

The Value of Official Statistics

Lessons from Intergovernmental Transfers

Benjamin Roseth
Angela Reyes
Karla Yee Amézaga

Institutions for Development
Sector

Innovation in Citizen
Services Division

TECHNICAL
NOTE N°
IDB-TN-1682

The Value of Official Statistics

Lessons from Intergovernmental Transfers

Benjamin Roseth
Angela Reyes
Karla Yee Amézaga

September 2019



Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library

Roseth, Benjamin.

The value of official statistics: lessons from intergovernmental transfers / Benjamin Roseth,
Angela Reyes, Karla Yee Amézaga.

p. cm. — (IDB Technical Note ; 1682)

Includes bibliographic references.

1. Statistics-Government policy-Latin America. 2. Intergovernmental fiscal relations-Latin
America. 3. Latin America-Statistical services. I. Reyes, Angela. II. Yee Amézaga, Karla.
III. Inter-American Development Bank. Innovation in Citizen Services Division. IV. Title.
V. Series.

IDB-TN-1682

<http://www.iadb.org>

Copyright© 2019 Inter-American Development Bank. This work is licensed under a Creative Commons IGO 3.0 Attribution-NonCommercial-NoDerivatives (CC-IGO BY-NC-ND 3.0 IGO) license (<http://creativecommons.org/licenses/by-nc-nd/3.0/igo/legalcode>) and may be reproduced with attribution to the IDB and for any non-commercial purpose. No derivative work is allowed.

Any dispute related to the use of the works of the IDB that cannot be settled amicably shall be submitted to arbitration pursuant to the UNCITRAL rules. The use of the IDB's name for any purpose other than for attribution, and the use of IDB's logo shall be subject to a separate written license agreement between the IDB and the user and is not authorized as part of this CC-IGO license.

Note that the link provided above includes additional terms and conditions of the license.

The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the Inter-American Development Bank, its Board of Directors, or the countries they represent.



THE VALUE OF OFFICIAL STATISTICS

Lessons from Intergovernmental Transfers

Benjamin Roseth, Angela Reyes, Karla Yee Amézaga

Abstract*

Much has been written about the importance of evidence-based public policy. Nonetheless, few rigorous studies have been conducted on the cost to a country of the lack of good-quality statistical information. This paper seeks to fill this gap by taking a fresh approach: an analysis of the intergovernmental fiscal transfer programs whose budget allocation formulas include population criteria. Through a series of simulations in three Latin American countries (Bolivia, Ecuador, and El Salvador), it analyzes what would have happened if more accurate population estimates had been used when allocating transfers to subnational governments. By employing retrospective population estimations, significant results are obtained. In El Salvador, for example, due to inaccuracies in the measurement of the municipal population, approximately US\$92 million (in real 2018 dollars) were generated in bad resource allocation, that is, sent to municipalities by mistake, between 2000 and 2007. This is equivalent to 700 percent of the cost of the latest census and to more than 27 times the annual budget of the statistical office. Although certain deterioration in the accuracy of population estimates is to be expected, the scale of its impact highlights the need to invest in two aspects of statistics: the quality of projections to enhance accuracy, and a census every 10 years, in line with international standards.

JEL classifications: D60, D61, H3, H7, H72, H73

Key words: census, population projections, fiscal transfers, inefficiencies

* Benjamin Roseth is a Specialist in Modernization of the State at the Inter-American Development Bank (IDB); Angela Reyes and Karla Yee Amézaga are consultants at the same institution. The authors would like to acknowledge the support of Guiomar Bay, Population Affairs Officer at the Population Division of the Economic Commission for Latin America and the Caribbean (CDE-LADE); José Antonio Mejía, Lead Specialist at the IDB; Huascar Eguino, Lead Specialist at the IDB; and Byron Villacís, independent consultant. The following people and institutions made valuable contributions: Janine Perfit (IDB), Mario Sanginés (IDB), Camila Mejía (IDB), Philip Keefer (IDB), Axel Radics (IDB), Juan José Barrios (IDB), Javier Beverinotti (IDB), Eduardo Sojo, at Mexico's Centro de Investigación y Docencia Económicas (CIDE), Kristobal Salas, Centro de Investigación Económica y Presupuestaria (CIEP), Paraguay's Dirección General de Estadística, Encuestas y Censos, and Instituto Nacional de Estadística y Censo (INDEC).

For further information on population projections, download Villacís (2019) at: <https://publications.iadb.org/es/proyecciones-de-poblacion-un-estudio-comparativo> (available in Spanish only).

Table of Contents

1.	
Introduction: Why Quantify the Value of Statistics?	1
2.	
Measurement of Statistical Capacity in Latin America and the Caribbean	3
3.	
Other Approaches to Measuring the Value of Statistics	8
4.	
Methodology and Context: How Can the Value of Statistics Be Measured through Intergovernmental Transfers?	11
4.1. Limitations.....	16
4.2. Transfer Programs Analyzed	16
5.	
Outcomes: The Impacts of Inaccurate Population Data on Resource Allocation	20
5.1. Deviations between the Population Figure Used and the Real Figure.....	20
5.2. Fiscal Implications of Inaccurate Population Data	28
5.3. The “Winners” and the “Losers”	36
5.4. Is It Best to Use the Projections or the Census?.....	43
6.	
Conclusions	46
References	48
Annex 1. Methodological Note to the Maps	50
Annex 2. Methodology for Measuring the Transfers	51

1.

Introduction: Why Quantify the Value of Statistics?

Why is it important to quantify the value of statistics? Although the phrase “evidence-based public policies” seems to have become popular, and the demand for timely and good-quality data is at an all-time high (Merry, Davis, and Kingsbury, 2015). In Latin America and the Caribbean (LAC) the most basic and most comprehensive sources of information about a country—the population and housing censuses and the statistical products based on them—suffer from a series of limitations. Too often the censuses are postponed, while national statistical offices fail to receive a budget that is adequate to generate the basic data needed for decision making.

Censuses (population, housing, economic, and agricultural) are the most important and comprehensive primary sources of statistical information. Alongside household surveys and administrative registries, they make up a country’s statistical system. Based on the censuses, the sociodemographic characteristics of persons, housing, and households, such as health, education, or economic participation, are revealed. The geographical disaggregation offered by these data enables the design of targeted policies. Moreover, the census constitutes the basic sampling frame for the development of other operations within national statistical systems (NSS), which helps, among other things, to draw up national and local electoral districts and establish proportionality in parliamentary representation, and serves as a basis for the elaboration of population projections and estimates.

The information provided by a country’s statistical system also favors decision making by nongovernmental actors, such as firms, civil society organizations, the press, and citizens, and these decisions also impact on the economy and on the different areas of a country. Therein lies the importance of producing reliable, up-to-date, and good-quality official data.

In recent decades, various international organizations have highlighted the importance of statistics for development.¹ To comply with national development plan goals, as well as with the commitments framed in the Agenda 2030 and the Global Action Plan for Sustainable Development Data, more investment is needed to build capacity at national statistical offices (NSOs). This was highlighted in the most recent edition of the *Partner Report on Support to Statistics/PARIS21* (Paris 21, 2018). The report suggests that there is persistent underinvestment in statistics as, in the period 2014–2016, only 0.33 percent of all official development assistance was earmarked for official data and statistics, which is equivalent to US\$623 million. Of the total approved for statistical support, 8 percent was distributed in LAC, mostly

¹ This matter has been of central concern at diverse international forums, such as the Second International Roundtable on Managing for Development Results, organized by the multilateral development banks in Marrakech (2004), and the High Level Forum on Aid Effectiveness, of the Organisation for Economic Co-operation and Development (OECD), held in Busan in 2011.

Introduction: Why Quantify the Value of Statistics?

for providing support for the censuses of the 2020 round, whereas Africa received 56 percent.²

Although the fundamental role played by good-quality statistics in decision making is recognized, investment in this area is deficient. Dargent et al. (2018) argue that there are many reasons why the positive rhetoric pertaining to the value of statistics does not always translate into support for strengthening the institutions that produce official statistics in the region:

- i. The double-edged sword of transparency.* On the one hand, governments need data to make informed decisions. But, on the other, those same data can be utilized as a tool to enable citizens to carry out monitoring and demand accountability regarding the decisions of their governments, thereby reducing discretionality.

- ii. Loss of control.* Some governments or state organs might benefit from direct control over the production of statistics and therefore oppose the reforms aimed at strengthening NSOs.
- iii. Apathy.* Faced with a multiplicity of demands, major decision makers might not consider statistical capacity a priority.
- iv. Perception of low return.* Statistical capacity-building efforts might appear to be expensive and without clear benefits.

In LAC, these challenges have translated into significant gaps in the capacity of official statistics-producing institutions and in the investment dedicated to statistics in general. This paper puts forward an argument regarding the importance of investing in official statistics (including the census and statistical capacity in general), from a specific perspective: bad allocations of resources for inter-governmental transfers that are caused by imprecise municipal population figures. The argument builds on previous studies carried out in South Africa, New Zealand, and Scotland (discussed below), and constitutes the first time that this approach has been applied in Latin America.

² The report also highlights that these figures can be underestimated for many reasons, such as, for example, resources for statistical development projects that are classified under other headings or incomplete accounting of the resources provided by regional development banks.

2.

Measurement of Statistical Capacity in Latin America and the Caribbean

Although no single indicator with regional or international coverage can fully reflect a country's statistical capacity, various partial approaches reveal the challenges faced by national statistical institutions and systems.

In some countries of the region, there have been delays in carrying out the census, the cornerstone of a country's official statistics. This is mainly manifested in the time elapsed between censuses. Although the internationally recognized norm calls for a census to be taken every 10 years (United Nations, 2008), nine LAC countries failed to observe this norm in the latest round of censuses.³ Moreover, in various countries that did carry out censuses within the recommended period, problems arose that undermined that their legitimacy or utility. For example, the 2012 census data in Chile were never made official due to

a series of methodological questions;⁴ Paraguay's 2012 census suffered a high rate of census omission (25.6 percent), which made it impossible to generate certain statistics disaggregated by geographic area (DGEEC, 2015); and the 2012 census in Guyana, which recorded significant demographic changes, was not fully disclosed until 2016. Although a delay in the census might seem a minor matter, the implications are serious. The following section details how this can have an impact on intergovernmental fiscal transfers.

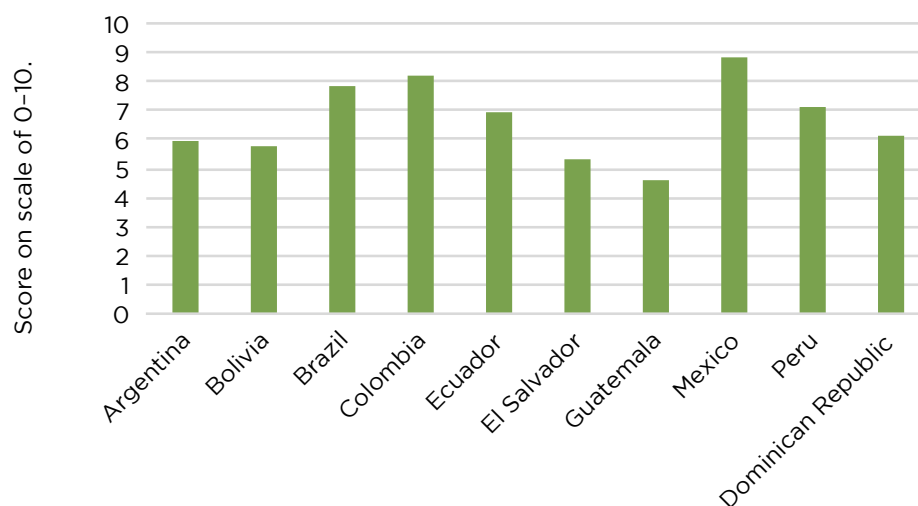
The National Statistical Capacity indicator, a multidimensional measurement designed by the Inter-American Development Bank (IDB), which covers aspects of resources, institutional rules and practices, methodologies and diffusion, reveals that there is great heterogeneity in the region (Dargent et al., 2018).⁵

³ According to data from CELADE, they were: Bolivia (11 years), Costa Rica (12), Colombia (13), El Salvador (15), Guatemala (16), Haiti (15), Honduras (12), Nicaragua (13), and Uruguay (15).

⁴ The areas called into question were: (i) the high rate of omission, (ii) the rate of masculinity, which differed from the household surveys; (iii) the numbers of foreigners, which differed from the migration surveys; (iv) a high percentage of absent householders; (v) the trustworthiness of the information submitted on digital forms. For more data, see the *Informe Final de la Comisión Externa Revisora del Censo 2012*, available at: <http://www.ine.cl/docs/default-source/censos/comisiones-investigadoras-censo-2012/comision-nacional/informe-completo.pdf?sfvrsn=4>

⁵ This indicator has only been applied once, to 10 countries in the region.

Figure 1. National Statistical Capacity Indicator (2015–2017) in Selected Latin American and Caribbean Countries



Source: Dargent et al. (2018).

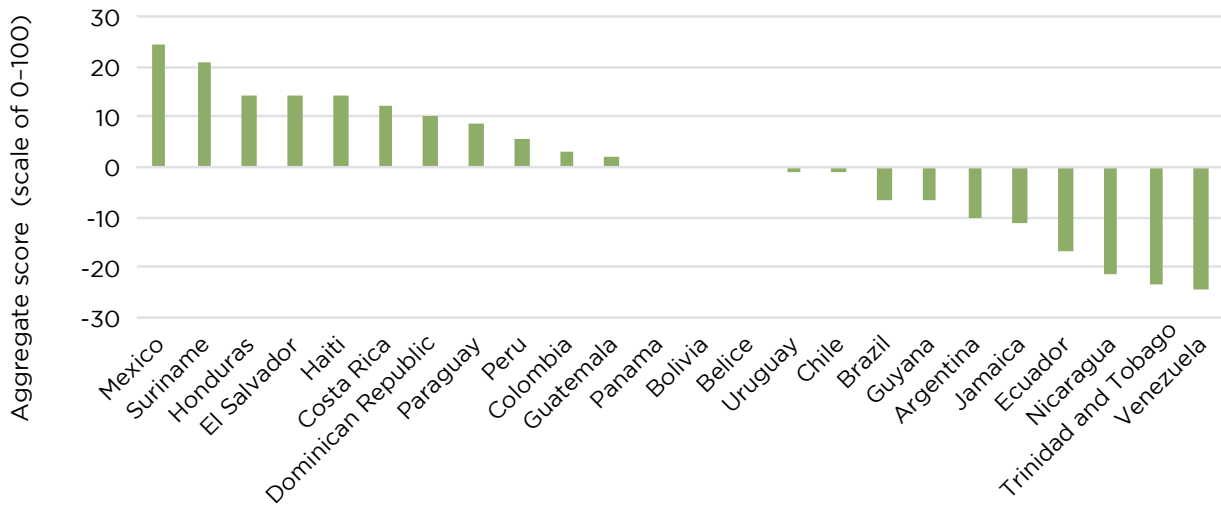
The World Bank’s Statistical Capacity Index (SCI) measures aspects of methodology, sources, and periodicity based on public information.⁶ It reveals that the scores of 10 out of 24 LAC countries worsened between 2005 and 2018. Figure 2 presents the change for each country in this period, and Figure 3 shows that in 2018, in the aggregate (simple average), the region fell back to approximately where it had been in 2005. Recently, the World Bank launched a new version of its SCI, called the Statistical Performance Indicator (SPI), which covers

a greater number of dimensions of statistical capacity, indicators, and countries. When the 146 countries common to both indices are compared using the 2016 values,⁷ significant changes in position in the ranking are noticeable: El Salvador, in fifth place according to the SCI, fell to position 48 on the SPI scale. According to the authors, this was attributable in part to shortcomings in the way that some indicators for the Sustainable Development Goals relating to childhood were measured (Cameron et al., 2019).

6 The SCI examines whether elements such as statistical methodology, periodicity, and timeliness in official data disclosure are in accordance with best international practices. However, as Beccaria (2017) suggests, this index fails to consider the data production process in depth, which also reflects the level of statistical capacity of the official data-producing offices.

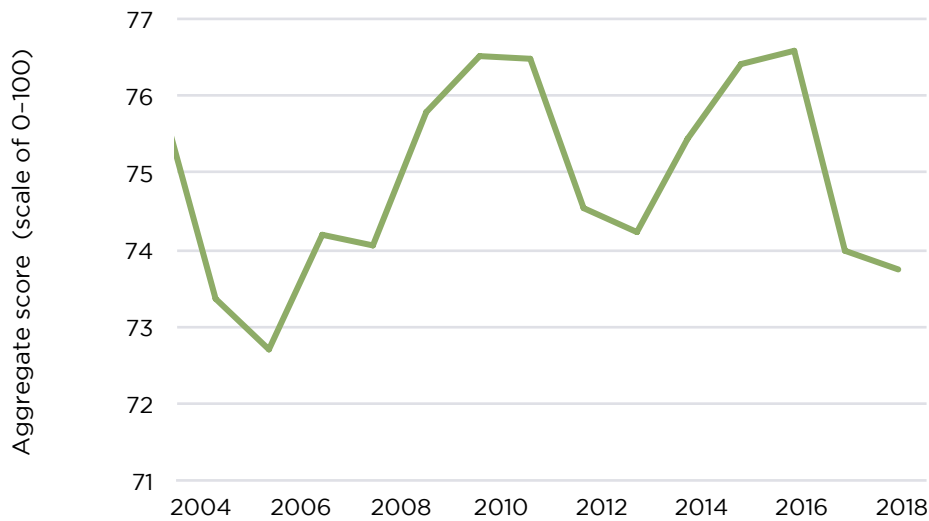
7 Only SPI values for 2016 are available.

Figure 2. Changes in Statistical Capacity in Latin America and the Caribbean (2005–2018)



Source: World Bank (2018).

Figure 3. Evolution of Statistical Capacity in Latin America and the Caribbean



Source: Open Data Watch, available at: <http://odin.opendatawatch.com/>.

Note: The average includes the 24 countries listed in Figure.

From the data availability and openness perspective, LAC also suffers a significant deficit in comparison with Organisation for Economic Co-operation and Development (OECD) countries. This is revealed by the Open Data Watch aggregate indicator, which evaluates 21 categories of data⁸ according

to their coverage (availability of the indicator and adequate level of disaggregation) and accessibility (whether diverse downloading options are provided, and in different formats; availability of metadata and open terms of use) (Figure 4).

Figure 4. Aggregate Score for Data Coverage and Openness, Latin America and the Caribbean vs. Organisation for Economic Co-operation and Development Countries (2017)



Source: Open Data Watch, available at: <http://odin.opendatawatch.com/>.

Note: Includes LAC 24 countries, the same ones shown in Figure 2, but without Costa Rica and including the Bahamas.

⁸ The categories include social, economic, and environmental statistics.

If the quality and coverage of economic and financial statistics are considered, LAC also lags behind. To encourage greater data transparency, which helps identify financial conditions and trends in time to take opportune actions, the International Monetary Fund (IMF) launched two data transparency initiatives: the Special Data Dissemination Standard (SDDS) and the General Data Dissemination System (GDDS). By participating in these standards, countries commit to improve the quality and timeliness of

official data disclosure, which can help, for example, reduce borrowing costs in international capital markets and improve the effectiveness of the IMF's own financial supervision and crisis prevention efforts⁹. Nonetheless, not a single country in the LAC region complies with the highest standards, (SDDS Plus), while 11 countries only comply with the most basic standard, the Enhanced General Data Dissemination System (e-GDDS). Map 1 presents the regional distribution of compliance with the IMF standards.

Map 1. Compliance with the IMF Quality and Coverage Standards for Economic and Financial Statistics in Latin America and the Caribbean



Source: IMF Dissemination Standards Bulletin Board (DSBB), available at: <https://dsbb.imf.org/>

⁹ For more information, see: <http://dx.doi.org/10.5089/9781589065574.069>.

3.

Other Approaches to Measuring the Value of Statistics

There are various approaches to measuring the monetary value of official statistics. Some have been empirically tested, whereas others only exist in the theory. Some are capable of including a country's entire statistical production, while others focus on specific products. This section briefly describes these approaches and identifies the knowledge gap that they leave to LAC decision makers, especially finance ministries, a gap that the approach adopted in this paper seeks partly to address.

The Conference of European Statistics (CES), of the United Nations Economic Commission for Europe (UNECE) (2017), has identified five approaches, each with significant disadvantages:

- i. Operating costs:* adding together all expenditures associated with official statistics production. Although this approach might be useful for demonstrating that the cost of official statistics is relatively low in comparison with other expenditures, UNECE recognizes that this does not reflect the differences in data quality or coverage and does not permit adequate comparisons between countries and over time. Moreover, the concept of cost does not necessarily reflect value in terms of the different uses made of the statistics and the benefits that they generate.
- ii. Shadow prices:* determining the prices that official statistics would have received in the private market if they were not a public good, through analysis of similar products. The challenge of this approach lies chiefly in the difficulty of finding equivalents in the private market. Among other products, this inconvenience is seen in the case of the census: a statistical product of public and unlimited use that serves as the basis for an enormous quantity of statistics (for example, as a denominator) and statistical operations (for example, as a sampling frame) and for which no equivalent exists in the private market.
- iii. Contingent valuation:* uses surveys to ask how much money people would be prepared to pay for official statistics. The United Kingdom's Economic and Social Data Service (ESDS), a service that promotes the use of data for research and teaching, with an annual budget of US\$4.18 million (GBP 3.3 million), adopted this approach. This office asked its users about their willingness to pay for a subscription and came up with a yearly average of US\$6.750 (GBP 5.333). Applied to its user base of 23,000 persons, this is equivalent to approximately US\$140 million (GBP 111 million). The major challenge of this approach is the impossibility of verifying whether the survey responses would correspond to subsequent behavior in the real world.
- iv. Revealed preference:* calculates the opportunity cost of an action that depends on the use of official statistics. For example, it calculates

the revenue lost by a communication medium (newspaper, television, radio, Internet, etc.) by publishing an article that uses official statistical data, instead of publishing publicity of the same size (or the same duration in the case of radio and television). This approach has been employed by Mexico's National Statistical and Geographical Institute (Instituto Nacional de Estadística y Geografía, or INEGI) and Spain's National Statistical Institute (Instituto Nacional de Estadística, or INE). After making this calculation, INEGI found that its statistics were worth US\$151 million per month. For its part, INE estimated that its statistics were worth US\$53 million per month. A significant challenge to this approach is that it fails to consider the value of statistics for public policy ends.

- v. *Impact evaluations:* measuring the impact on economic or social outcomes of the availability of specific data, in general for use by citizens or decision makers. A range of studies has argued that there is a causal relationship between data availability and results, such as the demand for education (Jensen, 2010), the use of health and welfare services (Björkman and Svensson, 2007), and the targeting of conditional transfer programs (Alatas et al., 2012), among others. The chief limitations of this approach lie in its specificity (it focuses on a particular case rather than on statistical production in general) and in the lack of evaluable factors.

There is one further approach that has been empirically tested and is most similar to the one employed in this study. It is based on measuring the bad allocation of public funds when updated census information is unavailable.

- i. *Scotland.* In a study for the Registrar of Scotland, Aldridge (2006) analyzed the ex ante cost-benefit ratio of the 2011 census. The author compared allocations to the Health Board Areas based on district population projections

taken from the population figures provided by the 2001 census, with the allocations that would have been made if the data from this census had not been used. After adding the absolute values of both allocations (the real and the hypothetical) for each district (as otherwise the sum would be 0, given that the money not transferred to one district would be transferred to another) and for each year between 2002 and 2011, the author concluded that the bad allocations total is equivalent to more than nine times the estimated cost of the 2011 census.

- ii. *South Africa.* Following a request from the government of South Africa, Spencer et al. (2017) weighed the advisability of conducting a new census just five years after the 2011 census. In common with Scotland's example, their approach consisted of estimating the effects on public budget allocations to subnational governments of either conducting a census in 2016 or not doing so. The authors concluded that, although the census improved allocation accuracy, the benefits did not justify the investment and that it would be more profitable to invest in building capacity to obtain better intercensal projections.
- iii. *New Zealand.* In a study for the national statistical institute of New Zealand, Bakker (2014) estimated the cost-benefit ratio of the census. In common with the reports from Scotland and South Africa, this study mainly analyzed the increase in accuracy and specificity in public resource allocation achieved by using census data. It concluded that the benefits, estimated at more than US\$680 million (NZD 1,000 million), easily outweighed the costs.

These exercises leave some knowledge gaps when it comes to measuring the value of statistics for the LAC region. In particular, there are few examples from the region (with the exception of the aforementioned case of the INEGI). Moreover, the approaches mentioned by the UNECE fail to adopt the perspective

of a finance ministry decision maker, who must weigh proposed expenditure in investing in official statistics (for carrying out the census or strengthening statistical capacity in general) against other spending priorities; nor do they quantify the social cost generated by

using poor-quality statistics in public policymaking. Although the aforementioned examples of Scotland, New Zealand and South Africa take this approach, the differences in context could undermine their relevance for the policy dialogue in LAC.

4.

Methodology and Context: How Can the Value of Statistics Be Measured through Intergovernmental Transfers?

This paper provides elements to quantify the value of official statistics in the context of the discussion of budget priorities among government decision makers. The concept of value can be understood in several ways. One of these is the effective execution of resources and, in particular, that the resources allocated to a certain policy objective effectively reach the intended beneficiaries. Consistent public policy execution is important not only for the purposes of the policies themselves, but also for their construction: policies are a product of a democratic process in which political representatives reach an agreement about how resources will be distributed to the different regions of the country. In this sense, deviations caused by deficiencies in the data used are arbitrary and undermine the legitimacy of the political agreement.

Intergovernmental fiscal transfers provide an important perspective for understanding the role of statistics in sound public policy execution. These transfers finance nearly 60 percent of subnational expenditure in developing countries and in economies in transition. Moreover, they create accountability incentives and mechanisms that in turn impact fiscal administration, efficiency, and fairness in public service provision and in citizens' evaluation of government performance. There are two types of transfers. The first are conditional transfers that are offered in return for compliance with certain conditions (that

is, the money transferred must be spent on specific projects or services) and are allocated based on the type and the level of expenditure of the service financed. Second, unconditional transfers can be per capita transfers, equalization transfers of fiscal capacity, or equalization transfers of fiscal capacity and expenditure. In contrast to conditional transfers, unconditional transfers are determined by formulas that aim to reduce discretionality and seek to adhere to criteria of fairness, efficiency, predictability, flexibility, and allocation of responsibilities (Boadway and Shah, 2009).

This approach is relevant in LAC due to the proportion of budgets that are executed at the subnational level and due to the prevalence of allocation formulas that depend on official statistics to transfer resources to departmental and municipal governments. This trend has been increasing in recent decades: the proportion of public expenditure executed at the subnational level in Latin America rose from 13 percent in 1985 to 25 percent in 2010 (IDB, 2018). These resources usually reach subnational governments through an allocation formula, and many of the formulas depend on data provided by the census or on subsequent projections, in particular of population and of unmet basic needs, which also depend on population data as a denominator. Map 2 presents a panorama of these transfer programs in LAC.

Methodology and Context: How Can the Value of Statistics Be Measured through Intergovernmental Transfers?

Map 2. LAC Transfer Programs with Census Data-based Allocation Formulas



Source: Authors' elaboration from official sources in each country.

Note: Mexico's Ramo 33 and Ramo 28 are the transfer programs used to allocate resources to the states. Ramo 28 is for general use, whereas Ramo 33 supports expenditure in specific areas (health, education, educational and social infrastructure, and public safety).

The effects of a bad allocation will depend to a large extent on the capacity of cities or municipalities to access alternative sources of revenue. Large cities have particular expenditure needs, such as social services programs, mass transit systems, and security, but they also have the capacity to generate more revenue, for example, through tax collection. For their part, smaller cities have fewer expenditure needs. Although they do not enjoy the same economies of scale as big cities, they commonly have lower institutional capacity and more restricted revenue collection options, and in some cases depend on property taxes. Rural governments frequently face higher poverty rates, more limited alternative sources of revenue, and higher costs for public service provision (Boadway and Shah, 2009).

Problems elaborating, updating, or interpreting population projections affect not only the allocation of government transfers, but also many other areas of public management. Population data affect numerous indicators, such as the rates of fertility, illiteracy, homicide, malnutrition, infant mortality, unemployment, poverty and inequality, to name a few, which in turn determine the design and implementation of public programs. Therefore, the lack of updated and precise demographic data can impact the efficiency of education, health, social development, security, and infrastructure programs, and so on.

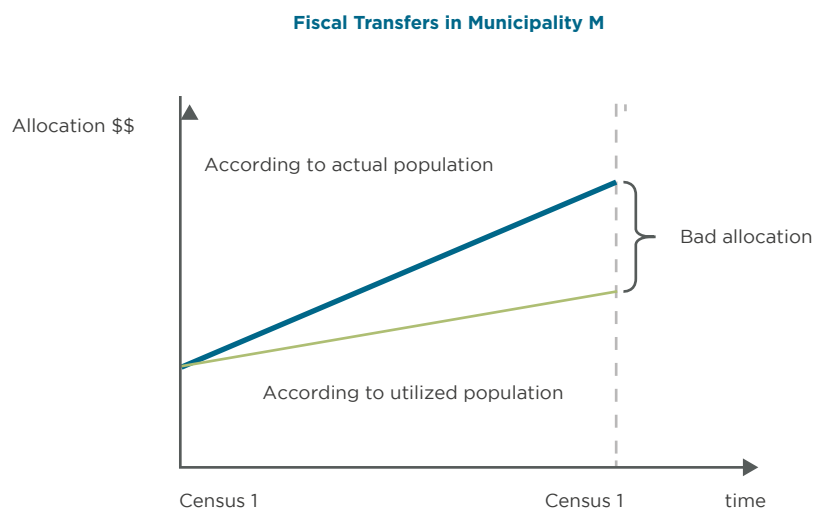
However, estimating the future population is a complex exercise, especially as the level of geographic disaggregation of the analysis increases. A certain degree of inaccuracy is therefore to be expected when estimating the municipal population over a period of 10 years (the typical intercensal period) or an even longer time span. The majority of the region's countries forecast population using the census results alongside information provided by administrative registries and demographic surveys. For this purpose, they make assumptions regarding fertility, mortality,

and migration for the medium and the long term and, on this basis, forecast the population for various decades. At the subnational level, the processes are more complicated given that disaggregated information is not always continuously available or lacks sufficient standards of quality or coverage needed to make population projections. It is owing to these complexities that the quality of the projections depends to a large extent on the countries' statistical capacity, above all when it comes to measuring migratory movements in smaller areas. For this reason, population projections are generally elaborated with a built-in margin of error and are considered estimates, even though they may thereafter be used for purposes that require precision, such as the allocation of transfers to municipalities.

In aggregate terms, and assuming a fixed ceiling for the total resources transferred as part of the transfers program (as is the case in the majority of the programs of this type in LAC), the discrepancy between the population projections and the evolution of the real population results in a significant redistribution of transfer resources or, in other words, money that is sent to places other than the originally planned destination. The result is similar for countries that use the census population (instead of projections) throughout the entire intercensal period: the reference population used to calculate the allocations begins to diverge from the real population, causing distortions in transfer policy execution, as it becomes further and further removed from demographic reality.

In the context of this paper, *bad allocation* is defined as inadequate allocation of intergovernmental fiscal transfers as a result of the lack of updated population figures. The cause of this bad allocation is illustrated in Figure 5, which shows how in one municipality (M), the gradual deviation between the estimate of the population used and the real population results in a similar deviation in the resource allocation.

Figure 5. Example of Deviation in the Allocation of Transfers at the Municipal Level



The total bad allocation in monetary terms corresponds to the total sum of money, in absolute values, sent to the wrong destinations due to inaccurate population data. To find out which municipalities receive more or less than their due, the period between the two last censuses must be analyzed and an estimate made, for each municipality, of *how much it would have received if the allocation had been calculated based on a population that was closer to reality*. The more accurate population is provided by the updated population projections¹⁰—that is, those carried out retroactively based on the latest census—and using their data as the main adjustment factor.¹¹ In general, the calculation consists of estimating

the following formula for the total redistribution caused by inaccurate population data:

$$\text{Total inefficiency of the country} = \sum_{m=1}^n |a_m - b_m|$$

where: m = municipality; a = real population-based allocation; b = hypothetical population-based allocation. Six steps are required to complete the calculation:

- i. Find out the total amount to be transferred according to population for each year.

Example: in the country Poblancia, the transfers program has a total amount of US\$1 million, equivalent to 10 percent of tax revenues, for the year in question. The allocation formula states that 50 percent is distributed in equal parts and the remaining 50 percent in direct proportion to the population. Therefore, in the sample year, US\$500,000 are transferred according to population.

- ii. For each municipality and each year, calculate how much was received in population-based

10 Other terms used for the updated projections include adjusted estimates, adjusted retrospective population estimations. All refer to population projections made for a period in the past on the basis of new information.

11 The majority of the Latin American countries use the demographic components method, which results from the compensatory equation, broken down according to gender and age: $N^{t+5} = N^t + B^{t,t+5} - D^{t,t+5} + I^{t+5} - E^{t+5}$; where N^t is the projection estimated at the starting point of the projection period; N^{t+5} represents the estimated population at the end of the five-year period; $B^{t,t+5}$ represents the births of women of reproductive age occurred in the period; $D^{t,t+5}$ represents deaths; finally I^{t+5} and E^{t+5} represent the total number of immigrants and emigrants in the period. The procedure includes estimates of fertility and mortality rates, and numbers of migrants, with which to make projections in predetermined periods (United Nations, 2011).

Methodology and Context: How Can the Value of Statistics Be Measured through Intergovernmental Transfers?

transfers. This consists of multiplying the total to be transferred in the program according to population (numeral 1) by the proportion of the total population that occupies each municipality.

Example: according to the original population projections—the official source for calculating the allocations—this year Poblancia has a total population of 160,000 inhabitants in two municipalities, Alegre and Triste. Alegre, a growing city, this year has 120,000 inhabitants (75 percent) while Triste, a municipality that depended on an already worked-out mine, 40,000 inhabitants (25 percent). Therefore, this year Alegre received $0.75 \times 500,000 = \text{US\$}375,000$ and Triste received $0.25 \times 500,000 = \text{US\$}125,000$, according to population.

- iii. *For each municipality and each year, calculate how much would have been received in population-based transfers if an accurate figure had been used.* This consists of replacing the population figure used for one closer to reality. This paper uses updated retrospective population estimations and supposes that this figure is more precise than one yielded by either the census or the estimations. This is because it has the benefit of additional information, such as the latest census and the latest administrative registries, which can disclose changes in population that have occurred subsequent to the time when the population data used to allocate the transfers (census or original projection) was gathered.

Example: According to the population-adjusted projections, Poblancia has a total population of 200,000 inhabitants (not 160,000, as the original projections suggested), divided into the same two municipalities, but in different proportions: Alegre has 140,000 inhabitants (70 percent) and Triste 60,000 (30 percent). Therefore, if the adjusted projections had been used to calculate the allocations, Alegre would

have received $0.70 \times 500,000 = \text{US\$}350,000$ and Triste would have received $0.30 \times 500,000 = \text{US\$}150,000$.

- iv. Calculate the differences between what each municipality effectively received and what it would have received if a more accurate population figure had been used.

Example: Using the original projections, Alegre received US\$375,000, while with the adjusted projections it would have received US\$350,000, that is: US\$25,000 less. Triste, in contrast, received US\$125,000 with the original projections and would have received US\$150,000 with the adjusted projections, that is: US\$25,000 more.

- v. *Calculate the total bad allocation: Add together the absolute values of all the differences between what each municipality received and what it would have received for all the years.*

Example: This year the difference was US\$25,000 more for Alegre and, for Triste, US\$25,000 less. In absolute values, the difference was US\$50,000, which is the total bad allocation due to inaccurate population data. This amount is equivalent to 10 percent of the population-based allocation that year and 5 percent of the total allocation for that year.¹²

- vi. *Analyze which municipalities “won” and which “lost” for having used an inaccurate population figure.* The municipalities that received more than they would have received if a more accurate population figure had been used are clas-

12 A complementary perspective to the one adopted by this paper is that of a finance ministry that allocates resources. Whereas in the example described, both the surplus and the deficit count as bad allocation because both represent deviations from the original transfer policy intention, for a finance ministry, it might be more relevant to estimate how much money failed to reach its intended destination. Taking the hypothetical example of Alegre and Triste, this amount would be \$25,000 (that Alegre received instead of Triste).

sified as winners, while those that received less are the losers.

Example: This year Alegre is a winner municipality, given that it received US\$25,000 more than it should have based on its real population. In contrast, Triste is a loser municipality for having received US\$25,000 less than its due. In other words, for having grown less than expected, Alegre ended up winning, whereas Triste ended up losing by having grown more than the projection.

4.1. Limitations

An important clarification about this approach (and the approaches in Scotland, New Zealand and South Africa mentioned above) is that a bad allocation of funds, which consists of sending too much money to one destination and too little to another according to the objectives of the policy in question, is not equivalent to a loss of these resources in monetary terms. The loss in this case is the deviation between the intention of public policy and its execution. Assuming optimal public policy design (with perfect information, exclusively concerned with citizen welfare and free from any undue influence), any deviation from the intention would lead to diminished social outcomes. Nonetheless, neither this analysis nor those cited in Scotland, New Zealand, and South Africa make that assumption; therefore, they do not investigate the effects on development results arising from deviations between the intentions of transfer programs and their execution. They only go as far as the intrinsic value of executing the policy exactly as it was intended. Nonetheless, as previously mentioned, this intrinsic value is also important insofar as it is a product of a democratic process and a political balance. A further important clarification is that the true *intention* behind the construction of allocation formulas will remain unknown in the absence of a specific study of the matter. One simplifying assumption that underlies these calcula-

tions is that by including the population variable in the allocation formula, the intention is to transfer a quantity of resources that corresponds to the population that lives in that municipality (or department) *at the time when the transfer is made*. In some countries the source of the population data used in the allocation formulas is always provided by the current census rather than the population projections, even though the latter are made by the country's NSO. This decision can be the product of a political equilibrium: for example, if the municipalities that know they are going to lose population in the coming decade (and therefore, also, transfer allocations) have sufficient influence, they will lobby to ensure that the population figure from the census is used. It may also be due to doubts about the quality of the NSO's population projections at the subnational level, or other reasons. Nonetheless, the real reasons are unknown.

4.2. Transfer Programs Analyzed

The transfer programs in three Latin American countries—El Salvador, Bolivia, and Ecuador—were analyzed according to the methodology described above.

4.2.1. El Salvador: Municipal Economic and Social Development Fund (Fondo para el Desarrollo Económico y Social de los Municipios, or FODES)

Established by Law 74 (1988), FODES aims to guarantee the economic and social development and the economic autonomy of the municipalities.¹³ The Law requires that at least 80 percent of funds be used for investment expenditure. This consists of an annual

¹³ Law 74 can be consulted at: https://www.asamblea.gob.sv/sites/default/files/documents/decretos/171117_072901100_archivo_documento_legislativo.pdf

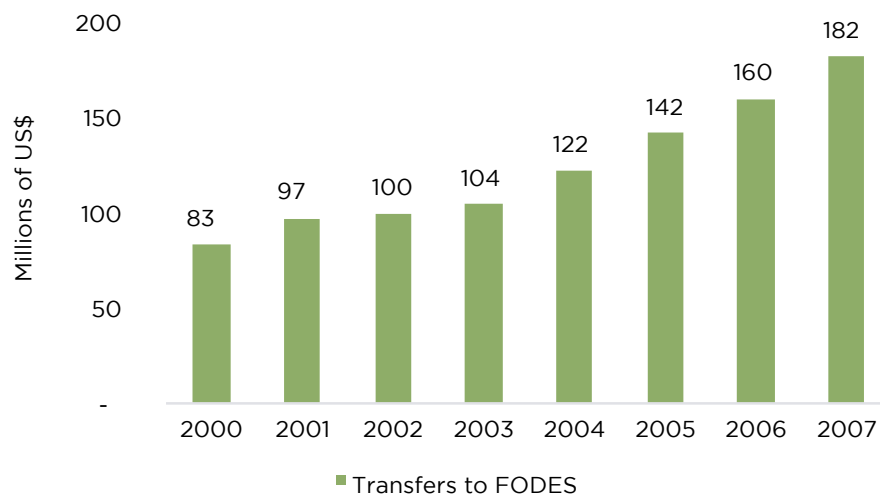
Methodology and Context: How Can the Value of Statistics Be Measured through Intergovernmental Transfers?

contribution equivalent to 8 percent of the State's current net budget revenues, which are transferred to the municipalities in monthly quotas. Fund management is the responsibility of the Salvadoran Municipal Development Institute. The fund is distributed according to the following criteria: 50 percent population-based, 25 percent equality-based (in equal parts), 20 percent poverty-based (according to an index of 14 variables provided by the census) and 5 percent based on territorial extension. The simulation presented in the following section was carried out based on the 50 percent corresponding to population. It is worth

highlighting that, in accordance with Law 74, this item is distributed in inverse proportion: the smaller municipalities receive more and the large ones less. Annex 2 contains details of the formula. The Law establishes that the source of the population data used for the allocation formula is the 1992 census.

The last two censuses in El Salvador were carried out in 1992 and 2007. For the purposes of this paper, data were accessed regarding the transfers made between 2000 and 2007. The total allocation to FODES was growing during this period, as shown in Figure 6.

Figure 6. El Salvador: Total FODES Budget (2000–2007)¹⁴



Source: Finance Ministry of El Salvador (n.d.)

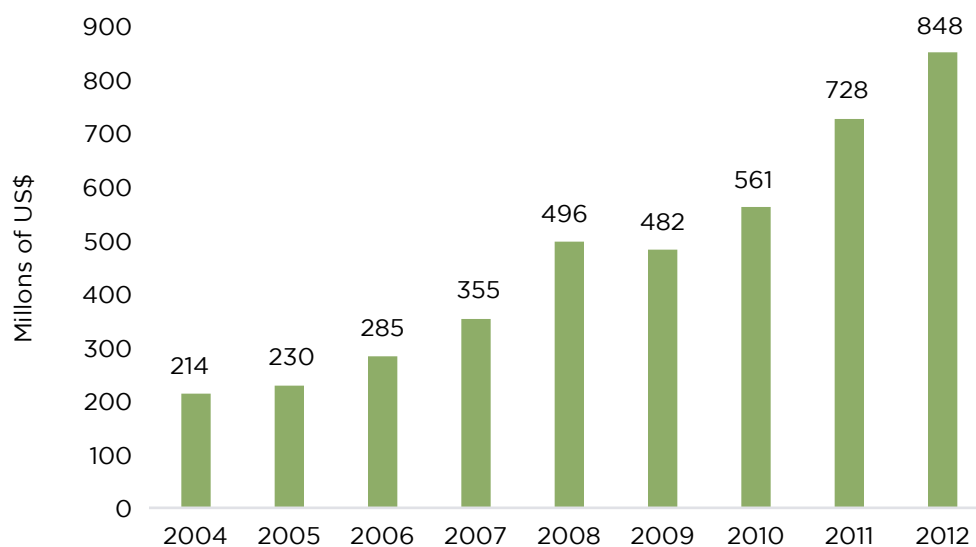
¹⁴ The total amounts of the transfer programs of the three countries are expressed in nominal dollars, to maintain consistency with official sources. The calculations of inefficiencies, shown below, were carried out in real 2018 values.

4.2.2. Bolivia: Co-participation

Law 1551 (1994) established the guidelines for tax co-participation with municipalities within the framework of political and economic decentralization. With respect to transfers to the municipalities, the Law establishes, in Articles 20 and 21 regarding tax co-participation, that this consists of the transfer of 20 percent of national revenues to local govern-

ments. It further establishes that the resources will be distributed among beneficiary municipalities entirely according to the number of inhabitants in that municipality. Combined with this, the Law determines that at least 90 percent of revenues received as tax co-participation must be allocated to public investment. The last two censuses were taken in 2001 and 2012; data for the period 2004–2012 were used for this study.

Figure 7. Bolivia: Population-based Transfers (2004–2012)



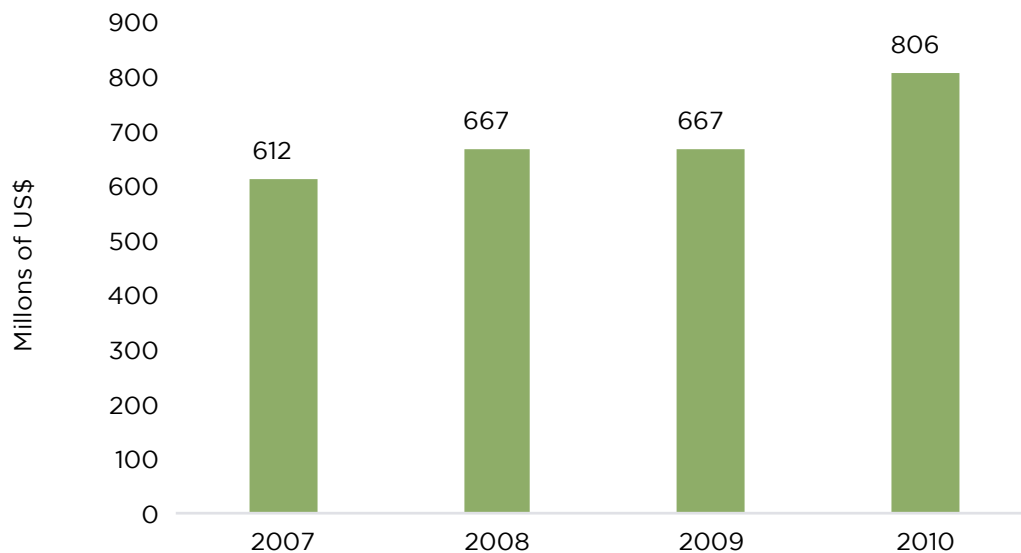
Source: National Statistical Institute of Bolivia.

4.2.3. Ecuador: the Fifteen Percent Law

The Law for Fifteen Percent Distribution to Local Governments (1997),¹⁵ also known as the Fifteen Percent Law, stipulated that 15 percent of the central government budget would be distributed to sub-national governments (provincial and cantonal). Its purpose was to foster investment in “economic, social and cultural development projects” and, to this end, it established a ceiling of 20 percent that can be used for current expenditure. The distribution formula consists of 50 percent directly proportional to

population and 50 percent proportional to the level of unmet basic needs. In 2010, the Fifteen Percent Law was replaced by an overall reform of the decentralization framework, the Organic Code on Territorial Organization, implemented in 2011; nonetheless, the Law was still in force throughout the entire period of analysis, the last intercensal period 2001–2010. For the purposes of the study, data were accessed pertaining to the transfers to cantons made under the Fifteen Percent Law during the 2007–2010 period. Figure 8 shows the evolution of the total amounts allocated to the cantons in this period.

Figure 8. Ecuador: Allocations to the Cantons under the Fifteen Percent Law (2007–2010)



Source: Ministry of Economy and Finance of Ecuador.

¹⁵ The Law can be consulted at: <https://www.acnur.org/fileadmin/Documentos/BDL/2008/6608.pdf>
<http://www.discapacidadesecuador.org/images/stories/File/DISTRIBUCION%20DEL%2015%25.pdf>

5.

Outcomes: The Impacts of Inaccurate Population Data on Resource Allocation

Inaccuracies in population data have significant implications for resource allocation in intergovernmental transfer programs. This section presents (i) the scale of the deviations between the population data used and the “reality” (approximated through updated projections);¹⁶ (ii) the impacts of these deviations on the accuracy of the transfers; (iii) the distribution of the *winnings* and *losses* caused by these deviations between the municipalities, and (iv) a special analysis of Bolivia and El Salvador, two countries that use the static census population throughout the entire intercensal period, rather than population projections, to establish whether this practice delivered a higher or lower level of bad allocation distribution.

5.1. Deviations between the Population Figure Used and the Real Figure

How can the scale of the difference between the population data used—whether provided by projections or the census—and “reality” be established? The approach adopted in this paper is a comparison with the updated population projections. Under normal institutional conditions, these projections are elaborated following population census-taking. The results of the census are reconciled with the available administrative registries (mainly births, deaths, and migration), alongside assumptions and estimates provided by demographic or health surveys. Through these inputs, the population for the intercensal period is estimated.

In two of the countries analyzed (Bolivia and El Salvador), the census is used as the source of population data for calculating allocations. This is of particular interest in El Salvador, given that the lapse between the last two censuses was particularly long (1992–2007) and during that period the country experienced a series of significant changes in its demographic base (such as the end of a 12-year civil war

¹⁶ Some countries use different terminology to describe original and adjusted projections. Paraguay uses *anteriores* (previous) and *vigentes* (current), while Ecuador uses the term *retroproyecciones* (retrospective population estimations) to refer to adjusted projections.

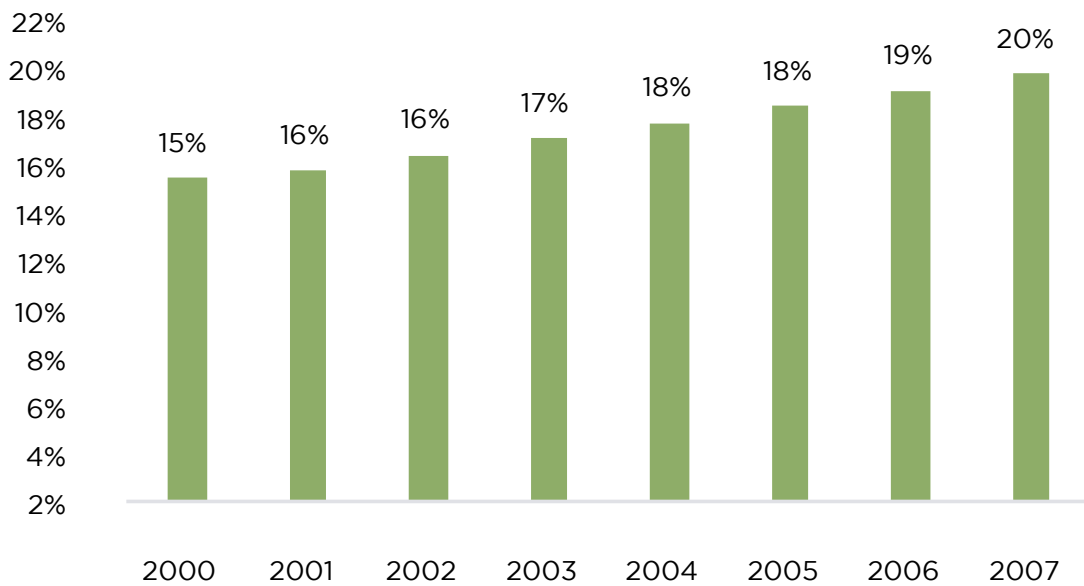
in 1992, a hurricane that left around 30,000 people homeless in 1998, a series of earthquakes that damaged approximately 20 percent of the housing stock in 2001, a drought that affected 80 percent of agricultural production in the same year, and high emigration levels, with more than half a million people leaving for the United States between 1990 and 2007). In Ecuador, population projections are the official source of population data for budget allocations.

The figures and maps presented below show the discrepancies between the population used and the population figures from the updated projections in the three cases. In the figures, the year-on-year discrepancies are calculated. These are the sum for all municipalities of the difference in absolute value between the figure used to make the allocations (census or original projection) and the figure reflected in the updated projection, in terms of the percentage of the total population according to the source used (census or original projection). The maps present an alternative view, disaggregated by municipality and aggregated for the period analyzed, which helps visualize the distribution of population discrepancies in the interior of the country and to easily identify concentrations of municipalities with higher (or lower) levels of discrepancy.

The figures reveal a clear pattern: the differences between the population data used for allocations and the updated population are growing year-on-year. This highlights the fact that the models used by the statistical offices have only limited capacity to predict population changes at the subnational level, and that time is a major aggravating factor when it comes to making accurate projections. The maps identify the places where the discrepancies are generated.

Some examples of where the census population and the updated population show two very distinct realities are noticeable. In El Salvador, the municipality San Isidro Labrador has 121 inhabitants according to the 1992 census, but the updated projections indicated that the population had reached around 2,800 in the period 2000–2007, which represents a percentage of population discrepancy of 2,180 percent. An additional five municipalities of El Salvador (Cinquera, San Agustín, San Fernando, Tonacatepeque and Torola) also revealed discrepancies of between 100 and 300 percent. Similarly, in Bolivia, nine municipalities revealed extremely high percentages of discrepancy in population figures, of between 100 and 300 percent, considering that the median for all municipalities is 24 percent.

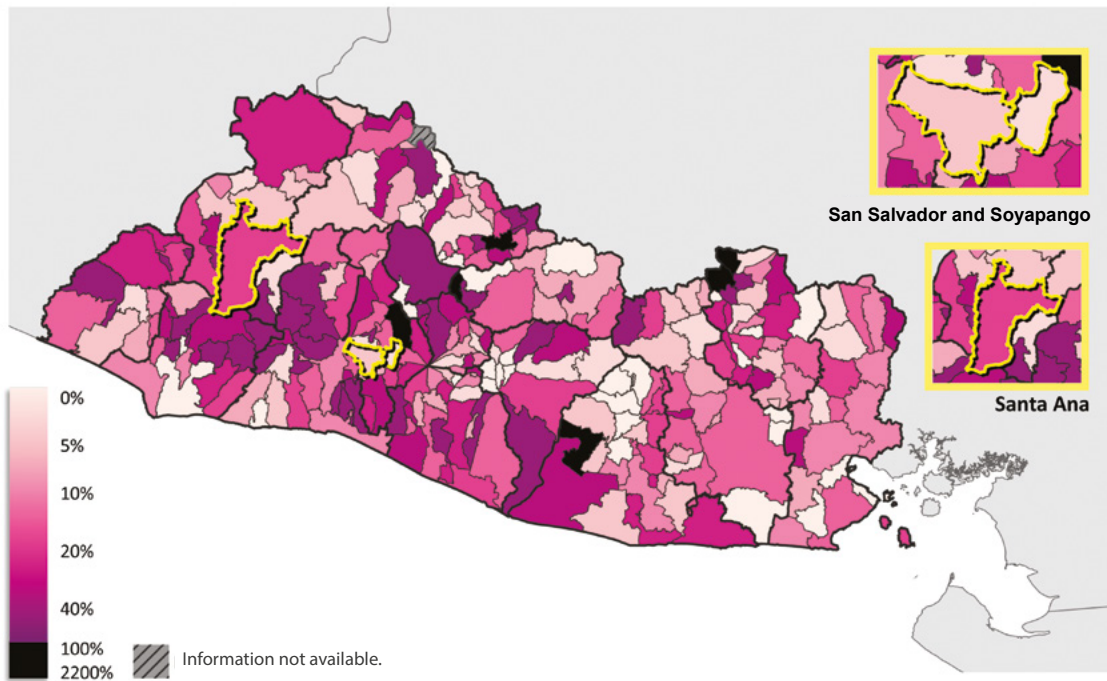
Figure 9. El Salvador: Discrepancies in Population Figures (2000–2007)
(1992 census vs. updated projection)



Source: Authors' elaboration, based on data from El Salvador's Directorate General for Statistics and Census (Dirección General de Estadística y Censos, or DIGESTYC).

Note: Population discrepancies refers to the sum for all municipalities of the difference in absolute value between the figure used to make the allocations (census or original projection) and the figure reflected in the updated projection, in terms of the percentage of the total population according to the source used (census or original projection).

Map 3. El Salvador: Population Discrepancies (2000–2007)¹⁷



Source: Authors' elaboration, based on data of the DIGESTYC of El Salvador.

Note: Population discrepancies refers to the sum for all municipalities of the difference in absolute value between the figure used to make the allocations (census or original projection) and the figure reflected in the updated projection, in terms of the percentage of the total population according to the source used (census or original projection).

¹⁷ In all the maps, the color coding is based on quantile distribution to enable clearer visualization of the different values and reveal the existence of extreme values.

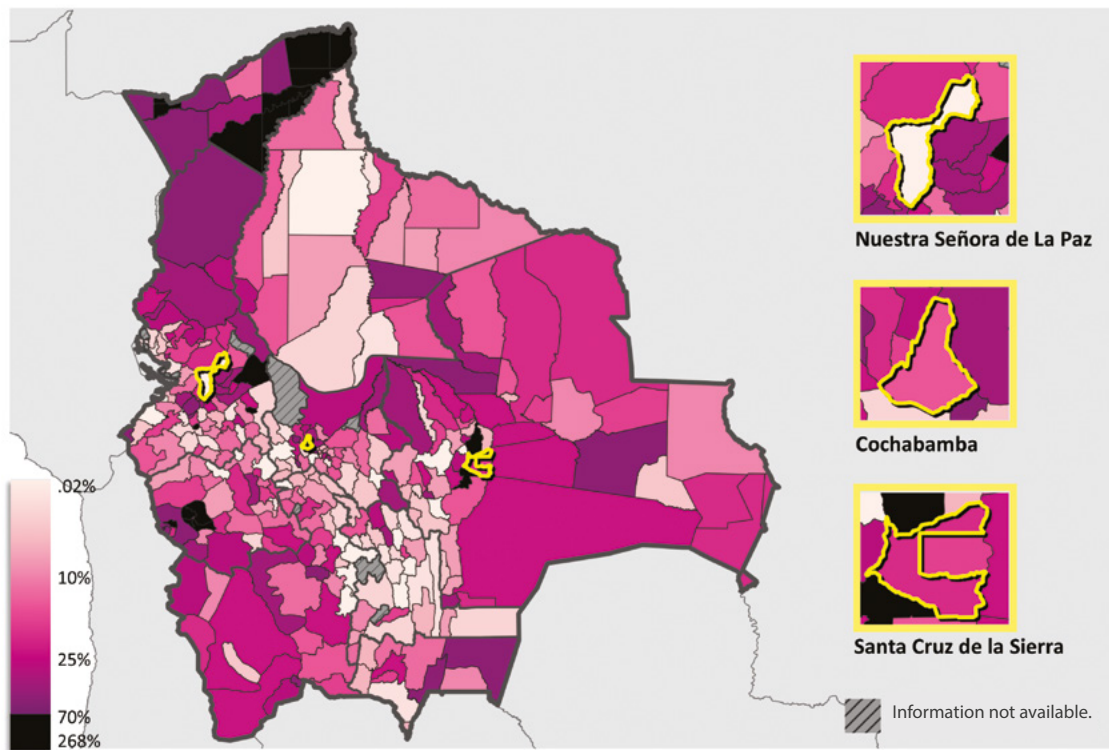
Figure 10. Bolivia: Population Discrepancies (2004–2012) (2001 census vs. adjusted projection)



Source: Authors' elaboration, based on data from Bolivia's National Statistical Institute (INE) (<https://www.ine.gob.bo>).

Note: Population discrepancies refers to the sum for all municipalities of the difference in absolute value between the figure used to make the allocations (census or original projection) and the figure reflected in the updated projection, in terms of the percentage of the total population according to the source used (census or original projection).

Map 4. Bolivia: Population Discrepancies (2004–2012) (2001 census vs. updated projection)



Source: Authors' elaboration, based on data from Bolivia's INE (<https://www.ine.gob.bo>).

Note: Population discrepancies refers to the sum for all municipalities of the difference in absolute value between the figure used to make the allocations (census or original projection) and the figure reflected in the updated projection, in terms of the percentage of the total population according to the source used (census or original projection).

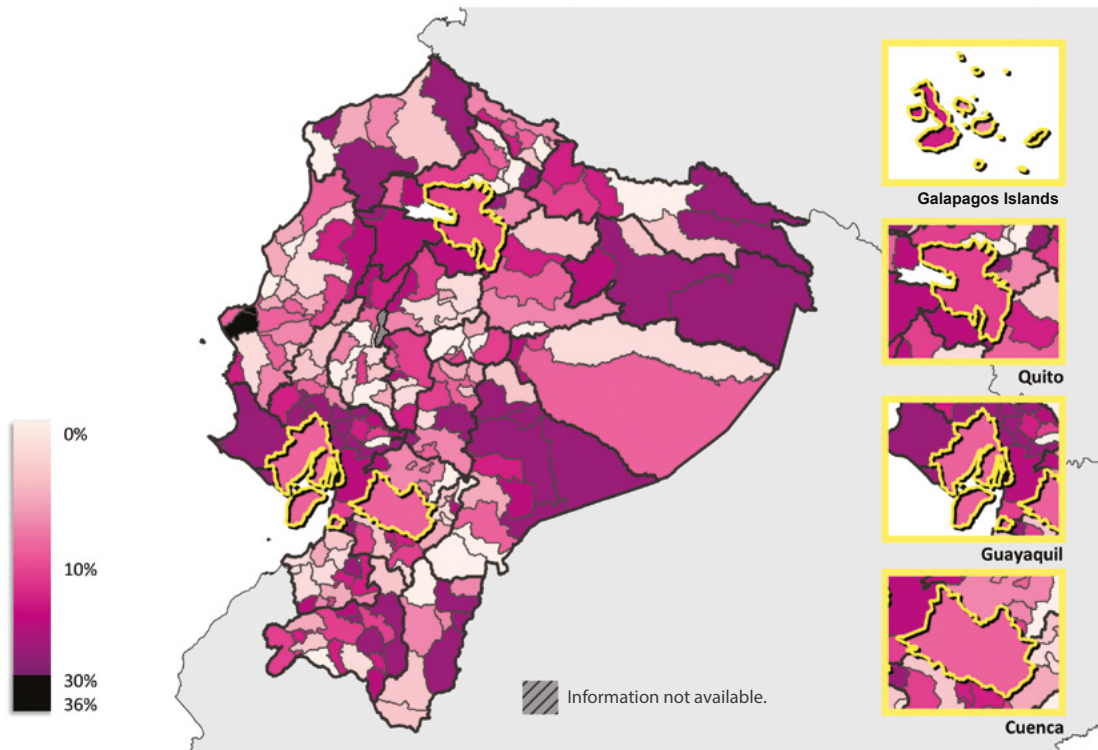
Figure 11. Ecuador: Population Discrepancies (2007–2010) (original projection vs. adjusted projection)



Source: Authors' elaboration, based on data from Ecuador's National Institute of Statistics and Censuses (Instituto Nacional de Estadísticas y Censos, or INEC).

Note: Population discrepancies refers to the sum for all municipalities of the difference in absolute value between the figure used to make the allocations (census or original projection) and the figure reflected in the updated projection, in terms of the percentage of the total population according to the source used (census or original projection).

Map 5. Ecuador: Population Discrepancies (2007–2010) (original projection vs. updated projection)



Source: Authors' elaboration, based on data from Ecuador's INEC.

Note: Population discrepancies refers to the sum for all municipalities of the difference in absolute value between the figure used to make the allocations (census or original projection) and the figure reflected in the updated projection, in terms of the percentage of the total population according to the source used (census or original projection).

5.2. Fiscal Implications of Inaccurate Population Data

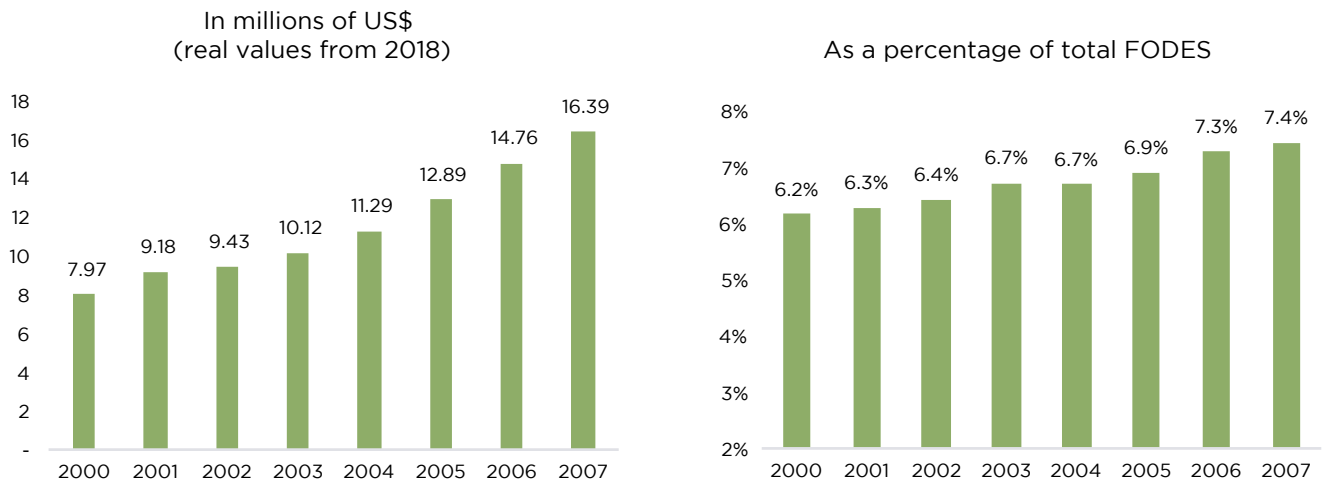
In El Salvador and Ecuador, the population criterion is responsible for 50 percent of allocations, whereas in Bolivia it determines 100 percent of co-participation resource allocation (in El Salvador it is inversely proportional, and directly proportional in the other two countries). Therefore, it is expected that the deviations between the figure used and the updated figure yield significant differences between what was allocated to each one of the municipalities and what would have been allocated if there had been an updated population figure. In consonance with the differences between the population figure used and the updated one, with the passage of time the amount of the money sent to wrong destinations continues to grow.

The following figures show, year-on-year, how much money was sent to the wrong places, that is, the extent of bad allocation, understood as the difference between what was allocated to each municipality and what would have been allocated if there had been an updated population figure. The figures show the sum of the discrepancies at the municipal level, both in absolute terms and in terms of the percentage of the total transfer program budget, for the year in question. This is denominated total annual bad allocation.

Similarly, the maps show the accumulated total (for the entire period analyzed) of the deviations between what was allocated to each municipality and that which would have been allocated based on an updated population figure, expressed as a percentage of the total effectively assigned to the municipality in question. This is denominated total accumulated bad allocation.

5.2.1. El Salvador

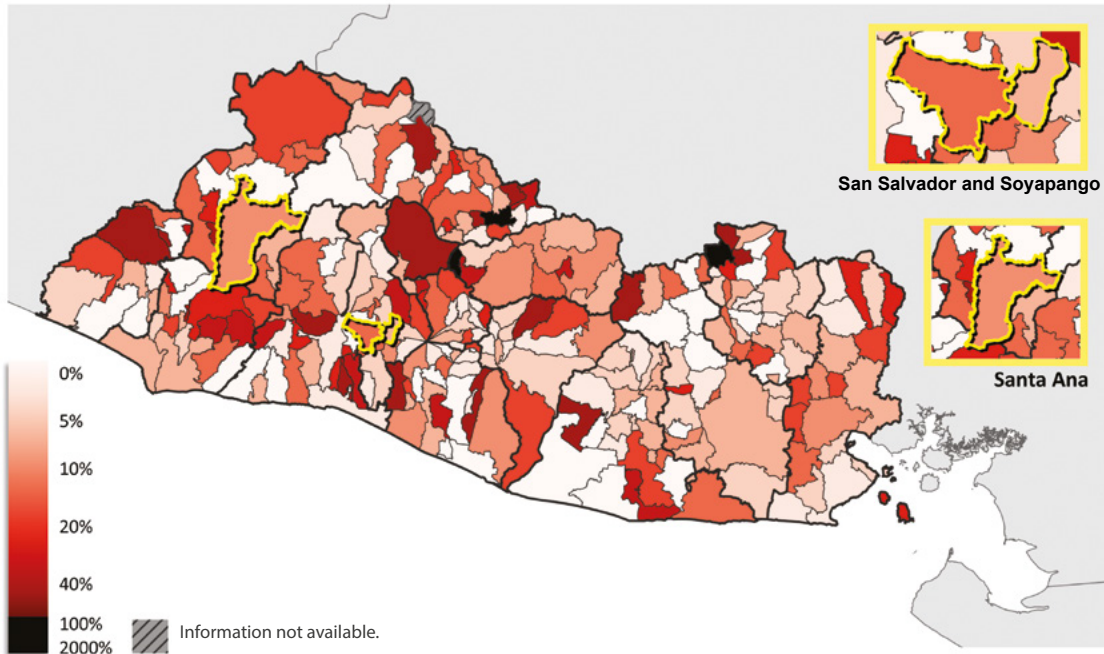
Figure 12. El Salvador: Total Annual Bad Allocation (2000–2007)



Source: Authors' elaboration, based on data from DIGESTYC (<http://www.digestyc.gob.sv/>), the Finance Ministry of El Salvador (<https://www.mh.gob.sv/pmh/es/>), and the Salvadoran Municipal Development Institute (<http://www.isdem.gob.sv/>).

Note: The Figure shows the sum for each municipality of the difference between what was allocated and what would have been allocated if there had been an updated population figure, both in absolute terms and in terms of the percentage of the total budget of the transfers program for the year in question.

Map 6. El Salvador: Total Accumulated Bad Allocation (2000–2007)



Source: Authors' elaboration, based on data from DIGESTYC (<http://www.digestyc.gob.sv/>), the Finance Ministry of El Salvador (<https://www.mh.gob.sv/pmh/es/>), and the Salvadoran Municipal Development Institute (<http://www.isdem.gob.sv/>).

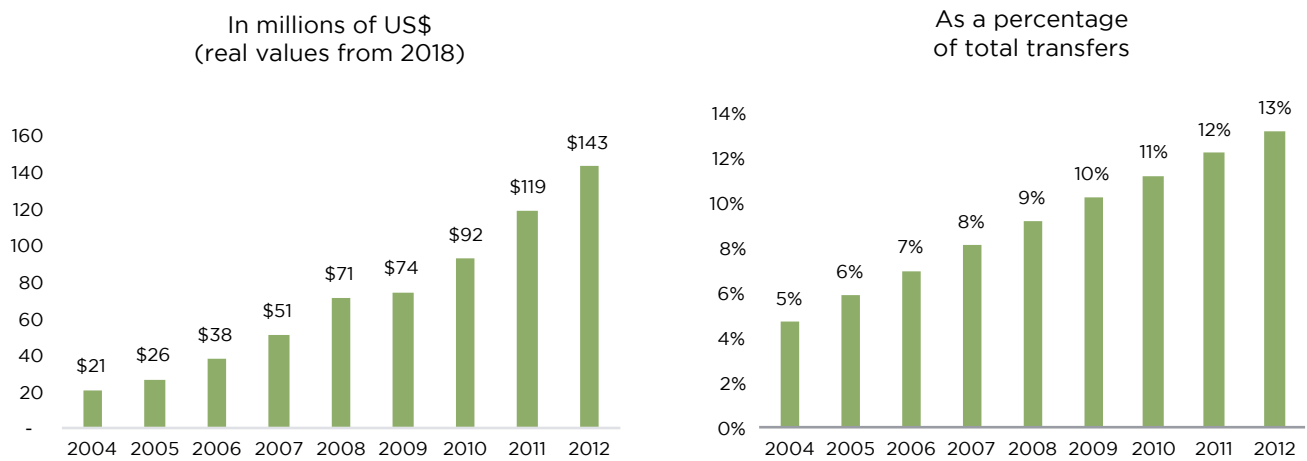
In El Salvador, it is estimated that for the entire period analyzed (2000–2007), the deviations between the population registered by the census and the one reported in the updated projections resulted in bad allocations of US\$92 million (in real 2018 values) of the FODES budget, equivalent to 6.8 percent of total transfers for that period. Between 2002 (year in which the census should have been taken according to the 10-year rule) and 2007 (year in which the census was conducted), bad allocations were generated

totaling US\$75 million (in real terms), approximately five times more than the cost of the 2007 census.

No significant geographic pattern is discernible in the distribution of bad allocation, nor is there a relationship with the municipalities by poverty level (measured using the percentage of unmet basic needs) or population concentration. In two of the municipalities with the highest bad allocation values (Cinquera and Torola), 90 percent and 96 percent of their population, respectively, have at least one unmet basic need.

5.2.2. Bolivia

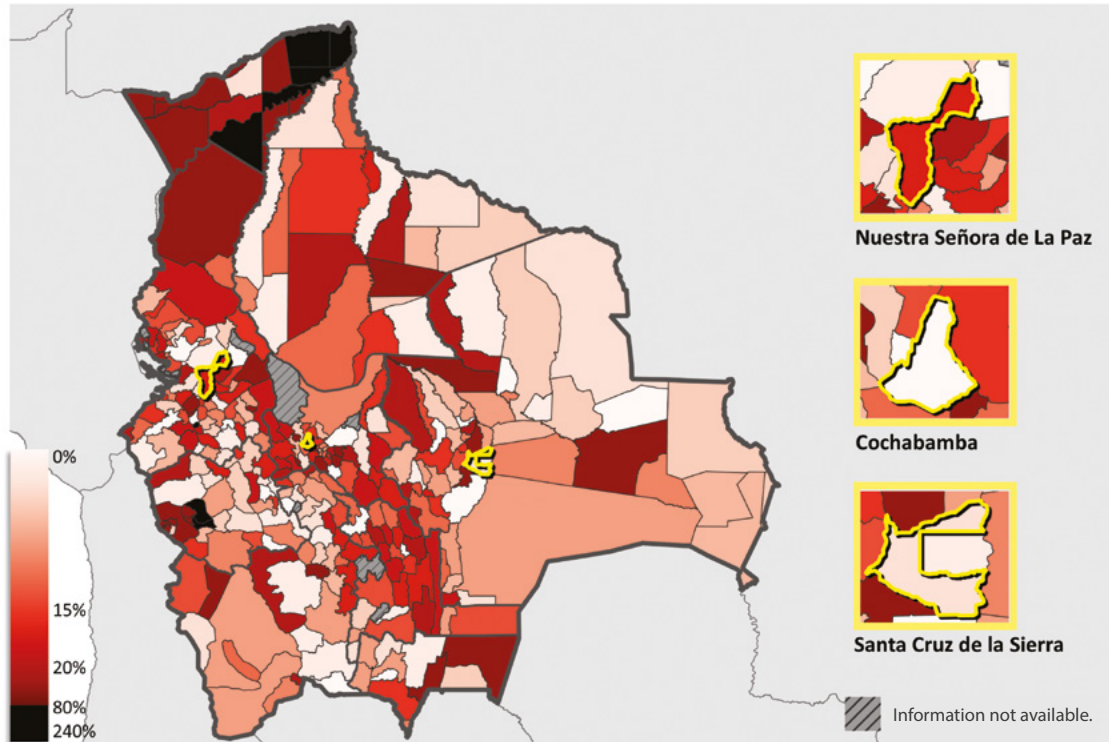
Figure 13. Bolivia: Total Annual Bad Allocation (2004–2012)



Source: Authors' elaboration, based on data from Bolivia's INE (<https://www.ine.gob.bo>).

Note: The figure shows the sum for each municipality of the difference between what was allocated and what would have been allocated if there had been an updated population figure, both in absolute terms and in terms of the percentage of the total budget of the transfers program for the year in question.

Map 7. Bolivia: Total Accumulated Bad Allocation (2004–2012)



Source: Authors' elaboration, based on data from Bolivia's INE (<https://www.ine.gob.bo>).

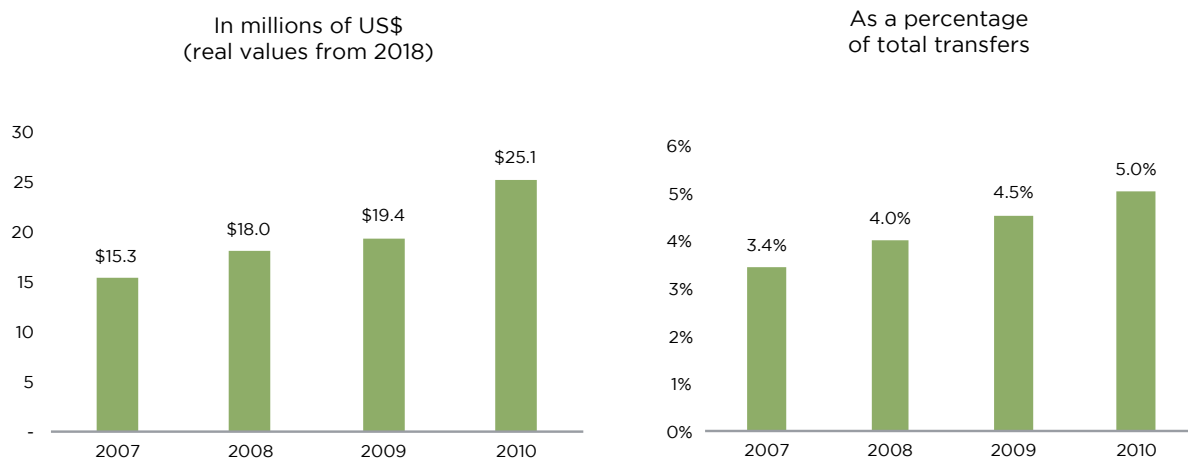
In Bolivia, total bad allocation was US\$633 million between 2004 and 2012 (in real 2018 values), the highest amount among the countries analyzed (Bolivia also had the largest fund to distribute). This occurred largely due to the fact that 100 percent of the transfers for tax co-participation were population-based. The bad allocation in Bolivia is equivalent to 10 percent of total co-participation transfers made in that period.

A slight geographic pattern is discernible in that many of the municipalities with the highest bad

allocation levels are located in the western part of the country, a region that also registries the highest percentages of unmet basic needs. Moreover, there is a significant concentration of municipalities with high bad allocation levels in the north of the country which, moreover, has low population concentrations (between 2,000 and 3,000 persons). This finding is to be expected, given that a small population is more sensitive to any deviation in absolute terms.

5.2.3. Ecuador

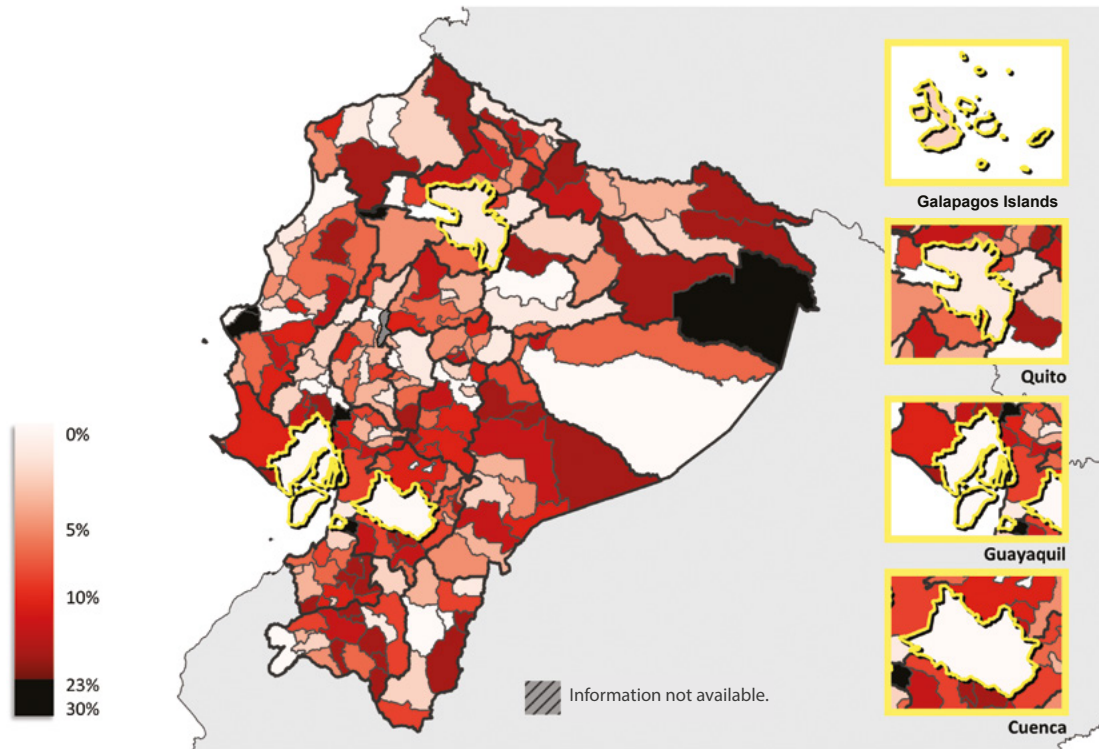
Figure 14. Ecuador: Total Accumulated Bad Allocation (2007–2010)



Source: Authors' elaboration, based on data from the INEC (<https://www.ecuadorencifras.gob.ec/institucional/home/>) and Ecuador's Ministry of Economy and Finance.

Note: The figure shows the sum for each municipality of the difference between what was allocated and what would have been allocated if there had been an updated population figure, both in absolute terms and in terms of the percentage of the total budget of the transfers program for the year in question.

Map 8. Ecuador: Total Accumulated Bad Allocation (2007–2010)



Source: Authors' elaboration, based on data from the INEC (<https://www.ecuadorencifras.gob.ec/institucional/home/>) and Ecuador's Ministry of Economy and Finance.

In the case of Ecuador, the total bad allocation between 2007 and 2010 rose to US\$78 million (in real 2018 values), which represents 4.4 percent of the total resources transferred to the municipalities under the Fifteen Percent Law in that period. With regard to the distribution of bad allocation, no significant concentrations of cantons with high values (or low) are discernible, nor is there a clear relation-

ship between bad resource allocation and population distribution or the incidence of unmet basic needs. Although the majority of cantons maintained their levels of bad allocation year-on-year with slight deterioration, the Pucará canton stands out, as its percentages of bad allocation fluctuated considerably from 2007 to 2010 (27 percent, 13 percent, 0.6 percent and 14 percent for each year, respectively).

5.2.4. Bad Allocation in Perspective

A further perspective that helps measure bad allocation caused by inaccurate population data is obtained by comparing it with other amounts, such as the cost of the census, the transfer program, or the NSO budget. Table 1 presents these comparisons. While bad allocations represent a relatively small proportion of the total transfer program budget (from 4.3 percent in Ecuador to 10.2 percent in Bolivia), the comparisons with the costs of the censuses and NSO budgets are most extreme. In Ecuador, the country with the lowest bad allocation in terms of the

transfer program budget, the costs were equivalent to 121 percent of the cost of the last census (using real amounts adjusted to 2018 values). With regard to the comparison between bad allocations and NSO budgets, in El Salvador bad allocations accumulated in the eight years analyzed are equivalent to more than 27 times the annual NSO budget (in real terms). In Bolivia, this ratio is even more extreme, given that the total of bad allocations rises to more than 14 times the cost of the last census and to more than 130 times the annual NSO budget. It is less extreme in Ecuador, but bad allocations nonetheless represent more than 1.2 times the cost of the census and almost three times the annual NSO budget.

Table 1. Comparison of Total Bad Allocations with the Cost of the Census, the Transfer Program Budget, and the NSO Budget

Country	Date of latest census	Cost of latest census (in US\$ 2018) ^{a, b}	Period analyzed	Bad allocations (BA), total (in US\$ 2018) ^b	BA as percentage of the transfers program in the period analyzed (%)	BA as percentage of the cost of the latest census (%)	BA as percentage of the NSO budget (2018) ^{c, b} (%)
El Salvador	2007	\$13,159,059	2000-2007	\$92,046,923	6.80%	699%	2.784%
Bolivia	2012	\$44,304,753	2004-2012	\$633,703,234	10.20%	1.430%	13.038%
Ecuador	2010	\$63,994,374	2007-2010	\$77,726,534	4.30%	121%	296%

Notes: ^a Sources for El Salvador, Bolivia, and Ecuador, authors' extrapolations based on Perfit et al. (2012).

^b The values were converted to real 2018 prices using the formula: $Final\ value = Initial\ value * \left(\frac{Final\ CPI}{Initial\ CPI} \right)$

^c The NSO budgets were disclosed by the NSO themselves through a questionnaire provided by the IDB in 2016.

5.3. The “Winners” and the “Losers”

Given that in the three cases analyzed the total amount of money allocated to the municipalities is fixed, inaccurate population data means that resources are redistributed among municipalities. According to the updated projections, municipalities with a real population higher than the one registered in the figure on which allocations were based (either the census or original projection) received less than their due and are therefore the losers. Municipalities with a real population lower than the one recorded in the figure used received more than was due, making them the winners (except in El Salvador, where this relationship is inverted due to the formula that allocates resources in a ratio inversely proportional to the population. This section analyzes the winning and losing municipalities in terms of location, size, and poverty poverty, both from the perspective of some specific examples and in the aggregate.

The following figures show the trends in average winnings and losses at the municipal level

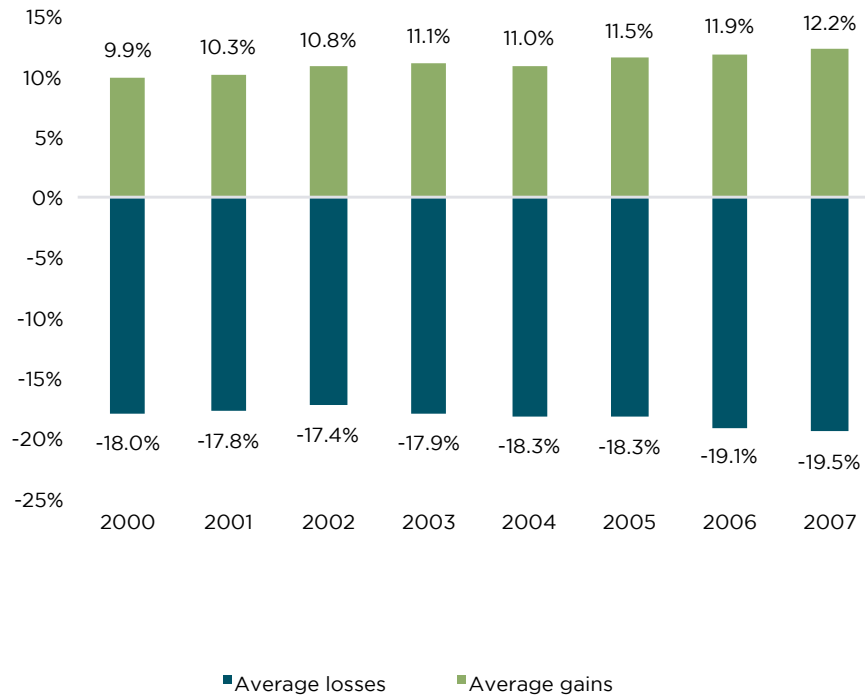
year-on-year. The two groups are shown separately: on the one hand, what the average was (as a percentage of effective allocation) for the municipalities that received more than their due for the year in question and, on the other, what the average was for the municipalities that received less than their due for the year in question. The maps show the geographic breakdown for the entire period analyzed of the deviation for each municipality, either upward or downward, as a percentage of effective allocation.

In all the cases, the average winnings and losses at the municipal level are increasing constantly, which is consistent with the trend in the deviation between the census population figure and the updated projection.

It is worth highlighting that in the three countries, year-on-year, average losses for the loser municipalities were higher than the average for the winners. Similarly, as the maps illustrate, for all three cases, the maximum amount of the total loss (for the entire study period) exceeds the maximum amount of total gain. This reflects the fact that it is more common to seriously underestimate populations than to seriously overestimate them.

5.3.1. El Salvador

Figure 15. El Salvador: Average Winners and Losers (2000–2007)¹⁸

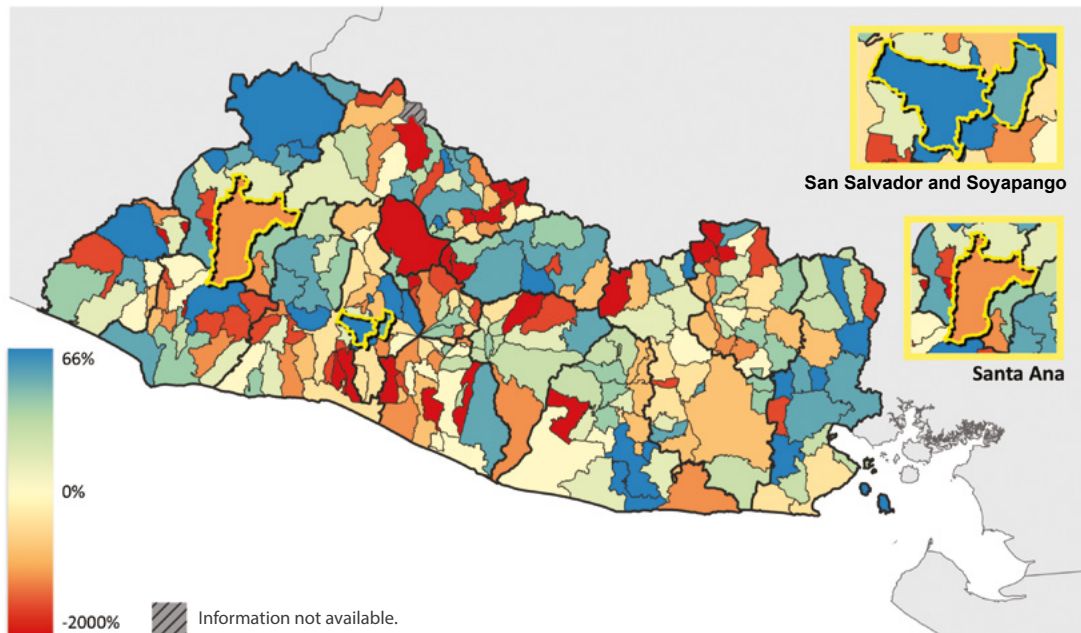


Source: Authors' elaboration, based on data from DIGESTYC (<http://www.digestyc.gob.sv/>), the Finance Ministry of El Salvador (<https://www.mh.gob.sv/pmh/es/>), and the Salvadoran Municipal Development Institute (<http://www.isdem.gob.sv/>).

Note: The figure shows for each group (winners and losers), the average deviation between what the municipality received and what it would have received if an adjusted population figure had been used.

¹⁸ Does not include extreme values (below -130 percent).

Map 9. El Salvador: Winners and Losers (2000–2007)



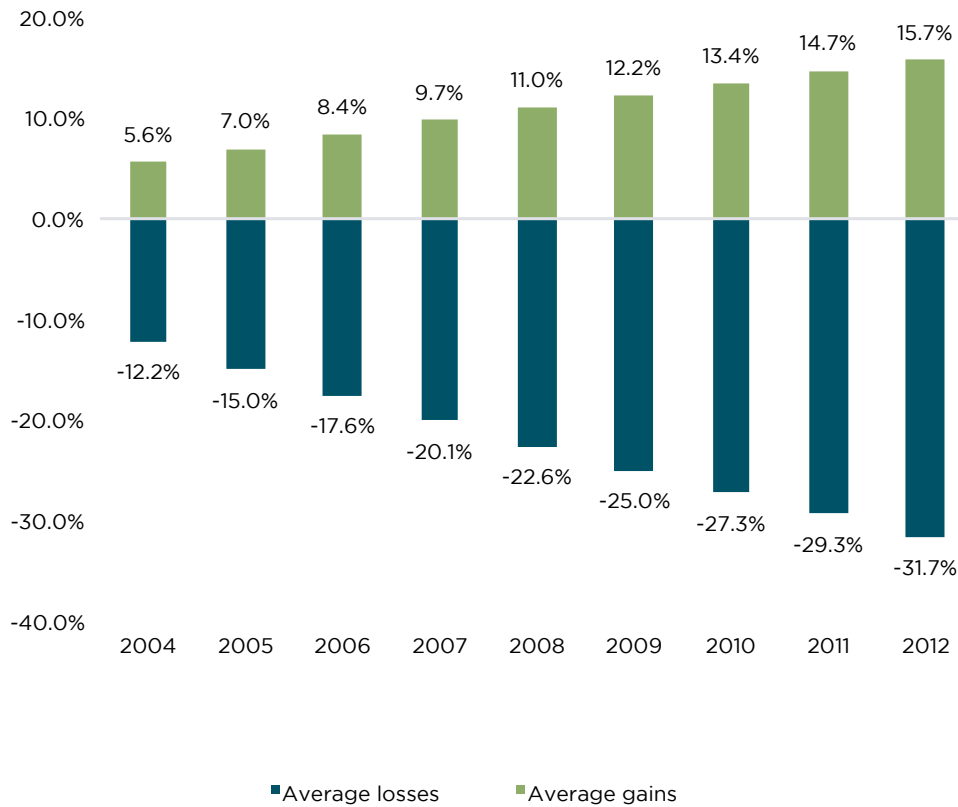
Source: Authors' elaboration, based on data from DIGESTYC (<http://www.digestyc.gob.sv/>), the Finance Ministry of El Salvador (<https://www.mh.gob.sv/pmh/es/>), and the Salvadoran Municipal Development Institute (<http://www.isdem.gob.sv/>).

In El Salvador, the winner municipalities (those that received more than their due), on average, went from receiving 9.9 percent more in 2000 to 12.2 percent more in 2007. The losers (those that received less than their due) went from receiving 18 percent less to 19.5 percent less in the same period. There is no discernible geographic pattern with regard to the location of the winners and losers. Nonetheless, some specific cases, where the amount transferred greatly exceeded the amount based on the adjusted projections, are worth highlighting. The municipality of Colón, which presents the highest amount of bad

allocation, received 47 percent more (US\$207,000) in 2000 and 68 percent more (US\$649,000) in 2007. Similarly, in the municipality of San Salvador, the country's capital, the transfer surplus was 6 percent (US\$35,000) in 2000, and it reached 25 percent (US\$329,000) in 2007. The highest percentages of bad allocation were seen in the municipalities that *lost* due to the use of outdated projections: San Isidro Labrador lost out by 2,075 percent (US\$36,000) in 2000 and 1.923 percent (US\$75,000) in 2007, whereas Torola lost out by 188 percent (US\$30,000) in 2000 and 176 percent (US\$61,000) in 2007.

5.3.2. Bolivia

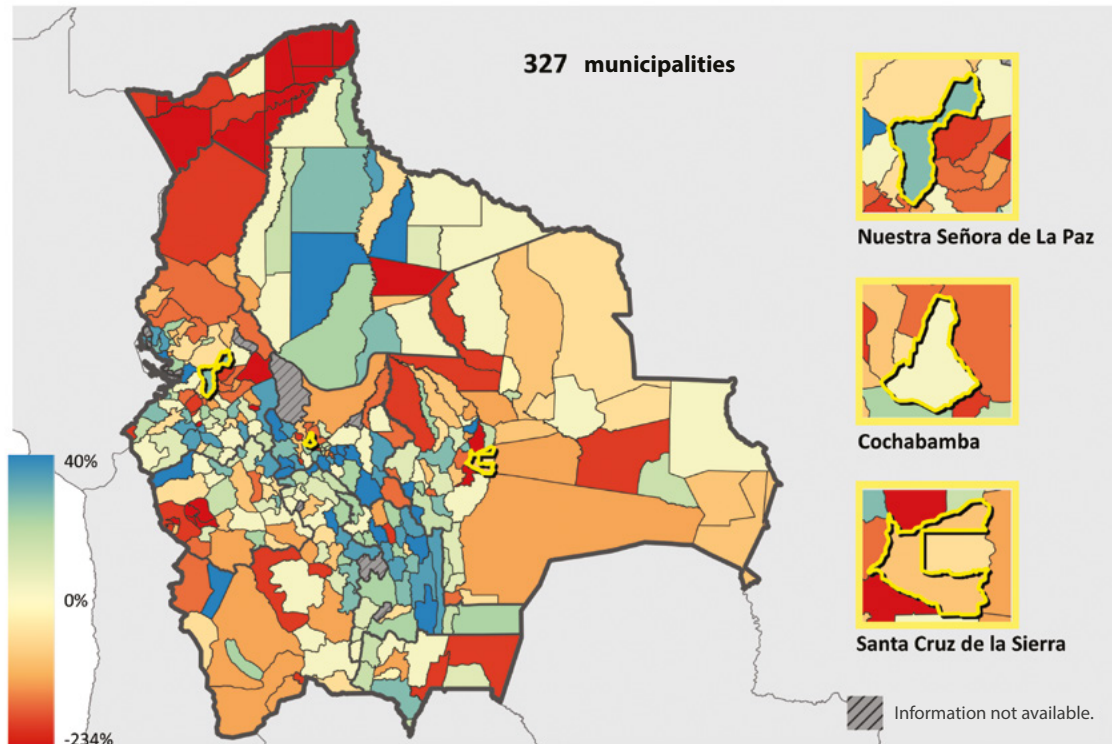
Figure 16. Bolivia: Average Winners and Losers (2004–2012)



Source: Authors' elaboration, based on data from Bolivia's INE (<https://www.ine.gob.bo>).

Note: The figure shows for each group (winners and losers) the average deviation between what the municipality received and what it would have received if an adjusted population figure had been used.

Map 10. Bolivia: Winners and Losers (2004–2012)



Source: Authors' elaboration, based on data from Bolivia's INE (<https://www.ine.gob.bo>).

In Bolivia, the winner municipalities went from receiving, on average, 5.6 percent more in 2004 to 15.7 percent more in 2012. The losers went from receiving 12.2 percent less to 31.7 percent less in the same period. There is no discernible geographic pattern with regard to the location of the winner and loser municipalities; in general, the winners are concentrated in certain parts of the north, south, and west, and the majority are municipalities with the lowest territorial extension. Among the municipalities most affected by bad allocation are Escara, which received

116 percent less (US\$25,000) in 2004 and 299 percent less (US\$226,000) in 2012, and Santos Mercado, with 95 percent less (US\$12,000) in 2004 and 251 percent less (US\$113,000) in 2012. In contrast, other municipalities benefited from the use of projections based on the census, rather than adjusted ones, such as Huachacalla, with 17 percent (US\$12,000) in 2004 and 50 percent (US\$75,000) in 2012, and Alalay, with transfers higher by 16 percent (US\$25,000) in 2004 and 42 percent (US\$188,000) in 2012.

5.3.3. Ecuador

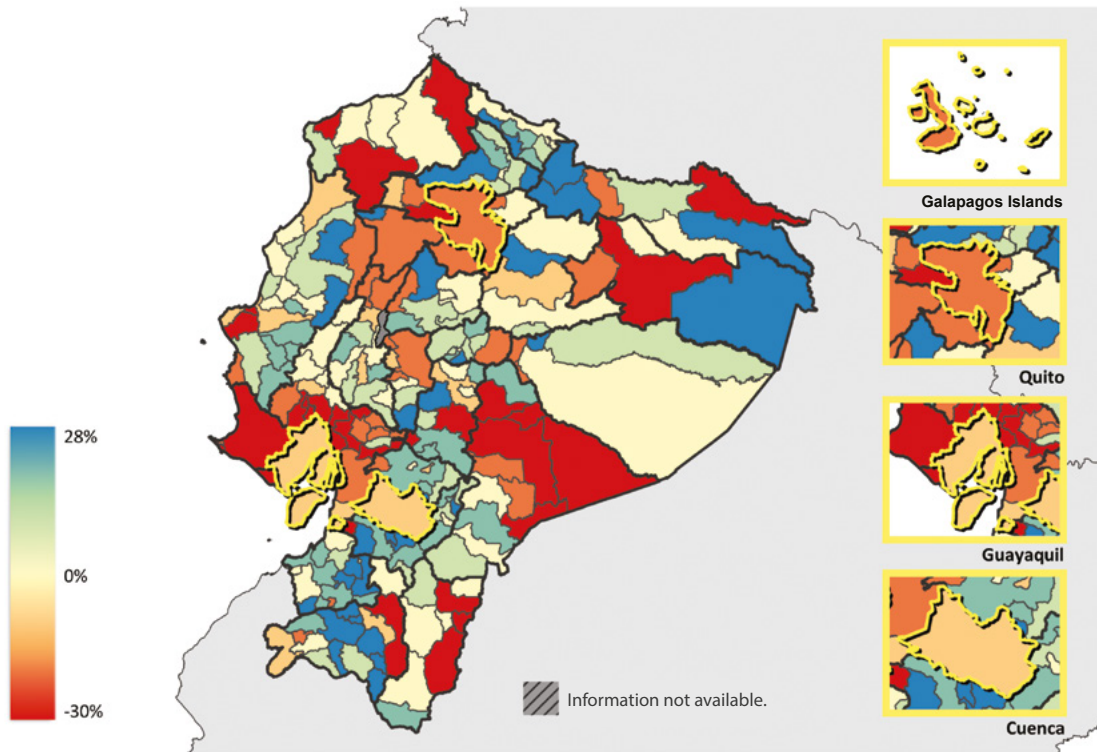
Figure 17. Ecuador: Average Winners and Losers (2007–2010)



Source: Authors' elaboration, based on data from the INEC (<https://www.ecuadorencifras.gob.ec/institucional/home/>) and Ecuador's Ministry of Economy and Finance.

Note: The figure shows for each group (winners and losers) the average deviation between what the municipality received and what it would have received if an adjusted population figure had been used.

Map 11. Ecuador: Winners and Losers (2007–2010)



Source: Authors' elaboration, based on data of the INEC (<https://www.ecuadorencifras.gob.ec/institucional/home/>) and Ecuador's Ministry of Economy and Finance.

In Ecuador, the winner cantons went from receiving, on average, 5.6 percent more in 2007 to 8.4 percent more in 2010, and in this same period the losers went from receiving 6.4 percent less to 9.5 percent less. There is no noticeable geographical pattern in the location of the winner cantons and losers. Among the cantons most severely affected by bad allocation are San Miguel de los Bancos, which received 22 percent less (US\$59,000) in 2007 and 36 percent less (US\$126,000) in 2010, and Montecristi, which received

22 percent less (US\$240,000) in 2007 and 33 percent less (US\$479,000) in 2010. The cantons that benefited were Aguarico, with 20 percent in its favor (US\$27,000) in 2007 and 27 percent (US\$51,000) in 2010; Chilla, with 17 percent more allocation (US\$12,000) in 2007 and 24 percent more (US\$22,000) in 2010, and La Concordia, whose extra allocation was equivalent to 28 percent of the transfers based on the original projections, and corresponded to US\$340,000 in 2007 and reached US\$460,000 in 2010.

5.4. Is It Best to Use the Projections or the Census?

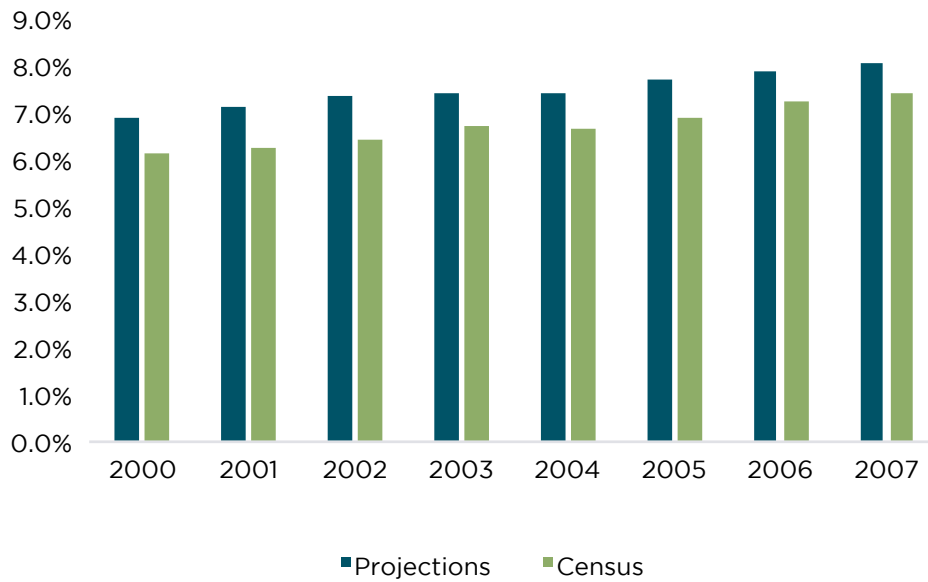
Two of the cases analyzed—Bolivia and El Salvador—use the census population figure rather than the projections elaborated by their NSOs. At first glance, this would seem to be bad practice: using a static population figure over a long period (11 years in Bolivia, 15 in El Salvador), during which any country experiences significant demographic changes, must surely result in significant deviations with respect to reality. At the same time, elaborating population projections is a complex exercise that depends on a country's statistical capacity—as the registration of births, deaths and internal migration are a primary source of information—and rests on a series of assumptions about the future. In the absence of adequate statistical capacity and quality of the aforementioned registries, the accuracy of the projections will be limited. This section analyzes the cases of Bolivia and El Salvador, comparing the deviation generated between the allocations based on the census and the hypothetical allocations based on the adjusted projections, with the

deviation that would have existed if the original projections had been used. In these two cases, using the census instead of the projections is shown to be the better option, as using the projections would result in higher levels of bad allocations. There were significant differences between the population recorded by the census and the real population (according to the adjusted projections), but in the aggregate these differences were lower than those obtained between the original and the adjusted projections.

The following two figures show the total annual bad allocation, effectively observed by using the census data, and the total annual bad allocation that would have been generated if the original projections had been used. As seen in the previous figures, bad allocation is defined as the sum of the absolute values of the difference between what is allocated using the census (or the projection) and that which would have been allocated with updated projections.¹⁹

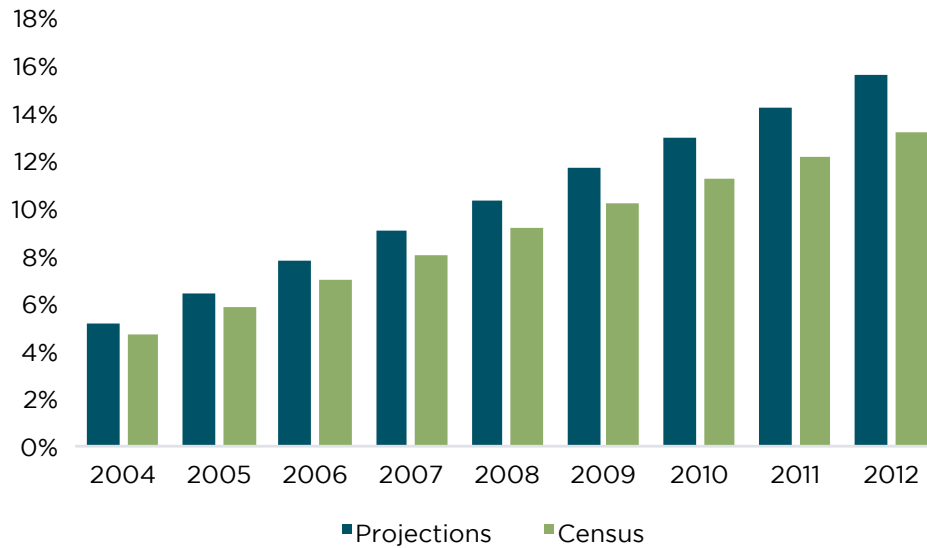
¹⁹ The results presented here are not clear enough to conclude that in all cases it is better to use the census population rather than the population projections.

Figure 18. El Salvador: Bad Allocation with the 1992 Census vs. Original Projections



Source: Authors' elaboration, based on data from DIGESTYC (<http://www.digestyc.gob.sv/>), the Finance Ministry of El Salvador (<https://www.mh.gob.sv/pmh/es/>), and the Salvadoran Municipal Development Institute (<http://www.isdem.gob.sv/>).

Figure 19. Bolivia: Bad Allocation with the 2001 Census vs. Original Projections



Source: Authors' elaboration, based on data from Bolivia's INE (<https://www.ine.gob.bo>).

The fact that the census—a static figure—yields an estimate that is closer to the future population of the municipalities than the figure achieved by the population projections highlights the need to improve the quality of the inputs that inform projections at the subnational level. Although the

transfer program design stipulates that the census be used for allocating resources, there may be a multiplicity of other policies and indicators, or cases of use in academia or the private sector, which depend on these projections, despite their deviations over time.

6.

Conclusions

With few exceptions, Latin America suffers from deficient statistical capacity. According to measurements made by the IDB, IMF, Open Data Watch, and the World Bank, Latin America lags behind the advanced countries and has failed to improve in recent years. In some cases, this is manifest in a failure to prioritize the census, with regard to either planning or dedicated investment. In other cases, it is evident in the NSO's lack of funding or even independence, which undermines its capacity to fulfill the basic responsibility to provide data for domestic and international purposes, as well as its credibility.

Inaccurate population data generate serious problems in public expenditure execution. The bad allocation totals caused by the poor quality of population data generally exceed, in some cases by a huge margin, the annual NSO budget, and the cost of carrying out a census. At the same time, the simulations presented here represent the lower limit with respect to problems of bad allocation, given that: (i) fiscal transfer allocation formulas often incorporate other variables apart from population, such as unmet basic needs, which are particularly susceptible to the generation of deviation over time, as in many countries this figure is not updated during the intercensal period through projections or new surveys; and (ii) fiscal transfers are only one of the uses of much of the census data. Other important examples are public program and investment planning,

such as assigning teachers to schools (based on an expected number of students) or building new roads (based on population projections for different cities).

Geographically, bad resource allocation is not evenly distributed, which creates winning and losing municipalities. Due to the deviation between the population recorded in the source of information used to allocate the transfers and the real population, many municipalities end up receiving fewer resources than they are entitled to by law. This represents a hidden bias in resource allocation. The gaps in allocations experienced by the loser municipalities can cause difficulties in implementing the activities targeted by transfer programs, in particular public investment, which is the approach of all the programs analyzed.

The simulations presented here should inform the debate about funding for statistical institutes and NSSs by demonstrating that data inaccuracy, generated by a lack of capacity and/or regularity, can result in serious execution errors that, at the same time, undermine the effectiveness of other public policies that are fundamental for development. In addition to investment in infrastructure and training the personnel needed to carry out censuses, more resources must be invested, even at the subnational level, and greater coordination encouraged between the members of the country's NSS to strengthen administrative registries. Having an integrated, standardized, and functional system of registries enables

access to the inputs needed to estimate and forecast population during intercensal periods. Moreover, administrative registries can be used to complement or substitute the use of sampling surveys, which greatly reduces the cost and enhances the updatedness, accuracy, and comparability of the data obtained.²⁰

Subnational population projections must be carried out more frequently, and corresponding investments should be made in the NSS's administrative registries, which provide the projection inputs, to make this possible. All the discrepancies and inefficiencies mentioned in this paper derive from the extended time lapse between updates. Making regular updates of the projections depends in essence on three factors: the NSO's capacity to manage the inputs and statistical models generated by the projections, the existence of good-quality administrative data that feeds into the projections (in particular on births, deaths, and migration) and coordination between the administrative information-producing entities (which include the civil register and the subnational governments, among others) and the NSO. Investment must be made in all three elements. The United Kingdom provides a good example in this regard. The United Kingdom's NSO, the Office for National Statistics,

makes subnational population projections every year. These incorporate births and deaths reported by local health entities known as Clinical Commissioning Groups, and migration information provided by three sources: the National Health Service Central Register, the Patient Register Data Service and the Higher Education Statistics Agency. A further approach for improving projection quality is the one taken by Mexico's INEGI, which carries out a large-scale intercensal survey five years following the census to update the population estimates.

This paper stresses the importance of conducting a census every 10 years. Even without substantial investments in the NSO's statistical capacity, or in the NSS, one way of limiting public policy distortions generated by inaccurate population data is to respect the internationally recognized 10-year rule. The simulations presented here show that with each passing year, the projection (or the figure from the latest census) diverges further and further from reality and the consequences become increasingly serious for all beneficiaries of policies that depend on population criteria. Obviously, haphazard census-taking is not enough (and ends up causing problems such as those mentioned at the beginning of this paper). It is, however, crucial that countries make the requisite investments and implement quality controls so that the census can effectively deliver an accurate headcount.

²⁰ See the study by Villacís (2019) for more on how Latin American countries currently make their population projections, and how this compares with leading countries around the world.

References

- Alatas, V., et al. 2012. Targeting the Poor: Evidence from a Field Experiment in Indonesia. *American Economic Review* 102(4): 1206-1240.
- Aldridge, J. 2006. 2011 Census Business Case. Edinburgh, United Kingdom: General Register Office for Scotland.
- Bakker, C. 2014. Valuing the Census. Wellington, New Zealand: Statistics New Zealand. Available at: <https://www.stats.govt.nz/assets/Research/Valuing-the-Census/valuing-the-census.pdf>
- Beccaria, L. 2017. Capacidad estadística. Una propuesta para su medición. Washington, D.C.: IDB. Available at: <https://publications.iadb.org/es/capacidad-estadistica-una-propuesta-para-su-medicion>.
- Björkman, M. and J. Svensson. 2007. Power to the People: Evidence from a Randomized Field Experiment on Community-Based Monitoring in Uganda. *Quarterly Journal of Economics*, 124(2): 735-769.
- Boadway, R. and A. Shah. 2009. *Transferencias fiscales intergubernamentales: principios y práctica*. Washington, D.C.: World Bank. Available at: <https://elibrary.worldbank.org/doi/abs/10.1596/978-9-5883-0753-4>.
- Cameron, G. J., et al. 2019. Measuring the Statistical Capacity of Nations. Washington, D.C.: World Bank.
- Dargent, E., G. Lotta, J. A. Mejía and G. Moncada. 2018. Who wants to know?: The Political Economy of Statistical Capacity in Latin America. Washington, D.C.: IDB. Available at: <https://publications.iadb.org/handle/11319/8899>
- DGEEC (Dirección General de Estadísticas, Encuestas y Censos). 2015 Paraguay: Proyección de la población nacional, áreas urbana y rural por sexo y edad, 2000-2025. 2015 Review. Asuncion, Paraguay: DGEEC. Available at: <http://www.dgeec.gov.py/Publicaciones/Biblioteca/proyeccion%20nacional/Estimacion%20y%20proyeccion%20Nacional.pdf>
- Finance Ministry of El Salvador (n.d.). Salvadoran Municipal Development Institute. Available at: <http://isdem.gob.sv>.
- IDB (Inter-American Development Bank). 2018. Decentralization and Subnational Governments Sector Framework Document. Washington, D.C.: IDB.
- Jensen, R. 2010. The (Perceived) Returns to Education and the Demand for Schooling. *The Quarterly Journal of Economics* 125.2: 515-548.

References

- Merry, S. E., K. E. Davis, Oas and B. Kingsbury (Eds.) 2015. *The Quiet Power of Indicators: Measuring Governance, Corruption, and the Rule of Law*. New York, NY: Cambridge University Press.
- Perfit, J. T., M. Russell, G. A. Moncada and J. E. Muñoz Ayala. 2012. Estimación de algunos efectos y determinantes del uso de distintas tecnologías en los censos de población de América Latina y el Caribe. *Notas de Población Vol.39. No.95*: 65-105. Santiago, Chile: ECLAC.
- Spencer, B. D., J. May, S. Kenyon and Z. Seeskin. 2017. Cost-Benefit Analysis for a Quinquennial Census: the 2016 Population Census of South Africa. *Journal of Official Statistics* 33.1: 249-274. Available at: <https://www.degruyter.com/downloadpdf/j/jos.2017.33.issue-1/jos-2017-0013/jos-2017-0013.pdf>
- UNECE (United Nations Economic Commission for Europe). 2017. Value of Official Statistics: Recommendations on Promoting, Measuring and Communicating the Value of Official Statistics. Available at: https://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/2017/CES_4-Value_of_Official_Statistics_for_endorsement_for_upload.pdf
- United Nations. 2008. Principles and Recommendations for Population and Housing Censuses, Review 2. New York, NY: Statistics Division, United Nations. Available at: https://unstats.un.org/unsd/demographic-social/Standards-and-Methods/files/Principles_and_Recommendations/Population-and-Housing-Censuses/Series_M67Rev2-E.pdf
- _____. 2011. *Proyecciones de Población a Largo Plazo*. Santiago, Chile: ECLAC.
- Villacís, B. 2019. *Proyecciones de población: un estudio comparativo*. Washington, D.C.: IDB. Available at: <https://publications.iadb.org/es/proyecciones-de-poblacion-un-estudio-comparativo>.
- World Bank. 2018. *Statistical Capacity Index 2018*. Washington, D.C.: World Bank. Available at: <http://datatopics.worldbank.org/statistical-capacity/SCIdashboard.aspx>

Annex 1.

Methodological Note to the Maps

The maps shown throughout this work were elaborated using the QGIS 3.2.2-Bonn program. The Coordinate Reference System is EPSG:4326. The Geographic Coordinate System is WGS84. The shapefiles with geopolitical borders were provided directly by the NSOs of each country, except in the case of Ecuador, where the geopolitical borders used are available from the Database of Global Administrative Areas or GADM 3.6.

Certain cities were highlighted in each map to show them in greater detail due to their territorial extension, population or economic importance. For some municipalities, there was no extant information regarding population, transfers, or unmet basic needs, and these are shown on the maps in grey and marked “information unavailable.”

The color coding of the maps is divided by using the quantile method, which is generated by QGIS. This method was chosen for its capacity to display the different levels of variability and thereby differentiate extreme values more clearly.

Annex 2.

Methodology for Measuring the Transfers

Bad allocation in the allocation of the fiscal transfers was calculated using the following formula:

$$\text{Total bad allocation } x = \sum_{m=1}^n |a_m - b_m|$$

where m = municipality; a = effective population-based allocation; b = hypothetical population-based allocation.

The following section describes the databases used, the assumptions for each country, and the additional calculations carried out to construct the series that feed into the formula.

Bolivia

Census and Population Projections

Bolivia's INE provided the population data series, both for the 2001 census and for the projections. For this country, calculation of the bad transfer allocations was made by comparing what was allocated based on population data from the 2001 census with what would have been allocated if the retrospective population estimations made on the basis of the 2012 census were used (updated projections).

Notes on updated projections: Between the 2001 census and the 2012 census, 25 new municipalities were created as result of the breaking up of existing municipalities. To compare the databases, it was necessary to enter the new municipalities into the database of the updated projections, which was done by adding the population of these municipalities based on information provided by the INE, to recreate the original municipalities according to the 2001 census.

Notes on original projections: The original projections (elaborated by the INE based on the 2001 census) were not used for the calculation of total bad allocation. Nonetheless, they were used for the calculation in Section 5.4. In this case, it was necessary to extend the series of projections for 2011 and 2012, given that the INE series lacked projections for that year. For this purpose, the rate of annual average growth per municipality was calculated for the period 2004–2010 of the original projections, and this rate of growth was applied to calculate the population in 2011 and 2012.

Calculation of Transfer Allocations

Population-based transfers in Bolivia are calculated using only the population criterion, which means they are allocated proportionally to the number of people living in each municipality of the country. Bolivia's INE provided the figures for the total amount allocated to each municipality, and there is a series with a periodicity from 2004 to 2016. Therefore, calculation of the bad allocation was carried out for the period 2004–2012.

Note on unmet basic needs: the information regarding unmet basic needs per municipality in Bolivia corresponds to the 2012 census and was provided by CELADE, the population division of the Economic Commission for Latin America and the Caribbean (ECLAC).

Ecuador

Census and Population Projections

The series of population data at the cantonal level, both for the 2001 and the 2010 censuses, and for the projections were obtained from the INEC. In the case of Ecuador, calculation of the bad transfer allocations was made by comparing allocations based on the projections taken from the 2001 census, which are denominated original projections (OPs), with what would have been allocated if the retrospective population estimation is made on the basis of the 2010 census²¹ (updated projections) had been used.

21 Projections obtained from: <http://sni.gob.ec/proyecciones-y-estudios-demograficos>

Calculation of Transfer Allocations

As previously mentioned, 50 percent of the transfer allocations is population-based. The Ministry of Economy and Finance Information provided the information total transfers made under the so-called Fifteen Percent Law, and the series has a periodicity from 2007 to 2010. To calculate the allocations, 50 percent of the total transfers made under the Fifteen Percent Law was multiplied by the population share of each municipality in the total population.

Note on unmet basic needs: The information regarding unmet basic needs per municipality in Ecuador corresponds to the 2010 Census and was provided by CELADE, the population division of ECLAC.

El Salvador

Census and Population Projections

El Salvador's DIGESTYC provided the series of population data, both for the 1992 census and for the projections. For this country, calculation of the bad transfer allocation was made by comparing what was allocated based on population data from the 1992 census with what would have been allocated if the retrospective population estimations based on the 2007 census had been used (updated projections).

Notes on updated projections: The updated projections for El Salvador were carried out in 2014 and were only available for the 2005–2007 period. Nonetheless, analysis was required for the period 2000–2007, since information about transfers was available for these years. Therefore, the series of updated projections was extended backward using the rate of average annual growth for each municipality between 2005 and 2007, to obtain municipal retrospective population estimations for the years 2000–2004.

Calculation of Transfer Allocations

As previously mentioned, 50 percent of transfer allocations in El Salvador are population based. Information regarding the total amount of the FODES transfers was provided by the Finance Ministry and the Salvadoran Institute

of Municipal Development. To calculate the allocations per municipality by population, the formula established in Law 74 (1988) was used, which established that:

$$\begin{aligned} & \textit{Municipal allocation } m \\ & = \textit{Population } m_2 * \textit{ degree of per capita ratio} \\ & * \textit{ Constant of population weighted per capita} \end{aligned}$$

The degree of per capita ratio is a fixed value, established according to the following table:

Table A2.1. Per capita Ratio

Population ranges	Per capita ratio
From 1 to 10,000	5
From 10,001 to 20,000	4.5
From 20,001 to 30,000	4
From 30,001 to 40,000	3.5
From 40,001 to 50,000	3
From 50,001 to 60,000	2.5
From 60,001 to 70,000	2
From 70,001 to 80,000	1.5
From 80,001 to 90,000	1
More than 90,001	0.5

$$\textit{Constant of population weighted per capita} = \frac{50\% \textit{ of total transfers}}{\textit{total weighted population}}$$

$$\Sigma (\textit{population } m * \textit{ degree of per capita ratio } m)$$

Note on unmet basic needs: The information about unmet basic needs by municipality in El Salvador corresponds to the 2007 census and was provided by CELADE, the population division of the ECLAC.

