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

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Abstract

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, driven by expenditures on long-term employment. Additionally, we found a meaningful effect on allowances to the municipal Council, but we did not find a robust impact on transfers to health, transfers to community programs and municipal investment, while the increase in transfers to education is small with respect to the employment expenditures effect. These results are complemented with evidence of an increase in Mayor's probability of reelection in municipalities that experimented a large expansion on employment expenditures, which links our findings with the clientelism mechanism of resource rents. Our findings also have several implications for the fiscal decentralization debate in resource-abundant economies.

Keywords: resource windfalls, clientelism, municipalities, 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 (Bhattacharyya and Holder 2010; Boschini et al 2007, 2013; Collier and Goderis 2012, among others) 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 patronage or self-enrichment of municipal officers.

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. If 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 clientelism mechanism reduces the efficiency of the economy by transferring labor to unproductive jobs in the public sector. On the other hand, empirical evidence suggests that resource windfalls may also be deviated to finance personal wealth accumulation, by increasing different kinds of direct payments to municipal officers. For instance, Caselli and Michaels (2013) show that, in the case of oil windfalls to municipalities in Brazil, the misallocated funds may be assigned to a combination of patronage and self-enrichment.

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. Specifically, since a resource boom can be understood as a complex phenomenon that can have associated shocks in resource rents but also in production, which may have different effects through the political process (Maldonado 2014), we interpret the legal reform of 2005

as the rent channel of a resource boom. In that sense, the use of a structural legal change allows to better isolate the specific effects of resource rents. Our empirical strategy consists in a difference-in-differences approach to compare mining municipalities, which were affected by the reform of 2005, to their peers located in nonproducing areas, including municipality-specific and time effects. To that aim, we take advantage of the highly detailed data on municipal expenditures available in Chile, which comes from the *National System of Municipal Information* (SINIM) and covers the period 2001-2015.

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 aimed to be used for development projects in local areas. 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 short-term employees (called *honorarios*), whose contracts end 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 robust 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. Even if these findings are not directly attributable to patronage, they support the prediction of a large expansion of public-sector employment from an increase in resource rents.

Chilean data also allows us to evaluate the effect on allowances received by the members of the municipal Council in mining municipalities, which may be indicative of resources deviation to financial personal wealth accumulation. The municipal Council in Chile is composed by the mayor and a group of 6 to 10 councilors according to local population, all of them elected by popular vote. We found a sizable and statistically significant increase on allowances, while the effect on travel expenses assigned to municipal employees seems to be meaningful for municipalities where mining represents a high percentage of their income. We cannot conclude from this evidence that resource revenues are being deviated, but it is hard to think on efficiency reasons to justify a considerably higher increase of allowances in mining municipalities relative to other municipalities in the country. On the other hand, when

analyzing other municipal expenses, we did not find a significant impact on transfers to health or transfers to community programs, the impact on municipal investment is not robust to alternative econometric specifications, while the increase in transfers to education is small with respect to the municipal employment effect.

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 or possible resource deviation for personal purposes. Nevertheless, our results do not lead us to assert that fiscal decentralization should be discarded. For instance, the Robinson, Torvik and Verdier (2006, 2014) framework also suggests that the extent to which resource revenues are deviated depends on the quality of institutions. Hence, the evidence of this paper reinforces a common policy recommendation, which is not as commonly taken into account: any fiscal decentralization process should be accompanied by improvements in accountability at the local level.

This paper is framed into a large literature that has 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 shown 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) or by endogeneity issues regarding the resource intensity variable (Brunnschweiler and Bulte 2008). Nevertheless, these 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. In that sense, 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[1]. For instance, 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) used 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, diminished 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, while they may had been assigned to a combination of patronage and self-enrichment. Our paper contributes to this new wave of studies by providing empirical evidence on specifics political-economy channels through which resource revenues are claimed to operate –the expansion of public-sector employment expenditures and the increase in direct payments to municipal officers.

Closely related to our paper there are the frontier contributions of Maldonado (2014) and Monteiro and Ferraz (2012), which address the relationship between resource windfalls, electoral outcomes and public goods provision. By exploiting data at the municipal level in Peru, Maldonado (2014) documented a non-monotonic response in electoral outcomes, public-good provision and municipal employees, and he found a large positive impact on the number of temporary public-sector employees. On the other hand, Monteiro and Ferraz (2012) found that the increase in oil production in Brazil affects electoral outcomes in the short-term, but not in the medium-term, and they also found a large effect on employees hired on a temporary-basis. Our work complements these findings on public-sector employment in at least three ways. First, unlike these previous works, we document that the expansion of municipal employment expenditures is driven by long-term employment, which suggests that the characteristics of local regulations influence the operation of the public-sector employment mechanism from resource revenues, but they do not avoid it. Indeed, while Chile imposes several restrictions on the hiring of short-term employees at the municipal level, the

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

opposite is the case of Brazil, where municipalities cannot use oil windfalls to hire permanent employees, which may explain differences in the effects on short and long-term employment in each case. Second, while they evaluate effects on the number of public-sector employees, we exploit our data by focusing on municipal expenditures on public-sector employment. Since short-term employees tend to imply lower costs than their long-term peers, it is possible that even if the number of long-term employees has a lower increase, they may account for the largest part of revenues misallocation. Nevertheless, we present evidence on voting effects from the expansion of public-sector employment, in order to link higher expenditures on employment to the clientelism mechanism proposed by theory. Moreover, we also approach a possible increase in direct payments to municipal officers by analyzing the allowances assigned to the Municipal Council. Third, we use a different mechanism as a source of exogenous variation, a change in the legal framework to assign mining revenues to municipalities, which we interpret as a direct change in the rent channel effect of a resource boom. While significant advances have been made to obtain more credible identification strategies of the political resource curse, there is still much to build, and we see our framework as an expansion of traditional strategies exploiting changes in commodity prices and resource discoveries.

The rest of this paper is structured as it follows. Section 2 briefly describes the assignment of mining revenues to municipalities 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 intensive in mining production, specially copper, which is its main export product. 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 and Chile reached a 36.9% of world copper production in 2004, which have gradually diminished to

29.9% towards 2015. Figure 1 illustrates 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 one of 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 producers. The only revenues from mining that are collected by municipalities correspond to *mining patents*, which represent the right that must be paid to explore and produce in municipal territory. In practice, mining patents operate as an annual concession, in which those who exploit the territory for exploration or production purposes must pay an associated amount in advance in march of each year. Therefore, mining patents correspond to a fixed value for each hectare available for exploitation, which is regulated by the *Mining Code of Chile* (*article X*). The total amount collected from mining patents is distributed between the *Regional Development National Fund (RDNF)*, which assigns the resources to specific development projects at the regional level, and the municipalities where mines operate. Until 2005, 70 per cent of mining patents were transferred to the *Regional Development National Fund (RDNF)* and the rest 30 per cent were managed by local municipalities. The 2005's legal reform (law N°20.033) modified the current distribution rule to mining patents (regulated by law N°19.143) and established an equitable distribution of 50 per cent of mining patents to municipalities and the RDNF, which came into force during 2006. The declared aim of this policy was to compensate the local communities that were directly affected by the externalities of mining activities. As we will further discuss in Section 4.1, the legal reform was not designed to address particular financial needs of mining municipalities and it was not part of a larger reform to improve local finances.

To analyze the relative importance of mining patents to municipalities, we begin by briefly describing the main components of the municipal budget in Chile, which correspond to the *Permanent Own Income* (POI) and the *Municipal Common Fund* (MCF), while the rest of the budget corresponds to direct transfers from the central government and other minor sources. The main difference between the POI and the MCF is the way by which they are collected; while the POI corresponds to the fiscal resources that each municipality owns by itself, the MCF is a redistribution mechanism by which richer municipalities subsidize poorer

localities according to a set of established rules[2]. Therefore, mining patents are a part of the POI of municipalities located in producing areas. Table 1 presents a summary of the municipal budget for the period 2001-2015, considering municipalities located in non-producing areas (131), municipalities located in producing areas which had less than 5 per cent of its POI coming from mining in 2005 (161), the year before the reform was implemented, and municipalities located in producing areas which had more than 5 per cent of its POI coming from mining in 2005 (50). As it will be discussed below in Section 4.1, the distinction according to the relative importance that mining patents had in a mining municipality is relevant, since the magnitude of the effect of the 2005's legal reform on municipal revenues was proportional to that.

In 2005, the POI accounted for between 23 to 30 per cent of total municipal budget, according to the municipality group considered, while the MCF represented between 49 to 52 per cent of total budget. Altogether, these components conform what is called the Own Income (OI) of each municipality, which corresponds to the income that can be used autonomously by the municipal administration, and accounts for about three quarters of total municipal budget. In Table 1 we also observe the relative importance of mining patents in the municipal budget. By definition, non-mining municipalities had no income at all coming from mining patents in 2005. Municipalities that had less than 5 per cent of its POI coming from mining in 2005 had, on average, 0,6 per cent of its POI and 0,1 per cent of its total budget coming from mining. Therefore, the legal reform of 2005 should have had little impact on this group of municipalities. However, mining patents were relevant to the group of 50 municipalities that had more than 5 per cent of its POI coming from mining in 2005. For this group, mining patents represented around 7 per cent of its total budget and 35 per cent of its POI in 2005. The latter means that more than a third of the resources that a municipality owned by itself, so that were not received by transfers or redistribution mechanisms, corresponded to mining patents. In this context, the legal reform of 2005 should have had a meaningful impact on this last group of municipalities.

[2] A 35 per cent of the MCF 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 MCF will be redistributed from mining patents to other municipalities.

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 by the model of Robinson, Torvik and Verdier (2006, 2014). If 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. Therefore, an increase in fiscal income coming from natural resources may induce 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 determined in world markets. In the Chilean case, municipalities do not collect taxes from resource production or profits, so variations in international prices has no direct impact on the municipal budget, but it may have an indirect impact through production levels. Nevertheless, we claim that the legal reform of 2005 to mining patents can be viewed as an equivalent exogenous change in municipal income, capturing the rent channel of a resource boom, as we will further discuss in Section 4.1. Moreover, the resource windfall is modelled as a permanent increase in prices instead of short-term fluctuations, so the theoretical model analyzes a permanent resource boom that is, to some extent, analogous 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 be made 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 would operate in the same manner. Since this mechanism transfers labor to unproductive jobs in the public sector, the positive income effect of a resource windfall may 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 patronage may also be 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, especially in countries where institutions are not particularly weak, such as the case of Chile.

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[3]. 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

[3] 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 further discuss the quality of Chile's institutions, as well as its implications for the effect of resource revenues, in Section 5.2.

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 of resource rents 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[4]. Whether the Peruvian decentralization scheme or the Chilean centralized scheme lead to higher living standards for local communities depends, partially, 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. Moreover, Maldonado (2014) points out that the effect of additional resource rents on public-goods provision and clientelism has a non-monotonic relationship. Nevertheless, he also documented that, even if there is an increase in public-goods provision, this is not comparable to the magnitude of the resource boom. Moreover, Martinez (2016) shows that extra fiscal revenues have a different impact on local communities in Colombia whether they come from taxation or from oil

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

windfalls. This suggests that is the less accountable nature of resource rents, but not extra revenues itself, which leads to a misallocation of fiscal resources at the local level.

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. This is a common policy recommendation, but it is not that common to see it implemented in part because of lack of reliable evidence, which this new set of studies based on within-country analysis of resource rents is aiming to fill.

4. Empirical strategy

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). As explained in Section 2, *mining patents* correspond to the right that a mining company has to pay in order to exploit the local territory, which depends exclusively on the amount of hectares used for exploration and mining production. The total amount collected from this item is distributed between a regional fund to finance local development projects (*Regional Development National Fund*) and municipalities where mines operate. When the 2005's legal reform came into effect, the portion of *mining patents* assigned to municipalities increased in 20 percentage points, rising from 30 to 50 per cent of the total amount collected. We argue that this legal reform can be viewed mostly as an exogenous fiscal windfall for mining municipalities, which provides a useful quasi-experiment to estimate the effect of additional mining revenues through the political process, particularly its impact on public-sector employment expenditures.

We first need to analyze the validity of the 2005's legal reform as an adequate framework to our empirical strategy. A common issue refers to whether the reform was effectively exogenous to mining municipalities, since municipalities could have influenced the legal change by allocating resources to lobby and influence public debate. Since most affected

municipalities were small units, which did not have enough resources to individually affect public policy decisions, a key element is whether mining municipalities were grouped to impact on political outcomes. In Chile, during last decades' municipalities have been grouped in the Chilean Association of Municipalities (ACHM), which seeks to represent municipalities before other public authorities or the private sector. However, this organization is structured at the national level and do not directly respond to the interests of mining municipalities, while the legal reform was only relevant for this subgroup of municipalities. In the absence of an organization that looks after their own interests, mining municipalities formed the National Association of Mining Municipalities. However, this new organization was just founded in 2010, so mining municipalities were not properly organized so as to lobby when the reform was being discussed in 2005. Indeed, the National Association of Mining Municipalities has proposed additional legal changes referring to mining revenues in recent years. Since this was not the case in 2005, mining municipalities had very limited political power to influence public policies by that time.

A related issue refers to the motivation of the 2005's legal reform. It could have been the case that mining municipalities had larger financial needs which induced the reform to *mining patents*, which would be problematic to the validity of the exogeneity condition. Moreover, in that case an increase in employment expenditures after the reform could just reflect a response to a deficit in human capabilities. However, this was not the case of the 2005's legal reform. First, the declared aim of this policy was to compensate the local communities that are directly affected by the externalities of mining activities, and not to approach the financial needs of mining municipalities[5]. Indeed, the 2005's legal reform affected only *mining patents*, and it was not part of a larger reform to improve municipalities financial resources. In addition to the explicit aims of the legal reform, there is the fact that mining municipalities were, on average, richer than municipalities located in non-producing areas. In 2005 the average municipal revenues of mining municipalities that had more than 5 per cent of its municipal Permanent Own Income (POI) coming from mining, those who benefit the most from the reform, was cl$364 thousands per capita, far more than the average municipal

5 This fact is well documented in the minutes of the parliamentary discussions of the law N°20.033 during 2005 (*Library of the National Congress of Chile*).

budget of municipalities without any mining activity on their territories (cl$211 thousands of pesos per capita).

Even if the 2005's reform can be viewed as a mostly exogenous change, we still need to analyze whether it can be interpreted as a resource windfall. Most recent frontier contributions that analyze the impact of resource windfalls on political outcomes interpret them as an increase in the resource rents that a governmental unit receives, commonly due to an exogenous increase in commodity prices (Caselli and Michaels 2013, Monteiro and Ferraz 2012, Martinez 2016). However, Maldonado (2014) points out that resource windfalls should be understood as a more complex phenomenon that can have associated shocks in resource rents but also in production, and production changes may also have relevant effects through the political process. Following this definition, we argue that the legal reform of 2005 can be interpreted as the rent channel of a resource windfall, which allows us to identify the specific effects of this channel on municipal outcomes. Indeed, the impact of the 2005's legal reform on municipal revenues is equivalent to the impact that an increase in commodity prices would have on fiscal revenues in a country with royalties or direct taxes on mining profits. While an increase in prices may be associated with an increase in production, this is not the case of our legal reform framework, which allows us to better isolate the effect of the rents channel than the previous studies that attempt to do so. It is important to distinguish between both effects since, as shown by Maldonado (2014), changes in rents may have different consequences on political outcomes than changes in production.

A final concern that we have to approach is the fact that, even if the 2005's legal reform is an appropriate design to clear the effect of the rents channel from the production channel, we cannot dismiss the fact that a boom in commodity prices was occurring by the time the reform was implemented. If the 2000's boom in mining prices led to an increase in mining production, this can be problematic at least in two main aspects. First, since *mining patents* depends on the extension of the mining operated area, the increase in *mining patents* received by municipalities could be due not only to the 2005's legal reform, but also because of an increase in production. Second, as we already discussed in this section, an increase in mining production can also affect the political outcomes of interest. To explore this issue, Figure 3 shows the evolution of the value of copper production during the sample period, which

accounts for around 90 per cent of the entire mining sector[6], and decomposed this between its quantum component (metric tons produced) and its price component. We observe that the increase in the market value of copper production during the 2000s was almost entirely to price variation, while real quantities produced remained relative stable. For instance, produced metric tons of cooper even decreased in some years following the legal reform of 2005 (2005, 2008, 2011 and 2014) and they experimented small increases of less than 2 per cent in others (2006, 2009, 2010 and 2015), while they only exceeded a 5 per cent growth in year 2013 (6.3%). This evidence suggests that the price boom in Chile did not translate into a relevant production effect, which diminishes the concerns about this channel affecting our analysis. However, small aggregate increases in production could still have relevant effects to some specific municipalities, and since we do not possess reliable data on production at the municipal level, we should take this issue into account when interpreting our results.

4.2 The treated: Mining municipalities

Our empirical strategy is based on comparing municipalities located in mining areas, which were affected by the reform of 2005, to their peers located in non-producing areas. However, the definition of our treatment group is not as straightforward as it may be seen at first. Since the reform established that all municipalities with mining activities on their territory will benefit from a 20 percentage points increase in the portion collected from *mining patents*, the magnitude of the effect on municipal revenues is proportional to the relative importance that *mining patents* had before the reform was implemented. Therefore, even if in the abstract all municipalities located in mining areas are considered by the 2005's legal reform, in practice some of them were not effectively treated, since the reform implied a meaningless increase on municipal revenues.

Figure 4 shows the trend followed by the municipal Permanent Own Income (POI), in per capita terms, for distinct municipality groups according to the percentage of its POI collected from *mining patents* the year before the reform came into force. We can observe that municipalities for which *mining patents* represented less than 2.5 per cent of its POI had a parallel trend with municipalities located in non-producing areas, before and after the reform was implemented, suggesting that the effect of the legal reform of 2005 was negligible for

[6] Central Bank of Chile, National Accounts.

this group. A similar trend is observed in municipalities for which *mining patents* represented less than 5 per cent of its POI, since this group adds just a few municipalities to the 2.5 per cent group. However, when we considered municipalities for which *mining patents* represented more than 5 per cent of its POI, we observe that they followed a parallel trend with non-mining municipalities before the reform was implemented, but this trend was broken after the reform, experiencing a considerable increase in municipal income.

A complementary reason for which the legal reform of 2005 could have ended by being innocuous to mining municipalities with very low contribution from *mining patents* refers to the Chilean rule to allocate financial resources to municipalities. As we previously described in Section 2, municipalities receive transfers from the *Municipal Common Fund* (MCF), where a 35% of the latter depends on the relative richness of a municipality according to its POI. Since an increase in *mining patents* translates into a higher POI, this can be partially offset by a reduction in their transfers from the MCF.

The previous analysis suggests that an adequate empirical strategy should consider municipalities for which *mining patents* represented more than 5 per cent of its POI as the treatment group, since they have been actually affected by the legal reform. Figure 5 shows that our main variable of interest, municipal-employment expenditures in per capita terms, meets the parallel trends assumption when comparing this treatment group to non-mining municipalities. It can be noticed that municipal-employment expenditures were already higher in this group of mining municipalities before 2005, but the trend followed a parallel path with their non-mining pairs. After the legal reform came into effect, both groups seem to increase their expenditures on municipal employment, however, the rise is considerably larger in mining municipalities. Therefore, a difference-in-differences approach seems like a suitable approach to evaluate the effect of additional *mining patents* on municipal-employment expenditures. We also observe that the increase in municipal employment occurred one year after the reform took effect, and it continued expanding during following years, which suggest that municipalities had a lagged and gradual response to the increase in their budget from mining patents.

Even if the groups of mining municipalities which had more than 5 per cent of POI coming from *mining patents* seems like the suitable treatment group, this approach has relevant issues. The main problem refers to the fact that we are excluding a significant number of

municipalities located in producing areas. Under this criterion, the treatment group is composed by 50 mining municipalities and the control group contains 131 non-mining municipalities, but we still have 161 municipalities with some income coming from mining that are not being considered. Moreover, there is not clear economic justification to use the 5 per cent cutoff instead of a different threshold. Therefore, we will also use a second econometric strategy. As we will describe in Section 4.3, we will estimate an extended difference-in-differences model in which we include an interaction term between the treated municipalities and the percentage of its POI that came from mining the year before the reform was implemented. Therefore, we will be able to account for the fact that the legal reform had a proportional effect that could be meaningless to some mining municipalities without reducing the number of observations in our sample.

Finally, Figure 6 presents the location of mining municipalities that had more than 5 per cent of its POI coming from mining in 2005, mining municipalities that had less than 5 per cent of its POI coming from mining in 2005 and non-mining municipalities. We can observe that most municipalities with high income coming from mining are concentrated in the north-center area of the country where most of copper industry is located. Nevertheless, we evaluate an alternative specification in which we compare mining municipalities to their non-mining peers located in the north-center area, in order to account for possible common shocks affecting these regions of the country. The results of this exercise are consistent with the main results shown below in Section 5 and are available under request.

4.3 The Empirical Model

The main interest of this paper is to explain the effect on municipal-employment expenditures from a resource windfall, as well as its impact on other municipal expenses. Our empirical strategy exploits the 2005's legal reform to mining patents by comparing mining municipalities to municipalities located in nonproducing areas, for which we use two econometric models. We first use a standard difference-in-differences strategy (DD), considering the group of mining municipalities that were effectively affected by the 2005´s legal reform as our treatment group. As we discussed in Section 4.1, the effect of the 2005's legal reform was meaningless to a relevant group of mining municipalities, since its impact on municipal income depended on the relative importance that *mining patents* had on the

municipal Permanent Own Income (POI) before the reform was implemented. Therefore, we defined our treatment group as municipalities located in producing areas for which *mining patents* represented at least 5 per cent of its POI in 2005. Equation (1) shows the DD specification:

$$(1)\ \ Y_{mt} = \alpha_m + \gamma_t + \beta(Post_t x Min5_m) + \epsilon_{mt}$$

where Y_{mt} is a set of municipal outcomes in per capita terms for municipality *m* in year *t*. α_m and γ_t are respectively municipality and years fixed effects, to account for specific characteristics at the municipality level and common shocks that could have affected all municipalities in a certain year. $Post_t$ is a dummy that takes a value of 1 the years after the legal reform was approved and $Min5_m$ is a dummy that takes a value of 1 if the municipality belongs to the defined treatment group of mining municipalities (*mining patents* represented more than 5 per cent of POI before the legal reform was in force). Then, the parameter of interest is β, which accompanies the interaction between $Post_t$ and Min_m accounts for the differentiated effect on treated mining municipalities with respect to non-mining municipalities. ϵ_{mt} corresponds to the error term.

The standard DD estimator seems to be a natural approach to analyze the effect of the 2005's legal reform on mining revenues and municipal outcomes, but the definition of the treatment group can be problematic. For instance, even if we have shown in Figure 4 that the revenues of municipalities for which *mining patents* represented less than 5 per cent of its POI in 2005 follow a parallel trend to the group of municipalities located in non-mining areas, which suggests that they were not effectively treated, there is not clear economic justification to use the 5 per cent cutoff. Moreover, by establishing the 5 per cent cutoff we are ruling out a significant number of municipalities that are located in producing areas. To address this concerns, we use a modified DD specification, in which we control for the relative importance of *mining patents* in mining municipalities. Equation (2) shows this extended DD equation:

$$(2)\ Y_{mt} = \alpha_m + \gamma_t + \beta_1(Post_t x Min0_m) + \beta_2(Post_t x Min0_m x Pat_m) + \beta_3 Pat_m + \epsilon_{mt}$$

where $Min0_m$ is a dummy that takes the value of 1 if the municipality is located in a mining producing territory, so we do not exclude extra municipalities from our sample, and Pat_{mt} is the ratio of *mining patents* to the Permanent Own Income (POI) in municipality *m* in year 2005. The main difference between specifications (1) and (2) is that, besides using $Min0_m$ instead of $Min5_m$, we introduce an interaction term between $Post_t x Min0_m$ and Pat_m, which accounts for the differential effect of the 2005's legal reform on mining municipalities outcomes according to the relative importance that *mining patents* had in municipal income. Since the effect of the reform on municipal income was proportional to the relevance of *mining patents*, this specification incorporates the intensity of the treatment in our estimation. Therefore, β_2 accounts for whether the effect of the legal reform on municipal outcomes was conditional on the initial level of *mining patents*[7].

4.4 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. In this section, we explore the characteristics of our sample in the periods before (2001-2005) and after (2006-2015) the treatment. Table 2 presents summary statistics for our main municipal outcomes, that is, municipal total revenues and municipal employment expenditures in per capita terms, distinguishing between mining municipalities that had more than 5 per cent of its POI coming from mining in 2005 (municipalities with high income from mining), mining municipalities that had less than 5 per cent of its POI coming from mining in 2005 (municipalities with low income from mining) and non-mining municipalities.

We can observe that, before the legal reform, the expenditure on salaries were higher during the period 2001-2005 in mining municipalities with more than 5 per cent of POI coming from mining (cl$49,950 per capita) than in non-mining municipalities (cl$35,800)[8], and the group with the lower expenditures on salaries were the mining group with less than 5 per cent of POI coming from mining (cl$24,740). Then, after the legal reform began to

7 We also evaluate an alternative Instrumental Variable (IV) approach; in which we use the legal reform of 2005 as an instrument for the change in municipal revenues. The results under the IV approach were consistent with the main results that we show in Section 5 for both DD models and they are available under request.

8 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).

operate, salaries in municipalities with high mining income rose to cl$96,860 during the period 2006-2015, equivalent to a 94 percent increase. Meanwhile, salaries rose to cl$61,630 in the non-mining group, which represents a 72 percent increase. This shows that, posterior to 2005, salaries grew much faster in municipalities that received meaningful extra mining patents. On the other hand, total salaries per capita grew slower in municipalities with low mining income by the time of the reform (67 per cent).

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 than in municipalities with high mining income. In fact, after the legal reform of 2005, long-term salaries in municipalities with high mining income increased by 89 per cent, while they grew by only 63 per cent in the non-mining group and by 58 per cent in mining municipalities with low income from mining. Annual-term salaries in municipalities with high mining income increased by 126 per cent, while they grew by 106 per cent in the non-mining group and by 104 per cent in mining municipalities with low income from mining.

Even if the percentage increase was higher to annual-term salaries in all groups, they represent a lower total spent than long-term salaries, which responds to the Chilean municipal rules that put stricter limits to hire annual-term workers, and specially to short-term workers, than to long-term workers. Moreover, we also notice that the increase in long-term salaries in municipalities with high mining income was greater, in relative terms to its increase in the non-mining group, than the other kinds of municipal employment.

Table 3 presents summary statistics for other municipal outcomes in per capita terms, which include allowances assigned to the Municipal Council, travel expenses, municipal investment, transfers to health, transfers to education and transfers to community programs. We observe a particular large increase in allowances assigned to the Municipal Council, which grew from cl$7,400 per capita before the reform was implemented to cl$17,750 per capita, that is, a 140 per cent increase. This rate of growth is well above the increase in the non-mining group, which expanded by 84 per cent, while in the case of municipalities with low income from mining they expanded 76 per cent. On the other hand, we observe that the increase in spending on other municipal outcomes was not greater in the group of municipalities with high mining income than in the non-mining group. In fact, municipal

investment per capita increased 49 per cent in both groups, transfers to health increased 54 per cent in municipalities with high mining income, while they went up 68 percent in non-mining municipalities, while transfers to community programs increased by 107 per cent and 163 per cent, respectively. Only transfers to education increased more in municipalities with high mining income, increasing by 68 per cent, compared to the 48 per cent that went up in non-mining municipalities. These are no more than descriptive statistics, but they suggest a clear difference between the allocation of resources to municipal employment expenditures with respect to other components of municipal spending after the legal reform of 2005.

5. Results

5.1 Effects on municipal revenues and employment expenditures

In this section we analyze the impact of extra mining revenues on municipal revenues and employment expenditures, distinguishing among different kinds of municipal employees. Table 4 shows the results using the standard DD model, in which we consider as the treatment group municipalities with high mining income, that is, mining municipalities that had at least 5 per cent of its POI coming from mining patents the year before the legal reform came into force. In column (1) we show that municipal revenues effectively increased for this group of mining municipalities as a consequence of the 2005's legal reform. The point estimate is an increase of cl$101,720 per capita with a level of statistical significance of 1 per cent. This is a meaningful increase in municipal revenues when considering that the average municipal revenues was around cl$465.808 per capita for this group of mining municipalities during the whole sample period. Evaluating the impact on total municipal revenues is an important step for the analysis, since the 20 percentage points increase in mining patents could have been partially offset by a reduction in redistributive transfers received from the *municipal common fund* (MCF), a reduction in other direct transfers from the central government or by incentives to *fiscal laziness* in other components of the *permanent own income* (POI) that are collected by the municipality itself.

Column (2) presents the results for municipal employment expenditures in per capita terms. The magnitude of this effect is cl$21,400 per capita with a level of statistical significance of 1 per cent, while the average municipal employment expenditures for this

group of mining municipalities was cl$81.309 per capita during the sample period. Columns (3) to (5) present disaggregated results for the main kinds of municipal employment in Chile. According to these results, the largest increase in employment expenditures corresponds to long-term employees (called *planta* in Chile) –those who have a non-limit contract- and accounts for around 75 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 employment expenditures. Both coefficients have a level of statistical significance of 1 per cent. On the other hand, short-term employees (called *honorarios* in Chile) –those who have been employed for a temporary or specific task by the municipality- account for only 3 per cent of the total effect in salaries spending, but its coefficient is not statistically significant. These proportions may 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. In fact, 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) [9].

Table 5 shows the results using the extended DD model, in which we consider all mining municipalities as the treatment group and we include an interaction term to account for the relative importance that mining patents had on municipal Permanent Own Income (POI) the year before the reform came into effect. This approach allows us to avoid excluding municipalities with low mining income from the sample, even if the legal reform of 2005 may have a meaningless effect on their municipal budget.

Column (1) shows the effect on total municipal revenues per capita. We observe that the DD coefficient has a negative and statistically significant effect at 1 per cent, while the interaction term has a positive and statistically significant effect at 1 per cent. Consistent with the previous analysis, this means that whether the reform had a positive impact on a

[9] 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.

municipality located in producing areas depends on the relative contribution of mining patents to the municipal budget. Column (2) shows similar results for municipal employment expenditures. In order to interpret these results, we compute marginal effects according to the percentage of the Permanent Own Income (POI) that came from mining patents in 2005. Figures 7 plots marginal effects for municipal revenues and employment expenditures. We notice that, under this estimation, the effect on municipal revenues becomes positive for municipalities that had more than 10.1 per cent of its POI coming from mining in 2005, while the effect on employment expenditures becomes positive after 10.5 per cent.

Columns (3) to (5) show the disaggregated impact on different municipal employment categories. These results are consistent with those obtained with the standard DD model, with long-term employment expenditures accounting for the largest part of the total increase in municipal employment expenditures. By computing marginal effects, we notice that the coefficient for the long-term employment, annual-term employment and short-term employment turns positive for municipalities that had at least 9.1, 8.8 and 18.5 per cent of its POI coming from mining, respectively. A difference from the standard DD estimation is that short-term employment, even if continues to account for the smallest part of the aggregate effect on employment expenditures, now has a statistically significant contribution for municipalities with large revenues from mining. Considering that the average ratio of mining patents to POI was 35.5 per cent for the high mining income group (those that had more than 5 per cent of its POI coming from mining in 2005), the average municipality of this group would have an expansion of cl$12,604 per capita in long-term employment, cl$4,429 per capita in annual-term employment and cl$1.070 per capita in short-term employment, accounting for a total employment effect of cl$18.099 per capita. This represents almost a quart of average expenditures on municipal employment for this group of municipalities during the sample period (cl$81.309).

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 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 public-sector employment mechanism. An interesting fact from our results is that this mechanism operates mainly through long-term employment, while previous studies in Peru (Maldonado

2014) and Brazil (Monteiro and Ferraz 2012) have found that the mechanism operates through temporary employees. A first point may refer to the fact that Chile, unlike other countries, imposes stricter restrictions to hire short-term employees than long-term employees. For instance, in the case of Brazil, municipalities cannot use revenues from resource windfalls to hire long-term employees. Therefore, our results suggest that the public-sector employment mechanism can operate through different categories of employees, according to local restrictions and regulations, and it is not only associated to temporary employees. A second point refers to the fact that we focus on municipal employment expenditures by categories, while previous studies analyzed the effects on the number of employees. Since long-term employees tend to be costlier than their short-term peers, even in the case that short-term employees would have had a larger increase in number, the main source of revenues misallocation may reside in long-term employment.

5.2 Effects on allowances, travel expenses and other municipal expenditures

In this section we evaluate the effect of extra mining revenues on municipal outcomes that may be associated to deviation of resource to personal benefit, and compare them to other municipal outcomes that can be more directly linked to improvements in the living standards of the local community.

We first 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 allowances are conceived to finance the execution of Municipal Council tasks, it is hard to think on reasons for which the Municipal Council's needs may have suddenly increased in mining localities with respect to other municipalities in the country. Therefore, a large increase in allowances is not conclusive evidence of revenue deviation to own wealth accumulation, but points out in that direction. Table 6 show results for the standard DD model. Column (1) shows a point estimate of cl$7,060 per capita for allowances assigned to the Municipal Council, with a statistical significance level of 1 per cent. This a meaningful effect when we observe that the average amount of allowances assigned to the Municipal Council was cl$14.318 for the group of mining municipalities that had more than 5 per cent of its POI coming from mining, considering the whole sample period. Column (2) shows results for

travel expenses assigned to municipal employees, but in this case the effect is not statistically significant.

Columns (3) to (6) show results for other municipal outcomes that may be closely related to public-goods provision and local living standards. We observe a statistically significant increase in municipal investment of cl$12.490 per capita, however, this result is not robust when considering the extended DD model, as we will show below in Table 7. We do find a statistically significant effect on transfers to education of cl$8.310 per capita. In order to discuss if the allocation of extra mining revenues was balanced among the different local needs, it is illustrative to notice that the effect on transfers to education is only slightly higher than the effect on allowances assigned to the Municipal Council. Moreover, we did not find a statistically significant effect on transfers to health or transfers to community programs.

Table 7 presents results for the extended DD model. We found that the effect on allowances to the Municipal Council and the effect on transfers to education are consistent with the results of the standard DD model in Table 6. However, we observe that in this case the effect on travel expenses may be positive and statistically significant for municipalities that had more than a certain level of mining patents. In particular, by computing marginal effects on travel expenses, the effect turns positive for municipalities that had more than 8 per cent of its POI coming from mining in 2005. On the other hand, the extended DD model does not support a positive impact on municipal investment for any level of income coming from mining. Finally, while we did not find any effect on transfers to community programs, according to the extended DD model the effect on transfers to health may be positive in municipalities with large mining revenues (in particular, in municipalities were more than 29 per cent of its POI came from mining in 2005).

The results from this section complement our previous findings on municipal employment expenditures. As suggested by Caselli and Michaels (2013), the deviation of resource revenues at local governments may be a combination of clientelism and personal wealth accumulation. In Section 5.1 we found a significant expansion of public-sector employment expenditures that points out in the direction of patronage, which we will be analyzed with more detail in Section 5.3 by evaluating whether this expansion of employment expenditures had impact on voting patterns. On the other hand, it is extremely hard to prove that a portion of resource revenues had been deviated to personal benefit instead of the interests of the local

community. However, the results of this section suggests that extra revenues from mining were allocated, at least, in an unbalanced way among different local needs.

5.3 Public-employment expenditures, voting and public-goods provision

The Robinson, Torvik and Verdier (2006, 2014) model states a clientelism mechanism from resource rents, which is linked to an increase in political support and the probability of staying in power. We have found that extra mining revenues had a statistically significant and meaningful impact on municipal employment expenditures and allowances to the municipal Council, which is not the case for other municipal expenditures more closely related to the living standards of the local population. So far, this evidence suggests an unbalanced allocation of extra mining resources according to local needs, which may or may not be driven by an attempt to increase political support. To analyze whether our results are consistent with the theoretical claim of a clientelism mechanism, in this section we analyze the effect of extra mining revenues on electoral outcomes, specifically, on the probability of reelection of the Mayor and the probability that the political coalition of the Mayor remains in power.

We collected data on municipal elections for years 2000, 2004 and 2008, so we are able to build variables on reelection for the elections of 2004 and 2008, and we estimated a DD model to analyze the effect of mining revenues from the 2005's legal reform on these electoral outcomes. Our main variable of interests is a dummy variable that takes the value of 1 if the Mayor is reelected, while we also build a second variable that takes the value of 1 if political coalition of the Mayor remains in power. Since clientelism networks tend to be more related to personal affinities than to political identification, we should expect a stronger impact on the probability of reelection of the Mayor rather than on the permanence of the political coalition. Moreover, if the impact on political support is driven by the expansion of municipal-employment expenditures, we should expect that the effect is conditional on the magnitude of the increase in employment expenditures at each municipality. Therefore, we also include an interaction term considering the change in municipal-employment expenditures from 2004 to 2008.

Table 8 presents the results for these exercises. In column (1) and (2) we observe that the main effect on Mayor's probability of reelection and on the probability that the Mayor's

political coalition remains in power are not statistically significant. In columns (3) and (4) we introduced an interaction term considering the magnitude of the increase in municipal-employment expenditures. We found that the interaction term is statistically significant for the Mayor's probability of reelection, which means that the probability of reelection increased for municipalities with large expansions on municipal employment expenditures. This result is consistent with the propositions of Robinson, Torvik and Verdier (2006, 2014), in which public-sector employment is related to increasing political support, linking our previous results on municipal employment expenditures to the clientelism mechanism proposed by the model. On the other hand, we found that the effect on the reelection of the Mayor's political coalition is weaker and it is only statistically significant at a 10 per cent level, which is consistent with the idea that clientelism networks are not driven mostly by political identification, but by personal affinity to the local authority.

Even if results in Table 8 show a positive impact on political support in municipalities with large expansions on employment expenditures, we still need to incorporate the role of public-goods provision on these results. If the expansion of municipal employment expenditures led to an increase in the efficiency on public-goods provision, the increase in political support may be due to better public goods rather than to the clientelism mechanism. This could be the case if incumbents expanded public-sector expenditures in order to build state capacity instead of an attempt to patronage. Therefore, in Table 9 we show results when introducing an additional interaction term that accounts for the change in the provision of public-goods from 2004 to 2008. We use different proxies for the efficiency of public-goods provision which include the change in infant mortality rate, the change in the ratio of students to teachers in public schools, student's dropout from public schools and the change in square meters of green areas maintained by the municipality. Columns (1) to (8) show consistent results with respect to our previous findings by using any of these measures for public-goods provision: an increase in the Mayor's probability of reelection in municipalities that experienced large expansions on public-sector employment expenditures, while the impact on the probability that the Mayor's political coalition remains in power is weaker. These results reinforce the idea that the increase in municipal-employment expenditures is driven by the clientelism mechanism.

We also provide evidence on the direct impact of mining revenues on public-goods provision. Table 10 shows the impact of extra mining revenues on different measures of the efficiency of public-goods provision, however, we did not observe clear improvements on these indicators. On the contrary, infant mortality rate seems to increase, student's dropout from public schools also seems to increase in municipalities with large income from mining (but this effect is only statistically significant at the 10 per cent level) and the effect on green areas is not statistically significant. On the other hand, the ratio of students to teachers seems to improve after the legal reform of 2005. Taking together, this evidence suggest that the impact of extra mining revenues did not translate into a substantial improvement on public-goods provision.

Finally, our finding that municipalities with large expansions of municipal employment expenditures increased the Mayor's probability of reelection is consistent with the findings of Maldonado (2014), which found non-monotonic effects on municipal electoral outcomes in Peru, according to the magnitude of mining transfers. Moreover, our results show a significant impact on Mayor's probability of reelection in the election made only 2 years later after legal reform came into force, which is in line with Monteiro and Ferraz (2012) findings of a short-term impact from resource rents on electoral outcomes. More importantly, our results show an increase in political support associated with an expansion of municipal-employment expenditures, even when control by changes in public-goods provision, which allows us to stablish a closer link from our findings on employment expenditures with the clientelism mechanism proposed by Robinson, Torvik and Verdier (2006, 2014).

5.4 Discussion: Are institutions not strong enough at the local level?

Theoretically, the extent to which resource revenues expand employment expenditures depends on the quality of institutions. Several empirical studies have also highlighted the relevance of institutions for the effect of natural resources through the political process. For instance, Bhattacharyya and Holder (2010) uses a cross-country sample to find that the extent to which resource rents foster corruption is conditional on the quality of democratic institutions. Vicente (2010) reported that perceived corruption levels increase in Sao Tome and Principe relative to Cape Verde, two countries with weak institutions, after the former discovered oil. Moreover, Boschini et al (2007, 2013) and Collier and Goderis (2012) have

empirically shown that divergent results among resource abundant countries may be caused by differences in the quality of institutions and the specific characteristics of the natural resource that is extracted.

Chile is a resource-abundant 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[10]. 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[11], and has grown at even faster rates in previous decades, so it is usually mentioned as a resource-abundant country that may have overcome the resource curse. Despite all that, this paper found that mining revenues caused a significant expansion of municipal-employment expenditures at the municipal level, which are linked to voting effects, instead of increasing other municipal outcomes that can be more directly linked to the welfare of the local population.

A first explanation refers to the distinction between market-based and political-economy mechanisms, well addressed in Caselli and Michaels (2009)[12]. As natural resources are claimed to have multiple mechanisms, it is possible that Chile's institutional framework was able to avoid some of the market-based effects from mining rents, which allowed for an accelerated expansion of GDP, but still has some flanks to improve in order to avoid some of the political-economy mechanisms. A second point refers to the differences that can arise between central and local institutions within the same country. As discussed in Section 3.2, Chile has a highly centralized fiscal system, so institutions at the local level may have a lower development than central institutions and may not be prepared to efficiently handle suddenly increases in resource rents. 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 may be associated with lower accountability levels.

[10] 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.
[11] Central Bank of Chile, national accounts.
[12] This work corresponds to the working paper of Caselli and Michaels (2013): Do Oil Windfalls Improve Living Standards? Evidence from Brazil.

If local institutions are underdeveloped with respect to central institutions, the decentralization of resource revenues may result in efficiency losses, opening the door to patronage among other adverse political outcomes. Therefore, even if fiscal decentralization could increase public sector efficiency by bringing government action closer to the people, its overall effect on the economy would have no clear direction. Some previous empirical studies have found a consistently negative impact of fiscal decentralization on economic development (Zhangab and Zouab 1998), while more recent studies document a non-significant effect (Thornton 2007, Baskaran and Feld 2013). Nevertheless, most of the previous empirical literature on fiscal decentralization has not focused on revenues from natural resources, which are a key element of any decentralization process in many development economies and may have a differentiated effect in relation to other sources of fiscal revenues, as has been well documented for the case of Colombia in Martinez (2016).

The results for the Chilean case suggest that, even if a country may have strong institutions at the central government and low perception of corruption at the national level, any fiscal decentralization process should be accompanied by an accountability improvement process at local governments. To which extent local governments have lower levels of accountability, and whether this explains their behavior in face of additional resource revenues, are key elements that should be study in further research projects to have a better understanding of the effects of a fiscal decentralization process in resource-abundant economies.

6. Concluding remarks

This paper has examined the effect of an increase in mining revenues allocated to municipalities in Chile, induced by the legal reform of 2005, on municipal-employment expenditures and other municipal outcomes. This setting is a novel quasi-experiment that allow us to analyze the rent channel of a resource boom through the political process. 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 frontier wave of studies that have intended to measure the political impact of resource windfalls moving from national to local effects (Caselli and Michaels 2013, Maldonado 2014, Martinez 2016, Monteiro and Ferraz 2012, among others).

We found that the 20 percentage points increase in revenues collected from mining patents translated into a significant expansion of municipal employment expenditures, which was driven by expenditures on long-term municipal employment. We also found a meaningful increase on allowances assigned to the municipal process, but we did not find a robust effect on other municipal outcomes that are more directly related to local welfare such as municipal investment, transfers to health and transfers to community programs, while the effect on transfers to education was small compared to the effect on municipal-employment expenditures.

According to the Robinson, Torvik and Verdier (2006, 2014) model, resource rents may be allocated to patronage in order to increase political support. When analyzing electoral outcomes, we found that extra mining revenues increased the Mayor's probability of reelection in municipalities with a large expansion of municipal-employment expenditures, which links our results on municipal-employment expenditures to the clientelism mechanism proposed by theory. Moreover, while previous studies have found that the clientelism mechanism operates mostly through short-term employment (Maldonado 2014, Monteiro and Ferraz 2012), our results suggest that it can also operates through long-term employment expenditures, depending on local restrictions and regulations. In fact, while Brazilian municipalities analyzed by Monteiro and Ferraz (2012) are not allow to use resource windfalls on long-term employment, Chilean municipalities have larger restrictions on short and annual-term employment expenditures than on long-term employment expenditures, which may explain the different impact of resource rents in each case.

Finally, our findings suggest that Chilean institutions at the local government are not strong enough to avoid the adverse effects of resource rents through the political process, leading to an unbalanced allocation of extra revenues among local needs. Since the quality of central 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 global trend to fiscal decentralization must be taken with caution, especially in resource-abundant countries. Although much needs to be studied in the relationship between national and local institutions, and regarding a differentiated effect from natural resource revenues with respect to other sources of fiscal income, our results suggest that any

process of fiscal decentralization must be accompanied by an attempt to increase the levels of accountability at the local level.

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Tables

Table 1. Average municipal budget and mining patents in 2005

	Non-mining municipalities	Mining municipalities (<5%)	Mining municipalities (>5%)
N° of municipalities	131	161	50
Municipal budget			
POI as a % of total budget	0.274	0.299	0.227
MCF as a % of total budget	0.525	0.487	0.513
Others as a % of total budget	0.211	0.214	0.259
Mining patents			
Mining patents as a % of POI	0.000	0.005	0.355
Mining patents as a % of total budget	0.000	0.001	0.068

Notes: Own construction using SINIM data. Mining municipalities are separated into 2 different groups according to the percentage of its Permanent Own Income (POI) coming from mining patents in 2005.

Table 2. Summary statistics for municipal total revenues and employment expenditures.

	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
	Mining municipalities (>5%)					
	2001-2005			2006-2015		
Total municipal revenues per capita	246	319.31	432.67	496	539.06	782.63
Total salaries per capita	246	49.95	63.74	496	96.86	164.93
Long-term salaries per capita	246	37.27	44.84	496	70.58	117.05
Annual-term salaries per capita	246	8.40	11.54	496	19.01	34.78
Short-term salaries per capita	246	4.28	8.47	496	7.27	16.31
	Mining municipalities (<5%)					
	2001-2005			2006-2015		
Total municipal revenues per capita	801	144.84	169.17	1,606	217.27	216.20
Total salaries per capita	801	24.74	19.18	1,606	41.56	56.33
Long-term salaries per capita	801	19.10	14.79	1,606	30.26	40.97
Annual-term salaries per capita	801	4.14	4.29	1,606	8.43	11.78
Short-term salaries per capita	801	1.51	1.27	1,606	2.86	9.07
	Non-mining municipalities					
	2001-2005			2006-2015		
Total municipal revenues per capita	641	196.60	247.48	1,304	310.75	414.37
Total salaries per capita	641	35.80	42.15	1,304	61.63	85.84
Long-term salaries per capita	641	27.86	32.16	1,304	45.32	63.68
Annual-term salaries per capita	641	5.69	7.51	1,304	11.72	15.64
Short-term salaries per capita	641	2.25	5.10	1,304	4.59	13.38

Notes: All variables are expressed in thousands of Chilean pesos at constant prices of 2015. Mining municipalities are separated into 2 different groups according to the percentage of its Permanent Own Income (POI) coming from mining patents in 2005.

Table 3. Summary statistics for other municipal expenditures.

	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
	Mining municipalities (>5%)					
	2001-2005			2006-2015		
Allowances per capita	246	7.40	15.74	496	17.75	47.49
Travel expenses per capita	246	7.56	19.18	496	9.03	29.23
Municipal investment per capita	246	61.40	87.13	496	91.55	127.49
Transfers to education per capita	246	23.75	32.09	496	39.82	53.44
Transfers to health per capita	246	11.42	14.80	496	17.56	25.84
Community programs per capita	246	1.61	4.40	496	3.34	6.99
	Mining municipalities (<5%)					
	2001-2005			2006-2015		
Allowances per capita	801	2.08	5.27	1,606	3.66	11.55
Travel expenses per capita	801	1.22	3.81	1,606	1.56	4.92
Municipal investment per capita	801	28.44	50.77	1,606	32.59	40.32
Transfers to education per capita	801	11.65	12.41	1,606	16.92	22.03
Transfers to health per capita	801	6.74	8.24	1,606	10.38	18.27
Community programs per capita	801	0.57	1.00	1,606	1.40	2.19
	Non-mining municipalities					
	2001-2005			2006-2015		
Allowances per capita	641	3.86	9.00	1,304	7.12	16.89
Travel expenses per capita	641	1.80	4.00	1,304	2.28	4.80
Municipal investment per capita	641	36.16	67.48	1,304	53.36	121.22
Transfers to education per capita	641	16.12	26.41	1,304	23.74	43.15
Transfers to health per capita	641	7.69	9.64	1,304	12.91	24.33
Community programs per capita	641	0.74	1.41	1,304	1.95	3.47

Notes: All variables are expressed in thousands of Chilean pesos at constant prices of 2015. Mining municipalities are separated into 2 different groups according to the percentage of its Permanent Own Income (POI) coming from mining patents in 2005.

Table 4. Impact of mining revenues on municipal employment expenditures (DD results)

	(1) Total municipal revenues per capita	(2) Total employment expenditures per capita	(3) Long-term employment expenditures per capita	(4) Annual-term employment expenditures per capita	(5) Short-term employment expenditures per capita
PostxMin5	101.72***	21.40***	16.02***	4.73***	0.64
	(21.60)	(5.38)	(3.87)	(1.22)	(0.59)
Municipality FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	2,690	2,687	2,687	2,687	2,687

Notes: Min5 includes mining municipalities that had more than 5 per cent of its Permanent Own Income (POI) coming from mining in 2005. Post takes the value of 1 the years after the legal reform was implemented. All dependent variables are expressed in thousands of Chilean pesos at constant prices of 2015. Robust standard errors are reported in parentheses: *** p<0.01 ** p<0.05 * p<0.1.

Table 5. Impact of mining revenues on municipal employment expenditures (extended DD results)

	(1) Total municipal revenues per capita	(2) Total employment expenditures per capita	(3) Long-term employment expenditures per capita	(4) Annual-term employment expenditures per capita	(5) Short-term employment expenditures per capita
PostxMin0	-32.83***	-7.62***	-5.00***	-1.45***	-1.17***
	(9.85)	(2.44)	(1.76)	(0.52)	(0.40)
PostxMin0xPat	294.73***	72.45***	49.59***	16.56***	6.31**
	(94.92)	(25.40)	(17.45)	(5.86)	(2.55)
Municipality FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	5,098	5,094	5,094	5,094	5,094

Notes: Min0 includes all mining municipalities. Post takes the value of 1 the years after the legal reform was implemented. Pat is the percentage of the Permanent Own Income (POI) coming from mining in 2005. All dependent variables are expressed in thousands of Chilean pesos at constant prices of 2015. Robust standard errors are reported in parentheses: *** p<0.01 ** p<0.05 * p<0.1.

Table 6. Impact of mining revenues on allowances, travel expenses and other municipal expenditures (DD results)

	(1) Allowances to the Municipal Council per capita	(2) Travel expenses per capita	(3) Municipal investment per capita	(4) Transfers to education per capita	(5) Transfers to health per capita	(6) Transfers to community programs per capita
PostxMin5	7.06***	1.00	12.49**	8.31***	0.49	0.47
	(1.64)	(0.73)	(6.19)	(1.92)	(1.04)	(0.31)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,687	2,687	2,687	2,688	2,687	2,686

Notes: Min5 includes mining municipalities that had more than 5 per cent of its Permanent Own Income (POI) coming from mining in 2005. Post takes the value of 1 the years after the legal reform was implemented. All dependent variables are expressed in thousands of Chilean pesos at constant prices of 2015. Robust standard errors are reported in parentheses: *** p<0.01 ** p<0.05 * p<0.1.

Table 7. Impact of mining revenues on allowances, travel expenses and other municipal expenditures (extended DD results)

	(1) Allowances to the Municipal Council per capita	(2) Travel expenses per capita	(3) Municipal investment per capita	(4) Transfers to education per capita	(5) Transfers to health per capita	(6) Transfers to community programs per capita
PostxMin0	-1.40**	-0.49**	-8.14**	-1.25	-1.74**	-0.25**
	(0.62)	(0.21)	(3.69)	(1.01)	(0.73)	(0.13)
PostxMin0xPat	23.02***	7.59**	14.56	14.07**	6.10**	0.64
	(8.09)	(3.11)	(21.69)	(5.96)	(3.05)	(0.89)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,094	5,094	5,094	5,094	5,094	5,093

Notes: Min0 includes all mining municipalities. Post takes the value of 1 the years after the legal reform was implemented. Pat is the percentage of the Permanent Own Income (POI) coming from mining in 2005. All dependent variables are expressed in thousands of Chilean pesos at constant prices of 2015. Robust standard errors are reported in parentheses: *** p<0.01 ** p<0.05 * p<0.1.

Table 8. Impact of mining revenues on reelection of the Mayor and the political coalition

	(1) Mayor reelection (=1 if reelected)	(2) Coalition reelection (=1 if reelected)	(3) Mayor reelection (=1 if reelected)	(4) Coalition reelection (=1 if reelected)
PostxMin0	-0.085	-0.123	-0.189*	-0.162
	(0.078)	(0.077)	(0.100)	(0.099)
PostxMin0xEmploy			0.014***	0.009*
			(0.005)	(0.005)
Observations	518	518	516	516

Notes: The results consider the municipal elections of 2004 and 2008 (before and after the legal reform of 2005 was implemented). Min0 includes all mining municipalities. Post takes the value of 1 the years after the legal reform was implemented. Employ is the change in municipal-employment expenditures between 2004 and 2008. Robust standard errors are reported in parentheses: *** p<0.01 ** p<0.05 * p<0.1.

Table 9. Impact of mining revenues on reelection of the Mayor and the political coalition, considering changes in public-goods provision

	(1) Mayor reelection (=1 if reelected)	(2) Coalition reelection (=1 if reelected)	(3) Mayor reelection (=1 if reelected)	(4) Coalition reelection (=1 if reelected)	(5) Mayor reelection (=1 if reelected)	(6) Coalition reelection (=1 if reelected)	(7) Mayor reelection (=1 if reelected)	(8) Coalition reelection (=1 if reelected)
PostxMin0	-0.188*	-0.159	-0.193*	-0.167*	-0.250**	-0.190*	-0.270**	-0,278**
	(0.101)	(0.100)	(0.101)	(0.099)	(0.106)	(0.108)	(0.116)	(0.115)
PostxMin0xEmpl	0.015***	0.008	0.014***	0.008*	0.020***	0.011	0.016**	0.014*
	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)	(0.007)	(0.008)	(0.007)
PostxMin0xMort	-0.004	0.000						
	(0.006)	(0.006)						
PostxMin0xStud			-0.012	-0.016				
			(0.017)	(0.017)				
PostxMin0xDrop					-0.016	-0.001		
					(0.023)	(0.022)		
PostxMin0xGreen							0.005	0.011
							(0.007)	(0.007)
Observations	516	516	516	516	508	508	444	444

Notes: The results consider the municipal elections of 2004 and 2008 (before and after the legal reform of 2005 was implemented). Min0 includes all mining municipalities. Post takes the value of 1 the years after the legal reform was implemented. Empl is the change in municipal-employment expenditures. Mort is the change in the infant mortality rate. Stud is the change in ratio of students to teachers in public schools. Drop is the change in student's dropout rate in public schools. Green are the square meters of green areas maintained by the municipality. Robust standard errors are reported in parentheses: *** p<0.01 ** p<0.05 * p<0.1.

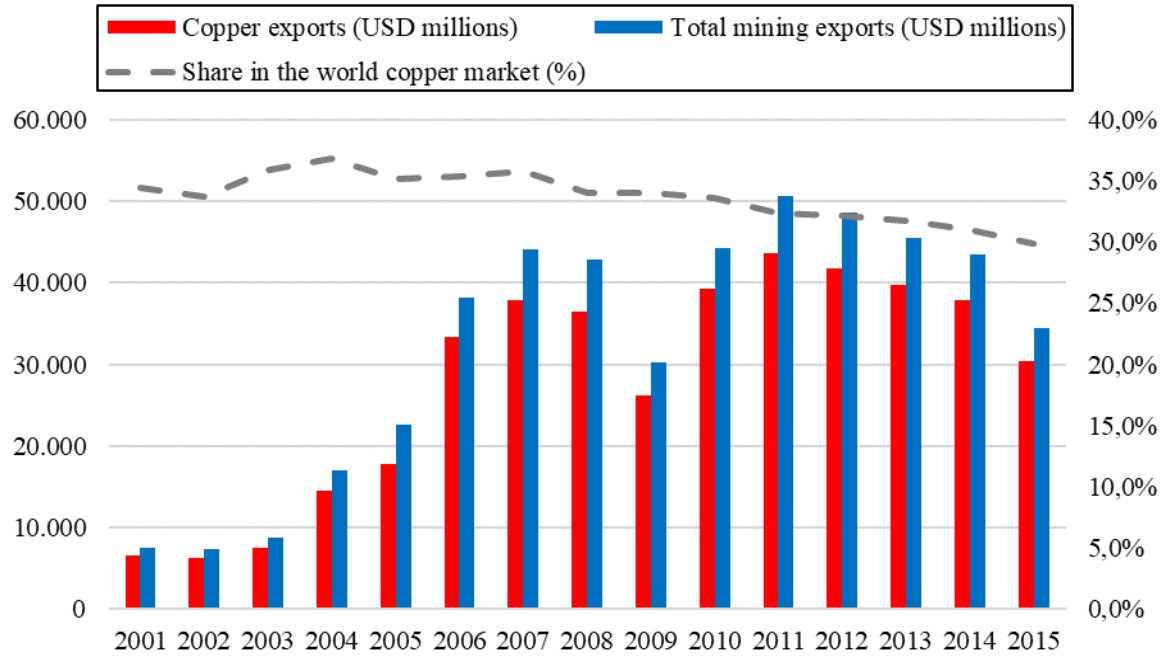
Table 10. Impact of mining revenues on the efficiency of public-goods provision

	(1) Infant mortality rate	(2) Ratio of students to teachers in public schools	(3) Student's dropout from public schools	(4) Square meters of green areas maintained by the municipality
PostxMin0	0.73**	-0.51***	0.21	-3.71
	(0.36)	(0.18)	(0.13)	(8.80)
PostxMin0xPat	0.64	0.34	0.88*	-0.66
	(2.43)	(0.52)	(0.45)	(5.15)
Municipality FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	4,830	5,080	4,975	4,496

Notes: Min0 includes all mining municipalities. Post takes the value of 1 the years after the legal reform was implemented. Pat is the percentage of the Permanent Own Income (POI) coming from mining in 2005. All dependent variables are expressed in thousands of Chilean pesos at constant prices of 2015. Robust standard errors are reported in parentheses: *** p<0.01 ** p<0.05 * p<0.1.

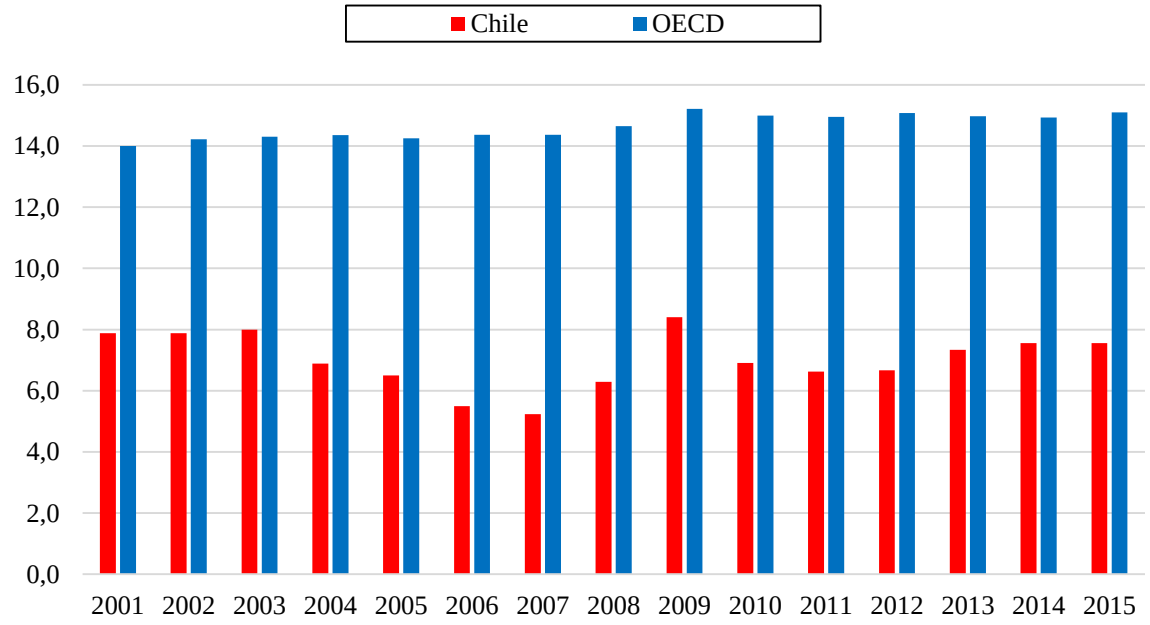
Figures

Figure 1. Evolution of copper and total mining exports in Chile (2001-2015)



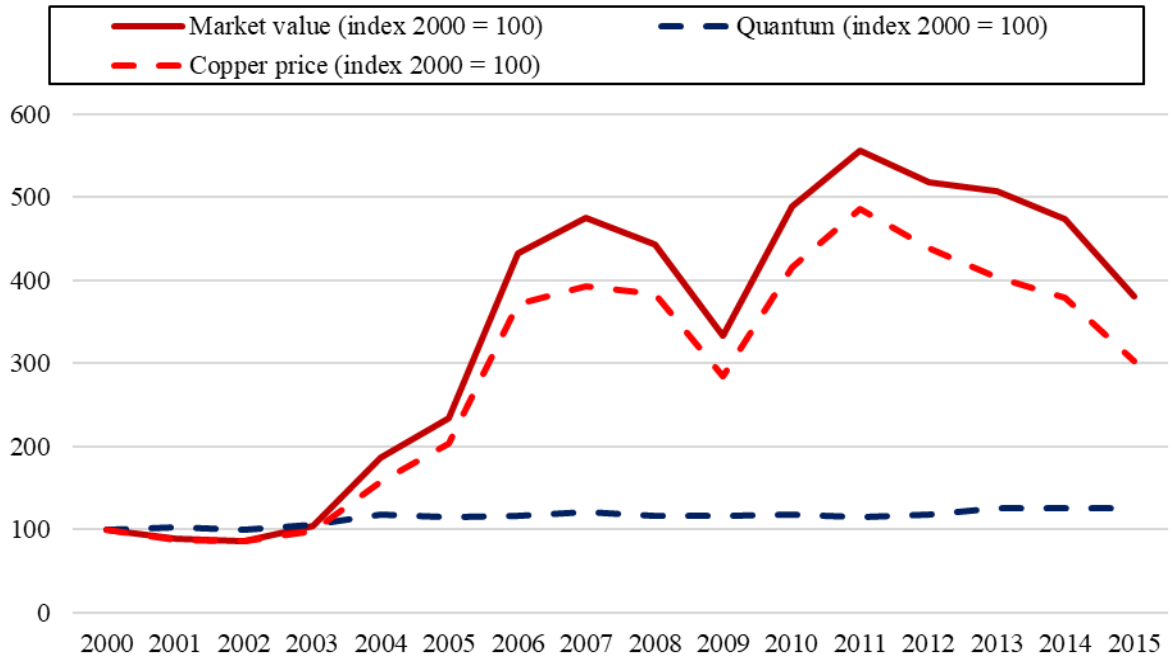
Source: Chilean Committee of Copper (COCHILCO).

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



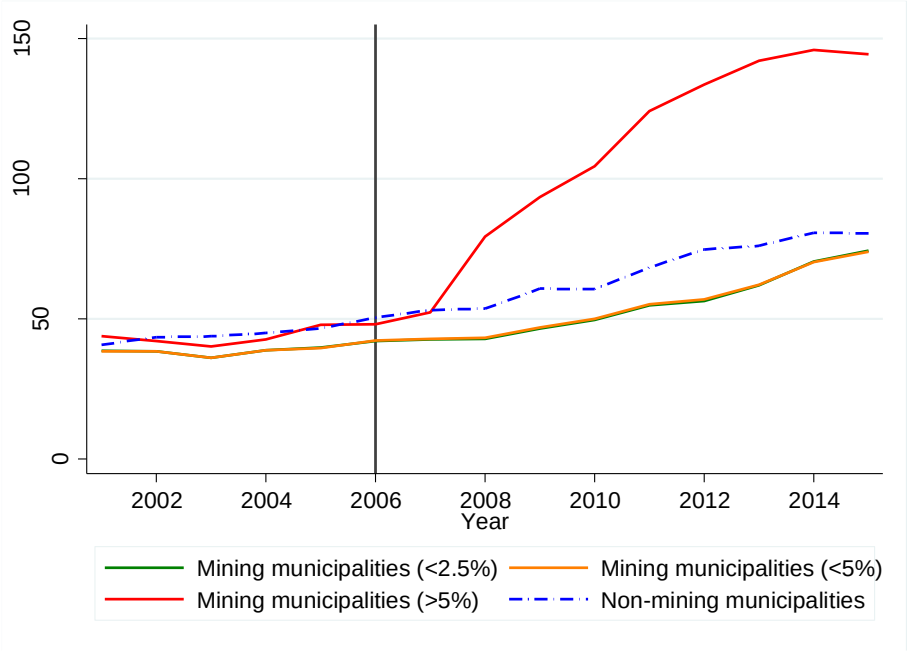
Source: OECD Fiscal Decentralization Database

Figure 3. Decomposition of copper production value in Chile (2000-2015)



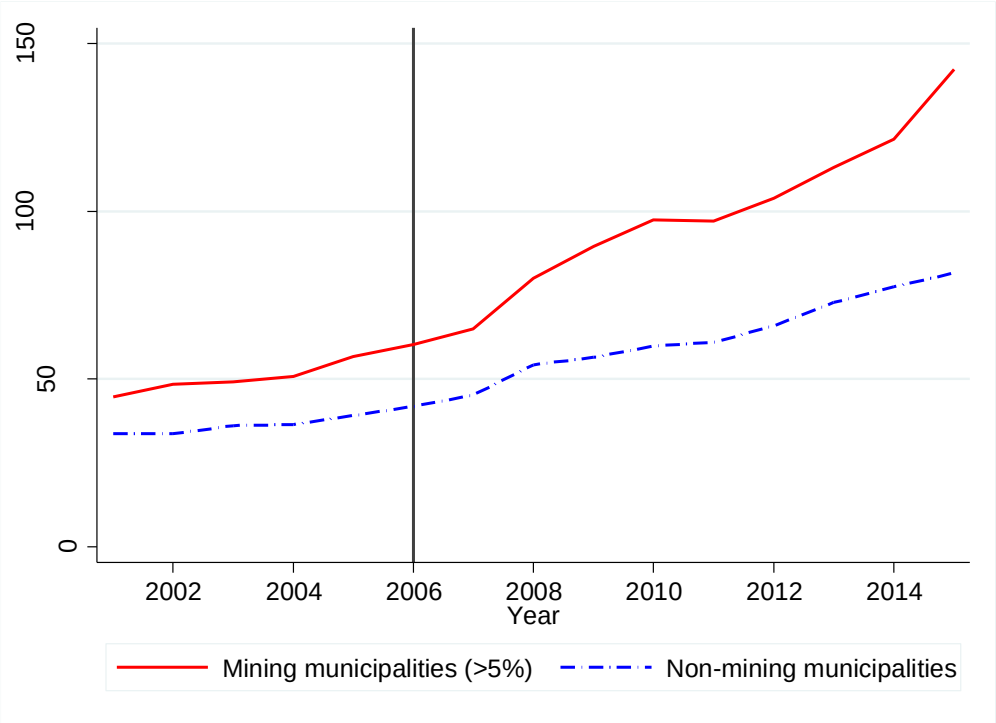
Source: Chilean Committee of Copper (COCHILCO), Central Bank of Chile.

Figure 4. Municipal Permanent Own Income by groups of municipalities (thousands of 2015 Chilean pesos)



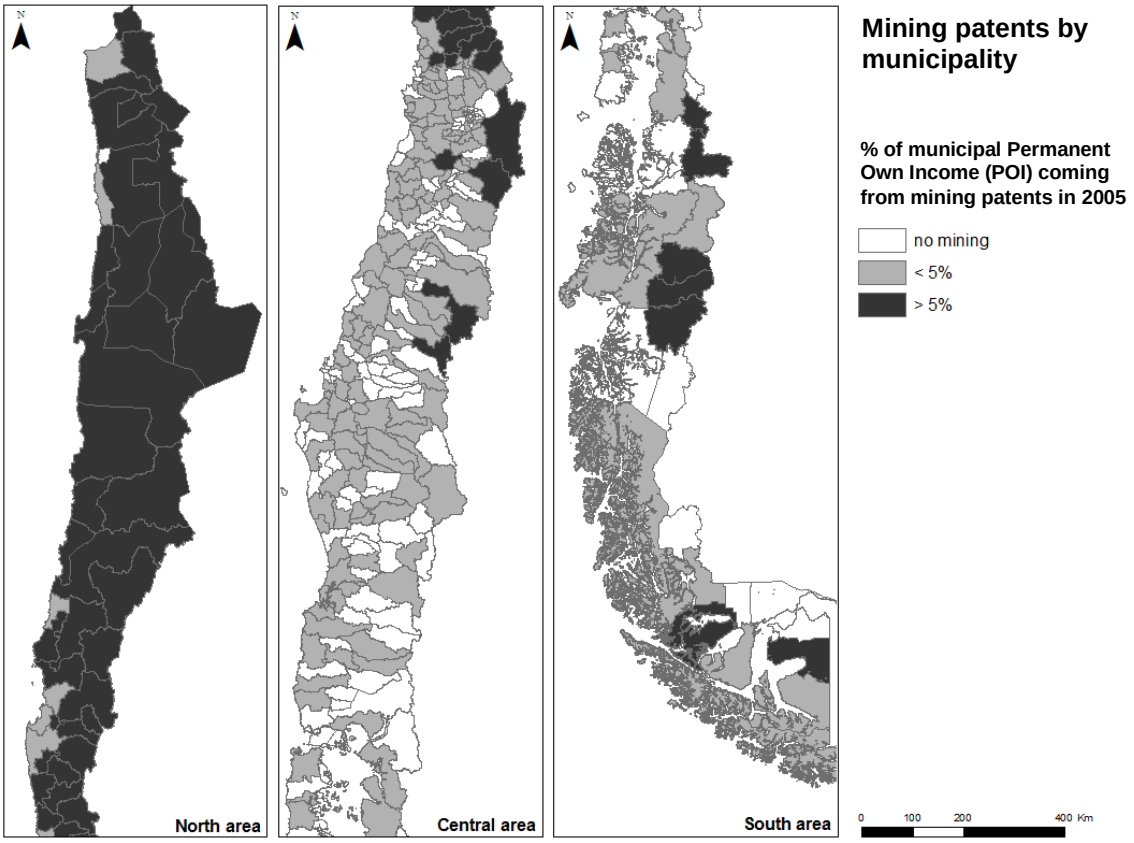
Notes: Mining municipality groups were constructed according to the percentage of their Permanente Own Income (POI) coming from mining in 2005 (<2.5%, <5%, >5%). Non-mining municipalities are all municipalities that did not have any income from mining in 2005.

Figure 5. Municipal employment expenditures by groups of municipalities (thousands of 2015 Chilean pesos)



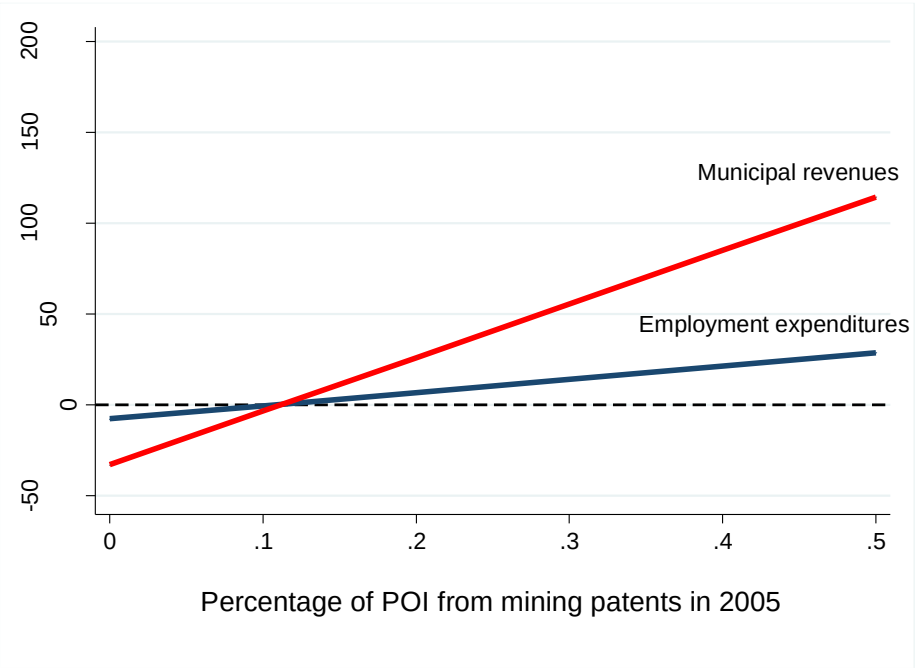
Notes: The mining municipality group correspond to municipalities located in producing areas that had more than 5% of their Permanente Own Income (POI) coming from mining in 2005. Non-mining municipalities are all municipalities that did not have any income from mining in 2005.

Figure 6. Geographical location of mining and non-mining municipalities, according to the relative importance of mining patents on municipal Permanent Own Income (POI).



Source: Own construction using SINIM data on mining patents and municipal Permanent Own Income (POI).

Figure 7. Marginal effects of the impact of mining revenues on total municipal revenues and municipal employment expenditures



Notes: The Figure plots the average marginal effects of mining revenues on municipal total revenues and municipal employment expenditures, according to the relative importance that mining patents had in the municipal Permanent Own Income (POI) in 2005. Marginal effects are computed using the results from the extended DD model shown in Table 5.