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The Local Impact of Mining in Peruvian Districts: Evidence of a Subnational Resource Curse?

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ABSTRACT

In the early 2000s, Peru experienced a major mining boom as global prices skyrocketed. At the same time, the country implemented a revenue-sharing arrangement between the national government and subnational governments, to redistribute the newly gained financial windfalls. Using census as well as survey data, we compare producing and non-producing districts in order to determine the effects of mining transfers on local development. We find evidence that producing districts were characterized by better development than non-producing districts before the establishment of a transfer of mining rents (the so-called *Canon Minero*). These effects persist when comparing districts over time. Concerning the effect of *Canon Minero* transfers on local development, we find that these transfers, through district governments' expenditures, contribute to a reduced poverty rate and increased per capita consumption when comparing producing as well as non-producing districts in producing provinces to non-producing districts in non-producing provinces.

Keywords: Subnational Resource Curse, Mining Transfers, Poverty, Local Development, Revenue Sharing
JEL Classifications: H23, H71, H75, Q33

1. INTRODUCTION

A question that has increasingly come up in recent years regarding literature on the resource curse is to what extent district communities are affected by the extraction of natural resources and whether there is such a thing as a subnational resource curse. Do mining communities show some of the same outcomes that were found in studies on the national-level resource curse or are they affected differently? We contribute to this discussion by analyzing the effect of mining activity and the transfer of mining rents on socioeconomic outcomes in Peruvian districts[1].

In the context of the extraction of natural resources and local development, Peru offers a unique case study. It is a mineral-rich country, and, in an effort to decentralize the accompanying rents, the government has implemented a clear set of rules on both how resource revenues have to be shared among different tiers of the government and how these transfers have to be spent. By studying the period before as well as after this set of rules was established, we investigate whether the districts' development paths were in any way affected by the mining activity and the corresponding redistribution of rents.

Peru has a long history of metal mining that started well before the Spaniards arrived in the 16th century. The Inca, who ruled over almost all of Peru since the beginning of the 15th century, are known to have decorated temples and other religious buildings with gold and silver, and these metals were also used for ornamenting royal households. Furthermore, they built tools from bronze and copper (Purser, 1971, p. 22). As legend has it, Francisco Pizarro,

1 Districts are the third and smallest administrative unit in Peru, after regions and provinces.

the Spanish conquistador who led the exhibition to conquer Peru, offered freedom to Atahualpa, the last Inca Emperor whom the Spaniards captured during the Battle of Cajamarca in 1532, if he were to fill the room in which he was held captive with gold and silver. Atahualpa obliged, unfortunately to no avail regarding his freedom, offering a glimpse of the amounts of gold and silver the Incas had extracted up to that point (Barretto et al., 2007; TePaske, 2010). But even before the rise of the Inca, there were cultures in the region, such as the Paracas, Chancay, and Chimu, that produced ornaments and tools made of gold, silver, and copper (Purser, 1971, p. 21).[2]

However, archeologists and historians alike agree that any mining activity must have been small-scale and superficial, thus not resembling a "mining industry" deserving of that designation (Lechtman, 1976). The actual mining industry was established by the Viceroy Toledo in the late 16th century, who drafted the first legislation regarding the mining of metals and also introduced a system of forced labor, the so-called *mita* (*mita* is a word from the Quechua language meaning "time") (Purser, 1971, p. 28).

After Peru gained its independence from Spain in 1821, the focus shifted away from metal mining for some time and toward two other extractable resources, guano, and nitrates. During this time, the mining industry was largely ignored by the authorities. Once it did make its way back to the forefront, technological progress was used to reopen old mines and to exploit minerals other than gold and silver, which were exploited predominantly in the preceding centuries[3]. However, due to several administrative decisions, the Peruvian mining industry was dominated by foreign actors who were barely taxed and, thus, siphoned off the vast majority of their proceeds to their home countries leaving Peru with hardly any income from the mines. This was partly remedied during the 21st century when more and more national mining companies were founded and a new constitution assigned mine ownership to the State. Nevertheless, there were still several foreign companies deeply involved in the mining industry, such as the country's most important mine, Cerro de Pasco, which was controlled and operated by a U.S.-based company (Purser, 1971, pp. 81ff.). To some extent, this is still the case today with companies such as Barrick Gold Corporation, Newmont Mining, and Rio Tinto, among others, operating in the country (KPMG, 2015, p. 25).

Today, Peru is one of the largest mining countries, both in Latin America and worldwide, according to the country's Ministry of Energy and Mines (MINEM) (MINEM, 2020, p. 50). Accordingly, the country generates significant amounts of mineral rents each year, roughly US$10 billion since the beginning of the 21st century (World Bank, 2021). However, even though these revenues accrue at the national level, mining rents are subsequently redistributed to subnational governments, i.e., regional, provincial, and district governments (a province consists of several districts, whereas a region is formed by several provinces) (Figure 1).

2 For a brief history on metallurgy in Peru, please see Appendix Figure 1.

3 This is especially true for silver, which accounted for more than 90% of the value of national mining production, dwarfing those of gold, copper, tin, mercury, lead, coal, and iron (Deustua, 1984, 1986).

Thus, these transfer payments, called *Canon Minero*, mainly benefit district governments, as they received about 61% of all transfers since the implementation of the *Canon Minero* in the early 2000s. The remaining share of these transfers has been distributed to regional governments and public universities within these regions, where these university funds are aimed at enhancing scientific and technological investigations that contribute to regional development. However, the fact that large shares of revenues are distributed to district governments poses the question of whether they are susceptible to a subnational resource curse as a consequence of these transfers.

This new revenue-sharing agreement and the coinciding increase in mineral prices brought about a sudden influx of financial means to district governments. As shown in Figure 2, the corresponding transfers rose 50-fold between 2001 and 2007. Since then, the amount of transfers distributed to the districts fluctuated from year to year, reaching a 10-year low in 2016. Nevertheless, these are still significant contributions to local budgets.

However, because the districts partake in the mineral rents to this extent leaves the question as to whether these funds are spent efficiently and for their intended purposes. As the *Canon Minero* is currently constructed, the rents have to be invested for the benefit of the local population[4]. Hence, it is not unreasonable to assume that districts experienced positive developments in the past two decades. Whether this is indeed the case is the main focus of this study.

We find evidence that producing districts, or those that would become producing districts later on, were characterized by better development than non-producing districts before the establishment of *Canon Minero* transfers. However, differences between districts within the same province do not appear to be significant. When comparing the Peruvian districts over time, using the introduction of the current revenue-sharing agreement as a treatment and treating producing and non-producing districts as treatment and control groups, these effects persist.

Concerning the effect of *Canon Minero* transfers on local development, we find that these transfers, through district governments' expenditures, contribute to a reduced poverty rate (of between 0.06% and 0.2% points) and increased per capita consumption (roughly 22%) when comparing producing districts and non-producing districts in producing provinces to non-producing districts in non-producing provinces. When comparing producing and non-producing districts within the same province, the effect is less significant regarding the share of the population that lives below the poverty line. In terms of per capita consumption and per capita income, citizens of producing districts appear to be better off than those in non-producing districts, as per capita consumption and per capita income are 23% and 17%

4 Even though this is stipulated by law, there is, to the best of our knowledge, no government body which enforces this rule. However, the Ministry of Energy and Mines, together with the Inter-American Development Bank, created a Map of Investments which enables citizens to track government expenditures. This offers at least a certain degree of transparency in terms of how government funds, such as *Canon Minero* transfers, are spent.

Figure 1: Administrative division of Peru into regions (left), provinces (middle), and districts (right)

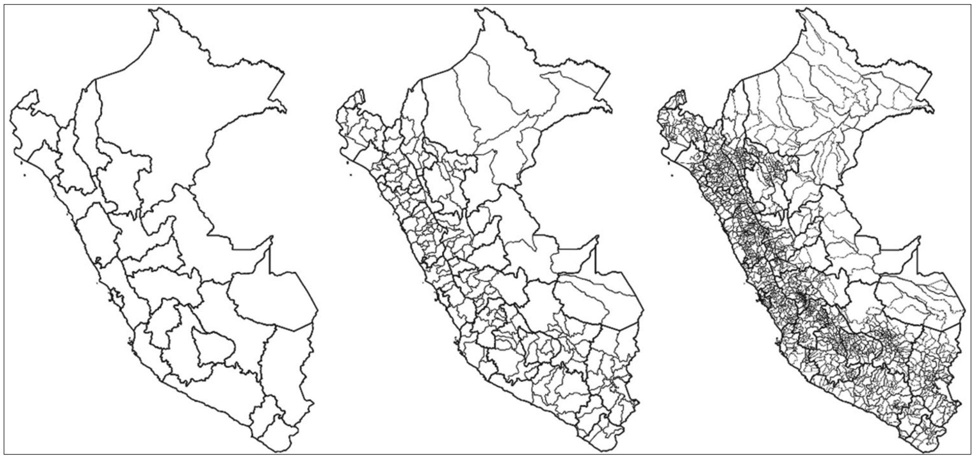
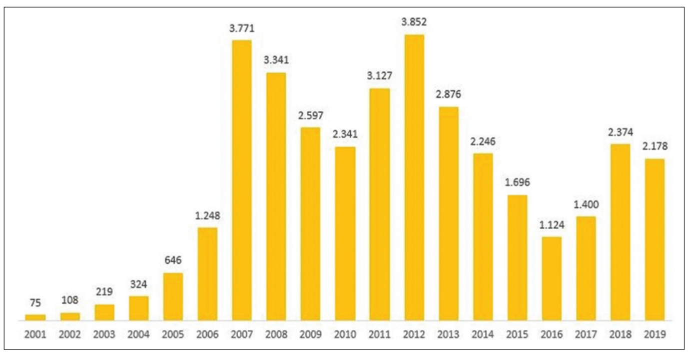


Figure 2: Canon Minero transfers to district governments in million S/[5]



(Source: Ministry of Economy and Finance, author's illustration)

higher in producing districts, respectively. Additionally, the effects of *Canon Minero* transfers are restricted to those districts that partake in these transfers and their immediate neighbors.

The rest of the paper is organized as follows. Section 2 presents the related literature concerning both the subnational resource curse in general and the effect of mining on local development in Peru specifically. Section 3 describes the development of today's legal framework of revenue sharing. In Section 4 we present the data as well as the methodology for the subsequent analysis, which is conducted in Section 5. In Section 6, we examine the effect of *Canon Minero* transfers via IV estimation. Section 7 concludes.

2. RELATED LITERATURE

In the academic literature, the resource curse is defined as "the whole set of unintended consequences that originate from resource extraction activity and trade that can end up negatively affecting the economic development of regions hosting the resources extraction industry or the entire country" (Fleming and Measham, 2013). This definition is helpful in two ways: First, the term "unintended consequences" is open to encompass a variety of socioeconomic impacts that may affect development, such as conflict, poverty or unemployment, among others. Second, it does not restrict the potential consequences of resource wealth to the national level but rather includes the subnational level as well (Fleming and Measham, 2013). This is important because avoiding the effects of natural resource extraction at the national level does not necessarily imply that these effects are also avoided at the subnational level.

Regarding this latter part of the resource curse theory, there is a growing body of literature that is not limited to studies of developing countries, with which the resource curse is mostly associated, but that also includes developed countries such as Norway, the U.S., and Australia (Borge et al., 2015; Boyce and Emery, 2011; Fleming et al., 2015; Freeman, 2009). What these studies have in common is that their results do not indicate unambiguous evidence of a curse associated with natural resource extraction, as some scholars are finding positive effects, others are finding negative effects, and some are finding none at all. However, a variety of potential causes have been identified that may contribute to a resource curse on the subnational level. These include, among others, local dependence on extractive revenues (Arellano-Yanguas and Mejía-Acosta, 2014; Bradshaw, 2006), the inefficient use of revenues (Carrillo Hoyos, 2019; Karl, 1997; Lawer et al., 2017; Ponce and McClintock, 2014), conflicts (Avcı and Fernández-Salvador, 2016; Gutiérrez Rodríguez, 2019; Paredes, 2016; Stammler and PEskov, 2008), and the environmental impact of resource extraction (Aragón and Rud, 2012; Porgo and Gokyay, 2017; Suutarinen, 2015; Tietenberg and Lewis, 2016).

A central finding of the literature is that many of the causes can be traced back to the quality of institutions, both nationally and locally. Oftentimes, factors such as political instability, volatility of resource rents, economically inefficient spending, and institutional capacity determine whether resource wealth turns out to be a blessing or a curse (Hassler et al., 2017; Khanna, 2017; Ponce and McClintock, 2014; Poncian, 2019).

Several studies deal with the effects of mining on local social and political outcomes and try to further narrow down the potential transmission channels through which the mining activity affects local development. Bebbington et al. (2008), for instance, study Peruvian and Ecuadorian cases and conclude that mining plays an important role in rural development, namely in the form of the

5 S/1 (one Peruvian Sol) ≈ US$0.25

interaction between communities (or rather social movements within communities), mining companies, and other actors, such as the state. The authors mention, however, that the degree to which this influence takes effect varies between geographical locations (Bebbington et al., 2008).

In Peru and many other countries, resource revenues are distributed to local governments in an attempt to foster local development, so far with mixed results, according to the literature. Arellano-Yanguas (2008, 2014) concludes that the mining boom caused by a sudden increase in world prices in the early 2000s and the subsequent distribution of resource rents to subnational governments did not have the intended effect. Although the sharing of revenues was deemed beneficial, at least economically, producing districts and provinces did not develop as expected, due to a myriad of reasons, such as lack of planning at the local level and labor turnover in subnational governments.

Other studies show that the mere transfer of funds to subnational governments does not influence development significantly. Rather, it is argued that factors such as citizen participation, management capacity for planning and spending at the district level, the interaction between institutions and public programs, and the ethics at play in the decision and execution of funds influence how politicians decide to spend these funds (Gustafsson and Scurrah, 2020; Magallanes Díaz, 2016; Pebe et al., 2017). Furthermore, research demonstrates that regions which receive a large share of the *Canon Minero* transfers but lack skills regarding project management, accounting and finance, planning, or coordination with other public agencies are less efficient in promoting social and economic development (Aragón and Casas, 2009; Magallanes Díaz, 2016; Zárate and Durand, 2005).

Apart from the way mining revenues are spent, social tensions have been identified as obstacles to growth and development, as the Peruvian mining sector is very conflict ridden[6] . The way these tensions arise has been actively discussed in the literature (Jaskoski, 2014; Ponce and McClintock, 2014; Sexton, 2020). One cause for social tensions are the conflicting interests of the parties involved, e.g., mining companies, the central government, local governments, and the communities, regarding future land and water use. Mining companies want to extend their exploration sites, whereas communities may be worried about their water supply (Preciado Jeronimo et al., 2015). In some cases, this has led to open, and sometimes violent, conflicts that forced mining companies to temporarily discontinue production (Triscritti, 2013).

Arellano-Yanguas (2011) finds that two main mechanisms generate local conflict over mining in Peru. The first is that the *Canon Minero* transfers themselves cause or exacerbate conflicts because they are either perceived to be or are indeed spent inefficiently. They cause disputes over the corresponding allocation criteria, and they enable local governments to pay higher wages to their employees than are paid to other public servants in the same district who are employed by the national government, such as teachers, police officers, or health workers. The second mechanism he identifies relates to tensions between mining companies and the local population that cannot be mitigated by the national government, as the national government is poorly integrated with local politics and is perceived to have a favorable position toward mining interests.

A rather different result is presented by Orihuela et al. (2019). The authors acknowledge the results from Arellano-Yanguas (2011), i.e., more transfers, more conflict, but argue that they are only valid for the beginning of the mining boom in the early 2000s. Instead, they argue that the number of mining conflicts rose even in times when mining transfers declined. Therefore, the authors conclude that the mining projects themselves are the main driver of local conflicts, albeit through a variety of potential channels.

In order to better evaluate the impact of mining on local development, several studies directly compare producing and non-producing districts and take a closer look at the effects on poverty, migration, and labor-market outcomes. Ticci and Escobal (2015), using census data and applying a propensity score matching methodology, find that mining companies attract larger inflows of migrant workers but, at the same time, have failed to support local populations in benefitting from business and labor opportunities associated with mining growth. This may indicate that effects on indicators of well-being, such as employment or the satisfaction of basic needs, materialize less quickly than those on demographic growth and the share of the immigrant population.

Zegarra et al. (2007), whose study serves as a baseline for the aforementioned study by Ticci and Escobal (2015) and who apply a similar approach, suggest that mining activity causes a crowding out of employment in the agricultural industry with regard to rural households and that urban households may experience an increase in income, but this increase is accompanied by restricted access to potable water and a higher probability of contracting illnesses.

Aragón and Rud (2013) offer another important study in this context. Analyzing the districts surrounding the Yanacocha gold mine, the largest gold mine in Latin America and the second-largest in the world, situated in the department of Cajamarca in Northern Peru, they find that the mine displays positive effects on real income for citizens of the city of Cajamarca and the surrounding rural areas. These positive effects are generated through backward linkages with local businesses and the subsequent increase in demand for production factors such as land and labor.

Regarding the broader context of the subnational resource curse, i.e., the relationship between mineral resource abundance or dependence and subnational development, this study relates to the literature that examines this phenomenon across (Haslam and Tanimoune, 2016; Hinojosa, 2011; Wegenast et al., 2020) as well as within (Boyce and Emery, 2011; Hota and Behera, 2019; Michaels, 2011; Papyrakis and Gerlagh, 2007; Ticci and Escobal, 2014) countries. In the specific context of Peru, we contribute to the recent literature by investigating the effect of revenue windfalls from natural resource extraction on local communities. Maldonado and Ardanaz (2017) demonstrate that districts which receive a large

6 Over 66% of all socio-economic conflicts in 2019 were associated with the mining industry (Defensoría del Pueblo, 2020, p. 110).

share of *Canon Minero* transfers are more efficient when it comes to the provision of public goods. The authors argue that this is due to an increase in political competition once the transfers reach a level at which it is more lucrative to run for public office than to be a potential beneficiary as an entrepreneur in the industrial sector. These results are corroborated by Maldonado (2017).

Moreover, both Zambrano et al. (2014) and Corral et al. (2016) show that natural resource extraction, minerals in one case and gas in the other, results in a reduction of poverty and an increase in economic growth in affected districts. Furthermore, Agüero et al. (2021), as well as Ticci and Escobal (2014), were able to show that the redistribution of mining rents, in general, leads to an increase in human capital accumulation, except for in those districts that receive the highest amounts of *Canon Minero* transfers.

Additionally, our analysis relates to the literature on fiscal transfers to subnational governments and their subsequent use in Latin American countries (Brollo et al., 2013; Caselli and Michaels, 2013; Diaz-Rioseco, 2016; Gervasoni, 2010; Litschig and Morrison, 2013; Monteiro and Ferraz, 2012). Brollo et al. (2013) study the effect of fiscal transfers both theoretically as well as empirically, and they find that in Brazil, increasing federal transfers to municipal governments lead to an increase in observed corruption and reduce the average education of local politicians. These findings are complemented by Caselli and Michaels (2013), who, examining the relationship between fiscal windfalls from oil production on local spending and living standards, only find small effects, if any, on local public services or household income. The authors conclude that these funds were mostly used for embezzlement or patronage. Similar results are obtained by Monteiro and Ferraz (2012), who find that fiscal transfers from natural resources were turned into additional government jobs but had little effect on infrastructure, education, or health.

Peru offers an interesting case study for the theory of a subnational resource curse. The country has introduced several reforms to the revenue-sharing agreement after it was first implemented. This revenue-sharing agreement aims to distribute mining rents in a way that mitigates developmental differences between the Peruvian districts. Nevertheless, as the relevant literature shows, people have misgivings about how these rents are utilized and whether their use is indeed efficient. That is why this paper focuses on the producing regions and whether the *Canon Minero* transfers these regions receive have any effect on the local communities.

In doing so, we contribute to the existing literature, especially the literature regarding mining in Peru, in several ways. First, we study the Peruvian districts both before and after the implementation of *Canon Minero* transfers. As far as we are aware, the vast majority of existing studies on the effect of mining on local development in Peru focuses on the period since the introduction of mining transfers, i.e., after 2004, but do not consider developments that took place beforehand. By considering the time before *Canon Minero* transfers were implemented, we are able to study both the district's development over a longer period of time as well as whether these developments were in any way impacted by the transfers. Second, since the *Canon Minero* transfers are accompanied by certain spending criteria, i.e., using the *Canon Minero* transfers for investments into public infrastructure, among other requirements, our study seeks to determine whether these criteria have the intended effect on the local population's well-being. Furthermore, by way of a difference-in-differences model, we apply a methodology that enables us to investigate how certain district characteristics have evolved over time and in which way this may have been influenced by the implementation of the current revenue-sharing arrangement. Again, as most studies in this context cover the period since the implementation of mining transfers, they examine whether there is an effect of the transfers on a variety of possible outcomes since the introduction of the revenue-sharing arrangement; but, by doing so, these studies do not consider how this relates to the development path districts were on before *Canon Minero* transfers were introduced.

3. REVENUE SHARING IN PERU

As was detailed above, Peru has a long history of mining activity, dating back to the days of the Incas and the conquistadors. However, only since the late 1970s has there been a political process to regulate the sharing of mineral revenues between the different tiers of government.[7] It took until the Constitution of 1979 that the first such system was implemented and it offered a clear guideline on how the proceedings from mining activities should be managed and redistributed. In the following years, especially since the early 1990s, frequent changes were made to the revenue-sharing arrangement introduced in 1979. These changes mainly concerned the share of the mining rents that was to be redistributed and, equally important, the criteria according to which these rents were to be distributed to regional, provincial, and district governments.

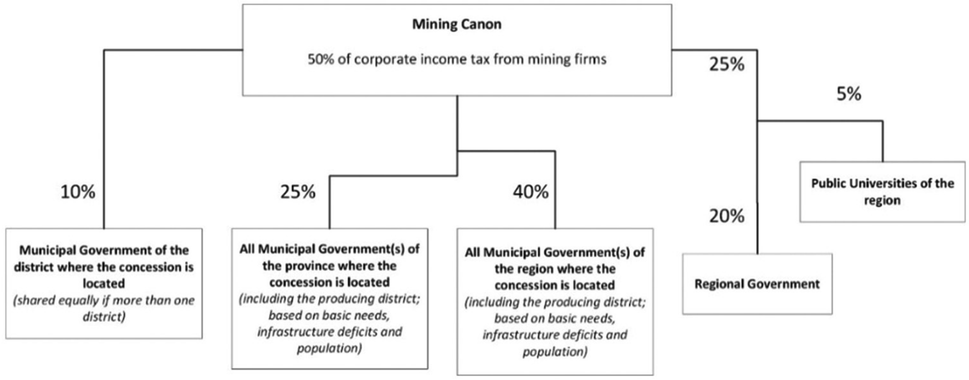
This process continued until 2004, when the current revenue-sharing arrangement was implemented. As stipulated in Law No. 28322, the sharing of mining revenues with subnational governments is conducted as follows:

Mining revenues are distributed according to not only the share of urban and rural population, measured as the share of total population in a given district, but also the population density, basic needs and infrastructure deficits. By taking these factors into account, poverty is now given more weight than before. Based on these criteria, 10% of the revenues have to be shared equally between all producing districts. The remaining 90% are distributed based on basic needs and infrastructure deficits as follows: 25% are allocated to district governments of the producing province, including the producing district, 40% are allocated to provincial governments of the producing region, including the producing province, and 25% are allocated to the government of the producing region. Of this last 25%, regional governments have to share 20% with public universities within their jurisdiction (Figure 3).

Although these most recent changes to the revenue-sharing arrangement were meant to lead to a more equal distribution of

7 Please see Appendix Figure 2 for a quick overview of the history of revenue sharing in Peru.

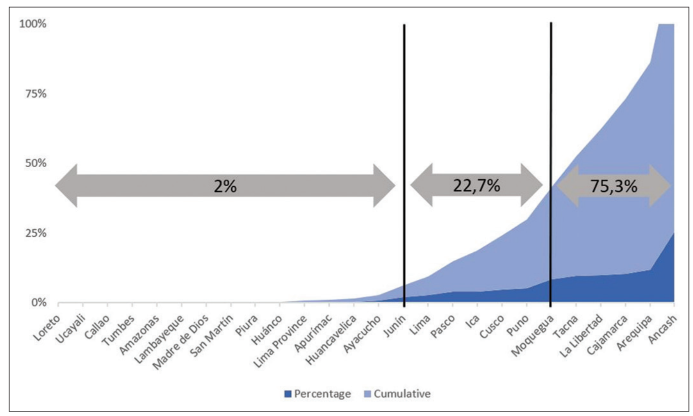
Figure 3: Distribution of the Canon Minero



(Source: Ministry of Economy and Finance[8], author's illustration)

the *Canon Minero* transfers, this was only partially achieved. Non-producing districts are now considered as well, but this is only true for non-producing districts in producing regions and not for non-producing districts in non-producing regions. Hence, mining revenues are only allocated to producing regions, causing a significant imbalance in the distribution of *Canon Minero* transfers as fewer than half of the 25 Peruvian regions have received 98% of the accumulated *Canon Minero* transfers since 2004 (Figure 4).[9] In addition, *Canon Minero* transfers are also not distributed equally among producing regions, as the amount received by each region via transfers depends on the production within that region. Consequently, these transfers are highly skewed towards those regions with a larger mining economy. Thus, those regions and the corresponding municipalities, districts and provinces possess significantly larger budgets than their counterparts in non-producing regions as well as in regions with less mining activity.

Figure 4: Distribution of accumulated Canon Minero transfers since 2004 to Peruvian regions



(Source: Ministry of Economy and Finance, author's illustration)

An important aspect of these *Canon Minero* transfers is that they are not made unconditionally; they come with strings attached. For example, subnational governments have to spend these transfers for the benefit of the community, i.e., on investments in public services or infrastructure, such as hospitals and schools, that fall into the jurisdiction of the respective government (Ministry of Economy and Finance, b). Similarly, universities, which receive 20% of the transfers to the regional government, have to spend their share of the *Canon Minero* transfers on scientific and technological investigations that contribute to regional development (Congreso de la República, 2013).

Despite the unambiguous requirements that district governments have on spending *Canon Minero* transfers, it is important to reiterate that they are not subject to any oversight regarding the way they spend these funds. This poses a fungibility problem that we cannot account for. As a result of the conditions that are attached to the *Canon Minero* transfers, district governments may decide to comply with these rules but, at the same time, reallocate their spending from the areas that receive a share of these transfers to other areas of the budget. Consequently, investment in, say, education will not have any additional effect if the "regular" budget for education is reduced by the same amount. However, because we are unable to properly account for this, we assume that district governments do not change their budget composition due to *Canon Minero* transfers.

4. EMPIRICAL APPROACH

4.1. Data

The question raised above, about whether the Peruvian districts suffer from a subnational resource curse, is analyzed at the district level, which represents the smallest administrative unit in Peru.[10] This has the distinct advantage that effects from mining activity can be identified more precisely than is possible when using aggregated data at the provincial or regional level. Furthermore, this approach provides us with comparable administrative units that differ in their resource endowment and, consequently, in the corresponding mining activity. As described above, this has a significant impact on the revenues allocated to each district.

8 Cp. Ministry of Economy and Finance (a).

9 Please see Appendix Figure 3 for a distribution of *Canon Minero* in monetary terms. For the distribution of *Canon Minero* transfers on the district level, please refer to Appendix Tables 1 and 2.

10 As shown in Figure 1 Peru is divided into regions, provinces and districts. Several districts form a province, whereas several provinces form a region.

In order to determine the effect of the *Canon Minero* transfers on the development of the Peruvian districts[11], the districts are divided into three groups: (i) producing districts, (ii) non-producing districts in producing provinces, and (iii) non-producing districts in non-producing provinces.[12] As producing districts receive a larger share of the *Canon Minero* transfers than non-producing districts in producing provinces, and these, in turn, receive a larger share than non-producing districts in non-producing provinces, the degree to which these districts are affected by the mining activities varies considerably and should offer an indication of how these effects shape the overall development of the districts.

All in all, Peru has 1874 districts. Of these, 221 can be classified as producing districts, 814 as non-producing districts in producing provinces, and 839 as non-producing districts in non-producing provinces. This classification was made based on data provided by the Ministry of Energy and Mines (MINEM). We removed districts without significant mining production in the observed time frame, i.e., those that had only sporadic mining activity between 2001 and 2017, those where mining activity ceased at the beginning of the observed period, or those where the mining activity did not start until or after 2017, as well as the districts in non-producing regions. Moreover, as district borders changed between 1993 and 2017, mostly due to splits of existing districts, consequently creating new districts for which we do not have observations at both points in time, we only consider those districts in our analysis that existed both in 1993 and in 2017. This leaves us with a sample of 1,483 districts as our primary unit of observation.

For the analysis, we use two sets of dependent variables at the district level. First, in order to describe the status quo before the introduction of *Canon Minero* transfers, the dependent variables include a set of district-specific initial characteristics taken from the 1993 census. These include total population, the share of rural population, the share of households with access to clean water, the share of households with electricity, and the illiteracy rate.

Subsequently, in order to set the benchmark for 2017, we consider three different socioeconomic indicators. The first, the share of the population below the poverty line as a measure of poverty, is taken from the poverty map for the year 2017 developed by the Peruvian National Statistical Institute. This poverty map is based on the census from 2017 as well as on the National Household Survey (*Encuesta Nacional de Hogares* [ENAHO]) from 2017 and 2018 (INEI, 2020). The other two dependent variables, per capita consumption and per capita income, are derived from the National Household Survey for 2017 (ENAHO, 2018). The National Household Survey, which is representative at the district level, is a survey that covers topics such as education, health, income, consumption, and characteristics of people's homes.

After setting the benchmarks for both 1993 and 2017, we turn to the main analysis, namely the effect of introducing the current revenue-sharing arrangement on the development of district communities. For this purpose, we follow a difference-in-differences approach, comparing producing and non-producing districts before and after the introduction of the revenue-sharing arrangement. For this part of the analysis, we apply the same dependent variables used for estimating the status quo in 1993, with the addition of a measure of the unemployment rate at the district level.

Additionally, we also use indicator variables with regard to the exact location of the mining activity. As described above, the Peruvian districts can be divided into three distinct subgroups, namely producing districts, non-producing districts in producing provinces, and non-producing districts in non-producing provinces. To capture this classification, we use three separate dummy variables that each take the value of 1 if a district falls into the respective category and 0 otherwise.

Furthermore, the analysis includes additional explanatory variables that account for differences across districts, independent of mining activity and the corresponding transfers. These include three time-invariant district characteristics: a district's surface area, a dummy variable indicating whether the provincial capital is located in a given district, and a binary variable indicating whether a district is located in the highlands (Peru is divided into three geographical areas, i.e., coast, highlands, and jungle). On the other hand, we consider the district-specific initial characteristics described above (total population, share of rural population, share of households with access to clean water, share of households with electricity, and the illiteracy rate) as additional controls.

For the analysis in Section 6, we use the same dependent variables used for the benchmark for 2017, with one important difference. The main explanatory variable is the amount of *Canon Minero* transferred to each district as reported by the Ministry of Economy and Finance (MEF) (Ministry of Economy and Finance, c). For the purpose of this study, we use the accumulated *Canon Minero* transfers for 2001 through 2017. As detailed above, these transfers are contingent on the level of mining activity in a given district. Thus, the more mining activity in a district, the higher the amount of *Canon Minero* transferred to said district, and the higher the potential impact of mining activity on the district population via these transfers.

This census of 1993 was several years before the concept of the *Canon Minero* was established in its current form (50% of corporate income tax and specific rules as to how these proceeds are to be shared with lower levels of government) as well as before the spike in mineral prices that led to a mining boom in Peru in the early 21st century. However, the 1993 census is the last census before the mining boom and using data from the 2007 census, the first census after 1993, would have missed observations from a time in which rising mineral prices contributed to an increased importance of the mining industry for the Peruvian economy.

4.2. Methodology

We start our analysis by developing a benchmark for the pre-*Canon Minero* period, i.e. comparing initial conditions across the Peruvian districts before the introduction of mining transfers. This is done in order to later be able to compare these results to the status quo after the transfers were implemented. For this purpose, we

11 Please see Appendix Figure 4 for the main transmission channels of mining activity on local development.

12 Please find a visual example of the three types of districts in Appendix Figure 5.

apply the district-specific indicators taken from the 1993 census described above as a set of dependent variables. Furthermore, we investigate whether these initial conditions differ between and across producing and non-producing districts (the latter in producing and non-producing provinces). This investigation is conducted based on the following regression equation:

$$\theta_d = \beta_0 + \beta_1 PD + \beta_2 NPDPP + X_d \beta_3 + \delta_R + \varepsilon_d \quad (1)$$

Where θ_d represents each of the district-specific characteristics taken from the 1993 census, *PD* is a dummy variable that takes the value of 1 if a district is a producing district and 0 otherwise, *NPDPP* is a dummy variable indicating whether a given district is a non-producing district in a producing province (1 if that is the case and 0 otherwise), X_d is a vector of time-invariant district characteristics, δ_R represents regional fixed effects, accounting for regions or provinces depending on the model specification, and ε_d is an error term. The subscript *d* denotes the district under observation.

Subsequently, the analysis turns to investigating the status quo regarding district development in 2017, albeit without considering *Canon Minero* transfers. For this purpose, we use the second set of outcome variables described above for our regression and apply the following regression equation:

$$Y_d = \beta_0 + \beta_1 PD + \beta_2 NPDPP + X_d \beta_3 + \theta_d + \delta_R + \varepsilon_d \quad (2)$$

Where Y_d represents the outcome variable of district *d*, i.e., the share of population below the poverty line and per capita consumption, and θ_d denotes the initial district-specific characteristics that were used as dependent variables above. All other variables are identical to the regression with regard to the status quo in 1993 (Equation [1]).

Having completed these parts of the analysis, we evaluate the impact of the introduction of *Canon Minero* transfers on the development of district communities. For this purpose, we apply a difference-in-differences approach to a third set of outcome variables. As the treatment, we consider the introduction of the current revenue-sharing agreement regarding mining rents, i.e., *Canon Minero* transfers, and treat producing and non-producing districts as our treatment and control groups.

The outcome of this treatment is modeled by the following equation:

$$Y_d = \beta_0 + \beta_1 Post_d + \beta_2 Treat_d + \beta_3 Post{*}Treat_d + X_d \beta_4 + \delta_R + \varepsilon_d \quad (3)$$

Where Y_d represents the outcome variable of district *d*, $Post_d$ denotes the two time periods of the analysis (*Post* = 0 indicates the pre-treatment, i.e., the period before the treatment, and *Post* = 1 indicates the post-treatment), $Treat_d$ depicts the treatment (*Treat* takes the value of 0 to indicate the *control group* and the value of 1 for the *treatment groups*) and $Post{*}Treat_d$, the treatment indicator, is the interaction of the treatment group, $Treat_d$, and the time indicator, $Post_d$. All other variables are identical to Equation (2).

As detailed above, we divide the districts into three distinct groups for our analysis.[13] We then run each regression comparing two of the three subgroups of districts to one another. This comparison is done in three ways: districts in any region, depicted as "Across and within regions" in the regression tables, within the same region ("Within region") as well as within the same province ("Within province"). Following this approach, we are able to determine whether there are significant differences between the three types of districts in relation to their geographic location.

For the purpose of this study, we consider producing districts as well as non-producing districts in producing provinces as two separate treatment groups and non-producing districts in non-producing provinces as the control group. With such an approach, there is one caveat, though: it only works as long as several important assumptions are fulfilled. Concerning the setting of this study, two of these assumptions need to be considered closely-the parallel trend assumption as well as the stable unit treatment value assumption (SUTVA).

The parallel trends assumption states that both the treatment groups and the control group were similar before the "treatment" (Angrist and Pischke, 2008, p. 171), i.e., the uptick in mining activity in Peru and the introduction of the *Canon Minero*. Put differently, both producing and non-producing districts, our treatment and control groups, need to develop along a similar path over time in the absence of the treatment. But, Peru has historically been a mining country, so it is safe to assume that producing and non-producing districts were not completely similar initially, with "initially" being the earliest point in time of the observed period, even though at that time mining happened on a far smaller scale than it does nowadays or even in the past two decades. However, because there was no real revenue-sharing arrangement before the introduction of the *Canon Minero* in the early 2000s, and, due to data availability, we treat producing and non-producing districts as similar enough before the introduction of the *Canon Minero*.

The other important assumption of a difference-in-differences model is the stable unit treatment value assumption (SUTVA) (Delgado and Florax, 2015). It states that the outcome for a given unit only depends on the treatment of that unit and not on the treatment of surrounding units. The assumption is therefore also called the no spillover assumption (Berg et al., 2020). However, in practice, this may be different as an effect on other units cannot generally be ruled out in all circumstances (Berg et al., 2020; Delgado and Florax, 2015). Hence, this assumption is not enforced strictly. We will discuss it in more detail in Section 6.2.

With that being said, the analysis focuses on the following hypotheses:

H_1: *Producing and non-producing districts developed along different paths after the introduction of* Canon Minero *transfers.*

H_2: *The differences in the district's development are caused by Canon Minero transfers.*

13 Please find the summary statistics of all variables in Table 1.

AQ3 **Table 1: Summary statistics**[14]

Variable	Obs.	Mean	SD	Min	Max
Log of accumulated *Canon Minero* transfers	1.483	12.322	1.972	4.61	18.178
% of population below poverty line (2017)	1.483	0.343	0.173	0.001	0.813
Log of per capita consumption (2017)	969	8.139	0.596	6.557	10.214
Log of per capita income (2017)	970	8.693	0.581	7.254	10.816
Log of district area	1.483	5.197	1.321	0.688	10.009
Provincial Capital	1.483	0.097	0.296	0	1
Highlands	1.483	0.742	0.438	0	1
Log of population (1993)	1.407	8.327	1.298	4.913	13.276
Log of population (whole sample)	3.185	8.352	1.373	4.913	13.924
% of rural population (1993)	1.407	0.585	0.309	0	2.082
% of households with access to clean water (1993)	1.406	0.234	0.241	0	0.993
% of households with access to clean water (whole sample)	3.192	0.45	0.34	0	1
% of households with access to electricity (1993)	1.688	0.253	0.302	0	0.997
% of households with access to electricity (whole sample)	3.171	0.496	0.355	0	1
Illiteracy rate (1993)	1.400	0.24	0.121	0.028	0.761
Illiteracy rate (whole sample)	2.883	0.200	0.106	0.018	0.917
Unemployment	2.887	0.686	0.673	0.14	0.97
Producing district (PD)	1.483	0.1	0.3	0	1
Non-producing districts in producing provinces (NPDPP)	1.483	0.548	0.498	0	1
Non-producing districts in non-producing provinces (NPDNPP)	1.483	0.351	0.478	0	1

Table 2: Initial conditions in 1993 in producing and non-producing districts in producing regions

Dep. Var.	Across and within regions			Within region			Within province
	PD	NPDPP	NPDNPP	PD	NPDPP	NPDNPP	PD
a) log of population in 1993	0.0438	−0.344***	0.363***	0.163*	−0.158***	0.112*	0.249***
	(0.0930)	(0.0578)	(0.0587)	(0.0882)	(0.0577)	(0.0631)	(0.0903)
b) % of rural population in 1993	−0.105***	−0.110***	0.158***	−0.0625***	−0.00785	0.0448***	−0.0596***
	(0.0251)	(0.0148)	(0.0144)	(0.0224)	(0.0144)	(0.0150)	(0.0218)
c) % of households with access to clean water	0.0634***	0.0577***	−0.0843***	0.0369**	−0.00439	−0.0147	0.0373**
	(0.0182)	(0.0109)	(0.0109)	(0.0173)	(0.0107)	(0.0110)	(0.0180)
d) % of households with access to electricity	0.159***	0.0458***	−0.110***	0.129***	−0.0333**	−0.0310**	0.114***
	(0.0257)	(0.0142)	(0.0140)	(0.0239)	(0.0142)	(0.0133)	(0.0264)
e) illiteracy rate in 1993	−0.0466***	−0.0394***	0.0595***	−0.0250***	−0.00544	0.0202***	−0.0198**
	(0.00942)	(0.00579)	(0.00573)	(0.00811)	(0.00567)	(0.00625)	(0.00777)
Observations	1.407	1.407	1.407	1.407	1.407	1.407	1.407
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	No	No	No	Yes	Yes	Yes	No
Province FE	No	No	No	No	No	No	Yes

All regressions are done via OLS. Robust standard errors in parentheses. The coefficients shown in the table are those of the dummy variables indicating the respective type of district. The control variables include the log of a district's surface area, a dummy variable indicating whether the provincial capital is located in a given district, and a binary variable indicating whether a district is located in the highlands. Significance levels: ***P<0.01, **P<0.05, *P<0.1

5. DISCUSSION OF THE RESULTS

5.1. Benchmark Regression

Table 2 depicts the results from estimating Equation (1); i.e., it shows the status quo in 1993 before mining production began, or rather before it began in earnest. The results show that producing districts (PD) were better off, in terms of the provision of basic services such as electricity and water as well as literacy of their residents, than their non-producing counterparts (non-producing districts in producing provinces [NPDPP] as well as non-producing districts in non-producing provinces [NPDNPP]). Furthermore, the results indicate that non-producing districts in producing provinces had developed further than non-producing districts in non-producing provinces, at least when comparing them across and within regions (Columns 2 and 3). When comparing these districts within regions, shown in Columns 5 and 6, the effects are markedly less significant.

Now that we have set the benchmark based on initial conditions in 1993, we take a closer look at the impact mining activity had in the following years until 2017. We do this by running Equation (2), where we estimate a different set of dependent variables and include the explanatory variables of the previous regression, depicted in Table 2, as additional control variables. This new set of dependent variables, which includes the share of the population that lives below the poverty line and average per capita consumption, was described above. At this stage, the regression does not yet include *Canon Minero* transfers. The advantages of this approach are twofold: First, we are able to examine the development of producing and non-producing districts independent of the impact of the transfers. Second, we set a benchmark to which we can compare the results once the transfers are included in the regression.

The results of the first regressions with the new set of outcome variables (Y_d) are depicted in Table 3. They show that producing districts are characterized by both higher per capita consumption

14 Please find a detailed description of these variables in Appendix Table 3.

Table 3: Mining activity's impact on producing and non-producing districts in producing regions by 2017

Dep. Var.	Within and across regions			Within region			Within province
	PD	NPDPP	NPDNPP	PD	NPDPP	NPDNPP	PD
a) % of population below poverty line	−0.0146	−0.0301***	0.0413***	−0.0248***	0.00716	0.00464	−0.0136
	(0.0104)	(0.00636)	(0.00677)	(0.00851)	(0.00545)	(0.00603)	(0.00880)
b) log of per capita consumption	0.0786*	0.0123	−0.0558**	0.0898**	−0.0227	−0.0242	0.0930*
	(0.0430)	(0.0252)	(0.0254)	(0.0423)	(0.0273)	(0.0283)	(0.0499)
c) log of per capita income	0.106**	0.0144	−0.0695***	0.0972**	−0.0242	−0.0258	0.103**
	(0.0453)	(0.0258)	(0.0259)	(0.0464)	(0.0269)	(0.0285)	(0.0491)
Observations	891	1.363	1.363	891	1.363	1.363	891
R-squared	0.592	0.646	0.612	0.769	0.686	0.668	0.831
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	No	No	No	Yes	Yes	Yes	No
Province FE	No	No	No	No	No	No	Yes

All regressions are done via OLS. Robust standard errors in parentheses. The coefficients shown in the table are those of the dummy variables indicating the respective type of district. The control variables include the log of a district's surface area, a dummy variable indicating whether the provincial capital is located in a given district, a binary variable indicating whether a district is located in the highlands, and the district-specific characteristics taken from the 1993 census (log of population, share of rural population, share of households with access to clean water, share of households with access to electricity and the illiteracy rate). Significance levels: ***P<0.01, **P<0.05, *P<0.1

and per capita income compared to non-producing districts, independent of whether these non-producing districts are located in the same province or a non-producing province. Additionally, producing districts have a lower poverty rate than non-producing districts within the same region. However, when comparing the three types of districts within and across regions, the results are a bit different. In this scenario the poverty rate is about 0.03% points lower in non-producing districts in producing provinces and about 0.04% points higher in non-producing districts in non-producing provinces.[15]

At the same time, the results indicate that per capita consumption is about 9% larger in producing districts than in non-producing districts in non-producing provinces. Interestingly though, the same cannot be said about the comparison of producing and non-producing districts within the same province. In this instance, the population in non-producing districts has a roughly 10% larger per capita consumption than their peers in the producing districts. Comparing non-producing districts in producing and non-producing provinces does not show any significant differences with regard to per capita consumption.

The results are similar when it comes to per capita income. Once again, we have a significant effect regarding producing and non-producing districts within the same province. In addition, producing districts appear to be characterized by higher per capita income than non-producing districts in non-producing provinces when compared both within and across regions.

5.2. Difference-in-differences

Having established both the benchmark for 1993 and the benchmark for 2017 and analyzed the respective status quo, we now turn to the effect of mining on the development of district communities over time. For this approach, we make use of the fact that the Peruvian districts can be organized into three distinct groups (producing districts, non-producing districts in producing provinces, and non-producing districts in non-producing provinces) and that they partake differently in the distribution of *Canon Minero* transfers. As mentioned earlier, producing districts and non-producing districts in producing provinces are treated as separate treatment groups, and non-producing districts in non-producing provinces are the control group. The treatment is the establishment of the current revenue-sharing agreement, which took effect in 2004. Because the treatment goes along with financial windfalls for districts of all three groups, albeit to varying levels, which, in turn, have to be invested for the benefit of the respective communities, the treatment should have a positive impact on district development that is more pronounced the higher the transfers.

The results of the difference-in-differences (diff-in-diff) estimation with the four different dependent variables mentioned earlier are presented in Table 4. They indicate that the treatment, namely the introduction of *Canon Minero* transfers from the national government to district governments, does have an effect when comparing producing and non-producing districts across as well as within regions, but not when they are in the same province. When comparing producing and non-producing districts within the same province, i.e., within a producing province, the only variable that shows a difference is the unemployment rate: The results show that producing districts have a lower unemployment rate than non-producing districts within the same province as a result of the treatment. However, with an estimated difference of 0.04% points, the difference in the district's unemployment rate is rather small.

Regarding the two dependent variables that measure people's access to basic social infrastructure, namely the share of households with access to clean water and electricity, the results indicate that there is only a significant treatment effect concerning producing districts and non-producing districts in non-producing provinces, both across as well as within regions (Columns 1 and 3). Interestingly though, the estimated coefficients are negative, implying that households in producing districts have less access to basic infrastructure than their counterparts in non-producing districts in non-producing provinces. Consequently, the results

15 Producing districts, non-producing districts in producing provinces, and non-producing districts in non-producing provinces. A province is called "producing" if there is at least one producing district in said province.

16 In order to put these estimates into perspective: In 2017, the average poverty rate was 29.9% in producing districts, 31.3% in non-producing districts in producing provinces and 37.8% in non-producing districts in non-producing provinces. Across all districts of the sample, the average poverty rate was 34.2%.

Table 4: Difference-in-differences regression of mining activity's impact on producing and non-producing districts in producing regions

Dep. Var.	Across and within regions		Within region		Within province
	PD versus NPDNPP	NPDPP versus NPDNPP	PD versus NPDNPP	NPDPP versus NPDNPP	PD versus NPDPP
% of households with access to clean water					
ATET	−0.0466*	−0.0221	−0.0469*	−0.0228	−0.0243
	(0.0280)	(0.0172)	(0.0262)	(0.0158)	(0.0243)
% of households with access to electricity					
ATET	−0.110***	−1.043	−0.112***	−1.030	0.929
	(0.0294)	(0.981)	(0.0273)	(0.966)	(1.043)
Illiteracy rate					
ATET	0.0933***	0.0831***	0.0938***	0.0833***	0.0101
	(0.0119)	(0.00757)	(0.0118)	(0.00747)	(0.0114)
Unemployment					
ATET	−0.00252	0.0413	−0.0043	0.0398	−0.0445***
	(0.07172)	(0.0683)	(0.0701)	(0.0674)	(0.0116)
Observations	1.294	2.584	1.294	2.584	1.875
Controls	Yes	Yes	Yes	Yes	Yes
Region FE	No	No	Yes	Yes	No
Province FE	No	No	No	No	Yes

All regressions are done via OLS. Robust standard errors in parentheses. The coefficients shown in the table are those of the treatment indicator (coefficient β3 in Equation [3]). The control variables include the log of a district's surface area, the log of a district's population, a dummy variable indicating whether the provincial capital is located in a given district, and a binary variable indicating whether a district is located in the highlands. Significance levels: ***P<0.01, **P<0.05, *P<0.1

seem to indicate that mining in and of itself negatively impacts people's access to basic infrastructure. This may be due to myriad reasons that are not immediately obvious by the stated coefficient.

As scholars have pointed out, not all district governments were prepared for the sudden spike in their budgets, as they lacked the necessary capacities (Aragón and Casas, 2009; Magallanes Díaz, 2016). Additionally, anecdotal evidence suggests that *Canon Minero* transfers were used to erect statues, re-pave the main town's central square, or complete other projects that do not have any effect on the district population, at least not in terms of people's well-being. This inefficiency becomes more apparent when comparing per capita transfers and district government's budgetary execution, as depicted in Figure 5, which highlights two key aspects. First, the relationship between per capita transfers and district government's budgetary execution appears to be negative. Second, many of the districts in regions that do not receive large *Canon Minero* transfers spend these funds rather effectively, given the ration of district government income to expenditures. However, for the districts with more mining activity, such as the districts in Tacna, Moquegua, or Ancash, the figure indicates that these districts are characterized by less effective spending. However, *Canon Minero* transfers appear to make district governments in producing districts slightly more effective.

In contrast to the aforementioned access to basic infrastructure as well as the rate of unemployment in Peruvian districts, the illiteracy rate, as a proxy for education, has a positive and significant coefficient in almost all iterations of the diff-in-diff model, the only exception being the comparison within producing provinces. This implies that across and within regions the introduction of *Canon Minero* transfers resulted in a lower illiteracy rate in the control group, namely non-producing districts in non-producing provinces, compared to the two treatment groups, producing districts and non-producing districts in producing provinces.

Overall, however, the effects are rather small. Therefore, the treatment in itself may not have had a very pronounced impact. Nevertheless, Hypothesis 1 cannot be refuted by these results, as producing and non-producing districts seem to indeed develop differently after the establishment of the current revenue-sharing arrangement, even though these differences appear to be small in magnitude and are different than expected. In the next section, we analyze the effect of the actual transfer of mining rents to district governments.

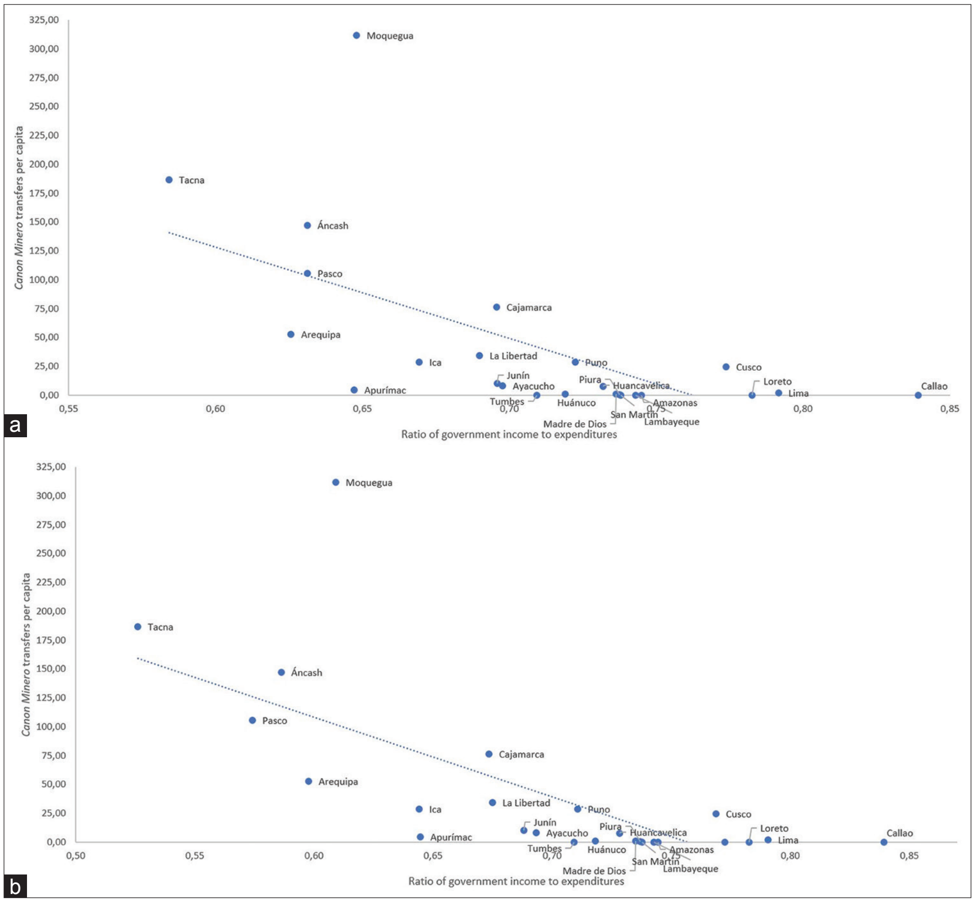
6. CANON MINERO

6.1. Impact of *Canon Minero*

After establishing both the benchmark for 1993 and 2017 as well as the diff-in-diff estimation without considering *Canon Minero* transfers, we now take a closer look at how these transfers may contribute to the development of producing and non-producing districts. This is done via a two-stage least squares (2SLS) regression, in which we compute the effect of *Canon Minero* transfers on district governments' expenditures and, subsequently, the effect of these expenditures on our outcome variables.

In the literature regarding the relationship between mining activity and local well-being in Peru, the effect of mining is often captured by using dummy variables for affected and unaffected districts (Loayza et al., 2013; Araoz, 2016; Ticci and Escobal, 2014; Zambrano et al., 2014). However, this approach has a significant drawback, as nearly 70% of Peruvian districts are in one way or another affected by the country's mining industry (Del Pozo et al., 2012). Consequently, only indicating whether a district, or a household for that matter, is affected by mining activity without considering the extent of the effect leads to an underestimation of the effect on mining and well-being (Maldonado, 2011). Hence, a more nuanced approach has to be taken in order to determine the potential effect of mining on the development of district communities.

Figure 5: Relation between average per capita *Canon Minero* transfers and budget execution in Peruvian districts (grouped at the regional level), 2007-2019 (a) Budget execution, including *Canon Minero* transfers (b) Budget execution, excluding *Canon Minero* transfers



(Sources: Ministry of Economy and Finance (MEF) and National Statistical Institute (INEI), author's illustration)

Therefore, the 2SLS approach described above was chosen. However, for this to be a valid approach, we need to make sure that *Canon Minero* transfers to district governments do not directly affect the variables of interest, i.e., the three outcome variables ((i) the share of the population that lives below the poverty line, (ii) log of per capita consumption and (iii) log of per capita income), but that they only do so by way of the district governments' expenditures. But, is this the case?[16]

Canon Minero transfers consist of corporate income tax from mining companies which is collected by the central government. The amount of corporate income tax each mining company has to pay to the Peruvian government depends on the scope of mining extraction as well as on global mineral prices. Both factors are independent of people's living conditions in district communities in mining districts. Moreover, *Canon Minero* transfers as such do not have any direct effect on district economies as they only contribute to the district economy through investments made by the district governments. Hence, these transfers do not affect the outcome variables directly but do so indirectly through district governments' expenditures.

However, there are certain limitations in our data that, for the sake of completeness, need to be addressed. As stated above, both the scope of mining extraction as well as global mineral prices are independent of people's living conditions. But, one may argue that global mineral prices may influence people's living conditions, not directly, though, but indirectly through employment and wages. As a result of increasing global prices, mining companies may be able to either pay higher wages to the existing workforce or hire additional employees. Both could lead to an improvement in local outcomes. At the same time, rising global mineral prices and the corresponding increase in mining revenue, also imply that there are more *Canon Minero* funds available for redistribution to district governments. As a consequence, district governments may be able to increase public spending, thus, affecting local development.

That is where the limitations within our data come to play. Because we rely on census data and because we cannot glean from the data the industry in which a respondent is employed, as we only have data on the respondent's employment status (e.g., employer, employee, freelancer, self-employed, etc.), we are not able to distinguish between people working in the mining sector and those employed in other sectors. Hence, we cannot control for any employment effects caused by fluctuating global mineral

17 We are aware that such a two-stage approach is usually associated with an IV regression. However, this is not what we intend to do here and neither do we try to create external validity in order to resolve endogeneity issues. As described above, the 2SLS approach was chosen because, given the nature of *Canon Minero* transfers and the way they have to be spent, it allows us to examine the relationship between these transfers and district governments' expenditures as well as between district governments' expenditures and the outcome variables.

prices, and, consequently, we cannot observe whether global mineral prices affect local outcomes.

Therefore, in order to deal with these limitations, we adjust our 2SLS approach accordingly. As a first step, we only consider non-producing districts, both within and outside of producing provinces. With these districts, the aforementioned limitations are not as pronounced, as we do not have to account for any direct effects from mining, especially in non-producing districts in non-producing provinces even less so than in non-producing districts in producing provinces. Only then do we include the producing districts in the analysis.

In the first stage of the 2SLS model, the relation between the *Canon Minero* transfers and district governments' expenditures is estimated with the following equation:[17]

$$w_l = \beta_0 + \beta_1 \, CM_1 + X_d \beta_2 + \delta_R + \varepsilon_d \qquad (4)$$

Where w_l represents the expenditures of district government l, and CM_l denotes the log of *Canon Minero* transfers to district government l. The remaining variables are specified as in Equation (1).

Subsequently, in the second stage, the effect of district governments' expenditures on the three dependent variables is estimated. This is done via the following expression:

$$Y_d = \beta_0 + \beta_1 \hat{w}_l + X_d \beta_2 + \delta_R + \varepsilon_d \qquad (5)$$

Where Y_d represents the outcome variable of district d, i.e., the share of population below the poverty line and the log of per capita consumption, and $\hat{w}_l$ is the dependent variable calculated in Equation (4), namely district governments' expenditures.

The results of the 2SLS regression that only includes non-producing districts, both within and outside of producing provinces, are depicted in Table 5. Regarding the share of the district population that lives below the poverty line, the results show that non-producing districts in producing provinces are characterized by less poverty than non-producing districts in non-producing provinces. According to the results, this is the case both when comparing these districts across as well as within regions. Consequently, *Canon Minero* transfers, via district government expenditures, appear to decrease poverty to a greater extent in non-producing districts in producing provinces than in non-producing districts in non-producing provinces. As the former receive a larger share of *Canon Minero* transfers than the latter, this result seems in line with the expected outcome, i.e., *Canon Minero* transfers have a more pronounced effect the larger the share a given district receives.

Nevertheless, the effect of *Canon Minero* transfers via government expenditure appears to be limited to a reduction of poverty as we do not find any evidence that the transfers, or rather the government expenditures, influence citizens' consumption or income. Hence, overall, citizens in non-producing districts in producing provinces may be characterized as less poor than their counterparts in non-producing districts in non-producing provinces without any significant differences in terms of income or consumption. This may indicate that there are no significant employment effects of *Canon Minero* transfers in these districts.

The results of the 2SLS regression that includes the non-producing districts as well as the producing districts, are presented in Table 6. Concerning the share of the district population that lives below the poverty line, the results show that there are significant effects of *Canon Minero* transfers between producing districts, non-producing districts in producing provinces, and non-producing districts in non-producing provinces, at least when these districts are compared both within and across regions as well as within the same region. In most model specifications, *Canon Minero* transfers, via district government expenditures, appear to decrease poverty in producing as well as non-producing districts in producing provinces. Therefore, these transfers seem to have a positive effect on the welfare of district communities in districts that are characterized by mining activity, and thus, benefit from the transfer of mining rents.

Regarding producing and non-producing districts within the same province, there is no significant effect of these transfers on poverty. This may be because these districts benefit to a comparable degree from mining transfers. Thus, the differences between these two groups of districts may not be large enough to warrant a significant effect, especially because there may also be spillover effects of investments in infrastructure projects in one district to surrounding districts. We analyze this in the following section.

18 Please find the results of the first stage regression in Appendix Tables 4-6.

Table 5: The impact of *Canon Minero* transfers, via district governments' expenditures, on non-producing districts in producing as well as non-producing provinces

Dep. Var.	Across and within regions	Within region
	NPDPP versus NPDNPP	NPDPP versus NPDNPP
a) % of population below poverty line	−0.108*** (0.0349)	−0.0666*** (0.000434)
b) log of per capita consumption	0.143 (0.110)	0.131 (0.153)
c) log of per capita income	0.117 (0.114)	−0.142 (0.181)
Observations	1.223	1.223
Controls	Yes	Yes
Region FE	No	Yes
Province FE	No	No

All regressions are done via 2SLS. Robust standard errors in parentheses. The coefficients shown in the table are those of the instrumented variable (coefficient *β1* in Equation [5]). The control variables include the log of a district's surface area, a dummy variable indicating whether the provincial capital is located in a given district, a binary variable indicating whether a district is located in the highlands as well as the district-specific characteristics taken from the 1993 census (log of population, share of rural population, share of households with access to clean water, share of households with access to electricity and the illiteracy rate). Significance levels: ***P<0.01, **P<0.05, *P<0.1

Table 6: The impact of *Canon Minero* transfers, via district governments' expenditures, on producing and non-producing districts in producing regions

Dep. Var.	Across and within regions		Within region		Within province
	PD versus NPDNPP	NPDPP versus NPDNPP	PD versus NPDNPP	NPDPP versus NPDNPP	PD versus NPDPP
a) % of population below poverty line	0.239***	−0.108***	−0.0293*	−0.0666***	−0.00677
	(0.0922)	(0.0349)	(0.0172)	(0.000434)	(0.0123)
b) log of per capita consumption	−0.0200	0.143	0.223**	0.131	0.229***
	(0.160)	(0.110)	(0.102)	(0.153)	(0.0768)
c) log of per capita income	0.0337	0.117	0.0740	−0.142	0.171**
	(0.146)	(0.114)	(0.113)	(0.181)	(0.0797)
Observations	610	1.223	610	1.223	894
Controls	Yes	Yes	Yes	Yes	Yes
Region FE	No	No	Yes	Yes	No
Province FE	No	No	No	No	Yes

All regressions are done via 2SLS. Robust standard errors in parentheses. The coefficients shown in the table are those of the instrumented variable (coefficient β_1 in Equation [5]). The control variables include the log of a district's surface area, a dummy variable indicating whether the provincial capital is located in a given district, a binary variable indicating whether a district is located in the highlands as well as the district-specific characteristics taken from the 1993 census (log of population, share of rural population, share of households with access to clean water, share of households with access to electricity and the illiteracy rate). Significance levels: ***P<0.01, **P<0.05, P<0.1

In contrast to the measure of poverty, district government expenditures seem to have less impact on per capita consumption and per capita income. Similar to the benchmark for 2017 (Table 3), in which we did not consider *Canon Minero* transfers, we only find significant effects for producing districts and non-producing districts in non-producing provinces within the same region (regarding per capita consumption) as well as for producing districts and non-producing districts in the same province. However, the magnitude of the effect is striking: The effect on per capita consumption is more than twice as high for producing districts compared to non-producing districts in non-producing provinces. Further, when comparing producing and non-producing districts, not only are the indicated effects much higher, but the sign changes as well. This implies that due to mining transfers, citizens of producing districts are significantly better off in terms of per capita consumption and income than they would be without these transfers.

Consequently, from the results, we can glean that mining revenues and the subsequent redistribution to district governments do indeed affect the development of producing and non-producing districts differently. However, two aspects are worth mentioning again, as they should be kept in mind in the context of the results shown above.

First, as mentioned above, confounding factors, such as direct effects of mining in producing districts cannot be completely accounted for. Therefore, these results have to be treated carefully, as the direct effects may be driving the results. Second, the results do not indicate what the causes are for the developmental differences between producing and non-producing districts. We know that the mining revenues have to be invested for the benefit of the district communities, i.e., they have to be invested in infrastructure projects as well as education and health services. But from the results depicted above, we cannot say with certainty which of the aforementioned channels is responsible for the effect of the mining revenues. Nevertheless, in terms of the underlying research question, we can confirm Hypothesis 2 that *Canon Minero* transfers have caused producing and non-producing districts to develop differently since the introduction of the current revenue-sharing arrangement between the national government and district governments.

6.2. Spillover Effects

Now that we have established that *Canon Minero* transfers affect the development of producing and non-producing districts, we examine whether any spillover effects exist due to geographical proximity, e.g., whether transfers to a given district have an impact on the development of neighboring districts[18] . As we can see in Figure 6, the producing districts are scattered across the whole country, mostly concentrated in the coastal and Andean regions. At the same time, it needs to be considered that *Canon Minero* transfers are not made unconditionally but that they have to be spent for certain kinds of investments (see Section 3). Therefore, it is likely that we will see spillover effects to neighboring districts in the form of access to what these funds have to be invested in, e.g., hospitals, schools, and new or improved roads, all of which cannot be restricted to citizens within a given district.

The spatial analysis is conducted via a spatial autoregressive model (SAR). The estimation of such a model requires the specification of a spatial weighting matrix W_{ij} that represents the spatial relationship between two units i and j. Put differently, the matrix W_{ij} defines what "nearby" means and sets this to "shares a border." Consequently, with such a SAR model we are able to differentiate between units that are close together and units that are further apart from one another.

Formally, such a spatial weighting matrix can be defined as (Belotti et al., 2017; Drukker et al., 2013):

$$W = \begin{bmatrix} 0 & w_{12} & \cdots & w_{1,n-1} & w_{1n} \\ w_{21} & 0 & \cdots & w_{2,n-1} & w_{2n} \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ w_{n-1,1} & w_{n-1,2} & \cdots & 0 & w_{n-1,n} \\ w_{n1} & w_{n2} & \cdots & w_{n,n-1} & 0 \end{bmatrix}$$

Where

19 As Waldo R. Tobler put it "everything is related to everything else, but near things are more related than distant things" (cp. Tobler (1970), p. 236). This is also known as Tobler's first law of geography.

$$W_{ij} = \begin{cases} 1, if \ \ j \, is \, a \, neighbor \, of \ i \\ 0, otherwise \end{cases}$$

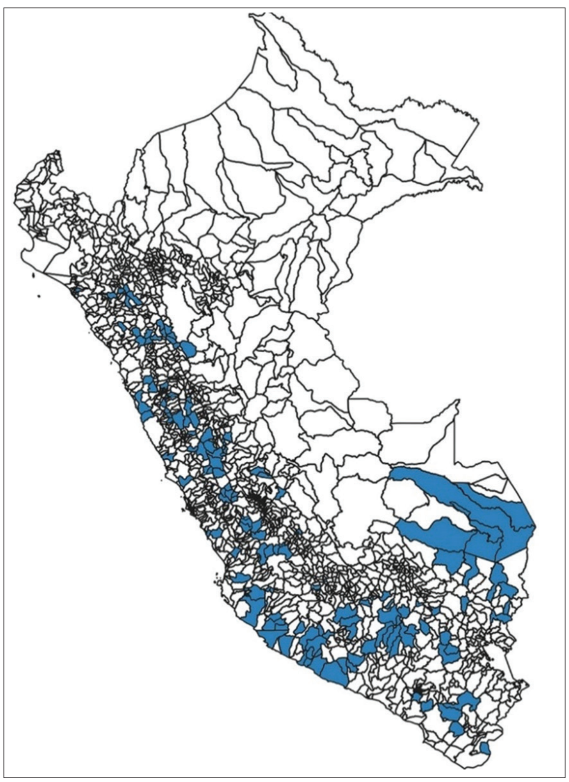
Hence, the SAR model applied in this study is specified as follows:

$$Y_d = \beta_0 + \beta_1 Canon_d + \beta_2 W_{Y_d} + \delta_R + \varepsilon_d \tag{6}$$

Where Y_d represents the outcome variable of district *d*, i.e., the share of population below the poverty line, per capita consumption, and per capita income, $Canon_d$ denotes the log of *Canon Minero* transfers to district *d*, and W_{Y_d} depicts the potential spillover effect of the outcome variable for district *d* on nearby districts as a result of *Canon Minero* transfers to district *d*. All other variables are identical to Equation (1).

In contrast to Section 6.1, *Canon Minero* transfers are not used as instruments for public spending. Furthermore, we only estimate the SAR model for a single period, 2017, as there were no *Canon Minero* transfers in 1993.

Figure 6: Producing districts (in blue)



The results of the aforementioned SAR model are depicted in Tables 7 and 8. These tables display the effect *Canon Minero* transfers have in a given district (direct effect), the effect they have on the surrounding districts (indirect effect), the overall effect on the district and its neighboring districts (total effect), whereby the total effect constitutes the sum of the direct and indirect effects. To establish the extent of any spillover effects, we distinguish between first-order neighbors (adjacent districts) and second-order districts (adjacent districts of adjacent districts).

The results regarding spillover effects to first-order neighbors shown in Table 7 indicate that there indeed is a spillover effect of *Canon Minero* transfers when it comes to poverty and per capita consumption, albeit a rather small one. In case of poverty, a 1% point increase in *Canon Minero* transfers, which is about US$5.46 million[19], reduces poverty in districts that receive transfers by 0.004% points. In their neighboring districts, the magnitude of the reduction of poverty is very similar (0.0039% points). In the case of per capita consumption, *Canon Minero* transfers cause an increase in per capita consumption, both in the district that receives the transfers as well as in neighboring districts. The difference here is that the direct effect on per capita consumption is significantly higher than the indirect effect. This implies that citizens of receiving districts benefit from transfers to their districts to a greater extent than citizens of neighboring districts.

As was detailed in Section 3, *Canon Minero* transfers have to be invested for the benefit of the community, e.g., they have to be invested in public services or infrastructure. As is the nature of such investments, their benefits are not limited to the specific geographic area where they are made, but are accessible by anyone. A new hospital also treats patients from the surrounding area, a new school may enable more students to study in adequate conditions, and improved roads allow farmers to sell their produce in additional markets, or at least they may access these markets more easily. However, as the results show these effects are rather small, so their significance should not be overstated. Nevertheless, the results demonstrate that citizens in neighboring districts also benefit from *Canon Minero* transfers.

Regarding the effect of *Canon Minero* transfers on second-order neighbors, we find rather different results (Table 8). The lack of

20 Based on the yearly average *Canon Minero* transfers to municipal governments between 2004 and 2017.

Table 7: Spatial spillover effects of *Canon Minero* transfers (first-order neighbors)

Variables	Direct effect	Indirect effect	Total effect
% of population below the poverty line	−0.00444** (0.002)	−0.00393** (0.0018)	−0.00838** (0.00379)
Log of per capita consumption	0.03908*** (0.0092)	0.00127*** (0.00035)	0.04035*** (0.0095)
Log of per capita income	0.0351*** (0.00902)	0.001*** (0.0003)	0.03612*** (0.0093)

Significance levels: ***P<0.01, **P<0.05, *P<0.1

Table 8: Spatial spillover effects of *Canon Minero* transfers (second-order neighbors)

Variables	Direct effect	Indirect effect	Total effect
% of population below the poverty line	−0.00304 (0.00199)	−0.00326 (0.00215)	−0.0063 (0.00414)
Log of per capita consumption	0.043*** (0.00937)	0.00024 (0.00026)	0.0432*** (0.00943)
Log of per capita income	0.0389*** (0.00919)	0.00018 (0.00021)	0.0391*** (0.00924)

Significance levels: ***P<0.01, **P<0.05, *P<0.1

significant indirect effects implies that there are no spillover effects to second-order districts. Therefore, any effect of *Canon Minero* transfers appears to be restricted to the districts that receive the transfers and their immediate neighbors[20]. This result is in line with Aragón and Rud, who find that the effect of mining on local communities decreases with increasing distance to the mine's location (Aragón and Rud, 2013).

7. CONCLUSION

Peru has long been involved in mining, but for most of the country's history, the regions, provinces, and districts in which the mining took place did not benefit at all from the revenues that were created in their territory. At first, this was because the mining industry was dominated by foreign mining firms that spent their revenues elsewhere, not in the regions in which their respective mines were located. But even when that changed, and with more and more national mining companies operating in the industry, there was no instrument in place to redistribute the proceeds from mining to subnational governments. That changed in 2001, when Peru passed Law No. 27506, which later became known as the Law of the Mining Canon; through this law, the *Canon Minero* was established. From then on 50% of corporate income tax was to be redistributed to producing districts, provinces, and regions.

This revenue-sharing agreement was slightly modified in 2004, but its main aim remained the same, to promote district communities. Such betterment was to be accomplished by spending mining transfers for the benefit of district communities, i.e., these funds had and still have to be spent on infrastructure projects as well as education and health. Thereby, communities with mining activity should be able to prosper and benefit to a larger extent than those without mining activity. This paper set out to establish whether these *Canon Minero* transfers have played a part in improving people's living conditions or whether Peruvian districts suffer from the subnational resource curse.

We do this by way of different approaches and with regard to various indicators of well-being, such as poverty, access to basic social infrastructure, and consumption. At first, we establish both the benchmark for 1993, well before the Law of the Mining Canon was passed, and the benchmark for 2017, several years after the fact. In the latter case, we initially do not consider the effect of mining transfers. Subsequently, considering that Peruvian districts benefit differently from the *Canon Minero* transfers, we apply a difference-in-differences approach. For this approach, we treat the establishment of the current revenue-sharing agreement as the treatment, where the producing districts and non-producing districts in producing provinces are our two treatment groups and non-producing districts in non-producing provinces are the control group. Lastly, by way of a two-stage least squares (2SLS) estimation, we analyze the effect of *Canon Minero* transfers on the development of district communities and investigate whether significant spillover effects apply to neighboring districts.

Regarding the benchmark for 1993, we find that producing districts were generally characterized by better access to basic infrastructure and higher education than their non-producing counterparts. As we receive similar results when comparing non-producing districts with one another, this indicates that non-producing districts in non-producing provinces were the least developed among the Peruvian districts in 1993. The results for the benchmark in 2017 corroborate these findings, such that after more than three decades communities in producing districts were still more developed.

After establishing the benchmark for 1993 as well as the status quo in 2017, we compare districts across time by way of diff-in-diff estimation, where the treatment is the establishment of the current revenue-sharing agreement. We find that the treatment affects the share of the population with access to clean water as well as electricity and the illiteracy rate both within and across regions. An effect on the unemployment rate can only be seen with regard to producing and non-producing districts in the same province. Interestingly though, the coefficients for the first three outcomes indicate that both treatment groups are affected negatively by the treatment.

Lastly, we investigate the actual effect of *Canon* Minero transfers. We do so by way of a 2SLS regression, in which we compute the effect of *Canon Minero* transfers on district governments' expenditures, and, subsequently the effect of these expenditures on our outcome variables. We argue that this is a valid approach, as *Canon Minero* transfers only depend on the scope of a company's mining activity in a certain district as well as global commodity prices, both of which are independent of people's living conditions, and only take effect via government expenditures (because there are clear restrictions on how these transfers may be used). Following this approach, we can show that *Canon Minero* transfers have a positive effect on the reduction of poverty, albeit not in districts within the same province, as well as on per capita consumption.

In addition to the 2SLS regression, we determine whether the spending of *Canon Minero* transfers causes significant spillover effects. We find that spillover effects exist for first-order neighbors, but not for second-order neighbors. This is in line with previous findings in the literature.

Concerning the overarching theory of the natural resource curse, our results indicate that the Peruvian districts do not seem to suffer from the symptoms usually associated with the resource curse, i.e., slower economic growth, less (institutional) development, and rent-seeking. On the contrary, producing districts appear to be more developed than non-producing districts. The reasons for this may be twofold: First, as mentioned above, mining transfers cannot be spent as district governments please; instead they come attached with unambiguous spending objectives. Second, producing districts receive the largest share of these transfers and, thus, can (and to some extent have to) make higher investments with regard to people's

21. Interestingly, the direct effect of *Canon Minero* transfers on the share of the population that lives below the poverty line is not significant in the context of potential spillover effects to second-order neighbors. However, both the coefficient and the standard error are very similar to the results presented in Table 7. Thus, the direct effect depicted in Table 8 is still comparable to the one shown in Table 7.

well-being. Therefore, mining rents could have a *positive* effect on district development which implies that, at least in this setting, natural resource extraction does not hinder but foster development.

With our analysis, we were able to demonstrate that the Peruvian districts developed differently over time and that these differences can be traced, to some degree, back to the *Canon Minero* transfers. Therefore, these transfers do not seem to be an adequate instrument to curb inequalities between the districts. This would potentially change if the entire revenue-sharing arrangement were to be overhauled such that non-producing districts, in both producing and non-producing regions, receive a larger share of the transfers compared to producing districts.

Nevertheless, there remain several questions about the current revenue-sharing arrangement, such as how the differences between the districts come to be and through which channels the *Canon* Minero transfers take effect. Therefore, future research should focus on further narrowing down these channels. As district communities have to invest the transfers they receive into areas such as education and health, and because regional governments are obligated to divert a share of their transfers to universities in their domain, there may be a long-term effect of *Canon Minero* transfers on education but it may still be too soon to observe significant effects.

At the same time, *Canon Minero* transfers may affect employment. For example, mining activity may attract higher-skilled laborers from other parts of the country who, by moving to the producing districts change the socio-demographic composition of the respective districts. This may bias results as a positive development outcome does not necessarily indicate an overall improvement for the entire population but could, instead, be the result of more highly educated and better-paid "migrant" workers. Another way employment may be affected is through an overall effect on employment in mining and non-mining areas, either directly related to the mining industry itself, indirectly through industries with linkages to the mining industry, or in the local public sector.

Another aspect that warrants further research is whether *Canon Minero* transfers are spent efficiently by district governments. As described in the introduction, some data suggest that only those districts that receive a modest amount spend their funds efficiently. Thus, further research may help with determining how this impacts district development compared to districts in which the *Canon Minero* transfers are higher but may be spent less efficiently.

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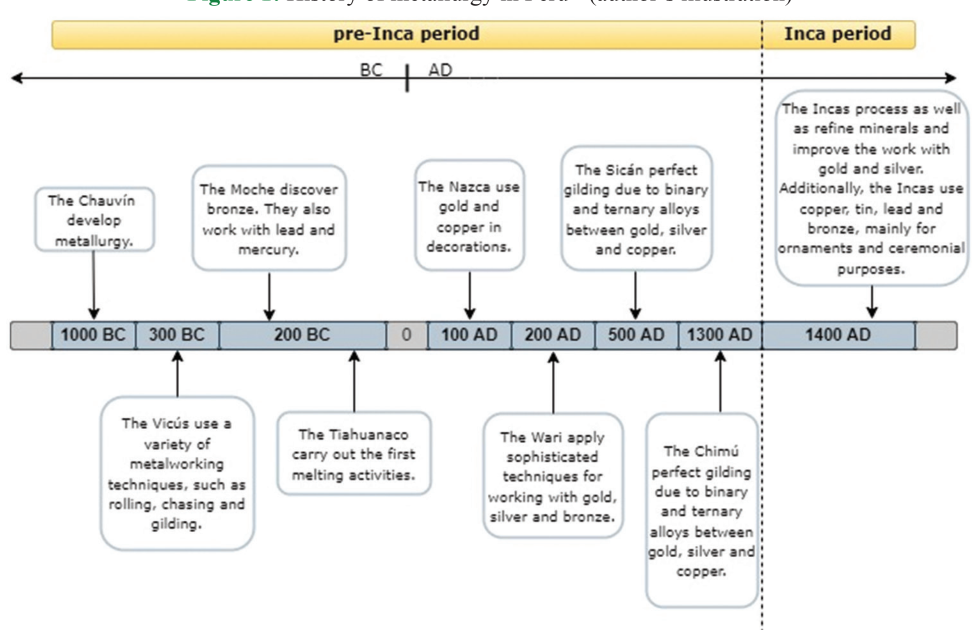
APPENDIX FIGURES

Figure 1: History of metallurgy in Peru[21] (author's illustration)



21 Cp. Contreras et al. (2020); Tumialán (2003).

Figure 2: History of revenue sharing (author's illustration)

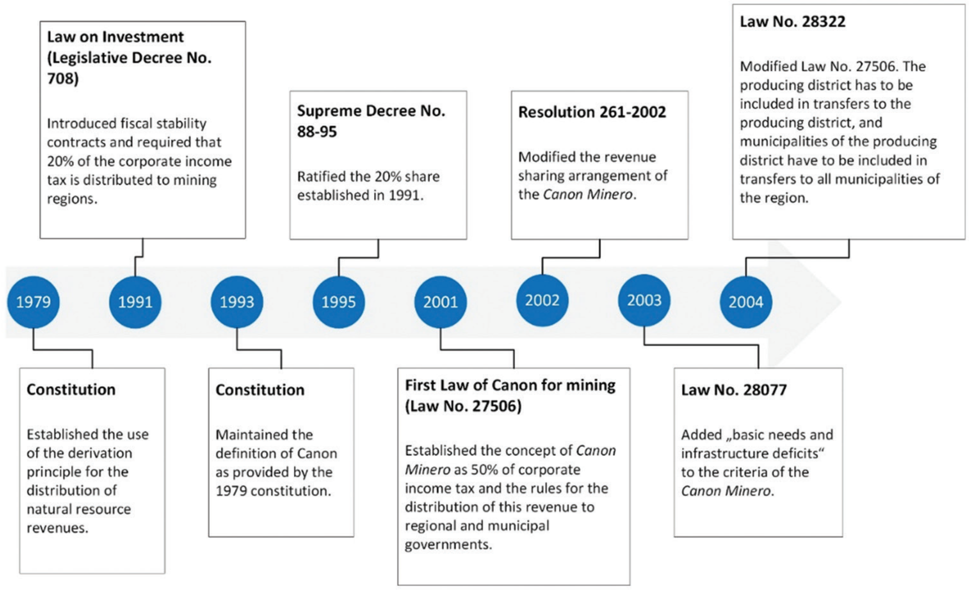
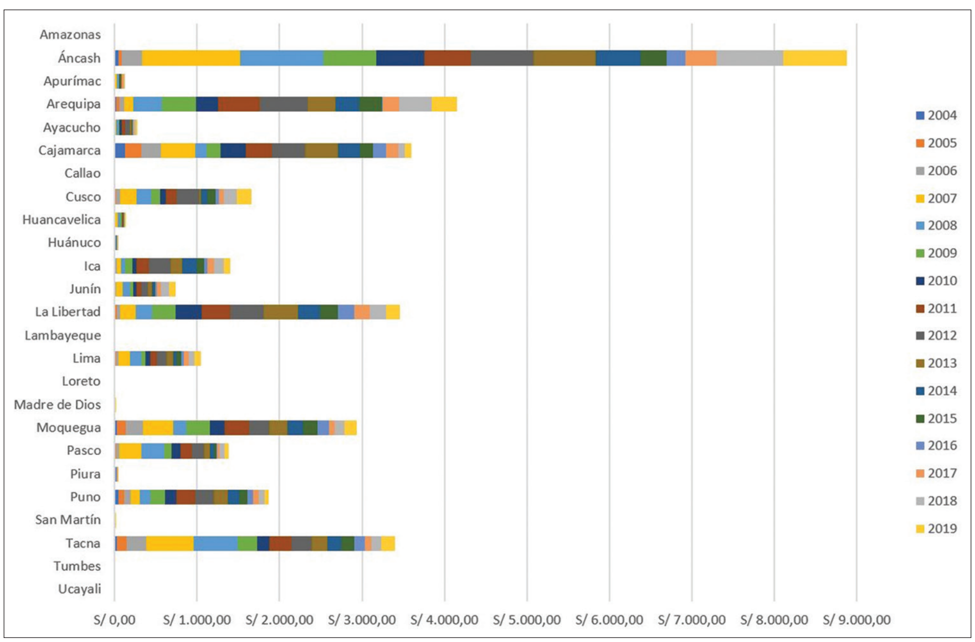
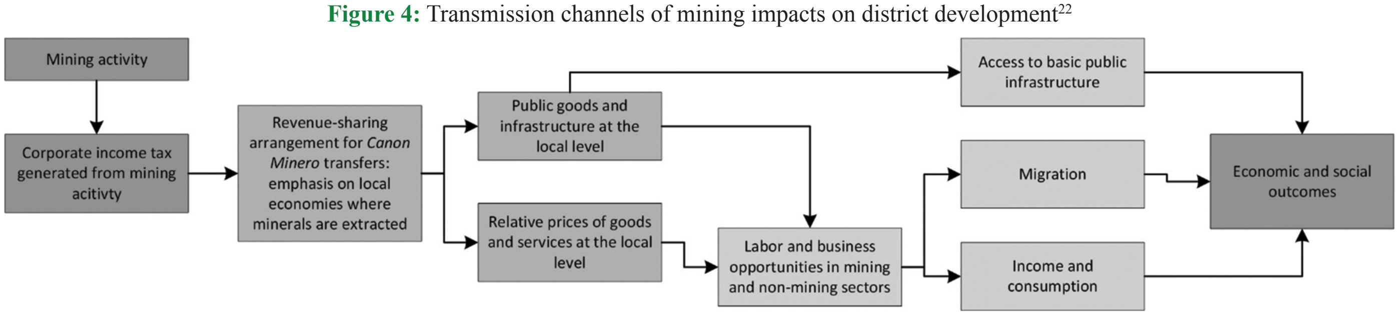


Figure 3: Distribution of Canon Minero transfers between 2004 and 2019 to Peruvian regions in million S/



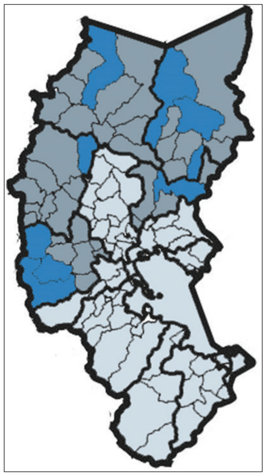
Source: Ministry of Economy and Finance, author's illustration

Figure 4: Transmission channels of mining impacts on district development[22]



22 Cp. Ticci, Escobbal (2014).

Figure 5: Producing districts (blue), non-producing districts in producing provinces (dark grey) and non-producing districts in non-producing provinces (light grey) in the region of Puno



APPENDIX TABLE

Table 1: Distribution of *Canon Minero* transfers (per capita) to district governments (2007)

Quantile	*Canon Minero* (total)	*Canon Minero* (mean)	*Canon Minero* (share of total) (%)
First	0-0.13	0.02	0.001
Second	0.13-34.18	13.44	0.76
Third	34.3-104.76	62.71	3.55
Fourth	106.78-306.76	181.67	10.26
Fifth	307.37-32,148.46	1,511.84	85.42
ALL			
Mean	353.58		20
Min	0		
Max	32,148.46		

Table 2: Distribution of *Canon Minero* transfers (per capita) to district governments (2017)

Quantile	*Canon Minero* (total)	*Canon Minero* (mean)	*Canon Minero* (share of total) (%)
First	0-1.09	0.24	0.04
Second	1.09-19.68	6.72	0.98
Third	19.78-54.17	34.96	5.08
Fourth	54.39-173.91	99.94	14.51
Fifth	174.27-5,556.87	548.18	79.40
ALL			
Mean	137.79		20
Min	0		
Max	5,556.87		

Table 3: Variable descriptions

Variable	Description	Source
Log of accumulated *Canon Minero* transfers	The log of accumulated *Canon Minero* transfers of each district between 2004 and 2017	Ministry of Economy and Finance (MEF)
% of population below the poverty line	Share of the population below the poverty line in 2017	National Statistical Institute (INEI)
Log of per capita consumption	Log of per capita consumption in 2017	National Household Survey for 2017 (ENAHO)
Log of per capita income	Log of per capita income in 2017	National Household Survey for 2017 (ENAHO)
Log of district area	Log of a district's area	National Statistical Institute (INEI)
Provincial Capital	Dummy, which takes the value of 1 if the provincial capital is located in a given district, and 0 otherwise	National Statistical Institute (INEI)
Highlands	Dummy, which takes the value of 1 if a district is located in the highlands, and 0 otherwise	National Statistical Institute (INEI)
Log of population	Log of a district's population in 1993 and in 2017	Census 1993 and Census 2017
% of rural population (1993)	Share of a district's rural population in 1993	Census 1993
% of households with access to clean water	Share of a district's households with access to clean water in 1993 and in 2017	Census 1993 and Census 2017
% of households with access to electricity	Share of a district's households with access to the electricity grid in 1993 and in 2017	Census 1993 and Census 2017
Illiteracy rate	District's illiteracy rate in 1993 and in 2017	Census 1993 and Census 2017
Unemployment	Unemployment rate in each district in 1993 and 2017	Census 1993 and Census 2017
Producing district	Dummy, which takes the value of 1 if there is mining activity in the district, and 0 otherwise	Ministry of Energy and Mines (MINEM)
Non-producing districts in producing provinces	Dummy, which takes the value of 1 if there is mining activity in the province but not in that district, and 0 otherwise	Ministry of Energy and Mines (MINEM)
Non-producing districts in non-producing provinces	Dummy, which takes the value of 1 if there is neither any mining activity in the district nor in the province, and 0 otherwise	Ministry of Energy and Mines (MINEM)

Table 4: The impact of *Canon Minero* transfers on producing and non-producing districts in producing regions (First stage)

Dep. Var.: Log of district governments' expenditures	First stage - 2SLS	
	Across and within regions	
	PD versus NPDNPP	NPDPP versus NPDNPP
Log of *Canon Minero* transfers	0.0534*** (0.0161)	0.0647*** (0.0119)
Observations	610	1,223
R-Squared	0.579	0.669
Controls	Yes	Yes
Region FE	No	No
Province FE	No	No

All regressions are done via 2SLS. Robust standard errors in parentheses. The control variables include the log of a district's surface area, a dummy variable indicating whether the provincial capital is located in a given district, a binary variable indicating whether a district is located in the highlands as well as the district-specific characteristics taken from the 1993 census (log of population, share of rural population, share of households with access to clean water, share of households with access to electricity and the illiteracy rate). Significance levels: ***P<0.01, **P<0.05, *P<0.1

Table 5: The impact of *Canon Minero* transfers on producing and non-producing districts in producing regions (First stage)

Dep. Var.: Log of district governments' expenditures	First stage - 2SLS	
	Within region	
	PD versus NPDNPP	NPDPP versus NPDNPP
Log of *Canon Minero* transfers	0.273*** (0.0404)	0.159*** (0.0279)
Observations	610	1,223
R-squared	0.651	0.702
Controls	Yes	Yes
Region FE	Yes	Yes
Province FE	No	No

All regressions are done via 2SLS. Robust standard errors in parentheses. The control variables include the log of a district's surface area, a dummy variable indicating whether the provincial capital is located in a given district, a binary variable indicating whether a district is located in the highlands as well as the district-specific characteristics taken from the 1993 census (log of population, share of rural population, share of households with access to clean water, share of households with access to electricity and the illiteracy rate). Significance levels: ***P<0.01, **P<0.05, *P<0.1

Table 6: The impact of *Canon Minero* transfers on producing and non-producing districts in producing regions (First stage)

Dep. Var.: Log of district governments' expenditures	First stage - IV (2SLS)
	Within province
	PD versus NPDPP
Log of *Canon Minero* transfers	0.440*** (0.0455)
Observations	894
R-squared	0.806
Controls	Yes
Region FE	No
Province FE	Yes

All regressions are done via 2SLS. Robust standard errors in parentheses. The control variables include the log of a district's surface area, a dummy variable indicating whether the provincial capital is located in a given district, a binary variable indicating whether a district is located in the highlands as well as the district-specific characteristics taken from the 1993 census (log of population, share of rural population, share of households with access to clean water, share of households with access to electricity and the illiteracy rate). Significance levels: ***P<0.01, **P<0.05, *P<0.1