IJW Canaviri, J. A. (2016). Measuring the concept of "wellbeing": A first approach for Bolivia. *International Journal of Wellbeing*, *6*(1), 36-80. doi:10.5502/ijw.v6i1.363

ARTICLE

Measuring the concept of "wellbeing": A first approach for Bolivia

Jose Antonio Canaviri

Abstract: This is a first approach to measuring wellbeing in Bolivia at subnational levels. The analysis includes the construction of a multidimensional index that calculates "distances" (Distance P2). The index considers the worst values of a set of indicators taken as a reference among municipalities (unit of analysis) and aggregates across time (from 2000 to 2011) and dimensions (material, social and human). The comparisons are of changes over time between municipalities, based on their wellbeing values. It aims to answer the following questions:

- What is the level of wellbeing of the Bolivian population from an objective-subnational perspective?
- Which municipalities have the highest and lowest levels of wellbeing?
- How has the wellbeing of the Bolivian population evolved over time at subnational levels?
- Which indicators contribute most to the measurement of wellbeing at subnational levels?

In general, the municipalities with the lowest values of wellbeing are concentrated in the Department of Oruro. In addition, if temporal analysis is included, these municipalities remain in the lowest positions. Overall, Bolivians' wellbeing decreased at subnational levels over time from 2000 to 2011.

Keywords: wellbeing, subnational, distance P_2, dimensions, multidimensional

1. Introduction

During the Bolivian president Evo Morales' administration, the Ministry of Development and Planning (2006) had developed a National Social and Economic Development Plan (NDP) for Wellbeing. The NDP was officially launched in 2006, and its main strategic guidelines aimed at the transformation of Bolivia to embrace the "wellbeing" concept, involving criteria such as life satisfaction and/or quality of life in a broad sense. Although the concept of life satisfaction became a strategic part of the public policy agenda of the Bolivian Government in the first period of Morales' governance, no attempts were made to measure it.

There is substantial evidence about measuring wellbeing in the literature and many of the studies focus on criteria for subjective and objective methods. Subjective wellbeing is commonly discussed in the psychology literature in terms of happiness, quality of life, and life satisfaction, although these constructs vary somewhat in definition (Seligson, Huebner, & Valois, 2005). Subjective measures of wellbeing (cognitive and affective aspects of wellbeing) mention that personal relations are the most important contributor to wellbeing, followed by work, leisure activities and interpersonal interactions, in that order (Nieboer, Lindenberg, Boomsma, & Bruggen, 2005). The subjective criteria are usually displayed as qualitative information, while objective criteria are exposed as quantitative information, including measuring GDP, GDP per

Jose Antonio Canaviri
UNICEF
acanaviri@unicef.org

capita, (Torras, 2008) and social indicators (e.g., net enrollment rate for primary education, child mortality, expectancy of life, poverty rates and others) (Alkire, 2011; Berenger & Verdier-Couchane, 2007; United Nations Development Programme, 2013).

This study intends to bring an approximation of measurement to the concept of "development and progress," translated – and under the assumption that the wellbeing concept is an appropriate approach to the former – into the NDP of Bolivia. The study uses information gathered before (2000-2005) and during Morales' first period of governance (2006-2010). The results of this study will provide inputs for public policy guidelines in order to identify which dimensions (e.g., material, social, human) and/or sectors (e.g., health, education) need more attention in terms of improving wellbeing, since currently there is no evidence about Bolivians' wellbeing. Given the fact that subnational information in Bolivia is scarce, the results will provide evidence and allow the government and decision makers to consider wellbeing issues from an objective and quantitative point of view, focusing on areas with low wellbeing (cities and municipalities).

The analysis includes the construction of a multidimensional index that calculates "distances" (Distance P_2), considering the worst values of a set of indicators taken as a reference among municipalities (unit of analysis) and aggregates across time (from 2000 to 2011) and dimensions (material, social and human). The multidimensional composite index at subnational levels will allow for an easy interpretation of the values, will facilitate the task of ranking municipalities according to their wellbeing values, and will reduce the size of the set of indicators to one single summary value.

The analysis includes the comparison of changes over time among municipalities, based on their wellbeing values, and aims to answer the following questions:

- What is the level of wellbeing of the Bolivian population from an objective-subnational perspective?
- Which municipalities have the highest and lowest levels of wellbeing?
- How has the wellbeing of the Bolivian population evolved over time at subnational levels?
- Which indicators contribute most to wellbeing at subnational levels?

In general, the municipalities with the lowest values of wellbeing are concentrated in the Department of Oruro. In addition, if temporal analysis is included, these municipalities remain in the lowest positions. Overall, Bolivians' wellbeing decreased at subnational levels over time from 2000 to 2011.

The study is structured in the following way. Section 2 provides the main objective and a review of literature on wellbeing; section 3 describes the method, domains and data; section 4 presents the main results; and section 5 describes policy implications and conclusions.

2. Review of Literature

Using a composite index or synthetic indicator has advantages and disadvantages that may be taken into account. For instance, a composite indicator should ideally measure multidimensional concepts which may not be captured by a single indicator, such as competitiveness, industrialization, sustainability, wellbeing, development and progress, single market integration or knowledge-based society. (OECD, 2008). Even though the main virtue of composite indexes is their usefulness for policy analysis (Nardo & Saisana, 2008) and their multidimensional approach (Booysen, 2002), if they are poorly constructed or misinterpreted, they may send erroneous messages and may be dangerous for policy making. The multidimensional indices are useful in

order to compare (e.g., via a benchmark) different countries, cities or municipalities, aggregating various indicators based on a framework.

In this sense, it is important to consider a theoretical framework which sustains and provides the basis for the selection and combination of variables into a meaningful measure (OECD, 2008; Booysen, 2002).

The interest in and the number of multidimensional and composite indexes has increased over the years. For instance, according to the OECD (2008), currently there are more than 160 composite indexes. The multidimensionality of composite indexes covers a wide spectrum of dimensions (see Booysen, 2002 for a detailed list of dimensions). Probably one of the best known composite indexes is the Human Development Index (HDI) by the UNDP (2013). The HDI was launched in 1990 and since then has been produced annually in order to compare countries relative to their development, according to the HDI values. The new version (2013) of the HDI considers three variables for estimation, namely, gross national income, years of schooling, and life expectancy. Another relatively well known index is the Multidimensional Poverty Index (MPI) by Alkire (2011). For the MPI estimation 10 components are chosen; two for health (malnutrition, and child mortality), two for education (years of schooling and school enrolment), and six for living standards (including both access to services and proxies for household wealth). As with the HDI, the MPI compiles information over three dimensions: education, health, and living standards (Ravallion, 2010).

A useful and recently redeveloped composite index is the method Distance P_2 (DP_2). It was initially developed by Pena (1977) and then exploited by Somarriba (2008), Somarriba and Pena (2009), Zarzosa (2009), Cuenca et al. (2010) and Rodriguez (2010). This approach takes as reference a location (e.g., country) and calculates distances from this "reference" point to compare other locations. Zarzosa and Somarriba (2013) use the DP_2 method when measuring social welfare in Spain at subnational (provincial) levels. The index uses information on different social indicators (e.g., literacy rate, unemployment, contribution pensions) from various life domains (e.g., health, education, work, social protection), aggregating them into a single summary index. According to the authors, this method fulfils the requirements for a composite index, such as existence and determination, monotony, uniqueness quantification, invariance, homogeneity, transitivity, exhaustiveness, additivity, invariance, conformity and non-arbitrariness in the importance attached to a single indicator. According to them, the main advantage of this approach is that "redundant" information from each single indicator, used to construct the composite index, is removed, and only the relevant information is included. Another application of DP_2 by Somarriba and Pena (2009) is applied when they measure quality of life in Europe. They compare the advantages and disadvantages of two approaches similar to DP_2 – Principal Components and Data Envelopment Analysis – and conclude that DP_2 is the optimal method for obtaining composite indexes for wellbeing. There are other applications beyond wellbeing such as that of Cuenca et al. (2010), who used DP_2 as a "new" proposal for the measurement of development applied to the Pacific countries of the African, Caribbean and Pacific Group (ACP); and Rodriguez (2010) presented a "new composite index" of child health in the Least Developed Countries of Africa.

To our best knowledge, there are only a couple of studies that have aimed to measure wellbeing in Bolivia. The first one is the Municipal Development Index for Children and Adolescents (IDINA), which used a composite index at subnational (municipal) level for health, education, social protection, habitability and economic capacity of household indicators. All the indicators were classified per age group (infants 0-5, children 6-13 and adolescents 14-17). Due to the difficulty of obtaining the information required for indicators – and especially because the

frequency of collection of information at the municipal level is scarce – the indicators were basically elaborated as a mix of sources and years (Economic and Social Policy Analysis Bureau (UDAPE) & UNICEF , 2005 & 2008). IDINA index values range from 0 to 1, 0 indicating that in a certain municipality children's rights are nonexistent, and 1 reflecting that children's rights are achieved completely, within the scope that children's rights are related to access to health, education, water and sanitation, all of which are considered as a protective environment. The second study is at the departmental level (one above municipal), based on a Quality of Life index. The authors (Ocampo & Foronda, 2007), use household survey data based on the household's characteristics. Using Principal Components Analysis, their main finding is that urban areas have better quality of life than do rural areas.

3. A multidimensional index for wellbeing in Bolivia

According to the OECD (2008) and Nardo and Saisana (2008), there are stages that are required to construct composite indexes. A *theoretical framework* is required, providing the basis for the selection and combination of single variables and indicators into a composite indicator. When selecting *data or variables* for the composite index, they should be chosen on the basis of their analytical soundness, measurability, country coverage, relevance and relationship with the phenomena under study (Booysen, 2002). *Imputation of missing data* is necessary to examine extreme values, since they may become unintended benchmarks. A *multivariate analysis* is useful in order to investigate the overall nature, structure and properties of the data and indicators, to assess the suitability of the data and to explain the methodological choices such as weighting and aggregation. *Normalization* is applied to the values of the composite index in order to be comparable and to take account of extreme values. *Weighting and aggregation* are applied to the indicators after considering the theoretical framework and possible correlation and compensability issues among indicators. It is desirable to carry out *robustness and sensitivity analysis* of the composite index in terms of the steps described before. Finally, the composite index should be transparent and able to be decomposed into its underlying indicators or values; if possible it should be linked to other variables or other published indicators, and the way it is presented should be clear in order to avoid misleading interpretations.

3.1 Theoretical framework: Domains

There is no formal agreement about which domains, even less, indicators, should be incorporated when analyzing wellbeing. For instance, for the Human Development Index, UNDP (2013) uses three dimensions: health, education, and living standards. The same applies to the Multidimensional Poverty Index by Alkire (2011). Various authors have suggested the following domains:

> *Stiglitz, Sen, & Fitoussi (2009):* Material living standards (income, consumption and wealth); health; education; personal activities including work; political voice and governance; social connections and relationships; environment (present and future conditions); and insecurity.
>
> *Somarriba & Pena (2009)*: Education, health, safety, satisfaction and happiness.
>
> *Epley (2008):* Crime, health, employment, education and recreation.
>
> *Heshmati (2008)*: Material wellbeing, health and safety, educational wellbeing, peer and family relationships, behaviors and risks, and subjective wellbeing.

Ocampo & Foronda (2007): Household characteristics (infrastructure, access to basic services) and their surroundings (crime and security, health, environment, education infrastructure).

Murias, Martinez, & De Miguel (2006): Consumption capacity, wealth stocks, inequality and economic insecurity.

White (2009): Material considerations (assets, welfare and standard of living); social considerations (social relations, access to public goods, attitudes to life and personal relationships); and human considerations (people's perception of their (material, social and human) positions, cultural values, ideologies and beliefs).

According to White (2009) the three dimensions (material, social and human) are associated with each other and none can exist without the others. Thus, it is important not to forget their unity when analyzing and measuring wellbeing. Another way to think about this is that for any element within people's wellbeing there are potentially three aspects to be considered: what people have or do not have (material); what people do or cannot do with it (social); what people think or feel (human). White also argues for a subjective element for each of the dimensions; however, given the lack of data for the subjective variables, these are not considered here. This approach is used for the study, and the main reason for that relates to the concept of progress and development mentioned in the NDP of Bolivia, and on the nature of data for Bolivia available at the subnational level (see Table 1 below).

Some considerations are important to bear in mind. First, when selecting the indicators (see Table 1 below) for the social dimension, the main criterion was to have a common infrastructure or place where people can interact with each other. In addition, for the material dimension, the number of personnel in health centers, hospitals, schools, colleges and institutes is used as a proxy for the availability of services in municipalities. Second, the classification of the indicators is indicative, in the sense that another indicator may also apply; however, given the lack of information at the municipal level in Bolivia, these dimensions and indicators are used for the analysis. Moreover, aggregating the indicators according to the dimensions does not affect the validity of the results or the estimation of wellbeing. In other words, the focus and relevance is centered in the set of indicators beyond the classification per se. A similar approach is applied in Pena (1977), Somarriba (2008), Somarriba and Pena (2009), and Zarzosa and Somarriba (2013).

Table 1a. Indicators, descriptive statistics and timeframe

Indicators (unit)	Dimension	Descriptive Statistics				Timeframe of Data (from 1992 to 2011)*														Missing Data (%)
		Mean	SD	Min	Max	92	99	00	01	02	03	04	05	06	07	08	09	10	11	
Extreme poverty (percentage)	Material	64.1	20.8	7.8	99.6				✓											0.0
Coverage of water (percentage)	Material	52.4	23.0	0.6	96.7	✓			✓											0.0
Coverage of sanitation (percentage)	Material	28.7	18.4	0.7	80.6	✓			✓											0.0
Infant mortality rate (per 1,000 births)	Human	77.5	21.9	38.0	170.4	✓			✓											4.0
Immunization vaccines for children (percentage) [a]	Human	77.3	19.6	0.0	100.0					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	1.7
Institutional deliveries (percentage)	Human	53.7	24.2	0.0	100.0					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	1.5
Children with diarrhoea (percentage) [b]	Human	33.3	18.3	0.0	100.0			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			0.0
Children with suspected pneumonia (percentage) [b]	Human	47.4	24.1	0.5	100.0			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			0.0
Net enrolment rate pre-primary (percentage)	Human	31.1	20.3	0.0	100.0			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		0.8
Net enrolment rate primary (percentage)	Human	82.6	18.9	0.0	100.0			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.7
Net enrolment rate secondary (percentage)	Human	38.5	21.2	0.0	100.0			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.5
Completion rate primary level (percentage)	Human	63.4	24.1	0.0	100.0				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1.5
Drop out school rate pre-primary (percentage)	Human	8.8	7.1	0.0	64.3		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				2.5
Drop out school rate primary (percentage)	Human	6.4	3.7	0.0	39.7		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				2.8
Drop out school rate secondary (percentage)	Human	9.1	5.8	0.0	60.0		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				2.8
Social investment MDG Poverty (per capita USD)	Material	2.0	5.4	0.0	144.6			✓	✓	✓	✓	✓	✓	✓	✓					27.3

Table 1b. Indicators, descriptive statistics and timeframe

Indicators (unit)	Dimension	Descriptive Statistics				Timeframe of Data (from 1992 to 2011)*														Missing
		Mean	SD	Min	Max	92	99	00	01	02	03	04	05	06	07	08	09	10	11	Data (%)
Social investment MDG Infant Mortality and Mother Health (per capita USD)	Material	3.6	6.3	0.0	183.2			✓	✓	✓	✓	✓	✓	✓	✓					17.9
Social investment MDG universal education (per capita USD)	Material	6.8	10.8	0.0	177.7			✓	✓	✓	✓	✓	✓	✓	✓					17.8
Total social investment (per capita USD)	Material	15.0	23.6	0.0	535.0			✓	✓	✓	✓	✓	✓	✓	✓					0.6
Doctors, nurses, and administrative personnel (per 100 thousand population)	Material	32.3	157.7	0.0	1937.2										✓					0.0
Health centers and hospitals (per 100 thousand population)	Social	3.1	5.0	0.0	48.0										✓					0.0
Schools, colleges and institutes (per 100 thousand population)	Social	20.2	37.6	0.0	451.2										✓					0.0
Teachers in schools and institutes (per 100 thousand population)	Material	116.2	315.3	0.0	3316.1										✓					0.0
		N		**46,521**								**TOTAL**								**4.5**[c)]

* National censuses carried out in 1992 and 2001

a) For children under 5 years old

b) Children with diarrhoea and suspected pneumonia in the last three weeks before the information was taken and that have been treated for these illnesses

c) Please see Appendix 1 for the imputation method.

3.2 Data

The database contains variables at the subnational level (327 municipalities) from 1992 to 2011[1] classified by the Millennium Development Goals (MDGs) elaborated by UDAPE of the Bolivian Ministry of Planning. UDAPE uses this information in order to track the progress of the MDGs in Bolivia. In addition, there are a few variables used in the analysis estimated by UNICEF Bolivia.

Information at subnational levels is scarce in Bolivia, thus information on these indicators is not regularly available for all years. The systems of information in Bolivia lack data reliability in terms of designing, collecting and assuring the quality of indicators, especially at subnational levels. Another problem is related to the availability of the data. Generally, data are available with two or more years of delay, impeding the chance of generating updated evidence. Information on the indicators' descriptive statistics, their years of availability, the dimension to which they belong, and the percentage of missing data is provided in Table 1 above.

3.3 Commonly used methods for aggregation and weighting

There are different approaches to aggregating indicators to construct a composite index by means of linear and non-linear techniques (Nardo & Saisana, 2008). Pena proposes a method for aggregation based on "distances" (DP_2). The distances are estimated by considering two countries or locations, taking one as a reference point, and the resulting value is divided by the standard deviation. Thus, variables are expressed in abstract units beyond the initial units of the single indicators, allowing the single indicators to be aggregated into a composite index (Somarriba, 2008). Therefore, the latter value is acting as a weight resolving two issues: the units of measurement and the weighting assigned to each observable variable in the composite index (Rodriguez, 2010). In addition, Pena (2009) proposes a "correction factor" which eliminates redundant information and keeps only the "new" information contributed by each single indicator. This correction factor also acts as a weight of the partial indicators. The method DP_2 allows for the aggregation of variables expressed in different measures, avoiding arbitrary weights and duplication of information.

The Human Development Index uses the geometric mean as an aggregation method, using three indicators: gross national income, years of schooling, and life expectancy. Using the latter method (in which indicators are multiplied and weights appear as exponents) is appropriate when the individual indicators appear in different scales. However, with this method, countries with higher scores are rewarded more and vice versa (Nardo & Saisana, 2008). Ravallion (2012) suggests that this method of aggregation may undermine the estimations by the HDI. For instance, variables such as longevity may have been substantially devalued in poor countries and valuations of extra schooling have risen four times higher than the valuations typically placed by the labor market on extra schooling. Thus, when using geometric aggregation, a country with low scores on one indicator will need a much higher score on the others to improve its situation (OECD, 2008).

Related to aggregation, there are implicit or explicit weights when constructing composite indexes. Generally, data comes in different units; therefore, the analyst should use a weighting model to aggregate the information. There are a number of techniques from statistical models used for this purpose, such as factor analysis, data envelopment analysis and unobserved component models (OECD, 2008). The weighting approach will depend ultimately on the analyst, derived from

[1] This range of time is not the same for each variable in the database, as detailed in Table 1 above.

consultation with experts, or may reflect policy priorities or theoretical factors. Booysen (2002) suggests that equal weighting should be the norm, given the fact that different weighting approaches lead to different results, and given that the subjectivity inherent in many of these weighting systems means all of them are subject to criticism.

Finally, it is important to bear in mind that no method is perfect, as detailed by the OECD (2008, p. 33): "[T]he absence of an 'objective' way to determine weights and aggregation methods does not necessarily lead to rejection of the validity of composite indicators, as long as the entire process is transparent."

3.4 The Distance P2 method

This section is based on Pena (2009), who describes the distance method using many indicators to construct a composite index. This method is based on "distances," in absolute or quadratic terms, between each indicator from different locations or in relation to a reference value. Let $X = \{x_{ij}\}$ be the data matrix for m unities (rows), in this case the municipalities, and the n indicators (columns), in this case the proposed indicators for wellbeing. Let X_j be the vector of the components in the status $j(j = 1, \dots, m)$, which may refer to a period of time or unit:

> $X_j = [x_{j1}, x_{j2}, \dots, x_{ji}, \dots, x_{jn}]$, where x_{ji} is the status for the i component in the status j where $(i = 1,2, \dots, n \; and \; j = 1,2, \dots, n)$. The reference group is defined by $X_* = [x_{*1}, x_{*2}, \dots, x_{*n}]$.

As regards the n components, the p-metric distance is defined as:

$$D_p = \left\{ \sum_i \left| x_{ji} - x_{*i} \right|^p \right\}^{\frac{1}{p}} \qquad (1)$$

The quadratic case will be when $p = 2$, and the simple distance case when $p = 1$. The Frechet distance (DF) (as cited in Pena, 2009) is defined as:

$$F(r,k) = \sum_i \frac{d_i(r,k)}{\sigma_i} \qquad (2)$$

where $d_i(r,k) = x_{ri} - x_{ki}$ and σ_i is the standard deviation of the values considering the *i-value*. From the Frechet distance the Ivanovic-distance (1963) is defined as:

$$DI(r,k) = \sum_{i=1}^{n} \frac{|d_i(r,k)|}{\sigma_i} \prod_{j=1}^{i=1} (1 - r_{ji.1,2,\dots,j-1}) \qquad (3)$$

where the factor $\prod_{j=1}^{i=1}(1 - r_{ji.1,2,\dots,j-1})$ is added to the DF distance function, which is 1 minus the product between the *i* and *j* coefficients correlation, where (*j*>*i*). This factor is introduced to take into account the duplicated information by measuring the r_{ji} coefficient and the degree of association between the new indicator introduced and that immediately above, once eliminated in both effects of all other included indicators.

Pena (2009) proposes the following DP_2 solution in order to eliminate redundant information by means of the correction factor:

$$DP_2 = \sum_{i=1}^{m} \frac{d_i}{\sigma_i} \left(1 - R^2_{i.i-1,i-2,\dots,1}\right) \text{ with } R_1^2 = 0 \qquad (4)$$

Where d_i and σ_i are the same as the DF indicators, the "correction factor" $\left(1 - R^2_{i.i-1,i-2,\dots,1}\right)$ aims to suppress unnecessary information. Suppose that the components are ranked by the iterative method described earlier in the following order: $x_1, x_2, \dots, x_n$. Assuming that x_2 has a linear dependence on

x_1, then the coefficient of determination in the regression of x_2 on x_1 gives the total variance in x_2 explained by the regression. Thus $1 - R_{21}^2$ is the x unexplained variance by the linear action of x_1. $1 - R_{21}^2$ can then serve as a correction factor for component x_2, since the part of the variance explained by the linear dependence is eliminated on the contribution made from this indicator to the DP_2. Similarly, if the synthetic indicator has considered components x_1 and x_2 and we want to introduce a new component $-x_3-$ linearly dependent on the above, the correction factor is $1 - R_{3.2,1}^2$; that is, the complement of the coefficient of determination in the regression of x_3 on x_2 and x_1. DP_2 enjoys all the properties required of a good distance indicator and also allows for inter-temporal comparisons to compare identical territorial units in various time periods. For a detailed and comprehensive explanation, see Pena (1977), Somarriba and Pena (2009) and Somarriba (2008).

In order to apply DP_2, a municipality that has the worst value is taken as a "reference."' Thus, DP_2 will estimate the "distance" of each municipality with regards to this "reference" municipality. A lower DP_2 value will be indicative that the value is closer to that "reference" or worst wellbeing value. In other words, higher DP_2 values will reflect higher wellbeing for a given municipality. To guarantee the fulfillment of the properties of DP_2, certain variables whose increase implies a worsening of wellbeing were multiplied by -1, so that an increase in the value of any variable might mean an improvement in the quality of life. For instance, the extreme poverty indicator ideal value will be the one that is low (it is better to have fewer poor people in a given municipality), thus, a low value for the indicator is preferred instead of a high value. However, a high value is also desired for other types of indicators. For example, it is better to have a high rate of net enrolment in the municipality than to have a low one.

4. Results[2]

Given the nature of the data (Table 1 above), mainly because of temporality, the analysis is carried out at three stages. The first stage examines the comprehensive encompassing indicators from 2000 to 2011. The second captures the period before Morales' first period of government, which is the years 2000 to 2005. Finally, indicators from the first period of Morales' government, from 2006 to 2011, are examined. The years from 1992 to 1999 are not considered, since only three indicators are available and the gap from 1992 to 2000 is large.

Following Somarriba and Pena (2009) and Somarriba (2008) to estimate the wellbeing indicator (WBI), there are stages for these estimations. The first stage estimates WBI values for those variables which have more than one year of information (see Table 1 above). For instance, *immunization vaccines for children* has information for 11 years; thus, in the first stage, the WBI estimation was made considering these 11 years. The second stage required estimation of WBI values (from the first stage) of variables which were not included in the first stage (e.g., those variables which only had one year of information, such as *health centers and hospitals*) in order to estimate the WBI values for each dimension (material, social and human). Finally, in the third stage, the WBI values for each dimension were used to estimate the total WBI values at subnational levels.

[2] All the analysis is carried out in MATLAB using the code kindly provided by Noelia Somarriba.

4.1 The period 2000-20113

4.1.1 Correction factors

The coefficient of the linear correlation value $|r|$ between each indicator and the wellbeing value is estimated below, as is the correction factor $\left(1 - R^2_{i.i-1,i-2,\ldots,1}\right)$ from equation (4), indicating how much each indicator contributes to the WBI. Table 2 below shows these values:

Table 2. Ranking of the variables according to order of entrance in the DP2 and correction factors

Indicator [Domain]	$\|r\|$	$1 - R^2$
Immunization vaccines for children **[H]**	0.6295	1.0000
Net enrolment rate primary **[H]**	0.5785	0.1129
Extreme poverty **[M]**	0.5430	0.0970
Total social investment **[M]**	0.5315	0.1057
Health centers and hospitals **[S]**	0.5303	0.8974
Institutional deliveries **[H]**	0.5050	0.4471
Social investment MDG universal education **[M]**	0.4972	0.7658
Social investment MDG infant mortality and mother health **[M]**	0.4777	0.6298
Teachers in schools and institutes **[M]**	0.4714	0.8831
Schools, colleges and institutes **[S]**	0.4702	0.7264
Doctors, nurses, and administrative personnel **[M]**	0.4623	0.3246
Net enrolment rate pre-primary **[H]**	0.4449	0.4858
Completion rate primary level **[H]**	0.4421	0.6661
Coverage of sanitation **[M]**	0.4245	0.6734
Social investment MDG poverty **[M]**	0.3937	0.1879
Net enrolment rate secondary **[H]**	0.3653	0.7219
Coverage of water **[M]**	0.3366	0.5787
Children with suspected pneumonia **[H]**	0.3294	0.7251
Children with diarrhoea **[H]**	0.2955	0.1995
Infant mortality rate **[H]**	0.1897	0.5753
Drop out school rate pre-primary **[H]**	0.1801	0.8893
Drop out school rate secondary **[H]**	0.1244	0.8192
Drop out school rate primary **[H]**	0.0180	0.5816

The ranking shows the order of the variables included in the analysis in accordance with their order of entrance; that is, according to their coefficient of linear correlation between the values of the indicator for each municipality and the WBI. *Immunization vaccines for children* retains all its information (100%), whereas *drop out school rate primary* has the lowest value of correlation, retaining only 58.1%. It is worth mentioning that the indicators for the Social Dimension *(number of health centers and hospitals per 100,000 population* and *number of schools, colleges and institutes per 100,000 population)* retain almost 90% and 73% respectively[4].

[3] The results described below are based on the single indicators detailed in Table 1 above, for which information is available from 2000 to 2011.

[4] Access to these services is vital for any group of people, given that most of the Bolivian population is considered poor; however, the extreme poverty variable only contributes ~10% but is highly correlated (r =54.3) with the WBI estimation.

4.1.2 WBI results

Once the WBI for each municipality (n=327) was obtained, all the values were normalized for a better interpretation, since the values obtained vary for each dimension and are not directly comparable. The values were normalized using the following formula[5]:

$$WBIS_j = \frac{x_j - x_{min}}{x_{max} - x_{min}}$$

where $WBIS_j$ is the standardized value of the WBI composite index for the j indicator

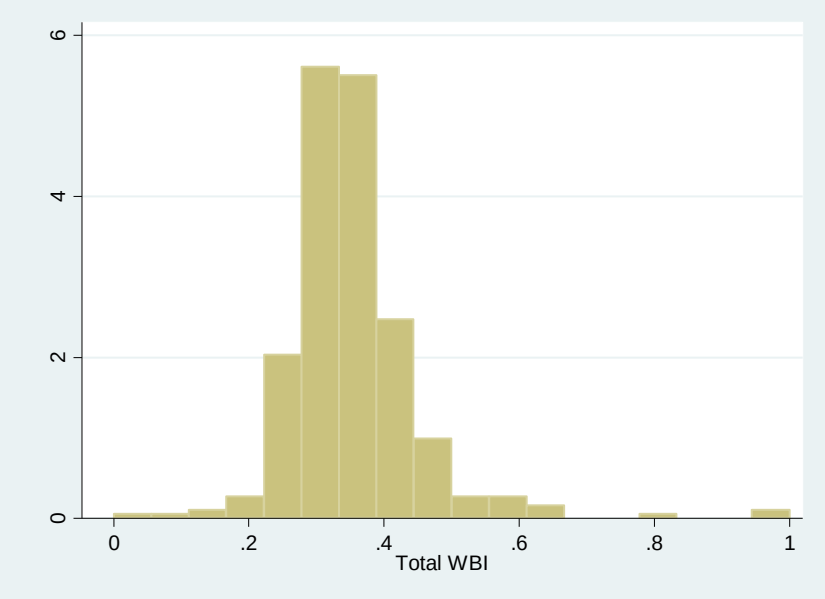
x_j is the WBI value without being standardized

x_{max} is the best WBI value

x_{min} is the worst WBI value.

The distribution of the WBI values (Figure 1 below) shows a concentration around ~0.352. In order to visualize the information in maps, classes are required. At first glance, the WBI values, ranging from 0 to 1, are concentrated at 0.3. In this context, classes are required to visualize the WBI values at subnational levels. For this purpose, quartiles are used to map the WBI values.[6]

Figure 1. Distribution of WBI values



The top three municipalities (Table 3 below and mapped in green in Figure 2[7] below) are the main municipalities (capital cities) of the three most important departments in Bolivia.

[5] The normalization was required, since the WBI values range from 0.012 to 20.143. Therefore, in order to have a more interpretable measure, the values were normalized from 0.000 to 1.000, 0.000 being the municipality with the lowest level of wellbeing.

[6] For a detailed list of all WBI values, please see Appendix 2.

[7] All the maps were generated using DevInfo software (www.devinfo.org), which was developed by UNICEF. Its aim is to help monitor the MDGs progress of countries.

Figure 2. Total WBI values estimated by P2D at subnational levels for Bolivia

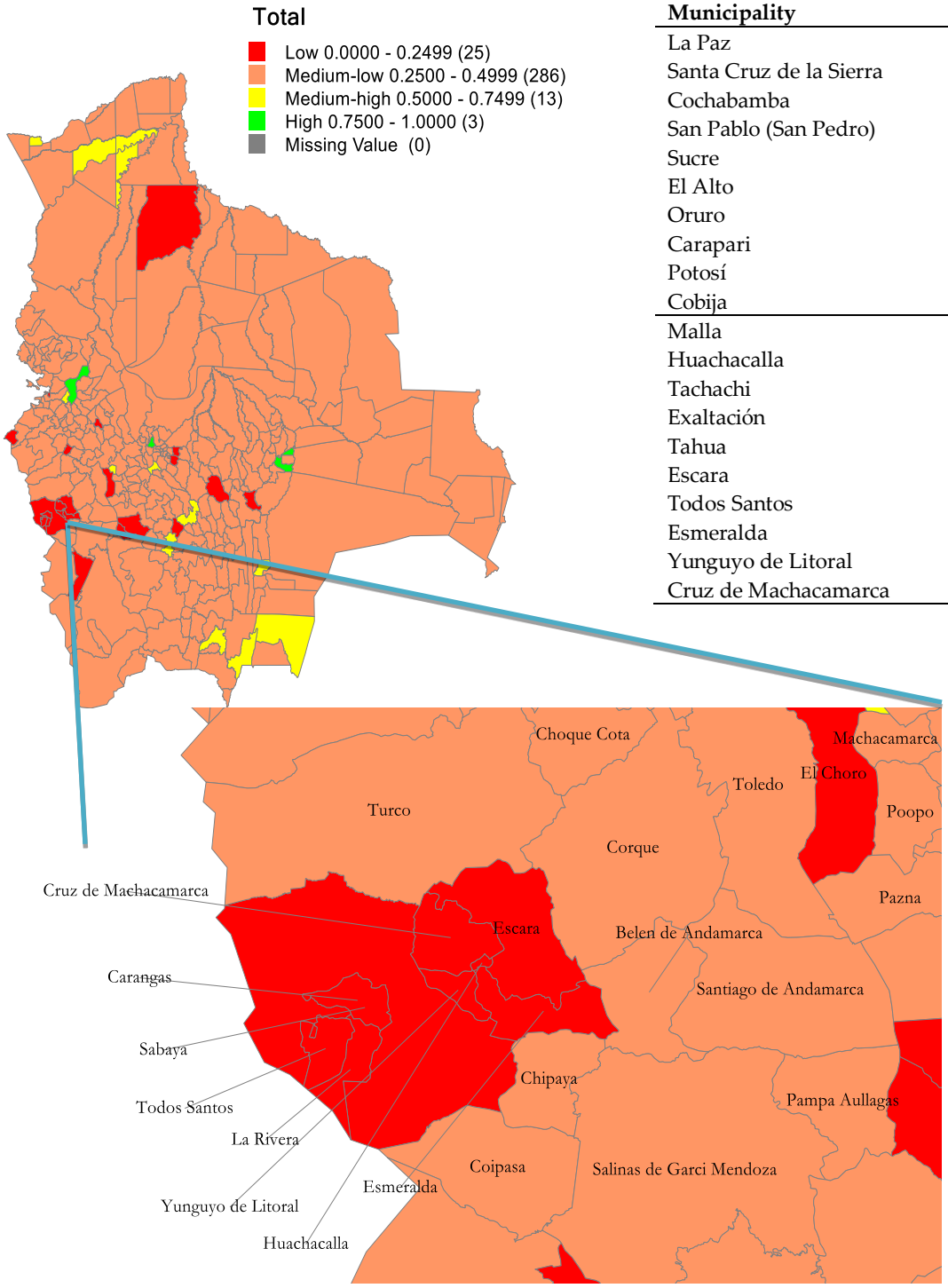


Table 3. Top and bottom 10 municipalities by WBI values

Municipality	WBI value
La Paz	1.0000
Santa Cruz de la Sierra	0.9915
Cochabamba	0.7879
San Pablo (San Pedro)	0.6547
Sucre	0.6373
El Alto	0.6287
Oruro	0.5918
Carapari	0.5826
Potosí	0.5821
Cobija	0.5760
Malla	0.2274
Huachacalla	0.2185
Tachachi	0.2175
Exaltación	0.2097
Tahua	0.2056
Escara	0.1748
Todos Santos	0.1649
Esmeralda	0.1510
Yunguyo de Litoral	0.0794
Cruz de Machacamarca	0.0000

There are 25 municipalities that have low WBI scattered around the map, and most of the municipalities (286) are concentrated in the medium-low class. Almost all of the bottom municipalities with low WBI values are located in the west of Bolivia. It is clear that municipalities

with the worst WBI value (including Huachacalla, Escara, Cruz de Machacamarca, Yunguyo de Litoral, Esmeralda and Todos Santos) are located near each other; therefore, there are policy implications, in the sense that the government should pay more attention to these areas (located in the rural area of Oruro city).

The average WBI value for each class was obtained and distances between classes were calculated. As shown in Table 4 below, the biggest difference, on average, is between high and low classes (342%). By classifying the municipalities by quartiles, the top three municipalities (WBI=0.925 average) are far away from the 25 low WBI values (WBI=0.210 average). A closer examination by dimension[8] below will enrich the analysis.

Table 4. Distances among WBI values
Units [%]

	High	Medium-high	Medium-low	Low
High	-	0.355 [62]	0.578 [166]	0.717 [342]
Medium-high	-	-	0.223 [64]	0.362 [173]
Medium-low	-	-	-	0.139 [66]
Low	-	-	-	-

The rationale behind de-constructing the total WBI values for each municipality by dimensions is related to the fact that the contribution of each dimension and single indicator will be visible, thereby enhancing the analysis of wellbeing at subnational levels (OECD, 2008). For the human dimension, the highest number of municipalities is in the class high (40) and the lowest number is in the class low (11). The human dimension is the most favorable dimension in terms of WBI values.

From Table 5 below, the main variables for the human dimension that are more related to the WBI are *immunization vaccines for children* and *net enrolment rate primary* (r=0.70 and 0.65 respectively). Of the three dimensions, the number of municipalities in the high class is highest (23) for this dimension (Figure 3 below). In addition, two variables from this dimension (*net enrolment rate secondary* and *drop out school rate secondary*) contributed the most to the WBI (94% and 87% respectively). Nevertheless, the social investment per capita in education and health are, on average, USD6.8 and USD3.6 (see Table 1 above); thus, from the results of the social dimension, it seems that these efforts from the government are not enough (see Figure 4 below). For this dimension, the availability of basic services such as *health centers and hospitals* and *schools, colleges and institutes* were the selected indicators, and they are highly correlated with the WBI estimation (r=0.95 and 0.99 respectively[9]); however, the number of *health centers and hospitals* retains 100% of its information, whereas *schools, colleges and institutes* retains only 11%. According to Figure below, the social dimension presents the worst WBI values of all dimensions. Almost all of the municipalities (321) are classified in the low class. From Table 4 above, the values, on average, for these indicators, are 3.1 and 20.2 per 100,000 population. The situation is dramatic for the health sector, since there is not enough supply of services at subnational levels, a problem closely related with low indicators for this sector (e.g., on average, nearly 50% of pregnant women have their newborns in health centers

[8] The classification by quartiles applies for each single dimension.
[9] Table not shown here because there are only two indicators.

and hospitals; seven out of 10 children are vaccinated; and seven out of 100 children die before reaching one year).

Table 5. Ranking of the variables according to order of entrance in the P2D and correction factors (human dimension)

Indicator	$\|r\|$	$1 - R^2$
Immunization vaccines for children	0.7044	1.0000
Net enrolment rate primary	0.6470	0.4723
Institutional deliveries	0.5464	0.6570
Completion rate primary level	0.4854	0.7684
Net enrolment rate pre-primary	0.4339	0.2451
Children with suspected pneumonia	0.4221	0.3689
Children with diarrhoea	0.3960	0.6986
Drop out school rate pre-primary	0.3888	0.1970
Net enrolment rate secondary	0.3452	0.9364
Drop out school rate secondary	0.3326	0.8655
Drop out school rate primary	0.1950	0.6397
Infant mortality rate	0.1770	0.7998

Figure 3. WBI values for human dimension

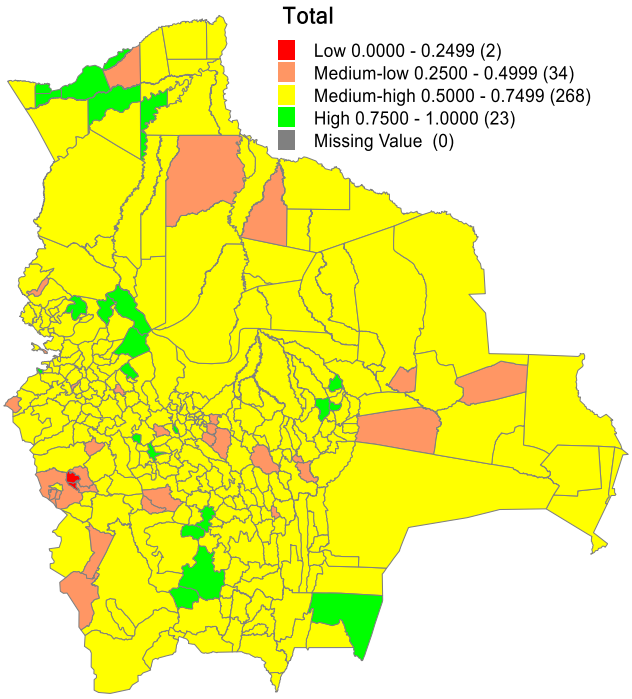
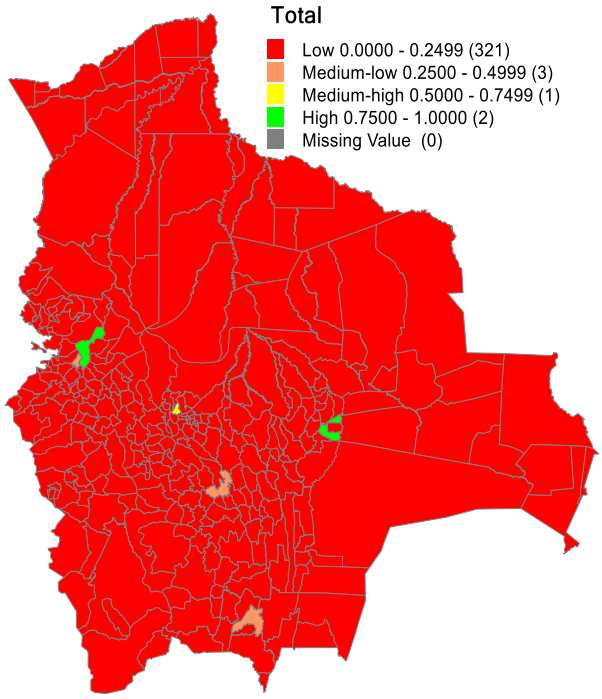
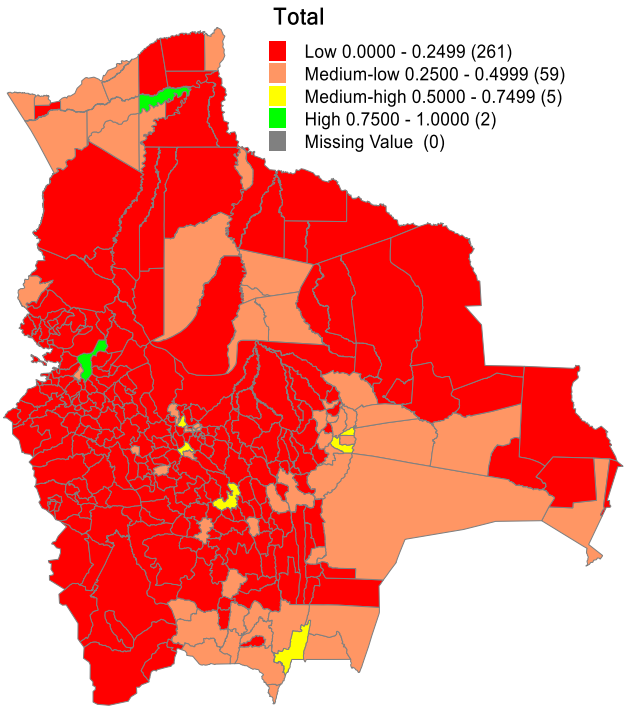


Figure 4. WBI values for social dimension



The material dimension is located in the middle of the three dimensions in terms of the WBI values (Figure 5 below).

Figure 5. WBI values for material dimension



According to Table 6 below, two of the indicators in this dimension (*extreme poverty* and *social investment in education*) are highly correlated with the WBI estimation (~0.61); however, the contribution by the *extreme poverty* indicator to the WBI estimation is low (17%) compared to the availability of *doctors, nurses and administrative personnel* and *total social investment* per capita in the municipalities.

Table 6. Ranking of the variables according to order of entrance in the P2D and correction factors (material dimension)

Indicator	$\|r\|$	$1 - R^2$
Social investment MDG universal education	0.6200	1.0000
Extreme poverty	0.5919	0.1690
Doctors, nurses, and administrative personnel	0.5903	0.9652
Total social investment	0.5767	0.8760
Teachers in schools and institutes	0.5655	0.7581
Social investment MDG infant mortality and mother health	0.5248	0.4983
Coverage of water	0.5133	0.7230
Social investment MDG poverty	0.4798	0.7376
Coverage of sanitation	0.3891	0.7863

Social investment in education retains 100% of its information and is highly correlated with the WBI estimation. This is in line with the indicators in the education sector and their improvement over the years (UDAPE and UNICEF, 2005; 2008). From Table 1 above, on average, the *net enrolment rate (NER)* reaches 83% and the *drop out school rate for primary* 6.4%; however, the NER for pre-primary

and secondary are low (31.1% and 38.5%) and the *drop out school* for the same levels are high (~9%). The availability of *doctors, nurses and administrative personnel* (as in the social dimension with the number of *health centers and hospitals*) retains 97% of its information, reflecting the importance of having a greater supply of these personnel and associated infrastructure in the municipalities, considering that, on average, only USD3.6 per capita is invested in health at subnational levels.

Finally, from the three dimensions, the material one is the one that contributes all of its information and is highly correlated with WBI estimation (Table 7 below). Therefore, having personnel (doctors, nurses and teachers) in the health centers, hospitals and schools accompanied by social investment in health and education are key elements to improve wellbeing at subnational levels.

Table 7. Ranking of the dimensions according to order of entrance in the DP2 and correction factors

Dimensions	$\|r\|$	$1 - R^2$
Material	0.8603	1.0000
Social	0.7014	0.6943
Human	0.6722	0.8905

4.1.3 Analyzing the bottom WBI values by dimension

As seen in Table 3 above, most of the municipalities in the "top 10" are the main capital municipalities in Bolivia. Therefore, it is not surprising that these municipalities have high WBI values, since these cities have better values for all indicators compared to all other rural municipalities. However, it is interesting to explore the "bottom 10" municipalities in order to analyze more deeply the reasons or factors affecting their WBI values and their performance in the rankings. Table 8 below shows the municipalities with lowest WBI values that fall into two (green) or three dimensions (red). In other words, municipalities in green have the lowest WBI values per dimension. In addition, those in red have the lowest WBI values per dimension plus the lowest WBI values in general. The three municipalities highlighted in red belong to the Department of Oruro, located in the east region of Bolivia (see Figure above). For instance, Todos Santos, Yunguyo de Litoral and Cruz de Machacamarca have the lowest WBI values in all three dimensions.

As per Table 6 above, health personnel (doctors, nurses and administrative staff) is an important variable that retains 97% of its information (r=0.59) in WBI estimation. For the fourth municipalities in green in Table 8 below, in the material dimension (columns 1 and 2), the availability of health personnel is very low. For instance, of the four, two (Todos Santos and Carangas) have only one nurse and one health centre. Even though the population in these municipalities is not high (388 and 556 persons, according to the National Statistics Institute, 2013) the situation is really dramatic for the Cruz de Machacamarca municipality. According to the INE (2013), the population for 2007[10] in this municipality was 2,176 persons, and they have neither a health centre nor health personnel in the area.

[10] Information for health personnel is available for 2007. Information was provided by the Economic and Social Policy Analysis Bureau (2009).

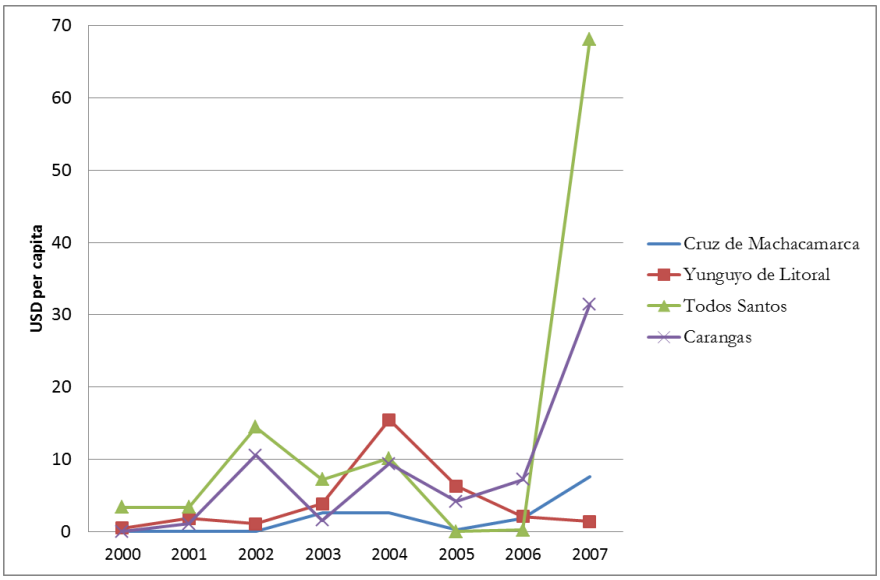
Table 8. WBI Values for the bottom 10 municipalities by dimension

WBI material dimension		WBI social dimension		WBI human dimension		WBI total	
Municipality	**WBI value**	**Municipality**	**WBI value**	**Municipality**	**WBI value**	**Municipality**	**WBI value**
Ingavi	0.0453	Todos Santos	0.0029	Alalay	0.4085	Malla	0.2274
Tahua	0.0438	Tacachi	0.0026	Catacora	0.3973	Huachacalla	0.2185
Todos Santos	0.0431	Coipasa	0.0021	Pailón	0.3673	Tacachi	0.2175
Apolo	0.0418	Carangas	0.0021	Todos Santos	0.3515	Exaltación	0.2097
Carangas	0.0370	Nazacara de Pacajes	0.0015	Huachacalla	0.3496	Tahua	0.2056
Yunguyo de Litoral	0.0280	Escara	0.0015	Escara	0.3011	Escara	0.1748
Chacarilla	0.0206	La Rivera	0.0015	Esmeralda	0.2948	Todos Santos	0.1649
Tacobamba	0.0197	Esmeralda	0.0014	Exaltación	0.2939	Esmeralda	0.1510
Cruz de Machacamarca	0.0015	Yunguyo de Litoral	0.0008	Yunguyo de Litoral	0.1633	Yunguyo de Litoral	0.0794
El Choro	0.0000	Cruz de Machacamarca	0.0000	Cruz de Machacamarca	0.0000	Cruz de Machacamarca	0.0000
At least 2 dimensions						3 dimensions	

Total social investment contributes to the material dimension, with 88% of its information (see Table 6 above). Analysis of this indicator shows Cruz de Machacamarca again has the worst values (Figure 2 below). Over the period 2000 to 2007, this municipality received on average USD1.9 for each person, compared to USD4.1, USD8.2 and USD13.4 for Yunguyo de Litoral, Carangas and Todos Santos respectively. Some other municipalities with a similar population size as that of Cruz de Machacamarca, such as Tacachi (2,316), Huachacalla (2,152), and San Antonio de Esmoruco (2,176) received USD8.5, USD5.7 and USD14.1 respectively in 2007.

In the social dimension, the availability of *health centers and hospitals* and *schools, colleges and institutes* are highly correlated with WBI estimation; however, only the first of these retains 100% of its information in the WBI calculation. In terms of availability of health personnel in these municipalities, on average, they have one doctor, four nurses and two health centers. In terms of education, Cruz de Machacamarca does not have any school or teacher in the area, whereas the other five have at least one school and a teacher (Yunguyo de Litoral), reaching 17 teachers in Todos Santos. Therefore, this fact relates to the lack of information available for any indicator in the education sector for Cruz de Machacamarca. All the children may attend a school near this municipality (such as Escara, Huachacalla or Yunguyo de Litoral, see Table 8 above). Escara and Carangas, the two new municipalities in green in this dimension (columns 3 and 4), have one and two schools and eight and three teachers respectively.

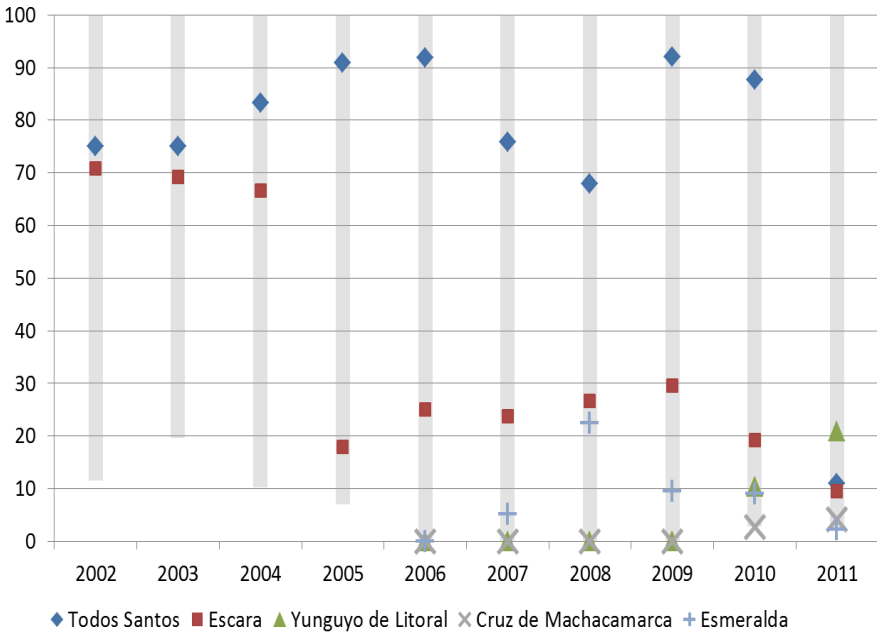
Figure 6. Total social investment per capita, 2000-2007 (selected municipalities)



Source: Elaborated based on social investment data at subnational levels by the Economic and Social Policy Analysis Bureau (2010)

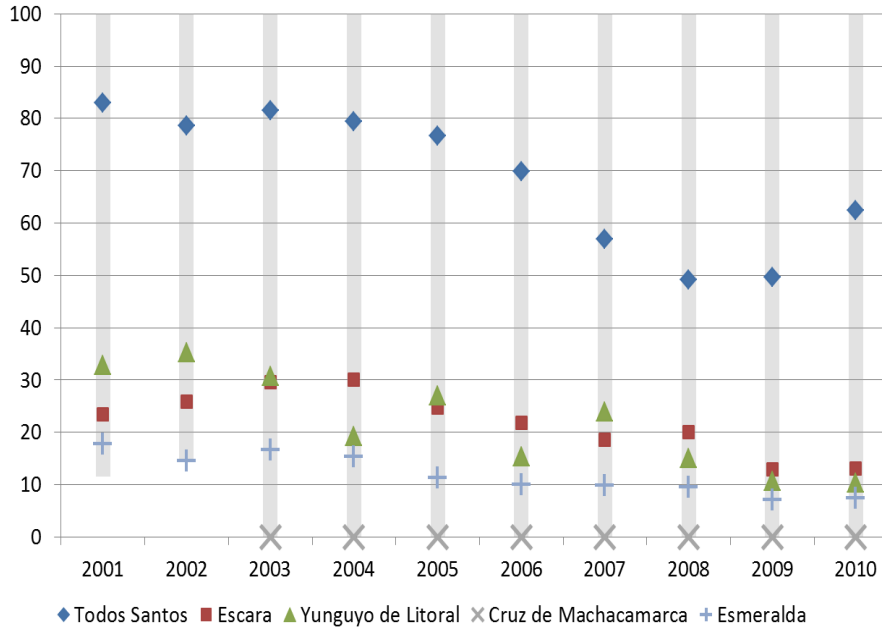
The performance of the municipalities in the third column of Table 8 above is reflected in Figures 7 and 9 below.

Figure 7. Immunization vaccines for children, 2002-2011 (selected municipalities)



Source: Elaborated based on municipal indicator. Dossier of Economic and Social Statistics data by UDAPE (2010b)

Figure 8. Net enrolment rate primary, 2001-2010 (selected municipalities)

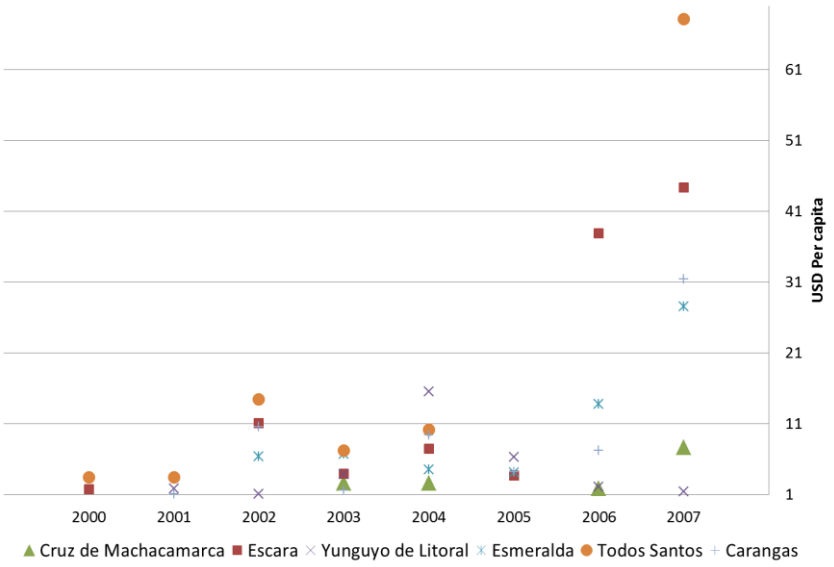


Source: Elaborated based on municipal indicator. Dossier of Economic and Social Statistics data by UDAPE (2010b)

The two indicators that are highly related to the WBI estimation are considered there. The grey line shows the range (maximum and minimum) of possible values for each indicator. Cruz de Machacamarca gets the lowest values for both indicators; however, as mentioned before, since the municipality does not have a school in the area, the NER indicator is not collected. Todos Santos gets the best values for both indicators, except for 2011 in the *immunization vaccines* indicator. Both figures are in concordance with the WBI ranking, although it is important to mention that Todos Santos has values that are closer to those for the top municipalities (~69% and 75% respectively) but the highest values for other "negative" indicators among these municipalities (e.g., *Infant mortality rate* (146.2)), *drop out school rate pre-primary, primary and secondary* (average 42.2)).

The social investment in the municipalities is essential in order to improve the conditions of their populations. Over the period from 2000 to 2007, the social investment per capita for some of the bottom 10 municipalities with the worst WBI values according to their WBI ranking benefits, such as Cruz de Machacamarca, required greater attention (Figure 9 below). For instance, from 2000 to 2002 there was no social investment; however, from 2003 the investment reached USD7.6 per capita in 2007. In contrast, from Figures 7 and 8 above, the municipality of Todos Santos has better indicators than do other municipalities, as well as greater social investment. From 2000 to 2003 Todos Santos had the highest per capita social investment, reaching the highest amount in 2007 among all the bottom municipalities (USD44.4). In contrast, the top 10 municipalities received, on average during the 2000 to 2007 period, USD33.8 per capita.

Figure 9. Total social investment per capita, 2000-2008 (selected municipalities)



Source: Elaborated based on social investment data at subnational levels by UDAPE (2010a)

4.2 A comparative analysis

As stated above, the main feature of the DP2 method is to estimate "distances," taking as "reference" a municipality with the worst values in its single indicators. Considering that we are interested in comparing the evolution over time of the WBI values for each municipality, two periods of time are used for this purpose: from 2000 to 2005 and from 2006 to 2011. The two periods shed light on the progress, in terms of wellbeing, for each municipality under the former and current (under the National Development Plan's scope) government's policies in terms of education, health and social investment. In order to achieve the objective detailed before, a "reference" municipality is taken for both periods. The municipality of Cruz de Machacamarca has the worst values, and the "distances" are estimated based on the values for each municipality. This procedure allows us to compare WBI values for both periods, taking as a reference the same municipality. For the first comprehensive analysis (from 2000 to 2011, as detailed before), all the single indicators were added to estimate the WBI values; however, for this two-period analysis, the estimation considers just those indicators that have information in both periods (e.g., *children with diarrhoea* has information from 2000 to 2009). Table 9 below shows the indicators that were included in the WBI estimation for both periods.

Comparing Table 9 below with Table 1 above, the indicators that do not have information for both periods, that is for 2000 to 2005 and 2006 to 2011, were excluded from the analysis (e.g., *infant mortality rate*), in order to have comparable indicators to analyze the evolution of WBI values over time. It is important to mention that the two indicators that matched the "social dimension" are not included in the following analysis; therefore, the analysis by dimension was not included either.

Table 9. Indicators and timeframe for WBI 2000-2011 estimation

Indicators (unit)	Timeframe of Data (from 2000 to 2011)											
	00	01	02	03	04	05	06	07	08	09	10	11
Immunization vaccines for children (percentage)			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Institutional deliveries (percentage)			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Children with diarrhoea (percentage)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Children with suspected pneumonia (percentage)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Net enrolment rate pre-primary (percentage)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Net enrolment rate primary (percentage)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Net enrolment rate secondary (percentage)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Completion rate primary level (percentage)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Drop out school rate pre-primary (percentage)	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Drop out school rate primary (percentage)	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Drop out school rate secondary (percentage)	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Social investment MDG poverty (per capita USD)	✓	✓	✓	✓	✓	✓	✓	✓				
Social investment MDG infant mortality and mother health (per capita USD)	✓	✓	✓	✓	✓	✓	✓	✓				
Social investment MDG universal education (per capita USD)	✓	✓	✓	✓	✓	✓	✓	✓				
Total social investment (per capita USD)	✓	✓	✓	✓	✓	✓	✓	✓				

4.2.1 Period from 2000 to 2005 vs. period from 2006 to 2011

The procedure for the estimation of the WBI for these periods is the same as that applied before (for 2000-2011); however, two stages instead of three were needed, since the WBI values for the dimensions are not included in the analysis. In the first stage, the DP_2 method of aggregation was applied to those single indicators which have more than a year of information. For instance, for *net enrolment rate for primary*, the WBI values were estimated using the available information, that is, from 2000 to 2005 (see Table 9 above). The second stage consisted of using the values obtained for each single indicator in the first stage to estimate the WBI values for the period from 2000 to 2005.

Figure 6 below shows both WBI distributions. The figure suggests that for the period from 2006 to 2011, most of the normalized values of wellbeing are aggregated at 0.425 – a wellbeing value less than that for the period from 2000 to 2005 (0.544). At first glance, it appears that the levels of wellbeing at subnational levels had decreased between the periods of time analyzed.

Figure 10. Distributions for WBI values by period of time

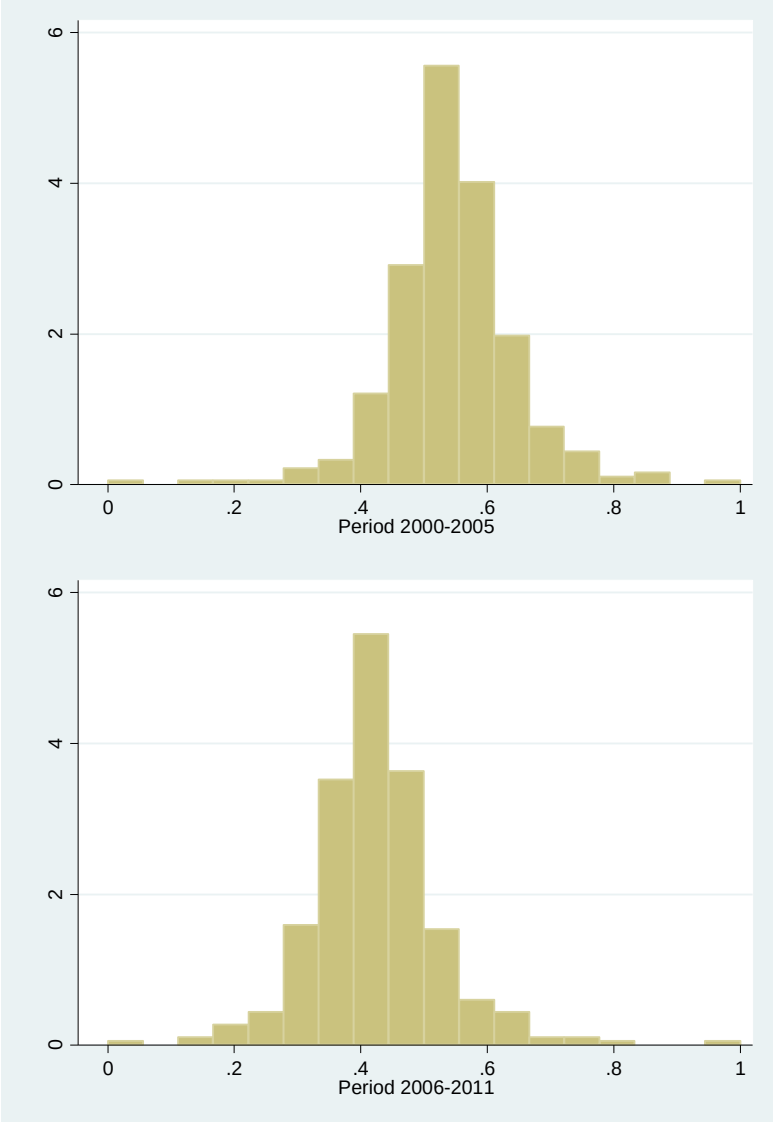


Table 10 below offers a description of the indicators that contributed most to the WBI estimation $(1 - R^2)$ and their absolute linear correlation $|r|$, with the resulting composite index. *Immunization vaccines for children* and *net enrolment rate for primary* contributed most to the estimation for the periods from 2000 to 2005 and 2006 to 2011 respectively. It is worth noting that *total social investment* per capita increased its contribution from 76% in the period from 2000 to 2005 to 96% in the period from 2006 to 2011, resulting in the second most important "contributor" to the WBI estimation in the period from 2006 to 2011.

Table 10. Ranking of the variables according to order of entrance in the P2D and correction factors for 2000-2005 and 2006-2011

2000-2005

Indicator	$\|r\|$	$1 - R^2$
Net enrolment rate primary	0.668	1.000
Immunization vaccines for children	0.574	0.695
Total social investment	0.503	0.756
Institutional deliveries	0.494	0.925
Social investment MDG infant mortality and mother health	0.465	0.571
Completion rate primary level	0.450	0.642
Social investment MDG universal education	0.413	0.921
Social investment MDG poverty	0.406	0.724
Net enrolment rate pre-primary	0.401	0.248
Children with suspected pneumonia	0.367	0.548
Net enrolment rate secondary	0.338	0.309
Children with diarrhoea	0.328	0.801
Drop out school rate pre-primary	0.273	0.925
Drop out school rate secondary	0.218	0.844
Drop out school rate primary	0.076	0.629

2006-2011

Indicator	$\|r\|$	$1 - R^2$
Immunization vaccines for children	0.696	1.000
Net enrolment rate primary	0.630	0.411
Total social investment	0.624	0.958
Social investment MDG infant mortality and mother health	0.574	0.342
Social investment MDG universal education	0.555	0.393
Institutional deliveries	0.525	0.619
Net enrolment rate primary	0.520	0.253
Children with diarrhoea	0.519	0.633
Completion rate primary level	0.492	0.650
Social investment MDG poverty	0.465	0.222
Children with suspected pneumonia	0.458	0.550
Drop out school rate secondary	0.374	0.199
Net enrolment rate secondary	0.363	0.953
Drop out school rate pre-primary	0.266	0.880
Drop out school rate primary	0.221	0.722

Figure 11 and Figure 12 below show the values for both periods.

Figure 11. WBI values for 2000-2005

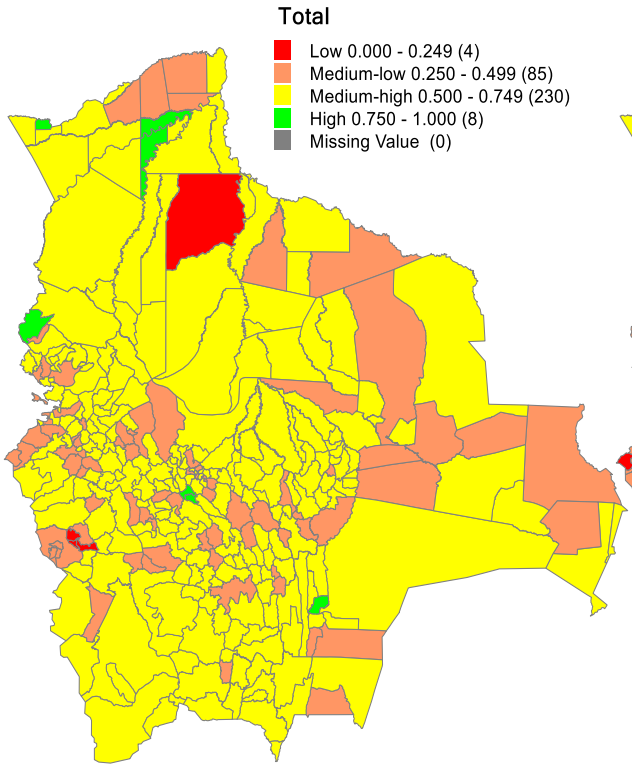
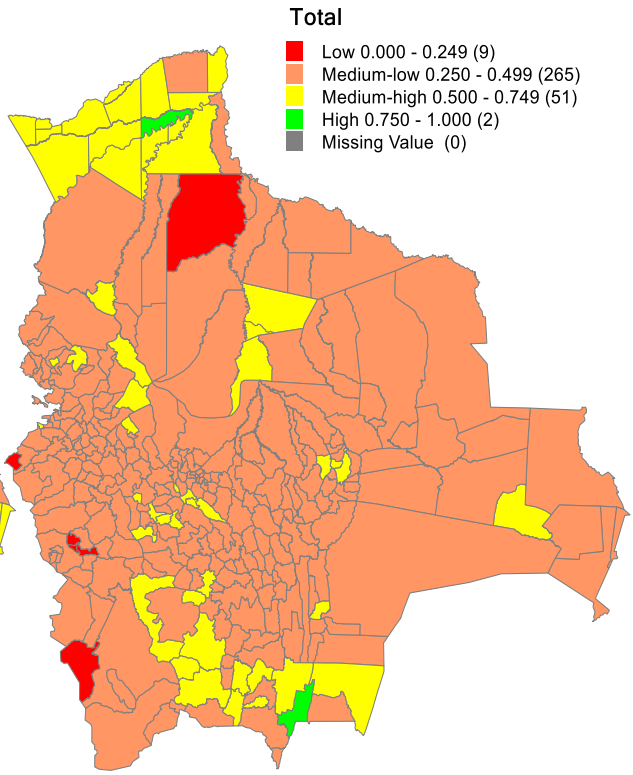


Figure 12. WBI values for 2006-2011 period



In general, most of the municipalities changed their condition from medium-high to medium-low between periods. The number of municipalities with higher WBI values reduced between periods from eight to two. In addition, Table 11 below shows the bottom 10 municipalities, according to their WBI values. As analyzed in the period 2000-2011 Cruz de Machacamarca, Yunguyo de Litoral, Esmeralda, and Escara appear in both periods.

Table 11. Lowest WBI values for 2000-2005 and 2006-2011 periods

2000-2005		2006-2011	
Municipality	**WBI Value**	**Municipality**	**WBI Value**
Eureka (Santos Mercado)	0.365	Escara	0.255
Catacora	0.359	San Pedro de Quemes	0.227
Escara	0.327	Tito Yupanqui	0.221
Ingavi	0.326	Catacora	0.200
Pailón	0.295	Tacachi	0.190
Nacebe (Santa Rosa de Abuna)	0.282	Exaltación	0.178
Exaltación	0.245	Esmeralda	0.175
Esmeralda	0.218	Huachacalla	0.161
Yunguyo de Litoral	0.159	Yunguyo de Litoral	0.132
Cruz de Machacamarca	0.000	Cruz de Machacamarca	0.000

These results suggest that subnational levels reveal important "differences" among municipalities, and, in line with UDAPE and UNICEF (2005 & 2008), the values for the capital cities are not the real scenario and do not necessarily reflect the situation for the rest of municipalities, in this case, in terms of wellbeing. The results are interesting, considering that the current government was elected in 2006 and since then some redistributive policies have been allocated in order to improve the condition of the most vulnerable and poor people such as, conditional cash transfers (e.g., the *Juancito Pinto* bonus aimed at retaining children in schools, and the *Juana Azurduy de Padilla* bonus aimed at improving pre and post control in women); the continuity to the establishment of an insurance scheme across Bolivia with universal, comprehensive and free coverage, to provide health benefits to children from birth to five years and pregnant women from the beginning of pregnancy until six months postpartum; and stable levels of social investment at national levels (17% of GDP). Despite these efforts, the wellbeing at subnational levels reveals important disparities that the population faces.

The complementary analysis below (Figure 13) was carried out on an annual basis (2002, 2003, 2006 and 2007) to see possible changes in the WBI values over the years to contrast with the findings obtained for the period 2000-2005 and 2006-2011.

Figure 13a. WBI values for 2002, 2003, 2006 and 2007

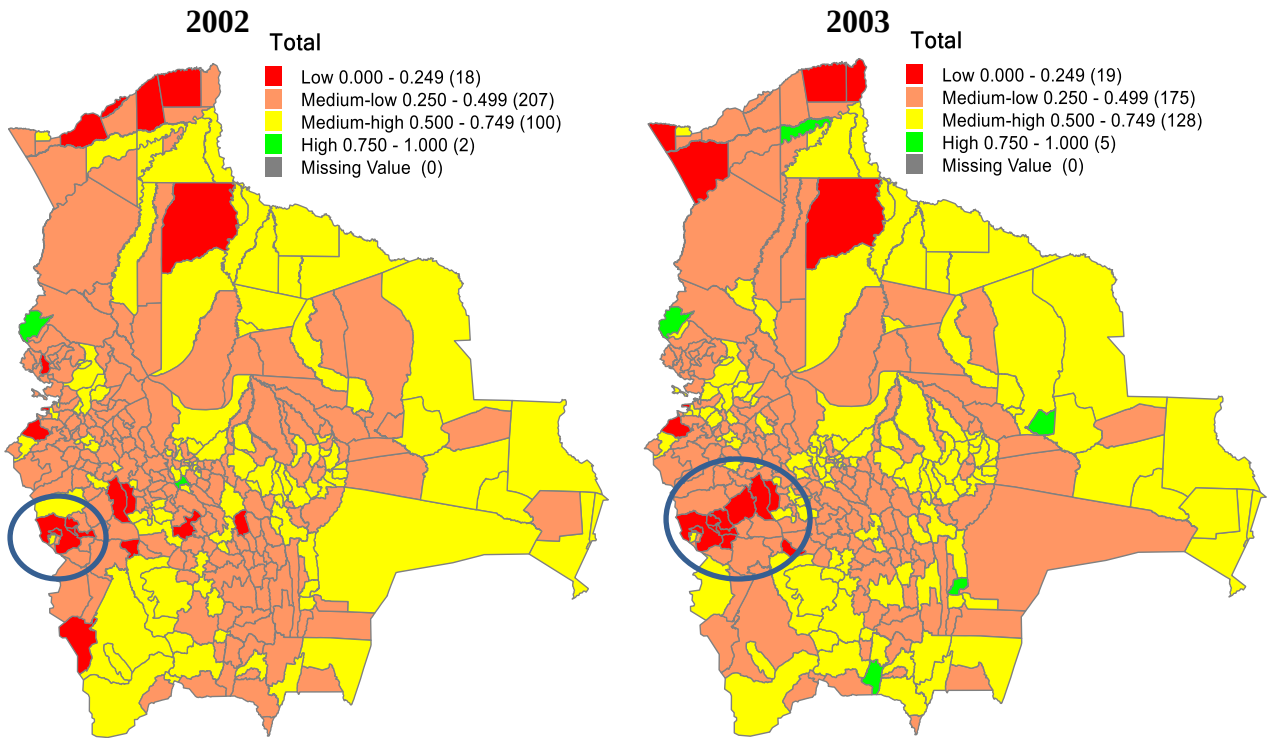
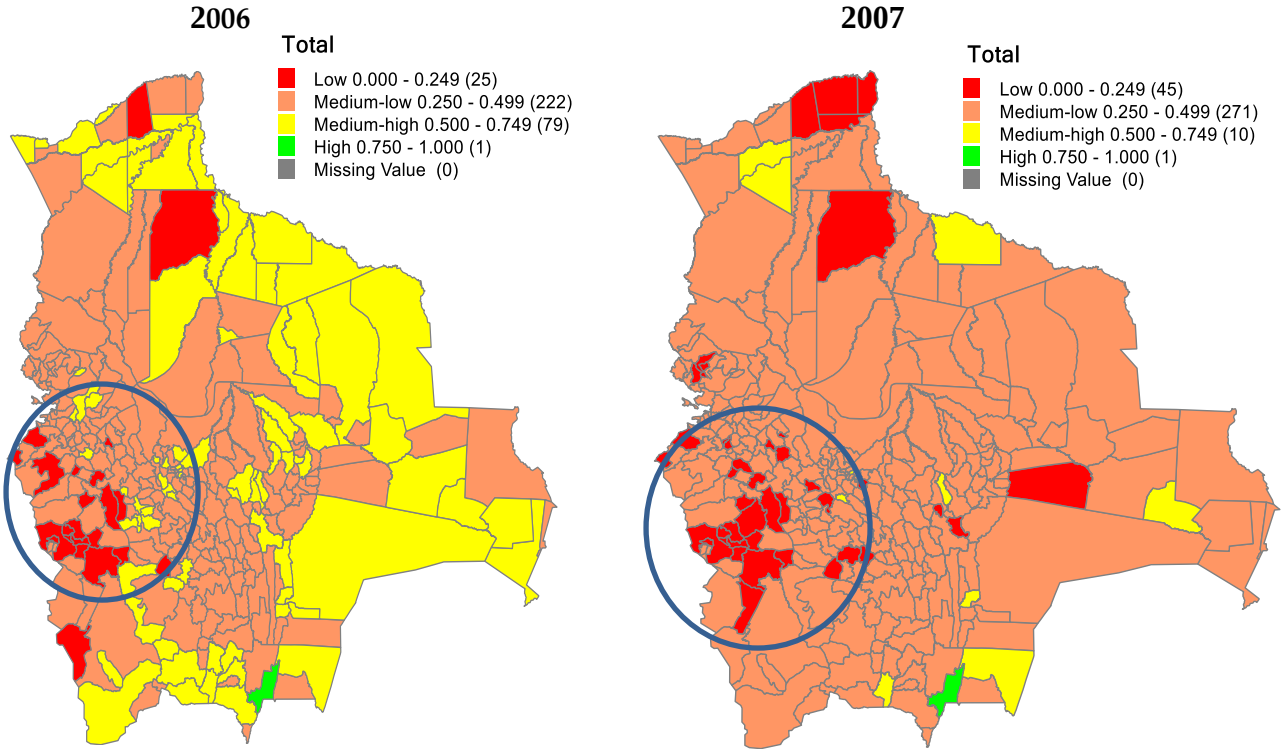


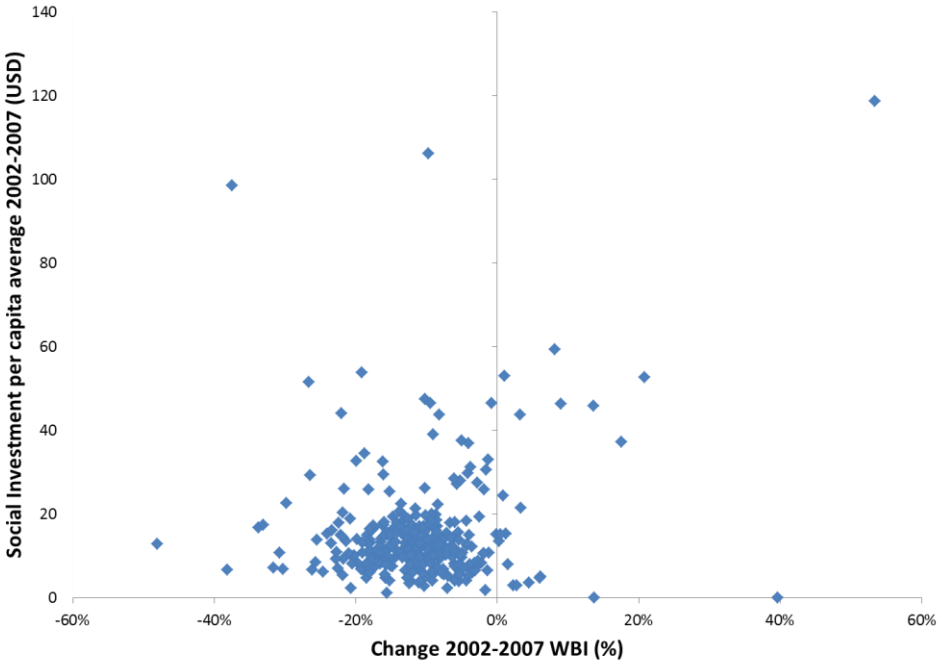
Figure 13b. WBI values for 2002, 2003, 2006 and 2007



As detailed in Table 9 above, the information for the annual estimation contains complete data sets for each single indicator. Despite the efforts of the current government, the level of wellbeing at subnational levels does not appear to have improved over the years. The common area where the worst WBI values appear remains over the years (blue circle). Moreover, the area appears to grow, since more municipalities get lower WBI values through the period of analysis. The number of municipalities in the low class increased from 18 in 2002 to 45 in 2007. Most (207) of them in 2002 belong to the medium-low class, increasing this number to 271 in 2007, being the predominant class in all years.

Most of the municipalities between 2002 and 2007 have a negative change in their WBI values, according to Figure 14 below. Only 21 (6% of total of municipalities) have a positive change in WBI values. The most remarkable municipality is Carapari, having increased its WBI value in 53%. The social investment achieved in this municipality is also noteworthy, reaching the highest, on average, from 2002 to 2007. Other municipalities such as Ingavi and Nacebe (Santa Rosa del Abuna) also have important changes in their WBI values. What is more, the former have no social investment from 2002 to 2007. In contrast, the monetary efforts aimed at Acasio and Arampampa, reaching ~USD100 per capita, are not sufficient to observe a positive increase in their WBI values.

Figure 14. Change in WBI and social investment for 2002-2007



5. Conclusions and recommendations

During the last decade, Bolivia has improved most of its economic and social indicators at national level. Real GDP, on average, reached 3.7%; GDP per capita increased from USD995 in 2000 to USD1,638 in 2010; extreme poverty decreased from 45% in 2000 to 26% in 2009 (UDAPE & World Bank, 2012); and human development via the HDI increased from 0.620 in 2000 to 0.675 in 2012. Despite these achievements, there is still room for improvement, especially in the social arena. The findings in this study reveal the disparities at subnational levels in Bolivia by analyzing the levels and their evolution over time, the identification of the municipalities with the lowest and highest levels of wellbeing, and the identification of the single indicators that contribute most to the wellbeing (WBI) estimation.

Most of the municipalities (286) during the 2000 to 2011 period of analysis are concentrated in the medium-low class (WBI values ranging from 0.25 to 0.49) and almost all of the bottom municipalities with low WBI values are located in the west of Bolivia. Only a few municipalities have higher WBI, and, classifying the municipalities by quartiles, the top three municipalities (WBI=0.925 average) are far away from the 25 low WBI values-municipalities (WBI=0.210 average), revealing the current disparities at subnational levels. The analysis of the periods 2000-2005 and 2006-2011 revealed similar patterns, situating most of the municipalities in the medium-high class; however, the level of wellbeing appears to be reduced between periods. In addition, the worst WBI values remained in both periods (Cruz de Machacamarca, Yunguyo de Litoral, Esmeralda, and Escara). Finally, the annual analysis of WBI values over time suggests again that the level of wellbeing decreased with the passing of time. The common area where the worst WBI values appear remains over the years (2002, 2003, 2006 and 2007). Moreover, the area appears to grow since more municipalities get lower WBI values through the period of analysis. These municipalities are located in the Department of Oruro, and, given the fact that they are located near each other; the government

should pay attention not only to this area (municipalities of Huachacalla, Escara, Cruz de Machacamarca, Yunguyo de Litoral, Esmeralda and Todos Santos) but also to the other low WBI municipalities.

The current supply of services in the education and health sectors in Bolivia are crucial for wellbeing. For instance, the *number of health centers and hospitals per 100,000 population* and *number of schools, colleges and institutes per 100,000 population* resulted in contributing 90% and 73% to the WBI estimation. The availability of *doctors, nurses and administrative personnel* contributes 97% of its information and the *number of teachers and schools and institutes* 88%, reflecting the importance of increasing supply of these personnel and infrastructure in the municipalities, considering that only approximately USD3.6 per capita is invested in health at subnational levels. Therefore, having personnel (doctors, nurses and teachers) in the health centers, hospitals and schools, accompanied by social investment in health and education, are key elements to improving wellbeing at subnational levels.

Even though the dimensions applied via the theoretical framework are indicative, and other single indicators can be included; the findings suggest that the social dimension (*number of health centers and hospitals per 100,000 population* and *number of schools, colleges and institutes per 100,000 population*) present the worst WBI values for all dimensions, and, from the three dimensions, the material one is the one which contributes all of its information to the WBI estimation.

In terms of social investment, this element result is important when estimating wellbeing. It is important to analyze more deeply the determinants for the municipalities that achieved a positive change in their WBI values from 2002 to 2007 in order to ensure that the most-needed municipalities receive sufficient funds to improve their conditions.

Even though these findings are an important input for further public policy, more evidence and research is required, especially taking into account that new data will be available at the end of 2013, resulting from the national census carried in 2012. Finally, it is imperative that the Government of Bolivia starts to design surveys to assess links between the various dimensions of wellbeing and that this information is used when designing policies in various fields (Stiglitz et al., 2009).

Author

Jose Antonio Canaviri
UNICEF
acanaviri@unicef.org

Publishing Timeline

Received 8 August 2014
Accepted 13 November 2015
Published 14 May 2016

References

Alkire, S. (2011). *Multidimensional poverty and its discontents* (OPHI Working Paper No. 46). http://dx.doi.org/10.2139/ssrn.2118543

Berenger, V., & Verdier-Couchane, A. (2007). Multidimensional measures of wellbeing: Standard of living and quality of life across countries. *World Development, 35*(7), 1259-1276. http://dx.doi.org/10.1016/j.worlddev.2006.10.011

Booysen, F. (2002). An overview and evaluation of composite indices of development. *Social Indicators Research, 59*(2), 115-151. http://dx.doi.org/10.1023/A:1016275505152

Bras, L., & Menezes, J. (2007). Improving cluster-based missing value estimation of DNA microarray data. *Biomolecular Engineering, 24*(1), 273-282. http://dx.doi.org/10.1016/j.bioeng.2007.04.003

Cuenca, E., Rodrıguez, J., & Navarro, M. (2010). The features of development in the Pacific countries of the African, Caribbean and Pacific group. *Social Indicators Research*, *99*(3), 469-485. http://dx.doi.org/10.1007/s11205-010-9594-7

Economic and Social Policy Analysis Bureau (2009). *Municipal infrastructure*. http://udape.gob.bo/index.php?option=com_wrapper&view=wrapper&Itemid=108

Economic and Social Policy Analysis Bureau (2010a). *Municipal social investment towards MDG*. http://udape.gob.bo/index.php?option=com_wrapper&view=wrapper&Itemid=127

Economic and Social Policy Analysis Bureau (2010b). *Dossier of economic and social statistics*. http://www.udape.gob.bo/portales_html/dossierweb2012/doss0709.htm

Economic and Social Policy Analysis Bureau & United Nations Children's Emergency Fund (2005). *Bolivia. Equity and children's rights. Municipal Development Index for children and adolescents*. La Paz, Bolivia: UNICEF.

Economic and Social Policy Analysis Bureau & United Nations Children's Emergency Fund (2008). *Bolivia. Equity and children's rights. Municipal Development Index for children and adolescents*. La Paz, Bolivia: UNICEF.

Economic and Social Policy Analysis Bureau & World Bank (2012). *Equal opportunities for children and youth of Bolivia*. http://www.udape.gob.bo/portales_html/docsociales/pdfoportunidades.pdf

Epley, D. (2008). A method of assembling cross-sectional indicators into a community quality of life. *Social Indicators Research*, *88*(2), 281-296. http://dx.doi.org/10.1007/s11205-007-9190-7

Heshmati, A. (2008). Measurement and analysis of child wellbeing in middle and high income countries. *The European Journal of Comparative Economics*, *5*(2), 227-286.

Ivanovic, B. (1963). Classification of underdeveloped areas according to level of economic development. *International Arts and Sciences Press, Eastern European Economics, 2*(1), 1-2. http://dx.doi.org/10.1080/00128775.1963.11647849

Ministry of Development and Planning (2006). *National Development Plan*. Murias, P., Martinez, F., & De Miguel, C. (2006). An economic wellbeing index for the Spanish provinces: A data envelopment analysis approach. *Social Indicators Research*, *77*(3), 395-417. http://dx.doi.org/10.1007/s11205-005-2613-4

Nardo, M., & Saisana, M. (2008). OECD/JRC *handbook on constructing composite indicators. Putting theory into practice*. https://www.oecd.org/std/42495745.pdf

National Statistics Institute (2013). *Demographic statistics*. http://www.ine.gob.bo/indice/visualizador.aspx?ah=PC2030905.HTM

Nieboer, A., Lindenberg, S., Boomsma, A., & Bruggen, A. (2005). Dimensions of wellbeing and their measurement: The SPF-IL scale. *Social Indicators Research*, *73*(3), 313-353. http://dx.doi.org/10.1007/s11205-004-0988-2

Ocampo, M., & Foronda, C. (2007). Study of quality of life in Bolivia: Methodology and measurement. *Investigacion y Desarrollo*, *7*(1), 25-40.

Organisation for Economic Co-operation and Development (2008). *Handbook on constructing composite indicators: Methodology and Guide*. Paris, France: Organisation for Economic Co-operation and Development.

Organisation for Economic Co-operation and Development (2011). *Society at a glance 2011: OECD social indicators.* http://www.oecd.org/social/soc/societyataglance2011.htm

Pena, B. (1977). *Problems of measuring welfare and related concepts. An application to the Spanish case*. Madrid, Spain: National Statistical Institute.

Pena, B. (2009). *The measurement of social welfare: A critical review*. *Estudios de economía aplicada*, *27*(2), 299-324.

Ravallion, M. (2010). *Mashup indices of development*. (Policy Research Working Paper 5432). http://dx.doi.org/10.1596/1813-9450-5432

Ravallion, M. (2012). Troubling tradeoffs in the Human Development Index. *Journal of Development Economics*, *99*(2), 201-209. http://dx.doi.org/10.1016/j.jdeveco.2012.01.003

Rodriguez, J. (2010). An index of child health in the least developed countries (LDCs) of Africa. *Social Indicators Research*, *105*(3), 309-322. http://dx.doi.org/10.1007/s11205-010-9778-1

Seligson, J., Huebner, E., & Valois, R. (2005). An investigation of a brief life satisfaction scale with elementary school children. *Social Indicators Research*, *73*(3), 355-374. http://dx.doi.org/10.1007/s11205-004-2011-3

Somarriba, N. (2008). *Aproximacion a la medicion de la calidad de vida en la Union Europea* (Doctoral dissertation, Universidad de Valladolid). http://www.eumed.net/tesis/2010/mnsa/index.htm

Somarriba, N., & Pena, B. (2009). Measuring the quality of life in Europe: The role of subjective information. *Estudios de Economia Aplicada*, *27*(2), 373-396.

Somarriba, N., & Pena, B. (2009). Synthetic indicators of quality of life in Europe. *Social Indicators Research*, *94*(1), 115-133. http://dx.doi.org/10.1007/s11205-008-9356-y

Stiglitz, E., Sen, A., & Fitoussi, J. P. (2009). Report by the Commission on the Measurement of Economic Performance and Social Progress. http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf

Torras, M. (2008). The subjectivity inherent in objective measures of wellbeing. *Journal of Happiness Studies*, *9*(4), 475-487. http://dx.doi.org/10.1007/s10902-007-9084-z

Troyanskaya, O., Cantor, M., Sherlock, G., Brown, P., Hastie, T., Tibshirani, R., . . . & Altman, B. (2001). Missing value estimation methods for DNA microarrays. *Bioinformatics, 17*(6), 520-525. http://dx.doi.org/10.1093/bioinformatics/17.6.520

United Nations Development Programme (2013). *Human Development Report 2013. The Rise of the South: Human Progress in a Diverse World.* http://hdr.undp.org/en/2013-report

United Nations Children's Emergency Fund (2010). Situation analysis of children and women in Bolivia. http://www.unicef.org/bolivia/UNICEF_Bolivia_-_Por_los_ninos_ninas_y_adolescentes_de_Bolivia(1).pdf

United States Agency for International Development (2008). *Classification of municipalities in Bolivia by criteria of Health: Guidelines for municipal public investment*. La Paz, Bolivia: Artes Gráficas Sagitario.

White, S. (2009). *Analyzing wellbeing: A framework for development practice* (WeD Working Paper No. 09). http://opus.bath.ac.uk/13944/1/WeDWP_09_44.pdf

Zarzosa, P. (2009). Estimación de la pobreza en las comunidades autónomas españolas, mediante la distancia DP2 de Pena. *Estudios de Economia Aplicada, 27*(2), 397-416.

Zarzosa, P., & Somarriba, N. (2013). An assessment of social welfare in Spain: Territorial analysis using a synthetic welfare indicator. *Social Indicators Research*, *111*(1), 1-23. http://dx.doi.org/10.1007/s11205-012-0005-0

Appendix 1

Imputation of Missing Data

Most of the time, data sets lack complete information on the variables of interest. In order to fill empty spaces in a data matrix, imputation techniques are needed. According to Nardo and Saisana (2008), there are three methods to deal with missing data: case deletion, single imputation, and multiple imputations. The first ignores possible differences between complete and incomplete samples and may produce biased estimates; moreover, the standard errors may be larger for samples that are small. Little and Rubin (2002) establish that as a rule of thumb, if a variable has more than 5% missing, values cases are not deleted (cited in Nardo & Saisana (2008)).

The last column of Table 1 shows there are missing data for most of the indicators in the study. The highest rates are for the social investment indicators, and for all of the data sets, the values reach less than 5% and thus the missing values do not represent a serious threat. As mentioned before, an imputation method was chosen. According to the OECD (2008), there are "implicit" and "explicit" modelings when treating missing data. Implicit modeling includes hot deck imputation, substitution and cold deck imputation; explicit modeling includes unconditional mean/median/mode imputation, regression imputation, and expectation maximization imputation.

Imputation values for all the missing data were estimated using the hot deck imputation method. In this method, the missing data is filled with individual data drawn from similar responding units. Implicit modeling uses an algorithm which uses implied underlying assumptions which need to be verified, in the sense that they are reasonable and fit for the issue under consideration (OECD, 2008). The algorithm used was "knnimpute" in MATLAB software. The algorithm was applied to the variables for which information was available for various years. For instance, data for children with diarrhoea are available from 2000 to 2009 (see Table 1 above). If a value is missed in that range of data, the algorithm searches within that range of values and calculates the most similar values.

KNN imputation calculates a weighted Euclidean distance d_{ik} between the target value i and each candidate value k, assuming r contains the missing indicator matrix, using the following expression (Bras & Menezes, 2007):

$$d_{ik} = \sqrt{\frac{\sum_{j=1}^{n} r_{ij} r_{jk} (x_{kj} - x_{ij})^2}{\sum_{j=1}^{n} r_{ij} r_{jk}}}$$

where r_{ij} is the element in the i row and j column of the missing indicator matrix r. The missing entry j of target value i is then estimated by the weighted average of the expression values of the K with most similar values to the j values:

$$\hat{y}_{ij} = \sum_{k=1}^{K} w_{ik} x_{kj}$$

where w_{ik} is the weight for the k neighbor value of target value i normalized by the sum of the inverse weighted Euclidean distance for all K neighbors:

$$w_{ik} = \frac{\frac{1}{d_{ik}}}{\frac{\sum_{k=1}^{K} 1}{d_{ik}}}$$

This method was proposed initially by Troyanskaya et al. (2001). According to the authors, using this method compared to others such as Singular Value Decomposition (SDV) – using a variety of

parameter settings and over different real data sets, and assessing the robustness of the imputation methods to the amount of missing data over the range of 1–20% missing values –provides a more robust and sensitive method for missing value estimation.

Appendix 2

WBI values estimated by DP2 for the period 2000-2011

Municipality	WBI Material	WBI Social	WBI Human	WBI Total
Sucre	0.5463	0.2807	0.7068	0.6373
Yotala	0.2148	0.0339	0.6486	0.3731
Poroma	0.0974	0.0503	0.6241	0.3204
Azurduy	0.1241	0.0334	0.6448	0.3333
Tarvita	0.1604	0.0391	0.6253	0.3428
Zudañez	0.1527	0.0240	0.5853	0.3167
Presto	0.1035	0.0227	0.5392	0.2764
Mojocoya	0.0958	0.0232	0.5953	0.2967
Icla	0.2579	0.0211	0.5964	0.3643
Padilla	0.1619	0.0466	0.6046	0.3379
Tomina	0.1844	0.0204	0.5778	0.3254
Sopachuy	0.1387	0.0186	0.5651	0.3002
Villa Alcalá	0.1769	0.0085	0.4529	0.2655
El Villar	0.0944	0.0140	0.5100	0.2569
Monteagudo	0.1700	0.0714	0.5907	0.3457
Huacareta	0.1238	0.0371	0.6742	0.3470
Tarabuco	0.1898	0.0528	0.6703	0.3794
Yamparaez	0.2153	0.0267	0.5615	0.3342
Camargo	0.2593	0.0486	0.6148	0.3838
San Lucas	0.1404	0.0940	0.6285	0.3582
Incahuasi	0.1072	0.0505	0.5914	0.3110
Villa Serrano	0.2712	0.0422	0.5939	0.3775
Camataqui (Villa Abecia)	0.1984	0.0112	0.5284	0.3070
Culpina	0.2084	0.0522	0.7212	0.4081
Las Carreras	0.2252	0.0161	0.6033	0.3514
Villa Vaca Guzman	0.1642	0.0347	0.5643	0.3172
Huacaya	0.1643	0.0085	0.5562	0.3032
Macharetí	0.1889	0.0237	0.5612	0.3218
La Paz	1.0000	0.7770	0.6338	1.0000
Palca	0.0852	0.0444	0.6301	0.3154
Mecapaca	0.1149	0.0305	0.6197	0.3179
Achocalla	0.1007	0.0253	0.5610	0.2853
El Alto	0.4593	0.4514	0.6063	0.6287
Achacachi	0.1495	0.1460	0.6047	0.3733
Ancoraimes	0.1417	0.0429	0.6540	0.3484
Coro Coro	0.0843	0.0372	0.5318	0.2711
Caquiaviri	0.1000	0.0524	0.6030	0.3136
Calacoto	0.1131	0.0503	0.5576	0.2993
Comanche	0.1282	0.0165	0.6285	0.3214
Charaña	0.1696	0.0142	0.6308	0.3388
Waldo Ballivian	0.1341	0.0058	0.7023	0.3502
Nazacara de Pacajes	0.1178	0.0015	1.0000	0.4654
Santiago de Callapa	0.0560	0.0360	0.5306	0.2583
Puerto Acosta	0.0882	0.0878	0.6346	0.3363
Moco Moco	0.1467	0.0616	0.7198	0.3856
Carabuco	0.0958	0.0484	0.5942	0.3065
Chuma	0.0826	0.0451	0.5037	0.2620
Ayata	0.1087	0.0293	0.6222	0.3158
Aucapata	0.1123	0.0185	0.7286	0.3571
Sorata	0.0889	0.0645	0.5821	0.3052
Guanay	0.2478	0.0336	0.7194	0.4164
Tacacoma	0.1478	0.0179	0.6646	0.3451
Quiabaya	0.1243	0.0080	0.6703	0.3336
Combaya	0.1298	0.0114	0.5797	0.2996
Tipuani	0.2141	0.0126	0.6392	0.3603
Mapiri	0.1624	0.0185	0.8667	0.4356
Teoponte	0.1343	0.0284	0.8103	0.4044
Apolo	0.0418	0.0611	0.6983	0.3324
Pelechuco	0.3460	0.0192	0.5837	0.3952
Viacha	0.2149	0.0835	0.6242	0.3833
Guaqui	0.1403	0.0185	0.5421	0.2913
Tiahuanacu	0.1576	0.0284	0.6207	0.3354
Desaguadero	0.1748	0.0128	0.7937	0.4081
San Andres de Machaca	0.1219	0.0292	0.6029	0.3133
Jesus de Machaca	0.1381	0.0505	0.6585	0.3519
Taraco	0.0605	0.0180	0.6051	0.2838
Luribay	0.2194	0.0313	0.6838	0.3887
Sapahaqui	0.1038	0.0410	0.5326	0.2813
Yaco	0.0970	0.0249	0.6114	0.3046
Malla	0.0884	0.0106	0.4486	0.2274
Cairoma	0.1029	0.0348	0.6097	0.3104
Inquisivi	0.0709	0.0720	0.5547	0.2893
Quime	0.1178	0.0161	0.6105	0.3094
Cajuata	0.1750	0.0199	0.8043	0.4155
Colquiri	0.0716	0.0610	0.7241	0.3556
Ichoca	0.0481	0.0273	0.5459	0.2578
Licoma Pampa	0.1225	0.0072	0.5398	0.2782
Chulumani	0.2300	0.0349	0.7124	0.4065
Irupana	0.1606	0.0463	0.7097	0.3809
Yanacachi	0.2375	0.0148	0.6028	0.3558
Palos Blancos	0.1600	0.0501	0.8229	0.4293
La Asunta	0.1058	0.0670	0.7858	0.3980
Pucarani	0.1033	0.0617	0.5485	0.2961
Laja	0.1027	0.0511	0.5979	0.3121

Municipality	WBI Material	WBI Social	WBI Human	WBI Total
Batallas	0.1025	0.0511	0.5499	0.2920
Puerto Pérez	0.0764	0.0199	0.5044	0.2494
Sica Sica	0.0931	0.0582	0.5355	0.2850
Umala	0.1249	0.0264	0.5398	0.2871
Ayo Ayo	0.0741	0.0259	0.6144	0.2966
Calamarca	0.1161	0.0250	0.5986	0.3074
Patacamaya	0.1678	0.0416	0.5830	0.3293
Colquencha	0.0941	0.0149	0.5350	0.2675
Collana	0.1935	0.0050	0.4379	0.2647
Coroico	0.2134	0.0336	0.6815	0.3862
Coripata	0.2138	0.0248	0.6862	0.3847
Ixiamas	0.1912	0.0262	0.6424	0.3575
San Buena Ventura	0.2126	0.0198	0.7279	0.3994
Gral. Juan José Perez	0.2057	0.0313	0.5262	0.3173
Curva	0.1117	0.0085	0.4852	0.2516
Copacabana	0.1411	0.0304	0.6245	0.3308
San Pedro de Tiquina	0.1114	0.0149	0.4908	0.2564
Tito Yupanqui	0.0685	0.0058	0.4849	0.2322
San Pedro de Curahuara	0.0878	0.0287	0.5508	0.2771
Papel Pampa	0.1152	0.0236	0.6542	0.3296
Chacarilla	0.0206	0.0080	0.5267	0.2304
Santiago de Machaca	0.2105	0.0179	0.5351	0.3176
Catacora	0.1572	0.0050	0.3973	0.2326
Caranavi	0.1851	0.1764	0.6450	0.4175
Cochabamba	0.6545	0.5580	0.6874	0.7879
Aiquile	0.1411	0.0640	0.5176	0.3000
Pasorapa	0.1398	0.0157	0.4406	0.2478
Omereque	0.1294	0.0213	0.6419	0.3294
Ayopaya	0.0980	0.0925	0.6314	0.3410
Morochata	0.0983	0.0973	0.5157	0.2949
Tarata	0.2233	0.0396	0.6841	0.3939
Anzaldo	0.1233	0.0536	0.5908	0.3188
Arbieto	0.2916	0.0192	0.6511	0.4004
Sacabamba	0.1533	0.0279	0.5983	0.3240
Arani	0.2190	0.0221	0.6256	0.3605
Vacas	0.1050	0.0255	0.4466	0.2396
Arque	0.0980	0.0393	0.5345	0.2789
Tacopaya	0.1715	0.0392	0.4804	0.2872
Capinota	0.2004	0.0320	0.6869	0.3823
Santivañez	0.1858	0.0182	0.5005	0.2929
Sicaya	0.0989	0.0049	0.7591	0.3586
Cliza	0.2771	0.0258	0.6201	0.3841
Toko	0.1674	0.0104	0.6158	0.3300
Tolata	0.2310	0.0063	0.5824	0.3412
Quillacollo	0.3108	0.0985	0.5910	0.4159

Municipality	WBI Material	WBI Social	WBI Human	WBI Total
Sipe Sipe	0.2139	0.0429	0.6105	0.3606
Tiquipaya	0.2347	0.0496	0.5747	0.3572
Vinto	0.2053	0.0362	0.5716	0.3381
Colcapirhua	0.2606	0.0210	0.4742	0.3146
Sacaba	0.2233	0.0910	0.5452	0.3571
Colomi	0.2424	0.0290	0.6615	0.3881
Villa Tunari	0.1803	0.1362	0.6380	0.3961
Tapacari	0.0918	0.1222	0.5731	0.3262
Totora	0.1013	0.0348	0.5960	0.3040
Pojo	0.2044	0.0305	0.5331	0.3194
Pocona	0.1012	0.0404	0.6098	0.3120
Chimoré	0.1758	0.0407	0.5790	0.3306
Puerto Villarroel	0.1778	0.0767	0.6483	0.3750
Entre Rios (Bulo Bulo)	0.1734	0.0334	0.6359	0.3503
Mizque	0.1898	0.0933	0.4687	0.3121
Vila Vila	0.1450	0.0171	0.4440	0.2519
Alalay	0.1535	0.0199	0.4085	0.2418
Punata	0.3127	0.0463	0.6761	0.4307
Villa Rivero	0.1607	0.0136	0.5724	0.3104
San Benito	0.2603	0.0234	0.5396	0.3426
Tacachi	0.0931	0.0026	0.4277	0.2175
Cuchumuela	0.1673	0.0077	0.5800	0.3140
Bolivar	0.1406	0.0366	0.5474	0.3010
Tiraque	0.2391	0.0666	0.6229	0.3860
Oruro	0.4258	0.2235	0.7752	0.5918
Caracollo	0.1592	0.0496	0.6666	0.3637
El Choro	0.0000	0.0098	0.5853	0.2469
Paria	0.1673	0.0503	0.6337	0.3537
Challapata	0.1513	0.0609	0.5702	0.3249
Santuario de Quillacas	0.1100	0.0085	0.4594	0.2401
Corque	0.0762	0.0267	0.6186	0.2996
Choque Cota	0.1174	0.0086	0.4967	0.2588
Curahuara de Carangas	0.1184	0.0207	0.6875	0.3435
Turco	0.2331	0.0160	0.6542	0.3759
Huachacalla	0.1707	0.0050	0.3496	0.2185
Escara	0.1180	0.0015	0.3011	0.1748
Cruz de Machacamarca	0.0015	0.0000	0.0000	0.0000
Yunguyo de Litoral	0.0280	0.0008	0.1633	0.0794
Esmeralda	0.0677	0.0014	0.2948	0.1510
Poopó	0.1146	0.0098	0.5776	0.2918
Pazña	0.1980	0.0169	0.6380	0.3548
Antequera	0.1153	0.0078	0.5726	0.2891
Huanuni	0.2268	0.0295	0.7580	0.4219

Municipality	WBI Material	WBI Social	WBI Human	WBI total
Machacamarca	0.2216	0.0114	0.6258	0.3573
Salinas G. de Mendoza	0.0747	0.0328	0.6505	0.3147
Pampa Aullagas	0.0570	0.0066	0.5739	0.2647
Sabaya	0.0901	0.0124	0.4630	0.2348
Coipasa	0.0634	0.0021	0.6500	0.2973
Chipaya	0.0744	0.0034	0.7308	0.3360
Toledo	0.0884	0.0182	0.6616	0.3191
Eucaliptus	0.2267	0.0115	0.6151	0.3551
Andamarca	0.1724	0.0167	0.6088	0.3318
Belén de Andamarca	0.0526	0.0049	0.6632	0.2993
Totora	0.0696	0.0290	0.6704	0.3194
Santiago de Huari	0.0665	0.0247	0.4795	0.2368
La Rivera	0.1026	0.0015	0.4703	0.2387
Todos Santos	0.0431	0.0029	0.3515	0.1649
Carangas	0.0370	0.0021	0.5338	0.2378
Huayllamarca	0.1880	0.0207	0.6037	0.3379
Potosí	0.4357	0.2089	0.7561	0.5821
Tinguipaya	0.1522	0.0854	0.6334	0.3616
Yocalla	0.1728	0.0276	0.6229	0.3423
Urmiri	0.0974	0.0056	0.5490	0.2709
Uncia	0.1836	0.0617	0.6336	0.3652
Chayanta	0.1619	0.0396	0.6550	0.3560
Llallagua	0.2777	0.0509	0.6343	0.4006
Betanzos	0.0885	0.0942	0.6298	0.3370
Chaqui	0.0587	0.0297	0.5904	0.2818
Tacobamba	0.0197	0.0452	0.5154	0.2405
Colquechaca	0.0725	0.0917	0.6485	0.3370
Ravelo	0.0968	0.0561	0.5875	0.3073
Pocoata	0.1262	0.0829	0.6770	0.3679
Ocurí	0.1106	0.0491	0.5588	0.2983
San Pedro	0.1035	0.0962	0.5900	0.3276
Toro Toro	0.0547	0.0494	0.7276	0.3452
Cotagaita	0.1469	0.1221	0.8180	0.4512
Vitichi	0.1082	0.0446	0.6695	0.3414
Sacaca	0.1237	0.0662	0.5503	0.3073
Caripuyo	0.1899	0.0358	0.5434	0.3197
Tupiza	0.2758	0.1361	0.7090	0.4656
Atocha	0.2569	0.0271	0.8334	0.4649
Colcha "K"	0.1390	0.0428	0.6191	0.3327
San Pedro de Quemes	0.1886	0.0035	0.4904	0.2839
San Pablo de Lipez	0.2032	0.0158	0.7309	0.3951
Mojinete	0.1480	0.0062	0.6632	0.3399
San Antonio de Esmoruco	0.1178	0.0078	0.6070	0.3045
Puna	0.0782	0.1360	0.5938	0.3348
Caiza "D"	0.1327	0.0343	0.6427	0.3364
Uyuni	0.2277	0.0635	0.7264	0.4230
Tomave	0.1419	0.0608	0.5383	0.3077
Porco	0.1583	0.0121	0.7658	0.3893
Arampampa	0.5031	0.0242	0.7172	0.5187
Acasio	0.4066	0.0214	0.7045	0.4718
Llica	0.1288	0.0233	0.7297	0.3665
Tahua	0.0438	0.0115	0.4403	0.2056
Villazón	0.3392	0.0678	0.7074	0.4637
San Agustín	0.1982	0.0078	0.6498	0.3560
Tarija	0.4017	0.2524	0.7274	0.5736
Padcaya	0.2850	0.0902	0.5735	0.3944
Bermejo	0.4036	0.0395	0.6270	0.4457
Yacuiba	0.3291	0.1034	0.5108	0.3922
Carapari	0.6247	0.0411	0.7316	0.5826
Villamontes	0.4294	0.0661	0.7644	0.5246
Uriondo	0.2095	0.0400	0.7268	0.4059
Yunchara	0.3915	0.0334	0.6606	0.4521
San Lorenzo	0.3412	0.0741	0.6001	0.4225
El Puente	0.3718	0.0478	0.6810	0.4582
Entre Ríos	0.3437	0.0857	0.6780	0.4607
Santa Cruz de la Sierra	0.7482	1.0000	0.6484	0.9915
Cotoca	0.2562	0.0456	0.6503	0.3960
Ayacucho	0.2906	0.0327	0.5379	0.3584
La Guardia	0.2744	0.0433	0.6260	0.3926
El Torno	0.2140	0.0628	0.5989	0.3640
Warnes	0.2787	0.0698	0.7128	0.4414
Okinawa 1	0.2752	0.0177	0.5982	0.3709
San Ignacio	0.2109	0.1061	0.6176	0.3881
San Miguel	0.1703	0.0340	0.5189	0.3006
San Rafael	0.1098	0.0100	0.4894	0.2531
Buena Vista	0.1778	0.0375	0.5873	0.3336
San Carlos	0.2213	0.0357	0.6290	0.3685
Yapacaní	0.1650	0.0767	0.5969	0.3482
San Juan	0.2071	0.0206	0.6838	0.3791
San José	0.2632	0.0346	0.6536	0.3959
Pailón	0.2673	0.0214	0.3673	0.2731
Roboré	0.2370	0.0509	0.6894	0.4064
Portachuelo	0.3038	0.0387	0.7606	0.4591
Santa Rosa del Sara	0.1407	0.0377	0.5711	0.3114
Colpa Belgica	0.2305	0.0106	0.7074	0.3947
Lagunillas	0.1619	0.0197	0.6653	0.3521
Charagua	0.3108	0.0636	0.7008	0.4473
Cabezas	0.2559	0.0305	0.5744	0.3581
Cuevo	0.2181	0.0127	0.6674	0.3737
Gutierrez	0.1754	0.0387	0.6905	0.3761
Camiri	0.4376	0.0620	0.7418	0.5169
Boyuibe	0.2167	0.0112	0.6065	0.3472

Municipality	WBI Material	WBI Social	WBI Human	WBI Total
Valle Grande	0.2772	0.0865	0.6995	0.4420
El Trigal	0.2497	0.0154	0.5394	0.3348
Moro Moro	0.1667	0.0180	0.5746	0.3157
Postrer Valle	0.0926	0.0129	0.4764	0.2417
Pucara	0.0958	0.0165	0.5266	0.2654
Samaipata	0.1909	0.0352	0.5466	0.3213
Pampa Grande	0.2093	0.0191	0.5285	0.3148
Mairana	0.2094	0.0257	0.6992	0.3886
Quirusillas	0.1722	0.0072	0.4616	0.2666
Montero	0.2878	0.0969	0.7881	0.4876
Gral. Saavedra	0.2145	0.0283	0.6784	0.3832
Mineros	0.2815	0.0278	0.7067	0.4228
Fernandez Alonso	0.1683	0.0208	0.7895	0.4069
San Pedro	0.2463	0.0309	0.7273	0.4179
Concepción	0.1393	0.0339	0.5287	0.2916
San Javier	0.1288	0.0247	0.5660	0.2990
San Ramon	0.1137	0.0200	0.7060	0.3489
San Julián	0.3303	0.0923	0.6159	0.4319
San Antonio de Lomerio	0.2008	0.0221	0.4458	0.2781
Cuatro Canadas	0.2527	0.0298	0.5096	0.3296
San Matías	0.1409	0.0379	0.5550	0.3048
Comarapa	0.2129	0.0444	0.6840	0.3914
Saipina	0.1946	0.0128	0.5548	0.3170
Puerto Suarez	0.2990	0.0253	0.7202	0.4347
Puerto Quijarro	0.1935	0.0174	0.6309	0.3501
Carmen Rivero Torres	0.1739	0.0158	0.6167	0.3354
Ascención de Guarayos	0.0955	0.0220	0.6309	0.3109
Urubicha	0.0537	0.0143	0.7151	0.3252
El Puente	0.1501	0.0287	0.5655	0.3094
Trinidad	0.3204	0.1173	0.6797	0.4645
San Javier	0.3095	0.0184	0.6331	0.4001
Riberalta	0.2478	0.1274	0.6629	0.4311
Guayaramerín	0.2486	0.0754	0.6095	0.3880
Reyes	0.1785	0.0431	0.6031	0.3428
San Borja	0.1741	0.0968	0.6721	0.3916
Santa Rosa	0.2347	0.0213	0.6486	0.3764
Rurrenabaque	0.2452	0.0351	0.6210	0.3750
Santa Ana	0.3074	0.0369	0.5194	0.3595
Exaltación	0.1909	0.0194	0.2939	0.2097
San Ignacio	0.1924	0.0937	0.6175	0.3752
Loreto	0.2981	0.0219	0.6744	0.4140
San Andrés	0.2650	0.0400	0.5677	0.3631
San Joaquín	0.1520	0.0180	0.5701	0.3076
San Ramón	0.1973	0.0142	0.4606	0.2796
Puerto Siles	0.2757	0.0041	0.6084	0.3698
Magdalena	0.1474	0.0353	0.5985	0.3246
Baures	0.1264	0.0126	0.5207	0.2742
Huacaraje	0.2325	0.0114	0.6462	0.3704
Cobija	0.4328	0.0465	0.9039	0.5760
Porvenir	0.2408	0.0201	0.8326	0.4550
Bolpebra	0.3567	0.0134	0.7457	0.4648
Bella Flor	0.3167	0.0155	0.7808	0.4634
Puerto Rico	0.4001	0.0267	0.7766	0.5012
San Pablo (San Pedro)	0.8216	0.0094	0.7373	0.6547
Filadelfia	0.2672	0.0276	0.7279	0.4256
Puerto Gonzalo Moreno	0.2483	0.0198	0.7485	0.4230
San Lorenzo	0.4672	0.0243	0.8054	0.5404
Sena	0.4134	0.0143	0.6438	0.4465
Nacebe (Santa Rosa de Abuna)	0.3175	0.0055	0.4149	0.3074
Ingavi	0.0453	0.0044	0.6731	0.3001
Nuevo Manoa (Nueva Esperanza	0.2720	0.0044	0.6524	0.3867
Villa Nueva	0.1987	0.0085	0.6159	0.3425
Eureka (Santos Mercado)	0.0723	0.0035	0.6502	0.3016

WBI values estimated by DP2 for period 2000-2011

Municipality	WBI 2000-2005	WBI 2006-2011	Municipality	WBI 2000-2005	WBI 2006-2011
Sucre	0.675	0.464	Sorata	0.470	0.385
Yotala	0.595	0.430	Guanay	0.698	0.483
Poroma	0.528	0.455	Tacacoma	0.516	0.446
Azurduy	0.571	0.452	Quiabaya	0.617	0.414
Tarvita	0.644	0.418	Combaya	0.558	0.388
Zudañez	0.509	0.412	Tipuani	0.578	0.493
Presto	0.452	0.422	Mapiri	0.644	0.526
Mojocoya	0.525	0.400	Teoponte	0.607	0.497
Icla	0.580	0.465	Apolo	0.527	0.479
Padilla	0.530	0.384	Pelechuco	0.758	0.407
Tomina	0.515	0.425	Viacha	0.553	0.442
Sopachuy	0.514	0.404	Guaqui	0.465	0.355
Villa Alcalá	0.418	0.321	Tiahuanacu	0.587	0.384
El Villar	0.490	0.364	Desaguadero	0.645	0.508
Monteagudo	0.515	0.389	San Andres de Machaca	0.423	0.352
Huacareta	0.547	0.417			
Tarabuco	0.603	0.450	Jesus de Machaca	0.455	0.380
Yamparaez	0.585	0.381	Taraco	0.406	0.307
Camargo	0.560	0.402	Luribay	0.681	0.429
San Lucas	0.585	0.437	Sapahaqui	0.511	0.321
Incahuasi	0.503	0.419	Yaco	0.525	0.421
Villa Serrano	0.599	0.407	Malla	0.377	0.268
Camataqui (Villa Abecia)	0.523	0.331	Cairoma	0.548	0.407
			Inquisivi	0.487	0.330
Culpina	0.587	0.489	Quime	0.490	0.413
Las Carreras	0.493	0.334	Cajuata	0.621	0.573
Villa Vaca Guzman	0.534	0.324	Colquiri	0.573	0.456
Huacaya	0.484	0.444	Ichoca	0.498	0.347
Macharetí	0.467	0.339	Licoma Pampa	0.477	0.331
La Paz	0.729	0.449	Chulumani	0.602	0.491
Palca	0.515	0.421	Irupana	0.579	0.461
Mecapaca	0.538	0.405	Yanacachi	0.510	0.350
Achocalla	0.490	0.381	Palos Blancos	0.644	0.517
El Alto	0.619	0.408	La Asunta	0.602	0.512
Achacachi	0.548	0.371	Pucarani	0.490	0.371
Ancoraimes	0.572	0.388	Laja	0.521	0.395
Coro Coro	0.457	0.318	Batallas	0.518	0.361
Caquiaviri	0.524	0.339	Puerto Pérez	0.530	0.302
Calacoto	0.542	0.330	Sica Sica	0.501	0.292
Comanche	0.566	0.433	Umala	0.451	0.324
Charaña	0.641	0.383	Ayo Ayo	0.516	0.398
Waldo Ballivian	0.669	0.428	Calamarca	0.539	0.359
Nazacara de Pacajes	0.798	0.596	Patacamaya	0.575	0.394
Santiago de Callapa	0.450	0.319	Colquencha	0.483	0.348
Puerto Acosta	0.547	0.416	Collana	0.421	0.296
Moco Moco	0.608	0.463	Coroico	0.583	0.465
Carabuco	0.483	0.361	Coripata	0.620	0.466
Chuma	0.480	0.286	Ixiamas	0.528	0.456
Ayata	0.572	0.396	San Buena Ventura	0.603	0.502
Aucapata	0.613	0.564	Gral. Juan José Perez	0.516	0.423

Municipality	WBI 2000-2005	WBI 2006-2011
Curva	0.432	0.316
Copacabana	0.499	0.413
San Pedro de Tiquina	0.460	0.301
Tito Yupanqui	0.458	0.221
San Pedro de Curahuara	0.519	0.310
Papel Pampa	0.550	0.413
Chacarilla	0.409	0.399
Santiago de Machaca	0.453	0.368
Catacora	0.359	0.200
Caranavi	0.526	0.459
Cochabamba	0.669	0.484
Aiquile	0.493	0.366
Pasorapa	0.405	0.319
Omereque	0.531	0.379
Ayopaya	0.558	0.458
Morochata	0.459	0.342
Tarata	0.637	0.498
Anzaldo	0.535	0.425
Arbieto	0.489	0.447
Sacabamba	0.592	0.431
Arani	0.546	0.462
Vacas	0.511	0.267
Arque	0.505	0.336
Tacopaya	0.519	0.352
Capinota	0.595	0.485
Santivañez	0.509	0.340
Sicaya	0.605	0.520
Cliza	0.564	0.434
Toko	0.454	0.436
Tolata	0.513	0.340
Quillacollo	0.547	0.385
Sipe Sipe	0.532	0.401
Tiquipaya	0.538	0.340
Vinto	0.520	0.425
Colcapirhua	0.401	0.295
Sacaba	0.468	0.340
Colomi	0.634	0.473
Villa Tunari	0.523	0.464
Tapacari	0.533	0.414
Totora	0.533	0.385
Pojo	0.671	0.303
Pocona	0.540	0.384
Chimoré	0.542	0.377
Puerto Villarroel	0.586	0.436
Entre Rios (Bulo Bulo)	0.507	0.397
Mizque	0.520	0.354
Vila Vila	0.438	0.413
Alalay	0.422	0.266
Punata	0.616	0.498
Villa Rivero	0.528	0.421
San Benito	0.497	0.371
Tacachi	0.382	0.190
Cuchumuela	0.485	0.357
Bolivar	0.499	0.404
Tiraque	0.611	0.482
Oruro	0.664	0.538
Caracollo	0.593	0.459
El Choro	0.399	0.351
Paria	0.517	0.387
Challapata	0.534	0.449
Santuario de Quillacas	0.377	0.354
Corque	0.544	0.428
Choque Cota	0.451	0.377
Curahuara de Carangas	0.565	0.454
Turco	0.747	0.441
Huachacalla	0.431	0.161
Escara	0.327	0.255
Cruz de Machacamarca	0.000	0.000
Yunguyo de Litoral	0.159	0.132
Esmeralda	0.218	0.175
Poopó	0.446	0.432
Pazña	0.553	0.543
Antequera	0.455	0.437
Huanuni	0.662	0.593
Machacamarca	0.545	0.459
Salinas G. de Mendoza	0.503	0.471
Pampa Aullagas	0.451	0.407
Sabaya	0.418	0.264
Coipasa	0.566	0.456
Chipaya	0.613	0.476
Toledo	0.514	0.438
Eucaliptus	0.616	0.436
Andamarca	0.610	0.427
Belén de Andamarca	0.519	0.448
Totora	0.588	0.475
Santiago de Huari	0.429	0.355
La Rivera	0.474	0.307
Todos Santos	0.478	0.313
Carangas	0.446	0.340
Huayllamarca	0.643	0.429
Potosí	0.667	0.550
Tinguipaya	0.575	0.395
Yocalla	0.559	0.434
Urmiri	0.552	0.341
Uncia	0.586	0.479
Chayanta	0.559	0.508
Llallagua	0.584	0.508
Betanzos	0.557	0.400

Municipality	WBI 2000-2005	WBI 2006-2011
Chaqui	0.500	0.425
Tacobamba	0.417	0.368
Colquechaca	0.532	0.411
Ravelo	0.497	0.378
Pocoata	0.614	0.498
Ocurí	0.461	0.437
San Pedro	0.549	0.429
Toro Toro	0.591	0.509
Cotagaita	0.690	0.552
Vitichi	0.587	0.479
Sacaca	0.497	0.399
Caripuyo	0.560	0.443
Tupiza	0.599	0.527
Atocha	0.743	0.597
Colcha "K"	0.581	0.392
San Pedro de Quemes	0.502	0.227
San Pablo de Lipez	0.739	0.470
Mojinete	0.657	0.410
San Antonio de Esmoruco	0.514	0.395
Puna	0.499	0.440
Caiza "D"	0.576	0.444
Uyuni	0.634	0.537
Tomave	0.540	0.371
Porco	0.589	0.620
Arampampa	0.863	0.597
Acasio	0.862	0.625
Llica	0.678	0.483
Tahua	0.394	0.328
Villazón	0.678	0.491
San Agustín	0.664	0.455
Tarija	0.594	0.458
Padcaya	0.548	0.454
Bermejo	0.605	0.480
Yacuiba	0.482	0.386
Carapari	0.738	1.000
Villamontes	0.730	0.624
Uriondo	0.555	0.515
Yunchara	0.621	0.618
San Lorenzo	0.541	0.525
El Puente	0.603	0.528
Entre Ríos	0.641	0.570
Santa Cruz de la Sierra	0.580	0.409
Cotoca	0.564	0.412
Ayacucho	0.564	0.376
La Guardia	0.569	0.437
El Torno	0.565	0.407
Warnes	0.587	0.548
Okinawa 1	0.512	0.430
San Ignacio	0.518	0.427

Municipality	WBI 2000-2005	WBI 2006-2011
San Miguel	0.492	0.344
San Rafael	0.414	0.330
Buena Vista	0.537	0.379
San Carlos	0.591	0.420
Yapacaní	0.517	0.418
San Juan	0.524	0.418
San José	0.555	0.464
Pailón	0.295	0.261
Roboré	0.587	0.514
Portachuelo	0.655	0.507
Santa Rosa del Sara	0.524	0.355
Colpa Belgica	0.477	0.445
Lagunillas	0.573	0.450
Charagua	0.665	0.449
Cabezas	0.447	0.351
Cuevo	0.623	0.440
Gutierrez	0.647	0.470
Camiri	0.753	0.599
Boyuibe	0.579	0.418
Valle Grande	0.659	0.494
El Trigal	0.541	0.419
Moro Moro	0.557	0.407
Postrer Valle	0.413	0.310
Pucara	0.464	0.329
Samaipata	0.501	0.403
Pampa Grande	0.492	0.378
Mairana	0.621	0.431
Quirusillas	0.441	0.282
Montero	0.673	0.518
Gral. Saavedra	0.587	0.437
Mineros	0.695	0.469
Fernandez Alonso	0.576	0.448
San Pedro	0.584	0.434
Concepción	0.476	0.360
San Javier	0.528	0.369
San Ramon	0.569	0.422
San Julián	0.611	0.473
San Antonio de Lomerio	0.510	0.277
Cuatro Canadas	0.381	0.302
San Matías	0.479	0.391
Comarapa	0.629	0.488
Saipina	0.513	0.386
Puerto Suarez	0.665	0.499
Puerto Quijarro	0.535	0.381
Carmen Rivero Torres	0.454	0.417
Ascención de Guarayos	0.550	0.426
Urubicha	0.567	0.459
El Puente	0.470	0.391
Trinidad	0.629	0.528

Municipality	WBI 2000-2005	WBI 2006-2011
San Javier	0.551	0.503
Riberalta	0.639	0.505
Guayaramerín	0.518	0.494
Reyes	0.524	0.389
San Borja	0.518	0.493
Santa Rosa	0.532	0.439
Rurrenabaque	0.596	0.442
Santa Ana	0.543	0.422
Exaltación	0.245	0.178
San Ignacio	0.518	0.476
Loreto	0.603	0.502
San Andrés	0.518	0.439
San Joaquín	0.533	0.376
San Ramón	0.426	0.338
Puerto Siles	0.523	0.442
Magdalena	0.525	0.391
Baures	0.437	0.367
Huacaraje	0.534	0.473
Cobija	0.858	0.641
Porvenir	0.614	0.642
Bolpebra	0.675	0.587
Bella Flor	0.585	0.652
Puerto Rico	0.686	0.749
San Pablo (San Pedro)	1.000	0.805
Filadelfia	0.549	0.601
Puerto Gonzalo Moreno	0.617	0.569
San Lorenzo	0.785	0.744
Sena	0.600	0.683
Nacebe (Santa Rosa de Abuna)	0.282	0.540
Ingavi	0.326	0.523
Nuevo Manoa (Nueva Esperanza	0.500	0.657
Villa Nueva	0.438	0.677
Eureka (Santos Mercado)	0.365	0.485

WBI values estimated by DP2 for years 2002, 2003, 2006 & 2007

Municipality	WBI 2002	WBI 2003	WBI 2006	WBI 2007
Sucre	0.596	0.633	0.491	0.356
Yotala	0.519	0.486	0.486	0.372
Poroma	0.339	0.407	0.378	0.298
Azurduy	0.371	0.325	0.405	0.267
Tarvita	0.387	0.528	0.371	0.297
Zudañez	0.479	0.492	0.465	0.356
Presto	0.248	0.309	0.275	0.271
Mojocoya	0.401	0.350	0.353	0.346
Icla	0.379	0.439	0.403	0.274
Padilla	0.422	0.459	0.367	0.324
Tomina	0.381	0.393	0.361	0.293
Sopachuy	0.435	0.417	0.407	0.363
Villa Alcalá	0.355	0.430	0.299	0.332
El Villar	0.402	0.424	0.397	0.357
Monteagudo	0.458	0.530	0.436	0.344
Huacareta	0.373	0.406	0.354	0.312
Tarabuco	0.409	0.494	0.402	0.339
Yamparaez	0.463	0.507	0.420	0.429
Camargo	0.476	0.472	0.458	0.350
San Lucas	0.481	0.563	0.408	0.368
Incahuasi	0.379	0.416	0.408	0.309
Villa Serrano	0.430	0.519	0.438	0.292
Camataqui (Villa Abecia)	0.500	0.656	0.444	0.345
Culpina	0.374	0.423	0.381	0.297
Las Carreras	0.371	0.389	0.342	0.273
Villa Vaca Guzman	0.475	0.414	0.280	0.305

Municipality	WBI 2002	WBI 2003	WBI 2006	WBI 2007
Huacaya	0.311	0.383	0.404	0.333
Macharetí	0.355	0.446	0.309	0.263
La Paz	0.701	0.748	0.566	0.435
Palca	0.344	0.418	0.439	0.328
Mecapaca	0.481	0.500	0.496	0.429
Achocalla	0.465	0.486	0.483	0.445
El Alto	0.584	0.692	0.524	0.444
Achacachi	0.447	0.465	0.382	0.359
Ancoraimes	0.360	0.429	0.358	0.321
Coro Coro	0.328	0.366	0.310	0.296
Caquiaviri	0.353	0.391	0.277	0.274
Calacoto	0.338	0.382	0.239	0.262
Comanche	0.470	0.446	0.384	0.373
Charaña	0.388	0.478	0.420	0.359
Waldo Ballivian	0.543	0.535	0.347	0.457
Nazacara de Pacajes	0.402	0.335	0.031	0.082
Santiago de Callapa	0.324	0.336	0.250	0.252
Puerto Acosta	0.360	0.372	0.318	0.273
Moco Moco	0.441	0.449	0.410	0.345
Carabuco	0.350	0.351	0.352	0.317
Chuma	0.247	0.364	0.251	0.212

Ayata	0.293	0.306	0.257	0.224	San Buena Ventura	0.479	0.564	0.455	0.331
Aucapata	0.436	0.414	0.322	0.166	Gral. Juan José Perez	0.431	0.499	0.367	0.351
Sorata	0.369	0.383	0.326	0.321					
Guanay	0.500	0.598	0.387	0.351					
Municipality	**WBI 2002**	**WBI 2003**	**WBI 2006**	**WBI 2007**	**Municipality**	**WBI 2002**	**WBI 2003**	**WBI 2006**	**WBI 2007**
Tacacoma	0.368	0.397	0.326	0.356	Curva	0.384	0.513	0.332	0.272
Quiabaya	0.404	0.414	0.382	0.224	Copacabana	0.457	0.505	0.426	0.403
Combaya	0.473	0.436	0.376	0.426	San Pedro de Tiquina	0.458	0.551	0.353	0.292
Tipuani	0.548	0.613	0.569	0.498					
Mapiri	0.459	0.480	0.455	0.391	Tito Yupanqui	0.308	0.226	0.252	0.257
Teoponte	0.426	0.416	0.387	0.324	San Pedro de Curahuara	0.377	0.501	0.294	0.254
Apolo	0.360	0.412	0.365	0.340					
Pelechuco	1.000	0.882	0.363	0.279	Papel Pampa	0.397	0.441	0.150	0.247
Viacha	0.488	0.545	0.470	0.395	Chacarilla	0.324	0.400	0.215	0.161
Guaqui	0.475	0.571	0.411	0.356	Santiago de Machaca	0.507	0.518	0.450	0.340
Tiahuanacu	0.534	0.561	0.462	0.407					
Desaguadero	0.429	0.447	0.392	0.386	Catacora	0.380	0.438	0.238	0.216
San Andres de Machaca	0.240	0.221	0.233	0.231	Caranavi	0.417	0.472	0.440	0.369
					Cochabamba	0.632	0.722	0.584	0.474
Jesus de Machaca	0.344	0.333	0.296	0.273	Aiquile	0.538	0.494	0.483	0.308
					Pasorapa	0.386	0.411	0.370	0.316
Taraco	0.243	0.247	0.278	0.308	Omereque	0.331	0.344	0.265	0.293
Luribay	0.454	0.486	0.438	0.420	Ayopaya	0.414	0.453	0.390	0.321
Sapahaqui	0.336	0.449	0.358	0.258	Morochata	0.351	0.405	0.386	0.264
Yaco	0.382	0.387	0.352	0.325	Tarata	0.597	0.633	0.498	0.421
Malla	0.293	0.252	0.217	0.229	Anzaldo	0.439	0.498	0.408	0.297
Cairoma	0.367	0.391	0.394	0.353	Arbieto	0.396	0.340	0.328	0.291
Inquisivi	0.292	0.291	0.411	0.326	Sacabamba	0.505	0.481	0.343	0.330
Quime	0.430	0.514	0.295	0.349	Arani	0.394	0.403	0.453	0.400
Cajuata	0.390	0.484	0.368	0.352	Vacas	0.485	0.505	0.396	0.416
Colquiri	0.340	0.408	0.325	0.364	Arque	0.273	0.300	0.372	0.300
Ichoca	0.328	0.353	0.262	0.243	Tacopaya	0.393	0.589	0.334	0.224
Licoma Pampa	0.357	0.319	0.331	0.227	Capinota	0.513	0.579	0.547	0.402
Chulumani	0.494	0.505	0.491	0.408	Santivañez	0.496	0.504	0.475	0.382
Irupana	0.375	0.451	0.447	0.372	Sicaya	0.352	0.419	0.320	0.412
Yanacachi	0.337	0.389	0.335	0.299	Cliza	0.606	0.604	0.464	0.410
Palos Blancos	0.400	0.458	0.407	0.380	Toko	0.482	0.382	0.415	0.348
La Asunta	0.290	0.324	0.389	0.341	Tolata	0.524	0.569	0.449	0.366
Pucarani	0.442	0.452	0.425	0.375	Quillacollo	0.487	0.572	0.463	0.381
Laja	0.454	0.511	0.416	0.345	Sipe Sipe	0.483	0.505	0.461	0.339
Batallas	0.481	0.520	0.422	0.397	Tiquipaya	0.511	0.504	0.395	0.303
Puerto Pérez	0.517	0.476	0.357	0.335	Vinto	0.565	0.605	0.536	0.412
Sica Sica	0.382	0.359	0.279	0.263	Colcapirhua	0.450	0.441	0.367	0.313
Umala	0.320	0.312	0.250	0.221	Sacaba	0.435	0.394	0.362	0.281
Ayo Ayo	0.534	0.507	0.384	0.375	Colomi	0.553	0.639	0.512	0.404
Calamarca	0.381	0.475	0.339	0.299	Villa Tunari	0.502	0.504	0.480	0.389
Patacamaya	0.556	0.551	0.509	0.325	Tapacari	0.396	0.563	0.334	0.299
Colquencha	0.298	0.404	0.275	0.234	Totora	0.405	0.404	0.428	0.364
Collana	0.341	0.389	0.255	0.144	Pojo	0.570	0.556	0.305	0.260
Coroico	0.501	0.575	0.508	0.430	Pocona	0.461	0.464	0.377	0.343
Coripata	0.480	0.603	0.455	0.392	Chimoré	0.412	0.431	0.380	0.279
Ixiamas	0.406	0.462	0.371	0.331					

Puerto Villarroel	0.507	0.514	0.474	0.381
Entre Rios (Bulo Bulo)	0.367	0.359	0.414	0.280
Mizque	0.431	0.415	0.371	0.313
Municipality	**WBI 2002**	**WBI 2003**	**WBI 2006**	**WBI 2007**
Vila Vila	0.441	0.430	0.402	0.313
Alalay	0.387	0.398	0.277	0.247
Punata	0.648	0.656	0.576	0.520
Villa Rivero	0.639	0.640	0.584	0.427
San Benito	0.483	0.545	0.525	0.409
Tacachi	0.317	0.473	0.249	0.204
Cuchumuela	0.427	0.650	0.448	0.409
Bolivar	0.374	0.469	0.314	0.266
Tiraque	0.509	0.561	0.527	0.419
Oruro	0.609	0.598	0.515	0.433
Caracollo	0.463	0.342	0.429	0.262
El Choro	0.132	0.032	0.041	0.067
Paria	0.402	0.424	0.459	0.308
Challapata	0.500	0.442	0.474	0.389
Santuario de Quillacas	0.290	0.240	0.266	0.283
Corque	0.373	0.226	0.274	0.183
Choque Cota	0.384	0.408	0.235	0.241
Curahuara de Carangas	0.334	0.459	0.314	0.267
Turco	0.571	0.339	0.392	0.377
Huachacalla	0.387	0.421	0.313	0.306
Escara	0.340	0.116	0.038	0.148
Cruz de Machacamarca	0.177	0.156	0.177	0.194
Yunguyo de Litoral	0.000	0.078	0.128	0.000
Esmeralda	0.004	0.000	0.167	0.029
Poopó	0.432	0.365	0.406	0.289
Pazña	0.615	0.545	0.582	0.472
Antequera	0.446	0.382	0.518	0.386
Huanuni	0.471	0.540	0.518	0.385
Machacamarca	0.448	0.403	0.413	0.353
Salinas G. de Mendoza	0.272	0.328	0.249	0.057
Pampa Aullagas	0.216	0.261	0.185	0.105
Sabaya	0.170	0.092	0.123	0.122
Coipasa	0.379	0.387	0.286	0.337
Chipaya	0.262	0.228	0.207	0.094
Toledo	0.225	0.225	0.125	0.106
Eucaliptus	0.530	0.524	0.404	0.424
Andamarca	0.465	0.386	0.340	0.266
Belén de Andamarca	0.325	0.288	0.172	0.101
Totora	0.435	0.443	0.301	0.271
Santiago de Huari	0.317	0.430	0.319	0.300
La Rivera	0.474	0.266	0.266	0.258
Todos Santos	0.599	0.675	0.485	0.416
Carangas	0.226	0.086	0.000	0.107
Municipality	**WBI 2002**	**WBI 2003**	**WBI 2006**	**WBI 2007**
Huayllamarca	0.609	0.499	0.354	0.318
Potosí	0.668	0.745	0.542	0.409
Tinguipaya	0.350	0.383	0.342	0.242
Yocalla	0.445	0.510	0.310	0.302
Urmiri	0.405	0.394	0.244	0.216
Uncia	0.536	0.517	0.526	0.364
Chayanta	0.436	0.476	0.431	0.360
Llallagua	0.573	0.597	0.575	0.452
Betanzos	0.442	0.423	0.366	0.284
Chaqui	0.449	0.454	0.339	0.255
Tacobamba	0.333	0.385	0.291	0.214
Colquechaca	0.242	0.361	0.304	0.255
Ravelo	0.315	0.379	0.282	0.262
Pocoata	0.442	0.400	0.377	0.297
Ocurí	0.350	0.386	0.351	0.296
San Pedro	0.288	0.395	0.344	0.309
Toro Toro	0.341	0.320	0.342	0.313
Cotagaita	0.476	0.527	0.434	0.299
Vitichi	0.500	0.461	0.411	0.359
Sacaca	0.280	0.328	0.293	0.234
Caripuyo	0.411	0.437	0.447	0.370
Tupiza	0.613	0.650	0.527	0.429
Atocha	0.550	0.666	0.517	0.452
Colcha "K"	0.518	0.449	0.413	0.329
San Pedro de Quemes	0.207	0.257	0.230	0.251
San Pablo de Lipez	0.625	0.653	0.564	0.416
Mojinete	0.515	0.470	0.431	0.431
San Antonio de Esmoruco	0.444	0.476	0.442	0.269
Puna	0.430	0.493	0.421	0.315
Caiza "D"	0.524	0.561	0.424	0.323
Uyuni	0.581	0.703	0.589	0.492
Tomave	0.510	0.561	0.465	0.349
Porco	0.475	0.595	0.540	0.394
Arampampa	0.991	0.647	0.572	0.420
Acasio	0.641	0.556	0.623	0.519
Llica	0.469	0.529	0.488	0.372
Tahua	0.271	0.298	0.310	0.218
Villazón	0.423	0.464	0.539	0.382
San Agustín	0.549	0.612	0.529	0.356
Tarija	0.576	0.656	0.539	0.427
Padcaya	0.478	0.559	0.530	0.440
Bermejo	0.499	0.480	0.460	0.399
Yacuiba	0.468	0.465	0.453	0.415

Carapari	0.500	0.646	1.000	1.000
Villamontes	0.550	0.666	0.647	0.552
Uriondo	0.409	0.387	0.357	0.339
Yunchara	0.430	1.000	0.567	0.554
San Lorenzo	0.405	0.450	0.603	0.400
El Puente	0.428	0.514	0.582	0.386
Entre Ríos	0.466	0.513	0.488	0.459
Santa Cruz de la Sierra	0.551	0.624	0.486	0.379
Cotoca	0.525	0.618	0.486	0.441
Ayacucho	0.455	0.462	0.373	0.298
La Guardia	0.500	0.572	0.486	0.381
El Torno	0.519	0.529	0.483	0.369
Warnes	0.520	0.536	0.540	0.394
Okinawa 1	0.387	0.548	0.462	0.343
San Ignacio	0.509	0.562	0.539	0.411
San Miguel	0.523	0.528	0.555	0.499
San Rafael	0.348	0.454	0.379	0.270
Buena Vista	0.492	0.535	0.470	0.421
San Carlos	0.582	0.647	0.554	0.456
Yapacaní	0.490	0.573	0.488	0.412
San Juan	0.408	0.431	0.416	0.338
San José	0.543	0.559	0.566	0.433
Pailón	0.341	0.366	0.291	0.232
Roboré	0.616	0.600	0.593	0.582
Portachuelo	0.536	0.660	0.603	0.494
Santa Rosa del Sara	0.470	0.553	0.520	0.326
Colpa Belgica	0.332	0.322	0.309	0.285
Lagunillas	0.366	0.394	0.384	0.341
Charagua	0.570	0.450	0.502	0.408
Cabezas	0.356	0.343	0.292	0.287
Cuevo	0.566	0.684	0.534	0.471
Gutierrez	0.519	0.555	0.551	0.421
Camiri	0.614	0.788	0.747	0.500
Boyuibe	0.486	0.527	0.528	0.363
Valle Grande	0.647	0.702	0.504	0.458
El Trigal	0.544	0.594	0.411	0.204
Moro Moro	0.493	0.498	0.388	0.412
Postrer Valle	0.460	0.427	0.350	0.238
Pucara	0.522	0.493	0.418	0.371
Samaipata	0.570	0.608	0.487	0.450
Pampa Grande	0.525	0.511	0.502	0.316
Mairana	0.626	0.576	0.619	0.523
Quirusillas	0.362	0.348	0.324	0.271
Montero	0.566	0.603	0.538	0.457
Gral. Saavedra	0.426	0.508	0.353	0.322
Mineros	0.513	0.672	0.434	0.341
Fernandez Alonso	0.395	0.398	0.448	0.310
San Pedro	0.425	0.475	0.515	0.383
Concepción	0.482	0.544	0.503	0.395
San Javier	0.537	0.572	0.467	0.429
San Ramon	0.414	0.645	0.437	0.353
San Julián	0.490	0.471	0.554	0.401
Cuatro Canadas	0.392	0.363	0.428	0.298
San Matías	0.556	0.528	0.488	0.414
Comarapa	0.532	0.536	0.547	0.462
Saipina	0.508	0.599	0.558	0.448
Puerto Suarez	0.658	0.684	0.609	0.475
Puerto Quijarro	0.548	0.550	0.422	0.415
Carmen Rivero Torres	0.478	0.502	0.526	0.427
Ascención de Guarayos	0.523	0.509	0.551	0.425
Urubicha	0.488	0.495	0.561	0.441
El Puente	0.393	0.387	0.435	0.328
Trinidad	0.592	0.693	0.530	0.492
San Javier	0.519	0.454	0.459	0.417
Riberalta	0.660	0.680	0.532	0.353
Guayaramerín	0.545	0.554	0.507	0.380
Reyes	0.551	0.437	0.388	0.311
San Borja	0.380	0.368	0.394	0.321
Santa Rosa	0.419	0.392	0.411	0.299
Rurrenabaque	0.499	0.613	0.457	0.366
Santa Ana	0.592	0.704	0.550	0.485
Exaltación	0.229	0.219	0.157	0.126
San Ignacio	0.409	0.490	0.443	0.337
Loreto	0.459	0.429	0.435	0.287
San Andrés	0.401	0.434	0.436	0.436
San Joaquín	0.578	0.622	0.514	0.471
San Ramón	0.593	0.528	0.596	0.396
Puerto Siles	0.517	0.532	0.512	0.485
Magdalena	0.541	0.640	0.577	0.516
Baures	0.507	0.600	0.550	0.454
Huacaraje	0.542	0.601	0.561	0.428
Cobija	0.554	0.726	0.652	0.464
Porvenir	0.386	0.394	0.260	0.328
Bolpebra	0.401	0.238	0.554	0.484
Bella Flor	0.112	0.250	0.668	0.251
Puerto Rico	0.508	0.487	0.663	0.535
San Pablo (San Pedro)	0.708	0.762	0.528	0.460
Filadelfia	0.312	0.197	0.488	0.280
Puerto Gonzalo Moreno	0.391	0.511	0.386	0.385
San Lorenzo	0.588	0.498	0.703	0.380
Sena	0.464	0.297	0.699	0.538

Municipality	**WBI 2002**	**WBI 2003**	**WBI 2006**	**WBI 2007**

Nacebe (Santa Rosa de Abuna)	0.277	0.311	0.459	0.450
Ingavi	0.004	0.263	0.163	0.245
Nuevo Manoa (Nueva Esperanza	0.311	0.247	0.281	0.071
Villa Nueva	0.358	0.438	0.574	0.237
Eureka (Santos Mercado)	0.082	0.187	0.277	0.196