Resource Windfalls and Public-Sector Employment: Evidence from Municipalities in Chile

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Abstract

In this paper, we study the effect of extra resource revenues on employment expenditures at the municipal level in Chile. We exploit a novel quasi-experiment: a legal reform in 2005 that increased the portion of mining patents assigned to municipalities where mines operate, from 30 to 50 per cent. Our main result is a statistically significant expansion of municipal employment expenditures in mining municipalities. Additionally, we did not find a significant effect on other municipal outcomes such as municipal investment, transfers to health and community programs, while the impact on transfers to education is less than half the municipal employment effect. Our findings have several implications for the fiscal decentralization debate in resource-abundant economies.

Keywords: natural resources, municipalities, patronage, fiscal decentralization.
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1. Introduction

To which extent would the allocation of natural resource revenues to local governments be spent in the benefit of the local community? In order to compensate citizens affected by the resource extraction process, several resource-abundant countries have turned toward fiscal decentralization policies that transfer the management of resource revenues to local administrations. On the other hand, a vast economic literature highlights the potential adverse outcomes of resource windfalls through the political process. Yet, most studies have focused on cross-country comparisons or have not directly tested the specific channels through which resource windfalls operate. This paper exploits the 2005's reform to mining law in Chile, which suddenly increased the portion of mining patents assigned to municipalities where mining companies operate from 30 to 50 per cent, to study the effect of an increase in resource revenues on municipal expenditures. In particular, we focus on whether extra revenues are allocated to improve social outcomes or whether they are used to expand municipal-employment.

Our work is based on the framework of Robinson, Torvik and Verdier (2006, 2014). When a permanent resource boom occurs, an incumbent politician has to decide if resource rents will be consumed or distributed as patronage in the form of public employment. Since the probability of staying in power is an increasing function of public-sector employment, there are strong incentives to deviate extra revenues to this purpose. This mechanism reduces the efficiency of the economy by transferring labor to unproductive jobs in the public sector. Moreover, if the clientelistic exchange is too high, the positive income effect induced by a resource windfall could turn negative.

In our context, the legal reform of 2005 to mining patents in Chile can be viewed as an exogenous change in municipal income that is analogous to a permanent resource boom. We use a difference-in-differences approach to compare mining municipalities, which were affected by the reform of 2005, to their peers located in nonproducing areas, accounting for geographical differences, regional-specific effects and time effects. Moreover, we take advantage of the highly detailed municipal data available in Chile, which comes from the *National System of Municipal Information* (SINIM) and covers the period 2001-2015.

We first check if the increase in mining patents effectively translate into higher total revenues to mining municipalities. We found that this is true in municipalities for which, the

year before the reform was approved, at least a 5 percent of their *permanent own income*[1] came from mining patents. We define this group as our treated municipalities, while the control group corresponds to municipalities that had no mining at all on their territory. An increase in municipal revenues was not obvious since the 20 percentage points increase in mining patents could be offset by *fiscal laziness* in collecting other kind of revenues, or by a reduction in transfers form the central government.

Our main result is that extra mining patents generate a sizeable and statistically significant expansion of municipal employment expenditures, even if mining patents in Chile were designed to be used for development projects in local areas. On the other hand, we did not find a statistically significant impact on municipal investment, transfers to health or transfers to community programs, while the increase on transfers to education is less than half the increase in municipal employment expenditures. These findings are not directly attributable to clientelism; however, they support the theoretical prediction of the preponderance of employment expenditures over other municipal areas more closely related to the living standards of the local community.

Chilean data also allows us to evaluate the effect on allowances received by the members of the municipal Council in mining municipalities. The municipal Council in Chile is composed by the major and a group of 6 to 10 councilors according to local population, all of them elected by popular vote. We found a statistically significant increase on allowances that is comparable to the magnitude of the increase in transfers to education. Moreover, we also found evidence of an increase in travel expenses assigned to municipal employees. Again, we cannot conclude from this evidence that resource revenues are being used to finance personal wealth accumulation. However, it is hard to think on efficiency reasons to justify a higher increase of allowances in mining municipalities, or to travel expenses, relative to other municipalities in the country.

We also distinguish among different kinds of municipal employees according to the length of their contracts. In Chilean municipalities, we can find three major categories of workers: long-term employees (called *planta*), whose contracts are mostly permanent over time, annual-term employees (called *contrata*), whose contracts have a fixed-term of one year, and

[1] In Chile, the *permanent own income* (POI) corresponds to the revenues that are directly collected by municipalities.

short-term employees (called *honorarios*), whose contracts ends when a specific task or service is completed. We found that the effect is larger in long-term contracts employees (called *planta* in Chile) than in annual-term contract employees (*contrata*), while the effect is not statistically significant in short-term employees (*honorarios*). These differences can be partially explained by the different regulations that rule the municipal expenditures on each kind of employment.

Our findings have important implications to the fiscal decentralization debate. In resource-abundant economies, the degree of fiscal decentralization is intrinsically related to the direct contribution of resource revenues to local governments. In the case of Chile, the only mining revenues that are managed directly by municipalities correspond to mining patents, which depend on the size of the exploration and production area, while corporate taxes on profits and sells are not assigned to municipalities. Whether a decentralization process will lead to higher living standards for local communities than this centralized scheme is not clear, since we should consider the efficiency-cost of an overexpansion of municipal employment. Nevertheless, our results do not lead us to assert that fiscal decentralization should be discarded. The Robinson, Torvik and Verdier (2006, 2014) framework suggests that the extent to which resource revenues are deviated to expand public-sector employment depends on the quality of institutions. Hence, the main policy recommendation from this paper is that a fiscal decentralization process should be accompanied by improvements in accountability at the local level.

This paper adds to a large literature that have approached the potential adverse effects of resource windfalls, beginning by the seminal works of Sachs and Warner (1995, 2001) on the *resource curse*. However, empirical evidence is not conclusive, since resource revenues seem to be a blessing for some countries but a curse for others. Some papers have empirically found that these divergent results may be caused by differences in the quality of institutions and the specific characteristics of the natural resource that is extracted (Boschini et al 2007, 2013, Collier and Goderis 2012). Nevertheless, the divergent results could also be due to the econometric limitations of cross-country comparisons. Since municipalities share a similar institutional framework, culture and political context, the within-country approach that we use to test the effect of resource windfalls through the political process allows for a clearer causal identification. Moreover, our source of variation in resource revenues is a legal reform,

which is a more exogenous variable than traditional resource intensity measures (Brunnschweiler and Bulte 2008).

Our approach is closely related to a new wave of quantitative studies on the *resource curse* that exploit pseudo-experiments, within-country variations and estimate local impacts[2]. Loayza and Rigolini (2016) found a mixed impact of mining on socioeconomic outcomes at local districts in Peru, since it has a positive income effect but a negative distributional effect. Dube and Vargas (2013) use municipal data in Colombia to show that an increase in oil prices, which is a capital-intensive resource, leads to greater violence, while an increase in the price of a labor-intensive commodity such as coffee, diminishes civil conflicts. Caselli and Michaels (2013) evaluated the impact of oil windfalls in living standards at the municipal level in Brazil and found that oil-rich municipalities expanded reported spending on public goods and services, but this expansion in spending did not lead to a corresponding increase in social outcomes. Our paper contributes to this wave of studies by providing empirical evidence on a specific political-economy channel through which resource revenues are claimed to operate –an expansion of public-sector employment that is motivated by gaining political support.

The rest of this paper is structured as it follows. Section 2 briefly describes the contribution of mining revenues to the municipal budget in Chile. Section 3 discusses the clientelism mechanism proposed by the theoretical literature. Section 4 describes the data and our empirical strategy. Section 5 presents our results on municipal-employment expenditures and other municipal outcomes. Section 6 offers some concluding remarks.

2. Mining and municipalities in Chile

The Chilean economy is heavily intensive in mining production. According to the *Chilean Committee of Copper* (COCHILCO), only copper exports reached US$30,371 million in 2015, which represented a 47.9% of the country total exports, while overall mining sector accounted for near US$34,400 million (54.3% of total exports). During the 2000's commodities boom these numbers were even larger: Chile reached a 36.9% of world copper production in 2004, which have gradually diminished to 29.9% towards 2015. Figure 1

[2] See Van der Ploeg and Poelhekke (2017) for a comprehensive review of this new wave of studies on resource revenues.

resume the evolution of copper exports, overall mining exports and Chile's participation on copper world market during the period 2001-2015.

The most basic administrative units in Chile are municipalities, for which we have detailed data on income and outcome variables from the *National System of Municipal Information* (SINIM*)*. Even if mining is the main economic activity of the country, municipalities do not directly receive any of the corporate taxes and mining-specific royalties that are charged on mining companies. The only revenues from mining that are collected by municipalities correspond to mining patents, which represent the right that has to be paid to explore and produce in municipal territory. Indeed, patents do not directly depend on the production level or profits, but, rather, on the extension of the mining area. Until 2005, 70 per cent of mining patents were transferred to the *Regional Development National Fund* and then redistributed through development projects at the regional level, while only 30 per cent were managed by the municipality where the mine operates. This context suddenly changed after the 2005's legal reform, when the percentage of mining patents assigned to municipalities increased from 30% to 50%.

In Chile, the main components of the municipal budget are the *permanent own income* (POI) and the *common municipal fund* (CMF), while the rest of the budget correspond to direct transfers from the central government and other minor sources. The main difference between the POI and the CMF is the way by which they are collected; while the POI corresponds to the fiscal resources that each municipality is responsible for collecting on its own, the CMF is a redistribution mechanism by which richer municipalities subsidize poorer localities according to certain established criteria[3]. Therefore, mining patents correspond to an item of the POI in the municipal budget.

Table 1 presents a summary of the municipal budget for the period 2001-2015, considering the full sample of municipalities, but also distinguishing between mining and non-mining municipalities. Whether a municipality in Chile is considered as a mining municipality is usually determined as a function of the contribution of mining patents to POI. As it will be

[3] A 35 per cent of the CMF is distributed according to the *permanent own income* (POI) per capita of each municipality. Hence, municipalities that are under the national average of POI per capita receive an amount that is proportional to their distance to the national average. This mechanism implies that when mining municipalities increase their revenues from mining patents, the rest of municipalities will be relative poorer, so a portion of the CMF will be redistributed from mining patents to other municipalities. We will pay special attention to this issue in Section 4 when we define our treatment and control groups.

discussed below in Section 4, we treat a municipality as a mining municipality if it collected more than 5 per cent of its POI from mining patents in 2005, right before the mining reform began to operate. We will show in Section 5 that for this group the reform significantly increased total municipal revenues. On the other hand, we define a municipality as non-mining if it did not collect any revenues from mining patents in 2005[4].

During the period 2001-2015, the POI accounted for around 27 per cent of total income while the FCM represented almost a 47 per cent. Altogether, these components conform what is called the Own Income (OI) of each municipality, which is the portion of the total municipal budget that can be used autonomously by the municipal administration. In Table 1 we also observe that mining patents are a minor component in the full sample of municipalities, but when we look to the group of mining municipalities they account for a 7.1% of total municipal income and a 33.5% of the POI. The latter means that around a third of the resources that are directly collected by a municipality located in a mining areas correspond to mining patents. Notice that, since the mining municipalities group is defined as having more than 5 per cent of mining patents over POI, municipalities that have between 0 and 5 per cent do not belong to mining nor to non-mining group.

3. Mechanisms – resource windfalls and public-sector employment

One of the channels through which a fiscal windfall is claimed to operate in the political process (in this case, a municipal windfall coming from mining patents), is addressed accurately by the model of Robinson, Torvik and Verdier (2006, 2014). Since the probability of remaining in power is an increasing function of active political supporters, an incumbent politician has incentives to expand public-sector employment in exchange for political support. An increase in fiscal income coming from natural resources induces the incumbent to offer unproductive jobs in the public sector, which leads to an efficiency loss in the economy.

The Robinson, Torvik and Verdier model can be applied to our local governments context under the same arguments, where the mayor is the relevant incumbent politician. In the model, the rise in fiscal income comes from an increase in resource prices that are exogenously

[4] We will discuss at length the appropriateness of this definition for mining and non-mining municipalities. Nevertheless, in Section 5.1 we will evaluate several alternative treatment and control groups as a robustness check for our results.

determined in world markets. In the Chilean case, municipalities do not collect taxes from resource production or profits, so the variation in international prices has no direct impact on the municipal budget. However, the legal reform of 2005 to mining patents can be view as an equivalent exogenous change in municipal income. Moreover, the resource curse is normally understood as resource abundance instead of short term price fluctuations, so the model studies a permanent resource boom that is analytically equivalent to the permanent rise in mining patents from 30 to 50 percent.

A different feature of the model, with respect to our context, is that in the case of Chilean municipalities the incumbent does not have to decide the amount of resources to be extracted in each period. Instead, the only decision to make is the amount of resource revenues that will be deviated to patronage and the amount to be used for other municipal expenditures. Nevertheless, the public-sector employment mechanism operates in the same manner. Since this mechanism transfers labor to unproductive jobs in the public sector, the positive income effect of a resource windfall can turn negative if clientelism is too high.

It is also important to approach why the deviation of fiscal resources to obtain political support should operate through an expansion of public-sector employment, that is, a clientelism relationship, instead of other kind of patronage relations. Even if we do not rule out the possibility that other forms of vote-buying are also present, there are reasons to think that clientelism is more likely to occur than transactions involving money payments. According to Robinson and Verdier (2013) a main point refers to credibility –an offer of employment may be more credible than the promise of money transfers. Moreover, an incumbent politician may be able to hire people in advance, while transfers of money could be subject to further institutional restrictions. On the same line, Coate and Morris (1995) suggested that public sector employment is a less explicit way to obtain political support than direct money transfers.

3.1 The role of institutions

Another key feature of the Robinson, Torvik and Verdier approach is that it can capture the divergent experiences of resource rich economies under the same framework. In this model, a resource boom increases total income if accountability is strong, but may decrease income if political institutions are weak. While Chile is still a developing economy, its political

institutions at the national level are significantly stronger than most of Latin American countries and they also compare well to some OECD economies[5]. According to our framework, this implies that an overexpansion of public-sector employment should be limited in the Chilean case. However, it is also possible that municipalities do not face the same levels of accountability than the central government, specially mining municipalities located in remote areas. Our results will provide some insights on whether accountability at the municipal level in a developing country such as Chile is enough to avoid excessive spending on public jobs.

Several empirical works have also asserted that the presence of a resource curse is conditional on the quality of institutions. Collier and Goderis (2012) show that the combination of poor governance and high-rent commodities such as oil and minerals can generate a *resource curse* in the long-run. Boschini et al (2007) find that high-value minerals are the most detrimental to economic development in a context of weak institutions, while Boschini et al (2013) show that the adverse effect of minerals can be reversed if institutions are strong enough. Nevertheless, these studies are based on cross-country comparisons that introduce an interaction between institutional quality and a resource-abundance measure into a growth regression. Our approach is slightly different, since we use a within country setting and we focus on a specific channel through the political process.

3.2 The debate on fiscal decentralization

In fiscal terms, Chile is a highly centralized country. As can be seen in Figure 2, tax revenues allocated outside the central government do not exceed 8.5 per cent during the sample period, while the OECD average is around 14 percent. In a resource-based economy, fiscal decentralization is closely related to the fiscal contribution of resource production to local communities where resources are extracted. In Peru, a neighboring mining country, 50 per cent of taxes from mining companies are directly assigned to local governments where mines operate[6]. Whether the Peruvian decentralization scheme or the Chilean centralized scheme

[5] For instance, Chile has the maximum score on the *Polity2* index (*Polity IV* database), which measures the quality of democratic institutions. Moreover, Chile ranks 24 around the world in the *Corruption Perceptions Index* 2016 from *Transparency International*. We will discuss the quality of Chile's institutions, as well as its implications for the effect of resource revenues, in Section 5.2.

[6] This decentralization scheme is known as the *Mining Canon* in Peru (Loayza and Rigolini, 2016).

lead to higher living standards for local communities depends on the effects of resource windfalls through the political process.

According to Loayza and Rigolini (2016), the effect of mining activity to local communities in Peru is mixed, as it has a positive income effect but a negative distributional effect. However, they focus on the overall effect of mining on socioeconomic outcomes but not on the specific effect of fiscal revenues through the local government. A more closely related study refers to Caselli and Michaels (2013), which found that an increase in revenues experienced by oil-rich municipalities in Brazil expanded reported spending on public goods and services without a correlate in social outcomes. Indeed, their evidence suggests that funds may be allocated to a combination of self-enrichment and vote buying.

Even if we do not aim to find a comprehensive answer to the effects of a fiscal decentralization policy from resource revenues, the Chilean quasi-experiment allows us to better understand its consequences through the political process. The presence of the public-sector employment mechanism would imply that a fiscal decentralization process should be accompanied by a corresponding improvement of accountability at the municipal level, in order to ensure that extra revenues will be efficiently spent in the benefit of the community.

4. Empirical strategy

The main interest of this paper is to explain the effect on municipal-employment expenditures from a resource windfall, so we first evaluate if the 2005's mining reform effectively increased total municipal revenues for our treatment group. After that, we will study the effect of extra mining patents on the aggregate municipal-sector employment, as well as the effect on disaggregated municipal-employment distinguishing between long-term, annual-term and short-term employees. Then, we will evaluate the effect of mining revenues on the allowances assigned to the members of the municipal Council, since there are no efficiency reasons for this item to increase more in the mining municipalities than in the noon-mining ones. Finally, we evaluate the behavior of other municipal expenditures such as municipal investment, transfers to education, transfers to health and transfers to community programs, in order to compare the magnitude of this effects relative to the impact on municipal employment.

Our empirical strategy is based on comparing mining municipalities, considered as our treatment group, to municipalities located in nonproducing areas, so they were not directly affected by the 2005's legal reform. To study the effect of the increase in mining revenues on municipal outcomes, our main equation is the extended difference-in-differences model presented in equation (1), which includes regional effects, to account for specific characteristics of each region along the country[7], time effects, to account for common shocks that could affected all municipalities in certain years, and a vector of geographical covariates, to account for differences between municipalities.

$$(1)\ Y_{ctr} = \alpha + \beta PostxMining_{ct} + \sum_{r=1}^{15} \rho_r Region_r + \sum_{t=2001}^{2015} \rho_t Year_t + \theta X_{ct} + \epsilon_{ctr}$$

Y_{ct} corresponds to a set of municipal outcomes, $Post$ is a dummy that take a value of 1 the years after the legal reform was approved, $Mining$ is a dummy that take a value of 1 if the municipality is a mining municipality and X_{ct} is a set of geographical controls that account for differences in the total squared kilometers of the commune (*area*), the distance to the regional capital (*distance*) and a dummy that takes the value of 1 if the municipality does not belong to the Metropolitan region (*province*), which is the most densely populated region of the country and where the national capital, *Santiago de Chile*, is located.

To compare our results, we also estimate a standard difference-in-differences regression that only includes the set of geographical control variables, as defined in equation (2).

$$(2)\ Y_{ct} = \alpha + \delta Post_{ct} + \gamma Mining_{ct} + \beta PostxMining_{ct} + \theta X_{ct} + \epsilon_{ct}$$

4.1 The treatment: The change to mining law of 2005

During 2005 the Chilean Parliament approved a reform to the distribution of mining patents law (law Nº 19.143). When the reform came into effect during 2006, the portion of mining patents assigned to municipalities increased in 20 percentage points, rising from 30 to 50 per cent. The aim of this policy was to increase the revenues that are received by municipalities

[7] Administratively, Chile is divided into 15 regions. The regions are designed by Roman numerals (they also have a name, but it is not relevant for our purpose), and are located in the following order from north to south: XI, I, II, III, IV, V, XIII, VI, VII, VIII, IX, X, XI and XII. The XIII region is the Metropolitan region of Chile where the capital (Santiago of Chile) is located.

directly affected by mining, in order to promote development projects that compensate local communities and improve their living standards. This reform was also viewed as a first step in the direction of achieving greater fiscal decentralization, which, in turn, was expected to increase efficiency in the allocation of resources throughout the country.

We argue that the legal reform of 2005 can be viewed mostly as an exogenous fiscal windfall for mining municipalities. Since most municipalities are small units, they do not have enough resources to individually affect parliamentary decisions. To lobby and influence public debate, municipalities in Chile are grouped into two main organizations: The Association of Municipalities of Chile (AMUCH) and the Chilean Association of Municipalities (ACHM). However, mining reforms are only relevant for a subgroup of municipalities, which were not properly organized so as to lobby for their own interests when the reform was being discussed. Indeed, the National Association of Mining Municipalities was founded in 2010 and has proposed legal changes referring to mining revenues during recent years. Since there was no strong association that brought together mining municipalities by 2005, mining municipalities did not exert relevant influence on the legal reform to mining patents.

Using data from the *National System of Municipal Information* (SINIM) during the period 2001-2015, we construct the binary variable called *Mining* to identify the group of mining municipalities, which we define as having more than 5 per cent of their *permanent own income* (POI) coming from mining patents during the year 2005, right before the legal reform began to operate. The control group is composed of all municipalities that did not have any resources from mining patents in year 2005. Under this criterion, the treatment group is composed by 46 mining municipalities, while the control group contains 126 non-mining municipalities. In Section 5 we will show that municipalities that had more than 5 per cent of mining patents had a positive budget effect from the legal reform of 2005, which shows that the legal reform was relevant for our treatment group. Also notice that we will not include in our estimation the municipalities that had less than 5 per cent, but more than 0 per cent, of mining patents, since they would not be an appropriate control group. However, in Section 5.2 we will evaluate several definitions for our treatment and control groups as a robustness check.

Figure 3 presents the location of mining municipalities, non-mining municipalities and the rest of municipalities along the Chilean territory. We can observe that most of mining municipalities are concentrated in the North area of the country where most of copper industry is located. This highlights the relevance of including regional effects on our main specification to account for specific shocks to some areas of the country.

We will analyze the trends that followed our main dependent variable, municipal-employment expenditures in per capita terms, before and after the legal reform of 2005. In Figure 4 we observe that municipal-employment expenditures were already higher in mining municipalities before 2005, but the trends of both groups followed a parallel path. This suggests that the difference-in-differences approach is a reasonable choice to evaluate the effect of mining patents on municipal employment. Moreover, after the legal reform came into effect in 2006, both groups seem to increase their expenditures on municipal employment, however, the rise is considerably larger in mining municipalities. We also observe that the increase in municipal employment occurred one year after the reform took effect, and it continued to expand during the following years. This suggest that municipalities had a lagged and gradual response to the increase in their budget from mining patents. In Section 5.2 we will also evaluate different post-treatment periods, in order to address concerns about shocks that could have affected municipalities after the reform.

The fact that municipal employment expenditures also increased for some non-mining municipalities is related to the 35 per cent of transfers from the *municipal common fund* (MCF) that is assigned according to relative *permanent own income* (POI). Hence, as mining municipalities increased their POI because of extra mining revenues, non-mining municipalities are relatively poorer and receive more transfers from the MCF. It is possible that other transfers from the central government to non-mining municipalities also increased as they became relatively poorer. However, we are interested in evaluating the effect of resource revenues on municipal employment. Since the budget increase of non-mining municipalities did not come from mining revenues, our approach is still suitable to identify a causal effect from mining revenues on municipal outcomes. Even so, we will take into account that the increase in revenues of our control group will make it more difficult to find a meaningful effect of mining revenues, so our estimations represent a lower bound for the real coefficients.

4.2 Descriptive statistics

Most of our data comes from the *National System of Municipal Information* (SINIM), which contains highly disaggregated data on municipal revenues and expenditures during the period 2001-2015[8]. In this section, we explore the characteristics of our sample in the periods before (2001-2005) and after (2006-2015) the treatment. Table 2 present summary statistics for our main municipal outcomes, that is, municipal employment expenditures, distinguishing between treatment (mining municipalities) and control (non-mining municipalities) groups. We can observe that, before the legal reform, the expenditure on per capita salaries were higher during the period 2001-2005 in mining municipalities (cl$47.780) than in non-mining municipalities (cl$32,760)[9]. Then, after the legal reform began to operate, salaries in mining municipalities rose to cl$94,090, equivalent to a 97 percent increase. Meanwhile, salaries rose to cl$56,990 in the non-mining group, which represents a 74 percent increase. This shows that, posterior to 2005, salaries grew much faster in municipalities that received extra mining patents.

We arrive to similar conclusions when observing the disaggregated expenditures among long-term and annual-term per capita salaries, while only partial-term salaries grew faster in non-mining municipalities. Moreover, the allowances assigned to the *municipal Council* grew from cl$6,970 to cl$17,380 in mining municipalities posterior to 2005, that is, a 149 percent increase, while in non-mining municipalities allowances increased by 90 percent during the same period. On the other hand, travel expenses increased from cl$7,390 to cl$9,130 in mining municipalities, while they increased from cl$1,470 to cl$1,940 in non-mining municipalities.

Table 3 present summary statistics for municipal revenues in per capita terms, other municipal outcomes in per capita terms (municipal investment, transfers to health, transfers to education and transfers to community programs) and the set of geographical controls described in section 4.1 (total communal area, distance to the regional capital and a dummy

[8] Strictly speaking, we have data until 2016. However, this last year a reform was made to the municipal employment expenditure limits (law Nº20.922), which relax expenditure restrictions and could affect our identification strategy. Therefore, 2016 data is excluded from our analysis.

[9] All the digits are expressed in thousands of Chilean pesos at constant prices of 2005. The exchange rate to 2015 US dollars corresponds to a factor of 650 (cl$650 per US dollar).

called *province* indicating whether the municipality is outside the Metropolitan region). Two comments are in order.

First, we can observe that municipal revenues per capita were higher in mining municipalities (cl$314.600) than in non-mining municipalities (cl$176.200). Nevertheless, mining activities can be considered to be randomly assignment among municipalities, since the process of exploration depends on large multinational mining companies and the central government, while municipalities exert little influence. Moreover, we can also observe that, on average, mining municipalities have a more extensive surface, they are further away from the regional capital and they are more concentrated outside the Metropolitan region. Therefore, it is important to account for these geographical differences in our estimation.

On the other hand, we observe that the increase in spending on other municipal outcomes was not greater in the group of mining municipalities than in the non-mining group, as was the case with municipal employment. In fact, municipal investment per capita increased 40 percent in mining municipalities, while the increase was 46 percent in the non-mining group. Transfers to health increased 60 percent in mining municipalities, while they went up 69 percent in non-mining municipalities. Only transfers to education increased more in the mining municipalities, increasing by 60 percent, compared to the 50 percent that went up in the other municipalities. These are only descriptive statistics, but they suggest a clear difference between the allocation of mining resources to municipal employment expenditures respect to other components of municipal spending

5. Results

We first show that municipal revenues effectively increased for mining municipalities. This is a key step for the analysis, since the 20 percentage points increase in mining patients could be offset by a reduction in redistributive transfers received from the *municipal common fund* (MCF), a reduction in direct transfers from the central government or by incentives to *fiscal laziness* in other components of the *permanent own income* (POI), which are collected by the municipality itself. Table 4 presents the results for municipal revenues per capita evaluating different thresholds to define the mining municipalities group. Columns (1) and (2) show a positive and statistically significant effect for our main treatment group, that is, municipalities that had more than 5 per cent of mining patents over POI in year 2005 before

the reform was implemented. According to our estimations, the magnitude of this effect is cl$93.500 for our main specification including regional-specific and time effects, while the coefficient is cl$89,300 per capita when we use the standard difference-in-differences equation. This is a meaningful impact since the group-average of municipal revenues per capita were cl$314,600 before the treatment period.

By way of comparison, Table 4 also presents the results for other definitions of mining municipality. The effect of mining patents on municipal revenues is not statistically significant when we consider as our treatment group the municipalities that received any amount of mining patents in 2005, which is shown in columns (3) and (4). Therefore, this would not be an appropriate treatment group to test the impact of mining patents through the political process. Columns (5) and (6) show that the effect is smaller than in our main group, and less statistically significant, when we use the group of municipalities that has more than 2.5 percent of mining patents. In addition, as one would have expected, columns (7) and (8) show that the effect is considerably higher when we take the group of municipalities that had more than 10 per cent of mining patents. Nevertheless, we well evaluate several alternative treatment groups in Section 5.2 as a robustness check.

We now evaluate the impact of the increase in municipal revenues on municipal employment expenditures. Table 5 present results for total municipal salaries per capita as well as a disaggregation by different kinds of municipal employment. Column (1) corresponds to our main specification including regional-specific and time effects. We can observe that the increase in mining patents lead to a statistically significant expansion of total municipal salaries per capita. The magnitude of this effect is around cl$19,890 per capita, while the average total municipal salaries in 2005 were cl$47,780 per capita for mining municipalities. The result is very similar using a standard difference-in-differences equation (cl$19,860 per capita), which is shown in column (2). These results are consistent with the Robinson, Torvik and Vernier (2006, 2014) framework, in which an exogenous fiscal windfall generated by natural resources is allocated to expand public-sector employment. According to the same model, our results suggest that Chilean institutions at the municipal level are not strong enough to avoid the presence of the clientelism mechanism.

Columns (3) to (8) presents disaggregated results for the main kinds of municipal employment in Chile. According to these estimations, the largest increase in salaries

corresponds to long-term employees (called *planta* in Chile) –those who have a non-limit contract- and accounts for around 72 per cent of the total increase in municipal employment expenditures. Annual-term employees (called *contrata* in Chile) –whose contracts have to be renewed at the end of each year- account for around 22 per cent of the total increase in salaries, while short-term employees (called *honorarios* in Chile) –those who have been employed for a specific task by the municipality- account for around 5 per cent of the total effect in salaries spending, However, the increase in expenditures of short-term employees is not statistically significant. These proportions can be partially explained by the differentiated legal restrictions that affect different kind of municipal employees. While the expenditure on long-term contract cannot exceed a 35 per cent of the *own income* (OI), annual-term contract expenditures and short-term contract expenditures are more restricted. Moreover, annual-term contract expenditures cannot exceed a 20 per cent of long-term contract expenditures (law Nº18.883), and expenditure on short-term contracts is restricted to 10 percent of long-term contract expenditures (law Nª19.280) [10].

To provide additional evidence to support the hypothesis of an inefficient increase in municipal employment financed by mining patents, we now evaluate the evolution of the allowances assigned to the *municipal Council*. In Chile, the *municipal Council* is composed by the Mayor and a group of councilors directly elected by popular vote, which range from 6 to 10 according to population. Since extra allowances are conceived to finance specific needs for the execution of *municipal Council* tasks, there is no reason to think that the *municipal Council's* needs suddenly increased in mining localities respect to other municipalities in the country. Moreover, we will also evaluate the travel expenses assigned to the municipal employees, for which there also no efficiency reasons that justify an increase compared to non-mining municipalities.

Table 6 resume these results. In column (1) we observe a statistically significant increase in allowances to the *municipal Council* of cl$8,090 per capita. This effect is meaningful when compared to its level before the reform to mining patents, where allowances accounted for cl$6,970 per capita in mining municipalities. The coefficient for the standard difference-in-

[10] The law Nº18.883 was recently modified by the law Nº20.922, which expand the limit of long-term employee expenditures from 35 to 42 per cent of the *Own Income*, while annual-term employee expenditures modify its limit from 20 to 40 per cent of long-term employee expenditures. Since this new regulation was published in May of 2016, it does not affect our sample period.

differences equation is also statistically significant and has a similar magnitude (cl$7,091 per capita), as is shown in column (2). In column (3) we also observe a statistically significant increase in travel expenses of cl$3,270 per capita. However, the effect on travel expenses is not statistically significant when we exclude regional-specific and time effects in column (4).

We have shown that the increase in mining patents leads to a significant increase of municipal revenues in mining municipalities, which translate into a large increase in municipal employment expenditures, and also to an apparently unjustified increase in allowances to the *municipal Council*. Now we investigate whether the increase in municipal revenues also leads to an increase in other municipal expenditures that could be more closely related to the living standards of the community. Table 7 presents the results for other municipal expenditures (municipal investment, transfers to education, transfers to health and transfers to community programs). In columns (1) and (2) we can observe that the effect on municipal investment is not statistically significant for either specification. Column (3) show a positive and statistically significant effect on transfers to education of around cl$9,170. The positive effect on transfers to education remains statistically significant when we exclude regional-specific and time effects in column (4), but its magnitude decreases (cl$6,340 per capita). Columns (5) and (6) show that the effect on transfers to health is not statistically significant under any specification. Column (7) shows a statistically significant effect on transfers to community programs but of only cl$850 per capita. However, column (8) shows that the effect on community programs is not statistically significant when we exclude regional-specific and time effects.

The results in Table 7 suggest that the effect in other municipal expenditures, which should have a more direct impact on living standards, is less clear than the effect in municipal employment expenditures. Indeed, the only meaningful increase in these outcomes corresponds to the increase in transfers to education. Nevertheless, this effect is less than half the impact on municipal employment, and only slightly more than the effect on allowances to the municipal Council. These large differences in the allocation of mining revenues is consistent with Robinson et al (2006, 2014) predictions. Moreover, this overexpansion of municipal sector employment could be due to patronage in the form of clientelistic exchange. On the other hand, the apparently unjustified increase in allowances and travel expenses points in the direction of diversion of revenues for personal enrichment.

5.1 Robustness check

The previous analysis identifies a large effect of mining revenues on public-sector employment by comparing mining municipalities to other municipalities along the country, conditional on geographic controls, regional-specific effects and time effects. This approach is supported by the parallel trends followed by both group of municipalities before the legal reform to mining patents (the treatment) was implemented. Nevertheless, in this section we address some possible concerns about our results.

One concern refers to our treatment group. In section 4.2 we defined mining municipalities as having more than 5 per cent of their *permanent own income* (POI) coming from mining patents right before the legal reform was implemented. Since this is somewhat an arbitrarily definition of mining municipalities, in Table 8 we evaluate our main regression on municipal-employment expenditures using alternative treatment groups. In columns (1) to (5) we define mining municipalities as having more than 4 per cent, 3 per cent, 2 per cent, 1 per cent and 0 per cent of mining patents, respectively. We observe that the effect on municipal-employment expenditures remains positive and statistically significant for all specifications except when we define mining municipalities as having any percentage of mining patents (more than 0 per cent). As we should expect, the magnitude of the effect reduces as we include in our treatment group municipalities that were less affected by the legal reform. These results suggest that the result of a significant expansion of municipal employment is not being driven by our definition of mining municipalities, while its magnitude does depend on the relevance of mining patents for this group.

Another possible concern refers to shocks affecting mining municipalities after the legal reform began to operate. We should be worried about other legal changes that could have affected regulations on municipal-employment expenditures or the municipal budget of mining municipalities. Regarding structural changes to municipal employment, we argued that spending limits on municipal employment were fixed during the whole sample period. Indeed, the only recent change in the municipal employment spending limit occurred in 2016, but this year was intentionally excluded from our sample. On the other hand, there were no legal changes that affected only the budget of mining municipalities during the period of study.

To make sure that our results are not capturing other income shocks during the post-treatment period that we are omitted, Table 9 present the results for our main regression on municipal employment expenditures but reducing the post-treatment period. Columns (1) to (9) show the results when we successively reduce the post-treatment end period from 2015 to 2007. We observe that the effect on municipal-employment expenditures remains statistically significant when we reduce the end period of our sample from 2014 to 2009, while the magnitude of the effect is slightly reduced each year. This suggest that our findings are not contaminated by posterior shocks to mining municipalities. Indeed, only when our post-treatment period ends in 2008 or 2007 the coefficient is positive but not statistically significant, which should be due to the lagged and gradual response of municipalities to an increase in their budgets.

As a further robustness check, we also evaluate alternatively control groups. First, we use the full sample of municipalities that are not considered as mining as a control group, that is, all municipalities that have less than 5 per cent of mining patents. Then, we evaluate a control group conformed by all municipalities that are neither mining or non-mining according to our definition (municipalities that have between 0 and 5 per cent of mining patents). Table 10 presents this results in columns (1) and (2). We observe that the effect of mining patents on municipal-employment expenditures is positive and statistically significant using both control groups, and the coefficient is even larger than in our main specification.

Finally, we also construct three additional control groups by dividing the country between the north-central area, south-central area and Metropolitan region of Chile[11]. Table 10 present these estimations in columns (3) to (5). We notice that the effect on municipal-employment expenditures is positive and statistically significant using either of these three subgroups of municipalities as the control group. The largest effect is respect to non-mining municipalities located in the Metropolitan region, followed by the group of non-mining municipalities located in the north-center area of the country.

5.2 Discussion: Are institutions not strong enough in Chile?

[11] Chile is administratively divided in 15 regions. We consider as north-center area the regions I, II, III, IV, V, VI and XV. South-center area corresponds to regions VII, VIII, IX, X, XI, XII and XIV. The Metropolitan Region is the name that receives the XIII region of Chile, where the capital (Santiago de Chile) is located.

Theoretically, the extent to which resource revenues expand employment expenditures depends on the quality of institutions. Some empirical studies have also highlighted the relevance of institutions for the effect of natural resources through the political process. For example, Bhattacharyya and Holder (2010) uses a cross-country sample to found that the extent to which resource rents foster corruption is conditional on the quality of democratic institutions. Other studies on natural resources and the political process have not tested directly the relevance of institutions, but have found evidence of corruption or misallocation of fiscal resources in developing countries that do not have strong institutions. Caselli and Michaels (2013) results suggest that oil windfalls in Brazilian municipalities were diverted to a combination of self-enrichment and patronage. Vicente (2010) reported that perceived corruption levels increase in Sao Tome and Principe relative to Cape Verde, two countries with similar institutions contexts, after the former discovered oil.

Chile is also a developing economy, but the quality of its institutions is well above the median of developing countries. For instance, Chile has the maximum possible score in the *Polity2* index developed by the *Polity IV project*, which measure the quality of the democratic institutions[12]. Moreover, Chile ranked 24 around the world in the *Corruption Perception Index* of 2016, developed by *International Transparency*. Furthermore, Chile's average GDP growth was 4.1 per cent during the period 2001-2015[13], and has grown at even faster rates in previous decades, so it is usually mention as a resource-abundant country that could overcome the resource curse. Despite all that, this paper found that mining revenues caused a significant expansion of municipal-employment expenditures, which, according to theory, could be due to clientelistic exchanges (Robinson, Torvik and Verdier 2006, 2014).

A first comment refers to the distinction between market-based and political-economy mechanisms, well addressed in Caselli and Michaels (2009)[14]. As natural resources are claimed to have multiple mechanisms, it is perfectly possible that Chile's institutional framework was able to avoid most of the market-based effects from mining, resulting in a

[12] The Polity 2 index consider aspects such as competitiveness of political participation, the regulation of participation, the openness and competiveness of the executive's recruitment and the institutional constraints on the executive.
[13] Central Bank of Chile database.
[14] This work corresponds to the working paper of Caselli and Michaels (2013): Do Oil Windfalls Improve Living Standards? Evidence from Brazil. Unfortunately, the extensive revision of market-based and political-economy mechanism was not included in the final version.

rapid expansion of GDP, but still have some flanks to improve in order to avoid some of the political-economy mechanisms, as patronage.

A related point are the differences that can arise between central and local institutions within the same country. We should consider that Chile has a highly centralized fiscal system (as discussed in Section 3.2), so institutions at the local level could have developed less than at the central level, and they may not be prepared to efficiently manage resource revenues. Moreover, because of the nature of mining activities, several mining municipalities are located in remote areas that are far away from the Metropolitan region of Chile (the most developed area of the country), which could result in lower accountability levels.

If local institutions are underdeveloped respect to central institutions, the decentralization of resource revenues could result in efficiency losses, as they will give space to patronage and other adverse political outcomes. Furthermore, even if fiscal decentralization could increase public sector efficiency by bringing the government closer to the people, its effect on the economy is still an open question. Some empirical studies have found a consistently negative impact of fiscal decentralization on economic development (Zhangab and Zouab 1998), while others have found a non-significant effect (Thornton 2007, Baskaran and Feld 2013). Nevertheless, most of the empirical literature on fiscal decentralization have not focused on revenues from natural resources, which could have differentiated effects respect to other sources of fiscal revenues[15].

Under the light of our results for the Chilean case and the previous points discussed in this section, our view is that, even if a country seems to have strong institutions at the central government and low perception of corruption, a fiscal decentralization process should be accompanied by an accountability improvement process at local governments. Nevertheless, many relevant issues are left for further research. To which extent local governments have lower levels of accountability, and whether resource revenues have a differentiated effect respect to other revenues, are two key elements for the fiscal decentralization debate in resource-abundant economies.

[15] For instance, Dalgaard and Olsson (2008) show that whereas fiscal windfalls generated by foreign aid lead to a decrease in corruption, resource revenues are positive correlated with corruption.

6. Concluding remarks

This article has examined the effect of an increase in mining revenues on municipal employment and other municipal outcomes, which was induced by the legal reform of 2005 in Chile. This setting is a novel quasi-experiment to obtain a more exogenous variation in fiscal revenues from natural resources. Moreover, the within-country approach allows to reduce concerns about differences in institutions, culture and the political context, which are hard to control under a cross-country regression. Our work is part of a recent set of studies that has intended to measure the impact of resource windfalls by exploiting natural experiments or resource discoveries, and have moved from national to local impacts (Caselli and Michaels 2013, Dube and Vargas 2013, Loayza and Rigolini 2016, among others). Although we are not the first to analyze the effects of a resource windfall through municipal spending, previous studies have not focused on the public-sector employment mechanism proposed by Robinson, Torvik and Verdier (2006, 2014).

We found that the 20 percentage points increase in mining revenues patents assigned to mining municipalities translates into a significant expansion of municipal employment expenditures. According to theory, this expansion could be motivated by patronage in the form of clientelistic exchanges. This effect is concentrated in long-term municipal employees, followed by annual-term employees, while the effect on short-term employees' expenditures is not statistically significant. Moreover, we did not find any effect on municipal investment and transfer to health, while the effect on transfers to community programs is meaningless. The only relevant positive effect on other municipal outcomes corresponds to transfers to education. Nevertheless, this coefficient is less than half the impact on municipal employment expenditures.

Exploiting the highly disaggregated data from the *National System of Municipal Information (SINIM)* of Chile, we were also able to evaluate the effect on allowances to the municipal Council and travels expenses assigned to municipal employees. Remarkably, we found a positive effect on allowances and travel expenses. We cannot directly attribute this result to the diversion of revenues for personal enrichment, however, it is hard to think of efficiency reasons for such an increase in spending on those items.

Our results on municipal employment expenditures hold after a wide range of robustness checks. Indeed, we evaluated different definitions of mining municipalities for our treatment

groups, different definitions of non-mining municipalities for our control group, as well as control subgroups from different geographic areas of the country, and different ranges for the post-treatment periods.

Finally, our findings suggest that Chilean institutions at the local government are not strong enough to avoid the public-sector employment mechanism. Since the quality of institutions in Chile is well above other developing economies, these results could be due to differences in accountability between national and local institutions. This point implies that the trend to fiscal decentralization must be taken with caution, specially in resource-abundant countries. Although much still needs to be studied in the relationship between national and local institutions, and regarding a differentiated effect from natural resources in the political process, the main policy recommendation of this document is that a process of fiscal decentralization must be accompanied by a process of improvement in the levels of accountability at the local level.

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Table 1. Average municipal budget and mining patents 2001-2015

	All municipalities (329)	Mining municipalities (46)	Non-mining municipalities (123)
Municipal budget			
POI as a % of total budget	0.273	0.268	0.268
CMF as a % of total budget	0.46	0.455	0.471
Others as a % of total budget	0.264	0.277	0.262
Mining patents			
Mining patents as a % of POI	0.054	0.341	0.004
Mining patents as a % of total budget	0.011	0.071	0.000

Notes: Own construction using SINIM data. Mining municipalities are defined as collecting more than 5 per cent of its permanent own income from mining patents in 2005.

Table 2. Summary statistics for municipal employment expenditures.

	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
	Mining municipalities (46)					
	2001-2005			2006-2015		
Total salaries per capita	226	47.78	65.23	458	94.09	169.77
Long-term salaries per capita	226	36.08	46.17	458	68.74	120.4
Annual-term salaries per capita	226	7.77	11.47	458	18.14	35.55
Short-term salaries per capita	226	3.93	8.55	458	7.21	16.83
Allowances to municipal Council per capita	226	6.97	16.17	458	17.38	49.2
Travel expenses per capita	226	7.39	19.72	458	9.13	30.34
	Non-mining municipalities (123)					
	2001-2005			2006-2015		
Total salaries per capita	609	32.76	36.32	1,226	56.99	80.35
Long-term salaries per capita	608	25.67	28.41	1,226	42.16	60.36
Annual-term salaries per capita	608	5.02	5.3	1,226	10.61	13.83
Short-term salaries per capita	608	2.08	5	1,226	4.21	11.88
Allowances to municipal council per capita	608	3.1	7.04	1,226	5.89	14.55
Travel expenses per capita	608	1.47	3.26	1,226	1.94	4.13

Notes: All variables are expressed in thousands of Chilean pesos at constant prices of 2015.

Table 3. Summary statistics for other municipal outcomes and geographic controls.

	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
	Mining municipalities (46)					
	2001-2005			2006-2015		
Municipal revenues per capita	228	314.6	447.4	458	527.58	805.9
Municipal investment per capita	226	58.72	88.4	458	82.59	118.6
Transfers to education per capita	226	23.44	32.42	459	40.47	54.38
Transfers to health per capita	226	12.43	15.03	458	19.92	26.38
Transfer to community programs per capita	226	1.57	4.56	458	3.46	7.24
Total communal area (km2)	225	64.12	67.3	457	64.63	66.83
Distance to the regional capital (km)	230	169.3	114.9	460	169.3	114.8
Province (=1, outside the Metropolitan region)	230	0.956	0.204	460	0.956	0.204
	Non-mining municipalities (123)					
	2001-2005			2006-2015		
Municipal revenues per capita	609	176.2	197.6	1,226	284.6	369.5
Municipal investment per capita	608	30.62	50.11	1,226	44.59	101.4
Transfers to education per capita	608	15.17	24.34	1,226	23.15	43.1
Transfers to health per capita	608	7.93	9.79	1,226	13.41	24.9
Transfer to community programs per capita	608	0.74	1.43	1,225	1.83	3.06
Total communal area (km2)	587	5.42	7.17	1.218	6.63	10.91
Distance to the regional capital (km)	615	108.7	338.4	1.230	108.7	338.2
Province (=1, outside the Metropolitan region)	615	0.756	0.43	1.230	0.756	0.43

Notes: All variables are expressed in thousands of Chilean pesos at constant prices of 2015.

Table 4. Municipal revenues

Dependent variable: Municipal revenues per capita	Treatment group: Mining >5%		Treatment group: Mining >0%		Treatment group: Mining >2.5%		Treatment group: Mining >10%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post x mining	93.5**	89.3*	-7.64	-13.16	64.84*	71.84*	160.10***	112.89*
	(41.19)	(48.72)	(12.02)	(17.10)	(35.04)	(43.10)	(60.09)	(48.00)
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	No	Yes	No	Yes	No	Yes	No
Time FE	Yes	No	Yes	No	Yes	No	Yes	No
Observations	2,479	2,479	4,825	4,825	2,584	2,584	2,322	2,322

Notes: Columns (1) and (2) correspond to our main treatment group, that is, municipalities that had more than 5% of their *permanent own income* (POI) coming from mining patents in 2005. Columns (3) – (8) evaluate alternative treatment groups. Odd columns estimate an extended model that includes municipality and year fixed effects, while even columns estimate a standard difference-in-difference model. Geographic controls include total municipal area, distance to the regional capital and a dummy that take a value of 1 if the municipality is outside the metropolitan region. Robust standard errors are reported in parentheses.
*** p<0.01 ** p<0.05 * p<0.1

Table 5. Municipal employment expenditures

Dependent variable:	Total municipal salaries per capita		Long-term salaries per capita		Annual-term salaries per capita		Short-term salaries per capita	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post x mining	19.86**	19.89***	15.61***	14.36**	4.23**	4.43**	0.02	1.10
	(8.44)	(9.16)	(5.97)	(6.55)	(1.84)	(1.84)	(1.05)	(1.00)
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	No	Yes	No	Yes	No	Yes	No
Year FE	Yes	No	Yes	No	Yes	No	Yes	No
Observations	2,476	2,476	2,476	2,476	2,476	2,476	2,476	2,476

Notes: Odd columns estimate an extended model that includes municipality and year fixed effects, while even columns estimate a standard difference-in-difference model. Geographic controls include total area of the commune, distance to the regional capital and a dummy that take a value of 1 if the municipality is outside the metropolitan region. Robust standard errors are reported in parentheses.
*** p<0.01 ** p<0.05 * p<0.1

Table 6. Allowances and travel expenses

Dependent variable:	Allowances to the Municipal Council per capita	Allowances to the Municipal Council per capita	Travel expenses of municipal employees per capita	Travel expenses of municipal employees per capita
	(1)	(2)	(3)	(4)
Post x mining	8.09***	7.09***	3.27**	0.85
	(2.54)	(2.54)	(1.45)	(1.93)
Geographic controls	Yes	Yes	Yes	Yes
Municipality FE	Yes	No	Yes	No
Year FE	Yes	No	Yes	No
Observations	2,476	2,476	2,476	2,476

Notes: Odd columns estimate an extended model that includes municipality and year fixed effects, while even columns estimate a standard difference-in-difference model. Geographic controls include total area of the commune, distance to the regional capital and a dummy that take a value of 1 if the municipality is outside the metropolitan region. Robust standard errors are reported in parentheses.
*** p<0.01 ** p<0.05 * p<0.1

Table 7. Other municipal expenditures

Dependent variable:	Municipal investment per capita		Transfers to education per capita		Transfers to health per capita		Transfer to community programs per capita	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post x mining	7.39	9.03	9.17***	6.34*	0.18	2.42	0.85**	0.7
	(8.6)	(8.71)	(3.33)	(3.54)	(1.77)	(1.71)	(0.37)	(0.47)
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	No	Yes	No	Yes	No	Yes	No
Year FE	Yes	No	Yes	No	Yes	No	Yes	No
Observations	2,476	2,476	2,476	2,476	2,476	2,476	2,476	2,476

Notes: Odd columns estimate an extended model that includes municipality and year fixed effects, while even columns estimate a standard difference-in-difference model. Geographic controls include total area of the commune, distance to the regional capital and a dummy that take a value of 1 if the municipality is outside the metropolitan region. Robust standard errors are reported in parentheses.
*** p<0.01 ** p<0.05 * p<0.1

Table 8. Alternative treatment groups

Dependent variable: Total municipal salaries per capita	(1) Treatment group: Mining >4%	(2) Treatment group: Mining >3%	(3) Treatment group: Mining >2%	(4) Treatment group: Mining >1%	(5) Treatment group: Mining >0%
Post x mining	18.33**	16.35**	13.82**	8.88*	-1.52
	(7.81)	(7.54)	(6.38)	(4.65)	(2.48)
Geographic controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	Yes	Yes
Observations	2,506	2,536	2,640	2,850	4,821

Notes: Columns (1) - (5) consider different treatment groups that are defined in terms of the percentage of mining patents that municipalities collect. The difference-in-differences estimation includes municipality-specific and year fixed effects. Geographic controls include total area of the commune, distance to the regional capital and a dummy that take a value of 1 if the municipality is outside the metropolitan region. Robust standard errors are reported in parentheses.
*** p<0.01 ** p<0.05 * p<0.1

Table 9. Alternative post-treatment periods

Dependent variable:	Post-treatment period from 2006 to:								
Total municipal salaries per capita	2015 (1)	2014 (2)	2013 (3)	2012 (4)	2011 (5)	2010 (6)	2009 (7)	2008 (8)	2007 (9)
Post x mining	19.86**	18.08**	17.83**	17.42**	17.08**	16.83*	15.66*	13.59	8.74
	(8.44)	(8.32)	(8.24)	(8.29)	(8.44)	(8.72)	(8.55)	(8.75)	(9.31)
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,476	2,309	2,140	1,971	1,803	1,634	1,465	1,298	1,135

Notes: Columns (1) - (8) considers different post treatment periods for estimation. The difference-in-differences estimation includes municipality-specific and year fixed effects. Geographic controls include total area of the commune, distance to the regional capital and a dummy that take a value of 1 if the municipality is outside the metropolitan region. Robust standard errors are reported in parentheses.
*** p<0.01 ** p<0.05 * p<0.1

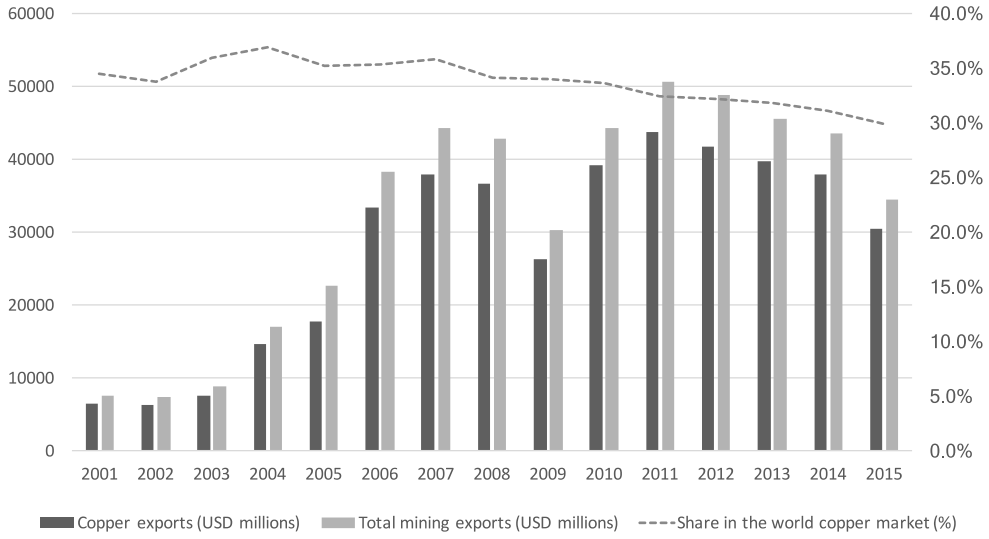
Table 10. Further robustness check

Dependent variable: Total municipal salaries per capita	(1) Control group: Municipalities with mining <5% (full sample)	(2) Control group: Municipalities with mining between 0% and 5%	(3) Control group: Non-mining municipalities located in the North-center area	(4) Control group: Non-mining municipalities located in the South-center area	(5) Control group: Non-mining municipalities located in the Metropolitan region
Post x mining	34.11***	24.74***	23.60**	15.71**	30.19***
	(6.73)	(5.61)	(10.82)	(7.89)	(7.07)
Geographic controls	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	No	Yes
Observations	4,821	3,021	986	2,166	1,126

Notes: Columns (1) - (2) consider alternative control groups that are defined in terms of the percentage of mining patents that municipalities collect. Columns (3) - (5) consider alternative control groups that include non-mining municipalities that area located in a specific area of the country. The difference-in-differences estimation includes municipality-specific and year fixed effects. Geographic controls include total area of the commune, distance to the regional capital and a dummy that take a value of 1 if the municipality is outside the metropolitan region.

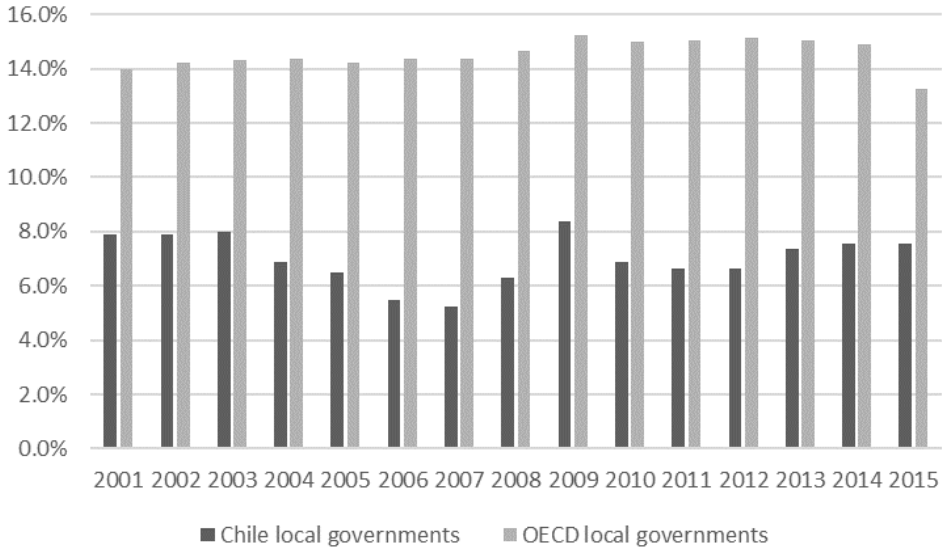
*** p<0.01 ** p<0.05 * p<0.1

Figure 1. Evolution of copper and overall mining activities in Chile



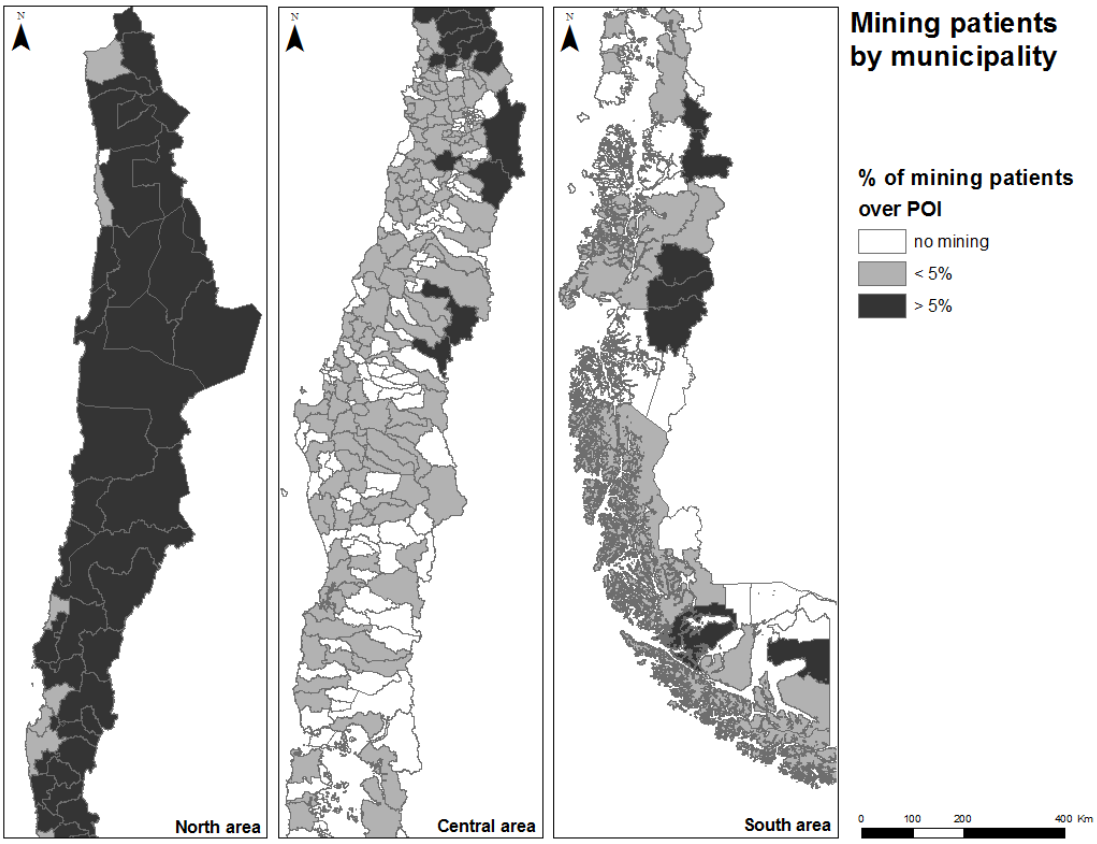
Source: Chilean Committee of Copper (COCHILCO).

Figure 2. Percentage of tax revenues allocated outside the central government



Source: OECD Fiscal Decentralization Database

Figure 3. Mining patents as a percentage of permanent own income (POI) by municipality



Source: Own construction using SINIM data on mining patents and permanent own income.

Figure 4. Municipal employment expenditures by groups of municipalities (thousands of 2015 Chilean pesos)