On the effects of decentralization of Natural Resource Revenues on local service provision in Peru*

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Abstract

The beginning of the commodities super cycle, starting in 2003, unfurled in producing countries, especially minerals and hydrocarbons, the called extractive boom that in Peru mainly affected subnational governments which share in tax revenues from extractive industries. The aim of this research is to analyze whether decentralization of natural resource revenues in Peru has contributed in improving the provision of local public services. To do so we Propensity Score Matching and use Differences in Differences estimator (diff-in-diff) which compares the performance of the local provision of public services by local governments benefiting from the exponential increase in these resources with those who have not been benefited, using the *extractive boom* as an exogenous change. The set of indicators used show the before and after of this event. The findings are surprising, given that show that districts that do not have these revenues are slightly better than those who participate together of these resources performance. Preliminary results show that the decentralization of natural resource revenues had a negative and statistically significant impact on household's access to piped water and electricity wiring.

Keywords: fiscal decentralization, resource booms, impact assessment, local goods provision

JEL Classification: Q3, H4, H27, H77

* This is a preliminary draft. All comments are welcome (neyra@merit.unu.edu)

1. Introduction

Several studies have discussed about this important limitations of fiscal decentralization on governance performance and the vulnerability of the countries to the decentralization of natural resource revenues (NRR). De Mello and Barenstein (2001), point out that "because improvements in governance take time to mature, fiscal decentralization should not be used as a catalyst for improving governance". More recently, Perez-Sebastian and Raveh (2016) found strong evidence that countries with high levels of fiscal decentralization are more vulnerable to the negative effects of NRR.

However, not much has been known about the specific relationship between decentralization of NRR and local goods provision. This is an important point in Latin-American countries, where NRR are playing a key role within different processes of decentralization reforms (Brosio and Jimenez, 2015). In the particular case of Peru, after a decade of fiscal decentralization, based mainly on NRR (Cheasty and Pichihua, 2015), it is important to explore and quantify the magnitude in which decentralization of NRR affects service provision at the local level.

Peru is a middle-income decentralized country. Since 2002, the country has started an ambitious political decentralization process, which implies the direct election of sub-national authorities and the transfer of functions and responsibilities to the local and regional governments. After starting decentralization process, subnational governments are become key actors in the political arena. According to the OCDE (2016), they are responsible for 40% of overall general government expenditure, similar to the average of OCDE countries.

Although spending and the provision of local public services have been significantly decentralized, there is a consensus about the progress of the fiscal side of decentralization. Several analyses (Cheasty and Pichihua, 2015; Martinez-Vazquez, 2013; Ahmad and Garcia-Escribano, 2011) agree that the Peruvian fiscal decentralization process is not yet complete because there is still no tax assignment to sub-national governments. Nevertheless, Peruvian subnational governments that

holding extractive industries within their territories, -mainly mining, gas and petroleum- have access to a revenue source, called *Canon*, linked to exploitation of natural resources, these revenues in the specialized literature are called *natural resource revenues* (NRR).

In Peru, the decentralization of NRR had the goal of compensating to extractive areas. In early 2005 the current scheme for compensation was established. The scheme is based on the so-called *localist policy paradigm* (Sachs et al., 2007), concentrating these resources in districts where activities of extractive industries are taking place. Nevertheless, although NNR allocations to districts with extractive industries have been growing fast, there is a gap between the amount of these revenues and technical and organizational capacities in local governments, which is not allowing this huge revenue to translate into higher levels of welfare and access to local services.

The rest of the paper is organized as follows. In Section 2 we discuss relevant institutional characteristics of the Peruvian local governments and decentralization of NRR, while in Section 3 there is a short description of the data and discusses the empirical specification, our identification strategy, and the hypotheses. The results are summarized in Section 4, before robustness regressions are discussed in Section 5. Concluding remarks are offered in Section 6.

2. Literature Review

Understanding the relationship between resource abundance and socio-economic wellbeing at subnational level has recently been an issue of interest amongst researchers in developed countries. By contrast, relatively few studies exist on the occurrence of this topic within Latin-American countries.

Black, McKinnish and Sanders (2005) conducted one of the earliest studies at subnational level in U.S. These scholars assess the impact of the coal boom on local labor markets, using county-level data from coal extractive areas in the U.S. Their findings show evidence of modest employment spillovers into sectors with locally traded goods. Their results, nevertheless, do not support the hypothesis that the mining coal boom crowded out other industries.

In a related paper, Papyrakis and Gerlagh (2007) performing analysis on the subnational level in the U.S. found out that the negative effects of resource abundance also hold at the state level. Their empirical study shows that resource abundance is a significant negative determinant of state growth. There are several works beyond subnational level in the U.S. Boyce and Herbert (2011), assess whether the negative effects of resource abundance exist at an even more disaggregated county level. Using panel data for U.S. counties, they show that resource abundance has a negative effect on local growth rates but has a positive effect on income levels. More recently, Weber (2014) assesses the effects of a natural gas boom in the U.S. on poverty, employment and income levels across the counties of three states. He found a mild effect on income and a positive effect on employment.

Tonts, Plummer and Lawrie (2012) focus on Western Australian mining towns using a cross-sectional analysis across mining-districts to analyze local welfare. Their findings show that socio-economic welfare at local level (resource-districts) depends on a range of factors including the nature of the particular mineral, the company structure, and the location.

Fleming and Measham (2015) analyze the case of energy extraction located across southern Queensland using census data. They use a quasi-experimental approach taking advantage of conditions provided by extraction areas (treatment) and areas without this extractive industry (control). The findings show that treatment areas have higher household/individuals income growth than control areas. They also include comparisons between energy extraction areas with no major mining history and other areas where mining was important before the energy boom, to better understand boom effects in areas with different initial mining industry importance in their economies. The results show that effective impacts are restricted to construction and professional services jobs, while the impact on agricultural jobs has decreased.

In a recent work focusing on Australia - during a period of NRR boom –, Fleming, Measham and Paredes (2015) analyze and show that resources abundance has been a blessing for local economies in its rural areas. Nevertheless, in parts of the country, little adverse effects have also been found. Ivanova (2014) states that personal income

is higher in mining communities, while the levels of income in some rural communities are lower than those in urban districts. Nevertheless, the educational outputs in mining communities are somewhat lower than in Queensland, while the population in the most disadvantaged quintile is higher in some mining districts.

Marchand (2012) analyses in energy-rich provinces of Western Canada the local effects of the resource booms (and busts) showing higher income growth and employment levels in areas where the energy industries are located versus comparable provinces elsewhere in Canada. Other recent studies (Papyrakis and Raveh, 2014) examined the effects of natural resource revenues across Canadian provinces and found that provinces rich on resources are negatively impacted. They construct a new panel dataset and find that resource windfalls are associated with inflationary pressures and reduced competitiveness in provinces rich on resources.

In Norway, Borge, Parmer and Torvik (2015), using instrumental variables, analyze the effects of hydropower industry revenues al local governments, and show that higher natural resource revenues reduce the efficiency in production of public goods.

Several works analyze the change of Brazil's regulatory framework of hydrocarbon's allocation (1997), after which a restricted subset of districts started to receive large amounts of royalties. Postali and Nishijima (2013) analyzed this policy to evaluate whether such royalties distributed under this new law contributed to improving some social indicators in the eligible districts. Using the difference-in-differences approach, they compare changes in social indicators within affected districts, taking the unaffected districts as control group. Their findings highlight that royalties had a positive effect on households' access to electric, water and waste collection, as well as on the decrease of the illiteracy rate. This means that the eligible districts were able to improve some of their social indicators. Using a quasi-experimental approach, Caselli and Michaels (2013) find for Brazilian local governments that the local economy and household income were positively affected by the extraction of hydrocarbon resources.

Three works have explored the relationship between mining industry, household's income and economic linkage using data from Peru. Just like the studies reviewed previously, these works focus on the relationship between extractive industries, local employment, inequality levels and household income, but do not try to quantify the effects of NRR on local service provision.

Loayza and Rogolini (2016), in a recent work, find that mining activities in Peru have a dual impact on local communities. On the one hand, these activities have a positive effect on producing areas in terms of consumption and poverty reduction. On the other hand, the researchers find evidence that mining is associated with an increase in inequality. They point out that this negative effect may explain the opposition of local communities to mining projects. Using microdata at household level, Aragón and Rud (2016) analyze a case study on one Peruvian region. They show that this increase in backward linkages had a positive impact on the region's economy and poverty reduction; the results also suggest that the mining benefit extends to surrounding areas not directly involved in mining.

Using a census, administrative and regionally representative data, Escobal and Ticcsi (2015) analyze local effects of the new mining activities and find that the mining sector attracts migration inflows. They also find educational indicators showing some positive effects in areas hosting the mining industry versus comparable areas elsewhere in Peru during the late Nineties.

The literature review shows us that the mainstream literature on the topic has been mostly focusing on developed countries such as Australia, Canada, and the United States. Hence prior research has not been very informative on the local effects of resource abundance in less developed countries, especially in nonfederal countries. On the other hand, no effort has been made to try to understand and quantify the specific relationship between decentralization of NRR and subnational governance, measured by the provision of local public services. Thus, this relationship is a relevant topic on the field of decentralization that scholars have not addressed yet.

Most likely this gap in the literature has not been filled yet due to the absence of data. One of the strongest points of this proposal is precisely that we have access to all the data that is required to analyze the Peruvian case. Taking prior observation into account, we hope that our research will be able to provide a valuable contribution to this relatively underexplored research area.

3. The institutional context

3.1. The fiscal decentralization process

The current decentralization process started in 2002, when Congress driven by democratic and economic objectives constitutionally declared Peru a "Decentralized state". The target was to increase accountability, empower local populations and, improve the governance and democratic quality by bringing decision makers closer to citizens. Economic arguments were also put forward; decentralization would improve the quality and access to public services, and reduce regional inequalities. By devolving responsibilities and resources the objective was to create a model of territorial development based on the principle of subsidiarity. As a result, Peru is structured in the form of a Presidential system comprising three independent branches (legislative, executive and judicial), with a two-tier sub-national system composed of regions and municipalities.

While there is no ideal degree of decentralization, there is a broad consensus that the fiscal decentralization process in Peru is incomplete (World Bank 2010, World Bank 2015, IMF 2015, Martinez-Vazquez 2013). An unfinished decentralization has had important aftermaths, such as the lack of accountability and co-responsibility at the subnational level, as well as a negative impact on the effective territorial development; to some extent, the absence of a system of cities (and thus the concentration in Lima), is also symptom of deficiencies in designs fiscal and institutional decentralization of Peru (World Bank 2015).

Although subnational governments are responsible for slightly above 40% of overall government expenditure, they have a lower degree of decentralization in revenues. Tax revenue is still highly concentrated on the national, leaving only a residual role to

subnational governments. The number of taxes assigned to subnational governments, particularly to local governments is very limited, and the latter do not have any space to determine their rates. The vast majority of taxes are raised by the central government: close to 87% of total tax revenues. Peru has seen little evolution on that matter, since in 1995; the national government collected 88% of all taxes.

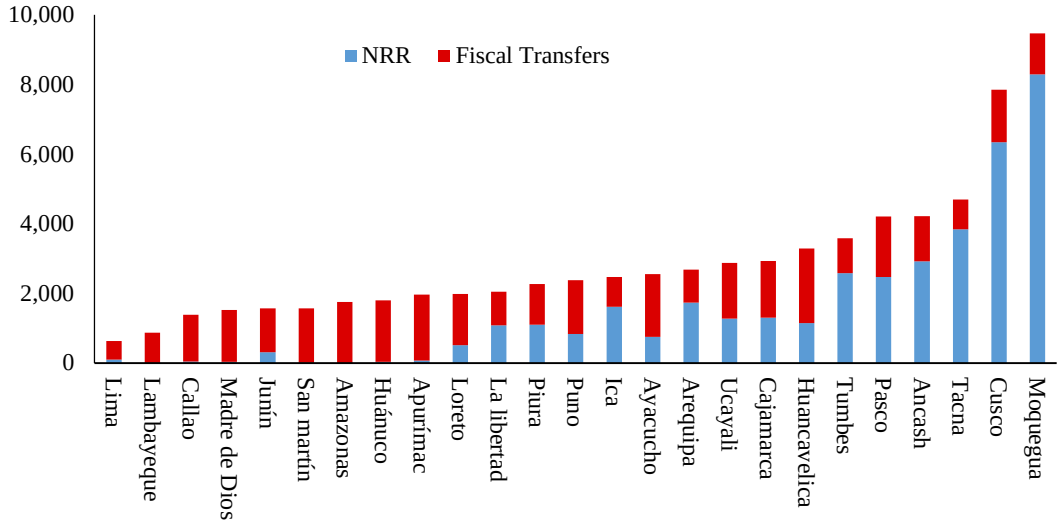
Local governments receive the following types of transfers to finance their responsibilities: Transfers from the national government (essentially deconcentrated expenditures with some level of discretionary in the transfers) and the equalization transfer called Fondo de Compensacion Municipal (FONCOMUN). Local taxes represent only around 11% of the total local revenue, the tax base at the local level is very narrow and is constituted mainly by only three taxes: the property tax, the tax on the property of vehicles and the tax on property transfers. As a result, municipalities exhibit a high dependence on transfers from the national government. In addition, strong regional socio- economic disparities and the spatial concentration of economic activity in Lima leads to a poor tax capacity to collect taxes outside the capital. Lima is responsible for over 80% of total tax revenues collected by municipal governments, and the per capita collection of revenue in Lima is approximately two times higher than the potential collection of intermediate cities (World Bank 2015).

The low degree of revenue autonomy or, the corollary high degree of dependence of local governments on intergovernmental transfers, exposes the system to serious weaknesses like the dependency on revenues from transfers limits the efficiency and accountability of local governments and the transfer-dependent system poorly complements the emphasis on a hard budget constraint and borrowing discipline introduced in other elements of Peru's decentralization design (Martinez-Vazquez 2013).

By producing districts natural resource revenues (Canon), a revenue sharing that subnational could spent discretionary have become an important source of revenue due to the substantial increased of the extractive activities revenues over the last decade. Although the Canon is the largest source of revenue for subnational governments only a limited number of municipalities receive it. The distributional

system of the canon mostly focuses on local governments, which receive 70% of the overall transfers. Regional governments only receive 15% of the canon and 5% is allocated to investments in science and technology.

Figure 1. NRR decentralized and Fiscal Transfers to local governments by department (average per capita 2010-2014)



Source: Author's elaboration based on official data.

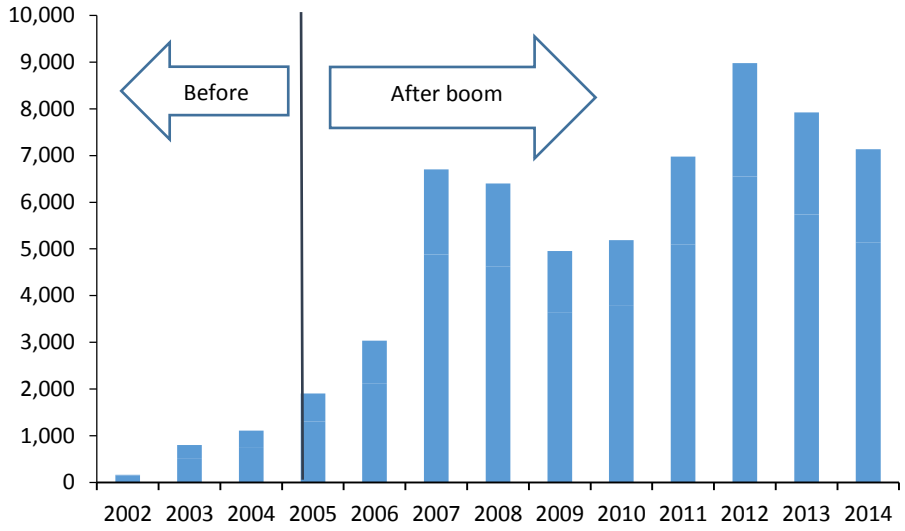
3.2. The asymmetric fiscal decentralization

The Peruvian Constitution establish that the *Canon* is a revenue only for jurisdiction where natural resources are extracted from. The law specifies the share of the revenues collected through the income tax on extractive industries that have to be assigned to subnational governments (which is 50 percent), and the procedure for computing the share that corresponds to each subnational government. The different kinds of Canon are: Canon from mining, gas, petroleum, fishing, and forest resources.

In contrast, local governments located on non-producing areas do not receive these revenues and are mostly financed by fiscal transfers from the national level. Different types of canon, henceforth called natural resource revenues (NRR), have increased dramatically due to the escalation of international prices of natural resources (commodities super cycle) and the steady growth of Peruvian exports of natural resources. As a result, the allocation of these revenues is highly uneven across the country.

Therefore, an asymmetrical fiscal decentralization has been consolidated in recent years in Peru. Under the same institutional framework, there are two kinds of local governments: municipalities which have Canon revenues (resource-dependent districts), and are financed within a context of fiscal decentralization, and others that have an arrangement more dependent on the national government fiscal transfers (non-resource-dependent districts).

Figure 2. Evolution of NRR decentralization in Peru (in PEN million)



Source: Author's elaboration based on official data.

Figure 2 shows that the remarkable evolution of decentralized NRR brought about a shock in subnational revenues in resource-dependent districts. These revenues increased 57-fold between 2002 and 2013. The NRR represent 88% of total revenues in resource-dependent districts. For this reason, it is important to know to what extent the NRR are increasing the welfare through provision of local service-delivery in districts exposed to the decentralization of NRR. Therefore, the main question that will guide this research is: "To what extent decentralization of NNR affect households that are located in resource-dependent districts in terms of local delivery-service?"

4. Empirical strategy and data

The aim of the proposed empirical analysis is to quantify the magnitude in which the decentralization of natural resource revenues affects local service provision. To address this goal, we use the tools of impact assessment.

The validity of any impact assessment is based mainly on how reasonably the problem of endogeneity of the variables is addressed, and a counterfactual scenario is built. That is, this methodology seeks to determine whether the level of welfare of individuals or households has changed due to the implementation of the policy. To determine this potential causality it is usually necessary to know the state of counterfactual intervention. That is, the situation in which there has been no implementation of the policy and compare the two situations for the same individuals. In most situations, this is clearly impossible; therefore, the impact assessment becomes a problem of missing information.

In this regard, the impact assessment methodologies have sought to construct comparison groups (counterfactual) in the most reasonable way by comparing the situation with intervention to the situation without intervention between relatively similar individuals (Ravallion 2008). For this reason, the ideal of impact assessment involves the use of randomization to determine the comparison groups. Impact assessment studies analyze the effect of the status quo of policies on variables of interest. That is, the impact of policies, where information about the group of individuals affected by the policy is observable is evaluated; therefore, in this research we will quantify the magnitude in which decentralization of natural resource revenues affects local service provision. The data necessary for the impact assessment are intensive in the use of information, for this reason we consider it necessary to use household surveys as well as additional databases.

Sources of Information

For this research, we are going to rely on secondary information. Two main sources of data gathered at the micro-data level, suitable for econometric analysis, has been used.

1) Information about delivery of local services, quality of subnational governments and, socioeconomic characteristics of households and individuals obtained from Peru's national statistical agency (Instituto Nacional de Estadistica e Informatica - INEI), which is in charge of carrying out the National Household Survey (Encuesta Nacional de

Hogares - ENAHO), a household survey conducted at national, regional, urban and rural levels, and conducted annually.

2) Information about natural resource revenues obtained from the Ministry of Economy and Finance (MEF). This data, which is reviewed by MEF at the end of the year, is registered by the Integrated Fiscal Management System (Sistema Integrado de Administracion Fiscal - SIAF), a system that compiles fiscal statistics that include all data related to revenue and expenditure carried out by national, regional and local governments. Peruvian fiscal data is consistent, reliable and timely information (IMF, 2015). According to this report, the Peruvian fiscal statistics has an advanced coverage; all subnational levels have been covered (1,965 local government units). This database includes characteristics on the assignment of intergovernmental transfers: date; quantity of transfers; spatial location and whether or not there is a natural resource revenue.

The dependent variables of interest to the impact assessment are:

Table 1. Local provision of services indicators – dependent variables

Indicators (variable name)	**Description**	**Source**
Electric energy (Energy)	Percentage of permanence private households with electric connection, coming from a general network or not.	ENAHO (INEI)
Piped water (Water)	Percentage of permanence private households with piped potable water connection, coming from a general network, wells, or reservoir.	ENAHO (INEI)
Sewer systems (Sewer)	Percentage of permanence private households with sewer connection, coming from a general network, wells, or reservoir.	ENAHO (INEI)

Propensity Score Matching (PSM)

We use propensity score matching (PSM), which is a method gaining extensive use in the quasi-experimental assessment analysis. PSM allow us to find out whether being exposed to the decentralization of NRR is generating significant effects on the local service-delivery. This methodology has already been used in similar works by authors like Ticsi and Escobal (2013) and Zegarra *et al.* (2007), to understand the impact of mining on local communities.

Matching estimators compare how effects differ for resource-dependent districts relative to observationally similar non-resource-dependent districts. The PSM analysis uses "data from a pool of units that do not participate in the intervention to identify what would have happened to participating units in the absence of the intervention" (Heinrich et al. 2010). To do so, we will able to directly match resource-dependent districts with non-resource-dependent districts that have similar characteristics as a control group, therefore, the variables on which the treated and control groups differ must be observable. The rich database available from ENAHO allows that condition to be met.

Matching estimators, also allow check the consistency of the outcomes taking into account different assumptions about specification and identification. In this research, we will use a set of variables, including demographic, spatial and socioeconomic information at the subnational level to generate valid matches for calculating the effects of decentralization of NRR.

Differences in Differences (DD)

The second econometric strategy is the Differences in Differences (DD) estimator, which constitutes the primary estimator. As mentioned above, the decentralization of NRR had been markedly small and stable until 2004, the year in which started the commodities super cycle and also the scheme of allocation to local governments was changed. Indeed, since 2005, a new NRR allocation arrangement has been launched, with a strong localist emphasis. Therefore, it is possible to establish two marked periods of evolution of the decentralization of NRR: a) The first until 2004, a period of low and stable international commodity prices and an allocation scheme of NRR with less local emphasis, and b) the second, since 2005, a period characterized by a marked

increase in international commodity prices and a change in the allocation scheme of NRR with a greater emphasis localist. These events provide, for the purposes of our research, a source of substantially valid exogeneity.

To implementation of DD estimator, the identification strategy involves to define two different types of districts, according to the levels of fiscal decentralization (access to NRR) that have reached their local governments. To define whether a district is resource-dependent, we define using NRR distribution in which local governments located in the fifth quintile are resource-dependent district and those located in the first quintile are non-resource-dependent ones. To specify the treatment variable, in this research, we will consider as a treated observation any household located in a resource-dependent district.

We use a specification of linear basic data panel. The regression to estimate the effects of decentralization of NRR can be written as:

$$y_{hdt} = \alpha_d + \beta(resourcedistrict_{hd}.revenue_t) + X'_{hdt}\theta + T'_t\varphi + \varepsilon_{hdt} \quad (1)$$

Where y_{hdt} is the outcome variable of household h in district d in year t; α_d are fixed effects at the district level; $resource_{i,j}$ is a dummy variable that takes the value of 1 if the household is located in a resource-dependent district; $revenue_t$, is a dummy variable that takes the value of 1 for the 2014 ("after") and 0 for the year 2004 ("before"); X_{hdt} incorporates various socioeconomic variables at the household level and district level. Additionally, we have opted to control the effect of decentralization of NRR at the regional level as a regressor in the X_{hdt} vector; $T'_t\varphi$ is a vector of dummies that aims to capture the temporality of the database between 2004 and 2014; finally, ε_{hdt} is White Noise. The parameter of interest is β which recovers the causal effect of interest and it is estimated using a linear basic data panel.

The Average Treatment Effects on the Treated (ATT) using the DD estimator, proposed in the above equation, compares households in resource-dependent districts and households in non-resource dependent ones, before and after that the increasing

international commodity prices, as valid sources of exogeneity, that can allow causal effects.

The key assumption of the DD estimator implies that unobservable factors that determine treatment exposure are constant over time. In the equation, the dummies show changes over time of the outcome variables for households exposed to the decentralization of NRR. Fixed effects at the district level α_d show features that are assumed invariant over time. The identification strategy in this counterfactual scenario requires control by systematic shocks in the variables of interest in resource-dependent districts that are potentially correlated with each other.

In DD estimations there is a potential problem of serial correlation, above all, in relation to the dependent variable, which can be correlated serially in positive way, and where the treatment variable, or the exposure to some policy, changes very little within the treatment unit over time. For this reason, it is necessary to correct the standard errors (controls for clustering and heteroskedasticity) at the district level. The correction of standard errors by cluster allows us to show the potential spatial correlation of households exposed to similar shocks.

4. Empirical Results

The change in the percentage of households living in housing with piped water is the first indicator that we used to test the effects of NRR decentralization. The provision of water and sanitation facilities lies more clearly within the remit of the local governments in Peru. This local service requires not only the initial investment to build the physical infrastructures but the existence of local institutional arrangements that assume responsibility for the management and maintenance of the systems. According to the PSM analysis, *resource-dependent districts* tended to improve less in this indicator than their comparable *non-resource-dependent districts* ones.

However, the estimates for the average effects and the standard errors vary quite widely depending on the method of calculation. According to the nearest neighbor method and the others three methods, *resource-dependent districts* improved less than their comparable *non-resource-dependent districts* group, with high t-statistics.

Although, these results are not robust because show significantly lower effects, the results of the four methods are consistent regarding the average negative effect of decentralization of NRR on the expansion of water supply services at local level.

Table 2. PSM: estimate of the average effect of decentralization of NRR on the change in the percentage of households with provision of local services – 2014

Matching estimation method	With piped water access		With electricity service		With sewerage access	
	Average effect on the treated	t statistic	Average effect on the treated	t statistic	Average effect on the treated	t statistic
Nearest neighbour	-0,095	-1,76	-0,007	-1,71	0,023	3,37
Radious (.001)	-0,010	-1,78	-0,008	-1,82	0,024	3,55
Kernel	-0,010	-1,86	-0,007	-1,60	0,025	3,66
Stratification	-0,018	-2,46	-0,009	-1,54	0,021	2,35

Another outcome variable is the percentage of households living in housing with electricity supply. The PSM analysis shows that *resource-dependent districts* improved their access to sewerage networks slightly less than the other districts between 2005 and 2014. Similarly, to the previous outcome variable, these results provide significantly lower effects, however the four analysis results are consistent regarding the average negative effect of decentralization of NRR on the provision of electricity services.

The percentage of households with toilets linked to the main network is the last outcome variable in to the PSM analysis. The result show that *being a resource-dependent district* had a positive impact on the expansion of the service of sewerage. Nevertheless, the average improvement in *resource-dependent districts* is slightly higher than in the comparable non-resource-dependent districts, and in three of the analysis, the results are statistically significant.

To sum up, *resource-dependent districts* tended to perform worse in term of providing potable water and expansion of electricity supplies to the households, and better regarding the expansion of sewerage service. These results can be refined.

On the other hand, the table three presents the results of the *Diff-in-Diff* analysis on the effects of the decentralization of NRR on the provision of local services using Differences in Differences estimator. We found out significant evidence suggesting that decentralization of NRR decrease the local provision of public services, at least in potable water and electricity supply.

The findings are product of the estimations of equation 1. This estimation include fixed effects at the district level, level controls as well as households and district dummy variables to control the temporal effect in the database; heteroskedasticity is corrected by cluster.

Table 3: Testing the impacts of decentralization of NNR on access to local services

Variable: $y_{h,d,t}$	Diif-in-Diff Treateds vs Controls
	ATT: $\delta_{1,DD}$
Percent of households living in housing with piped water (water, %)	-0.028** (0.041)
Percent of households living in housing with electricity supply (Electricity, %)	-0.015* (0.088)
Percent of households with toilets linked to the main network (Sewerage, %)	0.003 (0.0674)
Observations	968

*** Significant at 1%, ** significant at 5% y * significant at 10%. Standard errors in parentheses.

The Table 3 show the results using NRR distribution in which districts located in the fifth quintile are resource-dependent district (treated) and those located in the first quintile are non-resource-dependent districts (control). The most remarkable finding suggests that the decentralization of NRR had decreased in 2.8% the probability of access to potable water with piped linked to the main network, a result statistically significant at 5%. The results of the econometric model suggest also that an increase of decentralization of NRR is associated with a lower probability of access to electricity supply.

Finally, we find no evidence that a change on the level of NRR in local governments is associated with a change in the probability of access to toilets linked to the main network. A possible explanation of this result could be that the provision of sewerage networks and the correct functioning of these services requires not only the large initial investment to build the physical infrastructures but the existence of technical capabilities for the management and maintenance of the systems.

4. Concluding remark

Very little attention has been devoted to analyze the effects of decentralization of NRR on local delivery service in Peru after a decade of the called fiscal decentralization based on NRR with *localist emphasis*. In this paper, we make use of impact analysis tools like Propensity Score Matching and Difference in Difference for Peruvian districts to show that the NRR can have effects in improving the provision of local public services. Our analysis reveals that the decentralization of NRR had decreased in 2.8% the probability of access to potable water with piped linked to the main network. Likewise, resource-dependent districts experience tended to perform worse than non-resource-dependent districts in terms of expansion of electricity supplies to the households. In addition, we find also that the decentralization of NRR had no impact on the expansion of the service of sewerage.

These are important findings for fiscal decentralization policy-making. Our analysis demonstrates that the decentralization of fiscal windfalls have can have negative effects on the local level. A better understanding of these NRR decentralization effects is, hence, essential for adopting policy measures that support decentralization performance, particularly in resource-dependent jurisdictions.

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ANEXOS

Anexo 1

Estimate of the average effect of decentralization of NRR on households with piped water access - 2014

Matching estimation method	N° of resource-dependent districts (treated)	N° of non-resource-dependent districts (controls)	Average effect on the treated	t statistic
Nearest neighbour	546	614	-0,095	-1,76
Radious (.001)	546	614	-0,010	-1,78
Kernel	546	614	-0,010	-1,86
Stratification	546	614	-0,018	-2,46

Estimate of the average effect of decentralization of NRR on households living with electricity service - 2014

Matching estimation method	N° of resource-dependent districts (treated)	N° of non-resource-dependent districts (controls)	Average effect on the treated	t statistic
Nearest neighbour	546	614	-0,007	-1,71
Radious (.001)	546	614	-0,008	-1,82
Kernel	546	614	-0,007	-1,60
Stratification	546	614	-0,009	-1,54

Estimate of the average effect of decentralization of NRR on households with toilets linked to the main network – 2014

Matching estimation method	N° of resource-dependent districts (treated)	N° of non-resource-dependent districts (controls)	Average effect on the treated	**t statistic**
Nearest neighbour	546	614	0,023	3,37
Radious (.001)	546	614	0,024	3,55
Kernel	546	614	0,025	3,66
Stratification	546	614	0,021	2,35