incentives of politicians. This paper complements this literature by studying the effect of resource abundance on the "demand side" of political markets, in particular its effect on voters' levels of political support, which is believed to have important implications in order to understand voters' behavior. With regard to policy implications, recent scholarship shows that when citizens exhibit high levels of political support they are more willing to allocate resources for policy goals (Chanley et al 2000), more likely to accept decisions of authorities (Tyler ad Huo 2002), less likely to evade the payment of taxes (Scholz and Lubell 1998), less willing to tolerate corrupt behavior (Morris et al 2010), less likely to engage in clientelistic practices (Clearly and Stokes 2006), and more willing to obey to the law (Marien and Hooghe 2011)[72]. In addition, some scholars have found that trusting citizens are more willing to vote, follow politics, develop a sense of civic duty and to have a higher level of political knowledge (Mishler and Rose 2005); qualities that are considered relevant for the exercise of citizenship and related to the quality of democracy (Sen 1999). Therefore, whether resource abundance is associated with low levels of political support has relevant policy implications.

The Peruvian case offers an interesting setup for testing the implications of resource abundance on political support. Peru is one of the most important mineral producers of the world[73], playing mining activity a fundamental role in the recent success of the Peruvian economy[74]; a phenomenon that some analysts are calling the "Peruvian miracle". Despite the impressive economic growth performance over the past twenty years, Peruvian citizens are highly unsatisfied

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associated with resource exploitation such as environmental degradation, land expropriation, labor migration and the emergence of "public bads" (prostitution, crime, etc). Therefore, a decrease in political support would be also consistent with the reduced-form results if these side-consequences of resource exploitation are linked to the performance of politicians by citizens. A large literature in economics and political science shows that voters tend to reward or punish politicians even for events that are out of their control such as a good performance of local college football games, natural disasters or even shark attacks (Wolfers 2009, Achen and Bartels 2004, Cole et al 2009, Healy et al 2010). Therefore, the grievance hypothesis provides an interesting alternative channel to contrast the theoretical and empirical evidence for my proposed mechanism.

[72] For instance, Lindstrom (2008) shows that low levels of political support is positively associated to the likelihood of buying liquor illegally in Sweden. Dalton (2004) argues that in US states with low levels of political support citizens are less willing to comply with the rule that considers compulsory the return of the census form.

[73] Currently, Peru is the 2nd producer of silver, 3rd of tin and zinc, 4th of copper and lead, and 8th of gold.

[74] Mining represents 6.5% of the gross domestic product, 62% of total exports and 40% of income taxes. So, the economic impact of mining is fundamental for the country.

with democracy and their political institutions. Not only they are more willing to accept an authoritarian regime than the average Latin American, a striking fact given the recent history of massive corruption under the autocratic regime of Alberto Fujimori during the 90s, but also their levels of approval for participation in a coup d'état are among the highest in the continent[75]. The fact that Fujimori's self-coup in 1992 received widespread political support (80% in Lima, the capital city) is often taken as evidence of the potential negative effects of citizens' high levels of discontent with political institutions. Therefore, a growing economy highly dependent on mining along with citizens highly unsatisfied with the democratic system and political institutions offers a unique case study for those interested on the political consequences of resource abundance.

The basic results are as follows. Using different empirical specifications, I estimate a large reduction in the level of confidence in political institutions for the case of mineral producer district. I found that after the increase of mineral prices the level of confidence in the local government lowers by 5.1 percentage points in mineral producer districts, representing this effect a 15.16% reduction in the average probability of being confident in the local government. I also found a negative effect on the levels of confidence in other political institutions such as the congress (40% reduction), the ombudsman office (35% reduction) and the judiciary (13% reduction).

In the case of support for democracy, I estimate a non-monotonic relationship between natural resource rents and citizens' support for democracy. For districts with modest increases in mining rents, there is evidence of an increase in political support for democracy. Consistent with our theoretical framework, this increase in citizens' support for democracy is related to increases in public good provision and living standards. However, for districts with very high levels of mining rents, there is a decrease in citizens' support for democracy that is also related with decreases in public good provision and living standards found in these areas. Since the average district receives modest mining rents, the marginal effect is positive, indicating that the resource boom is related to a positive impact on citizens' support for democracy. These results are robust to a set of placebo tests.

The rest of the paper is organized as follows. In section 2.2, I provide an overview of the institutional background for this study. Section 2.3 discusses a simple theoretical framework. Section 3.4 presents the data and the basic variables of the analysis and Section 2.5 presents the research design. Section 2.6 introduces the econometric models and Section 2.7 reports the results, robustness checks and causal channels. Section 2.8 presents conclusions.

2.2. Institutional background

Democratic institutions are relatively new in Peru. Universal suffrage was lately introduced in 1980 along with open political competition. From 109 executive chiefs, only 4 were elected through universal suffrage since 1821; the year in which the country gained its independence from Spain. The last century, the country witnessed 48 years of authoritarian rule and no political regime –either authoritarian or democratic- lasted for more than 20 years. Some scholars argue that this political instability explains the fact that democratic beliefs and practices are not institutionalized in the country (Kenney 2004 and McClintock 1999).

During 90s the Peruvian party system collapsed giving origin to candidate-centered movements. As a consequence, the political system nowadays is highly fragmented; having these

[75] The last survey carried out by the Latin American Opinion Project (LAPOP) in 2010 shows that Peruvians have the lowest level of support for democracy in a sample of 25 countries of the American continent and are among the most unsatisfied with its functioning (Carrion and Zarate 2010). The support for an authoritarian regime is also among the highest in the continent (45%).

political organizations highly localized regional and political interests. The lack of strong political parties is recognized as a critical problem for many political scientists since they serve as instruments for solving coordination problems and as discipline devices for politicians as well as means to solve informational problems about policy preferences and accountability of politicians for citizens (Levitsky and Cameron 2003, Roberts 2006). Therefore, politicians in Peru are less accountable and more short-sighted due to lack of established political parties, creating more incentives for rent-seeking behavior in office.

Along the weak democratic institutions, the country is also very centralized country and subnational governments are highly depended of transfers from the central government. From a fiscal perspective, 97% of taxes are collected by the central government (Polastri and Rojas 2007). Consequently, local governments are highly dependent from central government transfers. On average, transfers from central government represent 57% of local governments' budget. A significant part of transfers from central governments are allocated in the form of the municipal compensation fund (FONCOMUN) and the Glass of Milk program (56% and 10% of all intergovernmental transfers). These transfers are universally distributed among local governments. The rest is allocated as targeted transfers. From these targeted transfers, Canon transfers (including all sources of Canon such as oil, hydropower, forest and gas Canon) represent a 91% of the total targeted transfers, being the mining Canon the most important one (79% of all Canon transfers). Therefore, mining Canon represents a significant fraction of local governments' budget in mineral-rich areas.

Mining is an activity with long tradition in Peru since colonial times. Historically, it has been associated to exploitation and environmental degradation, which explains the negative perception that this activity has in areas where is performed. During the 90s, mining experienced a significant expansion because of a set of laws and regulations oriented to promote foreign direct investment in the sector as part of the market reforms introduced under the rule of Alberto Fujimori. As a consequence, mineral production grew at an average rate of 7.2% between 1992 and 2000 while the average GDP did so at a rate of 4.8%. This growth was mainly driven by the start of new large scale operations in copper, gold and silver production. Today, Peru is one of the most important producers of minerals in the world.

Along with the legal framework for promotion of mining activity, in 1992 the Central Government passed the first Mining Canon Law (DS 014-92 EM) which stated that a 20% of income tax should be allocated to the areas in which the profits were generated. In 2001, as part of the decentralization process, this law was modified to increase the participation of these areas. The most important law is the Law 27506 (known as the Canon Law),which states that the 50% of income tax paid by mining companies will be allocated to the regional and local governments located in the areas 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 the region where the resource is exploited (40%). In addition, a 5% is allocated to the public universities of the region. This distribution rule has been changed several times in order to precise the criteria used to allocate the transfers among the local governments located in the same province and region of the mineral producer districts, although there is no evidence that these changes were motivated by a link between national and local politicians from the same party (Barrantes et al 2010).

2.3. Theoretical framework

The basic idea of the theoretical framework is that citizens' evaluation about effectiveness of democracy depends on how politicians use natural resource rents in order to provide public goods to citizens. This means that citizens' evaluation depends critically on the welfare effects of democracy compared to an alternative authoritarian regime[76]. Before proceeding, it is important to highlight some basic characteristics of the mining activity in order to understand how it can impact citizens' welfare in the face of a resource boom. Mining can affect welfare by two basic channels: a) a *direct effect* that can be either positive due employment and labor market opportunities related to mining production or negative because of environmental disamenities and the emergence of public "bads" (crime, prostitution, etc); and b) an *indirect effect* due to public goods provided by local governments funded with mining Canon revenues.

The first channel is a market effect because it depends on changes in production and prices in mineral-rich areas. The sign of this effect is ambiguous because it would depend on whether the benefits of this activity (labor and market opportunities) are higher than its costs (pollution and other disamenities). The second channel is a *political economy effect* because depends on how politicians use the transfers. The effect is also ambiguous because politicians can use mining rents for providing public goods (that can increase citizens' welfare and, as a consequence, their support for democracy) but also to engage in corruption, patronage and other of malfeasance in office (which can lead to a decrease in political support). Then, what matters is understand how a resource boom can affect the way politicians and elites operate is a given institutional setting, and how this behavior affects citizens' views about effectiveness of democracy. In the context of this paper, the emphasis is given to the political economy effect. Although the first channel is critical, I control for it in the empirical section since it is not the main focus of this study[77].

I consider a simple two-period decentralized democracy (see Appendix I for a full exposition) based on Bender and Drazen (2007 and 2009) and Caselli (2006). In this setting, there are elites, masses and politicians. Politicians can be local or national, but it is assumed that national politicians are incumbents (they are members of the government). Local politicians can be incumbents or potential competitors. It is assumed that the political system is fragmented, so national political parties are not relevant players in local politics. This assumption is consistent with our setting and may be also relevant for the case of other resource-rich countries. This basically implies that local politicians' decisions are mainly based on their ability to obtain or keep power in a given local political arena. It is also assumed that local governments are exclusively in charge of the provision of public goods and that the central government can only use direct transfers to specific groups as policy instrument.

The elite's problem is to decide whether to mount a coup or not. This decision depends on the opportunity cost of running a coup, which is in this setting any loss to elite's endowment and transfers from a centralized government who wants to buy them off as in Acemoglu and Robinson (2006). The centralized government can increase the opportunity cost of the elite by manipulating this transfer. It is assumed that this cost in increasing in citizens' support for democracy. Therefore, the higher the support for democracy, the less likely the elite to mount a coup.

Citizens face an inference problem regarding the effectiveness of democracy. They cannot distinguish whether current economic performance is a good predictor of long-term economic

[76] The idea that democracy is better than autocratic regimes in producing economic outcomes is extended but empirical evidence is not conclusive. For instance, in the case of economic growth Tavares and Wacziarg (2002) find that the overall effect of democracy on economic growth is moderately negative.

[77] Maldonado (2014) finds that mineral production play no role in explaining political outcomes and public good provision for the Peruvian case analyzing the same boom.

performance under democracy. They have subjective probabilities regarding the level of provision of public goods and idiosyncratic shocks. The provision of public goods can be used to affect the beliefs citizens have regarding the advantage of democracy with respect to non-democracy in terms of policy outcomes. Since citizens cannot fully observe the true level of public goods, then their levels of political support for democracy depends on a subjective distribution about the relative performance of democracy over non-democracy, which in turn depends on their beliefs about the level of public goods. Therefore, it can be established that public good provision can be used by local politicians to positively influence their beliefs about the effectiveness of democracy.

Although local politicians can influence citizens' attitudes towards democracy via the provision of public goods, there is no reason to believe that they would do so on purely altruistic grounds. The fact that politicians' incentives are local while the rules of the democratic game (political institutions) are defined at a national level creates a free-riding problem. In this setting, democracy is a public good for politicians; they prefer democracy over dictatorship because allow them to be elected and get rents but they don't internalize that, in countries with weak democratic institutions, in order democracy to work for citizens, they would need to collectively provide public goods to them. Therefore, politicians have to "invest" in democracy, at least until the point in which democracy is consolidated, but the public good nature of the latter create incentives for free-riding. If politicians could write a contract to commit themselves to provide the public goods needed for citizens to learn about the effectiveness of democracy, then citizens would learn that democracy "works" and political support would be high. In this scenario, democracy would be consolidated as the "only game in town". However, this type of contracts are difficult to enforce: it would be optimal for a single politician to deviate from this agreement, maximize his rents and still be able to run for office the next election since the impact of this deviation on aggregate political support would be minimal. Given the absence of enforcement technologies for such a contract, rational politicians would invest in public goods only in a way consistent with their own electoral incentives in their respective jurisdictions.

Since local politicians are only interested in gaining or keeping power, it is required to analyze how they decide the level of public good provision in the face of a resource boom taking into account their electoral incentives. The intuition here is that resource boom have ambiguous effects on political outcomes: on the one hand, it increases political competition due to the increase of the value of holding office, but –on the other hand- increases the fiscal resources that the incumbent can use in order to affect the electoral outcomes. Therefore, the final impact is going to depend on which effect is more important. Since local politicians use public good provision as the most important policy instrument to influence political outcomes, then they indirectly affect the levels of political support for democracy.

To illustrate this, let's consider a very simple two-period local economy with a large number of unskilled workers and two talented agents, one of them being the current incumbent. In the first period, this economy is composed by two sectors: the natural resource and subsistence sectors. The mineral resource sector is assumed to provide an exogenous flow rents to the local government. It is assumed that production in this economy depends on the provision of public goods by the local government. Therefore, the incumbent politician can influence the level of output in this economy according to the level of public goods he decides to provide.

The talented agent has managerial skills that can be used either in the industrial sector or politics. The talented agent problem is to decide whether to become an industrialist in the second period or a challenger to the incumbent politician. She compares the net benefit of becoming a politician against her opportunity cost in the industrial sector. If she becomes a politician, she

would face the result of an election in which she has some positive (exogenous) probability of winning. If she wins, she can extract rents from the municipality otherwise she would need to face the cost of losing the election. If she becomes an industrialist, she would hire unskilled workers to produce an industrial good that also depends on the stock of public goods.

Therefore, the incumbent politician problem is to maximize the net present value of his consumption taking into account the impact of his behavior on the decision of the talented agent of becoming an electoral challenger. A high level of consumption associated to a low provision of public goods reduces the opportunity cost for the talented agent of becoming a politician and increases the chance for the incumbent to face a competitor. The opposite is also true.

The game follows the next structure. During period 1, a level of mineral rents and public goods are given exogenously. The mayor is also exogenously determined in the first period. At the end of the first period the mayor decides his level of consumption with respect to public good provision for period 2. Once this level of public good is realized, the talented agent chooses whether to become an industrialist or a competitor for the incumbent. At the end of the second period there is an election.

The solution of this model delivers a non-monotonic pattern between mineral resource rents and political competition. In the presence of an increase in mineral resource rents per-capita, the value of holding power increases, making politics more attractive for the talented agent (reflected in an increase of the opportunity cost of involving in industrial production). Nevertheless, the mayor also has access to more mineral rents he can use to provide more public goods to reduce the opportunity cost of becoming an industrialist. This implies that, for low levels of mineral rents, the mayor can successfully prevent the entry of the talented agent into politics. However, this strategy would become useless for very high levels of mineral rents associated to a mineral resource boom since the value of holding power would be higher than the level of profits the talented agent can obtain in the industrial sector. Therefore, the mayor cannot prevent the entry of the talented agent into politics. As a consequence, the mayor reduces his level of investment in public goods since his probability of reelection has been reduced.

Therefore, a natural resource boom have non-monotonic effects on public good provision. More specifically, the model predict that natural resource rents per-capita are non-monotonically related to public goods provision. Since public goods is also positively related to political support for democracy, the natural resource rents also non-monotonically affect citizens' support for democracy. This basic result constitutes the core prediction to be taken to the data in the rest of the paper.

2.4. Data and variables

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 perceptions on a set of governance issues. In this paper, I use the surveys over the period 2002-2006[78]. 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). The full sample contains 91,150 observations for the period under analysis.

[78] The governance module was changed in 2007 and many questions related to democratic performance were dropped. Questions about confidence in political constitutions remain but we restrict the analysis to the same period to ensure consistency.

The set of dependent variables for the empirical analysis is composed by indicator variables of confidence in political institutions and attitudes towards democracy. These are constructed as dummy variables from the governance module. Specifically, I use as a proxy for confidence in political institutions a question which requires from the interviewed to answer whether she or he is confident on a set of institutions such as the local government, the congress, the judiciary, among others. The question considers the following levels of confidence: not at all, a little, more or less, a lot. I create a dummy variable equal to one for those who respond that they are more or less and a lot confident and zero otherwise. Similarly, I use questions about citizens' perceptions about democracy to approach their levels of confidence in the democratic system. Particularly, I use the question about performance of democracy. Here citizens are asked about whether democracy is working in the country. The categories to be chosen are very well, well, more or less, and bad. I create a dummy equal to one for those who respond that democracy is performing badly and zero otherwise. In this case, this variable only considers those who have a bad perception about the performance of democracy. I also create a similar variable for the question about whether democracy is not the best way of government. Finally, I also create a variable about whether citizens' belief an authoritarian regime would be preferable.

I report summary statistics for the respondents to the governance module in Table 2.1. In general, the levels of confidence in political institutions are low in the country. On average, only 28% of those living in mineral-rich districts are confident in their local government. This contrast with the almost 40% observed in non-mining Canon recipient districts. The same pattern is observed in the level of confidence for political parties, the judiciary, the Congress and the Ombudsman office. Citizens in mineral rich districts are less confident in political institutions. This is also true for the case of the indicators about democracy; in general, citizens in mineral rich areas are less willing to support the democratic system. Not only are they less supportive about democracy but also more willing to support an authoritarian regime[79].

Besides the measures of confidence in political institutions and democracy, the ENAHO survey also includes a large set of economic and demographic household characteristics. Descriptive statistics for a set of control variables for household characteristics and characteristics of the household head are also reported in Table 2.1. 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 wage earners and whether the household obtained its dwelling through an invasion. In most cases, these characteristics are similar between mineral and non-mineral rich 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. Complementary, I also include some baseline characteristics constructed from the 1993 census.

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 paper, I focus on the period 2001-2006.

Table 2.1 also presents basic summary statistics of mining Canon transfers. On average, mineral producer districts received 123 soles per-capita during the period under analysis. This

[79] One potential concern with the data is the presence of non-response and/or underreporting in the variables used to construct the dependent variables. Previous research using this dataset suggests that this concern is marginal (Hunt 2007 and Herrera et al 2005).

amount represents a 25% of the average monthly income per-capita in these areas. Canon recipient districts (excluding producers) receive 43 soles on average. These numbers do not take into account the extremes inequalities in the distribution of mining Canon transfers. For instance, whereas the percentile 90 of mineral producers gets 134 soles per-capita, the percentile 99 obtains 1,726 soles (3.6 times the average income per-capita for these areas). This is evidence that, whereas a large number of districts receive this transfer, only few of them get it in large magnitudes.

Mining Canon represents a significant part of the budget of local governments in mineral-rich areas. On average, represents a 16% of producer districts' budgets. There is also significant variation here, ranging from to less than 1% to a maximum of 70% of local government budget. The fraction is less significant for non-producer districts in mineral rich regions (9%). It is important to mention here that mining Canon is by far most important than other sources of Canon in these districts: for instance, the gas and oil Canon per-capita are about 7 and 6 soles respectively, significantly lower than the 43 soles for mining Canon for recipient districts. One exception is the per-capita oil Canon for non-recipients which is slightly lower in magnitude than the average per-capita mining Canon for producer districts.

The information of prices and production covers the period 1998-2007 and was collected from the Ministry of Energy and Mines. This information is used to construct a measure of real value of mineral production. The data are available for producer districts.

2.5. Identification Strategy

In order to establish a causal relationship between resource abundance and political support for democracy an exogenous source of variation in the former variable is needed to explain the latter. In this paper, I am be able to overcome issues about the endogeneity of political support by exploiting an exogenous variation in local revenues of a subset of Peruvian local governments which were benefited by a spectacular increase of their fiscal resources (Maldonado 2014). This rise was due to favorable fluctuations of the international prices of mineral resources they produce. By comparing the level of political support for democracy of citizens from local governments with and without natural resources, before and after the rise of their international prices, I expect to uncover the causal effect of a positive shock on local revenues on political support for democracy and confidence in political institutions.

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. This implies that movement of international prices can be considered exogenous to local economic dynamics in mineral-rich areas. 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.

Graph 2.2 presents the evolution of the international prices of the 8 most important mineral resources produced by the country[80] during the period of reference. As shown in the graph, these prices were quite stable from 1995 to 2003 and then 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

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

prices before 2003[81]. As a consequence, a significant exogenous variation in mineral prices is available in this setting to address issues of causality.

As a result of this exogenous rise of minerals prices, the country's exports experienced an extraordinary increase. Graph 2.3 shows the evolution of the country's total exports as well as its mineral resources exports. It is clear from the graph that there was 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, 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. Graph 2.3 shows the evolution of levels of production of the most important mineral products produced by the country over the period and contrast them with the evolution of prices. The data show that, in most of the cases, the production of minerals did not suffer a significant change during the period compared to 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 changes in production levels, at least for the period 2002-2206, the main focus of the empirical analysis due to data availability. I discuss in the empirical section several ways to address the potential endogeneity of mining Canon transfers related to endogenous responses in production related to the increase of prices.

The next step consists in understanding the connection between this shock and the increase of fiscal revenues of the local governments. I take advantage of a differential increase of revenues across 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. Given the high growth rates experienced in the period, all instances of government faced 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 2.4, 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 million of nuevos soles) during 2001 and 2002, having a spectacular increase since then reaching the extraordinary number of 4.15 billion in 2007[82].

This shock was heterogeneously distributed across the regions in the country. Since the distribution of mineral resources depends on the geographic characteristics, it should be observed 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)

[81] 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).

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

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 2.1. 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 may be expected.

2.6. Empirical model

The empirical strategy is based on a difference-in-difference model (DD). The basic specification is as follows:

(2.1) $y_{ijt} = \alpha_j + \lambda_t + \beta F(MC_{jt}) + X'_{ijt}\delta + \varepsilon_{ijt}$

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. MC_{jt} is a measure of mining Canon transfers per-capita allocated to district j in period t. $X'_{ijt}\delta$ includes district, household and individual 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.

The function $F(.)$ is introduced to account for the existence of non-monotonicities. I consider linear and quadratic specifications in the empirical analysis, consistent with the theoretical framework and previous literature (Maldonado 2014). The time fixed-effects accounts for the time-series changes in the measures of political support. The district fixed-effects controls for time-invariant characteristics at district level and the MC_{jt} accounts for changes in dependent variable in treated districts associated to the movement of mining Canon revenues after the increase of mineral prices. Identification in this setting requires controlling for any systematic shock to the political support measures of the districts affected by the increase of prices of mineral resources that are potentially correlated with, but not a consequence of, the revenues shock[83]. 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) extended to incorporate non-monotonic responses in a parametric way.

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)[84]. 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).

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[83] 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.

[84] 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.

This solution controls for clustering and heteroskedasticity, and it is valid as long as a large number of clusters are available; which is the case in the context of this paper[85].

The use of this continuous treatment variable is problematic since does not control for the fact that there may exist endogenous responses in production. I address this issue by directly controlling for the level of mining production. Alternatively, I study alternative robustness checks to evaluate whether the basic results are robust to changes in the composition of the sample.

The key assumption for the identification strategy is that, in the absence of the positive shock in local revenues, there are no differential changes in political support for democracy correlated with initial levels of mining Canon revenues. For instance, if the increase of local revenues due to mining Canon was concentrated in areas that were expected to change their political support levels, then this assumption would be violated. I provide reasons for what this is not the case. Using placebo tests, I show that the results of this paper are robust to a set of alternative specifications and that evidence against the basic identification assumptions is not available.

Along with the specification (1), I also estimate the following empirical model:

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

where $Canon_{jt}.HighP$ 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[86]) in treated districts. The logic here is to test whether being a mining Canon recipients matters rather than the magnitude of the transfer itself[87].

I use two different ways to specify the treatment variable in (2.2). 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[88]. Since it is arguably that such as a low level of transfers should have not any effect on political support for democracy, to consider districts like this as treated units may lead to incorrectly underestimate the effect of mining Canon revenues on political support. 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 political support since districts in the province where the mineral producer is located are also affected by the shock in revenues[89]. Therefore, using these

[85] 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.

[86] 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.

[87] This specification is similar to Thorton (2008) which also test whether the fact of being recipient of a transfer matter along with the magnitude of the transfer.

[88] 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.

[89] 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.

districts as counterfactuals for mineral producers leads to an underestimation of the effect of revenues on political support.

2.7. Results

2.7.1. Confidence in political institutions

I first estimate (2.2) in order to study the effect of the increase of prices in the mineral-rich areas on the level of confidence in local governments, the level of government entitled with the access to a part of the rents derived from the mining activity. I start by using the specification in which the treatment is defined for the case of mineral producer districts. The simplest specification estimates this relationship without controls (Column 1 in Table 2.2). The coefficient associated to the interaction is negative and statistically significant at 1% confidence level with a magnitude of -0.051 (standard error 0.015). This result implies that after the increase of mineral prices the level of confidence in the local government lowers by 5.1 percentage points, representing this effect a 15.16% reduction in the average probability of being confident in the local government (baseline of 0.34). After adding a set of controls (column 2) for the most important sources of revenues, urbanization level, household/individual characteristics and mineral production, the coefficient associated to the interaction shows a small reduction but it is still negative and significant at 1% confidence level with a magnitude of -0.045 (standard error 0.016). Column 3 of Table 2.2 estimates the same relationship using as treatment variable whether the observation lives in a Canon recipient district. Although the coefficient has the same sign, it is not statistically significant. This is not surprising since the level of per-capita transfers is really low for many of these local governments.

Columns 4 to 8 estimate versions of (2.1). Columns 4 and 5 estimates a linear specification of (2.1) with and without controls respectively whereas columns 6 and 7 do so for the case of the quadratic model. Column 8 considers a specification in which producer districts are dropped from the sample with the intention of controlling for potential endogenous production responses. No evidence of the role of the magnitude of mining Canon transfers is found. This suggests that the factors driving the results may be associated to the magnitude of the transfers but only in the extensive margin.

Since the local governments are the units of the government that receive the rents associated with the mineral activity in form of mining Canon, it is expected that citizens from mineral-rich areas are evaluating the performance of their local authorities taking into account this fact. The negative effect of mining Canon transfers on the confidence in the local government may reflect citizens' dissatisfaction about the way in which local governments in these areas are using this large increase of fiscal resources in terms of providing public goods that can benefit them. I discuss these issues later. However, it is possible that other units of the government as well as other political institutions can be negatively affected because the existence of spillover effects of this decrease of the level of confidence in local governments in these areas even though they have no relation with the generation or the use of these transfers[90].

I test for this possibility using the same specification used before. In particular, I use the specification with and without all control variables in (2.2)[91]. The results are presented in Table

[90] The literature of political support provides previous examples in which level of disapproval for a particular political institution can have spillover effects on citizens' support for other institutions. See Norris (2011) for details.

[91] Complete results for all the specifications are available upon request. Since these are robust to changes in the specification, I use the specification that includes all the control variables.

2.3. The political institutions considered in the analysis are political parties, the congress, the judiciary, and the ombudsman office. Overall, there is a negative effect of mining Canon transfers on the level of confidence in political institutions, except for the case of the political parties. The estimated effect is strongly significant in all the cases with a confidence level of 1%, except for the judiciary (confidence level of 5%). The estimated coefficients are similar in magnitude to those obtained for the case of the local governments (around 6 to 8 percentage points), except for the ones for the judiciary (3 percentage points) and the ombudsman office (13 percentage points). In all the cases, the effects are large and represent an important reduction in the average confidence level in political institutions. For instance, this reduction is 40% for the congress, 35% for the ombudsman office and 13% for the judiciary.

Overall, the empirical analysis suggests a negative effect of resource booms on the level of confidence in political institutions. These results are strongly statistically significant, robust to different set of controls and are large in magnitude. Although the transfers are targeted to local government, other institutions are also negatively affected by the increase of transfers even though they have no influence in the generation or in the use of these resources. These spillover effects can have important policy implications. It is important to note, however, that these results are driving for producer districts which represent a small fraction of the districts in the country (about 100 out of 1,836 districts) and are the ones that receives significant levels of transfers. For the average mining Canon recipients, it seems that there are not relevant effects.

2.7.2. Attitudes towards democracy

In the previous section I found a negative effect of the transfers on the level of confidence in political institutions. In this section, I explore the effect of transfers on political support for democracy. As in the previous section, I estimate the standard DD model of equations (2.1) and (2.2).

I first estimate the impact of mining Canon transfers on the perception about the (lack of) effectiveness of democracy. The dependent variable is a dummy equal to one if the interviewed person considers that the democracy does not work and zero otherwise. Table 2.4 presents the results of the empirical exercise using this dependent variable. The coefficient associated with the standard DD interaction is positive and statistically significant at a 1% confidence level (column 1) and it is robust after controlling for other type of transfers, urbanization, mineral production and individual/household characteristics (column 2). The magnitude of the estimated coefficient (0.061) is important (standard error 0.016) and represents a 44% increase in the average perception of the lack of effectiveness of the democratic system in these areas. In column 3 the alternative definition of treated district (mining Canon recipient) is used and not effect is found.

Columns 4 to 8 are based on equation (2.1). The specification in levels (columns 4 and 5) is not significant but the quadratic specification delivers evidence consistent with non-monotonicities in the relationship between mining Canon transfers and support for democracy. Consistent with our theoretical framework, districts that receive low levels of transfers show an increase in political support for democracy whereas in areas that got larger levels of transfers a reduction in political support is observed (column 6). This relationship is robust after controlling for other type of transfers, urbanization, mineral production and individual/household characteristics (column 8). These results are robust to the exclusion of mineral producer districts (column 9).

In order to interpret these results, it is required to evaluate the impact for the average district in terms of mining Canon transfers. Since the average level of transfer is low (41 nuevos soles per-capita), this implies that the net effect would be negative (-0.051). This implies that, for the average

district, the recent resource boom is related to a decrease in the negative perception regarding the effectiveness of democracy.

These results suggest that, after the increase of prices, citizens from the average district have the perception that the democratic system is more effective. Could this imply a decrease of the willingness to support for democracy by the citizens from mineral-rich areas? After all, citizens may feel satisfied about the way democracy is working but still be unsupportive to the idea that is the best way to organize the society. In order to explore this possibility, I run the same empirical model as above using as a dependent variable two measures of the approval of core regime principles: firstly, a measure of whether democracy is the best way of government and, secondly, an indicator of whether democracy is important for the interviewed. Table 2.5 and 2.6 present the results of the analysis.

The standard DD approach (columns 1 to 4 of Table V) shows a not statistical significant association between the increase of natural resource rents and citizens' perception about democracy being the best way of government. However, this result does not hold when estimating the DD model in (2.1). In this case, mining Canon transfers are negatively associated to the probability of considering that democracy is not working. Column 4 shows that this result in valid even in the simplest specification without controls and column 5 suggests that it's robust to controlling for other type of transfers, urbanization, mineral production and individual/household characteristics. Including the square of mining Canon transfers suggest the presence of non-monotonicities consistent with our theoretical framework (column 6), although the results disappear when other controls are included (column 7). However, dropping observations from mineral producer districts (column 9) does not affect the results obtained in column 6.

Results in Table 2.6 for the importance of democracy are consistent with those obtained in Table 2.5. Again, the specification in (2) is not significant, suggesting that being a mineral producer or a mining Canon recipient is not important (column 1 to 3). The non-monotonicities are more important here; whereas the linear inclusion of per-capita mining Canon transfers has no effect on considering democracy unimportant (columns 4 and 5), the addition of the square of mining Canon transfers becomes the relationship strongly statistically significant and with the expected signs (columns 6 and 7). These results are robust to dropping mining producer districts from the sample (column 8).

2.7.3. Robustness checks

In order to test the robustness of my previous results, I construct placebo treatments taking advantage of my DD design. As discussed in the identification strategy, I take advantage of the evolution of mineral prices, which were stable before 2003/2004 and experienced a large increase afterwards, and compare beliefs between mineral and non-mineral rich areas due to the differential access to mineral resource rents established in the Canon Law. Therefore, I can exclude observations for the years 2005 and 2006, in which the high mineral prices translated on higher mining Canon transfers for mineral-rich districts, and create placebo treatments for years of stable mineral prices. For my identification strategy to be valid, it must be the case that no effect of transfers on the outcome variables should be found.

The placebo treatment is defined as an indicator variable equal to one if the observation comes from a mineral producer district in 2004 and zero otherwise. Since observations from 2005 and 2006 are dropped from the sample, no change in terms of local revenues occurred during the period under study. Correspondingly, all the interactions in the DD analysis are adjusted to this new definition of the treatment variable. Using these new variables, I re-estimate the econometric models reported in Table 2.2 and Table 2.4 for analyzing the impact of mining Canon transfers on

the level of confidence on political institutions and on attitudes towards democracy respectively. The results are presented in Table 2.7 and Table 2.8.

I find no effect of the placebo treatment on my outcome variables using the DD model in Table 2.2. For instance, none of the reported coefficients for the local government is statistically significant (Table 2.7). The same is valid for the case of the effect of the increase of mining Canon transfers on attitudes towards democracy (Table 2.8). These results suggest that there is a real effect of the large increase of mining Canon transfers on the level of confidence in political institutions and on attitudes towards democracy.

2.7.4. Causal channels

A general picture emerges from the results previously discussed: in producer districts, the resource boom is related to a reduction of the level of confidence in political institutions. Also, support for democracy shows a non-monotonic relationship with mining Canon transfers implying that areas with large level of transfers show a large reduction in political support whereas places in which this increase was modest show an increase in support for democracy. These results are consistent with the theoretical framework discussed in section 2.3 and Appendix 2.1.

According to our theoretical framework, a non-monotonic pattern between natural resource rents and public good provision should be observed. I test this relationship in Table 2.9. I include a set of local public goods like access to water, access to public light, garbage collection, security services and access to library. In most cases, there is strong evidence of the non-monotonic pattern suggested by the theoretical framework. For the average district in terms of mining Canon transfer, the evidence suggest that the resource boom is related to a positive impact on public good provision. For district with very high levels of transfers, there is a negative impact on public good provision. These patterns are consistent with the observed pattern in terms of citizens' support for democracy.

These results are consistent with the literature about economic voting that emphasizes the role of material benefits. As it has been documented by an extensive literature (see Manacorda et al 2011 and Brunner et al 2010 for recent contributions), citizens' political behavior is responsive to economic shocks and policies that affect directly their well-being. Therefore, whether or not this increase of transfers has an effect on citizens' well-being is critical in order to explain these results.

To complement the analysis, I also analyze the role of resource booms on living standards. I estimate the same empirical model as in Table 2.2 using (log of) household consumption per-capita levels as proxy of well-being. The results are shown in Table 2.10. Although I do not find a clear pattern for the specification in (2.2), the evidence of non-monotonic effects on consumption per-capita is strong. The effect is positive for the specification in levels (column 4 and 5) but stronger for the case of the quadratic specification (columns 6 and 7). The results are robust to the exclusion of producer districts (column 8).

These results are consistent with our theoretical framework. Living standards follow the pattern of distribution of public goods. Therefore, in places where there were increases in public good provision and living standards, citizens are more willing to support the democratic regime. The opposite happens for very rich districts in terms of mining Canon rents. In these areas, the resource boom is related to reductions in public good provision and living standards, which in turn is related to low levels of citizens' political support for democracy.

These results differ from existing evidence in the empirical literature. For instance, previous work in Brazil (Caselli and Micheals 2013) and Cajamarca, one of the most important gold producer regions in Peru (Aragon and Rud 2013), find no evidence of increase in well-being

associated to the increase of mineral resource rents[92]. Maldonado (2014) shows that these results are inconsistent with theoretical models that highlight the existence of non-monotonic effects.

2.8. Conclusions

In this paper, I have explored the impact of resource booms on political support for democracy. The basic motivation was to provide a conceptual framework and a credible empirical analysis to study one important dimension of the political resource curse literature: how resource abundance can negatively affect the consolidation of democracy often observed in resource-rich developing countries. Rather than focusing exclusively on the behavior of politicians, the behavior of citizens is incorporated in a simple extension of the Bender and Drazen's (2007) piece. The basic idea of the model is that citizens' support for democracy in resource-rich areas critically depends on the way politicians use natural-resource rents to provide public goods that help them to learn that democracy "works". The model predicts that, when a resource windfall occurs, the incentive of politicians for providing public goods is non-monotonically related to the level of mining rents. Since local politicians only care about the reelection incentives, they invest in public goods as long they expect to be able to get reelected, otherwise they underprovide public goods and increase their rents. This pattern affects citizens' support for democracy. When mining rents are too high, local politicians cannot prevent competition, being their optimal response to reduce the provision of public goods, which in turn negatively affects support for democracy. For places with modest increases, the pattern is the opposite.

Using sub-national exogenous variation in the level of natural resource rents, I test empirically the basic results of this simple model. I find a significant reduction in the level of confidence in political institutions for the case of mineral producer districts, which typically are districts that receive large mining Canon transfers. Also, I found evidence on non-monotonic effects of mining rents, implying that areas that experienced a large increase of natural resource rents show a significant reduction in political support for democracy whereas the opposite happens in areas in which transfers were modest. A set of placebo tests suggest that no evidence against the identification assumptions of the empirical exercise is available so far. Evidence on causal channels are consistent with the theoretical framework in terms of public good provision and living standards.

This paper offers a complementary explanation to the political resource curse literature by exploring the role of citizens' perception about democracy as a factor that can have important implications for the consolidation of democracy. Although the role of citizens in democratic breakdown has been explored by many scholars (Bermeo 2003, and Linz and Stepan 1978), this is the first study –at least to my knowledge- analyzing this issue exploiting sub-national variation. My contribution is focused on suggesting that the risk of democratic failure and misgovernance is higher when citizens are more dissatisfied with the democratic system in the face of a resource boom. In this scenario, governance problems may arise leading to an increase in political instability and conflict. However, for places in which the resource boom is modest, natural resource rents are related to an increase of political support for democracy.

[92] Aragon and Rud (2013) study the case of Yanacocha, the second largest gold mine in the world and responsible of production of 45% of the gold exported by the country. They find that despite its magnitude and the fact the company has a policy oriented to increase the participation of local firms and workers, a 10% increase in the mine's activity was only associated to an increase of 1.7% in household real incomes. They also find that this effect is not explained by the impact of mining Canon transfers on household welfare.

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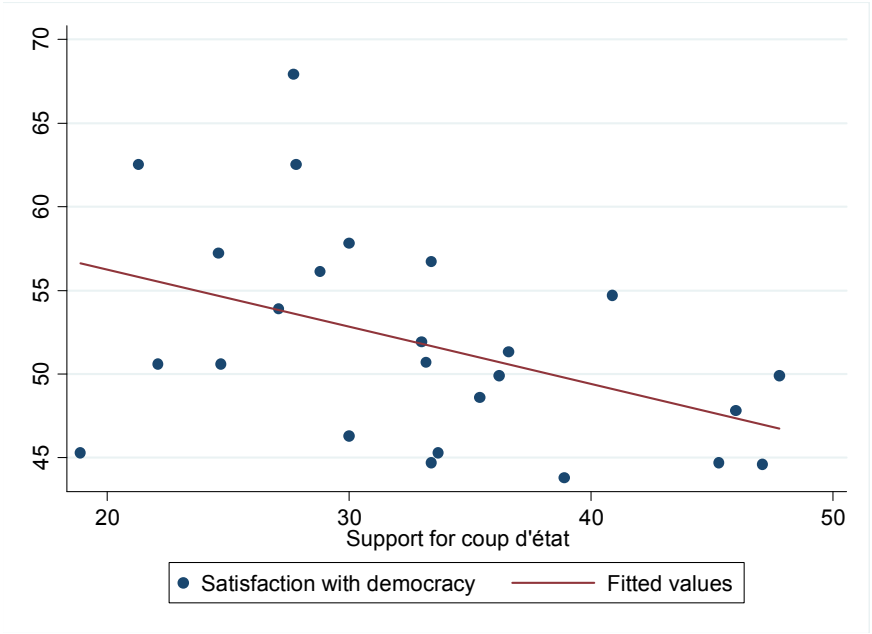
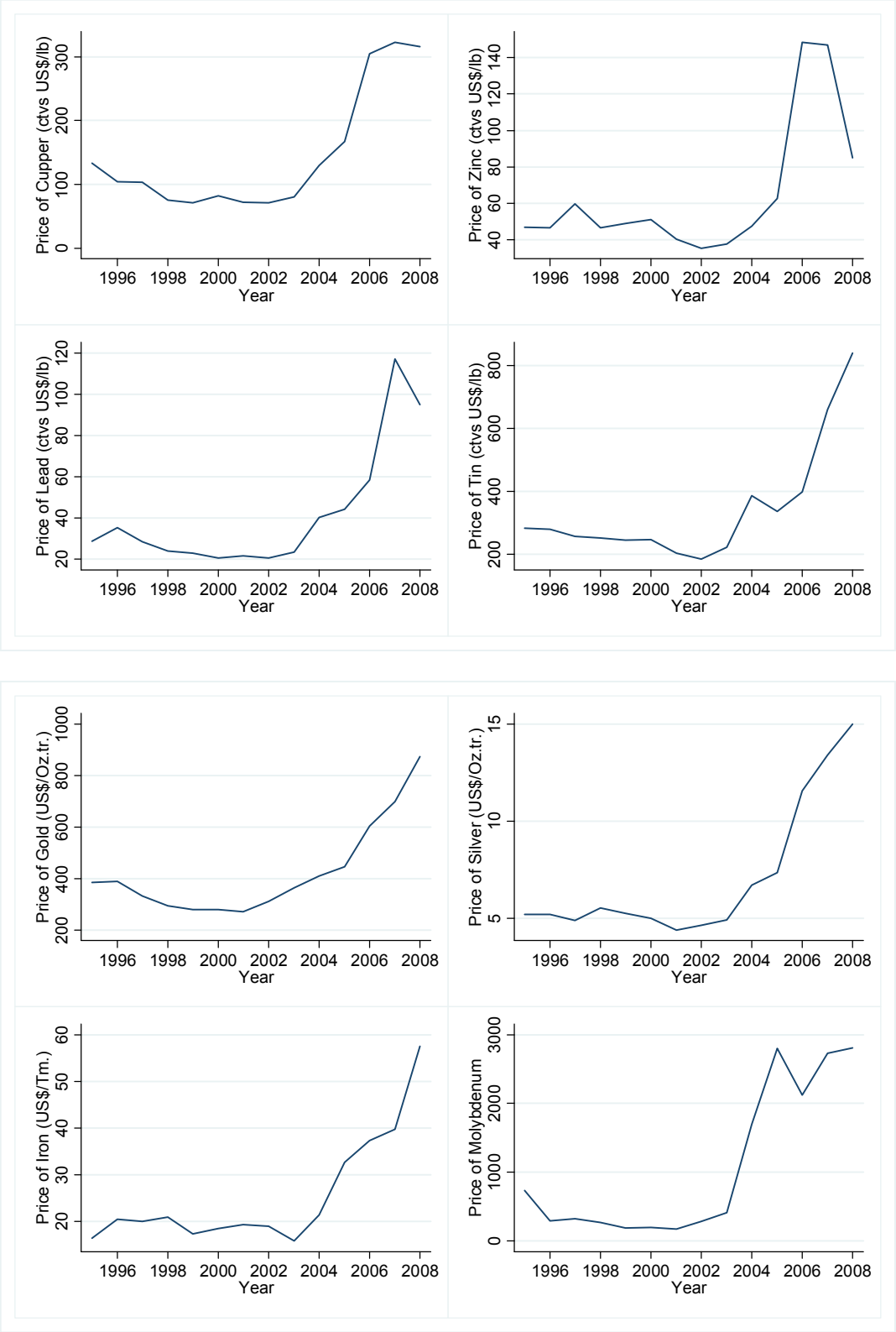
Figure 2.1: Satisfaction with democracy and political support for a coup d'état in Latin America countries, 2010



Source: LAPOP, 2010. The vertical axis is the fraction of citizens satisfied with democracy in their country. The horizontal axis is the fraction of citizens supporting a coup d'état in their country.

Figure 2.2: Evolution of commodity prices



Source: Ministry of Energy and Mines.

Figure 2.3: Evolution of mineral production and prices

1. Copper

2.Gold

3. Zinc

4.Lead

5. Silver

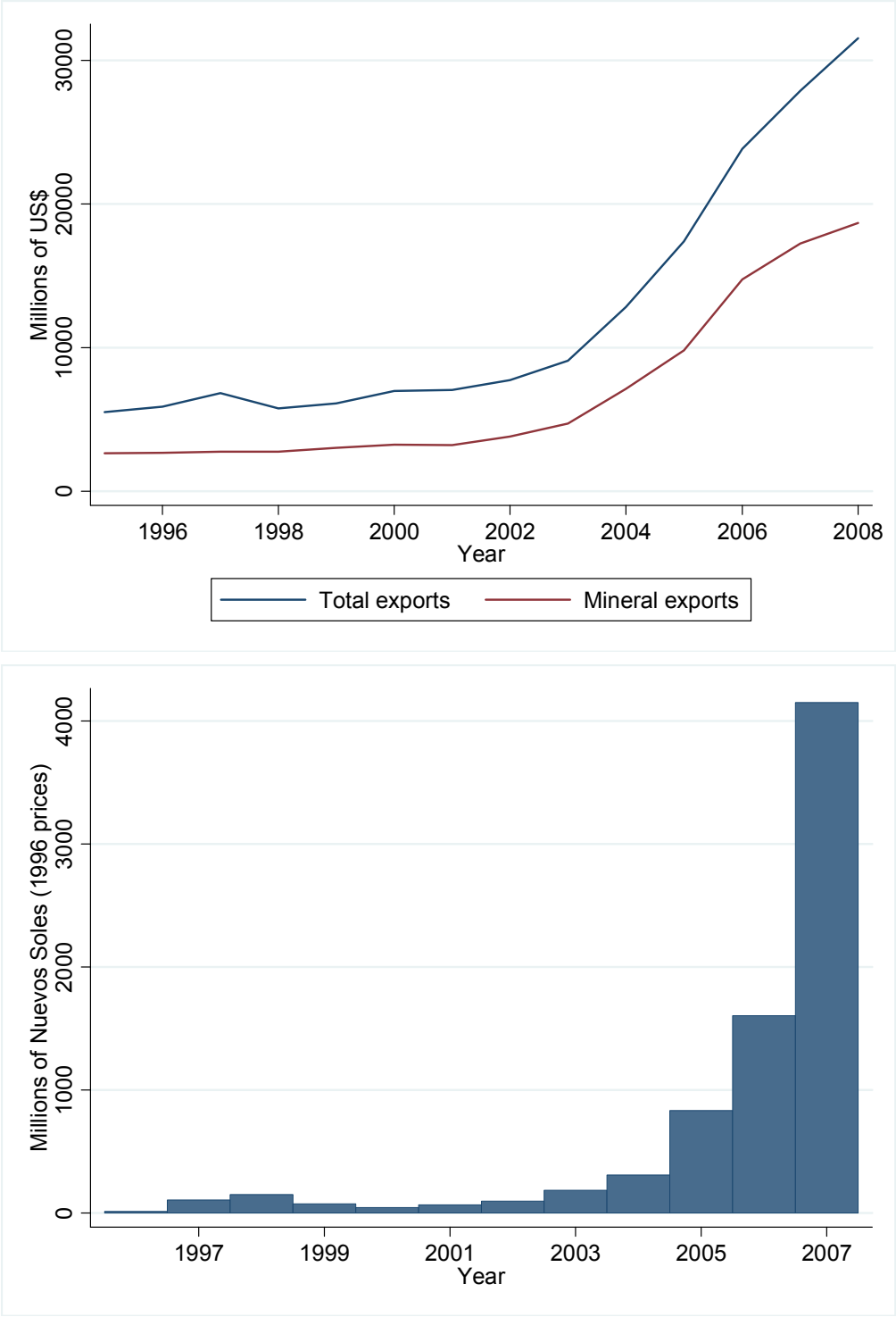
6.Iron

7. Tin

8.Molymbdenum

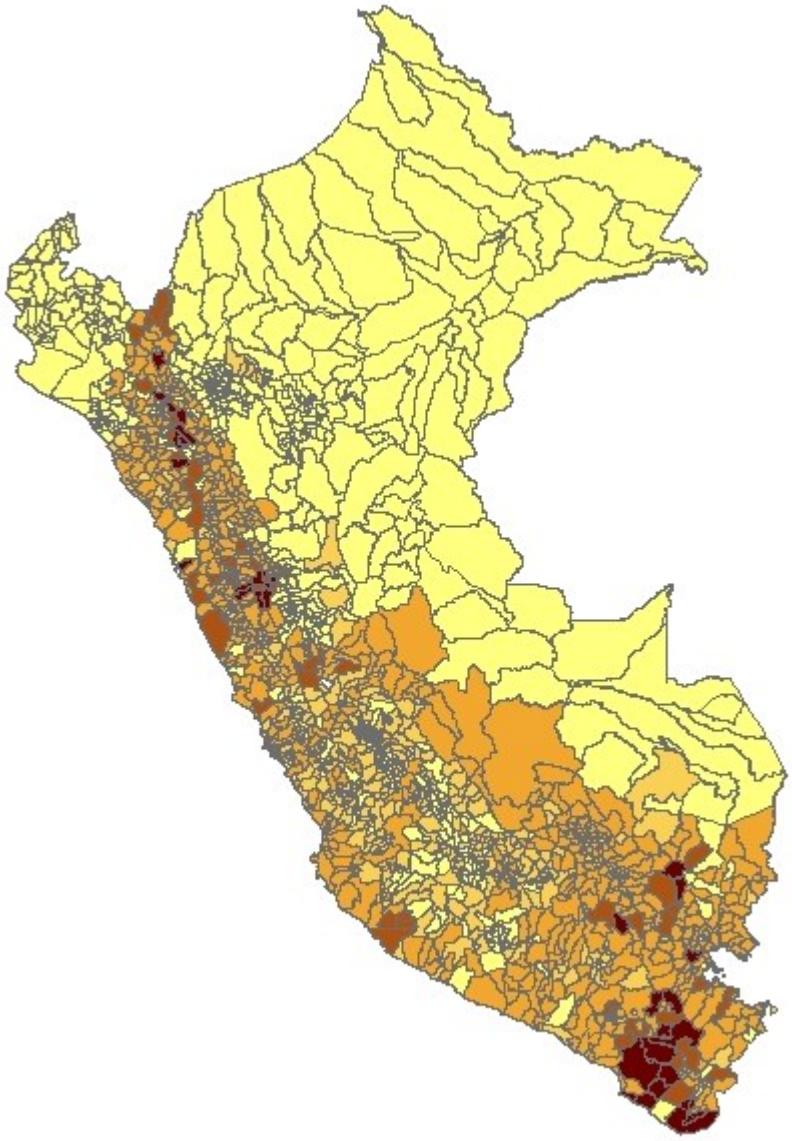
Source: Ministry of Energy and Mines.

Figure 2.4: Evolution of total exports, mineral exports and Mining Canon transfers



Source: Ministry of Economic and Finance.

Map 2.1: District Allocation of Mining Canon Transfers, 2006



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

Table 2.1: Summary Statistics

	Recipients	Producers	Non-recipients
Dependent variables			
Trust in political institutions			
Local government	32.0%	28.0%	39.7%
Political parties	10.3%	9.4%	13.1%
Judiciary	20.2%	17.9%	28.6%
Ombudsman office	34.3%	30.8%	44.6%
Congress	14.6%	11.9%	21.3%
Support for democracy			
Autocracy is the best way of government	22.5%	24.9%	19.8%
Democracy is not working	14.8%	15.6%	12.8%
Democracy is not the best way of government	8.3%	6.3%	5.7%
Transfers			
Mining Canon (per-capita)	43.11	122.68	-
p10	0.11	2.53	-
p25	0.92	8.37	-
p50	7.04	44.28	-
p75	39.13	82.14	-
p90	94.18	134.06	-
p99	414.64	1,725.65	-
Municipality Revenues (per-capita)	363.45	487.20	397.45
Net Municipality Revenues (per-capita)	320.34	364.52	397.45
Share of Mining Canon (%)	9.63	16.79	0.00
Other Canon Sources (per-capita)			
Oil Canon	5.79	0.00	93.26
Hydropower Canon	9.95	10.41	0.00
Forestal Canon	0.07	0.18	0.55
Fishing Canon	1.52	2.46	0.08
Gas Canon	6.37	0.46	0.43
FOCAM Canon	1.81	1.22	5.45
District Characteristics: Census 1993			
Population	12,339	10,788	22,618
% Rural Population	57.76	55.32	59.08
% Children (0-15 years old)	40.68	40.58	45.14
Malnutrition rates for Children	55.61	53.02	55.64
% Population without wastepipe-latrine	41.81	41.60	53.91
% Population without water	51.20	49.84	67.13
% Population without electricity	74.16	65.27	68.55
Female illiteracy rate	33.60	29.39	23.90
Altitude	2,326	2,720	498
Household characteristics			
Household members	4.33	4.08	4.71
Wage earners	1.96	1.77	2.07
Per-capita monthly income	353.47	476.26	334.43
Per-capita monthly consumption	353.54	442.07	333.47
Assets			
Bike	27.5%	27.3%	27.0%
Car/Van	7.3%	8.4%	4.2%
Trycicle	4.2%	4.8%	2.4%
Motor bike	2.1%	9.6%	5.3%

Truck	0.7%	0.8%	0.6%
Mototaxi	1.2%	2.1%	3.3%
Household head characteristics			
Age	48.8	46.1	47.7
Male	78.5%	81.3%	81.1%
Married	71.7%	73.4%	74.9%
Employed	86.0%	88.8%	86.8%
Unemployed	3.1%	2.7%	3.3%
Inactive	10.8%	8.5%	9.9%
Incomplete primary	32.0%	28.7%	32.1%
Complete primary	18.1%	14.7%	19.3%
Incomplete secondary	13.2%	16.0%	14.9%
Complete secondary	18.9%	21.4%	18.7%
Incomplete college	4.8%	5.6%	4.0%
Complete college	13.1%	13.5%	11.1%

Source: Household survey data from ENAHO 2002-2206. Census data from Census 1993. Transfer data from Ministry of Economics and Finance.

Table 2.2: Impact of Mining Canon Transfers on the Confidence in Local Governments

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If confident in the local government							
Treatment (1= Producer district after increase of prices)	-0.051***	-0.045***						
	(0.015)	(0.016)						
Treatment (1= Canon Recipient after increase of prices)			-0.019					
			(0.015)					
Mining Canon Transfers				0.001	-0.001	0.008	-0.006	-0.011
				(0.004)	(0.005)	(0.020)	(0.021)	(0.035)
Mining Canon Transfers^2						-0.001	0.000	0.000
						(0.002)	(0.002)	(0.002)
Transfer controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Urbanization control	No	Yes	Yes	No	Yes	No	Yes	Yes
Household level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Individual level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Mineral production control	No	Yes	Yes	No	Yes	No	Yes	No
Excluding producer districts	No	No	No	No	No	No	No	Yes
Mean dependent variable	0.34							
Observations	73,783	69,464	69,464	69,642	69,403	69,642	69,403	65,046
R-Squared	0.071	0.071	0.071	0.069	0.071	0.069	0.071	0.068

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All the specifications include district and year fixed effects. Transfers controls includes all intergovernmental transfers from the central government and includes the Fondo de Compensacion Municipal and dummy variables for whether the local government receives Canon transfers from oil, hydro power, forestal, fish, and gas exploitation. It also includes mining royalties and Camisea's development fund (FOCAM) transfers. Urbanization control is a dummy variable for whether the household is located in urban areas according to INEI's definition. Household's characteristics includes dummy variables for asset ownership (bike, car or van, tricycle, motorbike, truck and mototaxi), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. Individual controls include age, sex, a dummy variable for married and dummies for education level (complete primary, incomplete secondary, complete secondary, incomplete college and complete college). Mining Canon transfers are measured in thousands of new soles per-capita in prices of Lima in December 2001. Mining production is measured as the real value of production using 2001 international prices.

Table 2.3: Impact of Mining Canon Transfers on the Confidence in Regime Institutions

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If confident in political institution							
	Political Parties		Congress		Judiciary		Ombudsman	
Treatment (1= Producer district after increase of prices)	0.001	0.004	-0.050**	-0.046**	-0.035***	-0.032**	-0.109***	-0.103***
	(0.013)	(0.016)	(0.019)	(0.019)	(0.012)	(0.013)	(0.020)	(0.023)
Transfer controls	No	Yes	No	Yes	No	Yes	No	Yes
Urbanization control	No	Yes	No	Yes	No	Yes	No	Yes
Household level controls	No	Yes	No	Yes	No	Yes	No	Yes
Individual level controls	No	Yes	No	Yes	No	Yes	No	Yes
Mineral Production control	No	Yes	No	Yes	No	Yes	No	Yes
Mean dependent variable	0.11		0.16		0.22		0.36	
Observations	73,095	68,833	69,804	65,692	71,500	67,309	64,375	60,569
R-Squared	0.031	0.030	0.051	0.052	0.041	0.042	0.040	0.046

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All the specifications include district and year fixed effects. Transfers controls includes all intergovernmental transfers from the central government and includes the Fondo de Compensacion Municipal and dummy variables for whether the local government receives Canon transfers from oil, hydro power, forestal, fish, and gas exploitation. It also includes mining royalties and Camisea's development fund (FOCAM) transfers. Urbanization control is a dummy variable for whether the household is located in urban areas according to INEI's definition. Household's characteristics includes dummy variables for asset ownership (bike, car or van, tricycle, motorbike, truck and mototaxi), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. Individual controls include age, sex, a dummy variable for married and dummies for education level (complete primary, incomplete secondary, complete secondary, incomplete college and complete college). Mining production is measured as the real value of production using 2001 international prices.

Table 2.4: Impact of Mining Canon Transfers on Evaluation of Regimen Performance

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If consider that Democracy does not work							
Treatment (1= Producer district after increase of prices)	0.061***	0.067***						
	(0.016)	(0.015)						
Treatment (1= Canon Recipient after increase of prices)			-0.009					
			(0.013)					
Mining Canon Transfers				-0.013	-0.011	-0.055**	-0.044*	-0.085***
				(0.009)	(0.008)	(0.024)	(0.024)	(0.021)
Mining Canon Transfers^2						0.004**	0.003*	0.006***
						(0.002)	(0.002)	(0.001)
Transfer controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Urbanization control	No	Yes	Yes	No	Yes	No	Yes	Yes
Household level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Individual level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Mineral Production control	No	Yes	Yes	No	Yes	No	Yes	No
Excluding producer districts	No	No	No	No	No	No	No	Yes
Mean dependent variable	0.14							
Observations	77,585	73,208	73,208	73,428	73,150	73,428	73,150	68,399
R-Squared	0.008	0.010	0.010	0.007	0.010	0.007	0.010	0.010

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All the specifications include district and year fixed effects. Transfers controls includes all intergovernmental transfers from the central government and includes the Fondo de Compensacion Municipal and dummy variables for whether the local government receives Canon transfers from oil, hydro power, forestal, fish, and gas exploitation. It also includes mining royalties and Camisea's development fund (FOCAM) transfers. Urbanization control is a dummy variable for whether the household is located in urban areas according to INEI's definition. Household's characteristics includes dummy variables for asset ownership (bike, car or van, tricycle, motorbike, truck and mototaxi), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. Individual controls include age, sex, a dummy variable for married and dummies for education level (complete primary, incomplete secondary, complete secondary, incomplete college and complete college). Mining Canon transfers are measured in thousands of new soles per-capita in prices of Lima in December 2001. Mining production is measured as the real value of production using 2001 international prices.

Table 2.5: Impact of Mining Canon Transfers on Approval of Core Regime Principles

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If does not consider Democracy as the best way of government							
Treatment (1= Producer district after increase of prices)	-0.010	-0.008						
	(0.011)	(0.012)						
Treatment (1= Canon Recipient after increase of prices)			0.004					
			(0.011)					
Mining Canon Transfers				-0.009**	-0.005*	-0.032**	-0.015	-0.047*
				(0.004)	(0.003)	(0.014)	(0.014)	(0.025)
Mining Canon Transfers^2						0.002**	0.001	0.003*
						(0.001)	(0.001)	(0.002)
Transfer controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Urbanization control	No	Yes	Yes	No	Yes	No	Yes	Yes
Household level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Individual level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Mineral Production control	No	Yes	Yes	No	Yes	No	Yes	No
Excluding producer districts	No	No	No	No	No	No	No	Yes
Mean dependent variable	0.08							
Observations	65,779	61,967	61,967	62,149	61,915	62,149	61,915	57,902
R-Squared	0.001	0.007	0.007	0.001	0.007	0.001	0.007	0.008

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All the specifications include district and year fixed effects. Transfers controls includes all intergovernmental transfers from the central government and includes the Fondo de Compensacion Municipal and dummy variables for whether the local government receives Canon transfers from oil, hydro power, forestal, fish, and gas exploitation. It also includes mining royalties and Camisea's development fund (FOCAM) transfers. Urbanization control is a dummy variable for whether the household is located in urban areas according to INEI's definition. Household's characteristics includes dummy variables for asset ownership (bike, car or van, tricycle, motorbike, truck and mototaxi), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. Individual controls include age, sex, a dummy variable for married and dummies for education level (complete primary, incomplete secondary, complete secondary, incomplete college and complete college). Mining Canon transfers are measured in thousands of new soles per-capita in prices of Lima in December 2001. Mining production is measured as the real value of production using 2001 international prices.

Table 2.6: Impact of Mining Canon Transfers on Approval of Core Regime Principles

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If does not consider Democracy as important							
Treatment (1= Producer district after increase of prices)	-0.006	-0.011						
	(0.007)	(0.008)						
Treatment (1= Canon Recipient after increase of prices)			0.000					
			(0.009)					
Mining Canon Transfers				-0.008	-0.006	-0.034***	-0.027***	-0.037***
				(0.005)	(0.004)	(0.010)	(0.010)	(0.013)
Mining Canon Transfers^2						0.003***	0.002***	0.002**
						(0.001)	(0.001)	(0.001)
Transfer controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Urbanization control	No	Yes	Yes	No	Yes	No	Yes	Yes
Household level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Individual level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Mineral Production control	No	Yes	Yes	No	Yes	No	Yes	No
Excluding producer districts	No	No	No	No	No	No	No	Yes
Mean dependent variable					0.05			
Observations	76,964	72,659	72,659	72,879	72,600	72,879	72,600	67,880
R-Squared	0.001	0.004	0.004	0.001	0.004	0.001	0.004	0.005

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All the specifications include district and year fixed effects. Transfers controls includes all intergovernmental transfers from the central government and includes the Fondo de Compensacion Municipal and dummy variables for whether the local government receives Canon transfers from oil, hydro power, forestal, fish, and gas exploitation. It also includes mining royalties and Camisea's development fund (FOCAM) transfers. Urbanization control is a dummy variable for whether the household is located in urban areas according to INEI's definition. Household's characteristics includes dummy variables for asset ownership (bike, car or van, tricycle, motorbike, truck and mototaxi), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. Individual controls include age, sex, a dummy variable for married and dummies for education level (complete primary, incomplete secondary, complete secondary, incomplete college and complete college). Mining Canon transfers are measured in thousands of new soles per-capita in prices of Lima in December 2001. Mining production is measured as the real value of production using 2001 international prices.

Table 2.7: Placebo Treatment

Impact of Mining Canon Transfers on the Confidence in Local Governments

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If confident in the local government							
Treatment (1= Producer district after increase of prices)	-0.010	-0.006						
	(0.029)	(0.029)						
Treatment (1= Canon Recipient after increase of prices)			0.037					
			(0.026)					
Mining Canon Transfers				-0.160	-0.196	-0.075	-0.138	-0.235
				(0.143)	(0.160)	(0.371)	(0.397)	(0.405)
Mining Canon Transfers^2						-0.139	-0.097	-0.244
						(0.409)	(0.476)	(0.485)
Transfer controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Urbanization control	No	Yes	Yes	No	Yes	No	Yes	Yes
Household level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Individual level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Mineral Production control	No	Yes	Yes	No	Yes	No	Yes	No
Excluding producer districts	No	No	No	No	No	No	No	Yes
Mean dependent variable	0.43							
Observations	39,015	36,224	36,224	36,275	36,163	36,275	36,163	34,160
R-Squared	0.036	0.038	0.038	0.036	0.038	0.036	0.038	0.037

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All the specifications include district and year fixed effects. Transfers controls includes all intergovernmental transfers from the central government and includes the Fondo de Compensacion Municipal and dummy variables for whether the local government receives Canon transfers from oil, hydro power, forestal, fish, and gas exploitation. It also includes mining royalties and Camisea's development fund (FOCAM) transfers. Urbanization control is a dummy variable for whether the household is located in urban areas according to INEI's definition. Household's characteristics includes dummy variables for asset ownership (bike, car or van, tricycle, motorbike, truck and mototaxi), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. Individual controls include age, sex, a dummy variable for married and dummies for education level (complete primary, incomplete secondary, complete secondary, incomplete college and complete college). Mining Canon transfers are measured in thousands of new soles per-capita in prices of Lima in December 2001. Mining production is measured as the real value of production using 2001 international prices.

Table 2.8: Placebo Treatment
Impact of Mining Canon Transfers on Approval of Core Regime Principles

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: 1=If consider that Democracy does not work							
Treatment (1= Producer district after increase of prices)	0.003	0.013						
	(0.017)	(0.017)						
Treatment (1= Canon Recipient after increase of prices)			0.004					
			(0.011)					
Mining Canon Transfers				-0.010	0.035	0.100	0.156	0.180
				(0.080)	(0.081)	(0.237)	(0.236)	(0.267)
Mining Canon Transfers^2						-0.169	-0.187	-0.329
						(0.271)	(0.276)	(0.298)
Transfer controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Urbanization control	No	Yes	Yes	No	Yes	No	Yes	Yes
Household level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Individual level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Mineral Production control	No	Yes	Yes	No	Yes	No	Yes	No
Excluding producer districts	No	No	No	No	No	No	No	Yes
Mean dependent variable	0.15							
Observations	45,498	42,536	42,536	42,630	42,478	42,630	42,478	39,982
R-Squared	0.009	0.012	0.012	0.010	0.012	0.010	0.012	0.011

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All the specifications include district and year fixed effects. Transfers controls includes all intergovernmental transfers from the central government and includes the Fondo de Compensacion Municipal and dummy variables for whether the local government receives Canon transfers from oil, hydro power, forestal, fish, and gas exploitation. It also includes mining royalties and Camisea's development fund (FOCAM) transfers. Urbanization control is a dummy variable for whether the household is located in urban areas according to INEI's definition. Household's characteristics includes dummy variables for asset ownership (bike, car or van, tricycle, motorbike, truck and mototaxi), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. Individual controls include age, sex, a dummy variable for married and dummies for education level (complete primary, incomplete secondary, complete secondary, incomplete college and complete college). Mining Canon transfers are measured in thousands of new soles per-capita in prices of Lima in December 2001. Mining production is measured as the real value of production using 2001 international prices.

Table 2.9: Causal Channel

Impact of Mining Canon Transfers on Public Goods Provision

	Difference in Differences Estimates							
	Access to Water Network	Acess to Public Light	Garbage Collection		Security Services			Access to Library
			In Capital	Rest	Access	Personnel	Stations	
Mining Canon Transfers	0.007	0.027**	0.054*	0.103***	0.052***	0.154***	0.093***	-0.015
	(0.010)	(0.011)	(0.028)	(0.035)	(0.013)	(0.056)	(0.035)	(0.011)
Mining Canon Transfers^2	0.000	-0.001**	-0.002**	-0.004***	-0.001***	-0.004	-0.002	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.003)	(0.002)	(0.000)
Transfer controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urbanization control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mineral Production control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Excluding producer districts	No	No	No	No	No	No	No	No
Mean dependent variable	0.76	0.88	0.94	0.55	0.15	6.1	1.3	0.41
Number of observations	5,566	8,644	9,014	8,781	14,117	12,825	10,026	14,237
R2	0.242	0.264	0.017	0.113	0.115	0.242	0.078	0.013

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All the specifications include district and year fixed effects. Transfers controls includes all intergovernmental transfers from the central government and includes the Fondo de Compensacion Municipal and dummy variables for whether the local government receives Canon transfers from oil, hydro power, forestal, fish, and gas exploitation. It also includes mining royalties and Camisea's development fund (FOCAM) transfers. Urbanization control is a dummy variable for whether the district is located in urban areas according to INEI's definition. Mining Canon transfers are measured in thousands of new soles per-capita in prices of Lima in December 2001. Mining production is measured as the real value of production using 2001 international prices.

Table 2.10: Causal Channels

Impact of Mining Canon Transfers on Household Consumption

	Difference in Differences Estimates							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: Log (1+Household consumption per-capita)							
Treatment (1= Producer district after increase of prices)	0.048*	0.042						
	(0.026)	(0.029)						
Treatment (1= Canon Recipient after increase of prices)			-0.021					
			(0.031)					
Mining Canon Transfers				0.041**	0.039***	0.136***	0.113***	0.177***
				(0.016)	(0.013)	(0.036)	(0.030)	(0.041)
Mining Canon Transfers^2						-0.010***	-0.007***	-0.010***
						(0.003)	(0.002)	(0.003)
Transfer controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Urbanization control	No	Yes	Yes	No	Yes	No	Yes	Yes
Household level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Individual level controls	No	Yes	Yes	No	Yes	No	Yes	Yes
Mineral Production control	No	Yes	Yes	No	Yes	No	Yes	No
Excluding producer districts	No	No	No	No	No	No	No	Yes
Mean dependent variable (level)					347.20			
Observations	91,149	84,534	71,538	84,534	86,475	84,471	86,475	84,471
R-Squared	0.493	0.633	0.634	0.633	0.471	0.633	0.471	0.633

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All the specifications include district and year fixed effects. Transfers controls includes all intergovernmental transfers from the central government and includes the Fondo de Compensacion Municipal and dummy variables for whether the local government receives Canon transfers from oil, hydro power, forestal, fish, and gas exploitation. It also includes mining royalties and Camisea's development fund (FOCAM) tra/nsfers. Urbanization control is a dummy variable for whether the household is located in urban areas according to INEI's definition. Household's characteristics includes dummy variables for asset ownership (bike, car or van, tricycle, motorbike, truck and mototaxi), household consumption, number of earners, and a dummy for whether the dwelling was obtained through occupation. Individual controls include age, sex, a dummy variable for married and dummies for education level (complete primary, incomplete secondary, complete secondary, incomplete college and complete college). Mining Canon transfers are measured in thousands of new soles per-capita in prices of Lima in December 2001. Mining production is measured as the real value of production using 2001 international prices.

Appendix 2.1: Model

Consider a simple two-period decentralized democracy with n local governments inspired in Bender and Drazen (2009) and Caselli (2006). For simplicity, I normalized the size of districts to one. There are two classes, the elites E and the masses M which sizes are also normalized to unity. We have two types of governments in this setting: a centralized government which single function is to provide exogenous transfers to the elites and masses funded with taxes and local governments that provide public goods and receive natural resource rents. Given the intuition that citizens learn about democracy's effectiveness from the provision of public goods, it is assumed that only decisions made by local governments are relevant in this regard. This assumption is made for simplicity just to illustrate the role of subnational governments in affecting political support for democracy. Even if I allow a centralized government to intervene in affecting political support, the idea is that governance problems would be more acute than a situation in which subnational governments are supportive with democracy.

We assume that subnational governments do not have connections with the national government. This assumption is motivated by the lack of national political parties in Peru, due to the collapse of the national party system in early nineties. As a consequence, national politicians do not have links with local ones. In this scenario, only local politics matter and local politicians only care about their ability of keeping power in their respective political arena.

The intuition is then, when national political parties are weak, the fact that politicians' incentives are local while the rules of the democratic game (political institutions) are defined at a national level creates a free-riding problem. In this setting, democracy is a public good for politicians; they prefer democracy over dictatorship because allow them to be elected and get rents but they don't internalize that, in a country with weak democratic institutions, in order for democracy to work for citizens, they would need to collectively provide public goods in a level that allows citizens to learn about its effectiveness. Therefore, politicians have to "invest" in democracy, at least until the point in which democracy is consolidated, but the public good nature of the latter create incentives for free-riding. If politicians could write a contract to commit themselves to provide the public goods needed for citizens to learn about the effectiveness of democracy, then citizens would learn that democracy "works" and political support would be high. In this scenario, democracy would be consolidated as the "only game in town". However, this type of contracts are difficult to enforce: it would be optimal for a single politician to deviate from this agreement, maximize their rents and still be able to run for office the next election since the impact of this deviation on aggregate political support would be minimal. Given the absence of enforcement technologies for such a contract, rational politicians would deviate and to invest in public goods as long is consistent with their individual reelection incentives as I discuss below.

2.A.1. Elite's problem

The elite's problem is to choose whether to organize a coup against democracy. As in Acemoglu and Robinson (2006), the elite compares the benefits and costs of running a coup. This basically implies that the net benefit of non-democracy is higher than the net benefit under democracy. If the elite decides to organize a coup, they would get a (constant) flow endowment to y^E but face a cost ϕ that represents a fraction of the endowment that gets destroyed because of the

coup. It is assumed that this cost is increasing in the degree of support for democracy, so $\phi(\mu)$ where μ is an index of political support such that $0 < \mu < 1$ and $\phi'(\mu) > 0$. On the other hand, if the elite supports democracy, they would get transfer T^E from the central government to buy-off their support to democracy besides their endowment. There are also specific taxes for each group (τ^E and τ^M respectively). Therefore, given a discount factor of β , the two-period condition for an elite to mount a coup is the following:

$$(2.A.1)\quad [1-\phi(\mu)][1-\beta]\mathrm{y}^E > (1-\tau_1)\mathrm{y}^E + T_1^E + \beta E_1^E[(1-\tau_2^E)\mathrm{y}^E + T_2^E],$$

where E_1^E is the expectation regarding the policy. Consequently, for a coup not to be mounted by the elite, it must be true that:

$$(2.A.2)\quad \phi(\mu) \geq \frac{\tau_1 \mathrm{y}^E - T_1^E + \beta E_1^E[\tau_2^E \mathrm{y}^E - T_2^E]}{[1+\beta]\mathrm{y}^E},$$

Where the term in the numerator is the sum of the current net tax and the discounted expected value of the net tax in the second period whereas the denominator recovers the present value of endowment. This condition says that the cost of mounting a coup has to be higher than the ratio between the present expected value of the net tax and the present value of the endowment. The intuition is straightforward: the higher the support for democracy (higher values of μ), the more costly for the elite to mount a coup.

Of course, taxes and transfers can be used by the central government to influence the cost of a coup by affecting the opportunity cost of the elite. This result is consistent with previous literature regarding the use of transfers to buy-off the elite in order to prevent a coup (Acemoglu and Robison 2006, Dunning 2008). Since our interest is to highlight the role of citizens' political support, the emphasis is given to the behavior of the μ parameter. To do so, it is required to model how citizens solve the inference problem regarding the performance of democracy with respect to a non-democratic regime.

2.A.2. Citizen's inference regarding performance of democracy

In an unconsolidated democracy, citizens need to infer whether current economic performance is a good predictor of long-term economic performance. This inference problem can be modeled by decomposing the citizen's endowment in the following way:

$$(2.A.3)\quad y_t^M = y^D + g_t + \varepsilon_t,$$

where y_t^M is the citizen's observed income, y^D is the "underlying" performance under democracy (which is assumed to be constant for simplicity), g_t is the provision of public goods and ε_t is a shock to the current economic performance. Citizens' only observe y_t^M and make inferences regarding y^D. That also requires to consider the subjective probability distributions over g_t and ε_t .

Let's define y_t^A as the performance under autocracy and be $x_t = g_t + \varepsilon_t$ a new random variable with subjective cumulative distribution represented by $H^M(x_t)$. The probability that y^D is no less than y^A is $H^M(y_t^M - y^A)$[93].

The question now is how public goods can be used in order to influence citizens' beliefs regarding the performance of democracy over autocratic regimes. To answer this, I assume here that g_t is chosen before ε_t is observed and that the actual distribution of ε_t is $J(\varepsilon)$. Then, the government's expectation[94] of the probability that citizens believe that $y^D \geq y^A$ as a function of g_t is $\int_{\varepsilon} H^M(y^D - y^A + g_t + \varepsilon_t)dJ(\varepsilon)$. I additionally assume that y^A differs across individuals according to the distribution $F(y^A)$. In this case, the index μ (as seen by the government) can be defined as the expected fraction of the population who believe that the underlying performance of democracy is better than non-democracy in the following way:

(2.A.4) $$\mu(g_t) = \int_{y^A}\int_{\varepsilon} H^M(y^D - y^A + g_t + \varepsilon_t)dJ(\varepsilon)dF(y^A) > 0.$$

The basic implication is that changes in political support for democracy as a function of the public good provision depends on the distribution of $H(.)$, which in turn depends on citizens' beliefs regarding g_t. Since citizens cannot observe g directly, the effect of an increase in public good provision on citizens' support for democracy is the following:

(2.A.5) $$\frac{d\mu}{dg_t} = \int_{y^A}\int_{\varepsilon} h^M(y^D - y^A + g_t + \varepsilon_t)dJ(\varepsilon)dF(y^A) > 0.$$

This establishes a key result. Public good provision affects positively citizens' beliefs regarding the performance of democracy. Notice that it should not be any impact if citizens were full informed regarding g. The next step is to understand how local politicians choose g and the incentives they face at choosing it in the context of a natural resource boom.

2.A.3. Incumbent's choice of the level of public good provision

I discuss now how incumbents decide the level of public good provision in a face of a resource boom and how that affects citizens' political support. Recall that, for a local politician, democracy is a public good and their decisions regarding public good provision are going to be determined by their goal of keeping power rather than solving the learning problem citizens' face about the effectiveness of democracy. So, I follow Caselli (2006) in modelling the electoral incentives of incumbents during a resource boom. I relate this to political support for democracy below.

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[93] This follows from the fact that: $\Pr(y^D \geq y^A \mid y_t^M) = \Pr(y_t^M - x_t \geq y^A) = \Pr(x_t \leq y_t^M - y^A) = H^M(y_t^M - y^A)$.

[94] For simplicity, I assume that both the central and local government have the same expectation regarding citizens' beliefs.

The basic logic of this section is to model the interaction between an incumbent and a potential competitor. The incumbent politician decides the present value of his consumption by allocating the local government budget between political rents and public goods. He faces the potential competition of an entrepreneur who has to decide whether to work in the industrial sector or to become a challenger for the incumbent. Production of industrial goods depends on the level of public goods. Therefore, the incumbent can avoid political competition by providing more public goods to citizens in the face of a resource boom, making the opportunity cost of becoming a political challenger high. However, this boom also makes more profitable for the entrepreneur to become a challenger since the value of holding power is higher as well. Hence, there is a threshold value of natural resource rents after which it is optimal for the incumbent underinvest in public goods. This is due to the fact that, from the point of view of the entrepreneur, the potential rents of controlling office are higher than the level of profits he would make given the provision of public goods. Then, the incumbent cannot prevent entry and therefore he maximizes the present value of his consumption by underinvesting in public goods. As a result, the model predicts a non-monotonic relationship between the level of natural resource rents and the level of political competition which is a consequence of a non-monotonic relationship between these rents and public goods provision. This non-monotonic relationship between public goods and natural resource rents also implies a non-monotonic relationship between rents and citizens' support for democracy given the results summarized in the previous section (equation A.5).

Consider a two-period simple local economy. In the first period, this economy has two sectors: a) a natural resource sector and b) a subsistence sector. The natural resource sector produces a per-period flow rent C which will be assumed to be exogenous and is completely appropriated by the local government (controlled by the incumbent mayor). Each agent in this economy can produce in the subsistence sector. For simplicity, the output w_t depends on the stock of a public good g_t provided by the local government. Under the assumption of a linear production function, $w_t = \rho_x g_t$ where ρ_x is an exogenous technological parameter. In the second period it is possible to engage in industrial production. This activity is assumed to be more efficient but requires management skills or talent[95]. A talented agent can hire l_t workers and produce an output $q_t = \rho_y g_t l_t$.

The incumbent mayor seeks to maximize the present value of his own consumption. In the first period the mayor in power is exogenously given. The other $N+1$ individuals are either talented or untalented. The talented individuals can choose between producing in the subsistence sector; becoming an entrepreneur and hiring workers for producing in the industrial sector; or becoming a challenger to the incumbent mayor and running for office. It is assumed that the skills needed for being an entrepreneur are the same for engaging in politics. The untalented can work either in the subsistence sector or be employed as workers for talented individuals. For simplicity, I assume that there is just one talented individual to avoid strategic interactions among talented

[95] We assume that $\rho_x < \rho_y$ to capture the idea that producing industrial goods is more efficient than producing subsistence ones.

agents is this basic setting. If the talented agent runs for election he wins office with (exogenous) probability γ. With probability $(1-\gamma)$ he losses the election and has to incur in a cost D. The incumbent politician stays in office if the talented agent decides not to run for office or if he loses the election. All agents are assumed to be risk-neutral.

The timing of the game is as follows. The incumbent, the initial level of public goods and mining canon rents are exogenously given in period 1. Then, the incumbent maximizes the present value of his consumption with respect to the level of investment in public goods for period 2. At the beginning of period 2, the talented agent decides to become an entrepreneur or to become a challenger to the incumbent mayor. At the end of period 2 an election takes place. If the talented agent decides not to become a challenger, or if he loses the election, the period-1 mayor continues in office. Otherwise, the talented agent becomes the new mayor.

The model is solved by looking first at the competitor problem. He basically compares the cost and benefit of running for election. In particular, he will run for election if the utility of being the mayor is higher than the profits of being an industrialist:

(2.A.6) $\gamma\left[C+\tau\rho_x g_2 N\right]-(1-\gamma)D>(1-\tau)\rho g_2 N,$

where τ is a producer tax. The left-hand side term is composed by two expressions. The first one is the local government revenue for period 2 weighted by the probability of winning the election. The second term represents the expected cost of losing the election. The right-hand term is the level of profits after tax of becoming an entrepreneur in the industrial sector where $\rho=\rho_y-\rho_x$. After rearranging these expressions we find that the talented agent will run for election if and only if:

(2.A.7) $\gamma c-[(1-\tau)\rho-\gamma\tau\rho_x]g_2>(1-\gamma)d,$

where $c=C/N$ is mining Canon revenues per-capita and $d=D/N$. It is clear that the role of public goods depends on the level of tax, the probability of winning the election and the productivity parameters. The second term in the left-side hand of equation 2 recovers the difference between the opportunity cost (profits) and the return from running for election. After re-arranging terms, I establish the following lemma:

Lemma 1: *the talented agent will run for election if* $g_2<g^*$*, where*

(2.A.8) $g^*=\dfrac{\gamma c-(1-\gamma)d}{(1-\tau)\rho-\gamma\tau\rho_x}.$

This solution shows that the incumbent politician has incentive to invest in public goods since by this mean the opportunity cost of the talented agent can be increased[96]. On the other hand, Lemma 1 also suggest that the required level of public good is increasing in c. This implies that

[96] This requires that $(1-\tau)\rho>\gamma\tau\rho_x$. This assumption implies that local economic development reduces political competition which seems plausible.

larger levels of c make more likely that the incumbent mayor will face more political competition and, as a consequence, he will need to invest more in g to prevent political competition.

The incumbent politician's problem is to maximize the present value of consumption with respect to public good investment I. Therefore, his objective function is the following:

(2.A.9) $c+\tau\rho_x g_1+Z(c+\tau\rho_y g_2)+(1-Z)(1-\gamma)(c+\tau\rho_x g_2)-I,$

where

$$Z=\begin{cases}1 \text{ if } g_2 \geq g^* \\ 0 \text{ if } g_2 < g^*\end{cases}$$

subject to

$g_2 = g_1 + I$

$I \leq \tau\rho_x g_1 + c$

g_1, c given.

The first two elements are the (exogenous) local government's revenues for period 1. The third and fourth terms are the second-period revenues which depend on whether the talented agent runs for election (recovered by the indicator function Z) and his probability of winning it. The first constraint is the production function for the public good which is assumed to be linear. The second constraint is the budget constraint for period 1.

In period 1 the incumbent politician solves this problem by comparing the costs and benefits of investing in public good g . Notice that if the incumbent expect the talented agent to become a challenger, then one unit of resources invested in providing the public good yield a return of $(1-\gamma)\tau\rho_x$. On the other hand, when no challenger is expected, this return will be equal to $\tau\rho_y$. I impose the assumption that $\tau\rho_y > 1$ which basically means that the return of investing in g is higher than its opportunity cost. I also assume that $(1-\gamma)\tau\rho_x < 1$, which essentially implies that if the incumbent politician does not expect to be able to prevent a challenger then he does not invest in public goods at all. Using these two assumptions, the problem can be solved. Hence, the resulting lemma is the following:

Lemma 2: *Whenever $g^h \geq g^*$ the incumbent politician uses all its resources in period 1 to provide public goods and there are no incentives for the talented agent to become a challenger in period 2. When $g^h < g^*$ the incumbent politician makes no investment in public goods in period 1 and the talented agent becomes a challenger in period 2.*

This key result establish a non-monotonic relationship between public good provision and incumbent's electoral incentives. The next step is to link this result with the level of natural resource rents per-capita in the following way:

Proposition 1: *If* $c > \frac{(1-\gamma)d + g_1(1+\tau\rho_x)[(1-\tau)\rho - \gamma\tau\rho_x]}{\gamma - (1-\tau)\rho + \gamma\tau\rho_x} \equiv c^*$, *then the incumbent makes no investment in public goods in period 1 and faces a challenger in period 2. Otherwise, the incumbent uses all his resources in period 1 to provide public goods and the talented agent does not choose to become a challenger in period 2.*

This constitutes the basic result of this simple model. It establishes a non-monotonic relationship between public good provision and natural resource rents per-capita.

2.A.4. Natural resource booms and political support for democracy

I collect the results from previous sections to summarize the relationship between political support for democracy and natural resource booms. I have shown in section 2 that public good provision affects citizens' perceptions regarding the effectiveness of democracy (equation A.5). In section 3, I have established that natural resource rents are non-monotonically related to public good provision (Proposition 1). It is natural to link both results in the following way:

Proposition 2: *If* $c > \frac{(1-\gamma)d + g_1(1+\tau\rho_x)[(1-\tau)\rho - \gamma\tau\rho_x]}{\gamma - (1-\tau)\rho + \gamma\tau\rho_x} \equiv c^*$, *then the incumbent makes no investment in public goods in period 1 and citizens' political support for democracy is low in period 2. Otherwise, the incumbent uses all his resources in period 1 to provide public goods and citizens' political support for democracy is high in period 2.*

Notice that this result is due to the fact that local incumbent politicians do not internalize the effect of their decisions regarding public good provision on support for democracy. They choose g to affect political competition because they are interested in their own political survival. Even if they care, the public good nature of democracy creates a free-riding problem.

The empirical content of this result suggests that natural resource boom have a non-monotonic relationship with political support. For modest booms, the incumbent does not face significant competition since rents are used to prevent entry of competitors via a higher provision of public goods. This in turn indirectly increases the level of citizens' support for democracy. On the other hand, for large increases in natural rents per-capita, the incumbent cannot prevent entry, being his optimal response to underinvest in public good provision. As a consequence, citizens' political support for democracy will be lower.

Chapter 3

Natural Resource Windfalls and Efficiency of Local Government Expenditures: Evidence from Peru[*]

[*] I thank assistance by Sarita Ore and Victor Huamani during the development of this project.

3.1. Introduction

The recent boom of natural resources in developing countries have renewed the interest of international media, policy-makers and scholars in old questions regarding the role of natural resources in economic development. Whereas the abundance of natural resources has been usually linked to poor economic and political performance (Sachs and Warner 1995, Karl 1997 and Ross 1999, among others), the empirical evidence in this regard is largely inconclusive.

This is particularly acute for the case of the fiscal consequences of resource booms. The dramatic increase of the international prices of oil, minerals and some agricultural products has been associated to an important expansion of fiscal resources in resource-rich countries which has created an extraordinary opportunity to improve peoples' living conditions. This is also true for the case of subnational governments, which have experienced large increases in their budgets as a consequence of the implementation of legal frameworks that grant them access to an important fraction of these fiscal resources in many countries around the world[97].

Whether subnational governments are using these fiscal resources in an efficient manner has become a critical issue in many countries in which these allocation rules are in place, yet very little is known about how these systems work in practice and how they may affect the behavior of subnational politicians. Media has particularly highlighted the cases of perverse behaviors committed by political authorities, in which these authorities are portrayed as inefficient and corrupt, but we lack of systematic evidence on this regard[98].

In this paper, we study the Peruvian experience to shed light on these issues exploiting subnational variation in natural resource rents induced by a set of rules about the allocation of a fraction of the taxes paid by mining companies to the districts where mineral resources were extracted. These rules are known as "mining Canon"[99] in the country. We are particularly interested in the role of natural resource rents in explaining the levels of efficiency of local governments in Peru, paying attention to the way in which these rents can distort the behavior of local politicians. This issue has recently attracted a lot of interest among scholars (Ardanaz 2012) since anecdotal and previous empirical evidence has shown that the fiscal expansions related to resource booms have not been accompanied by increases in public good provision and improvement in citizens' well-being (Caselli and Micheals 2013, and Ferraz and Monteiro 2012)[100], suggesting that these fiscal resources are being wasted.

To understand the link between natural resource rents and local government efficiency, we suggest studying the behavior of local politicians. Following some recent scholarship (Caselli 2006, Maldonado 2014), we believe that this relationship is non-monotonic. The basic idea is that resource booms are related to an increase in political competition due to an increase in the value of holding office. On the other hand, there is also to incumbent advantage since mayors have more

[97] For instance, Indonesia, Ghana, Colombia, Brazil, Bolivia, Canada, Australia, just to mention few countries, have implemented mechanisms that share part of taxes and royalties paid by extractive companies with subnational governments. See Brosio and Jimenez (sf) for an overview.

[98] See, for instance, Caselli and Micheals (2013) and Monteiro and Ferraz (2012) for evidence for Brazil. Hunt (2007) and Maldonado (2011) offers evidence on corruption of public officials from Peru.

[99] Originally, "Canon" is a Spanish word used in the country to refer a tax related to a specific activity. The current use refers to a rule by which a fraction of the revenues collected by the central government is allocated to sub-national governments.

[100] This common view has been challenged for new studies that suggest that the effect of resource boom can be beneficial (Aragon and Ruud 2013) or that there is non-monotonic pattern in terms of public good provision (Maldonado 2014).

fiscal resources to influence electoral outcomes. In a simple economy in which production of a commodity depends on a public good (like roads), the incumbent politician can prevent entry of a potential competitor by increasing the provision of this public good, increasing in this way the opportunity cost of becoming politician. The optimal response of the potential competitor would be to produce this commodity rather than becoming a politician. However, for higher values of natural resource rents, the value of holding office would be higher than the profits of commodity production, in which case the agent's optimal response would be to run for election against the incumbent politician. Since the probability of reelection is lower with the competitor's entry, the optimal response of the incumbent politician would be to increase his political rents and to reduce the provision of public goods. As consequence, a non-monotonic relationship between natural resource rents and public good provision is expected.

We relate this non-monotonic pattern to the efficiency of public expenditures. An increase in the levels of rents of small magnitude will have a limited impact in the value of holding office, being the incumbent able to prevent entry. As a consequence, limited political competition is observed, creating room for inefficient use of the local government budget since the mayor's position is not challenged but more fiscal resources are available. As the level of rents increases, the value of holding office increase as well, facing the incumbent more competition. However, since more rents are available, the incumbent has incentives to invest in more public goods to avoid entry. As a consequence, an increase in efficiency is observed. However, when the change in natural resource rents is large, the value of holding office is higher than the expected profit in the industrial sector for the potential competitor, so the mayor cannot prevent entry and reduces public good provision. This reduction can still be consistent with higher levels of efficiency since this indicator only reflects a ratio between fiscal resources and public goods, and mayors invest less in both when they expect not to be reelected. Therefore, we expect a non-monotonic relationship between natural resource rents and efficiency of local governments' expenditures.

The Peruvian case offers and ideal scenario to explore the impact of resource booms on the efficiency of local governments. The country is one of the most important mineral producers of the world[101], being one country in which the recent resource boom has had dramatic consequences. Mineral production has been multiplied by more than 5 (from 1,350 to 7,050 US millions) and rents distributed to producer regions increased by 118-fold (from 7 to 827 US millions) from 1996 to 2010. This extraordinary increase in a very short-period have created few rich municipalities that have experienced a dramatic increase in their budgets creating an ideal scenario to study the impact of natural resource windfalls on local government efficiency. A final reason, it is the nature of the local political arena in the country, characterized by its high level of fragmentation and weekly connection with national political parties, making the Peruvian case less sensitive to strategic interactions between local politicians and national political parties that may affect the rules of mining rents distribution.

Using a difference in difference approach with a quadratic specification to account for the non-monotonicity implied by the conceptual framework, we find consistent evidence regarding the non-monotonic relationship between mining Canon rents and public expenditures. We first document a non-monotonic impact of mining Canon rents on different types of expenditures, particularly investment. Local governments with modest level of mining transfers show a positive

[101] Currently, Peru is the 2nd producer of copper and silver, the 3rd of zinc and tin, the 4th in lead and molybdenum, and 6th in gold. See Ministerio de Energia y Minas (2012) for details.

net effect whereas those local governments with extremely high levels of these transfers this effect negative.

We then use a Free Disposal Hull approach to estimate the efficiency scores for a set of combination of expenditures and public goods in transport, infrastructure, health and education. These scores are essentially the same when they are estimated with an alternative approach called Data Envelopment Analysis. In a second stage, we relate these scores to mining Canon rents to evaluate the levels of association between them in a cross-sectional Tobit regression. We also find a non-monotonic pattern. For a local government with average level of mining Canon rents, the effect is negative implying that in these municipalities mining Canon rents are negatively associated with efficiency. On the other hand, for richer mining rents recipients, the marginal effect is positive, suggesting that richer local governments are more efficient.

After finding consistent evidence with the theoretical framework, we explore the role of political competition as the main mediator factor between mining Canon rents and efficiency in local government expenditures. We find robust evidence of a non-monotonic relationship between mining Canon rents and political competition along the lines of Maldonado (2014). The marginal effect is negative for the average municipality (implying a reduction in political competition) but positive for richer municipalities (with the opposite effect on political competition). Although this increase in efficiency may appear positive at first sight, the reduction observed in public expenditures -as well as a reduction in the provision of public goods for richer municipalities- offer a somewhat more negative interpretation. Due to higher political competition, the increase in efficiency along a reduction in public good provision may reflect the strategic response of incumbent politicians to increase their rents since their political horizons have been reduced. It can be also consistent with a substitution towards alternative forms of redistribution (like clientelism) to influence electoral outcomes in a more competitive political environment.

Our results are robust to an ample set of budgetary, socio-economic and geographical controls. They are also robust to alternative ways to derive the efficiency scores and are also valid after relaxing the distributive assumptions of the second-stage Tobit model using a censored quantile regression approach. They are also robust to the type of public good analyzed.

This paper is related to a recent literature that explores the economic and political effects of natural resource booms. One strand of the literature has explored the impact of resource booms in the behavior of politicians with respect to electoral outcomes like reelection and political competition (Monteiro and Ferraz 2012, and Maldonado 2014). Other scholars have explored the impact of resource booms on citizens' well-being via public good provision (Caselli and Micheals 2013, Loayza et. al. 2013, and Maldonado 2014) and demand of local inputs (Aragon and Ruud 2013). Other dimensions explored by researchers include corruption (Brollo et al 2013, Maldonado 2011 and Vicente 2010), politician quality (Brollo et al 2013), conflict (Angrist and Klueger 2008, Arellano 2011, Dube and Vargas 2013) and citizens' confidence in political institutions and democracy (Maldonado 2012).

This paper also contributes to a large literature about the efficiency of local governments. Alfonso and Fernandes (2008) for Portugal; Balaguer-Coll et al (2007), Gimenez and Prior (2007) and Benito et al (2010) for Spain; Borge et al (2008) and Revelli (2007) for Norway; Da Conceicao and Stosic (2005) for Brazil; De Borger et al (1994) and De Borger and Kerstens (1996) for Belgium; Kalb et al (2012) for Germany; Geys et al (2009a and 2009b) for Flanders; Stevens (2005) for England; Worthington (2000) for Australia; and Herrera and Francke (2007) for Peru are some examples in the literature. More closely related to this paper is Ardanaz (2012), who

studies the role of oil royalties in explaining the efficiency of local government expenditures for Brazilian municipalities.

The rest of the paper is organized as follows. Section 3.2 provides some basic details about the institutional setting. Section 3.3 introduces a basic theoretical framework whereas Section 3.4 describes the data. Section 3.5 presents the empirical methodology and section 3.6 presents the empirical results. Section 3.7 concludes the paper.

3.2. Institutional background[102]

Local Politics. Although local governments are an old institution in Peru, they were granted constitutional political autonomy for the first time in 1979. Currently, there are about 1645 local governments, 1840 if we include the provincial governments that also play the role of local governments in the provincial capitals (195 in total). According to the current legal framework, municipalities are governed by the major and a council, having the former a great discretionary power in municipal government decisions. Mayors are granted 50% plus 1 seats in the municipal council, no matter the share of votes. In practice, this has constrained the ability of local political parties from the opposition to exercise political accountability.

Due to the collapse of the national party system in the late 80s, national political parties play a minor role in local elections[103]. One of the consequences of the breakdown of the political party system is the lack of party loyalty, which is especially common among local politicians. Many majors were re-elected under different political brands over the past years. As a consequence, local politics is highly personalistic.

Although electoral rules allow local politicians a high degree of freedom, the weak institutional capacity of local governments works as an important constraint for their political behavior. Most of the local governments in the country lack of stable and qualified public servants[104]. Not surprisingly, investment capacity is low.

According to the current legal framework, local governments' responsibilities can be classified in exclusive and shared. The first category includes urban and rural development, regulation and management of local public goods, local government organization, local development planning, and execution and monitoring of local public infrastructure (World Bank 2010:37). On the other hand, shared functions require coordination with other government levels (either provincial, regional or central government) and include participation in management of school services, public health, culture, sports and recreation, citizen security, transport, housing, and social programs and waste management. In practice, this overlap of functions has shown to be problematic since it has caused coordination problems among different levels of governments, affecting the performance of economic development and social programs.

Local public finance. Local governments are highly dependent from central government transfers since their ability to collect taxes is very limited. For instance, 97% of taxes are collected by the central government (Polastri and Rojas 2007). At the same time, transfers from central government represent 57% of local governments' budget. A significant part of transfers from

[102] This section follows Maldonado (2014).

[103] There is a large literature about the collapse of the party system in Peru in late 80s. See Tanaka (2002), Roberts (2006) and Seawright (2012) for an explanation of the origins and consequences of this collapse.

[104] Using the Registro Nacional de Municipalidades (RENAMU), Maldonado (2014) have estimated that only 21% of the local public servants have permanent contracts whereas 50% have temporary ones. More relevant is the fact that only 19% of local public servants have professional degrees. Aragon and Casas (2008) and Ponce and McClintock (2014) offer additional evidence about the role of limited state capacity for the case of local governments.

central governments are allocated in the form of the Fondo de Compensacion Municipal (FONCOMUN) and the Glass of Milk program (56% and 10% of all intergovernmental transfers). These transfers are universally distributed among local governments[105]. The rest is allocated as targeted transfers. From these targeted transfers, Canon transfers (including all sources of Canon such as oil, hydropower, forest and gas Canon) represent a 91% of the total targeted transfers, being the mining Canon the most important one (79% of all Canon transfers). Therefore, mining Canon represents a significant fraction of local governments' budget in mineral-rich areas[106].

Mining legal framework. Mining is an activity with long tradition in Peru since colonial times. Historically, it has been associated to exploitation[107] and environmental degradation, which explains the negative perception that this activity has in areas where is performed. During the 90s, mining experienced a significant expansion because of a set of laws and regulations oriented to promote foreign direct investment in the sector as part of the market reforms introduced under the rule of Alberto Fujimori (1990-2001). As a consequence, mineral production grew at an average rate of 7.2% between 1992 and 2000 while the average GDP did so at a rate of 4.8%. This growth was mainly driven by the start of new large scale operations in copper, gold and silver production. Today, Peru is one of the most important producers of minerals in the world.

Along with the legal framework for promotion of mining activity, in 1992 the Central Government passed the first Mining Canon Law (DS 014-92 EM) which stated that a 20% of income tax should be allocated to the areas in which the profits were generated. In 2001, as part of the decentralization process, this law was modified to increase the participation of these areas. The most important law is the Law 27506 (known as the Canon Law),which states that the 50% of income tax paid by mining companies will be allocated to the regional and local governments located in the areas 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 the region where the resource is exploited (40%). In addition, a 5% is allocated to the public universities of the region. This distribution rule has been changed several times in order to precise the criteria used to allocate the transfers among the local governments located in the same province and region of the mineral producer districts. Appendix 1 presents the legal framework related to mining Canon and other mineral resource-based rents.

Fiscal windfall and the boom of mineral resources. Since early 90's, the production of mineral resources experienced a significant increase as a consequence of the policies implemented to attract foreign investment in the mining sector. Figure 1 presents the evolution of the real value of mineral production for period 1996-2010. After 2000, mineral production experienced an extraordinary increase of about 200%. It is interesting to note that the most important variation occurred before the increase in prices of natural resources in 2003, which suggests that most of the observed variation should be a consequence of the new regulatory framework in the mining sector implemented during the market reforms based on the Washington Consensus.

Although the increase in production played an important role in the recent mineral boom, more relevant was the increase of mineral prices. Figure 2 presents the evolution of the

[105] The allocation of these transfers among districts follow distribution rules based on population size, infant mortality, illiteracy rates and poverty indicators based on basic needs. Those interested in the details, can consult MEF (2014).
[106] For period 2001-2010, Canon transfers represented 31% of total budgets in mineral producer districts.
[107] The best example of this is the mining Mita, a labor-forced system implemented by the Spanish Crown during colonial times.

international prices of the four most important mineral resources produced by the country (copper, gold, silver and zinc) during the period of reference. As shown in the graph, these prices were quite stable from 1995 to 2003 and then underwent an extraordinary rise until 2010. In almost all the cases the prices were multiplied by two or three times in relation to the average prices before 2003.

As a consequence of the combined increase in prices and quantities, mining Canon transfers experienced an extraordinary increase. This was also accompanied by a change in the rule of allocation of mining Canon transfers that increased the participation of regional and local governments from the areas where mineral resources are extracted from 20% to 50%. Figure 3 describes that evolution. The amount of transfers due to royalties and mining Canon were relatively low (roughly 67 and 95 million of nuevos soles) during 2001 and 2002, having a spectacular increase since then[108]. This windfall was particularly beneficial for mineral producer districts due to the allocation rule, creating a highly unequal distribution of rents across local governments. For instance, the Gini coefficient for the distribution of rents for the period is 0.8. This is a critical element since previous evidence for the Peruvian case suggests that the behavior of municipalities with extraordinary high levels of mining Canon transfers is different than the average Canon recipient[109].

These inequalities are also reflected geographically. Due to geological factors, there is significant spatial variation in mineral production which implies that different areas are affected by different prices and consequently they are benefited by the mining boom in different ways. This suggests that the effects of the mining boom should be heterogeneous. Map 1 shows the allocation of mining Canon transfers for 2010, the final year for which we have data. We observe a clear pattern with concentration of Canon-rich districts in the south (Tacna, Moquegua and Cusco), center coast (Ancash) and north (Cajamarca). The jungle and the coast close to the frontier with Ecuador are the areas in which Canon-poor districts are located.

3.3. Theoretical framework

To understand the relationship between local government efficiency and natural resource rents it is critical to model the behavior of local politicians and political elites in the face of a resource boom. Based on recent theoretical scholarship, we suggest that this relationship might be non-monotonic. For instance, Caselli and Cunningham (2009) explore an ample set of mechanisms for explaining the so-called political resource curse based on the behavior of the elite (or, "centralized mechanisms" using the terms proposed by the authors). In their models, an increase in natural resource rents raises the value of staying in power but also political competition. Due to the first mechanism, the elite allocates more time and resources to keeping power affecting its effort on productive activities and inducing negative spillovers on the private sector. These resources can be allocated either to boost citizens' welfare (creating a blessing) or to repress them. In the second mechanism, the increase of rents makes challengers more aggressive which in turn reduces the leader's time horizon, lowering the incentives for developing the non-resource sector leading to a resource curse. However, the leader can also react by increasing productive investment and increasing the value of the outside option of the challengers in which case the final result

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

[109] Maldonado (2014) finds strong evidence of non-monotonic relationship between mineral rents and political competition, reelection outcomes, public good provision, public employment, local government expenditures and living standard measures. These non-monotonic effects are mainly driving by extremely rich municipalities in terms of mining rents.

would be a blessing. Whether the final outcome is a curse or a blessing would depend on which mechanisms dominate.

The basic take-away of Caselli and Cunningham (2009) is the existence of potential non-monotonic responses in the presence of a resource boom. The logic is that resource booms attracts more competitors (political competition effect) but at the same time provides more fiscal resources that incumbents can use in order to keep power (incumbency advantage effect). Which effect dominates is going to depend on the magnitude of the boom. This basic intuition is exploited in Maldonado (2014), who adapts this basic model to analyze electoral competition in the presence of exogenous natural resource rents. In a simple two-period model, an incumbent politician decides the present value of his consumption by allocating the local government budget between political rents and public goods. He faces the potential competition of entrepreneurs, each of whom has to decide whether to work in the industrial sector or to become a challenger for the incumbent. He also faces competition of other local politicians that are active in the political market.

The provision of public goods is critical in this setting given that they are key inputs for production. When there is a resource boom of a modest magnitude, the incumbency advantage effect is going to dominate over the political competition one. The incumbent can reduce political competition by providing more public goods to citizens, making the opportunity cost of being or becoming a political challenger high. For those already in the political market, the increase in public good provision increases the opportunity cost of being politicians because of the new economic opportunities associated with the expansion of the stock of public goods. As a consequence, some of them will leave the political market to become entrepreneurs, reducing in this way the levels of political competition. Along the same lines, those who are not yet politicians will stay out of the political market.

As natural resource rents increase, the difference between both effects reduces and eventually there will be a threshold after which the political competition one would dominate over the incumbency advantage. The logic for this result is the following: when the boom is large in magnitude, the value of holding office is higher than the potential profits entrepreneurs can make in the industrial/service sector. As a consequence, some of them will be select themselves into politics, increasing political competition. Those already in politics would stay in the political market for similar reasons. Since public good provision cannot prevent political competition, the incumbent's optimal response is to reduce the provision of public goods and to increase his political rents.

A natural extension of this framework is to link the effects on political competition with the incentives local politicians face in order to use efficiently local government budgets. When the increase of natural resource rents is modest, local politicians do not face significant political competition. In fact, some competitors will leave the political market to take advantage of the economic opportunities related to the expansion of the stock of public goods. This reduction is competition creates room to manage local government budget in an inefficient manner since the incumbent's position is not challenged but more fiscal resources are available. Of course, this inefficiency drops as the level of rents increases since the incumbent react by providing more public goods when political competition is higher. In this case, the incentives for local politicians to manage public budgets more efficiently are higher.

Therefore, we expect a non-monotonic relationship between the size of natural resource rents and the efficiency of local government expenditures. Below certain threshold, the relationship is negative since the levels of rents are not high enough for the value of holding office to dominate over the incumbent's use of natural resource to prevent entry. Since the political

horizon of the incumbent is not affected, he has room to manage the budget in an inefficient manner. After this threshold, this relationship is positive since more political competition creates incentives for the incumbent to use the budget is a more efficient manner since his political horizon is now reduced.

The relationship between political competition and local government efficiency suggested by this framework is consistent with alternative political economy models, although –to the best of our knowledge- this is the first paper that emphasizes a non-monotonic relationship[110]. Scholars from the Chicago School have always emphasized the efficiency of political competition (Stigler 1972 and Wittman 1989), but other scholars have suggested that high levels of political competition could lead to inefficient provision of public goods (Polo 1998 and Svensson 1998). The idea is that more political competition can create political instability, increasing the incentives to seeking for rents, which is consistent with Caselli (2006) and Caselli and Cunningham (2009) and several other models in political economy (for instance, Acemoglu and Robison 2006, and Lizzeri and Persico 2005). Recent theoretical and empirical contributions seem to suggest that the welfare-improving effects of political competition seem to be more relevant (Besley et al 2010 and Ashworth et al 2014), but -as Besley et al (2010)- argues there is no a general theoretical presumption that this will be always the case.

Our theoretical framework suggests that both approaches can be accommodated. The model predicts that more political competition increases efficiency but at the same time it reduces public good provision. Whereas most scholars in the efficiency literature seem to believe that more efficiency is related to more public good provision (Asworth et al 2014), there is no reason to believe that this should be always the case. At the end of the day, an efficiency indicator measures the maximum level of output for a given level of inputs. So, it is perfectly possible to observe a reduction in public good provision consistent with an increase in efficiency.

We test the empirical implications of this theoretical framework in the following sections.

3.4. Data

3.4.1. Data Sources

We constructed a unique dataset from several data sources. A key element is the data on revenues and Canon transfers from the central government at district level over the period 1998-2010. This information was collected from the Ministry of Economy and Finance. It 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). Critically, it covers information about different type of expenditures that are critical inputs to develop the efficiency indicators.

The information about public goods was obtained from different sources. The most important one is the Registro Nacional de Municipalidades (RENAMU). This source is a census of municipalities carried out by the statistical agency yearly since 2001. The second source is the Census 2007. We constructed public good measures at district level.

We also collected information on mineral production and prices. It covers the period 1996-2010 and was collected from the Ministry of Energy and Mines. The data are available for each production unit. We aggregate the information to the district level for each producer districts over the period.

[110] Besley et al (2010) also has a model that includes the possibility of non-monotonic effects but their outcomes of interest are not related to efficiency.

We also used electoral data for period 2002-2010 to evaluate the role of political factors in explaining local governments' efficiency. These data were collected from the National Office of Electoral Processes (ONPE). We construct an indicator of political competition based on the Herfindahl-Hirschman (HH) index of market competition adapted from Skilling and Zeckhouser (2002). This measure use vote shares to compute the complement of the HH index.

We use different sources to construct a set of control variables for the determinants of local governments' efficiency. From RENAMU, we created a set of geographical controls and socioeconomic characteristics for all the municipalities. Information for the period 2002-2010 is available for the analysis. We also took advantage of pre-boom data from the Census 1993.

3.4.2. Summary statistics

Table 3.1 presents basic summary statistics of the mining Canon transfers. We distinguish between three types of districts: producers, Canon recipients (excluding producers) and non-Canon recipients. On average, mineral producer districts received 475 nuevos soles per-capita during the period under analysis. This amount represents a 25% of the average monthly income per-capita in these areas. Canon recipient districts (excluding producers) receive 92 soles on average. These numbers do not take into account the extremes inequalities in the distribution of mining Canon transfers. For instance, whereas the percentile 90 of mineral producers gets 877 nuevos soles per-capita, the percentile 99 obtains 9,479 soles. This is evidence that, whereas a large number of districts receive this transfer, only few of them get it in large magnitudes.

Table 3.1 presents also descriptive statistics for a set of socio-economic characteristics for districts using Census 1993 data. The evidence suggests important differences among districts regarding population size, percentage of rural population and basic needs. This is expected since mineral production is performed in areas that have been historically exposed to poverty and exclusion, which is reflected in their basic needs indicators.

3.5. Empirical Methodology

The empirical methodology is composed of two elements. In the first place, we use a difference in difference (DD) model to study the impact of natural resource windfalls on local governments' budgets. The second element consists in the use of efficiency analysis to evaluate whether local governments in resource-rich regions are using the fiscal windfall in an efficient manner.

3.5.1. Testing the impact of resource windfalls on local governments' budget

The basic specification for the DD is as follows:

(3.1) $$e_{it} = \alpha_i + \phi_t + \beta f(MC_{it}) + X_{it}^{'}\delta + \varepsilon_{it}$$

where e_{it} is the budget outcome of interest for district i in period t. α_i and ϕ_t are respectively district and years fixed effects. $f(MC_{it})$ is a measure of mining Canon transfers per-capita allocated to district i in period t. $X_{it}^{'}\delta$ includes district level characteristics and ε_{it} is an error term. The parameter of interest is β which recovers the effect of interest. The time fixed-effects accounts for the time-series changes in our measures of fiscal revenues or expenditures. The district fixed-effects controls for time-invariant characteristics at district level and the MC_{jt} accounts for changes in dependent variable in treated districts associated to the movement of

mining Canon revenues after the increase of prices of mineral resources. Identification in this setting requires controlling for any systematic shock to fiscal revenues or expenditures of the districts benefited by the increase of prices of mineral resources that are potentially correlated with, but not a consequence of, the revenues shock[111].

We specify $f(MC_{it})$ as a quadratic function. The reason of this methodological decision is based on the theoretical literature about the resource curse that suggests the existence of a strong non-monotonic pattern in the relationship between resource rents and economic and political outcomes[112].

We perform some corrections to standard inference procedures. We cluster standard errors at district level to control for within group dependence. As pointed out by Moulton (1986), inference without accounting for within-group dependence can severely underestimate standard errors. This also corrects for serial correlation common to DD models as highlighted by Bertrand, Duflo and Mullainathan (2004)[113].

3.5.2. Efficiency analysis

The efficiency analysis is based on techniques of frontier analysis. Typically, these techniques estimate the efficiency of a set of units by selecting the combination of input-output that reflect the most optimal use[114]. Then, those units whose combination of inputs-outputs deviates from this optimal combination are considered as "inefficient". Since Farell (1957), two types of efficiency are recognized: *technical inefficiency*, which is related to a situation in which a unit is using more inputs than technically required to produce a given output; and *allocative inefficiency*, which implies a sub-optimal use of inputs given current input prices and marginal productivities (Herrera and Pang 2005). Given the lack of information regarding input prices, we focus on technical efficiency in this paper.

Several approaches have been developed to estimate the efficiency frontier. The two basic ways to classify these approaches depend on whether the frontier is parametrically or non-parametrically estimated, or on whether the approach is stochastic or deterministic. We use a common non-parametric technique called Free Disposable Hull (FDH) developed by Deprins et al (1984), a variant of Data Envelope Analysis (DEA). In this approach, the frontier is constructed as a piecewise envelopment of the data using linear programming (Kalb et al 2012).

Technically, the FDH solves a linear programming problem of the following form (Geys et al 2009):

(3.2) $Min_{\{\lambda_k, z_1, z_2, \ldots, z_n\}} \lambda_k$

[111] 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. For a discussion, see Angrist and Pischke (2009), chapter 6.

[112] Maldonado (2014) follows this approach. He also shows that the parametric quadratic specification is robust compared to alternative non-parametric approaches.

[113] 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.

[114] The modern literature on efficiency measurement dates back to Farell (1957). For a review of the literature with emphasis on local governments' performance, see Worthington and Dollery (2000).

Subject to: (3.2.1) $\lambda_k C_k - \sum_{j=1}^{n} z_j C_j \geq 0$

(3.2.2) $\sum_{j=1}^{n} z_j y_{jr} \geq y_{kr}$ with $r = 1, ..., s.$

(3.2.3) $z_j \in \{0,1\}.$

C_k and C_j are respectively the total input for municipalities k and j. The output r for these municipalities is denoted as y_{kr} and y_{jr}. The number of outputs is represented by s and n is the number of districts. Finally, z_j are weights given to municipalities that are compared to municipality $k$in order to compute the efficiency score λ .

An advantage of this technique is that avoids the use of strong assumptions regarding the functional form of the relationship between inputs and outputs that are common in the deterministic frontier approach (DFA) and the stochastic frontier approach (SFA)[115]. Also, this technique keeps the assumptions regarding production technology to a minimum compared to DEA and the parametric approaches (in particular, it imposes free disposability of resources). In particular, DEA with variable returns to scale (DEA-vrs) assumes that the best-practice frontier is strictly convex. This assumption has been questioned on empirical grounds (Cherchye et al 2000). In any case, to recover DEA-vrs, it is enough to modify the condition in (2.3) by the following expressions:

(3.2.3') $\sum_{j=1}^{n} z_j = 0.$

(3.2.4) $\lambda_k, z_j \geq 0$ for $j = 1, ..., n.$

To the sake of completeness, the DEA approximation for the case of constant returns to scale (DEA-crs) is composed by equations (3.2), (3.2.1), (3.2.2) and (3.2.4). Since constant returns to scale imply that municipalities can linearly scale inputs and outputs without affecting efficiency (Geys et al 2009), it is considered that DEA-crs is too restrictive. We will not pursue this particular variant of DEA in the rest of the paper.

Despite the FDH advantages, there are also limitations associated to this technique. In particular, the quality of the data and the presence of outliers are critical. We control this issue by dropping the outliers before estimating the frontier. As a robustness analysis, we also estimate the frontier under a DEA approach. Results are qualitatively similar.

A critical concern for this approach is accounting for exogenous or non-discretionary variables. As pointed out by Stevens (2005), failing to account for these variables leads to an overstatement of the level of inefficiency. Two approaches have been proposed to deal with this issue. The first method consists in directly incorporate the exogenous variables into the

[115] These two econometric approaches are used to estimating frontier production functions in which a theoretical production function represents an ideal against which empirical functions are evaluated to construct measures of inefficiency. When the difference between this ideal and the empirical observations for a set of units is associated solely to the inefficiency of the unit, we call this a *deterministic frontier function*. When this difference is related to inefficiency and a set of random factors such as luck or unexpected shocks, then we term this as a stochastic frontier production function. See Greene (2008) for an in-depth treatment of both approaches.

computation of the efficiency scores using a parametric approach. Typically this implies imposing some additional structure in the error term associated to this model. The original inefficiency term of the standard parametric approach is further decomposed into a fraction explained by the non-discretionary variables and a residual inefficiency term[116].

The second approach is the so-called *two-stage approach*. In this approximation, the frontier is estimated without controlling for the exogenous factors. Then, a Tobit regression is implemented to assess the relationship between the estimated efficiency scores and the exogenous factors. The basic specification is the following:

(3.3) $\hat{\lambda}_i = a + bf(MC_i) + Z_i'\gamma + v_i \geq 1,$

where $\hat{\lambda}_i$ is the efficiency measure for district i estimated in the first step, $f(MC_{it})$ is a measure of mining Canon transfers per-capita for district i, and Z_i is a set of control variables. Given the cross-sectional nature of this part of the empirical analysis[117], we use different set of control variables in order to remove selection bias. Besides the traditional budget and socio-economic controls, we take advantage of the fact that mineral production critically depends on geographical dimensions to provide a causal interpretation for the reduced-form results by including altitude, longitude, latitude, and distance to province capital along a set of dummy variables to account for locational characteristics and region fixed effects. The identification assumption in our preferred specification is that -once budgetary, socio-economic and geographical dimensions have been accounted for- the differences in mining Canon transfers across municipalities in the same region is as good as random. Finally, as standard in this case of models, v_i is assumed to be normal with a zero mean and constant variance.

There is a debate in the literature regarding the benefits and shortcomings of both approaches. One advantage of the first approach is its ability to jointly provide a way to correct for the omission of exogenous factors and provides parameters estimates for them. The cost is the reliance in stronger assumptions regarding the structure of the error term. On the other hand, the two-stage approach does not rely in parametric assumptions to estimating the efficiency scores but it is likely to provide biased results if the first-step model is misspecified. We use the two-stage approach since we prefer a more parsimonious approach.

The two-stage approach has been questioned in several grounds. Many scholars have found the Tobit's strong distributive assumptions hard to defend. To address this issue, we implement a quantile regression model for censored data (QRC) as suggested by Powell (1986). This approach has also the advantage of allowing covariates to shift location, scale, and the entire shape of the distribution (Chernozhukov et al 2002) which permits to analyze heterogeneous effects. One drawback of the original Powell's (1986) approach is that the objective function is not convex, creating computational problems that has severely limited its practical use. This issue is addressed using the algorithm developed by Fitzenberger (1996).

[116] See Kalb et al (2012) for a recent application of this approach.

[117] Recall that the estimation of efficiency scores requires the accumulation of several years of expenditures to allow for time for the public goods to be delivered/constructed. Therefore, we typically accumulate the expenditures between 2001 and 2006 (or 2007) for public goods in 2007 (or 2010). This aggregation converts our original panel dataset in a cross-section of municipalities.

Another concern is the serial correlation of the estimated efficiency scores, which put into question the standard inference procedures (Simar and Wilson 2007)[118]. In addition, the input C and the output y are correlated with MC and Z by construction, which implies that v is correlated with MC and Z. Although both problems disappear asymptotically, they do so at a low convergence rate. Simar and Wilson (2007) suggests to implement an alternative bootstrap algorithm to address these issues. However, recent work by Johnson et al (2012) suggests that these concern might be overstated and that standard two stage estimators are consistent even when correlation between inputs and contextual variables is allowed. Moreover, standard Tobit models do not necessarily require a structural interpretation if the researcher is willing to read efficiency scores simply as measures of distance to a best-practice frontier (Bogetoft and Otto 2011), although some structuralist scholars might find that questionable (Simar and Wilson 2011). Since these issues are related to the distributive restrictions implied in Tobit models, the QRC should address them.

A final point is related to the orientation of the efficiency model. In an *input-oriented model*, the emphasis in on the amount of inputs used to produce a given outcome. The *output-oriented model* pays special interest in the amount of output generated for a given level of input. We will focus on the input-oriented approach since it is the most common approach followed by the literature. This seems to be the most appropriate approach although the behavioral model behind might not be consistent with the current behavior of local government in our setting. An input-oriented approach basically assumes that outputs are exogenous and that local governments have a significant control over inputs whereas in the output-oriented approach the opposite is true. It is more realistic to expect the true behavioral model for local governments in our setting to be somewhere in the middle. Whereas local governments have most of their revenues exogenously determined, they do have some influence in the way the spend revenues to provide public goods. On the other hand, the decision regarding the quantity and type of provision of public goods are partly under their control. So, we follow the literature in its emphasis on an input-oriented approach.

We discuss the results of this approach in the following section.

3.6. Empirical Results

In this section, we present results for the two proposed exercises. In the first place, we study how the boom of natural resource has impacted local governments' budgets. We then analyze whether the windfall has affect the efficiency of local government expenditure. We finally explore the role of political competition as the basic channel that explains the reduced-form results.

3.6.1. The impact of resource windfalls on local governments' budgets

To evaluate the impact of fiscal windfall is local governments' budgets, we run the DD model discussed above. The dependent variables are measured in nuevos soles in prices of Lima in 2001 in per-capita terms. The mining Canon transfers are measured in thousands of nuevos soles in per-capita terms. We also include the log of the real value of mineral production to account for any potential change in municipality budgets directly related to mineral exploitation.

Table 3.2 presents the results for different type of expenditures. We found that mining Canon transfers are non-linearly related to most of the expenditures categories under study with

[118] This is due to the fact that the estimation of efficiency scores depends on all observations, which creates this correlation by construction.

the exception of "Other current expenses" and "Debt". In cases like "Payroll", "Pensions" and "Finance investment", only one of the coefficients of the quadratic relationship is statistically significant.

The most important impact is related to "Investment". This is not surprising since local governments are required by law to use mining Canon transfers exclusively in investment. To interpret these results, it is important to consider the level of transfers allocated to a municipality given the estimated non-monotonic relationship. Since the average municipality in the sample receives 130 nuevos soles per-capita, this basically means that the effect is positive and equal to 844 nuevos soles of investment for each thousand soles of mining Canon transfers for this type of municipality. These coefficients basically imply a positive effect in all the range of possible values (maximum is 18,100 nuevos soles per-capita), although the effect is smaller (almost 100 nuevos soles in investment expenditures for each thousand soles received). These effects represent an important increase of about 300% compared to the average investment (313 nuevos soles per-capita).

There is also an important effect in the expenditure on "Goods and services", yet the effects are way more modest. The average municipality experiences an increase of 109 nuevos soles in expenditures on goods and services for each thousand nuevos soles received as mining Canon transfer. For the richest municipality, this increase is about 20 nuevos soles per each thousand nuevos soles. With the exception of Payroll, mineral production does not affect the level of expenditures.

Table 3.3 presents results of the impact of fiscal windfalls on functional expenditures. We consider the nine most important functions of local government in Peru. We find a pattern consistent with the non-monotonic relationship suggested by the theoretical literature. All the coefficients for the level and the square of mining Canon transfers are strongly statistically significant for almost all the expenditures categories studied with the exception of "Health and sanitation" in which case the coefficient for the square is not statistically significant.

The type of expenditure most affected by mining Canon transfers is "Transport", which is again consistent with the current legal framework that favors investment in infrastructure. This type of expenditure has also other economic and political properties that convert it in one of the most attractive use of mining Canon revenues. It is usually associated to construction and maintenance of roads and sidewalks, which is highly intensive in low-skilled labor, being a common way politicians use in order to get political support from citizens. It also has the advantage of serving as a signal for politicians to show citizens their quality[119].

To gauge an idea about the net effect of mining Canon transfers on transport expenditures, we proceed in the same way as above. The average municipality experienced an increase of about 250 nuevos soles in transport expenditure for each thousand nuevos soles of mining Canon transfers. The net effect for a mineral resource rich-municipality is more modest and becomes even negative for few of the richest ones.

Besides "Transport", "Planning" and "Agriculture" are the expenditures categories more benefited from the resource windfall. According to Arellano (2011b), the increase in "Agriculture" can be explained by the interest of local politicians to compensate citizens from rural areas for the

[119] There is ample evidence of the use of these mechanisms in mineral rich districts. See, for instance, Gil (2009) and Salas (2010) for the case of the districts in the area of influence of the mine Antamina in Ancash, and Arellano (2011b) for mineral-rich districts in Pasco and Moquegua.

potential negative effects of mining activity. It usually takes the form of irrigation projects, seed distribution or similar programs.

To sum up, we have found in this section a strong positive relationship between mining Canon transfers and local government expenditures. In the next section, we will explore whether local governments have used these increase in budgets in an efficient manner.

3.6.2. Efficiency of local public spending

We first derive the efficiency frontier using the FDH approach. We focus on four sectors: transport, infrastructure, education, and health. Due to space constraints, we discuss the results for transport, although the basic results are mostly the same for the other sectors (results available in the Appendix 3.1). We focus on transport since, as discussed above, is the expenditure category that experienced the most dramatic increase as a consequence of the resource windfall. Following Herrera and Francke (2007), we use one outcome for the analysis: sidewalks and roads constructed in urban areas (in square meters). Figure 3.4 presents a histogram with the distribution of efficiency scores. These results suggest that local governments in Peru are very inefficient (mean score of 0.12). Figure 3.5 presents the efficiency frontier for the case of urban roads under the FDH approach.

Table 3.4 presents the results of the Tobit model for efficiency scores. All the transfers, budgetary and production variables represent averages for period 2001-2007. The efficiency scores were constructed for 2010 in order to account for some time for expenditures to be converted into public goods.

Column 1 presents the results of the simplest specification in which the level and square of mining Canon transfers are included. The relationship between the level of mining Canon transfer and the efficiency score is negative (coefficient of -0.391 and standard error 0.041) and strongly significant from a statistical point of view. The square is also strongly significant (coefficient of 0.191 and standard error 0.051). Since the average mining Canon per-capita for the period is 67 nuevos soles, this implies that the efficiency score for the average municipality is negatively associated to mining Canon transfers. Only for municipalities in the top 1% of mining Canon transfers distribution the net effect is positive.

This is illustrated in Figure 3.6 which presents the marginal effects for the previous specification. For local government with mining Canon transfers close to the mean, we have that the effect of mining Canon on efficiency is negative (marginal effect of -0.36808). This marginal effect becomes positive for districts with average mining Canon above 1,000 nuevos soles. The economic significance of these coefficients is important. Since the average value for the efficiency score is 0.12, the impact of mining Canon on efficiency is related to an effect size of 3 for a municipality with average level of mining Canon transfers.

Column 2 adds to the previous specification the average real of production (measured in logs) for the period under analysis. We found a negative association between efficiency scores and mineral production (coefficient of -0.002, standard error 0.000). This implies that resource-rich districts are less efficient than non-producer districts after controlling for natural resource rents. This is not surprising since in many mineral producer districts mining companies have assumed a more direct involvement in the provision of public goods like health facilities, schools, and roads, or even funding social and economic projects in order to get citizens support (social license) to develop their operations and reduce social conflict[120]. This may have induced some level of

[120] See Arellano (2011b) for a discussion.

inefficiency by local governments since citizens' attention is now targeted on what mining companies can directly provide to citizens.

Column 3 incorporates new fiscal variables to the previous specification. We add the average executed budget and the most important transfers from the central government, the municipal compensation fund (FONCOMUN). In both cases, the coefficients are negative and statistically significant, although the sizes of these coefficients are lower than the ones estimated for mining Canon.

Column 4, 5 and 6 add a set of control variables. Column 4 includes controls for pre-boom socio-economic characteristics using census data for 1993. These characteristics include population size, percentage of rural population, and indicators of basic needs. Column 5 adds geographical characteristics including altitude, latitude, longitude, a dummy variable for capitals of provinces, a dummy for districts located in the coast, and the distance to the capital of the province. Finally, column 6 adds region fixed effects.

Overall, the coefficients for the level and the square of mining Canon transfers retain their signs and levels of statistical significance after adding control variables. As expected, the size of these coefficients lowers as a consequence of including the control variables, but they are very robust. The economic significance of these estimates is important even for the last specification. The same robustness is observed for the case of mineral production and the average executed budget. The coefficient of FONCOMUN is no longer significant after controlling for pre-boom socio-economic characteristics.

Table 3.5 presents the results using a DEA approach. The estimated coefficients are pretty similar to the ones found using the FDH technique. However, it is important to emphasize that similarity in coefficients is neither always expected nor relevant for the validity of our results. In fact, one should typically find efficiency scores estimated under FDH assumptions to be higher than those estimated for DEA (see, for instance, Geys et al 2009). As highlighted by Balaguer-Coll et al (2007), more relevant is that the role of explanatory variables are robust to the chosen technique, which is the case in our setting. In addition, there is some consensus that what matters is the relative performance of local governments rather than the specific value of the efficiency scores estimated for each of them.

We present in the Appendix 3.1 additional evidence on this regard for other measures of public goods in education, health and infrastructure for both approaches. The results are consistent with the ones discussed in this section. In particular, the non-monotonic pattern in terms of the role of mining Canon in explaining the efficiency scores is consistent with the empirical evidence. In some cases, we have found that the specific estimated coefficients differ between FDH and DEA approaches, but that –as discussed before- it is not relevant for the validity of the analysis.

3.6.3. Explaining the basic results: the role of political competition

We have estimated a non-monotonic relationship between mining Canon transfers and public expenditures and their levels of efficiency. Based on the conceptual framework in section 3.3, we hypothesized that the dynamics of political competition matters for explaining the impact of mining Canon rents on the efficiency of local government expenditures. We formally test this mechanism in this section using longitudinal data.

Table 3.6 explores the impact of mining Canon transfers on political competition using a DD design. The dependent variable is the measure of political competition suggested by Skilling and Zeckhauser (2002) defined as one minus the Herfindahl index of vote concentration. We use

as a treatment variable the average per-capita mining Canon transfer (measured in thousands of nuevos soles in Lima 2001 prices) for the period that includes the election cycles 1998-2002, 2002-2006 and 2006-2010.

Column 1 presents the results for the specification in levels. There is no effect on political competition. However, when the square of mining Canon transfers (column 2) is included, both coefficients become statistically significant, suggesting that the linear approximation is not consistent with the empirical evidence. The coefficient associated with the transfer level is negative (-0.955), while the square is positive (0.053). The results are not altered when the logarithm of the real value of mineral production in the district is included (column 3), which suggests that changes in production levels associated with the mining boom have no impact on political competition.

Given the non-monotonic nature of the phenomenon under study, the interpretation of the results requires estimating the net effect for a given level of mining Canon rents. In this case, for a district with a level of per-capita mining Canon transfers similar to the average (109 soles per year), the total marginal effect is -0.94. In relation to the average of the measure of political competition, the size of the effect is very small, about 1%. This is because levels of political competition in Peru are very high due to political fragmentation (average of 83.15 for a measure whose maximum value is 100). The impact of mining Canon is negative for most of the districts except those with very high levels of per-capita mining rents. These districts are in the top 1% of the mining rents distribution.

Columns 4, 5 and 6 present the analysis for several sub-samples. First, column 4 excludes observations from Lima. Since Lima concentrates more than half the country's GDP, it is important to evaluate whether the study results are robust to the exclusion of districts located in this region. As implied by the size and signs of the coefficients, excluding the districts of Lima has a marginal impact on the basic results.

Column 5 shows the results of a specification that excludes observations from non-producing regions. The intuition of this specification relates to the definition of the relevant counterfactual scenario. Non-producing regions differ in several ways from producing regions so the use of the former ones as part of the counterfactual scenario could be problematic. Excluding non-producing regions from the sample restricts the comparison between mining Canon recipient districts that differ in terms of the magnitude of the rents they receive. In this scenario, the emphasis is on the intensity in which districts are treated. The econometric results suggest that this concern is not relevant in the context of this paper. The results for the level and the square are not substantially modified in terms of magnitude of the coefficients and level of statistical significance.

Column 6 follows the same logic as the previous exercise but this time only excludes from the sample non-producing provinces. Again, the main results are robust to the exclusion of these provinces in terms of the coefficient's magnitude and in relation to their levels of statistical significance. In all previous cases the logarithm of the real value of mineral production is not statistically significant, confirming that changes in mineral production have no impact on political competition.

The evidence provided in this section is consistent with the theoretical framework outlined above. Political competition seems to serve as a device that forces politicians to increase their levels of efficiency in terms of spending public resources. Although is tempting to conclude that this increase in political competition is good for citizens, the fact that the level of expenditures also show this non-monotonic relationship with mining Canon transfers casts doubts regarding this

apparently beneficial effect. Since more political competition is also associated to shorter political horizons for incumbent politicians, it is possible that mayors are just increasing rents and the joint reduction in expenditures and public good provision can be consistent with an increase in efficiency.

3.6.4. Explaining the basic results: the role of public good provision

We turn now to the discussion about the role of public good provision. We evaluate here whether mining Canon revenues are non-monotonically related to the provision of urban roads per-capita. We estimate a cross-sectional least square specification similar to the one used in the Tobit analysis. Standard errors are clustered at district level. Results are presented in Table 3.7.

We find strong evidence in favor of the non-monotonic pattern previously suggested. The coefficients for the level of mining Canon and its square are strongly significant and with the expected signs. For the average municipality in the sample in terms of mining Canon transfers, the net impact is 2.895, which represents an effect size of 3.91 (mean urban roads square meters per-capita of 0.74). On the other hand, a municipality located at the 99 percentil experiences a net impact of -0.272 (negative effect size of 0.368).

Except the case of column 5, results are robust to the inclusion of budgetary, socio-economic and geographical/regional controls. In our preferred specification (column 6), the effects are larger. The net impact for the average municipality is 3.96 (effect size of 5.36).

In sum, the evidence is consistent with the theoretical framework. We evaluate the robustness of our results in the next section.

3.6.5. Robustness

We provide in this section additional evidence regarding the robustness of our results. The Appendix 3.1 to this paper already provides additional evidence with respect the non-monotonic relationship between mining Canon rents and efficiency scores for other public goods. In this section, we relax the strong distributive assumptions associated to Tobit models using QRC model suggested by Powell (1986). Inference was conducted using the resampling approach suggested by Bilias et al (2000).

Table VIII presents the result of the empirical exercise. We consider an input-oriented FDH model for the case of urban transport as benchmark using our preferred specification with region fixed effects and controls for budgetary, socio-economic and geographical variables. We follow the current practice in quantile regression models of estimating results for different conditional quantiles. In particular, we use quantiles 0.1, 0.3, 0.5, 0.7 and 0.9 in the analysis.

The evidence suggests a pattern consistent with the non-monotonic case previously discussed. Although some of the coefficients are estimated with less precision for the case of the extreme quantiles (0.1 and 0.9), the qualitative results are essentially the same. Interestingly, the results suggest that, conditional on the set of control variables discussed above, the impacts of mining Canon transfers are larger for the most efficient municipalities. For instance, the net effect is negative (-0.278) for the municipalities at the ninth decile of the conditional efficiency distribution, assuming the average mining Canon transfer of 67 nuevos soles for the period 2001-2007. This represent a reduction of 2.4 times the average level of efficiency in the sample (0.11). On the other hand, municipalities at the first decile have a net effect of -0.034, which represent a reduction of 29% with respect to the average level of efficiency in the sample.

It is interesting to note that results under standard quantile regression are pretty similar (see Figure 3.A.1 in the Appendix to this paper). This is not surprising if we take into account the fact that very few observations are close to the upper value of 1. Therefore, censoring seems not to be a significant problem in the sample.

To summarize, the evidence presented in this paper seems to be robust to relaxing the distributive assumptions associated to Tobit models. The results in this section also provides evidence regarding heterogeneous effects of mining rents.

3.7. Concluding Remarks

This paper analyzes how fiscal windfalls related to natural resource booms affect the efficiency of local governments' expenditures. Consistent with a basic theoretical framework that highlights the non-monotonic responses associated with resource booms, we estimate a negative impact of natural resource rents on efficiency for the districts with average level of mining Canon transfers but positive effects for the case of extremely resource-rich districts. These effects are explained by the strategic behavior of local politicians in a face of a resource boom which in turn affects the provision of public goods and as a consequence the level of efficiency in the use of local government budget.

The results of this paper calls for a more nuanced view regarding the role of resource booms on efficiency and public good provision. Whereas most of the existing evidence has suggested very modest impacts of resource booms in public good provision and increases in inefficiency, some new scholarship and the evidence presented in this paper suggest that these effects are not necessarily monotonic. Given the magnitude of the shock in natural resource rents, it might be the case that previous studies are simply capturing only part of the phenomena. However, the increase in efficiency for extremely mineral-rich regions does not necessarily represent good news since is related to reductions in public good provision. I believe this is an issue that requires more future research.

Despite these results, it is important to emphasize that this perverse increase impact of political competition in efficiency is only valid for few districts with extraordinarily high levels of mining rents. For most of the local governments in the sample, the increase in mining rents seems to be related to larger levels of inefficiency, a finding consistent with the existing literature. One key contribution of this paper is to show that the relationship between natural resource rents and efficiency is quite more complex. I also emphasize the role of political competition in this regard. I believe that scholars interested in understanding the determinants of local government efficiency would be better-off by incorporating political factors into the analysis in innovative ways. I hope our paper can be seen as an example in that direction.

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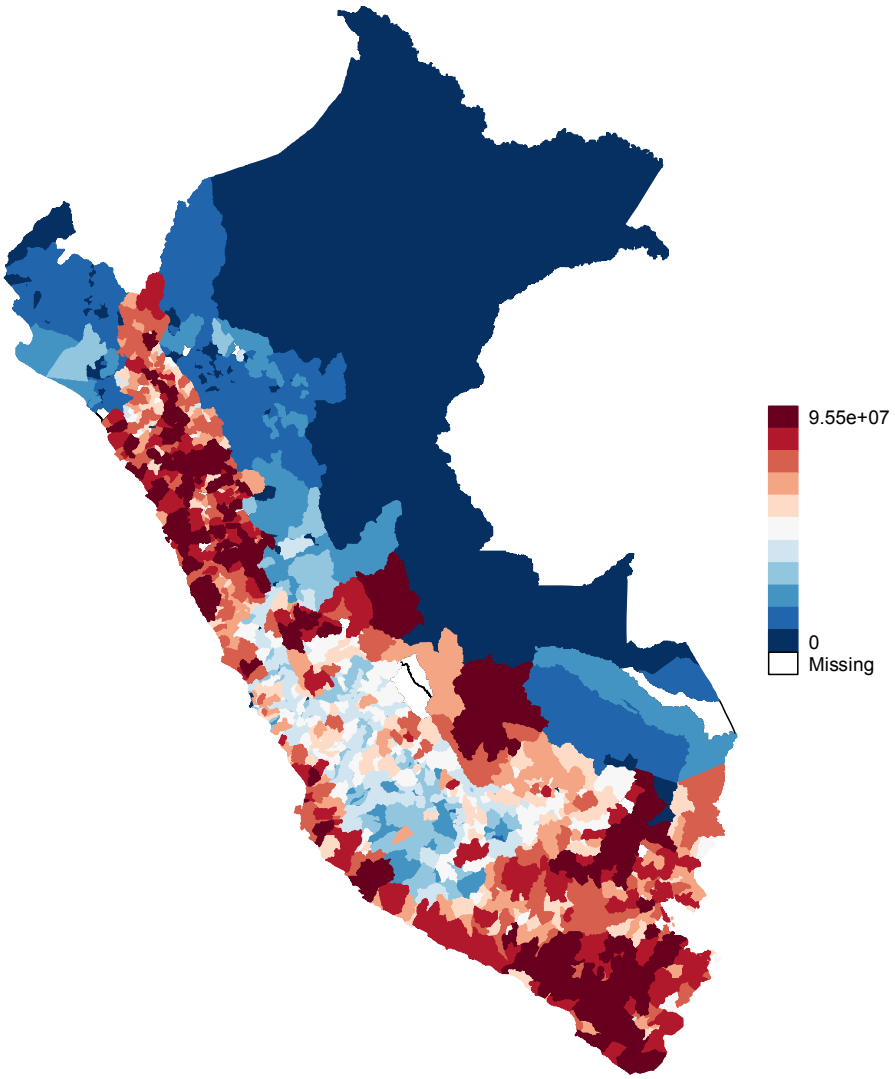
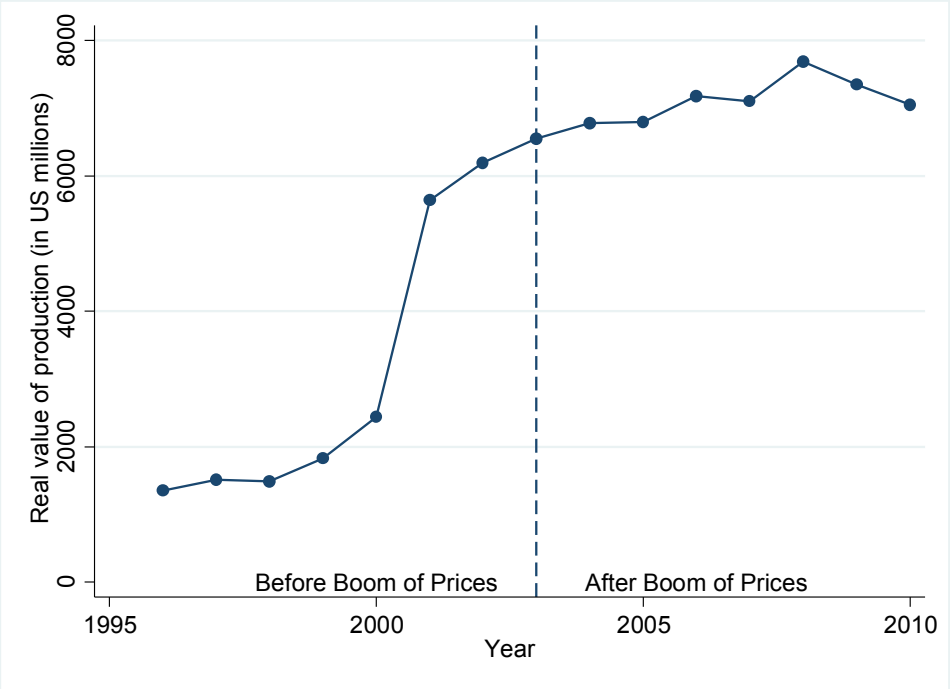
Map 3.1: Mining Canon allocation (2010)



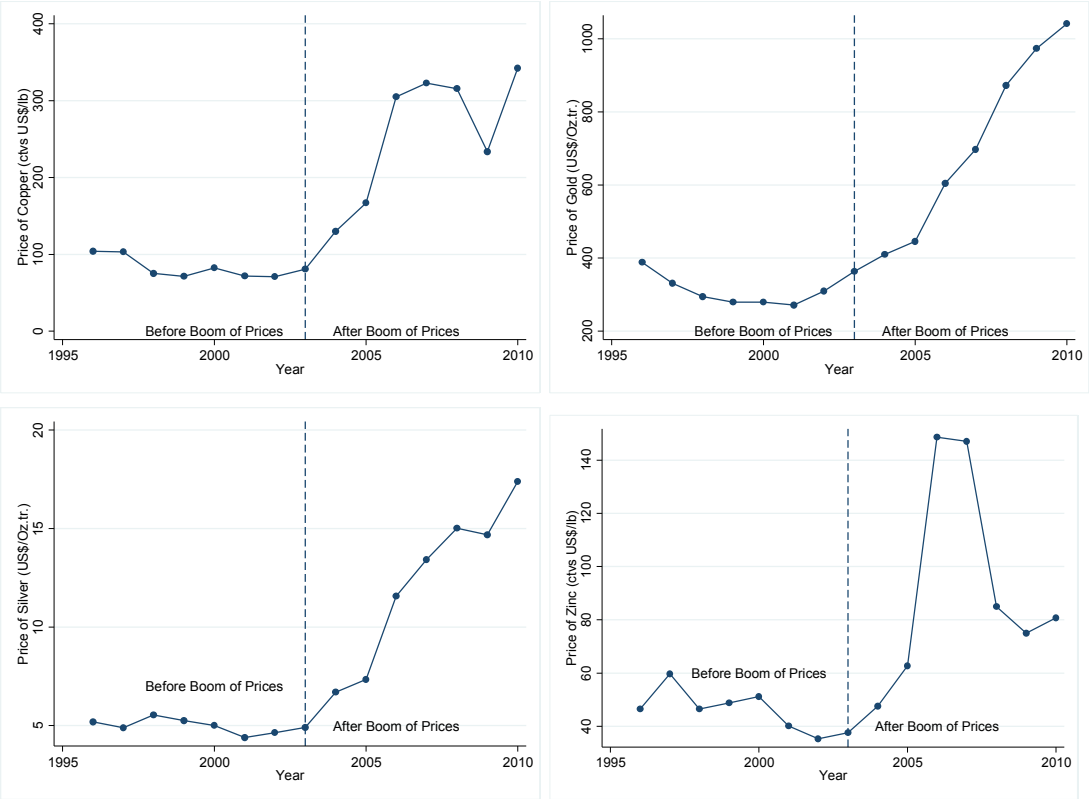
Source: Own elaboration based on administrative data from Ministry of Economy and Finance.

Figure 3.1: Evolution of Mineral Production



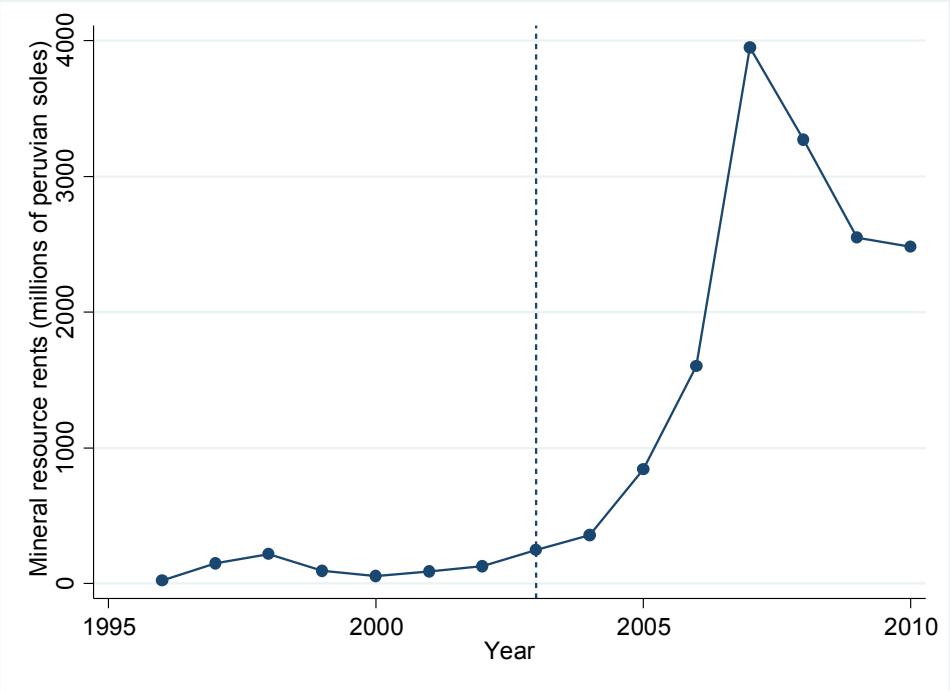
Source: Own elaboration based on administrative data from the Ministry of Energy and Mines. Calculations based on real production values in 2001 prices. Vertical line for year 2003, considered the year in which the boom started.

Figure 3.2: Evolution of Mineral Prices



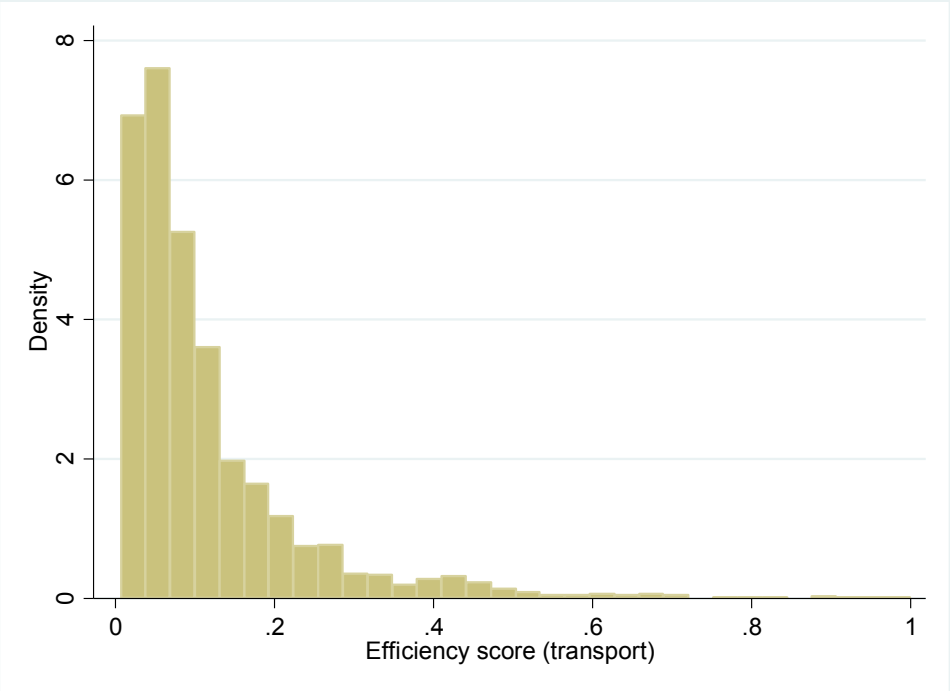
Source: Own elaboration based on administrative data from the Ministry of Energy and Mines. Vertical line for year 2003, considered the year in which the boom started.

Figure 3.3: Evolution of mining Canon rents distributed to local goverments (1996-2010)



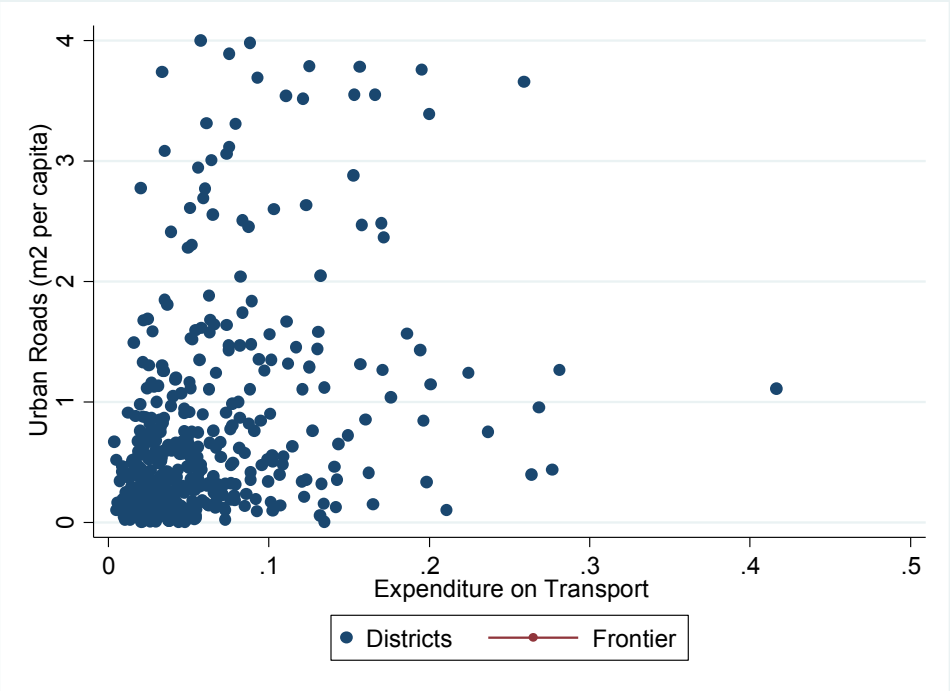
Source: Own elaboration based on administrative data from the Ministry of Economy and Finance. Monetary values expressed in 2001 Lima prices. Vertical line for year 2003, considered the year in which the boom started.

Figure 3.4: Histogram of efficiency scores for transport sector



Source: Own elaboration based on an input-oriented Free Disposal Hull model. The input is the average expenditure on transport for period 2001-2007. The output is square meters of urban roads per-capita in 2010.

Figure 3.5: Efficiency frontier for transport



Source: Own elaboration. The input is the average expenditure on transport for period 2001-2007. The outcome is square meters of urban roads per-capita in 2010.

Figure 3.6: Marginal effects of the impact of mining Canon on local government efficiency

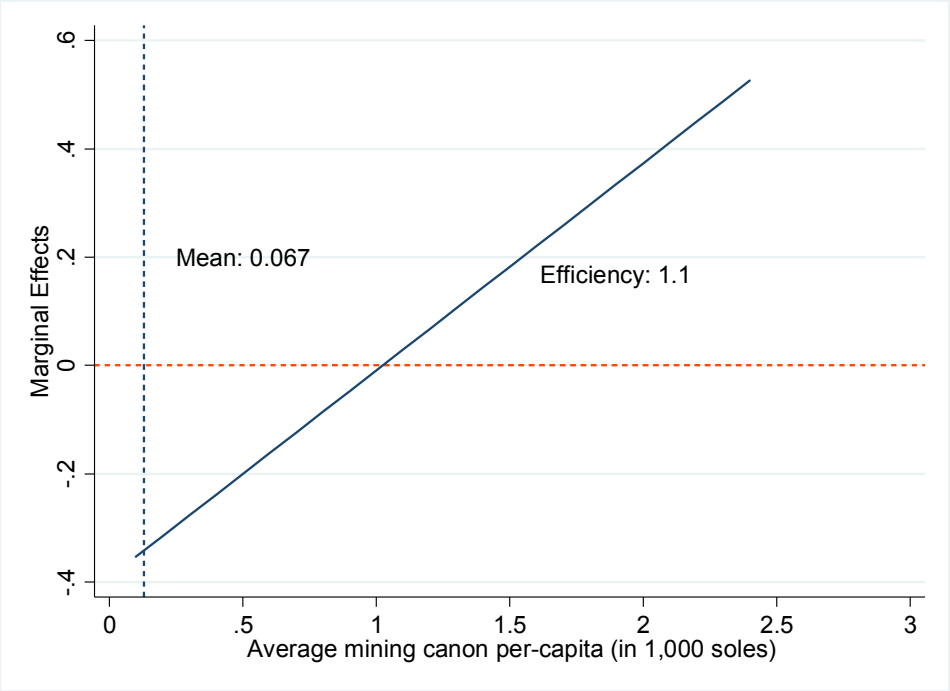


Table 3.1: Summary Statistics

	Recipients	Producers	Non-recipients
I. Transfers			
Mining Transfers (per-capita)	92.32	474.47	-
p10	0.09	0.39	-
p25	0.70	2.64	-
p50	4.92	27.75	-
p75	44.04	281.85	-
p90	179.31	877.38	-
p99	1,272.58	9,479.57	-
Municipality Budget (per-capita)	568.03	1,496.52	347.17
II. Mineral Production			
Real Value of Mineral Production (US$ in 2001)	-	2,324,875	-
Copper	-	898,122	-
Zinc	-	490,013	-
Lead	-	69,880	-
Tin	-	134,851	-
Molybdenum	-	17,171	-
Silver	-	219,311	-
Gold	-	466,456	-
Iron	-	29,070	-
III. District Characteristics: Census 1993			
Population	12,339	10,788	22,618
% Rural Population	57.76	55.32	59.08
% Children (0-15 years old)	40.68	40.58	45.14
Malnutrition rates for Children	55.61	53.02	55.64
% Population without wastepipe-latrine	41.81	41.60	53.91
% Population without water	51.20	49.84	67.13
% Population without electricity	74.16	65.27	68.55
Female illiteracy rate	33.60	29.39	23.90
Altitude	2,326	2,720	498

Source: Own.

Table 3.2: Impact of Natural Resource Booms on Local Government Expenditures

	Difference in Difference Estimates							
	Payroll	**Pensions**	**Goods and Services**	**Other Current Expenses**	**Investment**	**Finance Investment**	**Other Capital Expenditures**	**Debt**
Mining Canon per-capita	54.217*	0.307	119.261***	-0.147	936.501***	-0.030	9.159**	-0.226
	(31.269)	(0.208)	(29.923)	(0.439)	(68.537)	(0.019)	(4.223)	(0.934)
Mining Canon per-capita^2	-1.605	-0.018**	-3.009**	0.025	-26.704***	0.001	-0.455*	0.088
	(1.172)	(0.007)	(1.187)	(0.020)	(2.053)	(0.001)	(0.240)	(0.080)
Log of (1+Real Value of Production)	-0.551*	-0.004	-0.680	-0.073	3.775	-0.003	0.099	0.217
	(0.319)	(0.053)	(0.542)	(0.060)	(3.717)	(0.003)	(0.172)	(0.161)
Mean dependent variable	34.13	5.21	96.89	14.17	313.66	0.01	4.43	16.58
Number of observations	17,317	17,317	17,317	17,317	17,317	17,317	17,317	17,317
R2	0.101	0.721	0.238	0.043	0.488	0.002	0.019	0.083

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. Dependent variables are measured in per-capita terms.

Table 3.3: Impact of Natural Resource Booms on Local Government Expenditures

	Difference in Difference Estimates								
	Planning	**Agriculture**	**Social Assistance**	**Education and Culture**	**Energy and Natural Resources**	**Industry, Trade and Services**	**Health and Sanitation**	**Transport**	**Housing and Urban Development**
Mining Canon per-capita	269.258***	172.590***	34.600***	178.123***	14.972***	26.074***	108.534***	279.371***	38.571***
	(51.112)	(29.931)	(3.623)	(15.997)	(2.310)	(4.732)	(20.848)	(58.986)	(5.432)
Mining Canon per-capita^2	-7.611***	-4.757***	-0.410**	-6.152***	-0.556***	-1.011***	-1.872	-9.952***	-1.348***
	(1.964)	(0.987)	(0.171)	(0.879)	(0.089)	(0.153)	(1.649)	(1.810)	(0.239)
Log of (1+Real Value of Production)	-1.287	0.310	0.167	2.048	-0.349	-0.151	1.175	-0.529	0.329
	(0.962)	(0.824)	(0.353)	(1.673)	(0.303)	(0.293)	(1.175)	(1.386)	(0.352)
Mean dependent variable	164.89	38.46	42.95	57.99	13.80	9.25	66.66	68.29	20.24
Number of observations	17,317	17,317	17,317	17,317	17,317	17,317	17,317	17,317	17,317
R2	0.296	0.144	0.116	0.259	0.032	0.058	0.232	0.219	0.051

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. Dependent variables are measured in per-capita terms.

Table 3.4: Determinants of Local Government Efficiency

(Urban Transport using an input-oriented FDH model)

	Tobit Model					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Average Mining Canon per-capita	-0.391***	-0.378***	-0.244***	-0.207***	-0.199***	-0.132***
	(0.041)	(0.038)	(0.040)	(0.040)	(0.043)	(0.041)
Average Mining Canon per-capita^2	0.191***	0.188***	0.166***	0.153***	0.141***	0.087***
	(0.051)	(0.046)	(0.044)	(0.040)	(0.037)	(0.020)
Log of (1+Real Value of Production)		-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average FONCOMUN per-capita			-0.054**	-0.033	-0.008	-0.047
			(0.025)	(0.026)	(0.030)	(0.032)
Average Budget per-capita			-0.079***	-0.086***	-0.082***	-0.065***
			(0.016)	(0.017)	(0.019)	(0.018)
Socio-economic controls	No	No	No	Yes	Yes	Yes
Geographical controls	No	No	No	No	Yes	Yes
Region Fixed Effects	No	No	No	No	No	Yes
Number of observations	1,793	1,793	1,793	1,755	1,386	1,386

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White robust standard errors. The Mining Canon variable and its square are measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. All independent variables are averages for period 2001-2007. The efficiency score variable is measured for period 2001-2007. The variable used for its construction is the Urban Roads (square meters per-capita) using expenditures on Transport. The technique used was the input-oriented Free Disposal Hull (FDH). Socio-economic controls include population in 1993, percentage of rural population in 1993, population living in houses with inadequate physical characteristics in 1993, population living in households with children that are not enrolled in school in 1993, population living in overcrowded houses in 1993, population living in houses without wastepipe in 1993, and population living in houses with high economic dependency in 1993. Geographical controls include altitude, longitude, latitude, dummy for being province capital, dummy for being for being a coastal district and the distance to the capital province.

Table 3.5: Determinants of Local Government Efficiency

(Urban Transport using an input-oriented DEA model)

	Tobit Model					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Average Mining Canon per-capita	-0.388***	-0.375***	-0.271***	-0.233***	-0.249***	-0.157**
	(0.041)	(0.038)	(0.051)	(0.052)	(0.060)	(0.063)
Average Mining Canon per-capita^2	0.185***	0.182***	0.159***	0.145***	0.142***	0.080***
	(0.049)	(0.044)	(0.041)	(0.036)	(0.036)	(0.020)
Log of (1+Real Value of Production)		-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
		(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Average FONCOMUN per-capita			-0.100***	-0.082**	-0.073	-0.100**
			(0.037)	(0.039)	(0.047)	(0.051)
Average Budget per-capita			-0.054*	-0.063**	-0.052	-0.038
			(0.028)	(0.030)	(0.035)	(0.036)
Socio-economic controls	No	No	No	Yes	Yes	Yes
Geographical controls	No	No	No	No	Yes	Yes
Region Fixed Effects	No	No	No	No	No	Yes
Number of observations	1,793	1,793	1,793	1,755	1,386	1,386

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White robust standard errors. The Mining Canon variable and its square are measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. All independent variables are averages for period 2001-2007. The efficiency score variable is measured for period 2001-2007. The variable used for its construction is the Urban Roads (square meters per-capita) using expenditures on Transport. The technique used was the input-oriented Data Envelopment Analysis (DEA). Socio-economic controls include population in 1993, percentage of rural population in 1993, population living in houses with inadequate physical characteristics in 1993, population living in households with children that are not enrolled in school in 1993, population living in overcrowded houses in 1993, population living in houses without wastepipe in 1993, and population living in houses with high economic dependency in 1993. Geographical controls include altitude, longitude, latitude, dummy for being province capital, dummy for being for being a coastal district and the distance to the capital province.

Table 3.6: Impact of Natural Resource Booms on Political Competition

Average Transfers for Electoral Cycle	Difference in Differences Estimates					
	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: (1-Herfindahl Index)*100					
Mining Canon per-capita	-0.324	-0.955**	-0.948**	-0.932*	-0.853*	-1.066**
	(0.247)	(0.473)	(0.473)	(0.475)	(0.478)	(0.518)
Mining Canon per-capita^2		0.053**	0.053**	0.053**	0.048*	0.062**
		(0.024)	(0.024)	(0.025)	(0.025)	(0.026)
Log of (1+Real Value of Production)			-0.022	-0.017	-0.021	-0.016
			(0.057)	(0.061)	(0.057)	(0.057)
Excluding Lima	No	No	No	Yes	No	No
Excluding Non-producer Regions	No	No	No	No	Yes	No
Excluding Non-producer Provinces	No	No	No	No	No	Yes
Number of observations	4,162	4,162	4,162	3,746	3,386	2,138
R2	0.132	0.133	0.133	0.141	0.143	0.160

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. All specifications include district and year fixed effects. The treatment variable is measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001.

Table 3.7: Public Good Provision

Urban Transport

	Cross-sectional Ordinary Least Squares Model					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Average Mining Canon per-capita	3.152***	2.976***	1.957**	2.166**	1.654	4.391**
	(0.812)	(0.845)	(0.852)	(0.900)	(1.135)	(1.930)
Average Mining Canon per-capita^2	-2.140**	-1.993**	-1.857**	-2.106**	-1.458	-3.514**
	(0.876)	(0.895)	(0.824)	(0.885)	(1.087)	(1.680)
Log of (1+Real Value of Production)		0.013	0.011	0.011	0.009	0.000
		(0.013)	(0.011)	(0.012)	(0.014)	(0.013)
Average FONCOMUN per-capita			1.505*	1.129	3.593***	3.096**
			(0.817)	(0.870)	(1.272)	(1.444)
Average Budget per-capita			0.652***	0.616***	0.368	0.476**
			(0.227)	(0.221)	(0.228)	(0.214)
Socio-economic controls	No	No	No	Yes	Yes	Yes
Geographical controls	No	No	No	No	Yes	Yes
Region Fixed Effects	No	No	No	No	No	Yes
Number of observations	438	438	438	430	303	303

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White standard errors clustered at the district level. The Mining Canon variable and its square are measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. All independent variables are averages for period 2001-2007. Socio-economic controls include population in 1993, percentage of rural population in 1993, population living in houses with inadequate physical characteristics in 1993, population living in households with children that are not enrolled in school in 1993, population living in overcrowded houses in 1993, population living in houses without wastepipe in 1993, and population living in houses with high economic dependency in 1993. Geographical controls include altitude, longitude, latitude, dummy for being province capital, dummy for being for being a coastal district and the distance to the capital province.

Table 3.8: Determinants of Local Government Efficiency

(Urban Transport using an input-oriented FDH model)

	Censored Quantile Regression Model (Powell 1986)				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Average Mining Canon per-capita	-0.038	-0.055*	-0.107**	-0.143**	-0.303**
	(0.030)	(0.033)	(0.044)	(0.059)	(0.130)
Average Mining Canon per-capita^2	0.032*	0.054**	0.076**	0.103**	0.206
	(0.021)	(0.028)	(0.034)	(0.050)	(0.129)
Log of (1+Real Value of Production)	-0.001**	-0.001*	0.000	-0.001**	-0.002*
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Average FONCOMUN per-capita	-0.012	0.006	-0.016	-0.036	-0.095
	(0.020)	(0.015)	(0.023)	(0.027)	(0.074)
Average Budget per-capita	-0.040***	-0.055***	0.041**	-0.054***	-0.041
	(0.013)	(0.011)	(0.017)	(0.017)	(0.034)
Socio-economic controls	Yes	Yes	Yes	Yes	Yes
Geographical controls	Yes	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes
Quantile (tau)	0.10	0.30	0.50	0.70	0.90
Number of observations	1,386	1,386	1,386	1,386	1,386

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Bilias's et al (2000) standard errors. The Mining Canon variable and its square are measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. All independent variables are averages for period 2001-2007. The efficiency score variable is measured for period 2001-2007. The variable used for its construction is the Urban Roads (square meters per-capita) using expenditures on Transport. The technique used was the input-oriented Free Disposal Hull (FDH). Socio-economic controls include population in 1993, percentage of rural population in 1993, population living in houses with inadequate physical characteristics in 1993, population living in households with children that are not enrolled in school in 1993, population living in overcrowded houses in 1993, population living in houses without wastepipe in 1993, and population living in houses with high economic dependency in 1993. Geographical controls include altitude, longitude, latitude, dummy for being province capital, dummy for being for being a coastal district and the distance to the capital province.

Annex 3.1: Rules for mining Canon distribution

Transfer	Use / Destination	Constitution base	Form of allocation of the resources	Legal base
(1) Canon 1 /	Public Investment 2 /	* 50% Income Tax 3/	* 10% to the municipalities in the district where the natural resource is located. * 25% to the municipalities of the province where the natural resource is located. * 40% to municipalities in the region where the natural resource is located. * 40% to municipalities in the region where the natural resource is located. * 25% to regional government (80% CR and 20% for regional universities).	* Constitution of Peru (Article 77) assigns to districts a share of income received by the State due to the exploitation of natural resources. * Law 27,506, Canon Law (July 10, 2001) establishes the allocation rule to local and regional governments. * Supreme Decree 005-2002-EF, regulation of Canon. * Law 28,077 (September 26, 2003) and Law 28,322 (August 10, 2004) amended several articles of the Canon Law. These modification were regulated by Supreme Decree 029-2004-EF and EF-187-2004, respectively.
(2) Mining Royalty	Public Investment	* % on the value of minerals (or its equivalent) sold according to international prices.	* 20% to the local municipality where the mining concession is located. * 20% to the municipalities of the province where the mining concession is located. * 40% to the municipalities of the region where the mining concession is located. * 15% to the Regional Government. * 5% to the universities.	* Law 28258, Law of Mining Royalty (June 24, 2004), that establishes the mining royalties, its constitution, determination, administration, distribution and use. * Law 28323, Law that modifies the Law of Mining Royalty (August 10, 2004). * Supreme decree 157-2004-EF, Regulation of the Law of Mining Royalties (November 15, 2004). * Supreme decree 018-2005-EF, which dictates complementary norms of the regulation of the Law of Mining Royalties (January 29, 2004). * Ministerial resolution 163-2006-EF-15, which establishes the exchange rate and rank for the payment of mining royalties (March 22, 2006).

1. It includes mining, oil, hydropower, fishing, forest and gas Canon.
2. Valid for all Canon except the oil Canon, in which case the assignment rule is the following: in Loreto, Ucayali and Huánuco until a 20% can be used for current expenditures. In Piura and Tumbes, 100% has to be used for public investment.
3. Some variants for the cases of the oil, gas and fishing Canon exist. For the case of oil Canon, it is constituted on 12.5% of the Value of the Production. Details for other forms of Canon are discussed on www.mef.gob.pe.

Table 3.A.1: Determinants of Local Government Efficiency

(Total Literacy Rate using an input-oriented FDH model)

	Tobit Model					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Average Mining Canon per-capita	-0.357***	-0.358***	-0.315***	-0.181***	-0.155***	-0.106***
	(0.031)	(0.032)	(0.033)	(0.028)	(0.029)	(0.037)
Average Mining Canon per-capita^2	0.271***	0.271***	0.240***	0.177***	0.165***	0.082**
	(0.041)	(0.042)	(0.041)	(0.030)	(0.036)	(0.032)
Log of (1+Real Value of Production)		0.000	-0.000	-0.001*	-0.000	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average FONCOMUN per-capita			-0.141***	-0.043**	0.000	-0.053**
			(0.022)	(0.019)	(0.021)	(0.023)
Average Budget per-capita			0.000	-0.036**	-0.034***	-0.016
			(0.012)	(0.014)	(0.012)	(0.011)
Socio-economic controls	No	No	No	Yes	Yes	Yes
Geographical controls	No	No	No	No	Yes	Yes
Region Fixed Effects	No	No	No	No	No	Yes
Number of observations	1,793	1,793	1,793	1,755	1,386	1,386

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White robust standard errors. The Mining Canon variable and its square are measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. All independent variables are averages for period 2001-2007. The efficiency score variable is measured for period 2001-2007. The variable used for its construction is the Total Literacy Rate using expenditures on Education and Culture. The technique used was the input-oriented Free Hull Disposal (FDH). Socio-economic controls include population in 1993, percentage of rural population in 1993, population living in houses with inadequate physical characteristics in 1993, population living in households with children that are not enrolled in school in 1993, population living in overcrowded houses in 1993, population living in houses without wastepipe in 1993, and population living in houses with high economic dependency in 1993. Geographical controls include altitude, longitude, latitude, dummy for being province capital, dummy for being for being a coastal district and the distance to the capital province.

Table 3.A.2: Determinants of Local Government Efficiency

(Total Literacy Rate using an input-oriented DEA model)

	Tobit Model					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Average Mining Canon per-capita	-0.035***	-0.038***	-0.123***	-0.105**	-0.115**	-0.165***
	(0.006)	(0.005)	(0.042)	(0.043)	(0.057)	(0.047)
Average Mining Canon per-capita^2	0.018***	0.019***	0.018***	0.014***	0.014**	0.034***
	(0.006)	(0.007)	(0.005)	(0.005)	(0.006)	(0.007)
Log of (1+Real Value of Production)		0.000***	0.000	0.000	0.000	0.001***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average FONCOMUN per-capita			-0.118***	-0.095**	-0.101*	-0.084*
			(0.042)	(0.041)	(0.056)	(0.047)
Average Budget per-capita			0.069**	0.062**	0.070*	0.059*
			(0.030)	(0.030)	(0.040)	(0.034)
Socio-economic controls	No	No	No	Yes	Yes	Yes
Geographical controls	No	No	No	No	Yes	Yes
Region Fixed Effects	No	No	No	No	No	Yes
Number of observations	1,793	1,793	1,793	1,755	1,386	1,386

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White robust standard errors. The Mining Canon variable and its square are measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. All independent variables are averages for period 2001-2007. The efficiency score variable is measured for period 2001-2007. The variable used for its construction is the Total Literacy Rate using expenditures on Education and Culture. The technique used was the input-oriented Data Envelopment Analysis (DEA). Socio-economic controls include population in 1993, percentage of rural population in 1993, population living in houses with inadequate physical characteristics in 1993, population living in households with children that are not enrolled in school in 1993, population living in overcrowded houses in 1993, population living in houses without wastepipe in 1993, and population living in houses with high economic dependency in 1993. Geographical controls include altitude, longitude, latitude, dummy for being province capital, dummy for being for being a coastal district and the distance to the capital province.

Table 3.A.3: Determinants of Local Government Efficiency

(Health Clinics per-capita using an input-oriented FDH model)

	Tobit Model					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Average Mining Canon per-capita	-0.536***	-0.531***	-0.294***	-0.289***	-0.180***	-0.117*
	(0.049)	(0.048)	(0.069)	(0.071)	(0.053)	(0.070)
Average Mining Canon per-capita^2	0.245***	0.244***	0.208***	0.201***	0.163***	0.146***
	(0.053)	(0.052)	(0.051)	(0.052)	(0.047)	(0.042)
Log of (1+Real Value of Production)		-0.001	-0.001	-0.001**	-0.001	-0.000
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Average FONCOMUN per-capita			-0.078*	-0.075	0.005	0.048
			(0.046)	(0.047)	(0.040)	(0.043)
Average Budget per-capita			-0.141***	-0.127***	-0.165***	-0.195***
			(0.039)	(0.039)	(0.028)	(0.028)
Socio-economic controls	No	No	No	Yes	Yes	Yes
Geographical controls	No	No	No	No	Yes	Yes
Region Fixed Effects	No	No	No	No	No	Yes
Number of observations	1,793	1,793	1,793	1,755	1,386	1,386

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White robust standard errors. The Mining Canon variable and its square are measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. All independent variables are averages for period 2001-2007. The efficiency score variable is measured for period 2001-2010. The variable used for its construction is the Health Clinics per-capita using expenditures on Health and Sanitation. The technique used was the input-oriented Free Disposal Hull (FDH). Socio-economic controls include population in 1993, percentage of rural population in 1993, population living in houses with inadequate physical characteristics in 1993, population living in households with children that are not enrolled in school in 1993, population living in overcrowded houses in 1993, population living in houses without wastepipe in 1993, and population living in houses with high economic dependency in 1993. Geographical controls include altitude, longitude, latitude, dummy for being province capital, dummy for being for being a coastal district and the distance to the capital province.

Table 3.A.4: Determinants of Local Government Efficiency

(Health Clinics per-capita using an input-oriented DEA model)

	Tobit Model					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Average Mining Canon per-capita	-0.066***	-0.065***	-0.037***	-0.040***	-0.028***	-0.031***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.011)
Average Mining Canon per-capita^2	0.030***	0.030***	0.025***	0.026***	0.021***	0.024***
	(0.007)	(0.007)	(0.006)	(0.007)	(0.005)	(0.007)
Log of (1+Real Value of Production)		-0.000*	-0.000**	-0.000***	-0.000	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average FONCOMUN per-capita			-0.013***	-0.012***	-0.002	0.001
			(0.004)	(0.004)	(0.005)	(0.007)
Average Budget per-capita			-0.016***	-0.013***	-0.017***	-0.020***
			(0.003)	(0.003)	(0.003)	(0.005)
Socio-economic controls	No	No	No	Yes	Yes	Yes
Geographical controls	No	No	No	No	Yes	Yes
Region Fixed Effects	No	No	No	No	No	Yes
Number of observations	1,793	1,793	1,793	1,755	1,386	1,386

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White robust standard errors. The Mining Canon variable and its square are measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. All independent variables are averages for period 2001-2007. The efficiency score variable is measured for period 2001-2010. The variable used for its construction is the Health Clinics per-capita using expenditures on Health and Sanitation. The technique used was the input-oriented Data Envelopment Analysis (DEA). Socio-economic controls include population in 1993, percentage of rural population in 1993, population living in houses with inadequate physical characteristics in 1993, population living in households with children that are not enrolled in school in 1993, population living in overcrowded houses in 1993, population living in houses without wastepipe in 1993, and population living in houses with high economic dependency in 1993. Geographical controls include altitude, longitude, latitude, dummy for being province capital, dummy for being for being a coastal district and the distance to the capital province.

Table 3.A.5: Determinants of Local Government Efficiency

(Sanitation coverage rate using an input-oriented FDH model)

	Tobit Model					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Average Mining Canon per-capita	-0.582***	-0.575***	-0.321***	-0.299***	-0.194***	-0.143**
	(0.053)	(0.052)	(0.071)	(0.074)	(0.056)	(0.073)
Average Mining Canon per-capita^2	0.267***	0.266***	0.226***	0.220***	0.178***	0.155***
	(0.058)	(0.056)	(0.055)	(0.057)	(0.052)	(0.044)
Log of (1+Real Value of Production)		-0.001	-0.001**	-0.002***	-0.001	-0.000
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Average FONCOMUN per-capita			-0.093*	-0.057	0.014	0.027
			(0.047)	(0.048)	(0.040)	(0.044)
Average Budget per-capita			-0.150***	-0.145***	-0.175***	-0.190***
			(0.040)	(0.040)	(0.029)	(0.028)
Socio-economic controls	No	No	No	Yes	Yes	Yes
Geographical controls	No	No	No	No	Yes	Yes
Region Fixed Effects	No	No	No	No	No	Yes
Number of observations	1,793	1,793	1,793	1,755	1,386	1,386

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White robust standard errors. The Mining Canon variable and its square are measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. All independent variables are averages for period 2001-2007. The efficiency score variable is measured for period 2001-2010. The variable used for its construction is the sanitation coverage rate using expenditures on Health and Sanitation. The technique used was the input-oriented Free Disposal Hull (FDH). Socio-economic controls include population in 1993, percentage of rural population in 1993, population living in houses with inadequate physical characteristics in 1993, population living in households with children that are not enrolled in school in 1993, population living in overcrowded houses in 1993, population living in houses without wastepipe in 1993, and population living in houses with high economic dependency in 1993. Geographical controls include altitude, longitude, latitude, dummy for being province capital, dummy for being for being a coastal district and the distance to the capital province.

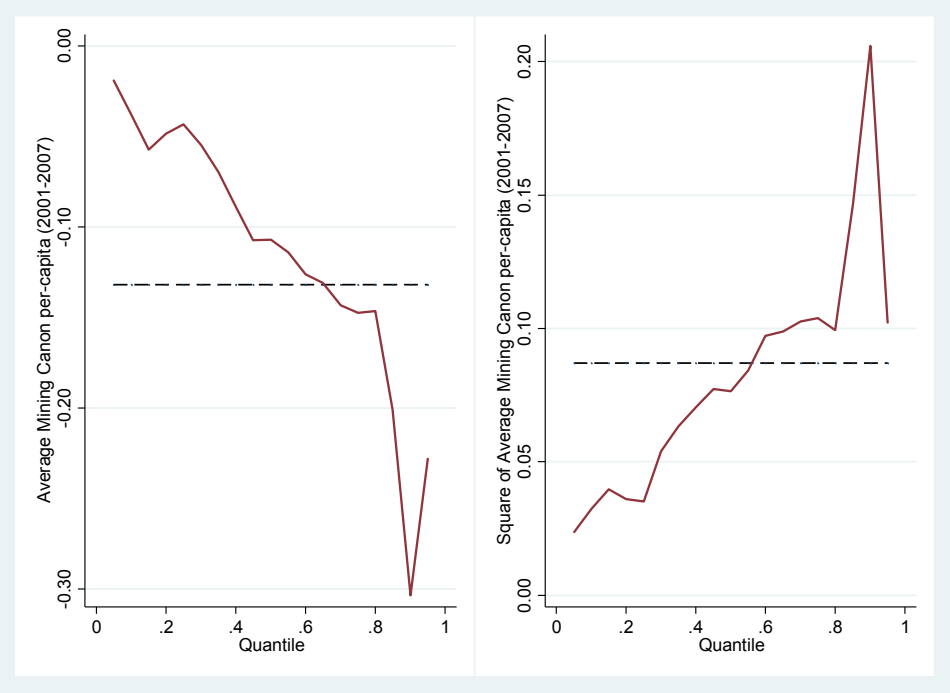
Table 3.A.6: Determinants of Local Government Efficiency

(Sanitation coverage rate using an input-oriented DEA model)

	Tobit Model					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Average Mining Canon per-capita	-0.087***	-0.083***	-0.069***	-0.019*	-0.025**	0.007
	(0.011)	(0.011)	(0.012)	(0.011)	(0.012)	(0.019)
Average Mining Canon per-capita^2	0.045***	0.044***	0.035***	0.025***	0.026***	0.015**
	(0.013)	(0.012)	(0.010)	(0.008)	(0.008)	(0.008)
Log of (1+Real Value of Production)		-0.000***	-0.001***	-0.000***	-0.000**	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average FONCOMUN per-capita			-0.068***	0.000	-0.006	0.007
			(0.011)	(0.009)	(0.011)	(0.018)
Average Budget per-capita			-0.001	-0.021***	-0.018***	-0.026**
			(0.005)	(0.005)	(0.006)	(0.012)
Socio-economic controls	No	No	No	Yes	Yes	Yes
Geographical controls	No	No	No	No	Yes	Yes
Region Fixed Effects	No	No	No	No	No	Yes
Number of observations	1,793	1,793	1,793	1,755	1,386	1,386

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Huber-White robust standard errors. The Mining Canon variable and its square are measured in 1,000 of nuevos soles. All monetary values are in prices of Lima in 2001. Real value of mineral production is measured in mineral prices of 2001. All independent variables are averages for period 2001-2007. The efficiency score variable is measured for period 2001-2010. The variable used for its construction is the sanitation coverage rate using expenditures on Health and Sanitation. The technique used was the input-oriented Data Envelopment Analysis (DEA). Socio-economic controls include population in 1993, percentage of rural population in 1993, population living in houses with inadequate physical characteristics in 1993, population living in households with children that are not enrolled in school in 1993, population living in overcrowded houses in 1993, population living in houses without wastepipe in 1993, and population living in houses with high economic dependency in 1993. Geographical controls include altitude, longitude, latitude, dummy for being province capital, dummy for being for being a coastal district and the distance to the capital province.

Figure 3.A.1: Standard quantile regression coefficients



Source: Own estimated based on the standard quantile regression model without censoring. Figure reports the coefficients for the level and square of average mining Canon transfers (2001-2007). Horizontal lines represents the OLS estimates.