Increased decentralization, basic services, and nutrition: Evidence from Bolivia

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Abstract

This paper aims to evaluate the impact of increased fiscal decentralization on outcomes as nutrition, access to safe water and sanitation in Bolivia during the 2000s decade. The results show that fiscal decentralization has not increased the access of the population to safe water or sanitation. Meanwhile, nutritional status of children less than 5 years old has slightly improved during the study period, suggesting a positive impact of increased decentralization on nourishment indicators. On the other hand, decentralization does not appear to be pro-poor, as the results show that the progress on nourishment indicators was greater in non-poor municipalities versus poor municipalities. Results are robust to different thresholds and deprivation measures.

Keywords: decentralization; nutrition; water and sanitation.

JEL: H7, Q25, I19

1. Introduction

Economic situation in Bolivia has progressed dramatically in the last 20 years. Besides economic growth (i.e., the increase of GDP), social indicators have also improved, in particular for the poor. For example, Eid and Aguirre (2013) finds that inequality in Bolivia has fallen 13 points (from 0.59 to 0.46 in the Gini coefficient) between 1999 and 2011, outperforming any other country in Latin America in terms of inequality reduction. Vargas and Garriga (2015) highlights poverty reduction (from 33.7 in 1996 to 16.2 percent in 2011, using a poverty line of USD2.5/day), a sustained macroeconomic stability (annual inflation rate was around 5% on average), and a favorable fiscal situation, by sustaining fiscal surpluses from 2006 to 2014.

Despite this remarkable progress, there are still important gaps that the country still needs to address. For example, according to last census (2012), only 40% of the population in the rural area have access to safe water (tap water), while the remaining 60% gets the water from unsafe or non-permanent sources (wells, rivers, or rain water). Regarding sanitation, 62% of rural households do not have access to any proper toilet facility. This lack of access carries potential negative consequences in health (particularly for pregnant women and small children), by the appearance of infectious diseases and inadequate absorption of nutrients (Sturzenegger, Martinez, & Gertner, 2016). The scenario adds the threat of perpetuating the vicious circle of poverty (that is, less access to safe water and sanitation leads to inadequate nutrition in childhood and thus to less productivity in adult age).

Nutrition is another area in which improvement is needed. For example, according to International Food Policy Research Institute (2016) and United Nations (2015), Bolivia outperforms only the poorest country in the region, Haiti in terms of children nourishment. While the country has accomplished the goal of reducing chronic undernourishment at the national level, in the rural area this goal is still far from being fulfilled (UDAPE, 2015b). There are also significant differences among regions of the country, with some of them showing impressive development, while others have scarcely shown progress. This dissimilarity indicates that the improvement in some of the most important indicators has been heterogeneous.

What is role of government in the economic and social indicators' improvement in the last 20 years? The answer to this question is complex, as it entails not only disentangling the role of central government as responsible for public policy (e.g. by framing the macroeconomic policy), but also the role of local/regional governments in the well-being of their constituencies. As mentioned, progress in the access to public services has been uneven considering a rural/urban or east/west distinction. This has to do with the level of decentralization, or up to what point the local governments can act to ensure economic and social progress of the citizens living in a given territory within a country.

This paper addresses the role of increased decentralization on the progress of key social indicators, such as child nutrition, safe water and sanitation. As a related question, it would be worth to investigate up to what extent this intervention has been pro-poor, that is, if has benefited more to the poor than to the non-poor.

The evidence on the impact of decentralization on poverty and poverty-related outcomes is broad, but not conclusive (see, among others, Martinez-Vazquez & Timofeev, 2009; Birner & von Braun, 2015 and Ahmad &

Brosio, 2009). In addition, many authors have tried to analyze the relationship between decentralization and poverty reduction or intermediate outcomes (e.g. Ahlin & Mörk, 2008a; Galiani, Gertler, & Schargrodsky, 2008; Soto, Farfan, & Lorant, 2012) but no study, to the best of my knowledge, has evaluated the impact of decentralization on nutrition improvement. In this sense, this paper aims to fill that gap in the literature.

The paper is divided into the following parts: Section 2 formulates the conceptual framework, Section 3 explores the existing empirical evidence of the impact of decentralization on poverty and poverty-related outcomes and Section 4 reviews the Bolivian decentralization process and the latest relevant developments associated with this reform. Sections 5 and 6 describe the data and present the empirical strategy. Sections 7 presents the results of the estimation and propose various robustness checks. Finally, Section 8 concludes.

2. Conceptual framework

In a broad sense, the process of decentralization entails the transfer of the tasks and duties[1] from the central government to a lower-level (regional or local) government tier. In theory, by having a better local knowledge about their constituencies' necessities, the local authorities could offer local public goods and services more efficiently than the central government would do. This preconception made decentralization a popular reform. Dillinger (1994) reports that already in the 90s decade over 80% of developing and transition countries were delegating responsibilities to local governments.

The "transfer of tasks" concept is extremely simplified. In fact, the decentralization process is a complex undertaking that involves various dimensions. There is a convention in the literature (see Birner & von Braun, 2015 and Schneider, 2003, among others) to distinguish among the following dimensions of decentralization. The first is the *political dimension*, which implies the assignment of certain governance processes (e.g. hold elections to choose local authorities). Meanwhile, the *administrative dimension* entails the transference of capabilities (mainly institutional capacity through human resources) to the local tiers of government. Finally, the *fiscal dimension* involves the assignment of economic resources from the central administration to the local governments, so they can afford the provision of local public goods.

Thus, decentralization could be seen as a policy innovation to improve the role of the central administration by introducing intergovernmental competition within smaller regional units. In addition, it establishes checks and balances amongst lower levels of government and ensures civil society participation in the policy decision-making process. Advocates of decentralization argue that is a way to bring near the government to the people, and in this sense improves the demand and supply of public goods, which in theory would be more efficient at the local level (Bardhan & Mookherjee, 1998).

Birner and von Braun (2015) point that decentralization should not be an achievement itself, but it could help to pursue desirable goals due to supply and demand factors. By supply factors, the authors refer to the ability

[1] The functions transferred ranges from the administration of local schools and hospitals, to the provision of water services and waste management.

of the decentralized level of government to provide the public goods in a more efficient way. Demand factors imply the power of constituencies to ask for public goods and oversee the behavior of local governments.

Thus, decentralization would involve a more efficient provision of local public goods by governments, monitored by the regional constituencies. Then, an increase in the wellbeing of the people living in provinces or towns would be expected, due to the proximity of the government and the use of information about local preferences. Figure 1 helps to have a better notion of the potential impacts of decentralization, by differencing them among short, medium and long-term effects.

Insert Figure 1 here

Although decentralization entails shifting the choice and decisions over public investments and interventions to the local level, it does not automatically guarantee an improvement in the provision of local public goods. For example, Mansuri and Rao (2012) claim that more participation by local constituencies would even harm welfare, beyond certain threshold. For example, if the voice *and* power to make decisions is given to local organizations, they might miss the optimal use of the resources. This is the case if local constituencies focus only in infrastructure (buildings, sidewalks, etc.), while another pro-poor investments are (socially) more profitable (e.g. agricultural extension services, access to credit and business opportunities, etc.). This scenario could be particularly harmful if it further involves corruption of the local authorities, added to the lack of capacity of the citizens in controlling and overseeing the prioritized projects.

Finally, although local provision could enhance the access to local public goods, decentralization does not imply that it will benefit to the poorest and marginalized. This can be relevant in the presence of a lack of institutional capacity at the local level, and if vulnerable local communities don't have the ability or the incentives to demand more and better services from their local government. In this sense, Birner and von Braun (2015) mention that decentralization could also pose risks for the poorest by "cementing" the poor outcomes by inefficient local authorities and nonexistent checks and balances.

3. Impact of decentralization: review of the literature

The evidence on the impact of decentralization on welfare is broad in terms of methodologies, outcomes, and indicators. On assessing decentralization, a common proxy for decentralization relies on its *fiscal* dimension. Fiscal decentralization reflect to which extent the central administration transfers economic resources to the local government to finance their operations and provide public goods (Panizza, 1999; Canavire-Bacarreza & Martinez-Vazquez, 2012; Martinez-Vazquez & Timofeev, 2009). In addition, decentralization could be approximated considering their other dimensions (i.e., political and administrative). *Political* decentralization proxy could be whether elections are held locally, or the proportion of people that takes part on them (Mookherjee, 2015). Meanwhile, *administrative* decentralization might be measured using the number of public employees working at the local level, normalized by the total working force or population (Ivanyna & Shah, 2014).

In terms of the outcomes, studies focus on education, health, and services offered at the local level, like sanitation, water, and waste management. Ahlin and Mörk (2008b) study decentralization's impact on education indicators in Sweden. The authors measure decentralization taking into account the fiscal and political dimensions and find that school spending and teacher density are more equally distributed after decentralization. Meanwhile, Galiani et al. (2008) find that administrative decentralization has a positive effect on education quality in Argentina, but it benefited more to the non-poor.

Regarding healthcare, Montero-Granados, Dios Jimenez, and Martin (2007) use the fiscal and administrative dimensions of decentralization, and concludes that it does not improve or even affect negatively the convergence rate of healthcare. In Colombia leads, Soto et al. (2012) find that fiscal and administrative decentralization lead to a decrease in infant mortality rates. However, this decrease is greater in non-poor municipalities, in comparison with poor municipalities. Moreover, using a cross-country panel but similar dependent variable, Jiménez-Rubio (2011) and Robalino, Picazo, and Voetberg (2001) finds a positive and considerable effect of (fiscal) decentralization on infant mortality. Considering a broader impact of decentralization, Gemmell, Kneller, and Sanz (2013) use a cross-country panel dataset (OECD countries) and finds that fiscal decentralization does not have a definite impact on economic growth. By the other hand, Baskaran and Feld (2013) finds that fiscal decentralization has a negative but non-significant effect on economic growth.

The revised empirical evidence shows that the impact of decentralization on outcomes like economic growth or child mortality is far from being conclusive. While the impact of decentralization has focused on traditional locally-delivered services such as education, health, and waste collection, to the best of my knowledge no study has addressed the relationship between decentralization and nutrition improvement as a key pro-poor intermediate outcome. Adequate nutrition, especially at early ages, is important because it helps to reduce child and infant mortality. Moreover, investments in nutrition boosts future productivity, by improving cognitive capacities and reducing the probability of repeating grades at the school (Alderman, Hoogeveen, & Rossi, 2009). In this sense, investing in nutrition becomes one of the most profitable social investments that public policy could achieve.

4. Decentralization in Bolivia

The Bolivian decentralization experience was in line with the global tendency to decentralize the power of central governments. Before 1994, competencies to provide public goods fell into the exclusive responsibility of the central government. On the other hand, budget allocation was a discretional attribute of the national administration, without any clear criteria or guideline. Regarding the political perspective, few of the municipalities held elections and the absenteeism rates were considerable high. Human resources assigned to the municipalities were low, considering that the functions of this level of government were neither clearly defined nor held accountable. By all these characteristics, Bolivia was considered one of the most centralized countries in the region (Faguet, 2004).

In 1994, the Bolivian government conducted a major reform aiming to restore power to lower levels of the territory (municipalities), through the transfer of income and expenditure responsibilities. The reform

provided additional attributions and functions to the municipalities, in sectors like health and education. All the infrastructure of these sectors (e.g. schools and municipal hospitals) was transferred to the municipal governments for their administration. In the second place, the reform established that the elected municipal authorities should supervise the performance of education and health workers. In addition, the responsibility of building new local infrastructure (e.g. in sectors as sanitation, water, and domestic roads) was transferred to each municipality.

Some indicators of the reform are summarized in Table 1, which shows the impact in the delegation of resources and responsibilities to the municipal governments in Bolivia. As can be seen, the shift from the centralized state model to a decentralized one has been impressive in terms of distributed revenues, local investment, and transfer of political power.

Insert Table 1 here

Previous to the reform, not all the municipalities[2] were legally recognized as administrative units. In this sense, few of them were entitled to receive funding from the central government, or to hold elections of local authorities. In this sense, the responsibility to provide local public goods was entirely of the central government. This caused the abandonment (in terms of access and delivery to basic services such as water and sanitation) of the poorest and remote areas in the country, and a completely lack of accountability. Being subject of central government transfers allowed to the municipal governments to invest in local public goods and to their authorities to be monitored by local constituencies and evaluated through the elections.

From 1994 onwards, municipal investment as a percentage of total public investment fluctuated between 14% and 36% (Figure 2). The behavior of public investment was largely influenced by the economic cycle, and the cycle at the same driven by the external context (e.g., the Asian crisis from 1997-1999, and the advanced economies slowdown in the beginning of the 2000s decade). From the mid-2000s, municipal public investment recovered in great extent, reaching a peak of 36% of total investment in 2008. Again, due to harsh economic conditions imposed by the global recession of late-2000s, municipal investment adjusted accordingly reaching a low record of 22% of total investment in 2011.

Insert Figure 2 here

Budgeting process in municipalities entail the elaboration of a participative plan (POA, for its acronym in Spanish), which details all the prioritized investments that the municipal authorities are requested to make during the year. In this sense, all the local investment is financed using municipal government revenues. The main sources of those are: i) own revenues, mainly taxes to real estate and vehicles; and ii) transfers from the central government, distributed according to the number of inhabitants of the municipalities. Transfers from the central government need to be invested at least in 80%, while the remaining 20% can be used for recurrent expenditures (e.g. salaries of local authorities, office supplies, etc.). Distribution of revenues for municipal governments is shown in Table 2.

[2] Municipalities are administrative unites smaller than provinces.

Insert Table 2 here

Considering the figures from Table 2, revenues of municipal governments increased noticeably in the 2000s decade. While this has to do with the favorable economic situation in Bolivia especially in the second half of 2000s decade (and thus an increase in the tax revenue that has to be distributed to the municipal governments), most of this increase is due to the extraordinary revenues earned by the central government coming from natural gas exports. Indeed, the increase in the international prices of fuels from a low USD 25 per barrel in 2001 to their maximum average in 2008 (USD 99.25) implied an almost fourfold growth in government revenues, ranging from Bs 16 thousand millions in 2001 to 87 thousand millions in 2012 (Figure 3).

Insert Figure 3 here

While dependence from central government transfers has reduced from 1996 to 2001, this tendency reversed in 2012, in which 74% of municipal revenues came from the center. The situation of dependence from the central government is even more dramatic for non-capital municipalities (i.e., small municipalities far from the most populated cities in the country), where the dependence rate have increased from 60% (2001) to 80% (2012).

There have been various attempts to evaluate the decentralization policy, especially in its fiscal dimension (i.e., the increase of fiscal transfers from the central government to municipal governments). For example, Gray Molina (2004) explores the impact of decentralization reform in poverty reduction between 1992 and 2001 using census data[3]. The author uses 3 types of explanatory variables for poverty reduction: i) social investments (main variable), ii) political variables[4], and iii) demographic controls. The study finds that social investments are positively and significantly related to poverty reduction, after controlling for demographic variables. Gray Molina (2004) also finds that political fragmentation (measured as mayor turnover for each municipality) affects negatively to poverty reduction, although the impact of social investment remains positive and statistically significant. A drawback of the study is that it does not address the potential problem of endogeneity between poverty reduction and decentralization. Andersen and Jemio (2016) shows that the system of intergovernmental transfers implied by the decentralization design has a positive and statistically significant impact on poverty reduction, as measured by the Unmet Basic Needs (UBN) criteria.

Ayo (2010) try to evaluate if decentralization reform in Bolivia benefited the most vulnerable groups in Bolivia. He concludes that the poor have benefited from decentralization, but less than the non-poor. Nonetheless, this conclusion comes from qualitative evidence only (interviews and surveys to local authorities), and in this way could not be assessed as rigorous in order to find out the actual impact of decentralization on poverty alleviation.

[3] Census data does not include data on consumption, but instead the author uses this information to build UBN (unsatisfied basic needs) indices, as a poverty proxy.

[4] Measured through the number of grassroots organizations and number of mayors in 1994-2000.

Faguet (2004) shows that decentralization reform in Bolivia allowed matching the people preferences' in municipalities with the public investment at that level after the reform. In other words, municipalities that fall short in sectors as education and health experienced greater public investment in the sectors they required most. In that sense, this evidence is a positive test of the matching local preferences with the investment that decentralization supposedly brings. However, Barja Daza, Villarroel Böhrt, and Zavaleta Castellón (2013) arrive at a different conclusion, stating that municipal governments are aligned to central government interests and policies, at the expense of local necessities. The authors argue that this result is derived from the lack of own resources by the municipal governments because most of the revenues that a municipal government possesses are provided by the central government[5].

The most closely related study to this is Inchauste (2009), which explores the relationship between decentralization and intermediate outcomes (education, health, and infrastructure indicators) in Bolivia between years 2002 and 2005. The author finds no strong evidence that the increase in municipal expenditures leads to an improvement of social indicators. However, the study relies on household surveys to construct indicators at the municipal level, without taking into consideration that the sampling process of the Bolivian household surveys impede to draw conclusions over social indicators to this level of disaggregation. In fact, only an urban/rural distinction is statistically representative using the household surveys.

5. Data

Table 3 shows the summary statistics of the main variables, for the years 2001 and 2012. This study relies on household surveys and census data collected from the Bolivian National Institute of Statistics; and on fiscal data coming from Ministry of Finance's administrative records. Using these sources, a panel of 314 local governments (municipalities) is built, for the indicated years. The reason for the time frame (2001, 2012) relies on the fact that those are census years, which are needed to calculate nourishment indicators at the municipal level. In that sense, variables as household size, population, illiteracy rate and access to safe water and sanitation come from census data.

Insert Table 3 here

Nutrition information at the municipal levels is estimated through a combination of two sources: census information, available for years 2001 and 2012; and Demographic and Health Surveys (DHS) for 2003 and 2012. DHS are a rich source of information on health and nutrition, which in combination with comprehensive census data allow the estimation of nutrition and health status indicators at local scale (for applications see Zhao & Lanjouw, 2002; Ebener et al., 2015; and Fujii, 2005).

Fiscal indicators regarding municipal revenues and expenditures come from administrative data. The dataset includes information about municipal revenues (own tax revenues and transfers from the central government)

[5] With the exception of capitals of departments (regions), and bigger cities, which are capable to collect enough local taxes (property tax) to fund their operations.

collected from the Ministry of Finance. Geographical information (area, altitude, slope and distance to the sea) comes from data compiled in UDAPE (2015a).

Measuring decentralization

It is important to delve into the rationale for the choice of the decentralization measures. First, while is difficult to find a single variable that embraces the multidimensional nature of decentralization (Martinez-Vazquez & Timofeev, 2009, p. 85), it would be useful to split the concept into their fiscal, administrative and political dimensions. In this research, the focus relies on the *fiscal* perspective of decentralization, but other dimensions of the decentralization process will be considered, as mitigating or increasing the impact via interaction effects.

In the available literature, decentralization has often been measured as the percentage of revenues or expenditure of municipal government out of the total revenues (expenditure) of the whole public sector (Panizza, 1999, p. 108). Arzaghi and Henderson (2005) measure fiscal *centralization* by using the ratio of central government in total government consumption expenditures, so this implies that *decentralization* should be measured as the ratio of local government expenditure (revenue) in total government expenditure (revenue). Martinez-Vazquez and Timofeev (2009) adopts a similar view, by using the share of revenue or expenditures that are transferred to local governments. Finally, Soto et al. (2012) affirm that the subnational share of government revenue (or expenditure) is the most commonly used measure of fiscal decentralization. Accordingly, I use the share of transfers that each municipality receives, over the total revenue of the central government, as one of the proxies for the degree of fiscal decentralization.

The reason for choosing this indicator relies on the fact that a significant increase in the transfer share would enable to the municipal government to make more investments and provide better and/or greater access to public goods, which in turn implies an improvement in nutritional status of children. As an alternative but related measure of fiscal decentralization, I use the municipal expenditure share (of total government expenditure), under the same logic for the increased revenues. Increased expenditure could allow the municipal authorities to increase the access to public goods, improving their citizen's welfare.

While the expenditure and revenue share measures would be relevant for a broad measure of welfare (such as nourishment), in the case of access to safe water and sanitation a "more focused" indicator of increased investment/expenditure is used. In this sense, in the models explaining the access to safe water and sanitation, the expenditure in sanitation expressed as a share of total expenditure is utilized as the main decentralization variable.

Regarding the other dimensions of decentralization, administrative decentralization is proxied using the proportion of public sector workers in the total workforce, per municipality. Thus, municipalities with a greater number of public servants could in theory be more effective providing local public goods. In addition, political decentralization is evaluated using the elections' participation in each municipality (voters over population entitled to vote in local elections). In addition, two measures are used to account for potential synergies of fiscal decentralization and political variables: the winning share of the local authorities, and a dummy variable

that indicates if the local government is aligned with the central government (same political party). The winning share would be important as it could indicate the degree of consensus in each municipality (i.e., a greater winning share would indicate greater political support and accountability, as suggested by Loayza, Rigolini, & Calvo-González, 2014), while the dummy for political alignment could reflect coordination between central and local governments. Table 4 details the variables that are used for the estimations.

Insert Table 4 here

6. Empirical strategy

In order to link decentralization to the described outcomes (nutrition, water, and sanitation), the following equation is estimated using OLS:

$$y_{mt} = \alpha_m + \delta_0 \cdot d2012_t + \phi \cdot X_{mt} + \boldsymbol{\beta} \cdot \boldsymbol{Z_{mt}} + \varepsilon_{mt} \qquad (1)$$

Where y_{mt} are the outcomes of interest (nutrition and access to sanitation and safe water) in municipality *m* and year *t*, α_m are municipality fixed effects, $d2012_t$ is a dummy variable that takes the value of one for the year 2012, X_{mt} is the main variable of interest (fiscal decentralization measure) in each municipality *m* in years 2001 and 2012 and $\mathbf{Z_{mt}}$ is a matrix of covariates. Based on Inchauste (2009), to account for the covariates I use the average family size, a proxy for the share of indigenous population and illiteracy rate. Additionally, regional GDP and population are included respectively to account for general economic performance at the local level[6], and because population is the main determinant of fiscal transfers. Robust standard errors clustered at the province level are used in the estimations, to control for potential outcome correlation within provinces (see footnote 5).

In addition to the estimation of (1), and in order to evaluate the potential interaction between different types of decentralization, I estimate the following equation:

$$y_{mt} = \alpha_m + \delta_0 \cdot d2012_t + \phi \cdot x_{mt} + \gamma \cdot x_{mt} \cdot g_{mt} + \zeta \cdot g_{mt} + \boldsymbol{\beta} \cdot \boldsymbol{Z_{mt}} + \varepsilon_{mt} \qquad (2)$$

In which g_{mt} are the political and administrative variables interacting with fiscal decentralization measures (based on the transfers from the central government and total and focused municipal expenditures). All the other variables remain as explained in the estimation of equation (1).

7. Results

7.1. Water and sanitation

Table 5 shows the results from the estimation of equation 1, with access to safe water as the dependent variable and the focused expenditure as the fiscal decentralization proxy. Column 1 show the base model (1)

[6] Regional GDP varies by department, which encompasses a number of municipalities. In Bolivia, there are 9 departments with an average of 35 municipalities per department.

without interaction of the fiscal decentralization measure with the administrative and political variables, while columns 2 to 5 show the estimation of the model with the interactions.

Insert Table 5 here

From the results, the effect of the expenditure in sanitation on access to safe water is statistically non-significant in all the estimated models. The lack of significant results suggests that despite the increase in the revenues to the municipalities in the period 2001–2012, investment in sanitation seems to have no effect in the access to safe water, after taking into account other potentially confounding factors. The lack of infrastructure and the high levels of investment to improve them might have made an additional safe water or toilet connection non-feasible or unprofitable, especially in less populated and remote areas. In fact, this is confirmed by the sign and significance of the coefficient on the rural proportion of households.

Similarly, municipalities with a higher rate of illiteracy have less access to safe water. This result is expected, given that illiteracy is related to multidimensional poverty and the absence of future opportunities. The coefficient on population is negatively correlated to the access to safe water, suggesting congestion in the use of this service/resource. Indeed, as the population of municipalities goes larger, there is competition over the use of limited goods and services, one of these being the access to water. This issue is of growing importance, given the increased processes of urbanization especially in areas near populous cities (Torres, 2008).

An interesting result emerges with the estimation of the model with interaction terms between fiscal and political/administrative decentralization. The interaction coefficient in column 5 implies that municipalities politically aligned with the central government experienced an increase in access to safe water, given the increase of the expenditure in water and sanitation. However, this result appears to be driven by major municipalities in the sample, as the estimation of the model using a sample excluding main cities (capitals of department and El Alto city[7]) results in a non-significant coefficient (although still positive).

Table 6 shows the impact of an increase in decentralization (sanitation expenditure) on the availability of toilet facilities. As in the case for access to safe water, the coefficients corresponding to the sanitation expenditure is nonsignificant for all the specifications (equation 1 and 2). Some characteristics are predictably associated with the access to proper sanitation. For example, municipalities with a higher degree of illiteracy tend to have less access to proper sanitation (negative sign in columns 2, 4 and 5). This is not surprising, provided that the lack of formal education is one of the main characteristics of marginalization (von Braun & Gatzweiler, 2014). In addition, regional GDP is positively associated with access to sanitation, reflecting that improving economic conditions could have helped to increase service delivery in the municipalities.

Insert Table 6 here

[7] El Alto city is a satellite city next to La Paz (seat of government) and one of the most populous cities in the country, after Santa Cruz (with population data for 2012).

7.2. Nutrition indicators

Table 7 shows the results of the regression model considering the proportion of underweight children as the dependent variable, with transfer and expenditure shares as fiscal decentralization indicators. The results also include the model with interaction terms. A negative sign of the decentralization variables is expected, meaning a reduction in the proportion of underweight children as a consequence of increased fiscal decentralization.

Insert Table 7 here

The transfers share seem to have a consistent effect on the average proportion of underweight children in the period 2001—2012, on almost all the specifications. Column 1 implies that an increase in the transfer share of 1% would decrease the proportion of underweight children in -0.0003. While this effect seems to be almost negligible, the increase in the transfer share during the 2000s decade needs to be taken into account (which was 93% [median]). Considering this, the implied decrease in the proportion of underweight children would be approximately 3 percentage points (93 x 0.0003).

Table 8 shows the results of the model using the expenditure side of fiscal decentralization. The effect of the fiscal decentralization proxy is noticeable smaller and less uniform amongst specifications. Indeed, the model without decentralization interactions (column 1) implies that, given a median 73% increase in the expenditure share from year 2001 to 2012, the decrease in the proportion of underweight children was approximately one percentage point. The models including the interaction terms (columns 2-5) shows that either the fiscal decentralization proxy has no statistically significant effect, or that the impact is very small (column 5 imply a decrease of 1 percentage point in the proportion of underweight children).

Insert Table 8 here

Regarding the proportion of stunted children as the dependent variable, Table 9 shows the results from the estimation using the transfer share as the fiscal decentralization proxy. The results also confirm that increased fiscal decentralization is associated with a reduction in the proportion of stunted children. The model in column 1 implies that the median increase in the transfer share of 93% decreased the proportion of stunted children in 5 percentage points. In turn, column 3 results implies that the effect of a 1% increase in the transfer share is associated with a reduction of 0.00102 in the proportion of stunted children, but the effect is reinforced when the share of public officials also increases. Figure 4 depicts the marginal effect of an increase in the transfer share given different levels of the share of public officials by municipality. Clearly, when there is high share of public officials (dotted line), the fiscal decentralization is more "effective" (i.e., the slope of the line is more pronounced). Conversely, if the share of public officials is low (continuous line), the increase in fiscal decentralization is almost flat.

Insert Table 9 here

Insert Figure 4 here

On the other hand, the interaction between political support and fiscal decentralization (column 4) is negative and statistically significant, *reinforcing* the effect of increased fiscal decentralization in the reduction of the proportion of stunted children. Figure 5 shows the marginal effect of increased fiscal decentralization conditional on different levels of political support (implied by the different slopes of the straight lines). In this case, municipalities in which there has been higher electoral support prove to be more effective in the reduction of stunted children provided an increase in fiscal decentralization[8]. Both the reinforcing effect of the share of public officials and of the political support on fiscal decentralization are robust to the exclusion of major cities (capitals of department and El Alto). In this sense, a major elected with high political support could be more pressed to improve their constituencies' welfare.

Insert Figure 5 here

Illiteracy is again one of the most important factors that are negatively associated with the probability of being stunted. In addition, household size appears to be a factor contributing to the probability of being stunted. This association is expected provided that bigger families perhaps have more children and so they find difficult to fulfill their nutritional requirements. Indeed, household size is a factor commonly associated with poverty (Abebaw & Admassie, 2014).

Table 10 shows in turn the model for stunting with expenditure share as the decentralization proxy. The effect of increased fiscal decentralization by the expenditure side seems to be weaker than from the revenue side. In effect, the model without interactions (column 1) shows no impact of increased fiscal decentralization on the proportion of stunted children. However, turning to the interaction between fiscal and other dimensions of decentralization (administrative and political), the effect seem to be consistent with the marginal effects from the transfer share model: both the share of public servants and political support seem to reinforce the effect of increased fiscal decentralization on the reduction of stunting. As with the model using the transfer share, household size and illiteracy are positively correlated with the proportion of stunted children.

Insert Table 10 here

[8] The reinforcing effect of political support and fiscal decentralization could be explained because the local authorities (majors) are elected by simple majority. Hence, a major could even be elected by little more than 10% (the minimum winning share in the sample was roughly 11%).

7.3. Heterogeneous effects by poverty status

Appropriate nutritional status and permanent access to safe water and sanitation are crucial for everybody, but even more for the poorest. Inadequate nutritional status for children imply the risk to fall in a poverty vicious circle (by limiting the development of cognitive and intellectual abilities of children and young women). For that reason, it is of special interest to take into account the distinction poor/non-poor when assessing the impact of fiscal decentralization on water, sanitation and nourishment status.

Accordingly, a model based on the basic specification (equation 1) is estimated, with initial poverty rates as the potential source of heterogeneous effects of increased fiscal decentralization. Poverty rates for 2001 were calculated by INE (2003) using the small area methodology and considering a monetary dimension of poverty. Then, the estimated model is:

$$y_{mt} = \alpha_m + \delta_0 \cdot d2012_t + \phi_1 \cdot X_{mt} + \phi_2 \cdot X_{mt} \cdot poor_{mt} + \boldsymbol{\beta} \cdot \boldsymbol{Z_{mt}} + \varepsilon_{mt} \qquad (3)$$

Where X_{mt} is the decentralization proxy according to y_{mt} (that is, expenditure share in water in sanitation for safe water and sanitation outcomes, and overall transfer and expenditure shares in the case of nourishment indicators). The set of covariates remains unchanged. To classify a municipality as "poor", a threshold of 0.5 is used, so a municipality with an average poverty headcount of 50% or more is assigned the poor status (*poor*=1)[9].

The results of the estimation for model (3) are shown in Table 11, considering the full specification (that is, municipal and year fixed-effects) using the four outcomes (water, sanitation, underweight and stunting). The coefficient of interest is the interaction of the *poor* dummy and the measures for fiscal decentralization. This coefficient is statistically significant for the model explaining the stunting status (using both decentralization measures, columns 4 and 6), reflecting that the progress has been lower for the *poorest* municipalities.

To clarify the marginal effect, Figure 6 presents the predicted value for the proportion of stunted children, differentiating the effect by poverty status. The figure shows that, while increased decentralization decrease the probability of being stunted overall (both poor and non-poor marginal effects have negative slopes), the *non-poor* progressed more than *poor*, i.e., the slope of the *non-poor* is steeper in comparison with the *poor* group, considering both the transfer and expenditure shares. The magnitude of the estimated coefficients implies that, given an increase of 50% in the transfer share, the decrease in the proportion of stunted children would be 1 percentage point for poor municipalities, while for non-poor municipalities this decrease would have be 4 percentage points. In the case of expenditure share, given an increase in the share of 50%, the decrease in the proportion of stunted children would is 0.5 percentage points, while for non-poor municipalities the decrease is 3 percentage points.

Insert Table 11 here

[9] The model does not include the *poor* dummy because only information regarding poverty status for the base year (2001) is available.

The result of "non pro-poorness" of increased fiscal decentralization is not depending on an arbitrary choice for the threshold of 0.5. As a robustness check, equation 3 was estimated using different thresholds for the poverty headcount (0.6 and 0.7). The signs of the coefficients of the interaction terms using different thresholds remain positive, irrespective of the used threshold, meaning that the pick of the threshold is not influencing the result of non-pro-poor characteristic of the increased transfers.

Insert Figure 6 here

In order to further contrast this result, an alternative (multidimensional) measure of poverty is used, concretely the Unsatisfied Basic Needs (UBN) index. I divided the UBN index into three quantiles and assign the lowest category the *poor* status (=1), and zero otherwise. Table 12 shows the estimated marginal effects of the increase in transfers using both indicators of poverty (monetary poverty and UBN poverty) and fiscal decentralization (transfer share and expenditures share). While the results using the UBN criteria and the transfer share are statistically non-significant, the interaction of the expenditure share and the *poor* dummy is positive, confirming the previous result and strengthening the fact that increased fiscal decentralization has not been pro-poor.

Insert Table 12 here

7.4 Robustness checks

7.4.1 Different samples

To confirm that the results from estimation of equation 1 are not driven by sample selection, a number of robustness checks were developed, excluding certain municipalities by some type of criteria. As a first exercise, those municipalities which are capitals of a department plus El Alto city were excluded. These municipalities are mostly urbanized and could have had better possibilities to increase access to basic services, as water and sanitation, and better health conditions (e.g., better hospitals in the cities) to avoid underweight or stunting. Table 13 present the results of model in equation 1 using the sample excluding capitals of department and El Alto city.

Insert Table 13 here

The results from the estimation of the models using the sample without capital cities are qualitatively the same as the full-sample model: increased fiscal decentralization has not increased the access of municipalities to safe water nor sanitation. Similarly, increased flow of resources to municipalities reduces the probability of being underweight and stunted, and although the effect is statistically significant, their economic significance is limited. The range of the estimated impact is -3 percentage points in the proportion of underweight children and almost -6 percentage points in the proportion of stunted children (using a median increase of 93% in the transfer share).

On the other hand, Table 16 show the results of estimating equation 1 using a sample consisting of the coldest municipalities (constructed using average temperature information). The sample was divided according to

their average temperature in three quantiles and assigned the value of one to the lowest quantile (cold=1). The reasoning behind this choice is that coldest municipalities are in general high-altitude plateaus, in which agriculture is very difficult to develop, and are in general poorer and marginalized areas. The exclusion of warmer municipalities would assure that the effects of increased decentralization are not driven by more favorable weather conditions in these municipalities. As Table 14 shows, the results qualitatively similar to those estimated for the full sample, even considering the drastic reduction in the sample size. In this sense, the results of the estimations do not appear to be driven by potential outliers.

Insert Table 14 here

Finally, Table 15 shows the results of estimation with a sample that excludes those municipalities with oil and natural gas resources. By excluding those municipalities, the effect of wealthier towns that could influence the positive results regarding service delivery are ruled out. However, excluding these municipalities does not affect the results of the estimations, and a (slight) reduction in the proportion of underweight and stunted children is still observed.

Insert Table 15 here

7.4.2 Instrumented regression

The relationship between decentralization and the access to sanitation, safe water and nutrition could be endogenous for different reasons. Including municipality and year fixed-effects help to alleviate the potential non-observable heterogeneity. In addition, the relationship between fiscal transfers and service delivery could be subject to reverse-causality. For example, a town with better living conditions would attract more people, increasing the transfers from the central government. To overcome the potential reverse causality bias, a 2SLS estimation method is used, based on a composite instrument variable.

Some authors suggest the use of geographic characteristics to instrument decentralization. It is argued that geographically diverse countries are more prone to decentralize because this feature is correlated with heterogeneous preferences (Canavire-Bacarreza & Martinez-Vazquez, 2012). However, while geographical variables could be claimed as truly exogenous, panel data requires an instrument with variation over units and time. Then, a composite instrument is used, comprising the interaction of the geographical variables interacted with other exogenous variable that exhibits variation over time[10].

The instrumental variable is composed of certain geographic characteristics of municipalities (area, altitude, distance to the sea and slope) multiplied by the international price of the oil (WTI). The international price of oil is used because it is closely connected to the finance of municipal governments (see Figure 3), considering the design of the intergovernmental system of transfers and the country exporting profile. Indeed, Bolivia as a country rich in natural gas, have increased greatly its fiscal revenues in the middle of the 2000s decade, because of two main factors:

[10] For applications, see Canavire-Bacarreza and Martinez-Vazquez (2012) and Esarey (2015).

a) *External factor:* the value of natural gas exports is linked to the international price of oil (WTI). Accordingly, an increase in WTI is positively associated with the revenues for the central government (ρ=0.91), and in turn, the central government distributes this extra revenue to the municipalities through revenue sharing arrangements as mandated by law, considering the number of inhabitants in each municipality.

b) *Internal factor:* in 2005, the government changed the tax scheme for hydrocarbons, requiring that the firms exploiting this natural resource now pay 50% of the value of hydrocarbons, instead of 18% that was the proportion set before this change in the law. This increase in the central government revenue implied a further increase in the transfers from the center to the municipal governments.

In that sense, it is possible to use the international price of the oil as an exogenous but closely related factor explaining the increase in the transfers from the center to the regional governments and, at the same time, seemingly unrelated to the service delivery and nourishment outcomes.

The exclusion restriction implies that WTI increase will affect the proposed outcomes only through the transfer and expenditure share, and not directly or indirectly through an omitted variable. The exclusion restriction does not hold if a boom in the natural gas exports benefit directly to the population, improving their situation in terms of access to water, sanitation, nutrition, and general living conditions. However, because the oil and natural gas sector is capital-intensive, it does not imply a much greater demand for jobs. In this sense, the direct benefit of an oil-based boom would be small[11].

The geophysical characteristics of each municipality to interact with the WTI price are: area, altitude, distance to the sea and slope. Considering the distribution of the four composite instruments, Table 16 shows the 2SLS results using $\log(Area \cdot WTI)$ as instrument[12].

Insert Table 16 here

The results from the first stage show that the composite instrument is adequate (F-statistic more than 10) only when nourishment indicators are used as dependent variables (Columns 3 and 4). However, the 2SLS results yield statistically non-significant estimates for all decentralization proxies. In this sense, a Hausman-Wu test was performed, in order to compare the estimates from OLS model and 2SLS under the null hypothesis that OLS would yield consistent estimates. In all cases (regarding the dependent variables), the results of the test fail to reject the null hypothesis to the 10% confidence level. Thus, endogeneity caused by reverse causality bias would not impose a serious challenge to the previous OLS-FE estimates.

Indeed, as transfers from the central government are driven by population, a migratory movement would need to be massive in order to change the transfer patterns. According to 2012 census data, the internal migratory movements have been modest, with only an average of 7% of people that lived in other part of the country

[11] The proportion of workers in the oil sector with respect to the total number of workers is very low (2% in 2001 and 3% in 2012), according to Census data.
[12] Area is measured in squared kilometers.

before. In that sense, it is unlikely that internal migratory movements influenced in greater extent the transfers from the central government to the local governments.

8. Conclusions

Increase in fiscal decentralization in Bolivia during the 2000s decade seems to have improved citizen's welfare only limitedly. Indeed, access to water or to sanitation at the municipal level did not see improvement, while the increased fiscal decentralization apparently helped to reduce the proportion of underweight and stunted less than 5 years old children at the municipal level. However, the magnitude of this effect was small in view of the huge increases in municipal revenues and expenditures in the ten-year span of the data.

The interaction effect between fiscal decentralization and the political and administrative dimensions of the decentralization process seems to be relevant in this setting. Specifically, a greater share of public servants in the municipal governments seems to reinforce the effect of fiscal decentralization on the reduction of stunted children. On the other hand, political support also appears as a key factor in order to reinforce the effect of increased transfers from the central government to the municipalities. Indeed, as the winning share was greater in local elections, the increase in fiscal decentralization appeared to be more effective in reducing the proportion of stunted children at the municipal level. These results confirm that the different dimensions of the decentralization process are dependent among them, so a reform entailing only one component could fall short in terms of the delivery of local public goods and impact on citizens' welfare.

Regarding heterogeneous effects distinguishing by poverty status, results show that increased fiscal decentralization has contributed to reduce the proportion of underweight and stunted children, but interestingly the effect seems to be stronger in non-poor municipalities, as compared to the poor ones. This result of "non-pro-poorness" proves to be robust to the threshold choice for considering a municipality as poor, as well as to the poverty indicator (e.g. UBN versus monetary poverty). This result shows that the potential benefits of decentralization sometimes are better exploited by the non-poor, given their favorable initial conditions in comparison with the poor ones (see among others Galiani et al., 2008 and Soto et al., 2012).

Overall, the results suggest that despite the remarkable change of responsibilities *and* the increase in economic resources transferred to local governments in Bolivia during the 2000s decade, the impact of fiscal decentralization has been limited. Future research should focus on developing further measures that capture in a more accurate dimension the change in the responsibilities of local or regional governments in specific sectors as water and sanitation, but in a broad sense as well. In addition, variables capturing the administrative and political dimensions of decentralization would be worth to explore. Such measures would give a better sense of the effectiveness of decentralization's impact on welfare and service delivery.

9. References

Abebaw, D., & Admassie, A. (2014). Correlates of Extreme Poverty in Rural Ethiopia. In J. von Braun & F. W. Gatzweiler (Eds.), *Marginality* (pp. 117–131). Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-007-7061-4_8

Ahlin, Å., & Mörk, E. (2008a). Effects of decentralization on school resources. *Economics of Education Review*, *27*(3), 276–284.

Ahlin, Å., & Mörk, E. (2008b). Effects of decentralization on school resources. *Economics of Education Review*, *27*(3), 276–284. https://doi.org/10.1016/j.econedurev.2007.01.002

Ahmad, E., & Brosio, G. (Eds.). (2009). *Studies in fiscal federalism and state-local finance*. *Does decentralization enhance service delivery and poverty reduction?* Cheltenham: Edward Elgar.

Alderman, H., Hoogeveen, H., & Rossi, M. (2009). Preschool nutrition and subsequent schooling attainment: longitudinal evidence from Tanzania. *Economic Development and Cultural Change*, *57*(2), 239–260.

Andersen, L., & Jemio, L. C. (2016). *Decentralization and poverty reduction in Bolivia: Challenges and opportunities*. Development Research Working Paper Series 01.

Arzaghi, M., & Henderson, J. V. (2005). Why countries are fiscally decentralizing. *Journal of public economics*, *89*(7), 1157–1189. https://doi.org/10.1016/j.jpubeco.2003.10.009

Ayo, D. (2010). *Democratizando la democracia: una mirada a la participacion popular en los albores de la Bolivia de las autonomias*: IDEA Internacional Programa Bolivia.

Bardhan, P., & Mookherjee, D. (1998). *Expenditure Decentralization and the Delivery of Public Services in Developing Countries.*

Barja Daza, G., Villarroel Böhrt, S., & Zavaleta Castellón, D. (2013). Diseño institucional e incentivos implícitos en la descentralización boliviana. *Revista Latinoamericana de Desarrollo Económico*. (19), 137–211.

Baskaran, T., & Feld, L. P. (2013). Fiscal decentralization and economic growth in OECD countries: is there a relationship? *Public Finance Review*, *41*(4), 421–445.

Birner, R., & von Braun, J. (2015). Decentralization and Poverty Reduction. In E. Ahmad & G. Brosio (Eds.), *Elgaronline. Handbook of multilevel finance* (pp. 471–505). Cheltenham [u.a.]: Elgar.

Canavire-Bacarreza, G., & Martinez-Vazquez, J. (2012). *Reexamining The Determinants Of Fiscal Decentralization: What Is The Role Of Geography?*

Dillinger, W. (1994). *Decentralization and its implications for urban service delivery* (Vol. 16): World Bank Publications.

Ebener, S., Guerra-Arias, M., Campbell, J., Tatem, A. J., Moran, A. C., Johnson, F. A.,. . . others. (2015). The geography of maternal and newborn health: the state of the art. *International journal of health geographics*, *14*(1), 1.

Faguet, J.-P. (2004). Does decentralization increase government responsiveness to local needs?: Evidence from Bolivia. *Journal of public economics*, *88*(3–4), 867–893. https://doi.org/10.1016/S0047-2727(02)00185-8

Fujii, T. (2005). Micro-level estimation of child malnutrition indicators and its application in Cambodia. *World Bank Policy Research Working Paper*. (3662).

Galiani, S., Gertler, P., & Schargrodsky, E. (2008). School decentralization: Helping the good get better, but leaving the poor behind. *Journal of public economics*, *92*(10-11), 2106–2120. https://doi.org/10.1016/j.jpubeco.2008.05.004

Gemmell, N., Kneller, R., & Sanz, I. (2013). Fiscal decentralization and economic growth: spending versus revenue decentralization. *Economic Inquiry*, *51*(4), 1915–1931. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/j.1465-7295.2012.00508.x/full

Graham, C. (1997). Building support for market reforms in Bolivia: the Capitalization and Popular Participation programs. In M. H. Peirce (Ed.), *Capitalization: The Bolivian Model of Social and Economic Reform.* Oxford: University of Miami and Woodrow Wilson Center.

Gray Molina, G. (2004). Popular participation and povety reduction in Bolivia. *Citizens in Charge*, 223.

Inchauste, G. (2009). Decentralization in Bolivia: has it made a difference? *Does decentralization enhance service delivery and poverty reduction*.

INE. (2003). Pobreza y desigualdad en municipios de Bolivia: estimacion del gasto de consumo combinando el Censo 2001 y las encuestas de hogares. *Documento de trabajo*.

International Food Policy Research Institute. (2016). *Global Nutrition Report 2016 From Promise to Impact Ending Malnutrition by 2030*. Washington, DC: International Food Policy Research Institute.

Ivanyna, M., & Shah, A. (2014). How close is your government to its people? Worldwide indicators on localization and decentralization. *Economics: The Open-Access, Open-Assessment E-Journal*, *8*(2014-3), 1–61. https://doi.org/10.5018/economics-ejournal.ja.2014-3

Jiménez-Rubio, D. (2011). The impact of fiscal decentralization on infant mortality rates: Evidence from OECD countries. *Social Science & Medicine*, *73*(9), 1401–1407. Retrieved from http://www.sciencedirect.com/science/article/pii/S0277953611005016

Loayza, N. V., Rigolini, J., & Calvo-González, O. (2014). More Than You Can Handle: Decentralization and Spending Ability of Peruvian Municipalities. *Economics & Politics*, *26*(1), 56–78. https://doi.org/10.1111/ecpo.12026

Mansuri, G., & Rao, V. (2012). *Localizing development: does participation work?*: World Bank Publications.

Martinez-Vazquez, J., & Timofeev, A. (2009). A fiscal perspective of state rescaling. *Cambridge Journal of Regions, Economy and Society*, *2*(1), 85–105. https://doi.org/10.1093/cjres/rsn027

Montero-Granados, R., Dios Jimenez, J. de, & Martin, J. (2007). Decentralisation and convergence in health among the provinces of Spain (1980-2001). *Social Science & Medicine*, *64*(6), 1253–1264.

Mookherjee, D. (2015). Political Decentralization. *Annual Review of Economics*, *7*(1), 231–249. https://doi.org/10.1146/annurev-economics-080614-115527

Panizza, U. (1999). On the determinants of fiscal centralization: Theory and evidence. *Journal of public economics*, *74*(1), 97–139.

Robalino, D. A., Picazo, O. F., & Voetberg, A. (2001). *Does Fiscal Decentralization Improve Health Outcomes?*: World Bank Publications.

Schneider, A. (2003). Decentralization: conceptualization and measurement. *Studies in Comparative International Development*, *38*(3), 32–56.

Soto, V. E., Farfan, M. I., & Lorant, V. (2012). Fiscal decentralisation and infant mortality rate: The Colombian case. *Social Science & Medicine*, *74*(9), 1426–1434.

Torres, H. (2008). Social and environmental aspects of peri-urban growth in Latin American megacities. In *United Nations Expert Group Meeting on Population Distribution, Urbanization, Internal Migration and Development* (pp. 21–23).

UDAPE. (2015a). Atlas Fiscal II. Retrieved from http://www.udape.gob.bo/index.php?option=com_wrapper&view=wrapper&Itemid=129

UDAPE. (2015b). *Octavo Informe de Progreso de los Objetivos de Desarrollo del Milenio en Bolivia.*

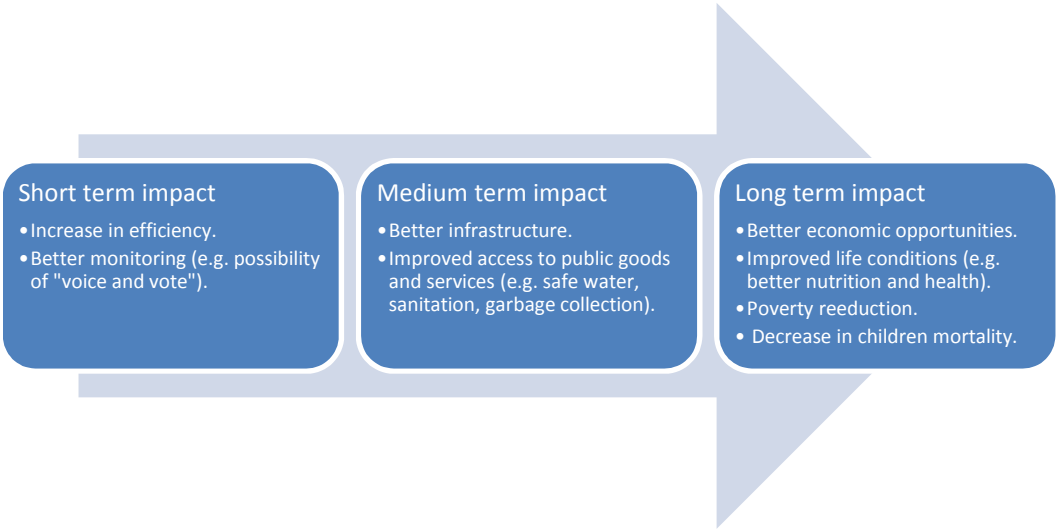
United Nations. (2015). *Work for human development*. *Human development report: Vol. 2015*. New York, NY: United Nations Development Programme.

von Braun, J. von, & Gatzweiler, F. W. (2014). Marginality—An Overview and Implications for Policy. In *von Braun, Gatzweiler (Ed.) 2014 – Marginality* (pp. 1–23). https://doi.org/10.1007/978-94-007-7061-4_1

Zhao, Q., & Lanjouw, P. (2002). *Using PovMap2 A user's guide. The World Bank, Washington DC.*

TABLES AND FIGURES

Figure 1. Potential impacts of decentralization over time



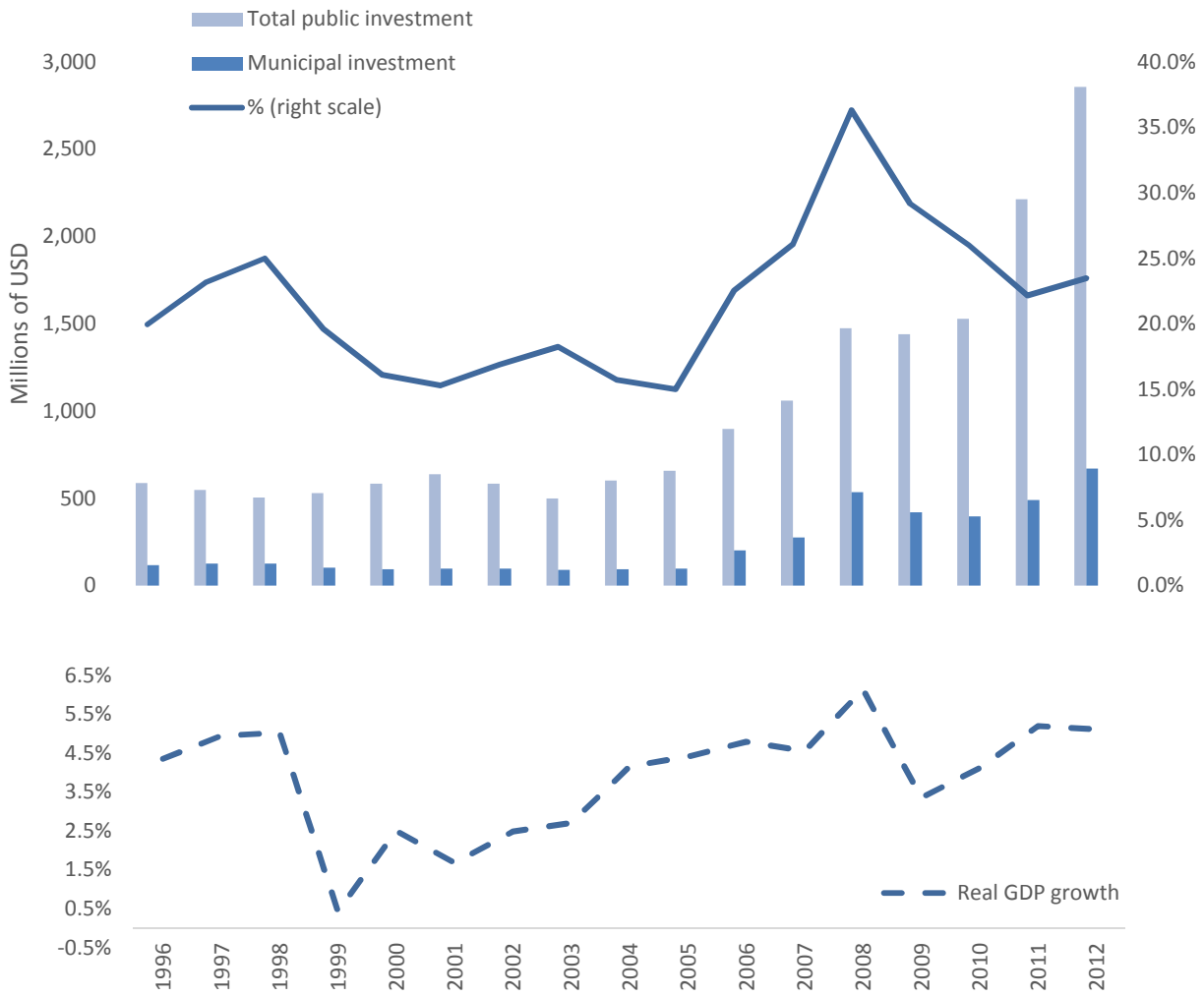
Source: Own elaboration

Table 1 – Situation before and after decentralization reform in Bolivia

Indicators	*Before 1994 reform*	*After 1994 reform*
Beneficiaries	Three cities perceived 90% of resources	Rural area perceive 50% of resources
Number of municipalities receiving central govt. funds	61	311
Share of central government funds	10%	20%
Main criteria for funding distribution	Legal residence of taxpayers	Population
Municipal investment over total investment	11%	20%
Social investment (in terms of GDP)	1.72%	3.62%
Investment in education (USD)	USD 10 million	USD 30 million
No. of officially recognized grassroots organizations	Less than 100	More than 19,000
Municipalities holding elections	124	311

Source: Graham (1997) and Barja Daza et al. (2013)

Figure 2. Total and municipal public investment in Bolivia (upper panel)
Real GDP growth (lower panel)



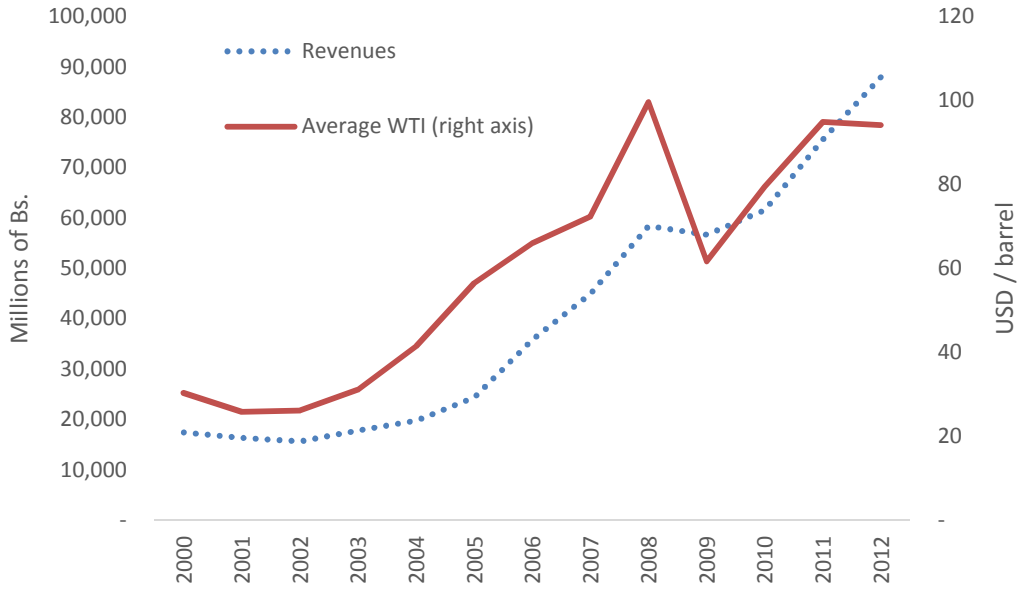
Source: Own elaboration using data from Ministries of Finance, Planning and UDAPE

Table 2. Distribution of municipal revenues (in millions of Bs. and in percentages)

	1996		2001		2012	
	Millions	*%*	*Millions*	*%*	*Millions*	*%*
Own revenues	193	8%	900	33%	1,695	10%
Transfers	1,865	82%	1,105	41%	12,169	74%
Other revenues	224	10%	723	27%	2,589	16%
Total	**2,282**	**100%**	**2,728**	**100%**	**16,453**	**100%**

Source: Own elaboration using data from the Ministry of Finance

Figure 3. National revenues and price of oils (WTI)



Source: Own elaboration using data from the Ministry of Finance

Table 3. Summary statistics

		2001		2012	
VARIABLES	**N**	**Average**	**SD**	**Average**	**SD**
Population (habitants)	314	25,540	92,091	31,075	112,360
Indigenous proxy[13] (proportion)	314	0.51	0.35	0.44	0.32
Illiteracy (proportion)	314	0.23	0.13	0.09	0.06
Household size (members)	314	6	1	5	1
Proportion of rural households	314	0.81	0.28	0.75	0.31
Regional GDP (in millions of Bs.)	314	3,490	2,382	5,381	3,644
Investment (in millions of Bs.)	314	6.76	21.02	34.85	99.99
Transfers from central govt (Bs. Per person)	314	149	41.56	1,503	1,040
Number of hospitals	314	8	13	9	14
Number of schools	314	45	58	51	79
Access to toilet (proportion)	314	0.40	0.27	0.48	0.27
Access to safe water (proportion)	314	0.38	0.23	0.50	0.23
Probability of being underweight	314	0.09	0.04	0.04	0.02
Probability of being stunted	314	0.47	0.12	0.23	0.09

Source: Own elaboration based on information provided by UDAPE, National Institute of Statistics and Ministry of Finance

[13] By using the proportion of persons that learn to speak in an indigenous language.

Table 4. Variables used in the estimation

Variable name	Description
Dependent	
Access to water	Proportion of households with access to safe water for drinking and cooking (tapped water)
Access to sanitation	Proportion of households with access to a toilet (exclusive or shared)
Stunting	Proportion of stunted children (chronic malnutrition, or low height for age in children less than 5 years old)
Underweight	Proportion of underweight children (acute malnutrition, or low weight for age in children less than 5 years old)
Fiscal decentralization indicators	
Transfer share	$\frac{\text{transfer to municipality}_m}{\text{total central government revenues}}\ [log]$
Expenditure share	$\frac{\text{expenditure}_m}{\text{total central government expenditures}}\ [log]$
Focused expenditure share	$\frac{\text{expenditure in sanitation}_m}{\text{total central government expenditures}}\ [log]$
Additional political and administrative indicators	
Political decentralization proxy	$\frac{\text{number of persons voting}_m}{\text{total number of persons allowed to vote}_m}$
Administrative decentralization proxy	$\frac{\text{number of persons working in public administration}_m}{\text{total number of workers}_m}$
Political support	Winning share of elected authorities, per municipality
Political alignment	Dummy variable [=1 if ruling party in municipality *m* is the same as the ruling party in central government]
Controls	
Rural	Proportion of households that live in rural area
Indigenous proxy	Dummy for indigenous status [=1 if person has learned to talk in indigenous (non-Spanish nor foreign) language]
Illiteracy	Average illiteracy rate
Household size	Average household size
Population	Number of habitants *[log]*
Regional GDP	Regional GDP *[log]*

Note: Subscript *m* indicates variation over municipalities. Regional GDP varies over department

Table 5. OLS model for access to safe water

	(1)	(2)	(3)	(4)	(5)
Expenditure in sanitation	0.00459	0.00455	0.0107	0.00235	-0.00355
	(0.00341)	(0.0196)	(0.0101)	(0.00635)	(0.00530)
Participation in elections		-0.0766			
		(0.402)			
Expenditure in sanitation x Participation in elections		-0.000693			
		(0.0298)			
Share of public workers			0.0125		
			(0.0382)		
Expenditure in sanitation x Share of public workers			0.00121		
			(0.00260)		
Political support				0.0588	
				(0.205)	
Expenditure in sanitation x Political support				0.00704	
				(0.0169)	
Political alignment					0.118
					(0.0788)
Expenditure in sanitation x Political alignment					0.0117*
					(0.00620)
Rural	-0.294***	-0.294***	-0.241***	-0.294***	-0.275***
	(0.0753)	(0.0761)	(0.0571)	(0.0744)	(0.0808)
Indigenous proxy	0.260*	0.246	0.208	0.229	0.221
	(0.154)	(0.155)	(0.143)	(0.165)	(0.154)
Illiteracy	-0.534***	-0.552***	-0.549***	-0.547***	-0.583***
	(0.134)	(0.146)	(0.126)	(0.150)	(0.126)
Household size	-0.00783	-0.00618	-0.00125	-0.00554	-0.00123
	(0.0248)	(0.0245)	(0.0245)	(0.0251)	(0.0245)
Population	-0.174***	-0.185***	-0.130***	-0.181***	-0.182***
	(0.0474)	(0.0452)	(0.0454)	(0.0482)	(0.0467)
Regional GDP	0.184***	0.183***	0.173***	0.182***	0.185***
	(0.0551)	(0.0556)	(0.0543)	(0.0545)	(0.0636)
Municipal and year fixed effects	Yes	Yes	Yes	Yes	Yes
N	480	480	478	480	480
R^2	0.64	0.64	0.64	0.64	0.65

*Clustered robust errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Clustering is at province level. Description of variables is given in Table 4.*

Table 6. OLS model for access to sanitation

	(1)	(2)	(3)	(4)	(5)
Expenditure in sanitation	0.00254	0.0120	0.0268	0.00493	0.00123
	(0.00421)	(0.0181)	(0.0197)	(0.00799)	(0.00625)
Participation in elections		-0.485			
		(0.364)			
Expenditure in sanitation x Participation in elections		-0.0173			
		(0.0276)			
Share of public workers			0.0857		
			(0.0550)		
Expenditure in sanitation x Share of public workers			0.00573		
			(0.00450)		
Political support				-0.0941	
				(0.209)	
Expenditure in sanitation x Political support				-0.00564	
				(0.0167)	
Political alignment					0.0127
					(0.0770)
Expenditure in sanitation x Political alignment					0.00205
					(0.00643)
Rural	-0.0485	-0.0417	-0.0337	-0.0424	-0.0407
	(0.0608)	(0.0651)	(0.0662)	(0.0608)	(0.0642)
Indigenous proxy	0.141	0.0862	0.146	0.125	0.121
	(0.131)	(0.124)	(0.125)	(0.129)	(0.130)
Illiteracy	-0.198	-0.275**	-0.192	-0.228*	-0.236*
	(0.120)	(0.124)	(0.118)	(0.136)	(0.124)
Household size	-0.0329	-0.0261	-0.0274	-0.0322	-0.0302
	(0.0260)	(0.0248)	(0.0255)	(0.0262)	(0.0254)
Population	-0.0227	-0.0677*	-0.0248	-0.0258	-0.0251
	(0.0395)	(0.0396)	(0.0457)	(0.0386)	(0.0404)
Regional GDP	0.0956**	0.0925**	0.0803*	0.0913**	0.0894**
	(0.0392)	(0.0397)	(0.0471)	(0.0388)	(0.0429)
Municipal and year fixed effects	Yes	Yes	Yes	Yes	Yes
N	480	480	478	480	480
R^2	0.46	0.49	0.47	0.46	0.46

*Clustered robust errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Clustering is at province level. Description of variables is given in Table 4.*

Table 7. OLS model for underweight (transfer share as decentralization proxy)

	(1)	(2)	(3)	(4)	(5)
Transfers share(log)	-0.0299***	-0.0428**	-0.0181	-0.0308***	-0.0312***
	(0.00789)	(0.0184)	(0.0184)	(0.00933)	(0.00873)
Participation in elections		0.148			
		(0.258)			
Transfers share(log) x Participation in elections		0.0183			
		(0.0250)			
Share of public workers(log)			0.0131		
			(0.0354)		
Transfers share(log) x Share of public workers(log)			0.00243		
			(0.00374)		
Political support				0.0225	
				(0.110)	
Transfers share(log) x Political support				0.00214	
				(0.0108)	
Political alignment					0.00731
					(0.0374)
Political alignment x Transfers share(log)					0.00123
					(0.00432)
Rural	0.0120	0.0126	0.0100	0.0118	0.0130
	(0.0197)	(0.0201)	(0.0204)	(0.0198)	(0.0196)
Indigenous proxy	0.0254	0.0257	0.0146	0.0256	0.0213
	(0.0678)	(0.0666)	(0.0764)	(0.0739)	(0.0705)
Illiteracy	0.110	0.102	0.108	0.116	0.102
	(0.0766)	(0.0776)	(0.0772)	(0.0717)	(0.0805)
Household size	0.00917	0.00893	0.0107	0.00922	0.00960
	(0.00846)	(0.00862)	(0.00854)	(0.00866)	(0.00847)
Population(log)	0.0242	0.0247	0.0180	0.0247	0.0237
	(0.0153)	(0.0175)	(0.0154)	(0.0156)	(0.0154)
Regional GDP(log)	-0.0225	-0.0227	-0.0226	-0.0221	-0.0240
	(0.0322)	(0.0317)	(0.0327)	(0.0331)	(0.0332)
Municipal and year fixed effects	Yes	Yes	Yes	Yes	Yes
N	628	628	623	628	628
r2	0.21	0.22	0.22	0.21	0.22

*Clustered robust errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Clustering is at province level. Description of variables is given in Table 4.*

Table 8. OLS model for underweight (expenditure share as decentralization proxy)

	(1)	(2)	(3)	(4)	(5)
Expenditures share(log)	-0.0145*	-0.0225	-0.0248	-0.0139	-0.0148*
	(0.00744)	(0.0206)	(0.0188)	(0.00848)	(0.00856)
Participation in elections		0.153			
		(0.287)			
Expenditures share(log) x Participation in elections		0.0127			
		(0.0264)			
Share of public workers(log)			-0.0435		
			(0.0376)		
Expenditures share x Share of public workers			-0.00267		
			(0.00376)		
Political support				-0.0138	
				(0.104)	
Expenditures share(log) x Political support				-0.0000293	
				(0.00960)	
Political alignment					0.00358
					(0.0308)
Political alignment x Expenditures share(log)					0.000457
					(0.00357)
Rural	0.00368	0.000728	-0.00757	0.00636	0.00396
	(0.0248)	(0.0255)	(0.0248)	(0.0238)	(0.0243)
Indigenous proxy	-0.0322	-0.0293	-0.0366	-0.0428	-0.0314
	(0.0912)	(0.0902)	(0.102)	(0.0994)	(0.0939)
Illiteracy	0.102	0.108	0.0943	0.0934	0.103
	(0.0894)	(0.0910)	(0.0882)	(0.0792)	(0.0952)
Household size	0.00632	0.00478	0.00596	0.00740	0.00656
	(0.00908)	(0.0100)	(0.00918)	(0.00872)	(0.00820)
Population(log)	0.0144	0.0220	0.00674	0.0127	0.0143
	(0.0179)	(0.0219)	(0.0194)	(0.0187)	(0.0177)
Regional GDP(log)	-0.00822	-0.00871	0.00563	-0.0111	-0.00809
	(0.0278)	(0.0280)	(0.0300)	(0.0291)	(0.0290)
Municipal and year fixed effects	Yes	Yes	Yes	Yes	Yes
N	530	530	525	530	530
R^2	0.19	0.20	0.21	0.20	0.19

*Clustered robust errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Clustering is at province level. Description of variables is given in Table 4.*

Table 9. OLS model for stunting (transfer share as decentralization proxy)

	(1)	(2)	(3)	(4)	(5)
Transfers share(log)	-0.0568***	-0.0509	-0.102***	-0.0306*	-0.0586***
	(0.0154)	(0.0318)	(0.0319)	(0.0174)	(0.0176)
Participation in elections		-0.0285			
		(0.383)			
Transfers share(log) x Participation in elections		-0.00690			
		(0.0403)			
Share of public workers(log)			-0.118		
			(0.0764)		
Transfers share(log) x Share of public workers(log)			-0.0124*		
			(0.00745)		
Political support				-0.489***	
				(0.171)	
Transfers share(log) x Political support				-0.0552***	
				(0.0167)	
Political alignment					0.0114
					(0.0668)
Political alignment x Transfers share(log)					0.00170
					(0.00751)
Rural	0.0508	0.0487	0.0240	0.0367	0.0518
	(0.0472)	(0.0464)	(0.0512)	(0.0478)	(0.0467)
Indigenous proxy	-0.0503	-0.0498	-0.0305	0.0242	-0.0537
	(0.114)	(0.114)	(0.120)	(0.122)	(0.118)
Illiteracy	0.650***	0.660***	0.681***	0.585***	0.643***
	(0.119)	(0.130)	(0.119)	(0.111)	(0.130)
Household size	0.0880***	0.0875***	0.0859***	0.0816***	0.0885***
	(0.0176)	(0.0172)	(0.0179)	(0.0173)	(0.0177)
Population(log)	-0.0125	-0.00969	-0.0273	-0.0163	-0.0129
	(0.0333)	(0.0348)	(0.0326)	(0.0353)	(0.0334)
Regional GDP(log)	0.0570	0.0567	0.0753*	0.0638	0.0558
	(0.0413)	(0.0415)	(0.0409)	(0.0404)	(0.0426)
Municipal and year fixed effects	Yes	Yes	Yes	Yes	Yes
N	628	628	623	628	628
R^2	0.56	0.56	0.57	0.58	0.56

*Clustered robust errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Clustering is at province level. Description of variables is given in Table 4.*

Figure 4. Marginal effect of an increase in the transfer share, by public officials share

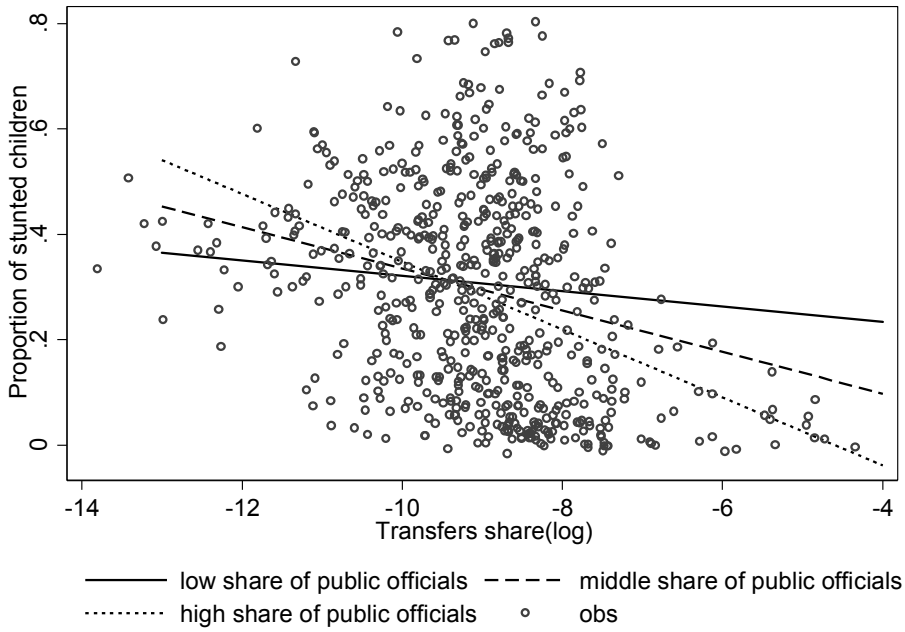


Figure 5. Marginal effect of an increase in the transfer share, by political support

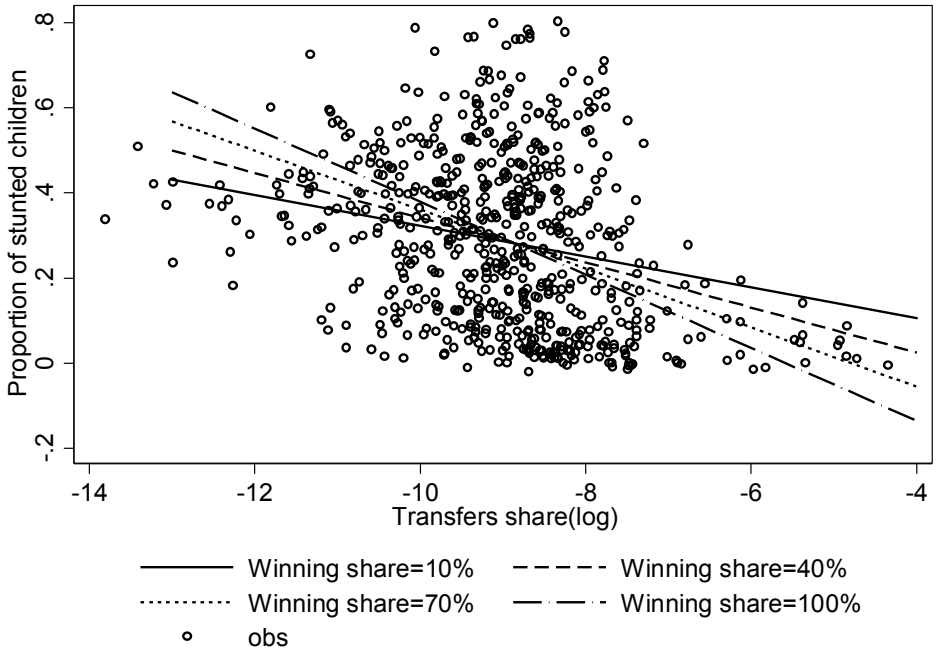


Table 10. OLS model for stunting (expenditure share as decentralization proxy)

	(1)	(2)	(3)	(4)	(5)
Expenditures share(log)	-0.0197	0.0217	-0.100***	-0.00398	-0.0273
	(0.0149)	(0.0368)	(0.0357)	(0.0152)	(0.0175)
Participation in elections		-0.389			
		(0.502)			
Expenditures share(log) x Participation in elections		-0.0561			
		(0.0547)			
Share of public workers(log)			-0.186**		
			(0.0935)		
Expenditures share(log) x Share of public workers(log)			-0.0199**		
			(0.00926)		
Political support				-0.442**	
				(0.175)	
Expenditures share(log) x Political support				-0.0495***	
				(0.0174)	
Political alignment					0.0831
					(0.0678)
Political alignment x Expenditures share(log)					0.0102
					(0.00784)
Rural	0.0335	0.0456	-0.00685	0.0257	0.0390
	(0.0606)	(0.0593)	(0.0675)	(0.0606)	(0.0573)
Indigenous proxy	-0.141	-0.100	-0.116	-0.0792	-0.119
	(0.132)	(0.137)	(0.133)	(0.139)	(0.139)
Illiteracy	0.658***	0.711***	0.695***	0.604***	0.690***
	(0.137)	(0.148)	(0.134)	(0.127)	(0.158)
Household size	0.0977***	0.101***	0.0916***	0.0923***	0.102***
	(0.0169)	(0.0191)	(0.0185)	(0.0170)	(0.0172)
Population(log)	-0.0391	-0.0309	-0.0597*	-0.0466	-0.0415
	(0.0327)	(0.0408)	(0.0335)	(0.0355)	(0.0330)
Regional GDP(log)	0.0576	0.0552	0.0973**	0.0609*	0.0631
	(0.0359)	(0.0356)	(0.0399)	(0.0362)	(0.0398)
Municipal and year fixed effects	Yes	Yes	Yes	Yes	Yes
N	530	530	525	530	530
R^2	0.56	0.57	0.58	0.57	0.56

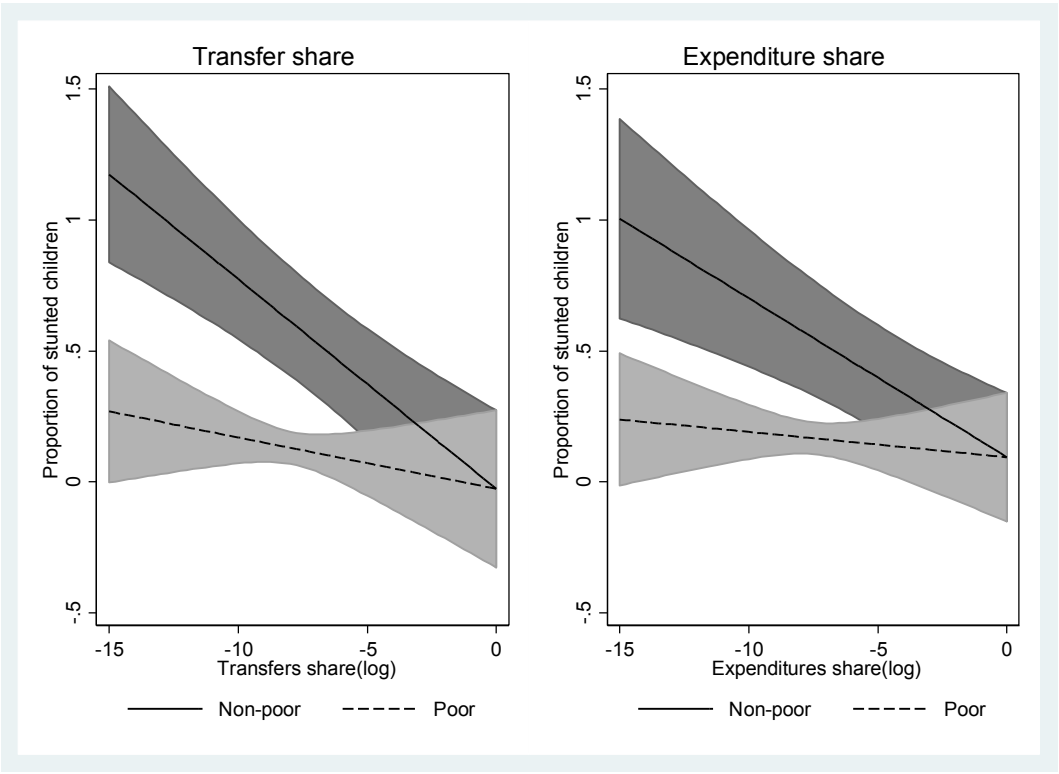
*Clustered robust errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Clustering is at province level. Description of variables is given in Table 4.*

Table 11. OLS models for access to safe water, toilet, underweight and stunting
Heterogeneous effects by poverty status

	(1) Water	(2) Toilet	(3) Underweight	(4) Stunting	(5) Underweight	(6) Stunting
Expenditure in sanitation	0.00851	0.00491				
	(0.00594)	(0.00566)				
Poor x Expenditure in sanitation	-0.00480	-0.00624				
	(0.00719)	(0.00670)				
Transfers share(log)			-0.0297***	-0.0801***		
			(0.00901)	(0.0167)		
Poor x Transfers share(log)			-0.000397	0.0604***		
			(0.00958)	(0.0164)		
Expenditures share(log)					-0.0175	-0.0607***
					(0.0106)	(0.0159)
Poor x Expenditures share(log)					0.00375	0.0511***
					(0.0108)	(0.0182)
Rural	-0.294***	-0.0456	0.0121	0.0397	0.00346	0.0304
	(0.0748)	(0.0585)	(0.0198)	(0.0477)	(0.0247)	(0.0598)
Indigenous proxy	0.257*	0.137	0.0244	0.103	-0.0244	-0.0359
	(0.153)	(0.133)	(0.0725)	(0.121)	(0.0930)	(0.139)
Illiteracy	-0.534***	-0.206*	0.110	0.715***	0.105	0.687***
	(0.134)	(0.121)	(0.0768)	(0.116)	(0.0902)	(0.131)
Household size	-0.00958	-0.0343	0.00916	0.0884***	0.00595	0.0928***
	(0.0247)	(0.0262)	(0.00844)	(0.0167)	(0.00908)	(0.0167)
Population(log)	-0.171***	-0.0194	0.0240	0.0117	0.0160	-0.0170
	(0.0477)	(0.0376)	(0.0157)	(0.0323)	(0.0167)	(0.0312)
Regional GDP(log)	0.185***	0.0924**	-0.0226	0.0677*	-0.00768	0.0650*
	(0.0547)	(0.0394)	(0.0324)	(0.0400)	(0.0279)	(0.0362)
Municipal and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	480	480	628	628	530	530
R^2	0.64	0.46	0.21	0.58	0.19	0.57

*Clustered robust errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Clustering is at province level. Description of variables is given in Table 4.*

Figure 6. Marginal effects of an increase of fiscal decentralization on stunting



Source: Own estimations

Table 12. OLS model for stunting, considering UBN poverty indicators

	(1)	(2)
Transfers share(log)	-0.0496**	
	(0.0204)	
Poor[UBN] x Transfers share(log)	-0.00917	
	(0.0162)	
Expenditures share(log)		-0.0482**
		(0.0220)
Poor[UBN] x Expenditures share(log)		0.0327*
		(0.0177)
Rural	0.0561	0.0250
	(0.0465)	(0.0604)
Indigenous proxy	-0.0565	-0.131
	(0.112)	(0.132)
Illiteracy	0.632***	0.691***
	(0.132)	(0.140)
Household size	0.0882***	0.0948***
	(0.0175)	(0.0170)
Population(log)	-0.0102	-0.0414
	(0.0344)	(0.0320)
Regional GDP(log)	0.0538	0.0660*
	(0.0427)	(0.0376)
Municipalities and year fixed effects	Yes	Yes
N	628	530
R^2	0.56	0.56

*Clustered robust errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.*
Clustering is at province level. Description of variables is given in Table 4.

Table 13. Results from OLS FE model, excluding capitals of department and El Alto city

	(1) Water	(2) Toilet	(3) Underweight	(4) Stunting	(5) Underweight	(6) Stunting
Expenditure in sanitation	0.00415	0.00306				
	(0.00372)	(0.00437)				
Transfers share(log)			-0.0318***	-0.0608***		
			(0.00768)	(0.0158)		
Expenditures share(log)					-0.0142*	-0.0219
					(0.00764)	(0.0156)
Illiteracy	-0.496***	-0.193	0.0976	0.655***	0.0936	0.688***
	(0.147)	(0.125)	(0.0802)	(0.126)	(0.0938)	(0.149)
Household size	-0.00470	-0.0325	0.00847	0.0884***	0.00579	0.0993***
	(0.0253)	(0.0266)	(0.00856)	(0.0179)	(0.00915)	(0.0175)
Population(log)	-0.175***	-0.0194	0.0252	-0.0120	0.0143	-0.0402
	(0.0498)	(0.0415)	(0.0155)	(0.0336)	(0.0183)	(0.0337)
Regional GDP(log)	0.205***	0.104**	-0.0279	0.0556	-0.0115	0.0589
	(0.0564)	(0.0406)	(0.0361)	(0.0448)	(0.0306)	(0.0387)
Municipal and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	461	461	608	608	510	510
R^2	0.65	0.46	0.22	0.57	0.20	0.56

*Clustered robust errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.*
Clustering is at province level. Description of variables is given in Table 4.

Table 14. Results from OLS FE model, excluding warmest municipalities

	(1) Water	(2) Toilet	(3) Underweight	(4) Stunting	(5) Underweight	(6) Stunting
Expenditure in sanitation(log)	0.00382	-0.000574				
	(0.00625)	(0.00953)				
Transfers share(log)			-0.100***	-0.0890*		
			(0.0284)	(0.0448)		
Expenditures share(log)					-0.0232*	-0.0521**
					(0.0122)	(0.0213)
Rural	-0.415***	-0.126	0.0247	0.151*	-0.0220	0.154
	(0.118)	(0.0933)	(0.0402)	(0.0796)	(0.0360)	(0.103)
Indigenous proxy	-0.144	0.0453	0.151	0.166	0.221	0.0907
	(0.256)	(0.198)	(0.117)	(0.168)	(0.140)	(0.182)
Illiteracy	-0.778***	0.183	-0.0109	0.414*	-0.135	0.408
	(0.192)	(0.206)	(0.196)	(0.240)	(0.231)	(0.292)
Household size	-0.00376	-0.0619	0.0213	0.147***	0.00635	0.128***
	(0.0328)	(0.0469)	(0.0153)	(0.0284)	(0.0120)	(0.0294)
Population(log)	-0.214**	-0.0438	0.0378	-0.0571	0.0227	-0.0494
	(0.0936)	(0.0631)	(0.0321)	(0.0499)	(0.0270)	(0.0506)
Regional GDP(log)	0.192*	-0.0737	-0.419***	-0.148	-0.215**	-0.0315
	(0.106)	(0.140)	(0.112)	(0.200)	(0.105)	(0.157)
Municipal and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	157	157	210	210	189	189
R^2	0.67	0.50	0.35	0.38	0.21	0.31

*Clustered robust errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.*
Clustering is at province level. Description of variables is given in Table 4.

Table 15. Results from OLS FE model, excluding municipalities producing oil and natural gas

	(1) Water	(2) Toilet	(3) Underweight	(4) Stunting	(5) Underweight	(6) Stunting
Expenditure in sanitation(log)	0.00417	0.000243				
	(0.00365)	(0.00460)				
Transfers share(log)			-0.0302***	-0.0534***		
			(0.00897)	(0.0152)		
Expenditures share(log)					-0.0136*	-0.0222
					(0.00797)	(0.0167)
Rural	-0.220***	-0.0111	0.0140	0.0741	0.000810	0.0767
	(0.0764)	(0.0642)	(0.0205)	(0.0503)	(0.0282)	(0.0661)
Indigenous proxy	0.198	0.103	0.0288	-0.134	-0.0122	-0.225*
	(0.158)	(0.134)	(0.0735)	(0.119)	(0.0907)	(0.127)
Illiteracy	-0.450***	-0.152	0.0624	0.594***	0.0667	0.628***
	(0.120)	(0.113)	(0.0789)	(0.134)	(0.0894)	(0.148)
Household size	0.0304	-0.0245	0.00489	0.0809***	0.00456	0.0958***
	(0.0193)	(0.0261)	(0.00935)	(0.0193)	(0.0100)	(0.0176)
Population(log)	-0.212***	-0.0196	0.0271*	-0.0150	0.0101	-0.0450
	(0.0480)	(0.0406)	(0.0161)	(0.0364)	(0.0189)	(0.0346)
Regional GDP(log)	0.143	0.00738	-0.0696	0.0395	-0.0430	0.0533
	(0.0913)	(0.0487)	(0.0546)	(0.0634)	(0.0465)	(0.0520)
Municipal and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	409	409	540	540	458	458
R^2	0.64	0.47	0.20	0.55	0.18	0.55

*Clustered robust errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.*
Clustering is at province level. Description of variables is given in Table 4.

Table 16. IV 2SLS model for access to safe water, toilet, underweight and stunting

	(1) Water	(2) Toilet	(3) Underweight	(4) Stunting	(5) Underweight	(6) Stunting
Expenditure in sanitation(log)	-0.131	-0.031				
	(0.418)	(0.205)				
Transfers share(log)			0.007	0.033		
			(0.029)	(0.064)		
Expenditures share(log)					-0.021	0.125
					(0.080)	(0.219)
Rural	-0.100	0.000	-0.017	-0.020	0.008	-0.063
	(0.608)	(0.278)	(0.033)	(0.070)	(0.063)	(0.174)
Indigenous proxy	0.146	0.112	-0.027	-0.179	-0.038	-0.020
	(0.555)	(0.254)	(0.062)	(0.120)	(0.144)	(0.288)
Illiteracy	-1.078	-0.334	0.124	0.682***	0.098	0.746**
	(1.861)	(0.906)	(0.084)	(0.148)	(0.117)	(0.298)
Household size	-0.020	-0.036	0.016	0.104***	0.005	0.126**
	(0.063)	(0.042)	(0.012)	(0.027)	(0.021)	(0.061)
Population(log)	-0.045	0.011	-0.022	-0.124	0.022	-0.196
	(0.430)	(0.212)	(0.044)	(0.098)	(0.092)	(0.264)
Regional GDP(log)	-0.011	0.047	-0.011	0.085**	-0.009	0.069
	(0.523)	(0.263)	(0.023)	(0.043)	(0.024)	(0.052)
N	360	360	628	628	432	432
R^2	-1.29	0.27	0.16	0.51	0.19	0.33
F-statistic (first stage)	0.14	0.14	15.74	15.74	1.22	1.22
p-value for endogeneity test	0.51	0.85	0.21	0.14	0.93	0.39

Clustered robust standard in parentheses. Cluster is at the province level. Description of the variables is given in Table 4
** p < 0.10, ** p < 0.05, *** p < 0.01*