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The Effect of Government Transfers on Poverty and Inequality

Three Different Perspectives about Decentralization and Social Policies in Bolivia

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LIST OF ACRONYMS

2SLS	Two-stage least squares
ATE	Average Treatment Effect
ATET	Average Treatment Effect on Treated
BONOSOL	*Bono Solidario*
BRIC	Brazil, Russia, India, and China
Bs.	*Bolivianos* (currency)
DHS	Demographic and Health Surveys
DiD	Difference-in-differences
EH	*Encuesta a Hogares*
FE	Fixed effects
FIS	*Fondo de Inversión Social*
FSE	*Fondo Social de Emergencia*
GDP	Gross Domestic Product
GE	General Entropy
GCOV	Group coefficient of variation
GGINI	Group Gini
GTHEIL	Group Theil
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
INE	*Instituto Nacional de Estadísticas*

IV	Instrumental variables
LSMS	Living Standards Measurement Study
MCA	Multiple Correspondence Analysis
MDID	Matching Difference-in-Differences
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PCA	Principal Component Analysis
PIT	Personal Income Tax
PLANE	*Plan Nacional de Empleo de Emergencia*
POA	*Plan Operativo Anual*
PSU	Primary Sampling Unit
RCT	Randomized Control Trial
RC-IVA	*Régimen Complementario al Valor Agregado*
RD	*Renta Dignidad*
SUTVA	Stable unit treatment value assumption
TOT	Treatment-on-Treated
UBN	Unsatisfied Basic Needs
UDAPE	*Unidad de Análisis de Políticas Económicas y Sociales*
UNICEF	United Nations Children's Fund
USD	United States Dollar
VAT	Value Added Tax
WTI	West Texas Intermediate

Abstract

Poverty and inequality in Bolivia have reduced to a great extent in the last 20 years in Bolivia. There are mixed opinions regarding the role of the state in this overall positive result, and consistent evidence of state intervention is still missing. This dissertation aims to explore the topic of the impact of government intervention on inequality and poverty from three different perspectives.

In the first chapter, I frame the theoretical framework and set the research questions of each of the chapters of the dissertation. In the second chapter, I examine the impact of a policy experiment in Bolivia in 2007/2008, in which the payment method of a cash transfer changed from a yearly lump sum to monthly installments. Both amounts do not differ if we take them in full, but the change in the payment method could have an impact given inherent behavior-specific constraints like lack of control of expenditures, propensity to overspend and inability to save regularly. I am interested in the effects that this policy change might have had on educational outcomes when the outcomes of those affected by the policy change are compared with those who were not affected. Results show an increase in attendance (around three percentage points) and a decrease in child labor (by eight percentage points) for older children (attending secondary school). The results are fairly robust to the use of different specifications. This suggests that a smaller but more regular, constant in time and predictable flow of cash transfers can be preferable to a once-a-year significant lump-sum transfer.

In Chapter 3, I 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 five years old has slightly improved during the study period, suggesting a positive impact of increased decentralization on nourishment indicators. The inclusion of other dimensions of decentralization policy (like administrative decentralization and the role of political institutions) are also analyzed, showing important interactions with fiscal decentralization. On the other hand, decentralization does not appear to be pro-poor, as the results show that the progress on nourishment indicators was more considerable in non-poor municipalities versus poor municipalities. These results are robust to different thresholds and deprivation measures.

In the last chapter of the dissertation, I study the topic of horizontal inequality. Horizontal inequality refers to the difference in income (or another welfare indicator) due to membership in a specific group (e.g., determined, by race, gender, location, etc.). This difference could be relevant in a context in which particular groups have been historically excluded, as the case of indigenous people in Bolivia. In this chapter, a tax-benefit incidence analysis model is used to assess the role of net public transfers on horizontal inequality in Bolivia for the year 2015. The group categories that are subject of the analysis are defined by ethnic status, gender, and location, besides a combination of these categories. Results show that the most significant group inequality is observed when the indigenous status is defined using an ethnolinguistic metric. However, the role of self-identification in determining indigenous status is less important in explaining the income gap. While the fiscal system seems to be progressive for indigenous and urban/rural categories, this progressivity is not present when the gender dimension is assessed.

Zusammenfassung

Armut und Ungleichheit in Bolivien haben sich in den letzten zwanzig Jahren in großem Umfang verringert. Es bestehen unterschiedliche Meinungen über die Rolle des Staates bei diesen insgesamt positiven Ergebnissen, durchgängige Belege für staatliches Eingreifen fehlen bisher. Das Ziel dieser Dissertation ist die Untersuchung der Auswirkungen staatlichen Eingreifens auf Ungleichheit und Armut aus drei unterschiedlichen Perspektiven. Im ersten Kapitel werden der theoretische rahmen und die Forschungsfragen für die einzelnen Kapitel der Dissertation festgelegt.

Im zweiten Kapitel wird Auswirkung eines Versuchs in Bolivien im Zeitraum von 2007 bis 2008 untersucht, bei dem die Überweisung von Bargeld von einer jährlichen Auszahlung des Gesamtbetrages zu monatlichen Abschlagszahlungen umgestellt wurde. Insgesamt bestand kein Unterschied in der Höhe der ausgezahlten Gelder, der Auszahlungsmodus könnte jedoch in Anbetracht von verhaltensspezifischer Einschränkungen, wie dem Mangel an Kontrolle bei Ausgaben, der Tendenz zur Mittelüberschreitung, und der Unfähigkeit zu regelmäßigem Sparen. Besonderes Interesse gilt den möglichen Effekten der Maßnahmen auf Bildungsergebnisse, wenn sie mit dem Ergebnis von Individuen verglichen werden, die nicht von den Maßnahmen betroffen waren. Die Ergebnisse zeigen eine Zunahme bei Schulbesuchen (ungefähr drei Prozent) und ein Absinken der Kinderarbeit (um acht Prozent) bei älteren Kindern (die weiterführende Schulen besuchen). Die Ergebnisse lassen sich stabil mit unterschiedlichen Spezifikationen verwenden. Dies deutet darauf hin, dass eine kleinere, konstantere und voraussehbarere Bargeldtransfers einer jährlichen Auszahlung des Gesamtbetrages vorzuziehen sind.

Im dritten Kapitel bewerte ich die Auswirkungen von zunehmender fiskalischer Dezentralisierung auf Indikatoren wie Ernährung, Zugang zu Trinkwasser und Hygiene in Bolivien in der ersten Dekade der 2000er Jahre. Die Ernährungssituation von Kindern unter fünf Jahren hat sich im Untersuchungszeitraum leicht verbessert, was darauf hindeutet, dass eine zunehmende Dezentralisierung positive Auswirkungen positive Auswirkungen auf Ernährungsindikatoren hat. Andere Dimensionen einer Dezentralisierungspolitik (die Dezentralisierung der Verwaltung und die Rolle von politischen Institutionen) werden ebenso analysiert, die wichtige Interaktionen einer fiskalischen Dezentralisierung aufzeigen. Dezentralisierung erscheint jedoch nicht pro-Armut zu sein, da die Ergebnisse zeigen, dass die Verbesserung in nicht-armen Gemeinden größer war als in armen Gemeinden. Diese Ergebnisse sind bei unterschiedlichen Grenzwerten und Entziehungsmaßnahmen stabil.

Im letzten Kapitel untersuche ich das Thema der horizontalen Ungleichheit. Horizontale Ungleichheit bezieht sich auf Einkommensunterschiede (oder auf andere Wohlfahrtsindikatoren) aufgrund der Zugehörigkeit zu einer spezifischen Gruppe (die z.B. durch die Rasse, das Geschlecht oder den Standort bestimmt werden). Dieser Unterschied könnte in einem Kontext relevant sein, in dem bestimmte Gruppen historisch angeschlossen wurden, in diesem Fall die indigene Bevölkerung Boliviens. Ein Analysemodell über Vorkommen von Steuervorteilen wird angewandt, um die Rolle von öffentlichen Transferleistungen auf die horizontale Ungleichheit in Bolivien in 2015 zu bestimmen. Die Gruppenkategorien, die in dieser Analyse untersucht werden, werden nach ethnischem Status, Geschlecht, Standort sowie eine Kombination dieser Kategorien ermittelt. Die Ergebnisse zeigen, dass die größte Ungleichheit beim indigenen Status vorliegt, der anhand einer

ethno-linguistischen Metrik bestimmt wird. Die Selbstidentifikation zur Bestimmung des indigenen Status ist jedoch weniger wichtig, um Einkommensunterschiede zu erklären. Während das Fiskalsystem für die Kategorien Indigen und Urban/Land progressiver zu sein scheinen, scheint dies bei der Untersuchung der Gender-Dimension nicht vorhanden zu sein.

CHAPTER

ONE

INTRODUCTION AND MOTIVATION

1.1 Background

Poverty and inequality in Bolivia have declined dramatically in the last 20 years. The International Financial Institutions (World Bank, IMF and regional investment banks) have acknowledged that the country achieved success pulling-out thousands of people out of poverty, halving the proportion of poor people from 2006 to 2016 (Vargas and Garriga, 2015). In the same line, the current government claims that it reduced inequality based on a combination of aggressive social policy while maintaining prudent fiscal management. It also seems clear that part of this success was based on the favorable external conditions, in specific the so-called "super cycle" of commodities' prices (Erten and Ocampo, 2013; Erdem and Ünalmış, 2016). It is plausible then that the success in reducing poverty and inequality was the result of sustained economic growth in the last ten years, in which the country grew continuously, at rates between 3,4% (2009, in the midst of the global financial crisis) and 6,8% (2013).

While the growth in Bolivia has been strong, there are some challenges that the country has to face to achieve long-term development. For example, maternal mortality is among the highest in the region (World Health Organization and UNICEF, 2014). In a related area, under-nutrition remains as one of the pressing issues concerning human capital formation. A recent report (IFPRI, 2017) have mentioned the lack of progress of the country (compared to other neighbors in the region) about hunger reduction. The disparities in the access to basic services (safe water and sanitation) between urban and rural areas might exacerbate this challenge. This is a problem in the development prospect of the country, as health status is a crucial determinant of future earnings, through its influence on the cognitive abilities of children (Bourguignon and Walton, 2007). Health issues harm the perspective of future earnings for the youth and adults, potentially creating a poverty-trap difficult to avoid.

Another area of concern is education. A great amount of resources out of the commodities' super-cycle have been spent in increasing education infrastructure. In addition, one of the most important conditional cash-transfer programs in the country is aimed to increase the enrollment rate of students in public schools. However, while infrastructure

is a necessary condition for improving the education, a change in focus towards a higher quality of education is required, and so more policy actions in this direction are needed. In addition, a recent report by the World Bank (de Hoyos et al., 2016) refers to the problem of the "ni-nis" generation: youth aged 15 to 24 years old that are not in school nor working[1]. One of the characteristics of the "ni-nis" is that they have dropped-out school, perhaps with the hope of earning a revenue to support their families. However, the job that an inexperienced and under-qualified youth could be able to get will be unstable and poor-paid. In the event of a negative shock, they will be back to unemployment and can be very difficult (or even impossible) for them to join school again. In this sense, this event could trigger a similar poverty-trap, affecting their lifetime income and productivity.

A combination of failure in education and health in certain stages of life (early in the case of health, and for education in the transition from the school to the job market or tertiary education) could challenge the country's profile for growth, potentially generating poverty and inequality traps (Bourguignon and Walton, 2007). This last is defined as a permanent state in which the most disadvantaged lack access to education, health, and economic opportunities. The persistence of inequality avoids social mobility and accumulation of wealth and human capital. This restriction can be deeply rooted in highly unequal societies, due to racial, religious or ethnic motivations, as well as other dimensions (e.g., gender, location).

Among policymakers and academia, there seems to be a consensus of the critical role that the state plays to prevent people falling into spirals of permanent poverty and inequality. It is accepted that the state should be a key actor in the developmental process (Acemoglu et al., 2015), taking its role as public goods provider, externalities' solver and as a guarantor of private property (Finan et al., 2015). In this sense, a way to achieve development is to conceive the state as a facilitator for the access of the population to basic goods and services like health and education. Then, we should aim for more efficient governments that tackle the necessities of their people, assuring the access to public goods and services, and guaranteeing property rights, adequate access to markets and the rule of law. Thus, the role of public policies is crucial in facilitating the progress of societies' (Miller et al., 2017).

The exposed arguments point to the existence of a critical connection between growth, inequality and poverty, and the role of the state through sound public policies. These links have been initially recognized by Bourguignon (2004), and subsequently acknowledged by further research (see, e.g., Fosu, 2017 and Ravallion, 2009). According to Bourguignon (2004), there has been a long-existing but mistaken dichotomy between equality and growth. Following this reasoning, the set of policies that promote growth should be separate from the role of social policies, that tackle issues like poverty and inequality. However, these concepts are closely linked, as Bourguignon (2004, p. 20) noted, "... developing countries sub-utilize their productive and growth potential to a greater degree in comparison to countries with fewer poor people or a more equitable distribution". In that sense, policies should promote equity for achieving high and sustained growth[2].

[1]The "ni-nis" denomination comes from the Spanish *"**ni** estudian **ni** trabajan"*.

[2]More recently, the focus has changed from inequality to inequity (Bourguignon and Walton, 2007), with this last term conceived as the lack of opportunities (Roemer, 2009), while the former is related to the distribution of income or consumption expenditures.

This dissertation then aims to throw light into the linkages between sustainable growth, poverty and inequality reduction and the influence of public policies on these outcomes.

1.2 Objectives of the study

Following Bourguignon (2004) and Montiel (2012), the links between inequality, growth, poverty reduction, and the potential influence of public policies on these outputs can be acknowledged using the conceptual framework depicted on Figure 1.1.

On the top of the figure, we have the goal of poverty reduction, both influenced by the distribution of income and economic growth. These concepts are at the same time related to each other: equity promotes economic growth through the opportunity to the individuals to exploit their capabilities, which in turn boosts development. Growth is defined by the so-called "deep determinants": human geography and physical geography. The human geography is referred to characteristics as race, ethnic diversity, religion. These are considered to be fixed, as well as the physical geography factors: climate, latitude, distance from the markets, among others. By being predetermined, it is assumed that public policies can hardly influence them.

Meanwhile, in the left-hand branch (distribution and distributional changes), the policies can and do have a crucial role in influencing the intermediate and proximate factors. One set of policies are aimed at increasing the institutional quality of a country, by improving contract enforcement, reducing corruption, and enhancing property rights, among others. The set of policies relevant to this dissertation is aimed to improve human capital, through advances in education, public services, and health, and by reducing group inequalities.

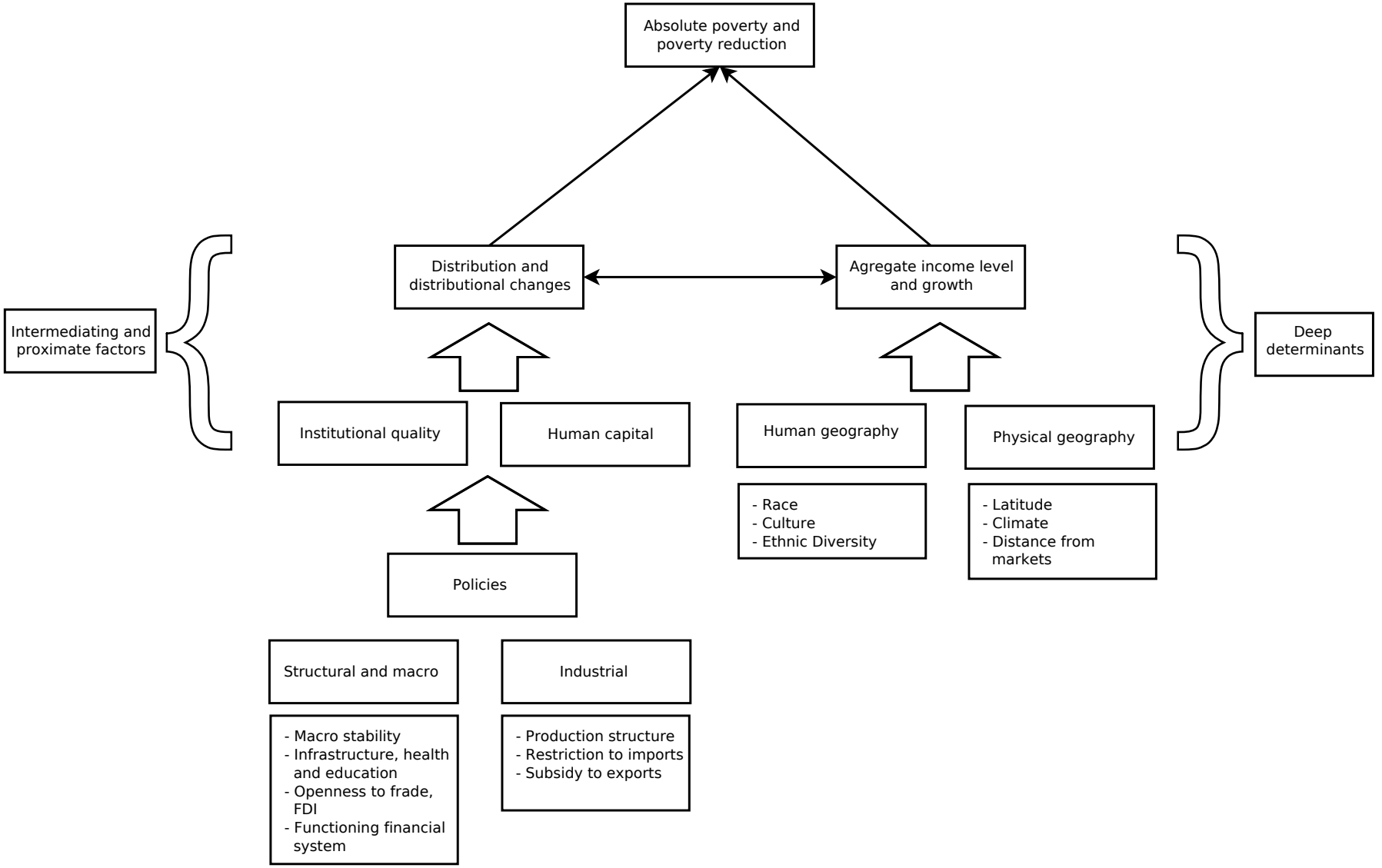
The overall objective of the dissertation will be to assess the role of the state in the developmental strategy in Bolivia, concerning specific policy measures. The policies that are subject to the analysis were aimed at:

- providing a safety net that could trigger investment in education and reduce child labor;
- increasing the transfers from the central government to the local governments, for improving infrastructure and health; and
- evaluating the influence of the system of transfers and taxes on horizontal (i.e., group) inequality.

The chapters of the dissertation will be based on this conceptual framework and will deal with policies related to education (chapter 2), health (chapter 3) and the fiscal system of taxes and transfers' influence on group inequality (chapter 4). Finally, chapter 5 will deal with the overall conclusions of the research and potential policy implications.

The focus on health and education outcomes is in line with the "equality of opportunities approach", in the sense that education and health contribute to the formation of human capital, and this is lastly the primary determinant for wealth (rather than income or consumption) redistribution (Bourguignon, 2004). At the same time, the fiscal

Figure 1.1: Conceptual framework



Note: Adapted from Bourguignon (2004) and Montiel (2012)

system of cash and in-kind transfers can contribute to raising the standard of living of the recipients, adding to their human capital accumulation. In this sense, the dissertation concerns long-term factors that contribute to sustainable growth and permanent reduction of poverty.

1.3 Structure of the dissertation

Chapter 2: The effects of an unexpected change in expected income on education and child labor: evidence from a Bolivian cash transfer

In this chapter, I study the unintended consequences that an exogenous change in the policy design (timing and size) of a cash transfer might have had on household's decisions over education and labor, for children and young people in school age (6 to 18 years old). Taken as a whole, the transfers do not differ in their magnitude, but from a behavioral point of view the change in the payment method could have an impact given inherent behavior-specific constraints like propensity to overspend and lack of commitment to save regularly.

I exploit the sudden and exogenous policy change using a difference-in-differences strategy. The objective is to assess the impact of this policy change on both school attendance and child labor comparing the outcomes of those affected by the policy change with those who were not. This study uses the combination of two rounds of a national-level household survey conducted in the country by the National Institute of Statistics, before and after the policy change (years 2007 and 2008). In addition to the use of difference-in-differences strategy, I use a combination of methodologies (matching+DiD) to account for potential differences between the treatment and control groups.

The expected contribution of this chapter is to shed light on the effect of a *change in the design* of a cash transfer. While there are plenty of evidence regarding the positive impact of cash transfers over a variety of outcomes (e.g., income, poverty, nutrition, etc.), few studies address the change in specific characteristics (as timing and size) that might affect the effectiveness of such transfers.

Research Questions

- What are the effects of the change in the design (timing and size) of a cash transfer given to the elderly in Bolivia?
- Has the change in timing and the size of the cash transfer increased attendance and decreased child labor in those households affected by the policy change?
- What are the implications for policy design, provided the restrictions of economic agents regarding lack of control of expenditures, propensity to overspend, or inability to save regularly?

Chapter 3: Increased fiscal decentralization, basic services, and nutrition: evidence from Bolivia

A fundamental question motivates the second chapter: does (fiscal) decentralization increase the delivery of public services or improve nutrition? This chapter explores this question, by exploiting an unusual increase in fiscal resources transferred by the central government to the municipal governments. The increase in the transfers should have improved the access of households to water and sanitation, and at the same time enhanced general living conditions leading to reduced child (under five-years-old) undernutrition. Besides exploring fiscal decentralization, I examine potential interactions with administrative and political decentralization, using elections data at the municipal level.

The dataset utilized to explore this issue comes from various sources: the fiscal transfers come from administrative records; the demographic characteristics and the access to safe water and sanitation come from two rounds of census data (2001 and 2012). For nutrition indicators, I combine the census data with demographic and health surveys (DHS) for years close to the census information to estimate nutrition indicators at the municipal level (nutrition maps methodology). The identification strategy relies on the use of a fixed-effects panel data estimator, in which the municipal and year fixed-effects allows to control for potential unobserved characteristics that could be correlated with the explanatory variables of the model.

This chapter aims to fill a gap in the literature, regarding the impact of fiscal decentralization on child-nutrition indicators. Also, the chapter explores the potential relationship between public sector management, service delivery, and the political institutions.

Research Questions

- Has increased fiscal decentralization increased the access of the population to basic services (safe water and sanitation), or improved child nutrition (specifically, by reducing stunting and underweight rates in under-five years old children)?
- Does the fiscal decentralization interact with administrative decentralization measures, and with political factors involved in the decision-making at the municipal level?
- Does the fiscal decentralization benefited the poor?

Chapter 4: Addressing horizontal inequality in Bolivia: what is the role of fiscal policy?

Finally, the third chapter studies the role of fiscal policy in the (reduction of) horizontal inequality. Horizontal inequality refers to the difference in income (or another welfare indicator) as a result of the membership to a specified group (determined, e.g., by race, gender, location, etc.). This difference could be relevant in a context in which specific groups have been historically excluded, as the case of indigenous people in Bolivia.

With this objective in mind, I use a tax-benefit incidence analysis model to assess the role of net public transfers (in-kind and cash transfers minus taxes) on horizontal

inequality in Bolivia for the year 2015. The group categories are defined by ethnic status, gender, and location, in addition to intersectionalities among those categories (e.g., being woman *and* indigenous, as compared with a base group). The document explores novel ways of defining the indigenous status, by using ethnolinguistic criteria. Besides, I study the combination of specific characteristics (e.g., location, self-identification) that could contribute to the native condition, through the estimation of an "indigenousness index". The methodology relies on a microsimulations model calibrated for Bolivia using the 2015 household survey carried out by the National Institute of Statistics.

The value added by this chapter relies on evaluating the impact of the fiscal policy on reducing between-groups inequality. So far, much focus has been put on the exploration of the absolute (or vertical) inequality, without taking into consideration the horizontal dimension of inequality. Research in this area is important because it could allow the overcome of exclusion concerning the so-called "equality of opportunities".

Research Questions

- Has the fiscal system of taxes and transfers reduced the horizontal inequality in Bolivia? In particular, what was the effect of the fiscal system over the inequality of indigenous vs. non-indigenous, female vs. male, and people living in rural areas vs. people living in urban areas, in the income distribution?
- How is this inequality increased if we combine more than two characteristics belonging to the groups? (i.e., being woman and indigenous).
- Is possible to integrate various dimensions to create a synthetic measure of indigenousness? What is the relationship of this synthetic measure with income?

CHAPTER

TWO

THE EFFECTS OF AN UNEXPECTED CHANGE IN EXPECTED INCOME ON EDUCATION AND CHILD LABOR: EVIDENCE FROM A BOLIVIAN CASH TRANSFER

2.1 Introduction

Conditional and unconditional cash transfers are increasingly used in emerging countries as a strategy to fight against poverty. Barrientos (2012) reports that between 0.75 and 1 billion people globally receive recurrent social transfers. In the Latin American region, the leading experience of *Progresa - Oportunidades* in Mexico and *Bolsa Escola - Bolsa Familia* in Brazil triggered a number of programs that rely in conditional and unconditional cash transfers. In Bolivia, one of the most important cash transfer programs is the *Renta Dignidad* transfer, which is an unconditional pension scheme providing a monthly sum of money to the Bolivian elderly (60 years old or more).

Renta Dignidad (RD) has its origins in the BONOSOL, an oldest unconditional cash transfer. From their beginning in 1997, BONOSOL Program transferred Bs.1800 (approximately USD 260, considering a rate of change of Bs.7=USD 1 in 1997) in cash to citizens over 65 years old. In December 2007, a law changed the scheme from 2008 onwards, changing some characteristics of the Program like the eligibility criteria (which was reduced from 65 years to 60 years old), the name of the Program (from BONOSOL to *Renta Dignidad*) and, most importantly, the timing of the transfer: instead of giving it as a lump-sum once-a-year transfer of USD 240, the Program changed the transfer to be instead a *monthly* installment of near USD 20.[3].

This chapter tries to shed light on the potential consequences of this change in education and child labor outcomes. The research aims to contribute to the literature about the impact of the change in relevant characteristics of cash transfers' programs. In other words, we want to know better the potential consequences of a change in the *design* of cash transfers' programs over specific indicators (in this case, education and child labor).

[3]This amount varied slightly if the recipient was already receiving other pension. Details are provided in subsection 2.2.2.

While *Renta Dignidad*'s amount was approximately the same as BONOSOL considering the yearly sum, this change might have had important consequences for the recipients and their families. BONOSOL's amount was sizable compared to average monthly income (Martinez, 2005 reports that BONOSOL's amount represented around 27% of national per capita income, 50% of income of the poor and 85% of annual income of the extreme poor), so it could have served as a start-up capital, easing credit constraints and enabling risk-taking activities that would lead to future increased returns. Because of saving constraints, it is possible that the smaller, but more frequent payments would be diluted through increased consumption without a lasting profitable use, although this claim is an empirical one.

One of the potential uses of a cash transfer could be to invest in the education of children in school age. Education is one of the most profitable investments (Psacharopoulos and Patrinos, 2004), considered as one of the most important means for improving life standards and getting out of poverty in the long term (Mihai et al., 2015). There is plenty of evidence regarding the positive impact of education on earnings (see Card, 2007 for a survey of the literature; a clever study exploiting an exogenous change with robust evidence is provided in Duflo, 2004), health (Kemptner et al., 2011), and wealth (Boshara et al., 2015). In turn, there is consensus about the (mostly) positive impact of conditional and unconditional cash transfers over education (among others, see Araujo et al., 2017 for evidence of the impact of a cash transfer program in Ecuador; de Groot et al., 2015 analyze the impact of a cash transfer in Ghana). However, there are few studies regarding the impact of the change in cash transfers' programs design over education (to the best of our knowledge, Barrera Osorio et al., 2011 is the only one that addresses this topic using a randomized control trial [RCT] in Colombia). In that sense, this research aims to contribute to the body of evidence with respect to the changing design of cash transfers, exploiting an exogenous policy modification in Bolivia.

The chapter encompasses the following sections: in the second part we will discuss the BONOSOL origins, their turning into RD and the potential consequences of this policy change, the third section will frame the empirical strategy and describe the data. In the fifth section we will present the results of the impact evaluation and present various robustness checks. Finally, Part 6 will conclude by suggesting possible strands for further investigation.

2.2 Background

2.2.1 Origins of BONOSOL

Cash transfers are relatively a new phenomenon in the Bolivian social policy. Preceding those, public works programs for generating jobs and income in financial stress times were probably among the first safety net programs. One of the first public works programs (not only in Bolivia but in Latin America) was the Bolivian FSE program (*Fondo Social de Emergencia* - Emergency Social Fund), which ran from 1987 to 1991. FSE invested roughly USD 198 million and helped to create 21.000 new direct jobs (Siri, 2003) and later, FIS and PLANE programs replaced FSE relying as well in a public works scheme to offer temporary jobs and income to vulnerable households.

A particular type of cash transfer, the "BONOSOL"[4] was implemented in 1997. It was a non-contributory pension scheme, consisting in a sum of money transferred to all elderly when they turned 65 years old and later-on, provided they had 21 years old or more up to December the 31th, 1995[5]. The funding for BONOSOL pension scheme came from the revenues of the privatization of some of the biggest public enterprises owned by the Bolivian state until 1995. BONOSOL transfer started in 1997 with a budget of approximately USD 87 million for that year, involving roughly 364,000 beneficiaries (Antonio, 2007). It was planned that this pension scheme would have a limited duration over time, and that the last beneficiary would receive their BONOSOL in year 2056 (Gamboa-Rivera, 2006). According to estimations, in the first 38 years the dividends from the Bolivian slice[6] would fund the pension scheme, while in the following years it should be financed by selling the remaining stock.

As mentioned, coverage of the transfer was universal for all elderly who had 65 years old or more, but restricted to the cohort aged 21 and over in 1995 (according to the Bolivian Capitalization Law 1544). The cash benefit involved a yearly transfer of Bs.1800 (roughly USD342 using the USD/Boliviano average official exchange rate in 1997), which was a very significant amount taking into account the poverty levels of the country and the enormous differences about quality of life between rural and urban areas. One particular characteristic was that the beneficiary received the transfer in their birthday each year after he/she turned 65 years old (starting on their 65th birthday).

BONOSOL program was subject to critics from its beginning due to the following factors (Gamboa-Rivera, 2006): i) the transfer was granted in an electoral year (1997), which lead to prebendalism suspicion; ii) there were doubts regarding its financial sustainability over time; iii) life expectancy was less than 65 years old in Bolivia at that time, so the actual impact of the transfer would not be relevant. Despite these criticisms, the administration initiated the distribution of the transfer in 1997. The new administration that took over the government in 1998 discontinued the cash transfer for two years, but started their distribution again in 2000, with a much smaller amount (USD 60 instead of USD 240). Timing of the benefit's distribution remained annual, but the administration changed the name to "Bolivida" (for more details see Barja and Urquiola, 2003). Earlier BONOSOL (with the initial sum of money) was re-established in 2002, restoring the lump-sum to USD 240 and changing the name back to "BONOSOL". Due to the Asian financial crisis at the end of the 90s, the government was pressured to carry out a tax reform in the country, but failed in their attempt[7]. After strong social unrest, President Sanchez de Lozada (who established the BONOSOL for the first time) resigned in 2003. Despite this adverse scenario, payment of the BONOSOL was maintained until 2007, although criticisms on the funding of the universal pension scheme remained (for example see Garron, 2007).

[4]Abbreviation in Spanish which means "Solidarity Bond".

[5]This is specified in the Law 1732, which created the transfer.

[6]The privatization scheme was a partial privatization, in which 50% of the public enterprises were sold to international investors and the remaining 50% were transferred to all Bolivian nationals that were 21 years old or older up to December the 31th, 1995.

[7]Basically, they tried to set up a proper income tax, but dealt with a drastic reduction of popular support (Perreault, 2006)

2.2.2 Policy change: from BONOSOL to *Renta Dignidad (RD)*

At the end of 2007, several changes were made to the BONOSOL program. The Congress approved those changes to the law on November 28, 2007, although the new scheme would start from January, 1, 2008. Among various modifications to the original BONOSOL, the new pension transfer included the following features: i) the name changed to *Renta Dignidad*; ii) the beneficiaries will be 60 years old or older Bolivian citizens (instead of 65 years old); and iii) the cash transfer would be paid monthly, instead of yearly as the BONOSOL. The amount of the RD transfer was Bs200 monthly (USD 27) for people not receiving any other pension, and Bs150 (USD 20 or 75% of the whole transfer) for people with another pension scheme.

We argue that the change in the timing of the transfer could have consequences in the decision making process of the recipient households (a household where at least an eligible member lives) and, in specific, we want to investigate if this change could have influenced the schooling decisions for children in school age (6 to 18 years old) living in the household.

The change in the cash transfer policy could have affected schooling decisions through various channels. One of these channels could be financial: at the beginning of the school year (which in Bolivia runs from February to November), the families need to spend a large sum of money in their children enrollment, for example by purchasing uniforms, textbooks and other types of school materials. Given the unexpected and sudden policy change in December of 2007 (and active since January 2008), the households in which a recipient lives received a much smaller quantity of money (provided their expectations about receiving a sizable lump sum). The reasoning implies that the households cannot afford anymore the fixed expenditure in education demanded by their children at the beginning of the year, and this maybe lead to a reduction in the education expenditure. The policy change then involves a reduction in enrollment or attendance, or even an increase in child labor, if the shock is strong enough that push families to look for other sources of income.

It could be argued that, because the transfer is given to the elderly, it should not have any other effect than on the own recipient's decisions (e.g., increasing its consumption). Indeed, maybe this could be the case for elderly living alone[8]. However, Latin America is one of the regions of the world with the most presence of extended families (Scott et al., 2015), meaning that it is likely that the elderly live with their children and grandchildren. This implies that a transfer given to an elderly (and all the changes to it) have more chances of affecting the decisions of the extended family. For example, Bertrand et al. (2003) explores the implications of cash transfers given to old adults in South Africa, provided that in South Africa many families still encompasses elder members living with the nuclear family. The authors find that when elderly are eligible for receiving the pension, there is a reduction of working hours of other members of the extended family. As another example, Duflo (2003) explore the potential effect of a social pension on nutrition indicators of children living with elderly (multigenerational households). She finds that the cash transfer had a positive impact on nourishment indicators (reducing

[8]Although even in this setting we could not rule-out potential transfers to their children or grandchildren.

stunting and wasting), especially on girls, when the recipient was a female pensioner. This evidence suggests that the effect of a cash transfer given to elderly could have impacts on the extended family, dependent on the context.

The consequences of the change in the timing of the transfer are not necessarily negative. A monthly transfer, even if smaller than the earlier one, imply that the household have a continuous flow of resources that could serve to afford recurrent expenditures, for example, to pay school fees, transport to the school, or other recurrent costs. In this sense, the policy change could instead imply an increase in school enrollment and attendance, and/or a decrease in child labor. By testing both possibilities, the effect of this policy change is indeed an empirical question.

2.2.3 Potential consequences of the change in the timing: empirical evidence

A part of the recent literature regarding policy interventions and their effect in development are focused in the role of "nudges". This concept involves a slight change in policy, in order to change or improve certain behavior. An example would be changing the default option in an application for retirement scheme triggered retirement savings (Beshears et al., 2009). Since the seminal work of Richard Thaler (see Thaler, 1985; Kahneman et al., 1991; Barberis and Thaler, 2003, among others), it has been recognized that most of the assumptions in which microeconomic theory relies are unrealistic, despite simplifying the analysis (Gowdy and Erickson, 2005; Datta and Mullainathan, 2014). One of these assumptions is the behavior of economic agents about the future. In a standard model of decision, we assume that a rational economic agent discounts the future by using a known rate (discount rate), and that this rate is constant over the time. However, studies have challenged this view about the future and how we evaluate the decisions to take, by formulating other discounting mechanism called "hyperbolic discounting", in which economic agents are more impatient in the near future, while in the far future they are more patient: the so-called present bias.

World Bank (2015) mentions that the present bias can affect the financial decisions made by households and make them sub-optimal. People tend to postpone difficult and complex financial decisions, for example regarding which insurance scheme to pick, but are more impatient on immediately-satisfying experiences, such as consumption. A potential consequence of this behavior is to over-consume in the present and to avoid taking important long-term decisions, like to which insurance scheme to affiliate. Policy can avoid this present bias through nudges and reminders, modification of default options, facilitating the so-called commitment devices, simplifying financial education, and using emotional persuasion.

Given the difficulty of economic agents regarding compromise (reflected in the present-bias problem), a potential policy solution would be to match the timing of income with the specific needs of the recipients. For example, Duflo et al. (2011) finds that farmers in Kenya increase fertilizer use if they can pre-purchase it at the harvest time, when they most probably have the available funds. In this way, by changing the possibility of purchasing the fertilizer in advance and by varying the timing of transfers to coincide with

the purchase, policy makers help to reconcile the needs of the farmer with their funds' availability.

Haushofer and Shapiro (2013) uses a transitory cash transfer scheme and make an experiment by varying the timing of the transfer (monthly and small transfer vs. a much higher lump-sum at over a longer period). The authors find that the lump-sum transfers favor asset accumulation but the monthly transfer favor food security (through more consumption). Additionally, the authors find that the lump-sum transfer is associated with lower levels of cortisol, meaning that the people that is receiving the lump-sum transfer is less stressed than the people receiving the monthly transfer. This would be because of the inability of the monthly recipients to save in order to make an important investment (which would require an initially-big amount of money). The authors do not find a difference with respect to the gender of the recipient (being this lump sum or monthly).

There is evidence that large lump sums might facilitate asset building or serve for investment. Muriithi and Matz (2015) study the effect of selling horticultural products in Kenya over smallholders' welfare measures (income and assets). The smallholders could sell their products to domestic or foreign markets (or both). One characteristic of the domestic market was that the smallholders were paid in bulk (as a single payment), while if the transaction involved the foreign market the payments were instead spread in installments. The authors find that the commercialization through the exports market was positively correlated to increased income but not to asset-building. This finding was explained by the fact that the proceeds for the foreign commercialization, as paid in installments, could be easily "eaten up", preventing their potential use for purchase durable goods (investment), provided the absence of savings mechanisms.

Similarly, Barrera Osorio et al. (2011) find evidence that the modification in the timing of a conditional cash transfer in Colombia improves educational outcomes (increases enrollment and attendance, and decreases child labor). The modification consists in holding back a part of a regular (bi-monthly) transfer and to give the retained funds as a lump sum at the beginning of the next school year. The rationale would be that at the beginning of the year there is a greater need for sizable expenditures like textbooks, uniforms and so on, and the yearly sizable transfer would serve better to this objective. In effect, the authors report that one of the most important reasons for dropping out school is the financial constraints that some households face, especially at the beginning of the school year. In this sense, retaining funds this year and make them available in the next school year would alleviate potential savings or credit constraints. So, coinciding the time of the necessity with the time (and the magnitude) of the transfer could increase welfare for the recipients.

While the evidence presented so far favors the retention (collection) of transfers, to make them coincide with specific needs of the recipients, another empirical strand argues that partitioning payments could be welfare-improving. For example, if households are impatient and they tend to over-consume resources when the payments are made, increasing the frequency of the payments would allow households to smooth consumption, and thus to increase welfare.

For example, Stephens and Unayama (2011) uses an exogenous yet expected change in a pension payment in Japan. The pension timing was once every three months and

then it changed to once every two months. The authors find that, after the change in the timing, households can smooth consumption better. The reason is that given an impatient behavior, household's consumption increase upon reception of the income/transfer and then significantly declines over the exhaustion cycle of the payment. In this sense, this evidence suggest that more frequent payments may reduce fluctuations in consumption.

Shapiro (2005) finds that people receiving food stamps in the US decrease their caloric intake by 10 to 15 percent over the month, reflecting short-term impatience and, as the end of the month approaches, the recipient households are in hardship reducing the quality or even the quantity in terms of the caloric intake. In this sense, they argue, a policy recommendation to ameliorate this behavior is to break the payments twice a month instead of once a month. In doing so, the resulting consumption smoothing allows to better plan their caloric intake during the month, and in this way to increase their welfare.

Using hospitalization records in California from years 1994 to 2000, Dobkin and Puller (2007) notes a sudden increase in the use of certain illegal drugs after payment of welfare benefits on the first day of the month. This behaviour implied a costly peak regarding restricted health resources (hospital, qualified human resources, etc.) each month. The authors then used an exogenous change in the timing of welfare distribution, and find that a more staggered distribution of welfare benefits helped to smooth the cycle of drug abuse and further hospitalization. Here, a policy recommendation would be to consider alternative timing of welfare benefits to avoid a potential "full wallet" effect that could have an adverse effect on drug abusers.

From this literature review, we could conclude that the effect of a change in the frequency of payments depends on the context and purpose of the money. For one side, the first group of evidence shows that accumulation of payments serve better if specific needs match a bigger transfer, i.e. one that requires a "pooling" of resources, thus improving the welfare of the recipients. Meanwhile, the second group of evidence suggest that a more phased distribution of resources help to smooth consumption and in this way to increase well-being of the recipients.

Considering the above, we plan to explore further the Bolivian experience on the change of timing of BONOSOL/RD transfer to evaluate its consequences for the recipients and their families. A change in the timing of a payment or transfer might lead to adjustments in the individual as well in the household's decisions. Individual and collective decisions are related to how much to spend, save and/or invest, and spending in child's education is one of the most important decisions that a family can take.

We picked attendance to the school and child labor as outcome variables because those reflect households' key decisions regarding the education of their children. While these activities are not mutually exclusive, a child who have to study and work at the same time will face greater challenges in comparison with a child whose only activity is to attend to the school, as plenty of research have shown in countries as Paraguay (Patrinos and Psacharopoulos, 1995), Tanzania (Akabayashi and Psacharopoulos, 1999) and Ghana (Heady, 2003). The effects of child labor ranges from decreased reading competence, increased chance of repetition and reduced educational attainment (Beegle et al., 2009), which could reproduce in last stance the poverty vicious cycle for the individuals and their families.

2.3 Empirical strategy

To find the impact of the change in timing of the BONOSOL/RD cash transfer scheme we would need to compare the outcomes with and without the policy change for the same households (counterfactual). Of course, this is not possible as we only see the "control" households (without the policy change) in 2007 and the "treatment" households (with the policy change) in 2008. A naïve approach addressing this problem is to consider the outcome in 2007 and compare it with the outcome in 2008. In doing so, we would be ignoring other factors (confounders) that could cause a change in the outcome after the policy change (Gertler et al., 2016; Blackman, 2013). To avoid this, we use instead a difference-in-difference (DiD) approach to estimate the causal effect of the policy change. DiD is often used to analyze the effects of policy changes or natural experiments (Blundell and Dias, 2009), and/or when the change comes unexpectedly (Khandker et al., 2009). DiD have the advantage of netting out the effect of any time-invariant effect that could also affect to the outcome before and after the policy change.

To apply the DiD strategy we need to define clearly the treatment and control groups, before and after the policy change (which happened as of January 2008). The treatment group is composed of those pupils living in a household in which an elderly who has been subject to the policy change also lives. An elderly was subject to the policy change if he/she turned 65 years old or more until December 31, 2007, so he/she received the BONOSOL in 2007 *at least once*. In turn, the control group are those pupils living in households in which there was no elderly entitled to receive the benefit as of 2007.[9]

Thus, a 65-years old person that received BONOSOL transfer in 2007 for the first time would not receive BONOSOL anymore from 2008 onwards. Instead, he/she received the much-smaller monthly transfer (RD). This example applies to all elderly that had at least 65 years old in 2007 and who received the BONOSOL in that year.

It is important to state that the policy change implied two main modifications: the first one, by changing the yearly transfer to a monthly one (and on which this research is focused). The second change is the modification in the criteria to be entitled to receive the transfer (60 years old instead of 65) from 2008 onwards. For our empirical strategy, we take into account *only* those households that have a recipient who had at least 65 years old in 2007 and received the BONOSOL in that year.[10] In this way, we are taking into account the potential effect that the policy change regarding the timing of the transfer could have had in household's education decisions[11].

In equation terms, the DiD coefficients can be estimated using OLS with the following expression:

$$\mathrm{y}_{ih} = \beta_0 + \beta_1 \mathrm{y2008}_{ih} + \beta_2 \mathrm{Treatment}_{ih} + \beta_3 \mathrm{y2008}_{ih} \cdot \mathrm{Treatment}_{ih} + \epsilon_{ih} \qquad (2.1)$$

[9] If the elderly were entitled to receive the benefit (i.e., had at least 65 years old by 2007) but not received it, we classify them as pertaining to the control group.

[10] Thus, we rule out the "new recipients" (i.e. those between 60 and 64 years old in 2008 and received the RD benefit in 2008 for the first time).

[11] There are a few cases in which a couple of beneficiaries live in the same household, with one recipient affected by the policy change and the other receiving the RD for the first time. In those cases, we assume that the dominating effect is that of the policy change, that is, the loss of the expected large transfer.

Where i and h subscripts refer to individual i living in household h. y2008 is a variable that takes the value of one for observations in year 2008 and zero otherwise (policy-change dummy). Treatment_{ih} takes the value of one if the pupil lives in a household where at least a beneficiary was subject to the policy change, and zero otherwise.

The coefficient of interest in this DiD setup is $\beta_1 + \beta_3$, i.e. the Average Treatment Effect on the Treated (ATET). This is because β_3 alone reflect the average treatment effect (ATE) of the policy change among treatment and control individuals. Instead, we are interested in the effect of the treatment (policy change) only on the treated individuals (ATET), i.e. on the individuals subject of the policy change (Imbens and Wooldridge, 2007; Newey, 2007).

The difference-in-differences method relies in two key assumptions: the 'parallel trends' assumption and the Stable Unit Treatment Value (SUTVA) characteristic (Blackman, 2013). The so-called parallel trends imply that the outcome of interest (in our case, the attendance to school and child labor) would have had the same trend, had the policy change did not happened. As this implies a counterfactual, there is no way to prove it. However, some authors (Blundell and Dias, 2009; Gertler et al., 2016; Khandker et al., 2009) consider that a plausible check for this assumption would be to plot the outcomes' paths (represented by their averages) before the policy change using previous round(s) of the data. In our case, we rely on a previous round of the household survey (2006) to plot such tracks, as shown in Figure 2.1:

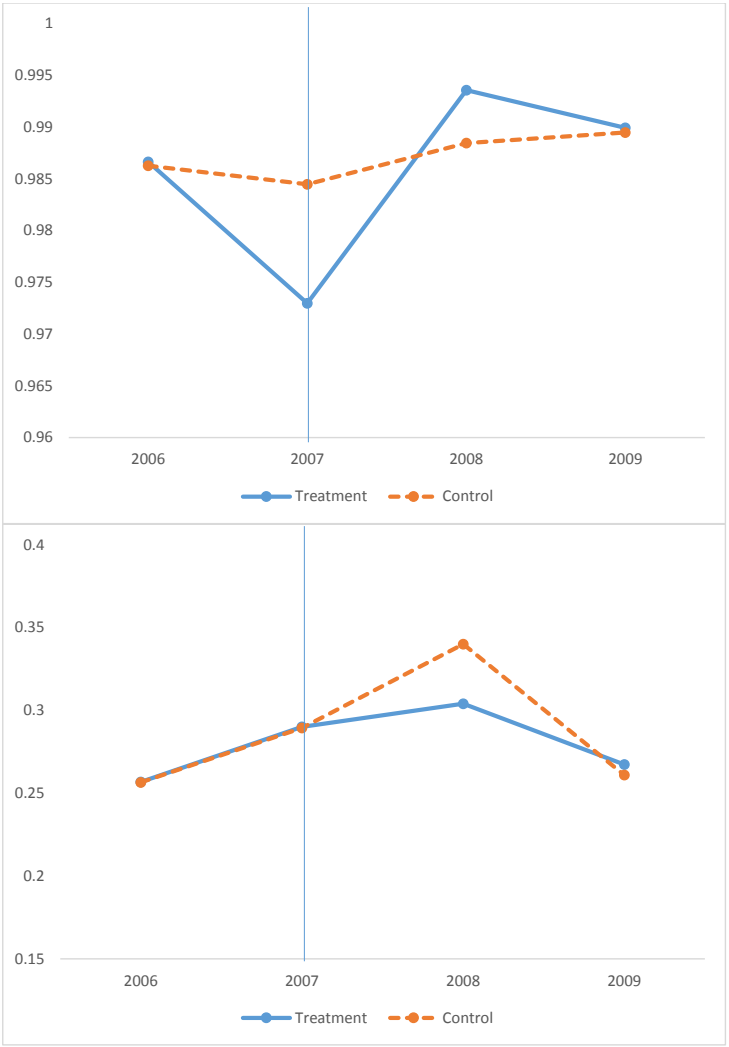
As Figure 2.1 shows, the paths of both outcomes are similar before the policy change (this is very clear in the case of child labor). In the case of the attendance rate, while the trends are roughly the same, it decreases noticeably for the treatment group in comparison with the control group in 2007 (just before the policy change). After the policy change, the average attendance rate in the treatment group increases significantly. In the case of child labor (lower panel), after the policy change the treatment group exhibits almost a flat trajectory, while the average of the control group increases more in comparison. While this evidence is not conclusive, it depicts that both outcome variables have roughly the same trajectory before the policy change, so we would plausibly expect that the behavior of both outcomes would have been the same in absence of the policy change.

In turn, the SUTVA assumption implies the absence of treatment spillovers. That is, despite not being subject to the treatment (policy change in our case), the control group would be influenced anyways and will change their behavior (so the evaluation of impact will be somehow "contaminated" Blackman, 2013). In the context of the present research, SUTVA implies that the policy change have not changed the behavior of those that were not subject of the policy change. We think that it would be difficult that the policy change, that was exogenous and totally unexpected, could trigger a change in the attendance rate or child labor of those who were not affected by the policy change. In that sense, assuming SUTVA in this case seems to be reasonable.

2.3.1 Data

We use a Bolivian household survey, the *Encuesta de Hogares* (EH) carried out by the National Institute of Statistics for years 2007 and 2008 (EH 2007 and EH 2008). In addition, we use earlier and later rounds (2006 and 2009 respectively), for robustness

Figure 2.1: Parallel trends check



Source: Own elaboration. The upper panel shows the trajectory of the average attendance rate for treatment and control group. Lower panel shows the trajectory of the average child work rate. The vertical line represents the policy change.

checks purposes. The EH is a household survey similar to World Bank's Living Standards Measurement Study (LSMS) survey. It incorporates a full set of socio-economic and demographic information about households in Bolivia[12]. While EH 2007 and EH 2008 information is collected by the same institution and using the same sampling procedure, both are based in independent sampling procedures. In this sense, the dataset is a repeated cross-sections for years 2007 and 2008 (and eventually years 2006 and 2009 as well). The sample size of the survey is 31,834 individuals in roughly 7,958 households assuming an average household size of 4 persons per household.

We are interested in educational outcomes that could have been affected by the policy change in BONOSOL/RD cash scheme. In this sense, our sample consists in children and youth whose age is between 6 and 18 years old[13]. We model the outcome variables as dummy variables: "attendance" takes a value of one if the person is currently attending to the school and zero otherwise; "worked" takes a value of one if the person reported that he/she worked at least one hour during the last week, and zero otherwise.

Table 2.1 presents descriptive statistics of the sample (children in regular school age, from six to eighteen years old), by comparing average individual and household characteristics for each year (2007 and 2008). The "treatment" column corresponds to those pupils living in a household that was subject to the policy change, in contrast to those who were not affected by this change ("control"). We apply a two-sided means test to both groups in each year.

Results from the means test show that none of the differences in our proposed outcome variables (attendance and child labor) is statistically significant for any of the two years. Considering individual characteristics of affected against those who were not affected by the policy change, Table 2.1 shows that there are statistically significant differences on native status and gender. In 2008, there are more native-origin children living in those households that were affected by the policy change than in the households that were unaffected. Meanwhile, there are more girls living in affected households, but again the difference is only significant for year 2008. Finally, children in affected households are enrolled in private schools more than non-recipients, although this difference is significant only for year 2007.

Regarding household characteristics, Table 2.1 shows that there are less school-aged members in recipient households than in non-recipient households. Recipient's households have heads that are consistently older than non-recipient's, perhaps because the recipients are the heads themselves, and so they pull up the average age. This fact could be consistent with female household head averages, which shows that there are more female household heads in recipient households, being this related to the characteristic feature of greater longevity of women in comparison with men. About other household characteristics, Table 2.1 shows that there are more recipients living in rural areas and more recipient households with native heads.

As shown in Table 2.1, the treatment group is remarkably larger than the control group. Some authors have suggested the use of matching techniques in combination with the DiD methodology [MDID] (Caliendo and Kopeinig, 2008; Gebel and Voßemer, 2014),

[12]Additional information about metadata of household surveys can be found at http://www.ine.gob.bo/anda/index.php/home

[13]This is the official age span for compulsory primary and secondary education.

Table 2.1: Summary statistics

	2007			*2008*		
Variables	**Treatment**	**Control**	**Diff.**	**Treatment**	**Control**	**Diff.**
Attendance	0.9715	0.9832	0.01	0.9931	0.9888	−0.01
Child labor	0.2539	0.2562	−0.00	0.2749	0.3058	0.04
Native proxy	0.1606	0.1772	0.00*	0.3058	0.2620	−0.05*
Female	0.4767	0.4854	0.03*	0.5395	0.4951	−0.05*
Private school	0.1192	0.0763	−0.04*	0.1203	0.0942	−0.03*
Age	12.3446	12.0236	−0.50	12.0825	11.9719	−0.15
First born proxy	0.5363	0.4604	−0.08***	0.5601	0.4612	−0.09***
HH members in school age	2.6451	2.8982	0.25***	2.3643	2.7796	0.41***
Rural household	0.3627	0.3153	−0.07	0.4777	0.4499	−0.04
Head is employed	0.7306	0.9174	0.17***	0.7526	0.9462	0.19***
Native household head proxy	0.3731	0.4159	0.01**	0.5326	0.4753	−0.07**
Age of the household head	59.0544	42.5340	−16.15***	59.2784	42.0641	−17.94***
Household head is female	0.3368	0.2299	−0.11***	0.3333	0.2121	−0.11***
Household head has college studies	0.1373	0.1475	0.01	0.0962	0.1129	0.02
Log of durable goods value	8.0460	7.8139	−0.19	7.9880	7.9144	−0.11
Log of monthly food expenditure	7.1329	7.0513	−0.07	7.2061	7.1709	−0.04
N	4797	446		4065	336	

Source: Own elaboration based on EH2007 and EH2008.
$* \ p < 0.1, ** \ p < 0.05, *** \ p < 0.01$

in order to ensure better comparability between treated and control groups, both before and after the policy change. As suggested in Blundell and Dias (2009), we will rely in an MDID strategy by estimating the propensity of being treated, using information on observable characteristics (at individual and household level) of the treated group after treatment to build the control groups. Afterwards, the DiD will be applied relying on the matched set of observations.

Specifically, to estimate the MDID, we follow the next steps[14]:

1. We use the treated group after treatment as the baseline for matching the remaining groups (treated/before, non-treated/before and non-treated/after).

2. With the estimated baseline, we reproduce the distribution of the variables used to apply the matching for the other three groups[15]

3. Once we have the baseline group and the matched sets of controls (each with their respective weights), we estimate the model as expressed in Equation 2.1 using only the baseline and the matched observations.

Following Guo and Fraser (2014), we use a set of variables that would probably influence the attendance and child labor outcomes. We classify the variables into individual characteristics and household characteristics. As individual characteristics, we use age, squared age, gender, native status of the children[16], a first-born dummy, and private school dummy. Household characteristics includes: number of household members in school age (6 y.o. to 18 y.o.), age of the household head, squared household head age, monthly food expenditures (log), self-assessed value of durable goods (log); gender and native status of the household head, if the household head is currently working, if he/she has some or completed university education and if the household is located in the rural area.

The balancing procedure proves to be effective, given the distribution of the propensity scores, as shown in Figure 2.2.

2.4 Results

2.4.1 Attendance

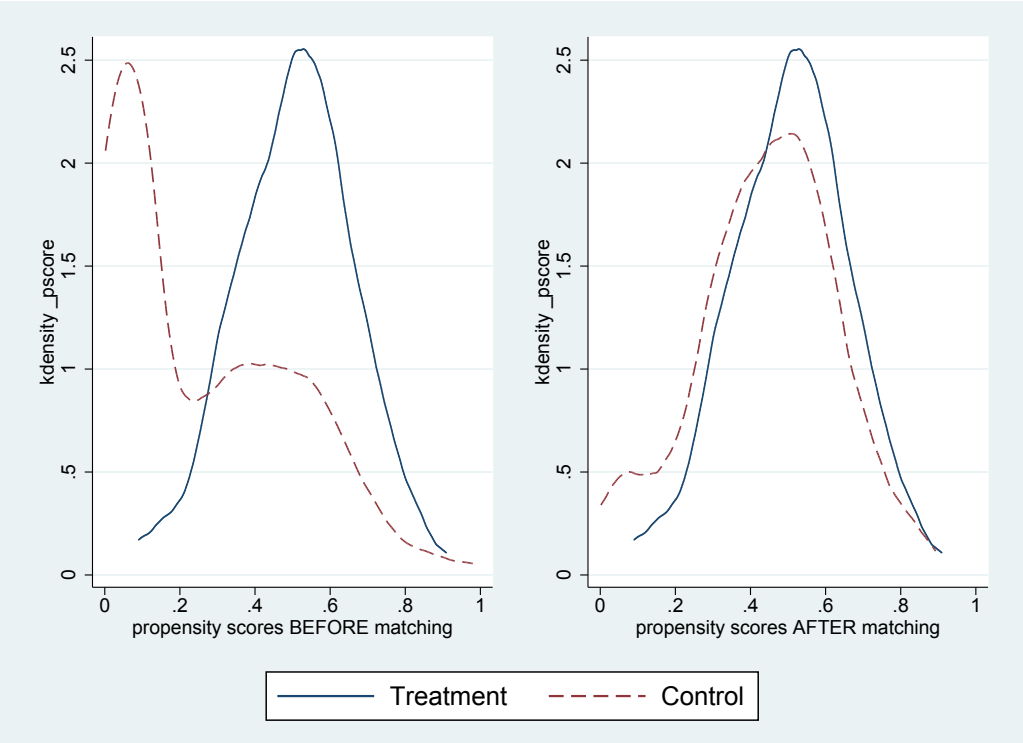
We report the results from the estimation of the model in Equation 2.1 using OLS for the attendance variable as defined above. We divide the estimation results in three parts: the first and second columns show the results corresponding to the primary cohort (6 y.o. to 11 y.o.) and secondary cohort (12 y.o. to 18 y.o.), respectively. The third column

[14]The regression results from the matching procedure are shown in the appendix.

[15]If a treated-after is not matched in some of the other three control groups, it needs to be dropped.

[16]There is a specific question in the questionnaire regarding self-membership into an indigenous group, but it is only asked to persons that are 12 years or older. So, we evaluate the native status by checking if the person has learned to talk in a native tongue, i.e. the variable takes the value of zero if the person has learned to talk in Spanish.

Figure 2.2: Distribution of propensity scores



Source: Own elaboration.

reports the results corresponding to the full sample (i.e., pupils between 6 and 18 years old).

Table 2.2 shows the results corresponding to attendance as an outcome variable of the DiD model. Policy change from BONOSOL to RD could imply a negative change in attendance because the affected families would adjust for this loss of expected income and, in an extreme case, stop sending their children to the school. However, other possibility could be that the frequent payments might enable to the household to plan better their expenditures, to have more predictability about their cash streams, and so to decide that their children attend regularly to the school.

The marginal effect of the policy change (ATET) is statistically significant at the 1% level, signaling a positive and statistically significant effect of the policy change on attendance to the school. The estimated coefficient implies that, without the policy change, the attendance rate would have been 0.96 instead of 0.99 (an increase of 3 percentage points). In addition, it is important to note that the effect on the secondary cohort is positive as well, indicating that grown-up pupils could have benefited from this policy change. The magnitude of the change in this cohort is the double than using the whole sample: without the policy change, the attendance rate in the secondary cohort would have been 0.925 instead of 0.9873 (the observed value), implying an increase of 6 percentage points.

This results are in line with the story regarding the positive effects of the policy change, presumably because it implied greater stability and predictability of payments. While the sizable lump-sum would have been useful in affording items as uniforms, textbooks, and school fees, it could be the case that the lump-sum needs to be available

Table 2.2: Estimation results from DiD + matching. Dependent variable=attend

	(1) Secondary	(2) Whole
Treatment	−0.049*	−0.029**
	(0.026)	(0.012)
y2008	0.021	0.007
	(0.016)	(0.006)
Treatment*y2008	0.042	0.026*
	(0.028)	(0.014)
ATET	0.062***	0.033***
F-test	7.531	7.373
p-value	0.006	0.007
Observations	610	1,228
R^2	0.027	0.014

$* \ p < 0.1, * * \ p < 0.05, * * * \ p < 0.01$

Note: Robust standard errors in parentheses. The coefficients were estimated using the matched sample. Matching procedure implied the dropping of primary-school cohort. Treatment take the value of one if the individual was treated, zero otherwise. y2008 takes the value of one in 2008, zero otherwise.

specifically at the beginning of the year, which is when families really need the money (Barrera Osorio et al., 2011). It is also important to note that the ATE (average treatment effect) is positive, implying that the policy change could have had a positive effect for both treated and non-treated groups (as indicated by the sign of the interacted coefficient [Treatment∗y2008]).

2.4.2 Child and youth labor

We consider in this section the effect of the policy change on the decision to work (considering school-aged pupils). Our dependent variable is a dummy variable which takes the value of one if the children/youth in school age have worked in the last week before the interview, and zero otherwise. Even if children reported not having worked in the last week, additional questions inquiry if they have taken part in work-related activities. Other activities considered as work are: helping in agriculture-related activities, working in the family business, street vending, and kitchen assistant, among others (excluding normal household chores, which are not considered as child labor). The question about labor activities is restricted to household members that have 7 years-old or more. In that sense, the size of the sample is slightly reduced in comparison with the other estimations.

Table 2.3 shows the results of the estimation and the corresponding marginal effects of the policy change (ATET) for pupils living in eligible households versus non-eligible households.

The results in Table 2.3 show a strong effect of the policy change (ATET) in the secondary cohort. This result is coherent given that a secondary-school child is more able to work (both physically and mentally), so the effect of the policy change could be relevant

Table 2.3: Estimation results from DiD + matching. Dependent variable=worked

	(1) Primary	(2) Secondary	(3) Whole
Treatment	0.053	−0.158***	0.006
	(0.047)	(0.061)	(0.039)
y2008	0.308***	−0.323***	0.014
	(0.054)	(0.057)	(0.039)
Treatment*y2008	−0.295***	0.214***	−0.071
	(0.076)	(0.078)	(0.055)
ATET	0.013	−0.109**	−0.057
F-test	0.059	4.114	2.223
p-value	0.807	0.043	0.136
Observations	555	610	1,165
R^2	0.067	0.058	0.003

$* \ p < 0.1, * * \ p < 0.05, * * * \ p < 0.01$

Note: Robust standard errors in parentheses. The coefficients were estimated using the matched sample. Treatment take the value of one if the individual was treated, zero otherwise. y2008 takes the value of one in 2008, zero otherwise.

only for this cohort. The statistically insignificant result regarding primary cohort is not surprising, given that the legal age for working in Bolivia was at least 14 years old. The estimated marginal effect imply that the proportion of working youth between 12 and 18 years old would have been 0.33 instead of the observed value of 0.27, a difference of about 6 percentage points. In addition, results from the parameters' estimation of the DiD model shows us that the ATE of the policy change (given by the interaction coefficient) is positive for the secondary school cohort, but its effect is attenuated by the y2008 dummy variable, indicating a strong decrease of child labor from 2007 to 2008 (the magnitude of the decrease is of 21 percentage points).

While the results using the full sample are weaker in statistical sense, the negative sign of the ATET indicates that the policy change might have triggered a reduction in child labor in general (for both cohorts).

2.4.3 Robustness checks

2.4.3.1 DiD and covariates

While the estimation of the MDID model is commonly utilized with datasets consisting of repeated cross sections, we should obtain similar results by using a related approach. This approach consists in estimating the model in Equation 2.1, including a set of covariates that take into account the differences between treatment and control groups. In other words, we estimate the following model by OLS:

$$\mathrm{y}_{ih} = \beta_0 + \beta_1 \mathrm{y2008}_{ih} + \beta_2 \mathrm{Treatment}_{ih} + \beta_3 \mathrm{y2008}_{ih} \cdot \mathrm{Treatment}_{ih} + \boldsymbol{\gamma} \cdot \mathbf{X_{ih}} + \boldsymbol{\psi} \cdot \mathbf{Z_h} + \epsilon_{ih} \quad (2.2)$$

Where i and h subscripts refer to individual i living in household h.

Independent variables include y2008 as a variable that takes the value of one for observations in year 2008 and zero otherwise (policy-change dummy). Treatment_{ih} takes the value of one if the pupil lives in a household where at least a beneficiary was subject to the policy change, and zero otherwise.

$\mathbf{X}$ is a vector of individual characteristics including gender, the proxy for native status and the interaction between both. Additionally, we include a dummy for the type of school the children attends (=1 for private school). Household characteristics are included in the vector $\mathbf{Z}$, including education of the household head, location of the household (urban or rural), among others. In all estimations, we use clustered standard errors at the primary sampling unit (PSU)[17].

Table 2.4 shows the results corresponding to attendance as an outcome variable of the DiD model. The marginal effect of the policy change regarding the whole sample is statistically significant, although its magnitude is rather small: it implies that the attendance proportion would have been 0.98 had the policy change not occurred.

Table 2.4: DiD model with covariates. Dependent variable=attend

	(1) Primary	(2) Secondary	(3) Whole
Treatment*y2008	0.007	0.019	0.014
	(0.006)	(0.018)	(0.011)
Treatment	−0.003	0.002	−0.001
	(0.006)	(0.015)	(0.010)
y2008	−0.003	0.011**	0.004
	(0.003)	(0.005)	(0.003)
ATET	0.004	0.030*	0.018*
F-test	0.574	2.912	2.772
p-value	0.449	0.088	0.096
Covariates	Yes	Yes	Yes
Observations	4432	4386	8818
R^2	.0067751	.0241238	.0206516

$* \ p < 0.1, ** \ p < 0.05, *** \ p < 0.01$

Note: Clustered standard errors in parentheses. Clustering is at the PSU (primary sampling unit) level. The dependent variable is measured at the individual level. The included controls are: if the children attends to a private school, a first-born dummy, gender, native status, and the interaction between both (measured at the individual level), as well as household controls.

With respect to the marginal effects by age cohort, the marginal effects (ATET) are statistical significant at the 10% level only for the secondary cohort. Another characteristic of the results for separate cohorts is that the variable corresponding to the post-policy change (y2008) is positive and statistically significant at the 5% level for the secondary cohort. This suggests that attendance has increased from 2007 to 2008 in the

[17]PSU is a geographical area consisting in 80 to 350 houses, from which the houses for the survey are randomly selected.

control group (i.e., those not subject to the policy change). This result coincides with the evolution of attendance rate as shown in Table 2.1.

According to the household characteristics, children living in more educated (as approximated by university education of the household head) and more mature household head are more prone to attend school attendance, being these the only statistically significant covariates in the model (see Table A1 and Table A2 in the appendix). The covariates of the model with cohort distinction confirm that children attending private school are less prone to attend to the school, but only in the secondary cohort. In that group the older children shows less attendance to the school, since older children near to the school completion could be more profitable out of the school rather than finishing their education.

In turn, Table 2.5 shows the estimation results using child labor as the dependent variable. The results indicate negative marginal effects (ATET) for the whole sample and for the secondary cohort (although only the result correspondent to the secondary cohort is statistically significant at 10% level). The ATET for the secondary cohort imply that the labor rate would have been 0.32 instead of the average observed rate of 0.23 (a difference of roughly 8 percentage points). In addition, results from the estimation shows that the ATE of the policy change (given by the interaction coefficient) is negative for the secondary school cohort, meaning that the policy change triggered a decrease in child work among eligible and non-eligible households.

Table 2.5: DiD model with covariates. Dependent variable=worked

	(1) Primary	(2) Secondary	(3) Whole
Treatment*y2008	0.029	−0.081	−0.032
	(0.045)	(0.050)	(0.040)
Treatment	−0.026	−0.000	−0.009
	(0.037)	(0.037)	(0.031)
y2008	−0.021	−0.002	−0.009
	(0.021)	(0.019)	(0.018)
ATET	0.008	−0.082*	−0.041
F-test	0.031	2.786	1.098
p-value	0.860	0.096	0.295
Covariates	Yes	Yes	Yes
Observations	3790	4386	8176
R^2	.345411	.3177649	.3291781

$* \ p < 0.1, * * \ p < 0.05, * * * \ p < 0.01$

Note: Clustered standard errors in parentheses. Clustering is at the PSU (primary sampling unit) level. The dependent variable is measured at the individual level. The included controls are: if the children attends to a private school, a first-born dummy, gender, native status, and the interaction between both (measured at the individual level), as well as household controls.

With respect to the other explanatory variables included in the model, we can see that most of them are aligned with economic theory and intuition (see Table A3 in the

appendix). For example, being native is positively correlated with child work, meaning that being a member of a traditionally dispossessed sector as an indigenous group would imply that the children in school age need to work to support their family expenditures. Another characteristic that is negatively correlated with child work is to be enrolled in a private school, because this implies an extra cost that only a wealthy family can afford.

So far, our results show that the policy change implied a child labor reduction only in the secondary-age cohort. As we have stated before, the policy change may have had different effects over household's education decisions. The sizable lump-sum could have helped the households to ease potential financial restrictions, and in this way the policy change could negatively impact attendance or caused an increase in child labor. On the other hand, the monthly cash transfer implied a change towards a continuous stream of additional income (despite being smaller), and the households could have incorporated this component of certainty in their expenditure decisions. Our results are more consistent with the second possibility, as we have established that the policy change triggered a reduction of child labor, in the secondary-school cohort. These results are consistent with the evidence regarding cash transfers, regarding increased school attendance (Edmonds, 2006; Akresh et al., 2013) and reduced child labor (Gee, 2010; de Silva and Sumarto, 2015; Edmonds and Schady, 2012).

2.4.3.2 Falsification tests

To assure that the effect of the policy change of RD/BONOSOL have affected the outcomes only between years 2007 and 2008 (years in which the policy change occurred), it would be useful to test a placebo policy change before and after the true policy change, in order to verify that for these periods the outcomes have not changed in the same direction than in the 2007/2008 period. This is one possibility of the so-called "falsification tests" (Gertler et al., 2016).

The testing procedure consists in estimating the marginal effects of nonexistent policy changes immediately before and after the BONOSOL/RD policy change. By evaluating these possibilities, we can discard that other factors apart from the policy change triggered the change in the educational outcomes.

We estimate the following equation, based in the DiD including covariates model:

$$\mathrm{y}_{ih} = \beta_0 + \beta_1 \mathrm{year}_{ih} + \beta_2 \mathrm{Treatment}_{ih} + \beta_3 \mathrm{year}_{ih} \cdot \mathrm{Treatment}_{ih} + \boldsymbol{\gamma} \cdot \mathbf{X_{ih}} + \boldsymbol{\psi} \cdot \mathbf{Z_{ih}} + \epsilon_{ih} \quad (2.3)$$

Where $\mathrm{Treatment}_{ih}$ here refers to a dummy variable for households in which a recipient lives (BONOSOL recipients in 2006 and 2007 and RD recipients in 2008 and 2009), year_{ih} considers either 2007 or 2009 (depending on which period -immediately before or immediately after- we are considering) and covariates are the same as of the DiD and covariates model.

Table 2.6 outlines the marginal effects for these periods[18], which are estimated following the same procedure as in Equation 2.2.

The fact that all except one of the estimated marginal effects are statistically non-significant is supportive of the results from the estimation of Equation 2.2. The marginal

[18]Complete results from the regression model are available in the appendix (Table A4.

Table 2.6: Marginal effects from the falsification test

	Attend			Labor		
	Primary	*Secondary*	*Whole*	*Primary*	*Secondary*	*Whole*
Before policy change						
ATET	-0.000	-0.031	-0.016	0.027	0.018	0.024
F-test	0.002	2.750	1.715	0.203	0.155	0.326
p-value	0.961	0.098	0.191	0.652	0.694	0.568
After policy change						
ATET	-0.001	-0.010	-0.005	0.014	0.042	0.034
F-test	0.847	0.420	0.461	0.081	0.622	0.667
p-value	0.358	0.517	0.497	0.776	0.431	0.415

$* \ p < 0.1, * * \ p < 0.05, * * * \ p < 0.01$
Source: own estimations using EH 2006-2007 and EH 2008-2009

effect of the policy change on attendance in the secondary cohort is statistically significant in the period before the policy change (2006-2007), although the coefficient is *negative*. However, this result does not invalidates our previous results with respect to the marginal effect of the policy change in the attendance rate. Given that the estimated marginal effect was positive, the negative marginal effect before the policy change actually imply that the policy change has been sufficiently strong to revert the potential tendency of this variable.

Jointly, the results from the placebo confirm the main results for the policy change between 2007 and 2008. The modification of BONOSOL into a monthly pension seem to have had consequences for working activities of children living in households subject to the policy change between 2007 and 2008 (specifically for the secondary school cohort).

2.4.3.3 Alternative control groups

Another possibility to test the robustness of our results would be to pick a control group sufficiently close to the treatment group (regarding to the variable that defines the boundary between both groups). In this case, that variable is the age: we defined the treatment group as those children living with pensioners (equal or more than 65 years old in 2007), so they were subject to the policy change in 2008. In that sense, as an additional robustness check we selected the control group as those not receiving the pension (i.e., the eldest family member having less than 65 years old in 2007), but somehow closer to this age threshold (for example, people which had 55 to 60 years old in 2007).

Accordingly, we restricted our control group according to two possible thresholds: 1) the eldest person living in the household being from 55 to strictly less than 60 years old in 2007 (control group A); and ii) the eldest person living in the household being from 50 to strictly less than 60 years old in 2007 (control group B). By restricting the control groups to these cohorts we try to control for potential unobservable characteristics that could be closely correlated to the age of the eldest person living with the household, but that is not sufficiently close to jump into the treatment group. In addition, to control those

characteristics that are observable, we apply the DiD model using the same covariates we include in the basic specification.

For the estimation of the DiD models we take into account the sample divided by age cohort and present the results distinguishing between primary and secondary age groups. Additionally, just as with the basic model, we take into account the fact that individuals in the sample may not be independent from each other, so we cluster the standard errors by the primary sampling unit (PSU). Then, we estimate the DiD model with covariates using the new-defined alternative control groups A and B (complete results are available in the appendix [Table A5]):

As we can see, the marginal effects corresponding to the child labor in the secondary school cohort are statistically significant and the signs of the effect are coherent with our previously estimated coefficient using the original control group. However, an additional feature that emerges from the modified control groups is that the marginal effect corresponding to the attendance is positive and statistically significant also for the secondary cohort. The sign of the marginal effect is consistent with the marginal effect of the policy change in child labor in the secondary cohort: while the policy change seems to have increased the attendance of the young people to school, at the same time it implied a reduction of the same group in working activities. Both marginal effects are observed using the alternative control group (Panel B). The robustness checks we applied are consistent with the main result that the policy change implied a reduction of the child labor in the secondary cohort and an increase in the attendance to the school.

Table 2.7: Marginal effects and OLS estimates for alternative control groups

Panel A: control group from 55 to 59 years old

	Attend		*Labor*	
	Primary	Secondary	Primary	Secondary
Treatment	−0.009	0.003	0.004	0.016
	(0.009)	(0.019)	(0.052)	(0.048)
2008 year dummy	−0.007	0.025	0.008	−0.037
	(0.008)	(0.021)	(0.061)	(0.048)
Treatment*year dummy	0.012	0.013	−0.001	−0.055
	(0.009)	(0.027)	(0.069)	(0.066)
ATET	0.005	0.038*	0.007	−0.092*
F-test	1.087	3.615	0.027	3.511
p-value	0.298	0.058	0.870	0.062
Observations	605	833	529	833
R^2	0.044	0.067	0.424	0.375

Panel B: control group from 50 to 59 years old

	Attend		*Labor*	
	Primary	Secondary	Primary	Secondary
Treatment	−0.008	−0.010	−0.009	−0.003
	(0.008)	(0.016)	(0.045)	(0.043)
2008 year dummy	−0.003	0.010	−0.094**	−0.041
	(0.004)	(0.012)	(0.044)	(0.035)
Treatment*year dummy	0.009	0.028	0.094	−0.050
	(0.006)	(0.021)	(0.058)	(0.057)
ATET	0.005	0.038**	−0.000	−0.092*
F-test	1.161	4.095	0.000	3.463
p-value	0.282	0.044	0.995	0.063
Observations	910	1,336	803	1,336
R^2	0.033	0.053	0.393	0.364

$* \ p < 0.1, * * \ p < 0.05, * * * \ p < 0.01$

Note: Clustered standard errors in parentheses. Clustering is at the PSU (primary sampling unit) level. The dependent variable is measured at the individual level. The included controls are: if the children attends to a private school, a first-born dummy, gender, native status, and the interaction between both (measured at the individual level), as well as household controls.

2.5 Conclusions

In this chapter we evaluate the potential effect that an unexpected policy change on a cash transfer to the elderly in Bolivia could have in school attendance and working activities of the children living with recipients of the transfer. Using matching techniques and a difference-in-difference methodology, we show that the change from a sizable yearly lump sum transfer to a much smaller monthly installment had a positive effect in the attendance rate and a negative one in child labor. The positive results have a bias towards older children: the effect of the policy change is statistically significant only for youth being in the secondary school (12 to 18 years old). We applied various robustness checks to reinforce the evidence presented by the main model, and we can claim that our results are specific to the period of the policy change. In this sense, the policy change seem to have had an overall beneficial effect over some educational outcomes, namely increased school attendance and reduced child labor activities.

Considering the monthly and yearly transfers, there is not *a priori* judgment about which of the schemes would be preferable. The empirical evidence is mixed with respect to a regular even small stream of income in counterpart to a rather big but long-interval lump sum transfer. Our results show that a monthly transfer could serve better the aim of getting children to keep going to the school, most probably due to the stability and continuity of the transfers, a result which have some support from the revised empirical evidence. While a sizable lump-sum transfer provides an important amount of money that could be used as a start-up capital, households might put more value on the regularity of the cash flows, by investing more in education after the policy change. Results regarding child labor, specifically in the secondary-cohort, support this evidence.

Possibly the potential of a sizable yearly transfer is more important when we consider other type of investments that households afford. In this sense, it is plausible that the potential use of the big lump sum could be more beneficial if we consider productive investments (i.e. investing in a small business or in acquiring productive assets). In this sense, future research could explore these possibilities by examining the relationship regarding timing of cash transfers and productive or other type of household-driven investments.

CHAPTER

THREE

INCREASED DECENTRALIZATION, BASIC SERVICES, AND NUTRITION: EVIDENCE FROM BOLIVIA

3.1 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 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 et al., 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 is related with the level of decentralization, or to 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 chapter 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 of the impact of decentralization on poverty and poverty-related outcomes is broad, but not conclusive (see, among others, Martinez-Vazquez and Timofeev, 2009; Birner and von Braun, 2015; Ahmad and Brosio, 2009). In addition, many authors have tried to analyze the relationship between decentralization and poverty reduction or intermediate outcomes (e.g. Ahlin and Mörk, 2008; Galiani et al., 2008; Soto et al., 2012) but no study, to the best of my knowledge, has evaluated the impact of decentralization on nutrition improvement. In this sense, this chapter aims to fill that gap in the literature.

The chapter 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.

3.2 Conceptual framework

In a broad sense, the process of decentralization entails the transfer of the tasks and duties[19] 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

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

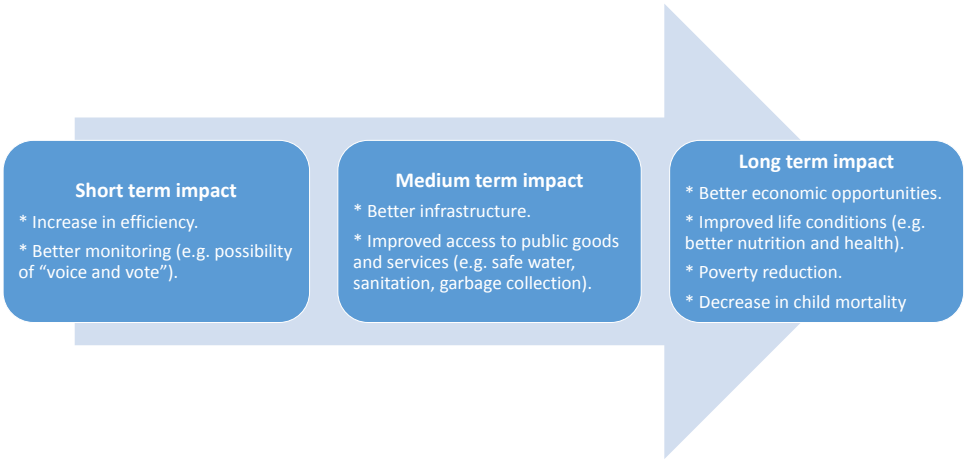
in the literature (see Birner and von Braun, 2015; Schneider, 2003, among others) to distinguish among three dimensions of decentralization. The first is the political dimension, which implies the assignment of certain governance processes (e.g. hold elections to choose local authorities). Further, the 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 it 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 should be more efficient at the local level (Bardhan and Mookherjee, 1998) in contrast to provision by the central government.

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 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 well-being 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 3.1 helps to have a better notion of the potential impacts of decentralization, by differencing them among short, medium and long-term effects.

Figure 3.1: Potential impacts of decentralization over time



Source: Own elaboration.

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 (2013) claim that more participation (beyond certain threshold) by local constituencies would even harm welfare. For instance, 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.

3.3 Impact of decentralization: review of the literature

The evidence of 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 reflects to which extent the central administration transfers economic resources to the local government to finance their operations and provide public goods (Canavire-Bacarreza et al., 2016; Martinez-Vazquez and Timofeev, 2009; Panizza, 1999). 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 and 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 (2008) 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) finds that administrative decentralization has a positive effect on education quality in Argentina, but it benefited more to the non-poor.

Regarding healthcare, Montero-Granados et al. (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, 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 et al. (2001) find a positive and considerable effect of (fiscal) decentralization on infant mortality. Considering a broader impact of decentralization, Gemmell et al. (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 et al., 2009). In this sense, investing in nutrition becomes one of the most profitable social investments that public policy could achieve.

3.4 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 discretionary 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 considerably 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 municipal government.

Some indicators of the reform are summarized in Table 3.1, 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.

Table 3.1: 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
Municipalities receiving central govt. funds	61	311
Share of central govt. funds	10%	20%
Distribution	Legal residence	Population
Municipal investment[a]	11%	20%
Social investment[b]	1.72%	3.62%
Investment in education	USD 10 million	USD 30 million
Grassroots organizations	Less than 100	More than 19,000
Towns holding elections	124	311

[a] As proportion of total investment
[b] As proportion of GDP
Source: Own elaboration based on Barja Daza et al. (2013) and Graham (1997)

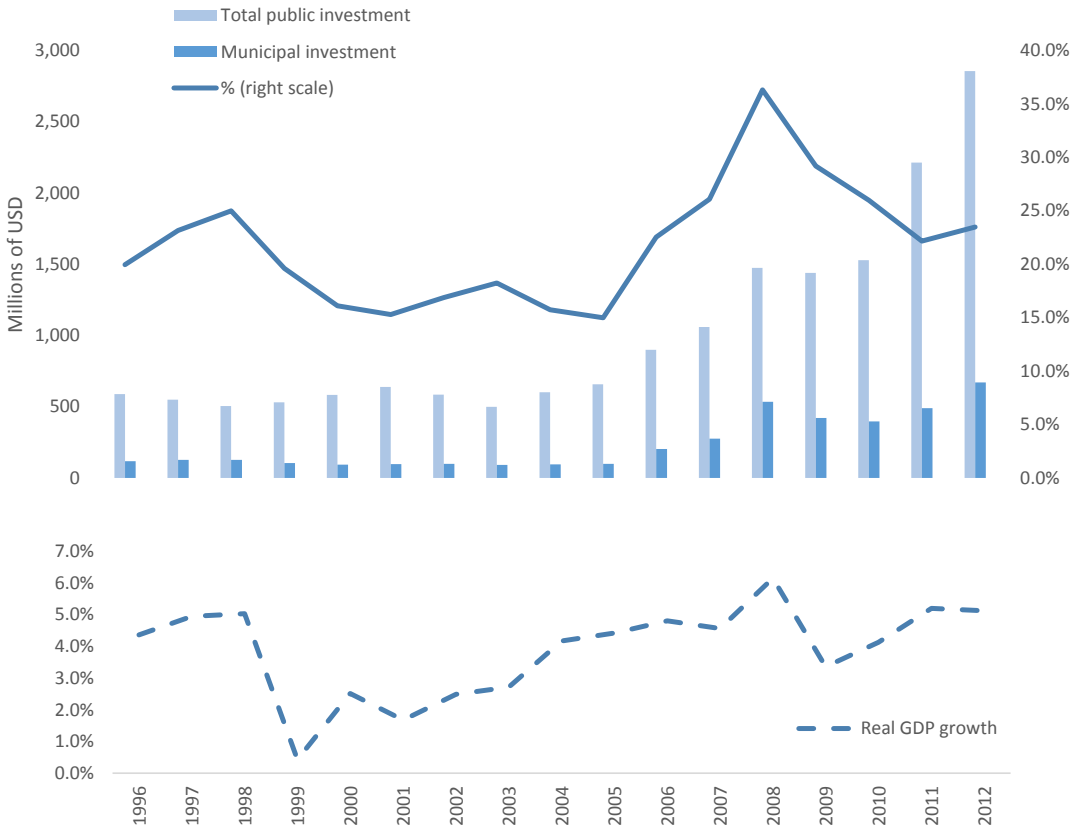
Previous to the reform, not all the municipalities[20] were legally recognized as administrative units. In this sense, few of them were entitled to receive funding from the central government, or to hold elections of local authorities. In this sense, the responsibility to provide local public goods was 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 remotest 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 3.2). The behavior of public investment was largely influenced by the economic cycle, and the cycle at the same was 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.

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. Those are composed of: 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. A maximum of 20% of total revenues can be used for recurrent expenditures (e.g. salaries of local authorities, office supplies, etc.), while the remaining 80% is to be used in in-

[20]Municipalities are administrative unites smaller than provinces.

Figure 3.2: Total and municipal public investment in Bolivia



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

vestments (mainly infrastructure). Distribution of revenues for municipal governments is shown in Table 3.2.

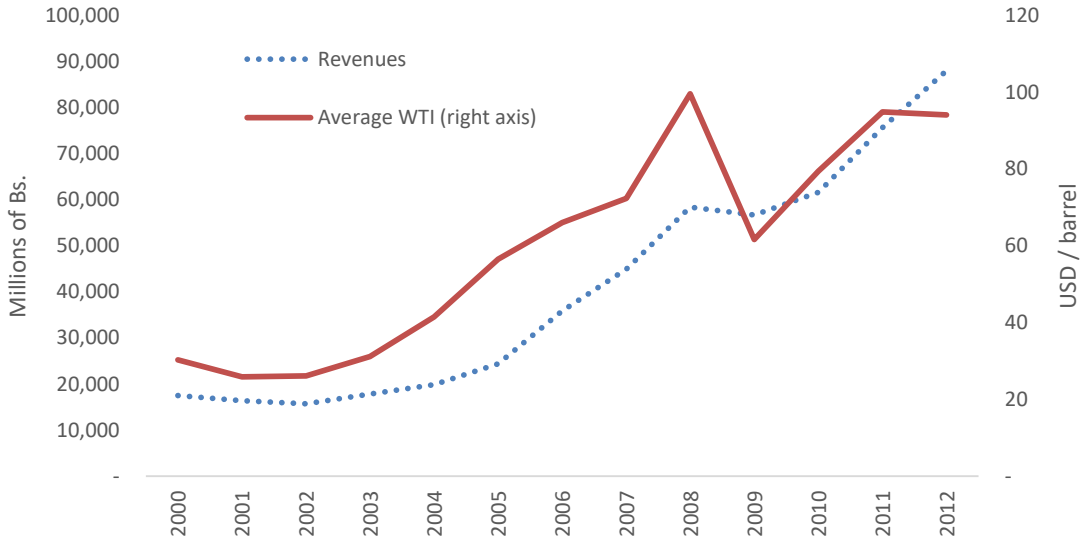
Table 3.2: Distribution of municipal revenues (in millions of Bs. and in percentages)

	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. Sum of percentages may differ from 100 due to rounding.

Considering the figures from Table 3.2, 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 3.3).

Figure 3.3: Central government revenues and price of oil (WTI)



Source: Own elaboration using data from the Ministry of Finance.

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[21]. The author uses 3 types of explanatory variables for poverty reduction: i) social investments (main variable), ii) political variables[22], 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[23] 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) tries 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.

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 et al. (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[24].

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

[21]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.

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

[23]That is, the person that leads the municipal government.

[24]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.

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.

3.5 Data

Table 3.3 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.

Table 3.3: Summary statistics

		2001		2012	
VARIABLES	N	Average	SD	Average	SD
Population (habitants)	314	25,540	92,091	31,075	112,360
Indigenous proxy[1] (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	1503	1040
Number of hospitals	314	8	13	9	14
Number of schools	314	45	58	51	79
Access to toilet (proportion)	314	0.4	0.27	0.48	0.27
Access to safe water (proportion)	314	0.38	0.23	0.5	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.

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 and Lanjouw, 2002; Ebener et al., 2015; 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) collected from the Ministry of Finance. Geographical information (area, altitude, slope and distance to the sea) comes from data compiled in UDAPE (2015a).

3.5.1 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 and Timofeev, 2009), 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.

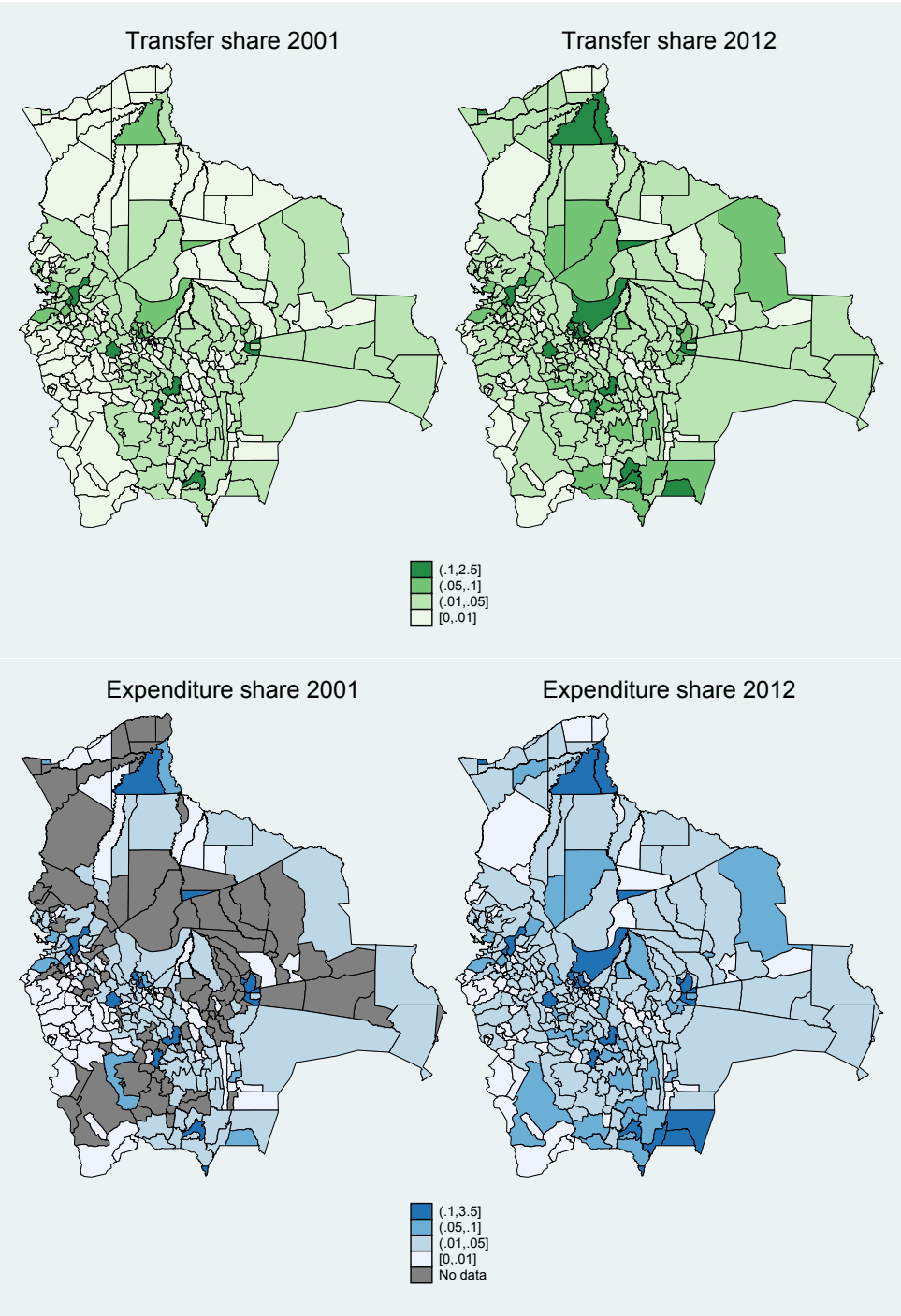
In the available literature, decentralization has often been measured as the percentage of revenues or expenditure of municipal government out of the total revenues (expenditure) of the whole public sector (Panizza, 1999). Arzaghi and Henderson (2005) measure fiscal *centralization* by using the ratio of central government in total government consumption expenditures, so this implies that decentralization could 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) affirms 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 the main proxy 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 (out 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.

Figure 3.4 shows the fiscal decentralization proxies (i.e., the transfer share and the expenditure share) in the 314 municipalities in Bolivia. As it can be seen, there is a noticeable geographic variability, and a general increase of the revenues (via transfers) and expenditures in 2012. It is also clear, however, that expenditure data is missing in some of the municipalities in 2001 (98 out of 314 observations for that year). In this sense, I rely primarily in the transfer share as the main fiscal decentralization proxy variable.

While the expenditure and revenue share measures are 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

Figure 3.4: Transfer and expenditure shares



Source: Own elaboration using data from the Ministry of Finance. The definition of the variables are provided in Table 3.4

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 et al., 2014), while the dummy for political alignment could reflect coordination between central and local governments. Table 3.4 details the variables that are used for the estimations.

3.6 Empirical strategy

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

$$\mathrm{y}_{mt} = \alpha_m + \gamma_0 \cdot \mathrm{d2012}_t + \phi \cdot \mathrm{X}_{mt} + \boldsymbol{\beta} \cdot \mathbf{Z_{mt}} + \epsilon_{mt} \tag{3.1}$$

Where y_{mt} is the outcome of interest (nutrition and access to sanitation and safe water) in municipality m and year t, α_m are municipality fixed effects, $\mathrm{d2012}_t$ 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), the covariates I use are the average family size, a proxy for the share of indigenous population and the average illiteracy rate per municipality. Additional covariates include the regional GDP[25] and municipality population. These variables are included to account for general economic performance at the local level (regional GDP), 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.

In addition to the estimation of Equation 3.1, and in order to evaluate the potential interaction between different types of decentralization, I estimate the following equation:

$$\mathrm{y}_{mt} = \alpha_m + \gamma_0 \cdot \mathrm{d2012}_t + \phi \cdot \mathrm{X}_{mt} + \delta \cdot \mathrm{X}_{mt} \cdot \mathrm{g}_{mt} + \zeta \cdot \mathrm{g}_{mt} + \boldsymbol{\beta} \cdot \mathbf{Z_{mt}} + \epsilon_{mt} \tag{3.2}$$

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

[25]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.

Table 3.4: Variables used in the estimation

Variable type and 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

and focused municipal expenditures). All the other variables remain as detailed in the estimation of Equation 3.1.

3.7 Results

3.7.1 Water and sanitation

Table 3.5 shows the results from the model estimation with access to safe water as the dependent variable and the focused expenditure as the fiscal decentralization proxy. Column 1 of the table shows the base model (Equation 3.1) 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 (Equation 3.2).

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 needed 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[26]) results in a non-significant coefficient (although still positive).

Table 3.6 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 are non-significant for all the specifications. 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

[26]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).

Table 3.5: FE OLS results, dependent variable=access to water

	(1)	(2)	(3)	(4)	(5)
Expenditure share in sanitation	0.005	0.005	0.011	0.002	−0.004
	(0.003)	(0.020)	(0.010)	(0.006)	(0.005)
Participation in elections		−0.077			
		(0.402)			
Expenditure share in sanitation · Participation in elections		−0.001			
		(0.030)			
Share of public workers(log)			0.013		
			(0.038)		
Expenditure share in sanitation · Share of public workers(log)			0.001		
			(0.003)		
Voter's support				0.059	
				(0.205)	
Expenditure share in sanitation · Voter's support				0.007	
				(0.017)	
Political alignment=1					0.118
					(0.079)
Political alignment=1 · Expenditure share in sanitation					0.012*
					(0.006)
Rural	−0.294***	−0.294***	−0.241***	−0.294***	−0.275***
	(0.075)	(0.076)	(0.057)	(0.074)	(0.081)
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	−0.008	−0.006	−0.001	−0.006	−0.001
	(0.025)	(0.025)	(0.025)	(0.025)	(0.024)
Population(log)	−0.174***	−0.185***	−0.130***	−0.181***	−0.182***
	(0.047)	(0.045)	(0.045)	(0.048)	(0.047)
Regional GDP(log)	0.184***	0.183***	0.173***	0.182***	0.185***
	(0.055)	(0.056)	(0.054)	(0.055)	(0.064)
Year 2012 dummy	−0.033	−0.022	−0.031	−0.028	−0.034
	(0.049)	(0.049)	(0.047)	(0.048)	(0.048)
Observations	480	480	478	480	480
R^2	0.64	0.64	0.64	0.64	0.65
Municipality FE	Yes	Yes	Yes	Yes	Yes

$*p < 0.1, **p < 0.05, ***p < 0.01$. Clustered standard errors in parentheses. Clustering is at the province level. Variables described in Table 3.4

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 and 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.

3.7.2 Nutrition indicators

Table 3.7 shows the results of the regression model considering the proportion of underweight children as the dependent variable, with the transfer share as the fiscal decentralization indicator. 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.

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 percentage points. 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 2.79 percentage points (93 x 0.0003).

Table 3.8 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).

Regarding the proportion of stunted children as the dependent variable, Table 3.9 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 percentage points in the proportion of stunted children, but the effect is reinforced when the share of public officials also increases. Figure 3.5 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.

Table 3.6: FE OLS results, dependent variable=access to sanitation

	(1)	(2)	(3)	(4)	(5)
Expenditure share in sanitation	0.003	0.012	0.027	0.005	0.001
	(0.004)	(0.018)	(0.020)	(0.008)	(0.006)
Participation in elections		−0.485			
		(0.364)			
Expenditure share in sanitation · Participation in elections		−0.017			
		(0.028)			
Share of public workers(log)			0.086		
			(0.055)		
Expenditure share in sanitation · Share of public workers(log)			0.006		
			(0.005)		
Voter's support				−0.094	
				(0.209)	
Expenditure share in sanitation · Voter's support				−0.006	
				(0.017)	
Political alignment=1					0.013
					(0.077)
Political alignment=1 · Expenditure share in sanitation					0.002
					(0.006)
Rural	−0.048	−0.042	−0.034	−0.042	−0.041
	(0.061)	(0.065)	(0.066)	(0.061)	(0.064)
Indigenous proxy	0.141	0.086	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	−0.033	−0.026	−0.027	−0.032	−0.030
	(0.026)	(0.025)	(0.026)	(0.026)	(0.025)
Population(log)	−0.023	−0.068*	−0.025	−0.026	−0.025
	(0.040)	(0.040)	(0.046)	(0.039)	(0.040)
Regional GDP(log)	0.096**	0.093**	0.080*	0.091**	0.089**
	(0.039)	(0.040)	(0.047)	(0.039)	(0.043)
Year 2012 dummy	−0.008	0.036	0.005	−0.003	−0.009
	(0.040)	(0.038)	(0.040)	(0.040)	(0.040)
Observations	480	480	478	480	480
R^2	0.46	0.49	0.47	0.46	0.46
Municipality FE	Yes	Yes	Yes	Yes	Yes

$*p < 0.1, **p < 0.05, ***p < 0.01$. Clustered standard errors in parentheses. Clustering is at the province level. Variables described in Table 3.4

Table 3.7: FE OLS results, dependent variable=underweight (transfer share)

	(1)	(2)	(3)	(4)	(5)
Transfers share(log)	−0.030***	−0.043**	−0.018	−0.031***	−0.031***
	(0.008)	(0.018)	(0.018)	(0.009)	(0.009)
Participation in elections		0.148			
		(0.258)			
Transfers share(log) · Participation in elections		0.018			
		(0.025)			
Share of public workers(log)			0.013		
			(0.035)		
Transfers share(log) · Share of public workers(log)			0.002		
			(0.004)		
Voter's support				0.023	
				(0.110)	
Transfers share(log) · Voter's support				0.002	
				(0.011)	
Political alignment=1					0.007
					(0.037)
Political alignment=1 · Transfers share(log)					0.001
					(0.004)
Rural	0.012	0.013	0.010	0.012	0.013
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Indigenous proxy	0.025	0.026	0.015	0.026	0.021
	(0.068)	(0.067)	(0.076)	(0.074)	(0.070)
Illiteracy	0.110	0.102	0.108	0.116	0.102
	(0.077)	(0.078)	(0.077)	(0.072)	(0.081)
Household size	0.009	0.009	0.011	0.009	0.010
	(0.008)	(0.009)	(0.009)	(0.009)	(0.008)
Population(log)	0.024	0.025	0.018	0.025	0.024
	(0.015)	(0.018)	(0.015)	(0.016)	(0.015)
Regional GDP(log)	−0.023	−0.023	−0.023	−0.022	−0.024
	(0.032)	(0.032)	(0.033)	(0.033)	(0.033)
Year 2012 dummy	0.023	0.025	0.025	0.023	0.023
	(0.019)	(0.022)	(0.020)	(0.021)	(0.020)
Observations	628	628	623	628	628
R^2	0.21	0.22	0.22	0.21	0.22
Municipality FE	Yes	Yes	Yes	Yes	Yes

$*p < 0.1, **p < 0.05, ***p < 0.01$. Clustered standard errors in parentheses. Clustering is at the province level. Variables described in Table 3.4

Table 3.8: FE OLS results, dependent variable=underweight (expenditure share)

	(1)	(2)	(3)	(4)	(5)
Expenditures share(log)	−0.014*	−0.022	−0.025	−0.014	−0.015*
	(0.007)	(0.021)	(0.019)	(0.008)	(0.009)
Participation in elections		0.153			
		(0.287)			
Expenditures share(log) · Participation in elections		0.013			
		(0.026)			
Share of public workers(log)			−0.043		
			(0.038)		
Expenditures share(log) · Share of public workers(log)			−0.003		
			(0.004)		
Voter's support				−0.014	
				(0.104)	
Expenditures share(log) · Voter's support				−0.000	
				(0.010)	
Political alignment=1					0.004
					(0.031)
Political alignment=1 · Expenditures share(log)					0.000
					(0.004)
Rural	0.004	0.001	−0.008	0.006	0.004
	(0.025)	(0.026)	(0.025)	(0.024)	(0.024)
Indigenous proxy	−0.032	−0.029	−0.037	−0.043	−0.031
	(0.091)	(0.090)	(0.102)	(0.099)	(0.094)
Illiteracy	0.102	0.108	0.094	0.093	0.103
	(0.089)	(0.091)	(0.088)	(0.079)	(0.095)
Household size	0.006	0.005	0.006	0.007	0.007
	(0.009)	(0.010)	(0.009)	(0.009)	(0.008)
Population(log)	0.014	0.022	0.007	0.013	0.014
	(0.018)	(0.022)	(0.019)	(0.019)	(0.018)
Regional GDP(log)	−0.008	−0.009	0.006	−0.011	−0.008
	(0.028)	(0.028)	(0.030)	(0.029)	(0.029)
Year 2012 dummy	−0.002	−0.010	−0.008	0.002	−0.001
	(0.019)	(0.023)	(0.021)	(0.022)	(0.019)
Observations	530	530	525	530	530
R^2	0.19	0.20	0.21	0.20	0.19
Municipality FE	Yes	Yes	Yes	Yes	Yes

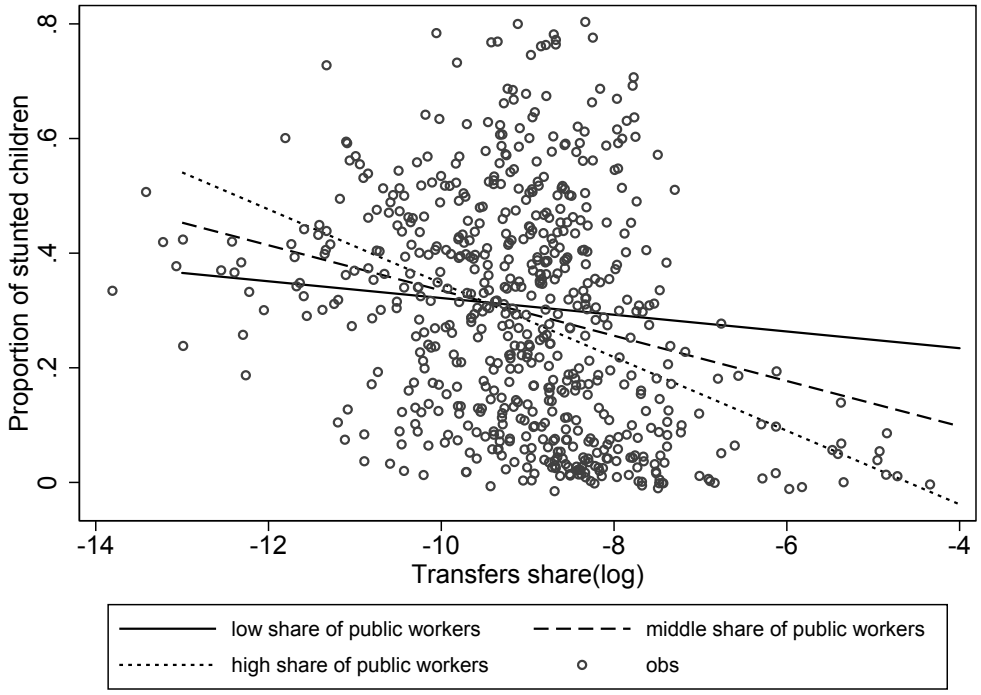
$*p < 0.1, **p < 0.05, ***p < 0.01$. Clustered standard errors in parentheses. Clustering is at the province level. Variables described in Table 3.4

Table 3.9: FE OLS results, dependent variable=stunting (transfer share)

	(1)	(2)	(3)	(4)	(5)
Transfers share(log)	−0.057***	−0.051	−0.102***	−0.031*	−0.059***
	(0.015)	(0.032)	(0.032)	(0.017)	(0.018)
Participation in elections		−0.029			
		(0.383)			
Transfers share(log) · Participation in elections		−0.007			
		(0.040)			
Share of public workers(log)			−0.118		
			(0.076)		
Transfers share(log) · Share of public workers(log)			−0.012*		
			(0.007)		
Voter's support				−0.489***	
				(0.171)	
Transfers share(log) · Voter's support				−0.055***	
				(0.017)	
Political alignment=1					0.011
					(0.067)
Political alignment=1 · Transfers share(log)					0.002
					(0.008)
Rural	0.051	0.049	0.024	0.037	0.052
	(0.047)	(0.046)	(0.051)	(0.048)	(0.047)
Indigenous proxy	−0.050	−0.050	−0.031	0.024	−0.054
	(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	0.088***	0.087***	0.086***	0.082***	0.088***
	(0.018)	(0.017)	(0.018)	(0.017)	(0.018)
Population(log)	−0.012	−0.010	−0.027	−0.016	−0.013
	(0.033)	(0.035)	(0.033)	(0.035)	(0.033)
Regional GDP(log)	0.057	0.057	0.075*	0.064	0.056
	(0.041)	(0.042)	(0.041)	(0.040)	(0.043)
Year 2012 dummy	0.056	0.051	0.046	0.040	0.057
	(0.038)	(0.037)	(0.039)	(0.040)	(0.039)
Observations	628	628	623	628	628
R^2	0.56	0.56	0.57	0.58	0.56
Municipality FE	Yes	Yes	Yes	Yes	Yes

$*p < 0.1, **p < 0.05, ***p < 0.01$. Clustered standard errors in parentheses. Clustering is at the province level. Variables described in Table 3.4

Figure 3.5: Marginal effect of an increase in the transfer share, by public workers' share



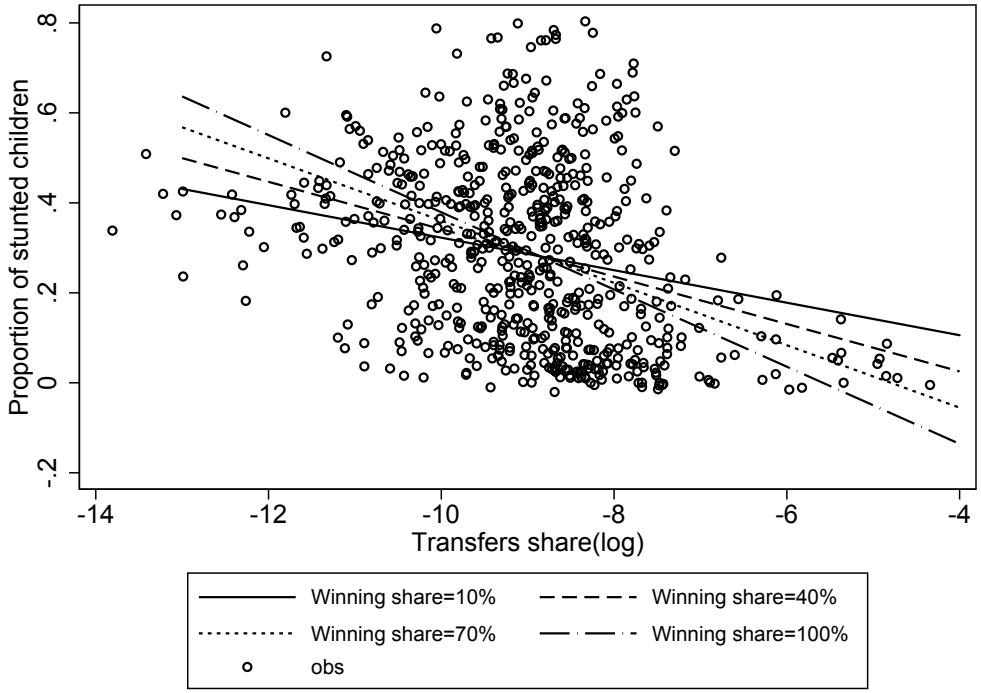
Source: Own estimations

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 3.6 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[27]. 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.

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 and Admassie, 2014).

[27]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%).

Figure 3.6: Marginal effect of an increase in the transfer share, by political support



Source: Own estimations

Table 3.10 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.

3.7.3 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, I estimate a model based on the basic specification, with initial poverty rates as the potential source of heterogeneous effects of increased fiscal decentralization.

Table 3.10: FE OLS results, dependent variable=stunting (expenditure share)

	(1)	(2)	(3)	(4)	(5)
Expenditures share(log)	−0.020	0.022	−0.100***	−0.004	−0.027
	(0.015)	(0.037)	(0.036)	(0.015)	(0.018)
Participation in elections		−0.389			
		(0.502)			
Expenditures share(log) · Participation in elections		−0.056			
		(0.055)			
Share of public workers(log)			−0.186**		
			(0.093)		
Expenditures share(log) · Share of public workers(log)			−0.020**		
			(0.009)		
Voter's support				−0.442**	
				(0.175)	
Expenditures share(log) · Voter's support				−0.049***	
				(0.017)	
Political alignment=1					0.083
					(0.068)
Political alignment=1 · Expenditures share(log)					0.010
					(0.008)
Rural	0.033	0.046	−0.007	0.026	0.039
	(0.061)	(0.059)	(0.068)	(0.061)	(0.057)
Indigenous proxy	−0.141	−0.100	−0.116	−0.079	−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	0.098***	0.101***	0.092***	0.092***	0.102***
	(0.017)	(0.019)	(0.018)	(0.017)	(0.017)
Population(log)	−0.039	−0.031	−0.060*	−0.047	−0.041
	(0.033)	(0.041)	(0.034)	(0.036)	(0.033)
Regional GDP(log)	0.058	0.055	0.097**	0.061*	0.063
	(0.036)	(0.036)	(0.040)	(0.036)	(0.040)
Year 2012 dummy	0.034	0.030	0.015	0.030	0.044
	(0.040)	(0.045)	(0.045)	(0.044)	(0.043)
Observations	530	530	525	530	530
R^2	0.56	0.57	0.58	0.57	0.56
Municipality FE	Yes	Yes	Yes	Yes	Yes

$*p < 0.1, **p < 0.05, ***p < 0.01$. Clustered standard errors in parentheses. Clustering is at the province level. Variables described in Table 3.4

Poverty rates for 2001 were calculated in INE (2003), using the small area methodology and considering a monetary dimension of poverty. The estimated model is:

$$y_{mt} = \alpha_m + \delta_0 \cdot d2012_t + \phi_1 \cdot X_{mt} + \phi_2 \cdot X_{mt} \cdot poor_{mt} + \boldsymbol{\beta \cdot Z_{mt}} + \epsilon_{mt} \quad (3.3)$$

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)[28].

The results of the estimation of Equation 3.3 are shown in Table 3.11, 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 effects, Figure 3.7 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 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 is 0.5 percentage points, while for non-poor municipalities the decrease is 3 percentage points.

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 choice of the threshold is not influencing the result of non-pro-poor characteristic of the increased transfers.

In order to further contrast this result, I use an alternative (multidimensional) measure of poverty, concretely the Unmet Basic Needs (UBN) index (Anand and Sen, 1994). For this, I divided the UBN index into three quantiles and assign the lowest category the poor status (=1), and zero otherwise. Table 3.12 shows the heterogeneous effects results using the UBN indicator of poverty. While the results using the UBN criteria and the transfer share are statistically non-significant, the interaction of the expenditure share

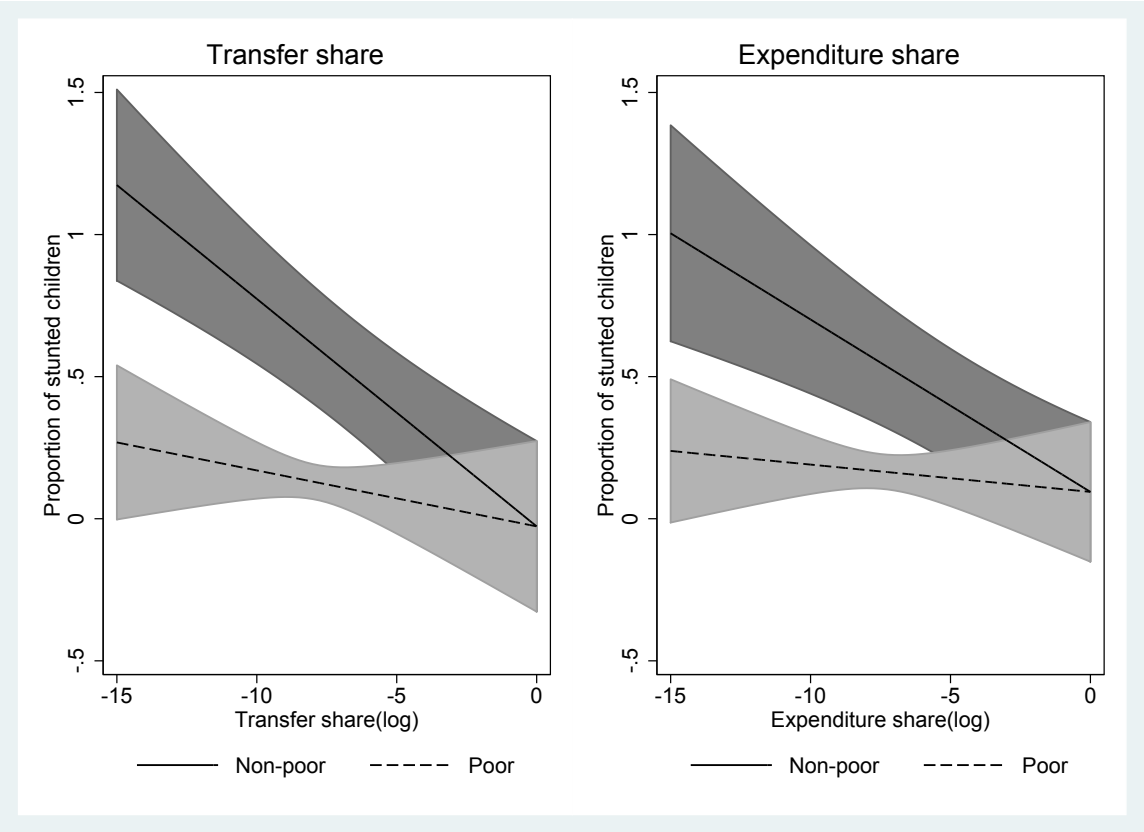
[28]The model does not include the single dummy *poor*, because information regarding poverty status is only available for the base year (2001).

Table 3.11: FE OLS results, by monetary poverty status

	(1) Water	(2) Toilet	(3) Underweight	(4) Stunting	(5) Underweight	(6) Stunting
Expenditure in sanitation	0.009	0.005				
	(0.006)	(0.006)				
Poor=1 · Expenditure in sanitation	−0.005	−0.006				
	(0.007)	(0.007)				
Transfers share(log)			−0.030***	−0.080***		
			(0.009)	(0.017)		
Poor=1 · Transfers share(log)			−0.000	0.060***		
			(0.010)	(0.016)		
Expenditures share(log)					−0.017	−0.061***
					(0.011)	(0.016)
Poor=1 · Expenditures share(log)					0.004	0.051***
					(0.011)	(0.018)
Rural	−0.294***	−0.046	0.012	0.040	0.003	0.030
	(0.075)	(0.058)	(0.020)	(0.048)	(0.025)	(0.060)
Indigenous proxy	0.257*	0.137	0.024	0.103	−0.024	−0.036
	(0.153)	(0.133)	(0.072)	(0.121)	(0.093)	(0.139)
Illiteracy	−0.534***	−0.206*	0.110	0.715***	0.105	0.687***
	(0.134)	(0.121)	(0.077)	(0.116)	(0.090)	(0.131)
Household size	−0.010	−0.034	0.009	0.088***	0.006	0.093***
	(0.025)	(0.026)	(0.008)	(0.017)	(0.009)	(0.017)
Population(log)	−0.171***	−0.019	0.024	0.012	0.016	−0.017
	(0.048)	(0.038)	(0.016)	(0.032)	(0.017)	(0.031)
Regional GDP(log)	0.185***	0.092**	−0.023	0.068*	−0.008	0.065*
	(0.055)	(0.039)	(0.032)	(0.040)	(0.028)	(0.036)
Year 2012 dummy	−0.032	−0.006	0.023	0.055	−0.001	0.037
	(0.050)	(0.041)	(0.019)	(0.036)	(0.019)	(0.038)
Observations	480	480	628	628	530	530
R^2	0.64	0.46	0.21	0.58	0.19	0.57
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes

$*p < 0.1, **p < 0.05, ***p < 0.01$. Clustered standard errors in parentheses. Clustering is at the province level. Variables described in Table 3.4

Figure 3.7: Marginal effects of an increase in fiscal decentralization, by monetary poverty status



Source: Own estimations

and the "UBN" poor dummy is positive (column 6), confirming the previous result and strengthening the fact that increased fiscal decentralization has not been pro-poor.

Table 3.12: FE OLS results, by UBN poverty status

	(1) Water	(2) Toilet	(3) Underweight	(4) Stunting	(5) Underweight	(6) Stunting
Expenditure in sanitation	0.005	0.006				
	(0.006)	(0.005)				
Poor by UBN=1 · Expenditure in sanitation	0.000	−0.009				
	(0.007)	(0.007)				
Transfers share(log)			−0.013*	−0.050**		
			(0.008)	(0.020)		
Poor by UBN=1 · Transfers share(log)			−0.021***	−0.009		
			(0.006)	(0.016)		
Expenditures share(log)					−0.008	−0.048**
					(0.012)	(0.022)
Poor by UBN=1 · Expenditures share(log)					−0.008	0.033*
					(0.010)	(0.018)
Rural	−0.293***	−0.039	0.024	0.056	0.006	0.025
	(0.076)	(0.060)	(0.020)	(0.047)	(0.025)	(0.060)
Indigenous proxy	0.258*	0.135	0.011	−0.057	−0.035	−0.131
	(0.153)	(0.133)	(0.066)	(0.112)	(0.090)	(0.132)
Illiteracy	−0.535***	−0.216*	0.069	0.632***	0.094	0.691***
	(0.132)	(0.122)	(0.080)	(0.132)	(0.090)	(0.140)
Household size	−0.009	−0.032	0.010	0.088***	0.007	0.095***
	(0.025)	(0.026)	(0.008)	(0.017)	(0.009)	(0.017)
Population(log)	−0.171***	−0.019	0.029*	−0.010	0.015	−0.041
	(0.048)	(0.037)	(0.016)	(0.034)	(0.018)	(0.032)
Regional GDP(log)	0.185***	0.093**	−0.030	0.054	−0.010	0.066*
	(0.055)	(0.040)	(0.032)	(0.043)	(0.028)	(0.038)
Year 2012 dummy	−0.033	−0.007	0.018	0.054	−0.002	0.036
	(0.050)	(0.041)	(0.019)	(0.039)	(0.019)	(0.040)
Observations	480	480	628	628	530	530
R^2	0.64	0.46	0.23	0.56	0.20	0.56
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes

$*p < 0.1, **p < 0.05, ***p < 0.01$. Clustered standard errors in parentheses. Clustering is at the province level. Variables described in Table 3.4

3.7.4 Robustness checks

3.7.4.1 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 3.13 present the results of the model without interactions (Equation 3.1) using a sample excluding El Alto city and the capitals of each of the nine departments.

Table 3.13: FE OLS results, excluding capitals of department and El Alto city

	(1) Water	(2) Toilet	(3) Underweight	(4) Stunting	(5) Underweight	(6) Stunting
Expenditure share in sanitation	0.004	0.003				
	(0.004)	(0.004)				
Transfers share(log)			−0.032***	−0.061***		
			(0.008)	(0.016)		
Expenditures share(log)					−0.014*	−0.022
					(0.008)	(0.016)
Rural	−0.284***	−0.044	0.011	0.052	0.002	0.038
	(0.078)	(0.063)	(0.020)	(0.048)	(0.025)	(0.062)
Indigenous proxy	0.273*	0.157	0.023	−0.049	−0.035	−0.133
	(0.154)	(0.134)	(0.068)	(0.114)	(0.092)	(0.136)
Illiteracy	−0.496***	−0.193	0.098	0.655***	0.094	0.688***
	(0.147)	(0.125)	(0.080)	(0.126)	(0.094)	(0.149)
Household size	−0.005	−0.033	0.008	0.088***	0.006	0.099***
	(0.025)	(0.027)	(0.009)	(0.018)	(0.009)	(0.017)
Population(log)	−0.175***	−0.019	0.025	−0.012	0.014	−0.040
	(0.050)	(0.041)	(0.015)	(0.034)	(0.018)	(0.034)
Regional GDP(log)	0.205***	0.104**	−0.028	0.056	−0.011	0.059
	(0.056)	(0.041)	(0.036)	(0.045)	(0.031)	(0.039)
Year 2012 dummy	−0.031	−0.010	0.024	0.062	−0.003	0.043
	(0.052)	(0.042)	(0.021)	(0.040)	(0.020)	(0.045)
Observations	461	461	608	608	510	510
R^2	0.65	0.46	0.22	0.57	0.20	0.56
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes

$*p < 0.1, **p < 0.05, ***p < 0.01$. Clustered standard errors in parentheses. Clustering is at the province level. Variables described in Table 3.4

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 -2.9 percentage points in the proportion of underweight children and -5.6 percentage points in the proportion of stunted children (using a median increase of 93% in the transfer share).

On the other hand, Table 3.14 show the results of the estimation using a sample excluding the warmest municipalities (using average temperature information for year 2001). 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 3.14 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.

Table 3.14: FE OLS results, excluding warmest municipalities

	(1) Water	(2) Toilet	(3) Underweight	(4) Stunting	(5) Underweight	(6) Stunting
Expenditure share in sanitation	0.004	−0.001				
	(0.006)	(0.010)				
Transfers share(log)			−0.100***	−0.089*		
			(0.028)	(0.045)		
Expenditures share(log)					−0.023*	−0.052**
					(0.012)	(0.021)
Rural	−0.415***	−0.126	0.025	0.151*	−0.022	0.154
	(0.118)	(0.093)	(0.040)	(0.080)	(0.036)	(0.103)
Indigenous proxy	−0.144	0.045	0.151	0.166	0.221	0.091
	(0.256)	(0.198)	(0.117)	(0.168)	(0.140)	(0.182)
Illiteracy	−0.778***	0.183	−0.011	0.414*	−0.135	0.408
	(0.192)	(0.206)	(0.196)	(0.240)	(0.231)	(0.292)
Household size	−0.004	−0.062	0.021	0.147***	0.006	0.128***
	(0.033)	(0.047)	(0.015)	(0.028)	(0.012)	(0.029)
Population(log)	−0.214**	−0.044	0.038	−0.057	0.023	−0.049
	(0.094)	(0.063)	(0.032)	(0.050)	(0.027)	(0.051)
Regional GDP(log)	0.192*	−0.074	−0.419***	−0.148	−0.215**	−0.032
	(0.106)	(0.140)	(0.112)	(0.200)	(0.105)	(0.157)
Year 2012 dummy	−0.107	0.089	0.254***	0.252**	0.095*	0.159**
	(0.075)	(0.067)	(0.068)	(0.122)	(0.050)	(0.079)
Observations	157	157	210	210	189	189
R^2	0.67	0.50	0.35	0.38	0.21	0.31
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes

$*p < 0.1, **p < 0.05, ***p < 0.01$. Clustered standard errors in parentheses. Clustering is at the province level. Variables described in Table 3.4

Finally, Table 3.15 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.

Table 3.15: FE OLS results, excluding municipalities producers of oil and natural gas

	(1) Water	(2) Toilet	(3) Underweight	(4) Stunting	(5) Underweight	(6) Stunting
Expenditure share in sanitation	0.004	0.000				
	(0.004)	(0.005)				
Transfers share(log)			−0.030***	−0.053***		
			(0.009)	(0.015)		
Expenditures share(log)					−0.014*	−0.022
					(0.008)	(0.017)
Rural	−0.220***	−0.011	0.014	0.074	0.001	0.077
	(0.076)	(0.064)	(0.021)	(0.050)	(0.028)	(0.066)
Indigenous proxy	0.198	0.103	0.029	−0.134	−0.012	−0.225*
	(0.158)	(0.134)	(0.073)	(0.119)	(0.091)	(0.127)
Illiteracy	−0.450***	−0.152	0.062	0.594***	0.067	0.628***
	(0.120)	(0.113)	(0.079)	(0.134)	(0.089)	(0.148)
Household size	0.030	−0.025	0.005	0.081***	0.005	0.096***
	(0.019)	(0.026)	(0.009)	(0.019)	(0.010)	(0.018)
Population(log)	−0.212***	−0.020	0.027*	−0.015	0.010	−0.045
	(0.048)	(0.041)	(0.016)	(0.036)	(0.019)	(0.035)
Regional GDP(log)	0.143	0.007	−0.070	0.040	−0.043	0.053
	(0.091)	(0.049)	(0.055)	(0.063)	(0.046)	(0.052)
Year 2012 dummy	0.021	0.044	0.036	0.046	0.009	0.027
	(0.051)	(0.036)	(0.028)	(0.043)	(0.024)	(0.043)
Observations	409	409	540	540	458	458
R^2	0.64	0.47	0.20	0.55	0.18	0.55
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes

$*p < 0.1, **p < 0.05, ***p < 0.01$. Clustered standard errors in parentheses. Clustering is at the province level. Variables described in Table 3.4

3.7.4.2 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 could attract more population, 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 et al., 2016). 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 with other exogenous variable that exhibits variation over time[29].

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 3.3), 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:

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 ($\rho = 0.91$), 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 would 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 are 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[30].

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 3.16 shows the 2SLS results using the $\log(\text{Area} \cdot \text{WTI})$ as instrument[31].

[29]For applications, see Canavire-Bacarreza et al. (2016) and Esarey (2015).

[30]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.

[31]Area is measured in squared kilometers.

Table 3.16: 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	−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)
Observations	360	360	628	628	432	432
R^2	-1.29	0.27	0.16	0.51	0.19	0.33
First stage F-stat	0.14	0.14	15.74	15.74	1.23	1.23
p-value for endogeneity test	0.51	0.85	0.21	0.14	0.93	0.39

$*p < 0.1, **p < 0.05, ***p < 0.01$. Clustered standard errors in parentheses. Clustering is at the province level. Variables described in Table 3.4

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 necessarily 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 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.

3.8 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 also shows that the potential benefits of decentralization could be 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.

CHAPTER

FOUR

ADDRESSING HORIZONTAL INEQUALITY IN BOLIVIA: WHAT IS THE ROLE OF FISCAL POLICY?

4.1 Introduction

The Latin American region has historically been one of the most unequal regions of the world. Goñi et al. (2011) states that inequality indicators (in particular the Gini coefficient) in the region are among the highest in the world, only after Sub-Saharan Africa, the most unequal region of the planet. Although in the last 20 years the Gini coefficient (which reflects the disparity between the top and the bottom of the income distribution) has drastically reduced (Lopez-Calva and Lustig, 2010), the region continues to have persistent inequality in various dimensions, including income, expenditures, wealth, education and health[32].

This chapter aims to shed light on the potential role of the fiscal policy (taxes and transfers) on the group inequality in Bolivia. By group (or horizontal) inequality, I refer to the difference in income (or other welfare indicator) as a consequence of the membership to a specified group (determined, e.g., by race, gender, location, etc.). The interest on this type of inequality lies on the potential exclusion of certain groups (e.g., indigenous or women) from individual economic and social progress, still present in certain societies. This exclusion could be rooted on colonial grounds and persisting over time (Acemoglu et al., 2001). Gender exclusion in turn is mostly based on the burden that some societies impose to women, regarding their role as family and child carers, thus limiting their access to education (Lewis and Lockheed, 2007).

The reduction of inequality is important for several reasons: from a moral point of view, we would aim to a more equal and fair society (especially regarding the so-called equality of opportunities (Roemer and Trannoy, 2014). In addition, some authors argue that more equal societies have stronger economic growth (Cingano, 2014), are happier (Graham and Pettinato, 2002), and because reducing inequality is a broader goal in comparison to reducing poverty. Inequality creates a society in conflict (Lindquist,

[32]While income distribution is used as the most widely-used source of inequality, the Gini coefficient could be also calculated using other non-income dimensions, e.g. years of education.

2011), which successively could harm long-term institutions, affecting development, and generating a vicious circle of poverty (Collier, 2008).

The downward trend in inequality mentioned above has been also observed in Bolivia in the last decades. For example, Eid and Aguirre (2013) finds that inequality in Bolivia fell 13 points (from Gini coefficient 0.59 to 0.46) between 1999 and 2011, outperforming any other country in Latin America in terms of inequality reduction. Some authors argue that the reduction of inequality is the result of redistribution policies (noticeably the increase in the minimum wage, see Canavire Bacarreza and Rios-Avila, 2015). Another view is that the reduction is a consequence of the boom in commodities' prices in the 2000s, which at the same time allowed the government to expand its social policy, for example through cash transfers. Vargas and Garriga (2015) state that the reduction in inequality was driven mainly by labor income, while non-labor income (e.g., transfers, remittances) played a minor role.

Despite of the fact that Bolivia is the country with the largest proportion of people that are self-identified or considered as indigenous in Latin America (Lustig, 2017), the horizontal dimension of inequality has been neglected in the research about drivers and determinants of income inequality reduction. For that reason, the question about the ability of public policy to reduce group inequality is still unexplored and important to address.

The chapter is structured in the following way: the next section reviews the relevant literature with respect to inequality in general, and to horizontal inequality in particular. Afterwards, I discuss the data and empirical strategy, for later present the results of the tax-benefit incidence model regarding group-inequality indicators. Then, some robustness checks and sensitivity analysis are explained, and final part exposes conclusions and potential policy recommendations.

4.2 Review of the literature

The evidence about the harming consequences of social segmentation on societies is well recognized. Easterly and Levine (1997) mentions ethnic fractionalization as the main factor behind poor public policies in a set of countries in Africa. At the same time, the existence of ethnic cleavages are correlated with low schooling, underdeveloped financial system and political instability, all of these factors leading to a poor economic growth outlook. Alesina et al. (2003) supports the hypothesis that ethnic and linguistic fractionalization are correlated with economic success or failure, although the authors state that it is difficult to claim causality because of endogeneity and measurement issues. Lack of social cohesion and potential conflict among indigenous and non-indigenous groups (due to extremely unequal access to economic resources and opportunities) are the factors that would explain the relationship between a highly fractionalized society and poor economic and social outcomes.

As in some African countries, ethnic fractionalization is also observed in Latin America, where indigenous population have been excluded from education opportunities, adequate health services, and access to formal jobs. For example, Psacharopoulos and Patrinos (1994) finds consistently an income gap between indigenous and non-indigenous

population in five countries of Latin America (Bolivia, Ecuador, Guatemala, Mexico, and Peru). Indigenous population often have less access to basic services as sanitation, safe water, and electricity than non-indigenous population, even considering locational differences, and have a greater probability of being poor (Trivelli, 2005).

While the the ethnic nature of fractionalization mentioned by these authors is prominent, other researchers have recognized the relevance of inter-group inequality using another criteria, like gender and location. Regarding location, if current global inequality is decomposed, the most important factor behind it is location (between-country) inequality, as compared to intra-country inequality. (Milanovic, 2012, p. 128). Despite this observation applies when cross-country comparisons are used, the same statement could apply within a given country, due to the acute differences between cities and the rural area (especially in developing countries). For example, Sicular et al. (2007) finds that the mean urban income in China is almost three-times the average income in the rural area. This pattern is also observed in other emerging countries (for India, see Sarkar and Mehta, 2010; for other BRIC countries, see Cevik and Correa-Caro, 2015). The case of gender inequality is also well documented in the literature and although the gender gap in terms of education years have reduced noticeably in Latin America in the recent years (Rodriguez-Castelan et al., 2016), women are systematically among the most vulnerable groups (Ñopo, 2012). In this sense, income inequality between men and women equally qualified persists, and this is an area in which more progress could be achieved (Schwab et al., 2017).

The role of fiscal policy and its impact on (vertical) inequality has been approached extensively. For example, Joumard et al. (2013) states that the effect of taxes on inequality varies according to the characteristics of each country, with respect to its welfare system, and the importance of indirect as opposed to direct taxes and the level of informality. Coady and Gupta (2012) affirms that the capacity of redistribution of the state is much more limited in a developing country as compared to a developed one because the taxes and transfers are considerably lower in the former than in the latter. In the specific case of Bolivia, Paz Arauco et al. (2014) affirm that distributional policies in Bolivia have been ineffective. This could be due to the lack of targeting of cash transfers, leading to leakages. Limitations in the amount of social transfers, and the (mostly regressive) tax system also plays a role. The authors find that the combination of tax and transfers actually end up harming the neediest (those in the bottom of the income distribution). This research focuses on vertical inequality measures (in specific, the Gini coefficient) to assess the distributional impact of fiscal policy.

There are a few studies that tackle the topic of horizontal inequality and fiscal interventions. Cabrera et al. (2015) find that fiscal interventions in Guatemala had very little effect over the reduction of poverty and inequality, most probably due to a malfunctioning tax system. On the other hand, Lustig (2017) examines the role of fiscal transfers and taxes on inequality indicators in Bolivia, Brazil and Guatemala. She finds that the fiscal systems in these countries reduce the income gap between the indigenous and non-indigenous, but this reduction is very limited. She attributes the limited effect of these policies to the small size of the transfers.

While the aforementioned authors already address the impact of fiscal interventions on inequality among ethnic groups, they rely on entropy indicators to measure the dis-

tinct components of inequality (within- and between- inequality). Thus, the horizontal inequality is measured using a specific indicator (the Theil index). This indicator could be decomposed in the between- and within-inequality components, with respect to the analyzed groups (Haughton and Khandker, 2009). The dimensions of inequality are often presented intuitively as proportions of total inequality. A potential problem with the use of this indicator, is that it depends of its contribution to a measure of "total inequality" (Stewart et al., 2005), and it is not an independent measure of group inequality.[33]

A second issue in the literature regarding indigenous inequality is the tendency to oversimplify the ethnic categorization, i.e. as a dummy variable. In principle this division is useful to have a first sense of the effect of the fiscal system on the ethnic gap. However, a white vs. non-white classification seems simplistic and could trigger biases in the analysis. In this sense, in this chapter I propose the construction of an ethnicity index, which takes into account various factors that better capture the degree of the ethnic condition of a household. The index is composed of three elements: self-identification, language, and location, each of these elements contributing to the "degree" of ethnicity.

Finally, the literature has increasingly addressed the important topic of "intersectionalities", a term coined to account for overlapping characteristics that could lead to increased inequalities (Crenshaw, 1991). Hence, it is not only the ethnic condition that could determine the exclusion of certain population groups, but the combination of two or more characteristics. Being, for example, indigenous and woman could determine a much more acute problem regarding discrimination of historically disadvantaged groups (Lenhardt and Samman, 2015).

4.3 Data and empirical strategy

4.3.1 Data

The data for the tax-benefit incidence model comes primarily from the 2015 Bolivian Household Survey (*Encuesta a Hogares* - EH 2015), carried out by the National Institute of Statistics. The household follows the format of the World Bank's Living Standards Measurement Study (LSMS) survey program, and incorporates a variety of personal and household information, related to demographic characteristics, household types, migration, health, education, labor, income and expenditures. The sample comprises 37,364 individuals grouped in 10,171 households. The data was collected between November and December of 2015. The household survey is representative at the national level, with an urban/rural distinction. The sampling process considered stratification at a primary sampling unit (PSU), with the use of expansion factors. These expansion factors allow to obtain the figures corresponding to the national level, from the collected sample.

Table 4.1 shows the demographic characteristics referred to the analyzed group categories. The table shows information regarding the counts and the proportions over

[33]For example, suppose that the calculation of the Theil index results in the following proportions: 25% of the inequality is due to between-group inequality and 75% is due to within-inequality. Now suppose that both components double and so the total inequality: the proportions will still be 25% between and 75% within, but the horizontal inequality will be in fact more severe than before the increase. Thus, the Theil indicator fails in signaling the worsening of group-inequality in this made-up case.

total population in the three categories: indigenous, gender and location (urban/rural). Regarding indigenous categories, the table includes information with respect to the *self-identification* status. In this sense, it reports the counting and proportion of those people that declared to pertain to one of the 37 indigenous groups formally recognized by Law[34]. Later in the chapter some alternatives will be explored regarding the classification of indigenous/non-indigenous using another criteria.

Table 4.1: Indigenous, gender and location proportions

Category	**Proportion**	
Non-indigenous	0.727	(0.0102)
Indigenous	0.273	(0.0102)
Male	0.495	(0.00238)
Female	0.505	(0.00238)
Urban	0.686	(0.00901)
Rural	0.314	(0.00901)

Standard errors between parentheses.
Source: Own calculations based on EH 2015.

The table shows that the self-declared indigenous proportion reach approximately 27% of total population, which is smaller in comparison with the 2012 Census' figure (41.7%). As this is based on self-declaration, this change could be driven by a lower effervescence for pertaining to an indigenous category, especially after the 2009 proclamation of a "new Plurinational state"[35]. With respect to the other grouping categories, the proportions show an even distribution between men and women, and that less than one third of the population lives in rural areas. In comparison with the proportion observed in 2012 (32.5%, according to the Census), this implies an increasing tendency for urbanization.

4.3.2 Empirical strategy

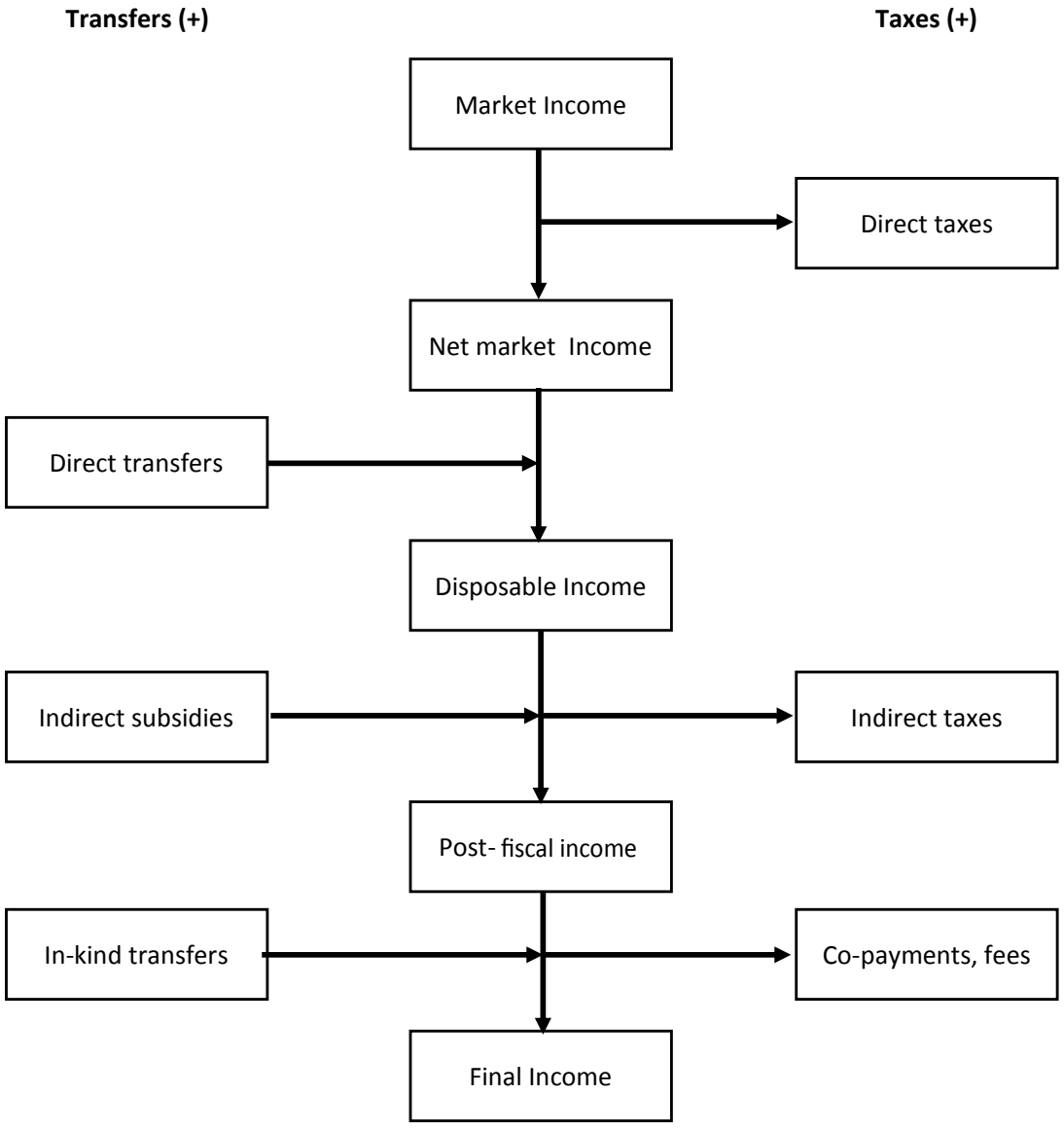
In order to estimate the impact of net transfer on horizontal inequality, I use a standard tax-benefit incidence analysis model (Demery, 2003). This methodology consists in the identification and quantification of components of the individual income, starting from labor income, capital transfers, remittances, and other private transfers. Subsequently, the model incorporates other sources of additional revenues (like subsidies and cash or in-kind transfers) and taxes to reach to the final income that an individual possesses after taking into account all the components of the income flow.

[34]Despite the large number of indigenous groups, in Bolivia there are two principal indigenous groups: the *aymara* and the *quechua*, which according to the last census (2012) accounted for 82% of the total indigenous population(self-declared).

[35]In 2009, a new Constitution was approved changing the name from "Republic of Bolivia" to "Plurinational State of Bolivia". This change supposedly reflected the multi-cultural character of the country, including its more than 30 ethnic groups, although many of them almost without relevant representation (Uprimny, 2011).

The components of the income flow are depicted in Figure 4.1, illustrating the different income concepts, and the sequential incorporation of taxes, transfers, and subsidies, to reach to the final income, which incorporates all public interventions. This standardized methodology has been applied in some countries/case studies to assess the role of public transfers/taxes in reducing inequality measured through a standard indicator (Gini, Theil or Atkinson measures) (Lustig and Pereira, 2016).

Figure 4.1: Income concepts



Source: Lustig and Higgins (2013).

All the income concepts, as well as the taxes and transfers, are measured in local currency (Bolivianos - Bs.[36]). The first component in Figure 4.1, the market income, is composed of labor income (both coming from dependent and independent activities), as well as capital income and private transfers (including remittances and social security

[36]At the end of 2015, the exchange rate Bs./USD was around Bs.7 per USD. This exchange rate is fixed *de facto*.

payments). As transfers are added and taxes are reduced from the disposable income, the market income turn into a final income, which includes all the deductions and cash and in-kind transfers the individual is entitled to. The same scope have been followed by Paz Arauco et al. (2014), Lustig and Pereira (2016) and Lustig et al. (2014), using the guidelines established in Lustig and Higgins (2013). The research strategy then consists in comparing the group-inequality indicators with and without government intervention (i.e., using the market income and the final income). All the components in between of those income concepts will be defined with detail later in subsection 4.3.3.

The framework expressed in mathematical terms is the following:

$$y_h = I_h - \sum_i T_i S_{ih} \tag{4.1}$$

Where I_h is the income before taxes and transfers; T_i are net taxes of type i and S_{ih} is the share of net tax i borne by unit h.

Given that the interest of the analysis lies on the indigenous, gender and urban/rural condition, the unit of assessment is the individual. Since the household is subject to a variety of transfers, this entails adding the income and transfers received by all the members of the family and then divide this whole amount by the number of household members. In this way, we come up with an estimate of each of the income components as shown in Figure 4.1.

One important matter is how the indigenous status of a person is defined. There are various potential indicators for indigenous status, but they can be controversial and difficult to identify. Martinez Cobo (1984) mentions for example the occupation of ancestral lands, common ancestry in these territories, culture (or specific manifestations of it, as religion, dress, etc.), and language as factors that define the indigenous status of a person. Regarding language, this criteria tends to be less subjective than the others (Permanent Forum on Indigenous Issues, 2009), and in addition could be easily identified using the household survey information. Other authors have also utilized the language criteria to define indigenous status (in the case of Latin America see Urrea-Giraldo and Rodríguez-Sánchez, 2014; for Asia see van de Walle and Gunewardena, 2001).

Thus, the criterion used to define the ethnicity will be twofold. The first benchmark will rely in the self-identification indigenous status of the individual, provided by a specific question in the questionnaire. The remaining criteria relies on an ethno-linguistic definition of the indigenous status: the person will be considered as indigenous if he/she speaks a native tongue in the first place (before Spanish), or if he/she has learned to talk in a native tongue, or if he/she speaks any native tongue. The other grouping variables (gender and urban/rural location) are explicitly defined in the survey data.

Measures of horizontal inequality

Traditional measures of (vertical) inequality include the Gini coefficient, the so-called entropy measures (Theil L and Theil T), as well as the Atkinson inequality measure (Haughton and Khandker, 2009). While the Gini coefficient cannot be decomposed into between and within-group inequality components, the entropy measures (Theil family)

can be decomposed in order to explore to which extent each dimension adds to total inequality.

To assess the impact of fiscal policy, one approach would be to calculate Theil L and Theil T indicators for the income distribution of each of the income concepts depicted in Figure 4.1, and then assess the change in inequality in both dimensions (within and between inequality) and how much represent each of them in total inequality. However, some authors argue that it is more adequate to have an independent measure of horizontal inequality, rather than using one that depends on its contribution to total (vertical) inequality (Stewart et al., 2005; Stewart et al., 2009; Stewart, 2011). Indeed, Stewart et al. (2005) propose the following indicators to measure the horizontal inequality over defined groupings (native status, gender or location):

1. Group coefficient of variation (GCOV):

$$\frac{1}{\bar{y}}\left(\sum_{r}^{R} p_r(\bar{y}_r - \bar{y})^2\right)^{\frac{1}{2}}$$

2. Group Gini (GGINI):

$$\frac{1}{2\bar{y}}\sum_{r}^{R}\sum_{s}^{S} p_r p_s|\bar{y}_r - \bar{y}_s|$$

3. Group Theil (GTHEIL):

$$\sum_{r}^{R} p_r \frac{\bar{y}_r}{\bar{y}} \log\left(\frac{\bar{y}_r}{\bar{y}}\right)$$

Where $\bar{y}_r$ is the group r mean income (pre and post-transfer/taxes), p_r is group r population share, and $\bar{y}$ is the mean income. In the notation, r can be characterized as indigenous, female or rural status, for each computed horizontal inequality indicator.

In this sense, the strategy involves the calculation of the mentioned group-inequality indicators in each of the income stages, to evaluate if the net transfers helped to reduce the ethnic, gender and locational income gap. Ideally, the role of the state would aim to level-up the income of the groups in most need. Historically, native, female and people living in rural areas were excluded from formal labor markets, adequate education and health, and so for that reason they could have less income. In an ideal setting, these characteristics (native status, gender and location) should not determine people's potential revenue (the so-called "equality of opportunities" approach (Roemer, 2009;Roemer and Trannoy, 2014).

4.3.3 Construction of the tax-benefit incidence model

Some assumptions must be made in order to build the tax-benefit incidence model. The first assumption is that we consider the income *per capita*: all the sources of (net and gross) income are aggregated and divided between the number of family members. The inequality indicators are then calculated using this per capita income. The second assumption is that the membership to each grouping category (native status, female, and

rural) is modeled using an indicator function, that takes the value of one if the individual belongs to each category, and zero otherwise. This assumption is relaxed later, when I calculate an indigenousness index (ranging from zero to one) that incorporates potential features of native status.

Market income

The first income component as showed in Figure 4.1 is the market income. This component was calculated by aggregating the labor income (considering dependent or independent activities), in-kind transfers related to the labor relationship, capital income, as well as all the private transfers (that is, all the transfers received by the individual that are not given by the government)[37].

In order to detect outliers, the calculated labor income was contrasted with the declared labor income incorporated as an original variable in the survey. In that sense, the `bacon` algorithm was applied (Weber, 2010) to the proportion of declared income between calculated income, to exclude those observations that lie above certain tolerance level (0.025). Using this level, a total of 1,589 (out of 12,298) observations were flagged as outliers and excluded from the analysis[38].

It is important to clarify the role of direct taxes in the Bolivian fiscal system. The closest tax to a personal income tax (PIT) is the complementary-VAT tax (RC-IVA). It consists in taxing personal income above a certain level (those who received more than Bs.9,164 per month in 2015 -around USD1,310-). However, these individuals are allowed to "discharge" the due amount by presenting their consumption bills up to certain sum to overcome this payment[39]. In this sense, the RC-IVA is a poor substitute of a PIT scheme and the tax revenue attached to it is low with respect to the whole tax revenue in Bolivia (representing around 0.8% of total tax revenue in 2015). In addition, as the household survey does not identify this tax, it cannot be incorporated in the analysis.

Disposable income

Disposable income calculation implies the first intervention of the government in the flow showed in Figure 4.1. This income concept is calculated by adding the direct transfers provided by the government to the beneficiaries. The direct transfers are basically coming from the three main cash transfers program active in the country: the *"Bono Juana Azurduy"* program, the *"Renta Dignidad"* universal pension scheme, and the *"Bono Juancito Pinto"* program.

The *"Bono Juana Azurduy"* is a conditional cash transfer program, and the beneficiaries of the transfer are pregnant women and children up to two years old, conditional on the regular attendance to medical check-ups (Vidal et al., 2015). The payments in cash given by the program are detailed in Table 4.2:

[37]The private transfers are: transfers from other persons in the country, remittances, compensation (e.g. redundancy payment) and non-labor earned transfers (private pension schemes).

[38]The proportion of excluded observations is 11.44%.

[39]For example, a person that in 2017 earns Bs12,000 (roughly USD 1710) monthly, would have to pay Bs321 in PIT concept. However, if this person presents bills for Bs2474, he/she can avoid the payment of this tax.

Table 4.2: Payments for the *"Bono Juana Azurduy"*

Item	Max. # of payments	Amount(Bs.)	Total(Bs.)
Pre-natal care	4	50	200
Payment on delivery	1	120	120
Post-delivery check-ups	12	125	1,500
TOTAL			**1,820**

Source: Own elaboration based on Vidal et al. (2015).

Given the information on Table 4.2, theoretically the maximum amount that a household could receive (per child and per year) is Bs.1,820 (approximately USD 260). In addition to this cash payments, the program also covers the delivery of the children in public hospitals, which will be included in the health-in kind transfers' component.

With respect to the *"Renta Dignidad"* program, it consists in a non-contributory pension scheme, provided to all citizens older than 60 years old (Escobar et al., 2013). The monthly amount provided in 2015 was either Bs.200 (USD 28) or Bs.250 (USD 35) depending if the recipient entitled to receive the benefit was receiving other pension benefit or not. The monthly amount is aggregated to get a yearly payment per person and household.

Finally, the *"Bono Juancito Pinto"* is a conditional cash transfer, consisting in the payment of Bs.200 (USD 28) annually to school students (both primary and secondary school) that are enrolled in public schools (run by the government) (Marco, 2012). The payment is conditional on the assistance to more than 80% of the school days during the last academic year (running from February to November).

Post-fiscal income

The next component in the estimation of the final income is the incorporation of indirect subsidies and indirect taxes in the household income. With respect to the indirect subsidies, the household survey allows to identify the subsidies to gasoline and propane gas (used for cooking). Together, they represent the main component of subsidies that can be identified using the household surveys[40].

With respect to the price of gasoline, it is fixed at a rate of USD 0.70 per liter, while the international price is the double (based on information in Agencia Nacional de Hidrocarburos, 2015). In that respect, the assumption I made is that the households would have spent twice as much on gasoline without the subsidy. This excludes a potential behavioral reaction to the subsidy's elimination, but as the microsimulation model is a non-behavioral model, this is an assumption that is needed to be made. The subsidy component is only activated if the household possess a vehicle and/or a motorcycle.

In the other hand, the price of propane gas paid by the families is around USD 3 per container. The international price of propane is set by the Mont Belvieu TX Propane

[40]Subsidies to hydrocarbons represented 2.5% of the total government expenditures in 2015 (Ministerio de Economia y Finanzas Publicas, 2015).

spot price[41]. In 2015, this price was around the double than of the domestic price of propane, so I assume that the expenditure in cooking gas of the families would have been twice as much as declared, provided there was no subsidy given. This again rules out any behavioral consequence of the elimination of subsidies.

At this stage of the calculation, I incorporate the indirect taxes component of the tax-benefit incidence model. While the household survey does not identify the indirect taxes paid by the individuals, I use the indirect taxes incidence estimated by Cossio (2001)[42]. The author calculates the impact of indirect taxes by distinguishing their impact with respect to different income quintiles. As expected, indirect taxes are regressive because poorest people pay a greater proportion of their income on those, as compared with richer people. Besides, given that in the rural area people are not expected to buy goods from formal businesses, it is likely that the incidence of these taxes is lesser as opposed to urban areas. In that sense, I assume that the structure of the indirect tax incidence in the rural area is one third of the incidence in the urban area[43]. The incidence rates are shown in Table 4.3.

Table 4.3: Estimated incidence of indirect taxes

Quintile	Urban incidence	Rural incidence
1st (poorest)	25.0	8.3
2nd	18.0	5.9
3rd	19.0	6.3
4th	17.0	5.6
5th (richest)	15.0	4.9

Source: Own elaboration based on Cossio (2001).

Final income

The last step involves the calculation of the final income, by incorporating the in-kind transfers to the post-fiscal income[44]. This is the component of the calculation that requires the most of assumptions, as it have elements of health care and education that are not identified accurately by the survey's questionnaire. The first element is the health care component of the in-kind transfers. In the health module of the household survey, I identify two interventions that don't require payment for the users of health services: the first one is the general health attention, which is assumed not to be incurred by the user but by the public facility. The imputed in-kind health transfer is a fixed amount of USD 217 if the health facility is located in the urban area, and of USD 108 if the facility is located in the rural area[45]. A caveat of this approach is that it cannot be determined

[41]Information available at https://www.eia.gov/dnav/pet/PET_PRI_SPT_S1_D.htm.

[42]While this reference is long-standing, the fact that the indirect tax rates has not changed provides support for relying on this source.

[43]The indirect taxes evaluated are: IVA (value-added tax), IT (a tax to transactions, is applied to the transfer of services and goods), ICE (a sin tax), and IEHD (an hydrocarbons tax).

[44]The component referred to co-payments and fees are assumed to be zero.

[45]These imputed values come from information regarding the public budget assigned to health, divided by the population (Paz Arauco et al., 2014).

how many times the person recurred to the health services. In that sense, I assume that the reported use of health facilities was done only once.

The second major health intervention is the delivery care. For women enrolled in the *"Bono Juana Azurduy"* program, this cost is covered by the health facility center. Again, I distinguish between rural and urban area regarding the cost of this service and impute a value of USD 653 for deliveries in the urban area, while the cost for rural areas is USD 326 (half the cost in the urban area). These values come from the *"Bono Juana Azurduy"* Program and represent the average cost for delivery attention in their respective areas.

The other major component in the in-kind transfers' component of the income flow is the one related to education. I assume that every family member that attends a public education center (primary, secondary, or tertiary education) receive an in-kind transfer provided by the government, by not having to pay fees for attending the education center. The imputed values are the same used by Paz Arauco et al. (2014), and varies depending on the level of education. For primary education, I assume a yearly cost of USD 317 for children in primary school; USD 250 for children in secondary school; and USD 1,338 for tertiary education. Again, these imputed values represent average costs, but in this case no distinction is made between urban and rural areas.

Finally, a small component of the in-kind transfers identified by the household survey is the *"desayuno escolar"*, a free breakfast provided by the government in public schools. The transfer given by this program is assumed to be valued in around USD 28 per year (Paz Arauco et al., 2014).

The summary statistics regarding the different income concepts as described in this section are shown in Table 4.4.

Table 4.4: Summary statistics of income concepts

	Mean	SD	CV
Market income	14,354	14,876	1.036
Disposable income	14,663	14,893	1.016
Post-fiscal income	12,594	13,025	1.034
Final income	13,913	12,954	0.931

Note: All figures in current Bs. SD=standard deviation. CV=coefficient of variation
Source: Own elaboration based on EH 2015

4.4 Results

4.4.1 Overall and within-group inequality

As a first step, overall inequality indicators were estimated to compare them with well-known sources. As the Gini coefficient is the most widely-used indicator for inequality, I concentrate in this measure. Table 4.5 compares the Gini's coefficient using the EH 2015

with other author's calculations for the same period of time (where possible).[46]. As it can be observed, the different estimations of Gini coefficients are very similar, providing a robustness check and adding confidence to the process of data cleaning. The actual figures can vary because of different methodologies, but the estimates lie among what is widely acknowledged regarding the overall inequality in the country.

Table 4.5: Estimated Gini coefficients

Year	Gini	Reference
2013	44.15	Solt (2016)
2014	48.40	World Bank (2017)
2015	45.53	CEDLAS (2017)
2015	48.30	UNU WIDER (2015)
2015	46.31	**Own calculation**

As a next step, I calculate inequality indicators for each of the group categories (indigenous, gender, and location), that is, *within* categories. This gives a better sense of the income distribution inside each category, as a complement of the group inequality indicators presented later in the chapter. Table 4.6 shows different inequality indicators for each of the groups analyzed. As per the Gini coefficient and the percentile ratio, the group with the most income inequality seems to be the rural, followed by the indigenous. Regarding sensibilities to different parts of the distribution, the general entropy measures (GE) indicate that the male group tends to be more unequal, especially in the top of the distribution[47].

Table 4.6: Within-group inequality indicators

	Gini	p90/p10	GE(0)	GE(1)	GE(2)
Non-indigenous	0.45	10.27	0.42	0.36	0.52
Indigenous	0.48	14.74	0.49	0.40	0.57
Male	0.47	11.96	0.46	0.51	0.91
Female	0.46	11.67	0.45	0.30	0.43
Urban	0.41	6.88	0.32	0.37	0.52
Rural	0.52	17.37	0.59	0.39	0.58

Source: Own calculations based on EH 2015

4.4.2 Decomposition of inequality

While the indicators showed in Table 4.6 point to the inequalities *within* each group, a first approach towards the inequality *between* groups is needed. As stated before, a

[46]The income concept used for this calculation was the disposable income, because it is used for official (reporting) reasons.

[47]General Entropy measures are useful to disentangle changes in different part of the distribution (Jenkins, 1999).

characteristic of the Theil inequality index is that it can be decomposed into within- and between- inequality. In this sense, Table 4.7 shows the Theil index [GE(0), GE(1) and GE(2)] for the different group categories, differentiating by its contribution to total inequality.

Table 4.7: Between- and within-inequality decompositions

GE(0)

	Indigenous	Gender	Location
Between	2.4%	0.1%	10.2%
Within	97.6%	99.9%	89.8%
Total	100.0%	100.0%	100.0%

GE(1)

	Indigenous	Gender	Location
Between	2.7%	0.2%	10.9%
Within	97.3%	99.8%	89.1%
Total	100.0%	100.0%	100.0%

GE(2)

	Indigenous	Gender	Location
Between	1.8%	0.1%	6.9%
Within	98.2%	99.9%	93.1%
Total	100.0%	100.0%	100.0%

Source: Own calculations based on EH 2015

The results on inequality decomposition reveal that the component that explain most of the overall inequality is the within-component, being the rural group the one that have the greatest component of group-inequality (between 7% and 10%). However, as stated previously, an independent measure of horizontal inequality would be more adequate to assess the level and changes of between-groups inequality. In that sense, the group-Gini coefficient was calculated in all the four stages as shown in Figure 4.1, using the grouping criteria defined previously[48]. Table 4.8 present a summary of all the group-Gini coefficients calculated for the grouping categories: indigenous (various specifications), gender, and location (urban vs. rural).

Indigenous inequality

The different group Gini calculations for indigenous status are shown in Figure 4.2. As this entails different measurement as stated previously (regarding the self-identification and the ethno-linguistic component), the evolution of the GGini for each of the categories is presented, alongside the distinct income stages.

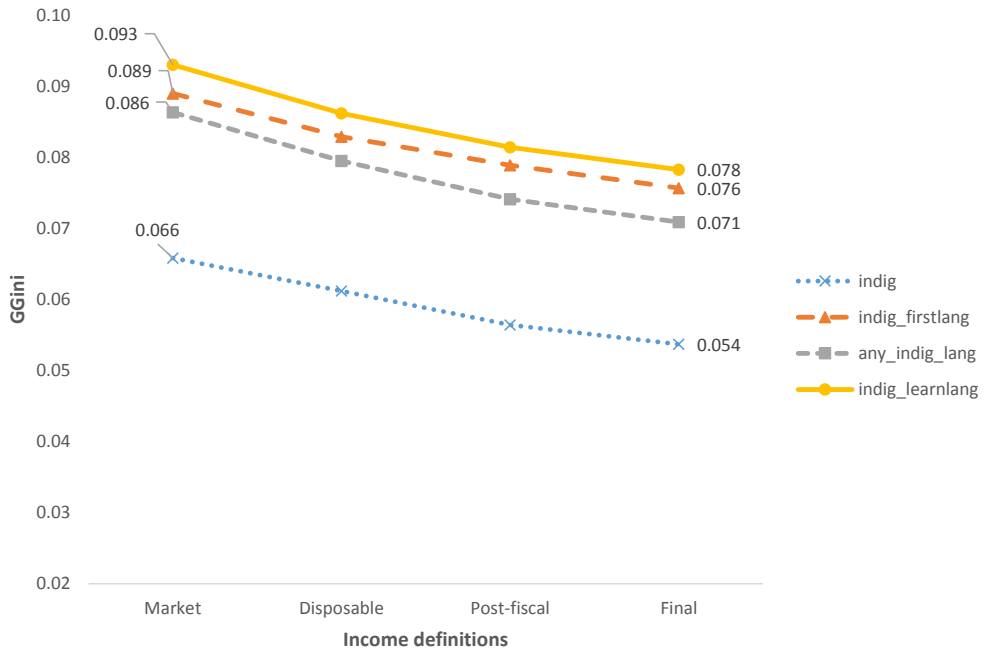
[48]Because of its direct interpretation (same as regular Gini coefficient), the GGini is used in all the remaining estimations. The results corresponding to the other group-inequality indicators (GCov and GTheil) are presented in the appendix.

Table 4.8: Group-Gini coefficients

	Indigenous				Gender	Location
	Self	First	Any	Learned		
Market income	0.066	0.089	0.086	0.093	0.019	0.135
Disposable income	0.061	0.083	0.080	0.086	0.018	0.129
Post-fiscal income	0.056	0.079	0.074	0.081	0.019	0.109
Final income	0.054	0.076	0.071	0.078	0.017	0.106

Source: Own calculations. The indigenous sub-categories are: *self* (self-identification of indigenous status); *first* (respondent declared a native language as the main that he/she uses); *any* (respondent declared that he/she can speak at least an indigenous language; and *learned* (respondent declared that he/she learned to speak in a native language).

Figure 4.2: Indigenous GGini for different ethnic classifications



Source: Own calculations

The first characteristic of this graph is that the fiscal system seems to be working in the expected direction: as net transfers are added to the market income, the ethnic group inequality reduces, irrespective of the classification of indigenous status. The GGini is, however, rather small even in the first stage of the income flow (with no state intervention). This confirms the results of inequality decomposition as shown in Table 4.7.

The second observation is that, assuming that being indigenous represents a disadvantage in terms of income distribution, the greatest group-inequality is associated with the ethno-linguistic definition of native status. Among this, the characteristic of having learned to speak in a native language (`indig_learnlang`) is the most important, followed by declaring an indigenous language as the first tongue (`indig_firstlang`). By contrast, the self-identification (`indig`) criterion is the less important (lower line) in terms of the contrast between indigenous and non-indigenous [49]. This result could be confirming the well-known fact that language is an important barrier in terms of the interaction between minorities and a majority group in the society (Lang, 1986), could produce segregation effects (Lazear, 1999), and could represent a burden in terms of educational opportunities (Parker et al., 2005).

Gender inequality

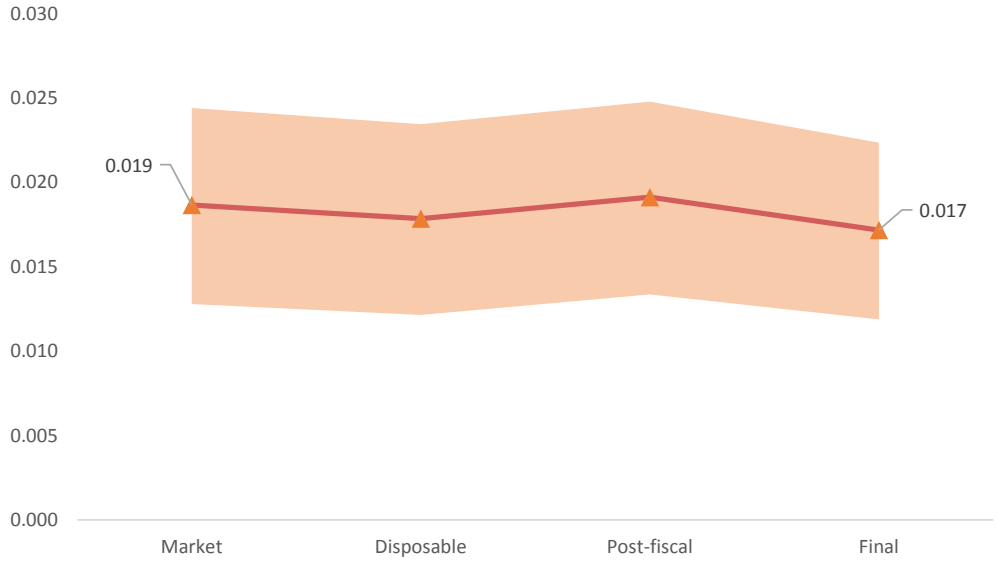
In the case of gender inequality, Figure 4.3 depicts the movement of the group-Gini with respect to the income concepts. The figure includes a point estimate and confidence intervals that were calculated using a bootstrap procedure (100 repetitions). The interesting observation here is that not all the state interventions reduced inequality as one would expect. Particularly, from the disposable income concept to the post-fiscal concept, the estimated group Gini *increases* from 0.017 to 0.019. Although marginal, the increase of group inequality reflects the fact that the indirect taxes component dominates the effect of the indirect subsidies. The fact that indirect taxes are mostly regressive is well known in the literature, either for developed economies (Garfinkel et al., 2006; Decoster et al., 2010) as well for emerging countries (Cabrera et al., 2015; Lustig et al., 2014) and particularly in the case of Latin America (Lopez-Calva and Lustig, 2010). This evidence suggests that the tax system in Bolivia is regressive, as its main taxing component relies on indirect taxes, combined with the negligibility of tax income. It is also surprising that the impact of net transfers on gender group-inequality is small (0.002), considering that one of the most important cash transfers is intended for women only (the *Bono Juana Azurduy*). This fact calls for a reform of the tax system not only in Bolivia but in Latin America, that historically have been one of the regions in the world in which the tax collection is among the lowest (as a percentage of the GDP) as a result of the flawed tax system (Corbacho et al., 2013).

Location inequality

Finally, Figure 4.4 shows the evolution of the group-Gini coefficient considering location (rural/urban) alongside the income definitions (reflecting the distinct state interventions,

[49] Results from the GCov and GTheil (available in the Appendix) confirm that the ethno-linguistic criteria is the most important when the group-inequality is assessed.

Figure 4.3: Gender GGini



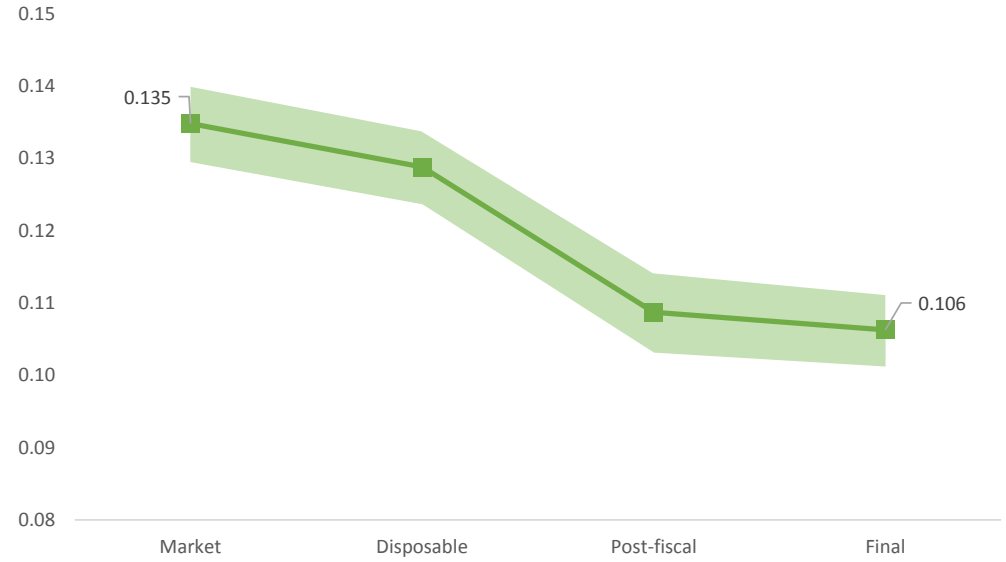
Source: Own calculations

as depicted in Figure 4.1). The first impression of the calculations is that this group inequality represents the largest Gini coefficient of the three categories (0.135 as compared with 0.09 for indigenous group inequality and 0.019 for gender group inequality). This would imply that the income differences between individuals living in urban versus rural areas is the most important type of single group inequality among those groups analyzed in the chapter. This result is also consistent with the empirical finding of the rural-urban gap in terms of consumption (Young, 2013), income (Hnatkovska and Lahiri, 2013), health (van de Poel et al., 2009), and life conditions in general. Rural/urban group inequality ultimately reflects the degree of marginalization of traditionally disadvantaged groups (von Braun and Gatzweiler, 2014), revealing the stark dissimilarities in productivity between traditionally rural sectors (mainly agriculture) with respect to more "urban" sectors (industry, services, etc.).

The evolution of the urban/rural group inequality with respect to the income concept reflects, however, that the state interventions reduce the income imbalance between persons from the rural area as compared with the urban area. This reduction, from 0.135 to 0.106 (decrease in 21%), represents the greatest reduction in comparison with the other two group inequality indicators [50]. This could be due to the fact that the incidence of the tax system (relying in indirect taxes) is more limited in the rural area, as the majority of business there are informal and not subject to taxes. Therefore, the impact on the individual consumer is limited, restricting the impact of this component in the locational group inequality indicator.

[50]The group inequality regarding the indigenous status (ethno-linguistic criteria) decreases in 15%, while the gender inequality decreases only in 11%.

Figure 4.4: Urban/rural GGini



Source: Own calculations

4.4.3 Intersectionalities

The combination of more than one characteristic in the group categories (gender, indigenous status or location) could explain a greater portion of horizontal inequality. For example, the indigenous condition could imply less opportunities e.g. in joining formal labor markets, but the condition of being indigenous *and* live in the rural area could involve even more discrimination and less economic opportunities. This combination of categories is coined under the concept of "intersectionality" (Crenshaw, 1991; Lenhardt and Samman, 2015), and is used to emphasize the greater disadvantage caused by the membership to more than one traditionally disadvantaged group.

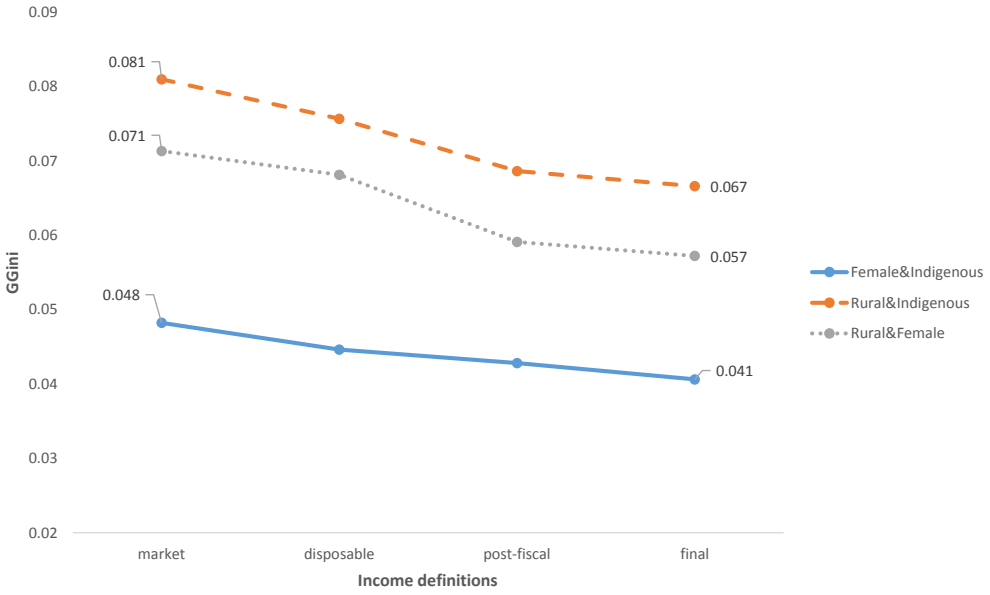
In this sense, in addition to consider group inequalities defined by single categories (i.e., indigenous, gender, and location), I combine two or more of these characteristics, and calculate the group Gini corresponding to each of these possibilities: being female and indigenous; being female and living in the rural area, and being indigenous and living in the rural area[51].

The results of the tax-benefit incidence model reveal that the rural/indigenous combination is the one that involves the greatest degree of disadvantage, from the point of view of group inequality. The group inequality in this component is smaller than the sum of the individual group-inequalities (indigenous and rural), but reflects the synergies of pertaining to more than one traditionally disadvantaged group. As expected, state intervention in all the income phases' results in decreasing group inequality (Figure 4.5).

Besides assessing the change in group-Gini coefficients, it would be useful to explore the inequalities within the distribution (e.g., by decile). For this, I calculate the average income proportion of the (supposedly) least advantaged group (e.g., being female and

[51]The definition of being indigenous was given by the ethno-linguistic characteristic of having learned to speak in a language.

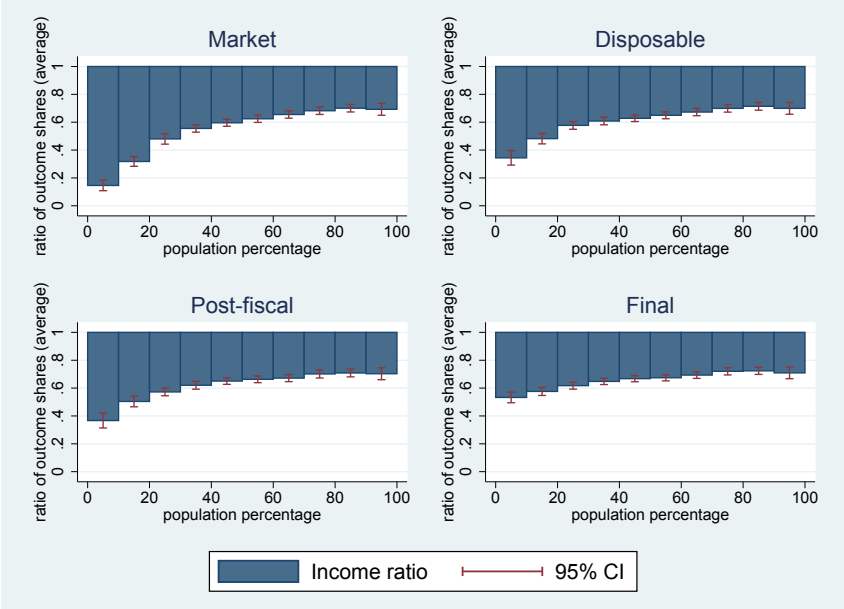
Figure 4.5: Intersecting inequalities



Source: Own calculations

indigenous) in terms of the base group (in this case, the income of the male and non-indigenous), for each income decile. Figure 4.6 shows the result of this exercise.

Figure 4.6: Income proportion of being indigenous and female



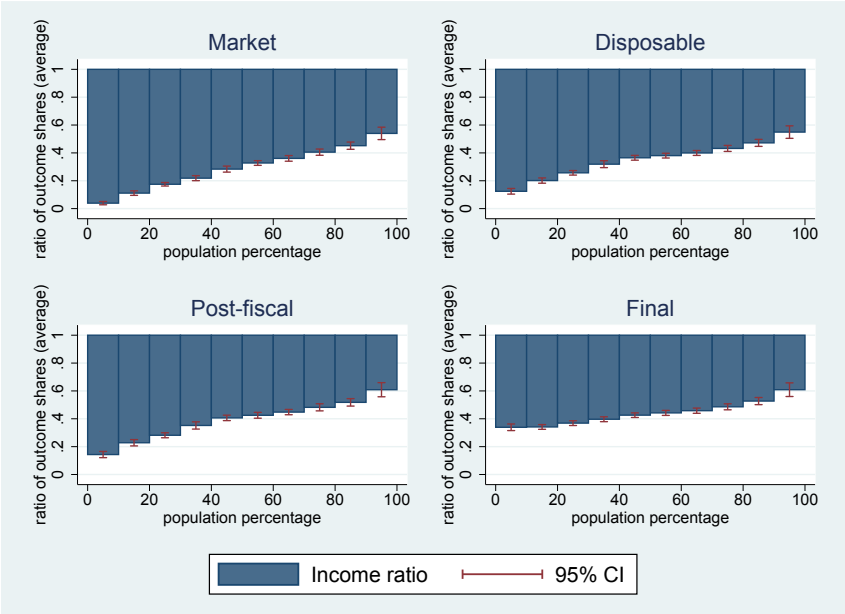
Source: Own calculations
The reference group is: non-indigenous and male.

From Figure 4.6, it can be seen that the market income for the bottom decile of the female and indigenous represents only a tiny fraction (14%) of the male and whites' income. In comparison with the top decile, this percentage is 68%. This shows that the

intersecting categories are in much disadvantage compared to the base categories, and that the situation is worst in the bottom decile (for the poorest of the poor). The good news is that, as the state intervenes (via transfers and taxes), this imbalance is partially corrected: in the bottom-right panel, the income of the poorest female and indigenous represents 53% of the male whites, while the percentage for the top decile is 69%.

With respect to the combination of rural area and indigenous, the differences are even greater. Figure 4.7 shows the histograms correspondent to this combination, for each income decile. The average income for the indigenous living in rural areas in bottom decile corresponds to only 3% of the reference income (white living in urban areas). In the top decile, the proportion is 53% and on average it reaches to 28%. The fiscal interventions seems to balance this stark difference, as the proportion in the bottom decile is similar to the one at the top decile (bottom-right panel). Again, however, the most disadvantaged group pre- and post- state intervention are the poorest (bottom decile).

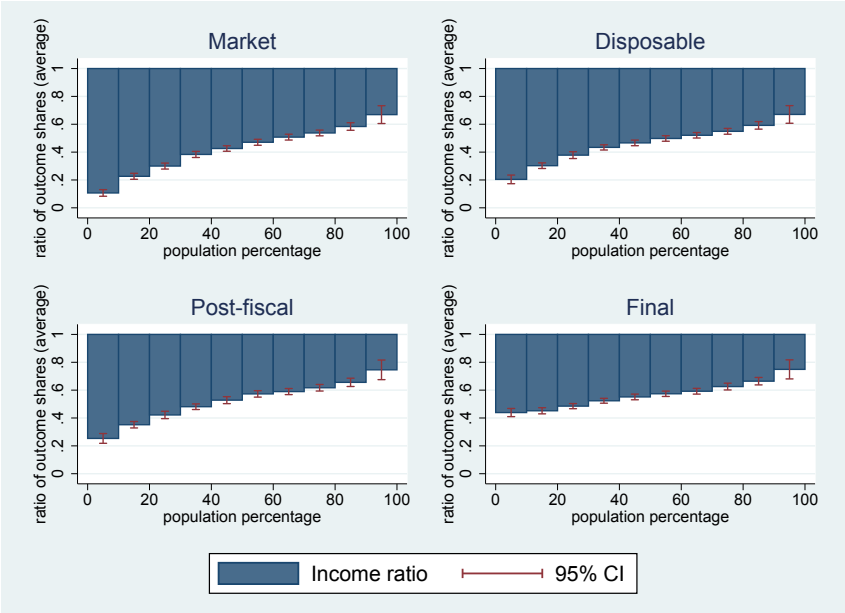
Figure 4.7: Income proportion of being indigenous and living in rural areas



Source: Own calculations
The reference group is: non-indigenous and urban.

Finally, Figure 4.8 show the proportions of income of women living in rural areas with respect to the reference group (men living in urban areas). The estimations show that the income of women living in rural areas (bottom decile) is 11% of men living in urban areas, in the same decile. This proportion jumps to 44% with the state intervention of taxes and transfers (bottom-right panel). On the other hand, the proportion for the top decile without state intervention is 65%, and with state intervention this proportion increases to 73% of the base group income (men living in urban areas).

Figure 4.8: Income proportion of women living in rural areas



Source: Own calculations
The reference group is: male and urban.

4.5 "Indigenousness" index and income inequality

The definition of indigenous status is complex and entail various dimensions, from the cultural characteristics to the self-identification as pertaining to a native category. One of the downsides in using a categorical (dummy) variable to define the indigenous status of an individual is that it tends to oversimplify this multi-dimensional character (McNeish and Eversole, 2013). In this sense, it would be worth it to explore the use of a synthetic measure for indigenous status, which incorporates various dimensions in the definition of this status.

Following Martinez Cobo (1984) and the report of the Permanent Forum on Indigenous Issues (2009), the components of a synthetic measure for indigenous status could be location, language, self-identification, religion and other cultural characteristics. Of these, location (urban or rural), language and self-identification could be identified using the EH 2015 household survey[52].

As a first step, a synthetic index of "indigenousness" was created based on the mentioned variables, applying the Multiple Correspondence Analysis (MCA) methodology (Wittenberg and Leibbrandt, 2017). The MCA approach has been identified as an alternative to the use of Principal Component Analysis (PCA) methodology (see e.g. Filmer and Pritchett, 2001), mainly because its use is more appropriate in the context of categorical rather than continuous variables (Howe et al., 2008).

Once the indigenousness index was computed, it was normalized to take a range of values between zero and one, for easier interpretation. Because the index was constructed

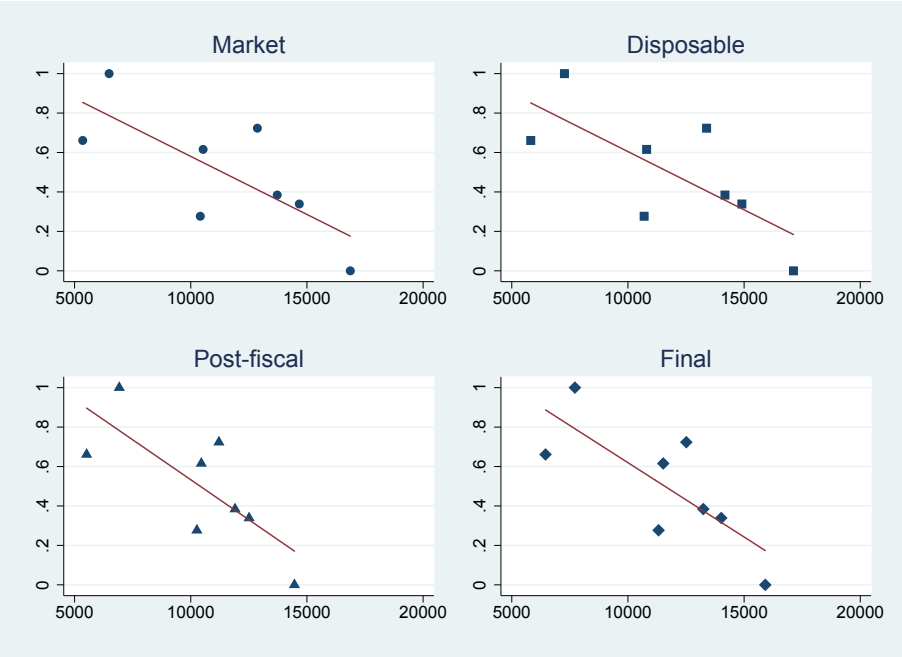
[52]Of the three ethno-linguistic criteria, I use the most relevant: "learned to speak in a native language". The combinations using the other two indicators are shown in the appendix.

based on three variables taking 0-1 values, their values are similar for individuals having the same characteristics (i.e., a particular value of the index corresponds to an individual that considers itself indigenous, lives in the rural area, and learned to speak in an indigenous language).

Figure 4.9 shows a scatterplot of the calculated indigenousness index, against the average values of the income concepts on each index value. The negative relationship between the index and all the income concepts is clear. This confirms the earlier finding in the sense that belonging or being associated with an indigenous status entails less income. This relationship is systematically observed alongside all the income concepts, and reinforces the idea of the great income discrepancies with respect to the indigenous origin/character of the individual. In addition, with high values of the index the income is homogeneously low, and the opposite is also true for low values of the index (high disposable income). More variability is observed around the average index, meaning that the middle class could be more "blended", in terms of self-identification, location and language.

As observed in Figure 4.9, the slope of the fitted curve tends to be slightly steeper with the successive state intervention (represented by the consecutive income concepts): this confirms the result of the positive impact of government intervention in reducing the ethnic income gap (see Figure 4.2).

Figure 4.9: Indigenousness index and income concepts



Source: Own calculations. In each of the four panels, the "indigenousness" index is plotted in the horizontal axis, and average income (in Bs.) in the vertical axis. The fitted line was estimated using OLS.

4.6 Sensitivity analysis

In order to verify the sensitivity of the main results to the chosen parameters, some modifications are applied to certain parameters of the tax-benefit incidence model. These parameters are: the indirect taxes' rates and the subsidy rates for gasoline and cooking fuel. Both parameters will affect to the post-fiscal income, as depicted in Figure 4.1, so the changes are observed only in this stage of the income concept flow.

4.6.1 Indirect taxes' rates

One of the assumptions for the incorporation of indirect taxes in the model was the adoption of the incidence rates as shown in Table 4.3, estimated by Cossio (2001). An additional assumption was that the incidence in the rural area was lower, due to the predominance of informality in this area. Instead, I assume that incidence in the rural area is 0.5, 0.75 and 1 successively, instead of the initial rate of 0.3. By assuming an incidence of 1 in the rural area, I assume that there is no difference between urban and rural areas with respect to the influence of indirect taxes. Results of this sensitivity check are provided in Table 4.9 and shown graphically in Figure 4.10.

Table 4.9: Sensitivity check, indirect taxes

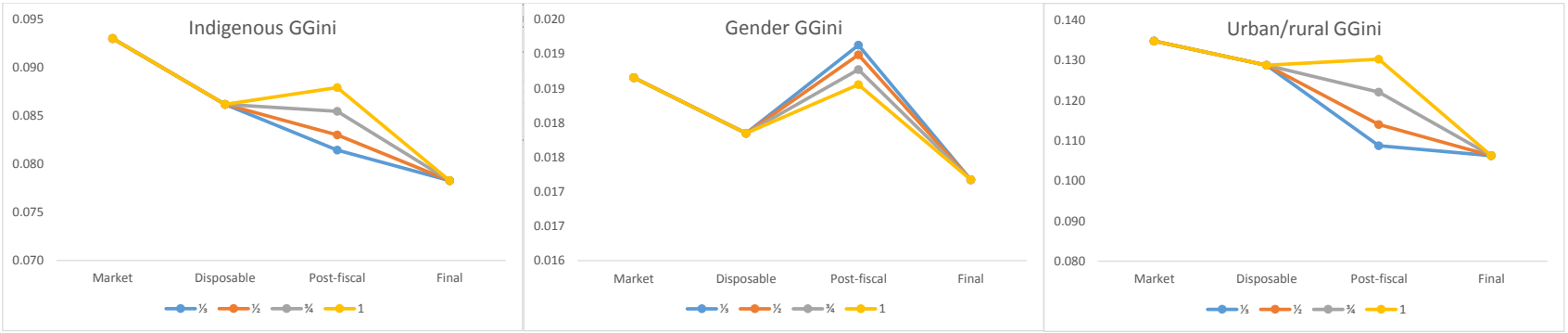
	Indigenous GGini[a]				Gender GGini				Location GGini			
Incidence[b]	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{3}{4}$	1
Market	0.093	0.093	0.093	0.093	0.019	0.019	0.019	0.019	0.135	0.135	0.135	0.135
Disposable	0.086	0.086	0.086	0.086	0.018	0.018	0.018	0.018	0.129	0.129	0.129	0.129
Post-fiscal	0.081	0.083	0.085	0.088	0.019	0.019	0.019	0.019	0.109	0.114	0.122	0.130
Final	0.078	0.078	0.078	0.078	0.017	0.017	0.017	0.017	0.106	0.106	0.106	0.106

Source: Own calculations. The incidence row is referred to the proportion of the indirect tax incidence assumed for the rural areas.

[a] For the calculation of the indigenous GGini, it was assumed that the relevant grouping category was based on the "learned to speak in a native language" characteristic.

[b] The original proportion in the main estimations was $\frac{1}{3}$.

Figure 4.10: Sensitivity check, indirect taxes



Source: Own calculations. Horizontal axis: income concepts; vertical axis: GGini

From the results shown in Table 4.9 and depicted in Figure 4.10, it can be seen that the increase of the indirect tax incidence in the rural area has a negative effect on the indigenous and the location (urban/rural) group-Gini (that is, it increases the group inequality). The increase is 4.9% when tax incidence changes from 0.33 to 0.5; 12.3% (when incidence is 0.75); and 19.8% when the same incidence is assumed both in urban and rural areas. In the same way, the indigenous group inequality increases as the incidence rises, because most of the indigenous people lives in the rural area[53]: the jumps are 2%, 4.9%, and 8%, from the base incidence of 0.33 to the same incidence as in the urban area. The sensitivity of the GGini to the indirect taxes incidence implies that, when an equal share is assumed between urban and rural areas (corresponding to the last column of each group category in Table 4.9), the impact of the indirect tax turns to be regressive.

The result of the exercise implies that gender group inequality *decreases* when the rural tax incidence increases. Although the decrease is very reduced in comparison to the change of the other GGinis[54], this could be because less women live and/or work in the rural area in comparison to those in the urban area. However, despite the different incidence rates of the indirect taxes in the rural area, their impact still is associated with an increase of the gender group inequality, proving the regressive nature of this type of tax, and the urge to reform the fiscal system.

4.6.2 Subsidy rate

The next sensitivity check consists in the modification of the subsidy rate for gasoline and cooking fuel. In the main estimations, it was assumed that subsidy rate for each of them was 50%, based on official figures. Here, I assume instead that the subsidy is sequentially reduced (25%) and eliminated (0%), for both fuels. The results of the exercise are shown on Table 4.10 and depicted in Figure 4.11. Unlike the results from the change in the incidence of indirect taxes, reducing and eliminating the fuel subsidies have a smaller impact in the group inequality, with respect to the three grouping categories, perhaps because the incidence of this expenditure is small in comparison with other spending categories (e.g., food or clothes). The change in the GGini for indigenous status and in the location GGini (urban/rural) is indistinguishable, as Figure 4.11 shows. The change in the gender GGini is the most discernible, although the effect of indirect taxes remains to be regressive, confirming this undesirable characteristic of the tax system in Bolivia.

[53]According to the 2015 household survey, 63% of the self-declared indigenous people live in the rural area.

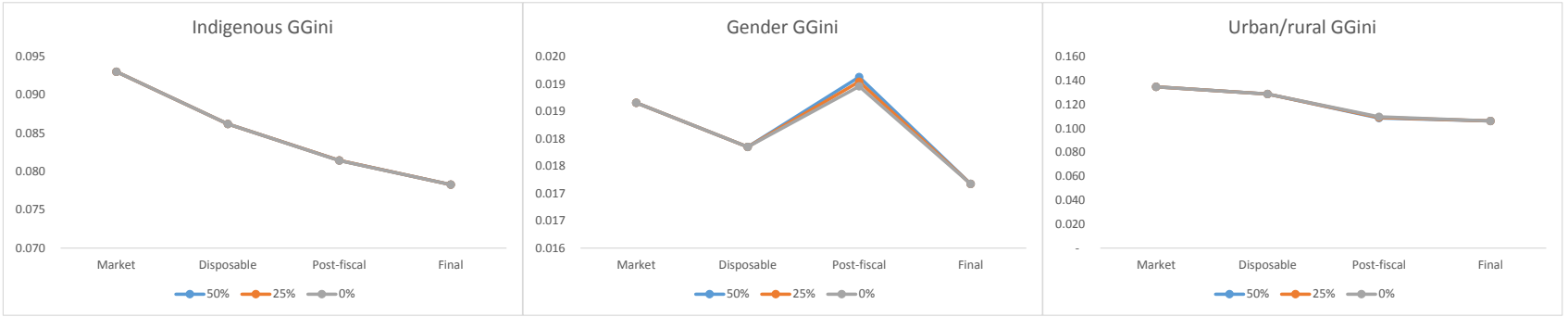
[54]The decrease goes from -0.7% to -3% when the incidence of the indirect tax in the rural area is increased.

Table 4.10: Sensitivity check, subsidies rate

	Indigenous GGini[a]			Gender GGini			Location GGini		
Subsidy rate[b]	50%	25%	0%	50%	25%	0%	50%	25%	0%
Market	0.093	0.093	0.093	0.019	0.019	0.019	0.135	0.135	0.135
Disposable	0.086	0.086	0.086	0.018	0.018	0.018	0.129	0.129	0.129
Post-fiscal	0.081	0.081	0.081	0.019	0.019	0.019	0.109	0.109	0.110
Final	0.078	0.078	0.078	0.017	0.017	0.017	0.106	0.106	0.106

Source: Own calculations. The subsidy row is referred to the different subsidy rates applied.
[a] For the calculation of the indigenous GGini, it was assumed that the relevant grouping category was based on the "learned to speak in a native language" characteristic.
[b] The original subsidy rate in the main estimations was 50%.

Figure 4.11: Sensitivity check, subsidies rate



Source: Own calculations. Horizontal axis: income concepts; vertical axis: GGini

4.7 Conclusions

The analysis of group inequality is relevant in contexts in which large segments of population have been historically excluded or marginalized. Being the country with the highest proportion of indigenous people in Latin America, the role of the state in reducing horizontal inequalities in Bolivia is worthwhile to examine. Existing research does not offer sufficient evidence of fiscal policy's effect over group inequality.

In this study, I evaluate the impact of the fiscal policy (system of taxes and transfers) in closing the ethnic, gender and urban/rural income gap. The results shows that the adoption of an ethno-linguistic criterion implies a greater income group-inequality. Within the ethno-linguistic components, the most relevant is if the individual learned to talk in a native language. This characteristic determines the biggest "shortcoming" regarding income distribution. Despite this, and according to the results, the government intervention seemed to reduce the income inequality associated with a native origin, as well as the inequality due to urban/rural location. The reduction due to government intervention is however very limited due to the small size of the transfers, leakages, absence of targeting, and the regressive character of the tax system. These characteristics have been also recognized as limiting factors in reducing (vertical) inequality in other study cases (for Guatemala, see Lustig, 2017; Paz Arauco et al., 2014 addresses the case of Bolivia).

Considering gender inequality, the relevant feature was that the state intervention (in form of net transfers) increases inequality in the transition from disposable income to post-fiscal income. This could be an indication of the failure of the tax system, which relies mostly in indirect taxes, rather than in direct taxes (e.g., an income tax) that are yet to be implemented in the country.

With respect to the other grouping indicators, the rural/urban component is the characteristic with the most income horizontal inequality. The imbalance could be due most probably to the difference in productivity of activities traditionally linked to the rural area (i.e., agriculture), in comparison with the more diverse activities in the urban area (industry, services, etc.).

I also explore the intersecting income inequalities, or the overlap of more than one category of the analyzed groups. The results imply that the indigenous living in the rural area are the most disadvantaged category of the three considered (female and indigenous, and female living in rural areas). This result is consistent with the individual results with respect to single group-inequalities. In addition, the issue of "indigenousness" is explored using an index that tries to synthesize the indigenous condition, based on certain characteristics (language, self-identification, and location) that are linked to this status. The results imply that, on average, a continuous variable reflecting "indigenousness" is negatively related with income, confirming the previous results.

The policy implications of the findings call for a better design of the transfers and taxing system. The fact that the cash transfers have a universal character, imply that there will always the risk of leakage, and that the people who need them least will end up benefiting from them the most. In addition, indirect taxes could cause the dilution of the positive effect of cash transfers on income. Even worse, the indirect taxes affect mostly to the poor (given its regressive nature). Policymakers need to fix the fiscal system for

it to bring sustainable effects on poverty and inequality reduction. In addition to this, policy interventions should aim to preserve and encourage the use of native languages from early childhood (Martinez, 2017), and facilitating their use in important sectors as health through trained translators (Laitin and Ramachandran, 2016) to avoid barriers in its provision.

Future directions for research could include the exploration of a behavioral tax-benefit incidence model, in which the change of the parameters (as the subsidy and tax rates) imply modifications in the decisions of the affected economic agents. In addition, the temporal dimension of the analysis could be also examined, allowing the analysis of a long-term impact of the fiscal system on inequality or poverty indicators.

CHAPTER

FIVE

GENERAL CONCLUSIONS AND POTENTIAL POLICY IMPLICATIONS

The chapters of this dissertation analyzed three different interventions from the public sector to tackle poverty and inequality. Despite of the acknowledged important reduction of poverty and inequality in Bolivia in the last 10 years, the evidence about the effectiveness of public sector intervention is mixed.

The first chapter analyzed the change from a sizable yearly lump sum transfer to a much smaller monthly installment. This exogenous policy change allowed to disentangle the potential consequences on the behavior of economic agents when faced with this apparently simple change. The relatively recent acknowledgment of behavioral limitations in development-related interventions motivated the analysis of this policy change. This modification might had important consequences, if we take into account the limiting role of certain behavioral characteristics as the lack of commitment, propensity to spend, and inability to save. Because its importance in human capital formation, we were interested in the impact that this policy change could had on education, and on child labor. Our results showed that the policy change increased the schooling attendance rate in the secondary cohort (12-18 years old), and reduced child labor, in the same age cohort. This result is consistent when considering some robustness checks. A limitation of the present study, however, is that it focuses on the "quantity" of education (attendance), but it does not explore the effects of cash transfers' design in the *quality* of education. The information requirements for this type of evaluation are greater, but the topic would be certainly worth to be explored more in depth in the future.

The policy implications lessons' regarding this exogenous change might be potentially useful and informative for policymakers. Cash transfers are widely used as a tool for social protection especially in developing countries, and vast research has consistently shown positive results regarding a variety of outcomes. This in turn would allow to break the inter-generational cycle of poverty. However, consistent evidence is missing with respect to the *design* of such programs, for example with respect to timing, size, and conditionality. The chapter showed that characteristics as stability, regularity, certainty, and a greater frequency of payments might be desirable, to keep young people in school. This small variation might prove to be especially relevant in the Latin American region,

in which almost 18 million of young people between 15-24 years abandon the school (de Hoyos et al., 2016), without a sustainable insertion in the labor market.

The second chapter of the dissertation addresses another aspect of human capital formation (health), and a different dimension of governmental transfers. There is a belief that decentralization policy, given that allows the government to be "closer to the people", automatically entail an increase in people's welfare. Among the possibilities are: a better local service delivery; the increase of monitoring the provision of public goods; and/or the improvement of the allocation and management of local resources. However, the evidence with respect to the impact of decentralization on intermediate and final outcomes is not conclusive. We assess the impact of a significant increase of national revenues in the 2000s decade in Bolivia (which in turn had to be redistributed to the local governments) to analyze its consequences on public service delivery (an intermediate goal), and child nutrition (a final outcome). The results showed a limited impact of increased fiscal decentralization, no improvement on access to safe water and sanitation, and a weak impact on nutrition indicators (with the most benefit corresponding to the non-poor municipalities). At the same time, we detected an interaction component between decentralization dimensions (fiscal, political, and administrative). It would be worth to explore these complementarities more in depth, through studies exploiting exogenous policy changes, or through the design of experiments or trials that allow to shed light into the issue of how to improve the public management, especially at the local government level.

The room for improvement of decentralization policy in Bolivia is ample. The country needs to go beyond the remarkable change of responsibilities and resources that have taken place more than two decades ago in the decentralization reform in Bolivia, to incorporate an institutional development perspective at the local level, through improvements in the governance processes and the specialization and training of local human resources. Another set of recommendations lies in the generation of own revenues of the local governments. The limitations of own-revenues' collection of the municipal governments pose problems akin to moral hazard-type issues: if the local government receives the lion's share of their revenues from the central government, they might not be careful or wise when spending or investing these resources. The results shown here seem to go in this direction.

Finally, the third chapter aimed at evaluating the government intervention on the reduction of existing income inequalities in important social groups in the society (in specific, indigenous people, female and population living in rural areas). Through the use of a tax-benefit incidence analysis, we showed that the greatest group-inequality is observed when the indigenous status is defined using an ethno-linguistic metric. However, the role of self-identification in determining the indigenous status is less important in explaining the income gap. In addition, locational inequality (urban/rural) is the highest of the three inequality measures analyzed, which reveals the great disparities between urban and rural areas in Bolivia in particular, and in development countries in general. The differential of living status, educational opportunities and productivity between rural and urban areas could explain the greater degree of inequality in comparison with more-developed urban areas. With respect to the gender inequality, the state intervention proved to be counterproductive at some point in the taxes-and-benefits flow. This is

most probably because of the characteristics of the tax system in Bolivia, which mainly relies on indirect (regressive) taxes rather than a personal income tax. The overlapping categories (e.g., indigenous and woman) imply clearly the greatest disadvantage in terms of income distribution, and constitute a vulnerable group that should be subject of social protection, e.g. through cash transfers. However, the presence of a regressive tax system and the lack of targeting limits the effectiveness of the social protection system.

One branch of potential policy recommendations about these findings deals with the degree of progressiveness of the tax system. The existing indirect tax scheme needs to be complemented with a proper income tax, which is currently not present. In addition, the system of cash and in-kind transfers needs a targeting scheme rather than being universal. However, the targeting process is difficult in essence, due to the problem of an accurate identification of those in most need of social protection. Means-test based transfers are imperfect and costly, and can be subject to significant leakages. Some innovations in the area include the use of satellite data to gather information about the quality of housing (in specific, the material of the roof) in order to better target the cash transfers (Abelson et al., 2014), the adoption of Community-Based-Targeting (Alatas et al., 2012), and the role of self-selection (Alatas et al., 2016). The other set of recommendations lie in the use and preservation of indigenous languages in countries such as Bolivia, which are still used by a great proportion of the population nowadays. Research has shown that early adoption of indigenous languages in primary education can contribute to greater cognitive development, improved attention, and improved levels of abstract and symbolic representation (Adesope et al., 2010). Even though in Bolivia the preservation of indigenous languages at school and at other instances have been boosted by the government in recent years, there is still much room for improvement to make the most of the use of multiple languages in a multicultural context.

The corollary of these three stories is that monetary resources are not a sufficient condition to achieve a sustainable reduction of poverty and inequality. A second generation of reforms entail a lot more than only the transference of money from the state, be it to individual economic agents in form of cash transfers, or to local governments via fiscal decentralization. This reform should address the development of local institutions, the reform of the tax system, and the improvement of education quality, among many other topics in the agenda. For this, the government will need to deal with more complex problems that require carefully-thought solutions, adequate planning, and results-based evidence.

APPENDIX

A

APPENDIX TO CHAPTER 2

Table A1: Complete results for attendance

	(1)	(2)	(3)
Treatment*y2008	0.017	0.014	0.014
	(0.012)	(0.011)	(0.011)
Treatment	−0.012	−0.001	−0.001
	(0.011)	(0.010)	(0.010)
y2008	0.004	0.004	0.004
	(0.003)	(0.003)	(0.003)
Native proxy		0.009	0.009
		(0.006)	(0.006)
Female		0.005	0.005
		(0.003)	(0.003)
nat_fem		−0.001	−0.001
		(0.005)	(0.005)
Private school		−0.013*	−0.013*
		(0.007)	(0.007)
Age		−0.004***	−0.004***
		(0.001)	(0.001)
First born proxy		−0.001	−0.001
		(0.003)	(0.003)
Number school aged HH members		−0.001	−0.001
		(0.001)	(0.001)
Rural household		−0.000	−0.000
		(0.004)	(0.004)
Head is employed		−0.019***	−0.019***
		(0.005)	(0.005)
Native household head proxy		0.002	0.002
		(0.004)	(0.004)
Age of the household head		0.003***	0.003***
		(0.001)	(0.001)
age_hhead2		−0.000***	−0.000***
		(0.000)	(0.000)
Household head is female		−0.002	−0.002
		(0.004)	(0.004)
Household head has college studies		0.010**	0.010**
		(0.005)	(0.005)
Log of durable goods value		0.002	0.002
		(0.001)	(0.001)
Log of monthly food expenditure		0.001	0.001
		(0.004)	(0.004)
_cons	0.984***	0.968***	0.968***
	(0.002)	(0.032)	(0.032)
Region	No	No	Yes
Covariates	No	Yes	Yes
Observations	8,887	8,818	8,818
R^2	0.001	0.021	0.021

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A2: Cohort results for attendance

	(1) Primary	(2) Secondary	(3) Primary	(4) Secondary	(5) Primary	(6) Secondary
Treatment*y2008	0.007	0.021	0.007	0.019	0.007	0.019
	(0.006)	(0.019)	(0.006)	(0.018)	(0.006)	(0.018)
Treatment	−0.003	−0.015	−0.003	0.002	−0.003	0.002
	(0.006)	(0.017)	(0.006)	(0.015)	(0.006)	(0.015)
y2008	−0.002	0.010*	−0.003	0.011**	−0.003	0.011**
	(0.002)	(0.006)	(0.003)	(0.005)	(0.003)	(0.005)
Native proxy			0.013***	0.004	0.013***	0.004
			(0.005)	(0.010)	(0.005)	(0.010)
Female			0.004	0.006	0.004	0.006
			(0.002)	(0.005)	(0.002)	(0.005)
nat_fem			−0.005	0.002	−0.005	0.002
			(0.003)	(0.010)	(0.003)	(0.010)
Private school			−0.000	−0.022*	−0.000	−0.022*
			(0.001)	(0.011)	(0.001)	(0.011)
Age			−0.000	−0.010***	−0.000	−0.010***
			(0.001)	(0.002)	(0.001)	(0.002)
First born proxy			−0.001	0.004	−0.001	0.004
			(0.002)	(0.005)	(0.002)	(0.005)
Number school aged HH members			−0.001	−0.001	−0.001	−0.001
			(0.001)	(0.003)	(0.001)	(0.003)
Rural household			0.000	−0.002	0.000	−0.002
			(0.003)	(0.007)	(0.003)	(0.007)
Head is employed			−0.000	−0.035***	−0.000	−0.035***
			(0.004)	(0.009)	(0.004)	(0.009)
Native household head proxy			−0.004	0.008	−0.004	0.008
			(0.004)	(0.007)	(0.004)	(0.007)
Age of the household head			0.000	0.005***	0.000	0.005***
			(0.000)	(0.002)	(0.000)	(0.002)
age_hhead2			−0.000	−0.000***	−0.000	−0.000***
			(0.000)	(0.000)	(0.000)	(0.000)
Household head is female			0.000	−0.002	0.000	−0.002
			(0.002)	(0.007)	(0.002)	(0.007)
Household head has college studies			0.001	0.019**	0.001	0.019**
			(0.001)	(0.008)	(0.001)	(0.008)
Log of durable goods value			0.001	0.002	0.001	0.002
			(0.001)	(0.002)	(0.001)	(0.002)
Log of monthly food expenditure			0.004	−0.001	0.004	−0.001
			(0.006)	(0.006)	(0.006)	(0.006)
_cons	0.997***	0.971***	0.961***	1.024***	0.961***	1.024***
	(0.002)	(0.004)	(0.040)	(0.057)	(0.040)	(0.057)
Region	No	No	No	No	Yes	Yes
Covariates	No	No	Yes	Yes	Yes	Yes
Observations	4,433	4,454	4,432	4,386	4,432	4,386
R^2	0.000	0.002	0.007	0.024	0.007	0.024

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A3: Complete results for child labor

	(1)	(2)	(3)
Treatment*y2008	−0.037	−0.032	−0.032
	(0.049)	(0.040)	(0.040)
Treatment	0.001	−0.009	−0.009
	(0.033)	(0.031)	(0.031)
y2008	0.051*	−0.009	−0.009
	(0.027)	(0.018)	(0.018)
Native proxy		0.191***	0.191***
		(0.031)	(0.031)
Female		−0.049***	−0.049***
		(0.010)	(0.010)
nat_fem		−0.001	−0.001
		(0.024)	(0.024)
Private school		−0.042***	−0.042***
		(0.013)	(0.013)
Age		0.024***	0.024***
		(0.002)	(0.002)
First born proxy		0.003	0.003
		(0.009)	(0.009)
Number school aged HH members		0.006	0.006
		(0.005)	(0.005)
Rural household		0.332***	0.332***
		(0.027)	(0.027)
Head is employed		0.124***	0.124***
		(0.016)	(0.016)
Native household head proxy		0.032*	0.032*
		(0.018)	(0.018)
Age of the household head		0.002	0.002
		(0.003)	(0.003)
age_hhead2		−0.000	−0.000
		(0.000)	(0.000)
Household head is female		0.015	0.015
		(0.014)	(0.014)
Household head has college studies		−0.038***	−0.038***
		(0.014)	(0.014)
Log of durable goods value		−0.005	−0.005
		(0.004)	(0.004)
Log of monthly food expenditure		−0.036**	−0.036**
		(0.015)	(0.015)
_cons	0.289***	−0.055	−0.055
	(0.018)	(0.117)	(0.117)
Region	No	No	Yes
Covariates	No	Yes	Yes
Observations	8,933	8,176	8,176
R^2	0.003	0.329	0.329

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A4: Cohort results for child labor

	(1) Primary	(2) Secondary	(3) Primary	(4) Secondary	(5) Primary	(6) Secondary
Treatment*y2008	0.007	−0.053	0.029	−0.081	0.029	−0.081
	(0.055)	(0.061)	(0.045)	(0.050)	(0.045)	(0.050)
Treatment	−0.025	0.003	−0.026	−0.000	−0.026	−0.000
	(0.037)	(0.040)	(0.037)	(0.037)	(0.037)	(0.037)
y2008	0.041	0.057**	−0.021	−0.002	−0.021	−0.002
	(0.032)	(0.028)	(0.021)	(0.019)	(0.021)	(0.019)
Native proxy			0.232***	0.149***	0.232***	0.149***
			(0.039)	(0.035)	(0.039)	(0.035)
Female			−0.016	−0.078***	−0.016	−0.078***
			(0.011)	(0.014)	(0.011)	(0.014)
nat_fem			−0.001	−0.001	−0.001	−0.001
			(0.030)	(0.033)	(0.030)	(0.033)
Private school			−0.001	−0.061***	−0.001	−0.061***
			(0.013)	(0.016)	(0.013)	(0.016)
Age			0.029***	0.023***	0.029***	0.023***
			(0.004)	(0.004)	(0.004)	(0.004)
First born proxy			−0.004	0.004	−0.004	0.004
			(0.014)	(0.013)	(0.014)	(0.013)
Number school aged HH members			−0.000	0.009	−0.000	0.009
			(0.006)	(0.006)	(0.006)	(0.006)
Rural household			0.300***	0.368***	0.300***	0.368***
			(0.030)	(0.032)	(0.030)	(0.032)
Head is employed			0.064***	0.171***	0.064***	0.171***
			(0.020)	(0.021)	(0.020)	(0.021)
Native household head proxy			0.021	0.044**	0.021	0.044**
			(0.020)	(0.021)	(0.020)	(0.021)
Age of the household head			0.009**	−0.005	0.009**	−0.005
			(0.004)	(0.004)	(0.004)	(0.004)
age_hhead2			−0.000*	0.000	−0.000*	0.000
			(0.000)	(0.000)	(0.000)	(0.000)
Household head is female			−0.007	0.033**	−0.007	0.033**
			(0.017)	(0.017)	(0.017)	(0.017)
Household head has college studies			−0.021	−0.049***	−0.021	−0.049***
			(0.016)	(0.019)	(0.016)	(0.019)
Log of durable goods value			0.000	−0.010**	0.000	−0.010**
			(0.005)	(0.004)	(0.005)	(0.004)
Log of monthly food expenditure			−0.051***	−0.021	−0.051***	−0.021
			(0.019)	(0.016)	(0.019)	(0.016)
_cons	0.215***	0.347***	−0.116	−0.003	−0.116	−0.003
	(0.020)	(0.019)	(0.148)	(0.137)	(0.148)	(0.137)
Region	No	No	No	No	Yes	Yes
Covariates	No	No	Yes	Yes	Yes	Yes
Observations	3,829	5,104	3,790	4,386	3,790	4,386
R^2	0.003	0.003	0.345	0.318	0.345	0.318

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Falsification test 2006-2007:attendance

	(1) *Primary*	(2) *Secondary*	(3) *Whole sample*
Treatment*y2007	−0.004	−0.016	−0.011
	(0.008)	(0.019)	(0.012)
Treatment	0.002	0.013	0.008
	(0.008)	(0.011)	(0.008)
y2007	0.003	−0.015**	−0.005*
	(0.003)	(0.006)	(0.003)
nat_prox	0.006	0.004	0.005
	(0.005)	(0.011)	(0.006)
female	0.004	0.006	0.005
	(0.003)	(0.005)	(0.003)
nat_fem	−0.004	0.003	−0.001
	(0.004)	(0.012)	(0.006)
priv_school	0.004**	−0.016*	−0.007
	(0.002)	(0.009)	(0.005)
age	−0.000	−0.008***	−0.004***
	(0.001)	(0.002)	(0.001)
child_ord== 1.0000	−0.001	−0.005	−0.007**
	(0.002)	(0.005)	(0.003)
schoolaged	0.001	−0.003	−0.001
	(0.001)	(0.003)	(0.002)
rural	0.004	−0.004	0.002
	(0.003)	(0.008)	(0.004)
empl_hhead	−0.004	−0.027***	−0.017***
	(0.004)	(0.008)	(0.005)
nat_hhead	−0.003	0.001	−0.001
	(0.005)	(0.007)	(0.004)
age_hhead	−0.000	0.002*	0.001*
	(0.000)	(0.001)	(0.001)
age_hhead2	0.000	−0.000*	−0.000**
	(0.000)	(0.000)	(0.000)
fem_hhead	−0.004	−0.001	−0.003
	(0.003)	(0.006)	(0.004)
sup_hhead	0.004**	0.004	0.003
	(0.002)	(0.007)	(0.004)
lgdur	0.002**	0.003*	0.003**
	(0.001)	(0.002)	(0.001)
lgfoodexp	−0.002	0.015**	0.006*
	(0.002)	(0.007)	(0.004)
chuquisaca	0.000	0.000	0.000
	(.)	(.)	(.)
la paz	−0.003	0.026**	0.010*
	(0.004)	(0.011)	(0.005)
cochabamba	−0.003	0.009	0.001
	(0.003)	(0.013)	(0.006)
oruro	0.002	0.001	−0.001
	(0.002)	(0.015)	(0.007)
potosi	0.001	0.009	0.003
	(0.002)	(0.014)	(0.006)
tarija	−0.004	0.004	−0.001
	(0.004)	(0.015)	(0.007)
santa cruz	−0.001	−0.016	−0.010
	(0.003)	(0.015)	(0.007)
beni	−0.011	−0.019	−0.017*
	(0.009)	(0.017)	(0.009)
pando	−0.005	−0.009	−0.008
	(0.006)	(0.022)	(0.010)
_cons	1.004***	0.955***	0.961***
	(0.018)	(0.052)	(0.026)
Region	Yes	Yes	Yes
Covariates	Yes	Yes	Yes
Observations	4,866	4,788	9,654
R^2	0.010	0.028	0.022

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A6: Falsification test 2006-2007:child labor

	(1) *Primary*	(2) *Secondary*	(3) *Whole sample*
Treatment*y2007	−0.009	−0.015	−0.009
	(0.059)	(0.048)	(0.042)
Treatment	−0.021	−0.001	−0.010
	(0.054)	(0.041)	(0.038)
y2007	0.036*	0.034*	0.034**
	(0.018)	(0.018)	(0.016)
nat_prox	0.233***	0.155***	0.192***
	(0.038)	(0.036)	(0.030)
female	−0.023**	−0.063***	−0.044***
	(0.010)	(0.013)	(0.009)
nat_fem	−0.019	0.031	0.006
	(0.034)	(0.036)	(0.027)
priv_school	−0.018	−0.038**	−0.034**
	(0.016)	(0.017)	(0.013)
age	0.029***	0.021***	0.023***
	(0.004)	(0.003)	(0.002)
child_ord== 1.0000	−0.001	0.002	0.001
	(0.013)	(0.013)	(0.009)
schoolaged	0.002	0.015**	0.010**
	(0.006)	(0.006)	(0.005)
rural	0.296***	0.339***	0.316***
	(0.027)	(0.030)	(0.025)
empl_hhead	0.053***	0.168***	0.118***
	(0.018)	(0.022)	(0.017)
nat_hhead	−0.002	0.038*	0.020
	(0.018)	(0.021)	(0.016)
age_hhead	0.007*	−0.009**	−0.002
	(0.003)	(0.004)	(0.003)
age_hhead2	−0.000	0.000**	0.000
	(0.000)	(0.000)	(0.000)
fem_hhead	−0.000	0.013	0.008
	(0.017)	(0.016)	(0.013)
sup_hhead	−0.028*	−0.060***	−0.044***
	(0.016)	(0.018)	(0.014)
lgdur	−0.002	−0.011***	−0.007*
	(0.005)	(0.004)	(0.004)
lgfoodexp	−0.007	−0.004	−0.007
	(0.014)	(0.016)	(0.013)
chuquisaca	0.000	0.000	0.000
	(.)	(.)	(.)
la paz	0.102***	0.012	0.056*
	(0.037)	(0.031)	(0.030)
cochabamba	0.022	0.020	0.025
	(0.042)	(0.034)	(0.033)
oruro	0.028	−0.026	0.001
	(0.041)	(0.033)	(0.031)
potosi	0.076*	0.012	0.047
	(0.041)	(0.043)	(0.035)
tarija	0.159***	0.149***	0.159***
	(0.047)	(0.037)	(0.036)
santa cruz	0.036	0.072**	0.060*
	(0.036)	(0.035)	(0.031)
beni	0.016	0.052	0.039
	(0.042)	(0.037)	(0.034)
pando	−0.103*	−0.123**	−0.110*
	(0.062)	(0.062)	(0.058)
_cons	−0.423***	−0.069	−0.222**
	(0.109)	(0.143)	(0.104)
Region	Yes	Yes	Yes
Covariates	Yes	Yes	Yes
Observations	4,091	4,788	8,879
R^2	0.315	0.263	0.283

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A7: Falsification test 2008-2009:attendance

	(1) *Primary*	(2) *Secondary*	(3) *Whole sample*
Treatment*y2009	0.000	−0.012	−0.006
	(0.002)	(0.016)	(0.008)
Treatment	0.004**	0.003	0.003
	(0.002)	(0.011)	(0.006)
y2009	−0.001	0.003	0.001
	(0.002)	(0.005)	(0.003)
nat_prox	0.007*	−0.007	0.000
	(0.004)	(0.009)	(0.005)
female	−0.001	−0.000	−0.001
	(0.002)	(0.004)	(0.002)
nat_fem	−0.004	0.003	−0.001
	(0.004)	(0.010)	(0.005)
priv_school	−0.005	−0.013	−0.010*
	(0.006)	(0.009)	(0.006)
age	−0.000	−0.004***	−0.002***
	(0.001)	(0.001)	(0.000)
child_ord== 1.0000	−0.004	−0.002	−0.004
	(0.003)	(0.004)	(0.003)
schoolaged	−0.001	0.003*	0.001
	(0.001)	(0.002)	(0.001)
schoolaged	0.000	0.000	0.000
	(.)	(.)	(.)
rural	−0.001	0.002	0.001
	(0.003)	(0.006)	(0.003)
empl_hhead	−0.002	−0.015**	−0.009**
	(0.005)	(0.006)	(0.004)
nat_hhead	0.000	−0.005	−0.002
	(0.003)	(0.006)	(0.003)
age_hhead	−0.000	0.001	0.000
	(0.000)	(0.001)	(0.001)
age_hhead2	0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)
fem_hhead	−0.002	−0.001	−0.001
	(0.003)	(0.005)	(0.003)
sup_hhead	−0.000	0.018***	0.009**
	(0.004)	(0.006)	(0.004)
lgdur	0.000	0.002	0.001
	(0.001)	(0.002)	(0.001)
lgfoodexp	0.006	−0.007	−0.000
	(0.006)	(0.005)	(0.004)
depto=1	0.000	0.000	0.000
	(.)	(.)	(.)
depto=2	−0.003	−0.005	−0.005*
	(0.003)	(0.004)	(0.003)
depto=3	−0.012***	−0.016**	−0.015***
	(0.004)	(0.006)	(0.004)
depto=4	−0.005	−0.003	−0.005
	(0.005)	(0.006)	(0.003)
depto=5	−0.003	−0.006	−0.005*
	(0.002)	(0.006)	(0.003)
depto=6	−0.001	−0.005	−0.003
	(0.002)	(0.006)	(0.003)
depto=7	−0.009	−0.025***	−0.017***
	(0.005)	(0.007)	(0.005)
depto=8	−0.009	−0.007	−0.008
	(0.007)	(0.008)	(0.005)
depto=9	−0.005	−0.001	−0.004
	(0.004)	(0.007)	(0.003)
_cons	0.969***	1.080***	1.017***
	(0.041)	(0.043)	(0.028)
Region	Yes	Yes	Yes
Covariates	Yes	Yes	Yes
Observations	4,281	4,144	8,425
R^2	0.008	0.016	0.012

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A8: Falsification test 2008-2009:child labor

	(1) *Primary*	(2) *Secondary*	(3) *Whole sample*
Treatment*y2009	0.058	0.100*	0.085**
	(0.051)	(0.054)	(0.041)
Treatment	−0.015	−0.069	−0.043
	(0.043)	(0.043)	(0.034)
y2009	−0.044**	−0.058***	−0.052***
	(0.020)	(0.020)	(0.018)
nat_prox	0.234***	0.228***	0.234***
	(0.038)	(0.037)	(0.030)
female	−0.009	−0.048***	−0.030***
	(0.011)	(0.014)	(0.009)
nat_fem	−0.049	−0.077**	−0.061**
	(0.031)	(0.034)	(0.024)
priv_school	0.000	−0.075***	−0.046***
	(0.017)	(0.019)	(0.014)
age	0.030***	0.020***	0.024***
	(0.004)	(0.004)	(0.002)
child_ord== 1.0000	−0.011	0.009	0.001
	(0.014)	(0.014)	(0.009)
schoolaged	−0.008	0.007	0.001
	(0.006)	(0.007)	(0.005)
schoolaged	0.000	0.000	0.000
	(.)	(.)	(.)
rural	0.220***	0.236***	0.229***
	(0.024)	(0.029)	(0.023)
empl_hhead	0.093***	0.193***	0.151***
	(0.024)	(0.028)	(0.021)
nat_hhead	0.015	0.069***	0.043**
	(0.020)	(0.023)	(0.017)
age_hhead	0.005	−0.007	−0.001
	(0.005)	(0.004)	(0.004)
age_hhead2	−0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
fem_hhead	0.016	0.068***	0.045***
	(0.018)	(0.019)	(0.015)
sup_hhead	−0.028	−0.045**	−0.037**
	(0.019)	(0.021)	(0.016)
lgdur	−0.008*	−0.002	−0.005
	(0.005)	(0.005)	(0.004)
lgfoodexp	0.006	−0.003	0.000
	(0.019)	(0.015)	(0.013)
depto=1	0.000	0.000	0.000
	(.)	(.)	(.)
depto=2	−0.069	0.027	−0.027
	(0.060)	(0.050)	(0.053)
depto=3	−0.145**	0.037	−0.060
	(0.062)	(0.053)	(0.054)
depto=4	−0.161**	−0.002	−0.084
	(0.065)	(0.064)	(0.059)
depto=5	0.013	0.031	0.013
	(0.065)	(0.058)	(0.059)
depto=6	−0.244***	−0.129**	−0.193***
	(0.063)	(0.058)	(0.058)
depto=7	−0.164***	−0.018	−0.095*
	(0.060)	(0.050)	(0.053)
depto=8	−0.203***	−0.000	−0.094
	(0.065)	(0.065)	(0.064)
depto=9	−0.273***	−0.302***	−0.286***
	(0.099)	(0.072)	(0.083)
_cons	−0.273	−0.096	−0.167
	(0.175)	(0.137)	(0.120)
Region	Yes	Yes	Yes
Covariates	Yes	Yes	Yes
Observations	3,641	4,146	7,787
R^2	0.319	0.266	0.287

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX

B

APPENDIX TO CHAPTER 4

Table B1: Group-coefficient of variation (GCOV)

	Indigenous				Gender	Location
	Self	First	Any	Learned		
Market income	0.147	0.226	0.158	0.211	0.037	0.289
Disposable income	0.137	0.210	0.145	0.196	0.036	0.276
Post-fiscal income	0.126	0.200	0.134	0.185	0.038	0.233
Final income	0.120	0.192	0.128	0.178	0.034	0.228

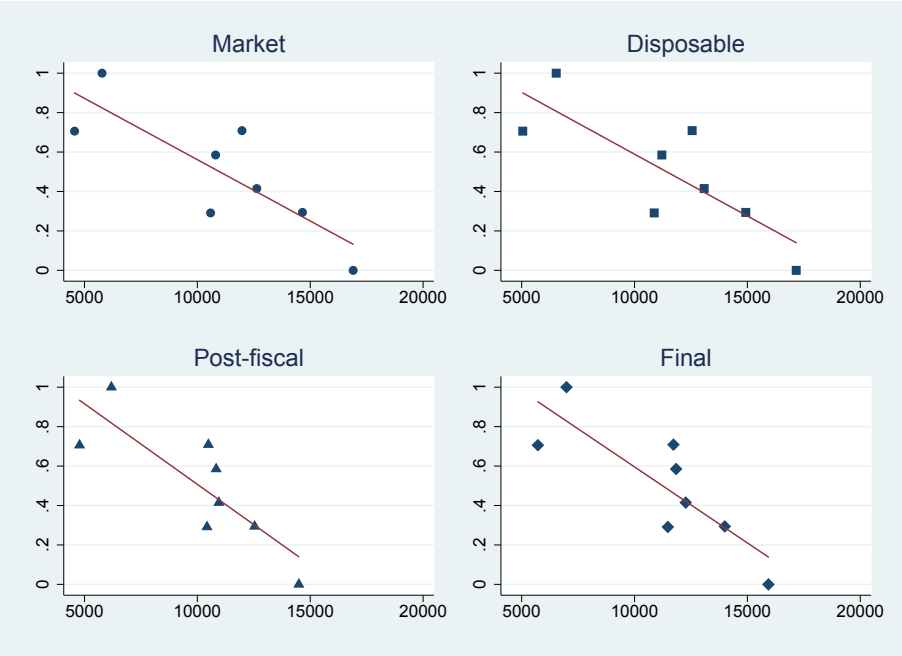
Source: Own calculations. The indigenous sub-categories are: *self* (self-identification of indigenous status); *first* (respondent declared a native language as the main that he/she uses); *any* (respondent declared that he/she can speak at least an indigenous language; and *learned* (respondent declared that he/she learned to speak in a native language).

Table B2: Group-Theil coefficient (GTheil)

	Indigenous				Gender	Location
	Self	First	Any	Learned		
Market income	0.012	0.031	0.013	0.025	0.001	0.046
Disposable income	0.010	0.026	0.011	0.022	0.001	0.042
Post-fiscal income	0.008	0.024	0.009	0.019	0.001	0.029
Final income	0.008	0.022	0.008	0.018	0.001	0.028

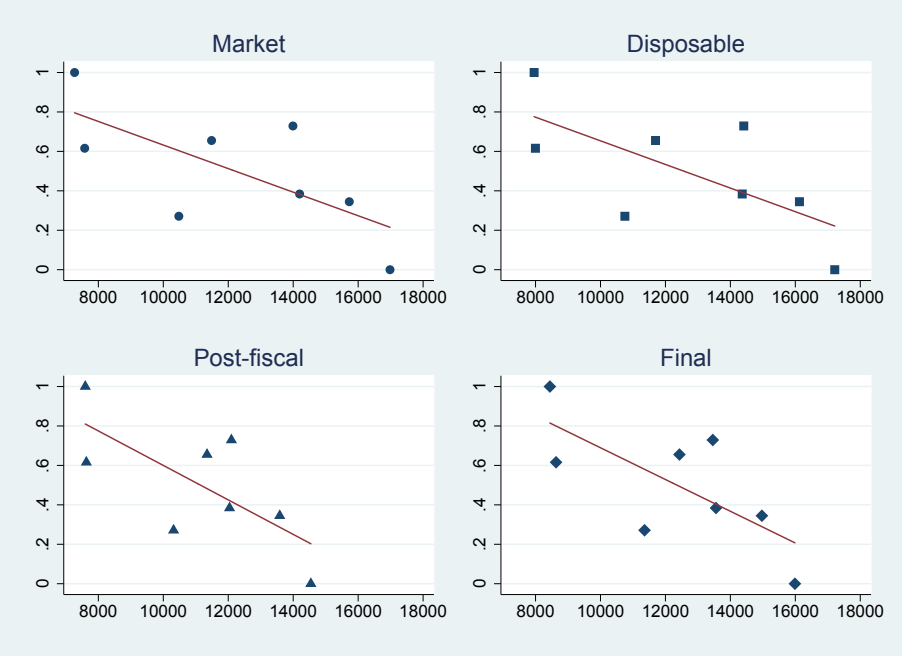
Source: Own calculations. The indigenous sub-categories are: *self* (self-identification of indigenous status); *first* (respondent declared a native language as the main that he/she uses); *any* (respondent declared that he/she can speak at least an indigenous language; and *learned* (respondent declared that he/she learned to speak in a native language).

Figure B.1: Indigenousness index and income concepts. Alternative 1, first indigenous language



Source: Own calculations. In each of the four panels, the "indigenousness" index is plotted in the horizontal axis, and average income (in Bs.) in the vertical axis. The fitted line was estimated using OLS.

Figure B.2: Indigenousness index and income concepts. Alternative 2, any indigenous language



Source: Own calculations. In each of the four panels, the "indigenousness" index is plotted in the horizontal axis, and average income (in Bs.) in the vertical axis. The fitted line was estimated using OLS.

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