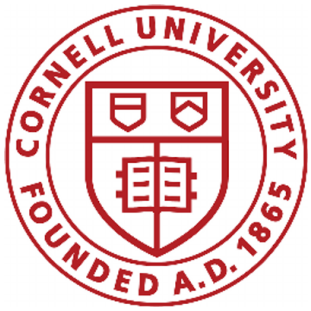
Poverty and Inequality trends in Chile from 1990 to 2013: Income-based and Multidimensional analysis.



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ABSTRACT

In this study, we analyze the evolution of poverty and inequality in Chile during a period of continuous growth. We use data from National Socio-Economic Characterization Survey to estimate poverty and inequality from 1990 to 2013 applying two approaches; income and multidimensional. We use decomposition methodologies to analyze the effects of economic growth on poverty and inequality, and the evolution of poverty and inequality by subgroups. Results show that overall when economic growth took place, poverty and inequality decreased independently on the method used for the analysis. Decomposition in urban and rural areas shows that people from rural sectors, generally present lower income levels and higher rates of deprivation. Race and age decomposition show that indigenous people and young adults, aged 18-29, display higher levels of deprivation, being Education and Social Security the dimensions having the largest contribution to the aggregate levels of poverty. Finally, the policy simulations suggest that a multidimensional approach can be a useful tool to analyzed the efficiency of targeted public policies.

Keywords: Foster-Greer-Thorbecke Index, Poverty Decomposition, Multidimensional Poverty Index, Multidimensional Inequality, Policy Simulations, Household surveys.

Biographical Sketch

Jose Joaquin Fernandez is native from Chile. He received a BS in Economics and MSc in Finance from the University of Chile. He worked as a volunteer for more than four years in TECHO Chile in poverty alleviation and affordable housing programs. Additionally, Joaquin used to work at the Chilean Ministry of Finance as Capital Market Adviser. In his former role he had active participation in the legislative discussion of several bills in the Chilean Congress, and also in the implementation of some financial sector regulations, such as those related to Consumer Protection (*SERNAC Financiero*), and Financial Inclusion. Along with his work at the Ministry of Finance, Joaquin worked as assistant professor at the Los Andes University and the Las Americas University, teaching Finance, and Microeconomics. At the present, he is finishing his MPA at Cornell University, with a concentration in Public and Nonprofit Management. His research interest includes Program Evaluation, Impact Investment, Poverty, and Inequality.

Dedication

I dedicate this work to my future wife, Maria Ignacia Infante, my family, and friends. This study is also dedicated to all the Chileans that deserve better public policies to address their daily problems.

Acknowledgments

I would like to thank Fulbright for the opportunity of pursuing a Master in USA and Cornell Institute for Public Affairs for supporting me during these two years. I also wanted to thanks Karina Acosta, Mauricio Bucca, David Jaume, Gary Fields, Ravi Kanbur, and especially Ignacio Fernandez for their advice and support in the completion of the present study.

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Chapter 1

Introduction

Evolution of poverty and inequalities has been a highly discussed topic in Chile in the last three decades. In general, there is an agreement on the high reduction of poverty rates achieved by the country since the 90's. However, whereas some authors have claimed that this achievement on poverty alleviation has been coupled with a reduction of income inequalities (e.g. Sapelli, 2011), others have argued that inequalities have remained mostly unaltered (Contreras et al., 2001).

Official data (see figure A.1) shows that poverty and extreme poverty declined since 1990, with the headcount index falling more than 30%. According to Contreras (2003), economic growth may have accounted for 85% of the poverty reduction during 1990 to 1996, where the average Gross Domestic Product (GDP) was 7.3%. The positive association between economic growth and the decline in poverty rates are shown in figure A.2. When Chile started to face a more moderate economic growth, poverty reduction shows a moderate decline as well (World Bank, 1997). For example, while the headcount index of 1990 was 1.65 times the one of 1996, the headcount index of 1996 was 1.24 times the one of 2003 (Bravo and Valderrama, 2011). Regarding poverty decomposition, poverty fell both in urban and rural areas, however, it remained considerably higher in rural areas and for indigenous people. Furthermore, Agostini et al. (2008) shows that poverty trends were widely diverse across geographic regions, with rural municipalities often being poorer than urban ones.

Chile has not been able to reduce income inequality at the same pace than poverty. Moreover, Chile has been among the most unequal countries in the world with the richest 20 percent of the population holding 12 times more income than the 20 poorest percent [1]. Chile ranks as the third

[1] Ratio of Income share held by highest 20% to Income share held by lowest 20%, with World Bank Data of 2013

more unequal country in Latin American only behind Brazil and Colombia, and has had the larger Gini Index among the OECD countries.

Chile has experienced a moderate decline in income inequality since 1987. According to World Bank (1997), the Gini index decreased from 0.55 to 0.53 between 1987-1994. Other authors suggest that whereas income inequality decreased in the long term, there were particular periods where inequality increased (e.g. Bravo and Valderrama, 2011). Similarly, Sapelli (2011) argues that for cohorts born between 1902 and 1978 income inequality increase to then decrease in the long term. Although income inequality has been declining, the high levels of income inequality coupled with a zigzagging trend have generated the misconception that income inequality levels in Chile have remained almost unaltered during the last 30 years.

As a consequence of some critiques arisen to the traditional measures of poverty used in Chile, the country updated its standards in January of 2015. Chile used to define poverty regarding absolute poverty line using the Cost of Basic Needs method. This approach establishes poverty line by an explicit bundle of food typically consumed by the poor at local prices. On the contrary, the new approach has incorporated a multidimensional poverty scope to complement the traditional poverty measures; and the concept of income per adult equivalent.

The present study aims to first, review the effects of economic growth in poverty and income inequality. Then, similarly to Contreras (2003), we use Datt and Ravallion (1992) decomposition approach to determine the effect of economic growth on poverty by the rise of incomes and the shift of the income distribution. Third, following Battiston et al. (2013), we compute the Multidimensional Poverty Index (MPI), which includes education, health, living standards, and social security. Fourth, we suggest a multi-attribute inequality approach that aims to be consistent with the implementation of the MPI. Finally, we perform several micro-simulations to analyze the effect of different public policies under the lens of the income-based and the multidimensional attribute approaches.

The present study is structured in five chapters. The first chapter present the questions and the contributions of the present study. The second chapter presents and describes the data used.

Chapter three shows the methodology used to undertake these questions. The fourth chapter provides the principal findings related to poverty, income inequality, multidimensional poverty, multidimensional inequality, results of micro-simulations, and the limitations of the present study. Finally, chapter five presents the mains conclusions and policy implications.

1.1 The Questions

1. Was the decline in poverty due to: a generalized rise of incomes (growth effect), government transfers (distributional effect), or both?

   A1. The poverty decline was overall due to economic growth and the shift in the income distribution. However, the poverty decline was caused mainly by growth from 1996 to 1998, and from 1996 to 2011.

2. What are the main issues that explain high inequality in Chile? Is there a mixed evidence regarding income inequality trends during the analyzed period?

   A2. The income inequality has remained high because the percentile 99 of income holds an important part of the total income. Income inequality declined during the whole period but increased during some specific periods.

3. What are the temporal trends of deprivation levels faced by the poorer sectors? Are these levels correlated with income deprivation (poverty lines)?

   A3. The deprivations levels faced by the poor decreased the 1990 to 2013 period, with education as the dimension that contributed most to the overall index. The correlation between dimensions of the MPI and income was relatively low.

4. Is the change on the MPI homogeneous across different geographic areas, ages, gender, and ethnicity?

   A4. The MPI does not substantially differ between gender, but a significant difference was found by ethnicity and age ranges. The young adults and indigenous people faced higher levels of deprivation that other groups. The Araucania, Los Rios, and Los Lagos were the

regions facing the highest levels of deprivation.

5. What is the temporal trend of multidimensional inequality? Is this trend correlated with Income inequality?

   A5. Multidimensional inequality declined by both the uni-dimensional and the multiple attribute index analysis. The decline in multidimensional inequality is correlated with a decrease in income inequality.

6. What role can play the Multidimensional Poverty Index for developing public policies? What is the effect of education and health policies on the scope this approach?

   A6. MPI provides an insightful analysis for targeting public policies due to its decomposable structure. The education and health programs caused a decline in the MPI. However, the researchers needs to consider the assumption taken to obtain more feasible and unbiased results.

1.2 My contributions

The present study contributes to current knowledge by updating and complementing previous research related to poverty and income inequality in Chile. It also complements available information regarding multidimensional poverty and provides a multidimensional inequality index that could be implemented along the MPI. Results from this study contribute with insightful information that can be used for improving the design of public policies targeting income, education, health, social security, and dwelling characteristics according to the levels of deprivation and the opportunity cost of each policy.

Chapter 2

Data

We use socioeconomic data for the 1990 to 2013 period taken from the National Socio-Economic characterization survey (CASEN by its Spanish acronym). This survey is designed to collect information at the household level and to describe socioeconomic characteristics of households including information regarding income, levels of education, labor characteristics, dwelling characteristics, and health. The CASEN is a cross-sectional survey that is used to evaluate government's social programs and fiscal expenditures. CASEN survey is conducted every two or three years by the Microdata Center of the University of Chile [2] and supported and organized by the Ministry of Social Development. CASEN surveys have been increasingly incorporating additional variables to make it more robust to develop public policies.

The survey uses cluster and stratified sampling to collect information from household members in urban and rural areas. The sampling is representative of all Chilean regions and some municipalities[3]. The data collected by the CASEN survey is entrusted and adjusted by ECLAC (UN Economic Commission for Latin America and the Caribbean). These data corrections are based on missing data, miss-reported income, and under or over reported information compared to National Accounts.

The first type of correction is related to missing data or non-responses related to people who declared themselves as been employed but did not report any income; widows that received a pension but did not declare it; and house owners that not declared the value of their rent. Then ECLAC performs corrections based on average income defined by the source of income and households group, where

[2] Observatorio Social from Alberto Hurtado University conducted 2009 round interrupting this process

[3] Auto-representation at the national level, but not at different levels of decomposition

these groups are determined by region, zone, educational attainment, and occupational sector among others.

The second type of correction is based on under or over reported income of households. In this case, ECLAC uses as a reference point the National Accounts System from the Central Bank to aggregate the income flows of the households. Then, the proportional difference between both sources of income is imputed uniformly to each CASEN's income recipient (Contreras, 2003).

Table 2.1 summarizes the information available in each CASEN wave regarding income, education, health, social security, and dwelling characteristics, which we use in the present study. Additionally, the table provides information about the sample size and number of households.

Table 2.1: CASEN available information 1990-2013*

Year	HHs	Individuals	Income**	Education	Health	Social Security	Housing
1990	25,793	105,189	✓	✓	✓	✓	✓
1992	35,948	143,459	✓	✓	✓	✓	✓
1994	45,379	178,057	✓	✓	✓	✓	✓
1996	33,636	134,262	✓	✓	✓	✓	✓
1998	48,107	188,360	✓	✓	✓	✓	✓
2000	65,036	252,748	✓	✓	✓	✓	✓
2003	68,153	257,077	✓	✓	✓	✓	✓
2006	73,720	268,873	✓	✓	✓	✓	✓
2009	71,460	246,924	✓	✓	✓	✓	✓
2011	59,084	200,302	✓	✓	✓	✓	✓
2013	64.842	218,491	✓	✓	✓	✓	✓

*HHs: Households surveyed

**Autonomous Income, Cash Transfers, and Total Income of the Household

Source: Own elaboration with Casen Data

We use CASEN researcher's manuals to make the sample representative of whole Chilean population through weights and expansion provided. These manuals also provide information regarding household and individuals income and transfer received from the government. We use the income information at the household level to estimate poverty and inequality measures. The information on education, health, social security and living standards from each CASEN wave is used to determine the multidimensional poverty index (MPI), the aggregate multidimensional inequality index and microsimulations. In the next chapter, we will describe the methods here mentioned.

Chapter 3

Methodology

3.1 Poverty Measures

We use the methodology developed by Foster et al. (1984), know as the *P alpha* family of indexes, to estimate poverty related to income or consumption. This approach uses income information and national poverty lines to determine the incidence of poverty. During the present study, we use the headcount index, as well as the poverty gap and the squared poverty gap to determine the evolution of poverty. The P_0 or headcount index is widely used in Chile, and it is the official measure used by the government to track poverty. This index uses the national poverty lines (Z_i) to provides the percentage of people which is below that cutoff. The second measure is the P_1 index which provides the income shortfall of those people situated below Z_i. Thus, this methodology aggregates the income deficits of the poor and provides an aggregate measure of the distance of "how far" are the poor from the selected cutoff Z_i. Similarly to P_1, the P_2 index provides a measure of distance from the poor people to Z_i, but establishes a greater weight on those people facing a larger shortfall. Therefore, the P_2 index is more sensitive to extreme cases of the income distribution, giving greater weight to extreme poverty (indigence).

Then the general FGT family of index can be described by the following equation

$$P_\alpha = \frac{1}{n} \sum_{n=1}^{q} \left(\frac{z - y_i}{z} \right)^\alpha \tag{3.1}$$

Poverty Decomposition

To determine if economic growth is associated with poverty reduction, we follow Datt and Ravallion (1992) method of decomposition. This approach states that changes over poverty are caused by a shift in the income distribution and rise or fall of household income. The method analyzes the effects of economic growth in poverty by an income effect and a distributional effect. Therefore, this methodology links the effect of economic growth on poverty, as the change in the poverty measure when the Lorenz curve is held constant to a certain level L_r. Then the redistribution component will be the change in the poverty measure when the mean income is held constant to a certain reference level μ_r.

Therefore, the change over a period of time can be expressed as follow.

$$P_{t+1} - P_t = G(t, t+1; r) + D(t, t+1; r) + R(t, t+1; r) \tag{3.2}$$

where $G(t, t+1; r)$ is growth effect, $D(t, t+1; r)$ is the re-distributional effect, and $R(t, t+1; r)$ is the residual.

3.2 Inequality Measures

The Gini Index and income shares ratios are estimated to determine trends in income inequality for the period 1990-2013. The results of these measures help to identify if income inequality increased, decreased or remain unaltered over the period. As many researchers have claimed, income inequality in Chile seems to have remained high and stable over the last twenty-five years. The share of the richest 10 percent of the population to the poorest 10 percent or ratio of richest 20 percent to poorest 20 percent can provide evidence regarding income held by the different shares of the population. However, one downside of the income share measures is that they are weakly Lorenz-consistent (Gary Fields, 2001). Thus, a deeper analysis is needed. Therefore, we also perform a Lorenz curve analysis following Jenkins (2008). We estimate Lorenz curve for each period based on per capita

household income, which includes autonomous income and transfer from the government.

Additionally, we estimate the Atkinson index to support these findings. This indicator it is characterized by comprising a parameter of sensitivity ϵ for different segments of the income distribution. Thus, this parameter could be understood as the researcher's sensitivity to inequality, and usually takes values of 0.5, 1, 1.5, or 2. Then, if ϵ takes a value of 0 the researcher does not assign a specific weight to a particular segment of the income distribution while a value of 2 gives a higher weight to the poorest people on income distribution. Therefore a higher level ϵ implies a higher income inequality sensitivity, giving greater weight to those people on the lower tail of the income distribution. Finally, we only use the Atkinson index for years 1990, 2000 and 2011 to complement the trends in income inequality over a $9 - 10$ years period, and differentiating between urban and rural areas but not at regional level.

Inequality Decomposition

To estimate the variance on inequality by subgroups, we perform an inequality decomposition by urban and rural areas. For this we estimate the Generalized Entropy (GE) indexes or Theil's family of measures to determine the within and between group effect following Cowell and Jenkins (1995). This method of decomposition allows estimating the contribution to the aggregate level of income inequality by differences in income inequality within groups and between groups.

Then, Theil's first measure or $Theil_L$ can be described as follows:

$$L = [x_u * L_u + x_r * L_r] + [x_u * ln(\mu/\mu_u) + x_r * ln(\mu/\mu_r)] \tag{3.3}$$

Where x_u is the fraction of the whole country population living in the urban area, and x_r is the proportion of the country's population in the rural area. L_u and L_r are the respectively Theil's measure for inequality in each zone. $ln(\mu/\mu_u)$ and $ln(\mu/\mu_r)$ are the mean income deviation of each area regarding to country's average income.

Therefore, the left bracket of equation 3.3 shows the within-group component, and the right bracket

sides the between-group component.

Equation 3.4 shows Theil's second measure or $Theil_T$. In the same fashion that Theil-L, the left side of the equation shows the within group element group while the right side shows the between group element or inequality variation.

$$T = \left[(\frac{x_u * T_u}{\mu}) + (\frac{x_r * T_r}{\mu}) \right] + \left[(\frac{x_u * T_u}{\mu}) * ln(\mu/\mu_u) + (\frac{x_r * T_r}{\mu}) * ln(\mu/\mu_r) \right] \tag{3.4}$$

In the present study, we perform both Theils measures, focusing in the within and between group components to understand the effect of inequality by groups on overall inequality, and how these inequality measures have evolved from 1990 to 2013.

3.3 Multidimensional Poverty

The multidimensional poverty analysis is conducting following the methodology developed by Alkire Foster (AF) of the Oxford Poverty and Human Initiative (OPHI). This method establishes a deprivation index for several dimensions or components. The AF method sets a vector $z = (z_1, ..., z_d)$ of deprivation cutoff to determine if the person i in the household h is deprived or not. Thus, if a random person i on dimension j reach a certain cutoff z_k, it can be summed that the individual i is not deprived on dimension j. On the contrary, if the same person i on dimension j does not reach cutoff z_k, he or she will be deprived on dimension j. Additionally, this methodology establishes a vector $w = (w_1, ..., w_d)$ of weights for each dimensions.

Therefore, if all dimensions are established as equally important, w should be set as a unique value and each dimension is added, which formally is defined as $\bar{w} * \sum_{j=1}^{d} h_j(k)$. On the other hand, if dimensions are weighted differently, then dimension j_i will have greater importance for the aggregate estimation.

This approach analyzes the situation of each individual i in the household h assigning a value of 1 or "deprived" if the individual does not meet the specific cutoff z_k, and 0 or "not deprived" if that

level z_k is reached. According to Alkire and Foster (2011) this methodology can be decomposed by regions and different subgroups, allowing a more in deep analysis.

In this study, we include twelve sub-dimension grouped in four overall dimensions which are: Health, Education, Dwelling characteristics, and Social Security and Employment status. These sub-dimensions and dimensions were recommended by OPHI to the Chilean government in 2014 and are summarize in Table 3.1.

Table 3.1: Multidimensional Poverty Index Chile

Weight	Education	Health	Social Security	Dwelling characteristics
1/12	Educational Attainment	Malnourished	Employment	Overcrowding
1/12	Educational underachievement	Health System Coverage	Retirement Savings	House Components
1/12	Years of Schooling	Health System Usage	Retirement Income	Drinking water and sanitation

Source: Ministry of Social Development, 2015

The thresholds or cutoff for each sub-dimension is established according to specific standards set by the Ministry of Social Development and OPHI (See Annex A.2). Thus, after estimating the levels of deprivation for each of the twelve sub-dimensions, the MPI is calculated by aggregating the four overall dimension according to the weights settled in Table 3.1. Then the MPI will be established according to the k cutoff that determines the particular value for which a household is considered to be deprived. In this study, we perform the analysis for $k = 25\%$, $k = 50\%$, $k = 75\%$, and $k = 100\%$ as a way to understand the number of households deprived in only one dimension [4], in more than one, or in all four dimensions. However, the Chilean government has established as the standard cutoff $k = 25\%$ or equivalent to be deprived in sum of one dimension. Therefore, most of our analysis done by using this cutoff.

The aggregation of dimensions can be summarize by the following equation,

$$M_0(X;Z) = \mu(c(k)) = HxA = \frac{q}{n} * \frac{1}{q}\sum_{i=1}^{q} c_i(k) \tag{3.5}$$

Where H is the traditional Headcount index, A is the intensity of poverty, and c_i is the deprivation

[4]This means that the household could be deprived in one sub-dimension related to Education, one sub-dimension related to Health, and one sub-dimension related to Social Security. Hence the household will be deprived if different combination makes the household deprived in at least three of the total twelve sub-dimensions.

score which is the weighted sum of the dimensions that are deprived (Alkire and Foster, 2011).

To increase the resolution of our analysis, we decompose the MPI by subgroup and dimensional contribution. The subgroup decomposition includes urban and rural areas, gender, race, age categories, and geographic order while the dimensional decomposition includes the four dimensions described as well as the twelve sub-dimensions. The description of both subgroup and dimensional decomposition are described in the next sections.

3.3.1 MPI subgroup decomposition

According to Alkire et al. (2015), M_0 can be decomposed by subgroups, estimating subgroup M_0 levels and comparing with M_0 aggregates levels. In the same fashion that the FGT family of indexes, this decomposition allows understanding the within-group effect and the between group effect regarding contributions to the aggregate MPI. Then, the overall M_0 is the following,

$$M_0(X) = \sum_{l=1}^{m} v^l M_0(X^l) \tag{3.6}$$

Where X^l is the achievement matrix of each subgroup, while $v^l = n^l/n$ is the population share of each subgroup on the overall population. Then, the contribution of each subgroup to the overall multidimensional poverty can be summarized as,

$$D_l^0 = v^l \frac{M_0(X^l)}{Mo(X)} \tag{3.7}$$

This equation point out that the contribution of each subgroup to the aggregate level of poverty $M_0(X)$ will depend on the population share v^l and the particular multidimensional poverty for each subgroup $M_0(X^l)$. Therefore, the size of the subgroup considers its relative importance to the overall levels of multidimensional poverty.

3.3.2 MPI dimensional decomposition

Another property of the MPI is that could be decomposed according to contributions of each dimension into to the aggregate M_0. The additive structure of the MPI allows expressing the index as a weighted sum of the censored headcount ratio $c_i(k)$. Then using the weight w_j for each dimension under analysis, $M_0(X)$ can be expressed as,

$$M_0(X;Z) = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{d} w_j g_{ij}^0(k) \tag{3.8}$$

Where $g_{ij}^0(k)$ is the censored deprivation matrix which row i represents the deprivation situation of an individual i in each of the j dimensions. Then, equation 3.8 can be reformulated into equation 3.9 to estimate the percentage contribution of each dimension to the aggregate level of multidimensional poverty,

$$M_0(X;Z) = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{d} w_j g_{ij}^0(k) = \sum_{j=1}^{d} w_j h_j(k) \tag{3.9}$$

Equation 3.9 shows that M_0 is the weighted sum of all j headcount ratios. Therefore, the contribution of dimension j over M_0 is denoted by ϕ_j^0, which is described by,

$$\phi_j^0 = w_j \frac{h_j(k)}{M_0} \tag{3.10}$$

Hence, the percentage contribution ϕ_j^0 and the censored headcount ratio $c_i(k)$ are can be used to analyze policy impact by subgroup.

3.4 Multidimensional Inequality

Multidimensional inequality can be understood as the inequality perceived in each particular dimension or as the aggregate inequality faced by an individual in multiple dimensions. Therefore, we first analyze each of the overall four dimensions through concentration curves ordered by income

and the Gini Index, and we compute the quintile gap for Education, which measures the difference between years schooling of the first and fifth quintile. Then, we estimate an aggregate index of multidimensional inequality following Maasoumi (1986) and a global index of multidimensional inequality suggested by Bourguignon (1999).

Maasoumi (1986) proposes an aggregate attribute function to estimate multi-attribute or multidimensional inequality, which can be decomposed between and within groups inequality by using additional measures such as Theil index described in section 3.2. He establishes $S_i = \sum_{i=1}^{N} x_{ij}$ as the attribute function, where $x_i j$ is the amount of attributes $j = 1, ...J$ received by an individual or household $i = 1, ..., N$. Therefore, x_{ij} denotes the row i in matrix NxJ, or in other words the amount of attributes j received by individual i. Hence, Maasoumi suggest that relative inequality of the population will be described by the function $S = (S_i, ..., S_N)$, and defined under Generalized Entropy family of indexes as,

$$I_\gamma(S) = \sum_{i=1}^{N} p_i \left[(S_i^*/p_i)^{1+\gamma} - 1 \right] / \gamma(1+\gamma) \tag{3.11}$$

Where $S_i^* = \sum_j S_j$ and $pi = 1/N$ is the population share of the i_{th} unit. Then to decompose by subgroup the Massoumi index can be extended as Theil's first and second measures, which will be described by,

$$L = I_0(S) = \sum_{i=1}^{N} S_i^* \ log(S_i^*/p_i) \tag{3.12}$$

$$T = I_1(S) = \sum_{i=1}^{N} p_i \ log(p_i/S_i^*) \tag{3.13}$$

However, to simplify the analysis is possible to standardize each dimension or attribute j through the following approach suggested by Jorda et al. (2014).

$$x_i j = \frac{x_i^j - x_{min}^j}{x_{max}^j - x_{min}^j} \ , \quad \forall \ i = 1, ...N \wedge j = 1, ..., J \tag{3.14}$$

This approach allows analyzing inequalities over attributes that are within the range $[0, 1]$ which facilitates the process of estimating the aggregated index. Hence, we calculate multidimensional

inequality using Maasoumi (1986) approach, but standardized the data of each dimension to simplify the process. Then, the equation that provides the multi-attribute index for the Atkinson index can be described as,

$$I_{MA}(\beta,\epsilon) = 1 - \frac{\left[\frac{1}{N}\sum_{i=1}^{N} s_i^{1-\epsilon}\right]^{\frac{1}{1-\epsilon}}}{\mu_s} \tag{3.15}$$

Where μ_s is the mean of S_i and ϵ is the inequality sensitivity or aversion to inequality.

In contrast to Maasoumi index, which estimates multidimensional inequality by stage, the global index of multidimensional inequality associate a real number to each joint distribution of the multiple dimension under analysis.

The methodology suggested by Tsui (1995) is widely used, and assumes a social welfare function continuous, symmetric, increasing, separable, strictly quasi-concave, and scale independent. However, we use an extension of this methodology suggested by Bourguignon (1999) who propose more restricted parameters of the social welfare function (equation 3.16). This index regulates the elasticity of substitution β, (restricting $\beta \leq 1$) and the inequality aversion ϵ.

$$I_B(\beta,\epsilon) = 1 - \frac{1}{N}\frac{\sum_{i=1}^{N}\left[\sum_{j=1}^{J}(\bar{w}_j x_{ij}^{\beta})\right]^{\frac{\epsilon}{\beta}}}{\left[\sum_{j=1}^{J}(\bar{w}_j \mu_j^{\beta})\right]^{\frac{\epsilon}{\beta}}} \tag{3.16}$$

Where $\bar{w}_j$ is the weight of each attribute of the social welfare function, x_{ij} is the amount of dimension j hold by person i, and μ_j is the mean of attribute j. Therefore, Bourguignon as well as Massoumi index is restricted to the level of substitution of the parameters β, the weight of the attributes on the social welfare function w, and the inequality aversion ϵ. Then, in the same fashion than Maasoumi index, this index is increasing in ϵ, and decreasing in β.

3.5 Public Policy Simulations

Following Gasparini et al. (2014), we compute several microsimulations through partial analysis (equilibrium) of different public policies. This analysis allows to review the impact of a shock or a particular policy on targeted population; we evaluate public policies related to taxes and government transfers, education, and health.

First, similarly to Mardones (2014), we review the feasibility of implementing a progressive tax rate and monetary subsidies as the tool for reducing income inequality in Chile. This policy simulation aims to reduce poverty and income inequality measured by FGT, GE, and Gini Indexes. This fiscal policy has a cost of \$0 because ti works by redistributing the income between richest and poorest people of the income distribution. We use household autonomous's income as the base case scenario, then the current and future tax burden and cash transfers are estimated to measure the changes in poverty and income inequality. We simulate an additional flat rate of 10% for the richest 99% of the income distribution, where the total amount collected is distributed evenly within the members of the poorest decile.

Second, the education policy evaluates the impact of *Free Higher Education Tuition* [5] in the MPI by analyzing changes in youth's unemployment rates. We assume that this policy should reduce the number of student age 18-23 looking for a job due to the positive relation between unemployment and enrollment, and the "relative" lower opportunity cost of higher education. Therefore, we assume a positive relation between unemployment and university enrollment, where the causality should go from $\Delta^{+}Un \rightarrow \Delta^{+}Enroll$ (Vasigh and Hamzaee, 2004). This simulation assumes that the higher enrollment in Universities should produce a decline in the Labor L because the students receiving the benefit will move out from the labor force. Moreover, this policy should produce a higher income for the first five deciles with a return to higher education of 19.5% and per capita income of US\$3,102, on average (Psacharopoulos and Patrinos, 2004). We do not perform any simulation regarding changes over income because of the strong assumptions that should have to

[5] The reform was implemented in January of 2016 and benefits those families with per capita income lower than 154,166 Chilean pesos

be taken, such as no changes in the labor markets conditions after the policy implementation. Therefore, we prefer to focus in youth unemployment rates and their impact on the MPI.

Finally, we analyze the implementation of Health Insurance with free universal coverage for all groups in the public health insurance system (FONASA) [6], evaluating the fiscal cost of this policy and its effect on the MPI through a cost-benefit analysis. We assume that the health plans covers those individuals who are self-employed and are not enrolled in any health insurance (public or private).

[6]Nowadays group C and D has to make a co-payment of 10% and 20% of the cost of medical service respectively

Chapter 4

Findings

4.1 Poverty

According to the official data (Figure A.1) Chile has been experiencing a declining trend in poverty rates since 1990. Poverty fell from 38.6% in 1990 to 7.8% in 2013. Figure A.1 shows an inverse relation between economic growth and poverty rate, suggesting that rapid growth could produce rapid poverty alleviation. The pre-Asian crisis (i.e. before 1998) shows the highest economic growth, which is coupled with the highest rates of poverty decline within the analyzed period. Poverty shows a reduction whether it is measured by the headcount index, poverty gap or squared poverty gap. The headcount index differs from the official data, showing higher levels of poverty between 2006-2013. Nevertheless, when poverty estimations are decomposed between urban and rural areas, this difference tend to disappear, but remains higher than the official figures (Table A.4). Additionally, our findings show that poverty increased during 2009, situation that is not accounted by the Ministry of Social Development. According to Table A.4, from 2006 to 2009 poverty increase in 1.5%, but then declined from 2009 to 2011 in 0.7%.

Table A.4 indicates that poverty increased from 2006 to 2009 in 1.5%, but then declined from 2009 to 2011 in 0.7. The squared poverty gap increased during 2009 but then decreased in 2011 coming back to the same levels reached in 2006. This situation may imply that the poorest persons of the income distribution did not present a revenue increase during 2009 to 2011, which could be a consequence of the relatively high unemployment rates caused by the 2009 economic crises [7]. The crisis probably produced higher unemployment on those unskilled workers who usually are located

[7] The unemployment rate reached over 10% between 2009-2010

Table 4.1: Poverty in Chile for the period 1990-2013 *

Year	Headcount Index	Poverty Gap Index	Squared Poverty Gap Index
1990	0.416	0.167	0.091
1992	0.361	0.132	0.067
1994	0.310	0.113	0.059
1996	0.263	0.093	0.047
1998	0.244	0.087	0.045
2000	0.227	0.081	0.042
2003	0.211	0.072	0.036
2006	0.157	0.050	0.024
2009	0.172	0.057	0.030
2011	0.164	0.051	0.024
2013	0.126	0.038	0.018

*Estimations without differentiating by urban and rural poverty lines.
Source: Own calculation from Casen 1990-2013

at the bottom part of the income distribution. Nevertheless, the overall trend showed by Table 4.1 and Table A.4 indicates that independently of the used measure (i.e. P_0, P_1 or P_2) poverty declined during 1990 to 2013.

4.1.1 Poverty decomposition

Regarding the evolution of poverty in urban and rural areas, Table A.4 shows that poverty has been declining in both areas; however poverty rates have remained relatively higher in rural than in urban areas. The trends in urban and rural poverty rates show a shift from 2006 to 2011 with poverty rates increasing during 2009. The latter was characterized by a period of a more moderate economic growth (see Table A.2 and Figure A.2 for further details) and higher poverty rates in urban than in rural areas, which opposes to the trend observed for the rest of the analyzed period. Similarly, the poverty gap and the squared poverty gap presented higher rural than urban poverty rates between 2006 and 2011.

Concerning decomposition by growth and distributional effect, table A.7 shows that during 1990-1996 both growth and distributional effect were significant to poverty alleviation. The headcount index between 1990 and 1992 declined in 5.7%, with growth and distributional effect accounted for

66% and 35% of the total change respectively. From 1992 to 1994 the distributional effect described 84% of the overall change while the growth effect 15%. On the other hand, the distributional effect had a negative impact on the total change on poverty for the periods of 1996-1998, 2000-2003, 2006-2009, and 2009-2011. Thus, the poverty decomposition for this latter period suggests that the decline in poverty was driven most of the time by the growth effect.

Finally, Table A.8 shows a negative relation between growth and distributional effect and poverty rates for the period of 1990-1996 and 1996-2003. On the other hand, we find a positive association between distributional effect and poverty rates during 2003-2011 while a negative relationship between growth effect and poverty rates for the same period. This situation suggests that growth effect consistently caused a decline in poverty from 1990-2011 while the distributional effects produced a decrease in poverty for some specific periods.

4.1.2 Poverty and government Transfers

Table A.6 compares the poverty rates based on total and autonomous income. On average, the effect of cash transfer on the headcount index during 1990-2013 was 0.053% at a national level while 0.051% and 0.074% in urban and rural areas respectively. This trend is also observed for the poverty gap and the squared poverty gap. The data suggests that government transfers had a higher impact on rural poverty than urban poverty, but with an overall positive impact. These findings are consistent with Contreras et al. (2001), who found that government's transfers have had a positive effect on reducing poverty levels. However, as was shown in Table A.8, from 2006 to 2011 the distributional effect had a negative impact on poverty which suggest that government transfers are an ineffective strategy for poverty alleviation.

4.2 Income Inequality

Income inequality shows a decline between the 1990 to 2013 period (A.3). However, a deeper analysis of the data shows that this decline was not constant during this period. From 1990 to 1992

income inequality shows a reduction, which is a consequence of an increase in the share of total income held by the first fourth quintiles, and reduction of the share held by the fifth. Therefore, the Lorenz curve of 1992 dominated the Lorenz curve of 1990. On the other hand, from 1992 to 1994 the first fourth quintiles reduced their share of total income, whereas the fifth quintile increased its share. This is shown by the presence of Lorenz-crossing for the 1990-2013 period. Furthermore, Figure A.3 shows the presence of Lorenz-crossing from 1990 to 1994, 1994 to 1998, 1998 to 2003, and 2009 to 2011. Thus, the period between 2003-2009 seems to be the only period which presented a decrease in income inequality in the within years analysis.

Regarding inequality indexes, data from Table 4.2 shows a reduction in the Gini Index of 0.73 point during the 1990-2013 period. However, the variation of this index is not consistent across years, with falls and rises within this periods. For example, the Gini Index declined in 0.05 between 1994 and 1996 but then increased in 0.11 by 1998. The Gini Index, the income share of $p90/p10$, and income share of $p75/p25$ show a fall from 2000 onward, which implies that income distribution became more equal during the period. However, the income share of $p99/p10$ shows that income inequality increased between 2003 and 2011. This situation suggests that Chile's high-income inequality is due to the richest 99% of the population that holds a disproportionately large share of the total income. This analysis is supported by the Table A.9, which reports a lower Gini Index when the inequality is estimated for an income distribution that excludes the richest 99%. However this number is still high for international standards. The Gini index from the truncated distribution shows a drop of 0.069 from 1990 to 2013. The Generalized entropy measure also shows a considerable decline in income inequality, but inequality rose and fell during the period such as in the year 1994 and 2011.

When income inequality is analyzed by segmenting the whole period in three sub-periods defined by average income growth of table A.2, there is Lorenz-dominance of $L_{2003-2011} \succ L_{1996-2003} \succ L_{1990-2006}$. Therefore, income distribution became more equal between 1990 to 2011 (Figure A.4). During the same period, income inequality fell for the whole period and within periods. Income inequality increased during specific periods, such as 1998 and 2000, which are years were Chile faced economic crises (i.e. Asian crises and Dot-com bubble), but then decreased for the rest of

Table 4.2: Income inequality in Chile by Households percapita income *

Year	Income share p99-p10	Income share p90-p10	Income share p75-p25	GINI
1990	39.17	11.05	3.31	0.561
1992	42.59	10.08	3.22	0.556
1994	37.33	10.62	3.34	0.557
1996	36.03	10.98	3.41	0.552
1998	37.31	11.69	3.44	0.563
2000	34.02	11.17	3.31	0.568
2003	34.79	9.85	3.16	0.550
2006	28.39	9.14	3.05	0.524
2009	23.33	8.69	2.91	0.524
2011	27.07	8.67	2.84	0.513
2013	26.22	7.98	2.76	0.488

*Adjusted Household total income

Source: Own elaboration with Casen Data

the period. Therefore, this suggests that income inequality tends to increase during periods of macroeconomic vulnerabilities.

The results from the Atkinson index for periods 1990, 2000 and 2011 (see table A.11 in the annex) present similar evidence than those from figure A.4. These results show that income inequality declined during 1990-2011, falling from 0.264 to 0.219. This trend remains unaltered at different levels of inequality sensitivity, showing a consistent decrease in income inequality across sensitivity levels. Furthermore, table A.10 also shows that income inequality decreased for both urban and rural areas from 1990 to 2011 supporting the evidence for an overall inequality reduction during this period.

4.2.1 Inequality and government Transfers

Table A.10 presents the effects of government transfer on income inequality. The effect of cash transfers on the Gini Index was on average -0.013, with a higher impact during 2009-2011. This situation shows that the consequences of government transfer on income inequality were positive but limited, which is consistent with previous studies (e.g. Palma, 2014).

4.2.2 Inequality decomposition

As is shown in Table A.13, the Generalized Entropy (GE) indexes suggest a within-group component as the primary factor that explains inequality variations. This situation is supported by both Theil's first and second measures. However, the GE shows a different trend of income inequality between urban and rural areas. The First Theil measure shows that income inequality was lower in rural areas than urban areas for most of the period while Theil second measure shows a mixed trend during the analyzed period. Theil's second index shows that income inequality was higher in rural areas than urban areas for 1990, 1992, 1998, 2000, and from 2006 to 2011.

Regarding Theil's first measure, the within-group effect explains on average 96.35% of the variation related to income inequality during the period, while the between-group component only 3.57%. This situation suggests that variations on income inequality are explained mainly by differences in income inequality within groups. The year 1994 showed a larger impact of the between-group component to explain the overall inequality. However, this element only describes 7.22% of total income inequality for this years. Similarly to Theil's first measure, the results from Theil's second method showed a large effect of the within-group component, with an average effect on income inequality of 97.2%. The between-group component explained on average only 2.81% of the total income inequality of the period. Therefore, both Theil's measures suggest that policies aiming to reduce aggregate income inequality should target first the within-group income inequality.

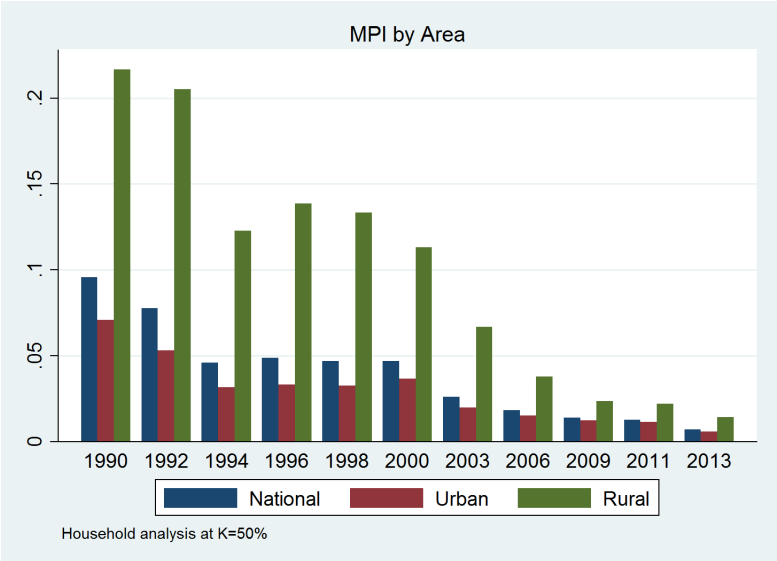
4.3 Multidimensional Poverty

The Multidimensional poverty index (MPI) shows a similar trend than income-based poverty measures. Figure 4.1 indicates that multidimensional poverty has been falling since 1990. For example, the percentage of the population deprived in at least three sub-dimension ($k = 25\%$ or deprived in at least one overall dimension) was reduced from 27.7% in 1990 to 12.5% in 2013. Additionally, the percentage of people deprived in at least six sub-dimension ($k = 50\%$) was reduced from 9.5% in 1990 to less than 1% in 2013. Finally, the percentage of the population deprived in more than six

sub-dimensions was almost negligible since the year 2000. (see figure A.7 and A.8 in the Annex). Figure 4.1 show that rural zones have had higher poverty rates than urban zones, which is consistent across different levels of poverty cutoff, whether K is equal to 1, 2 or 3. However, as is shown in figure 4.1 both urban and rural areas experienced a decline in poverty rates. Rural poverty was 39.7% in 1990 decreasing to 18.4% in 2013, whereas urban poverty decreased from 24.5% in 1990 to 11.6% in 2013.

The subgroup decomposition is shown in figure A.6). Even though rural areas incidence of poverty was higher than urban areas, its contribution to the aggregate level of poverty declined over time. Rural contribution to the overall level of multidimensional poverty in 1990 was 24.85% while for 2013 rural's contribution dropped to 19.69%. This lower contribution to the MPI over time is related to lower MPI in rural areas, but also due to a shift in the population share between urban and rural areas.

Figure 4.1: Multidimensional Poverty 1990-2013 by Area



Source: Own elaboration with Casen data

Table 4.3 indicates that poverty measured by the headcount index remained high by 2013, with

41.8% of the population deprived in at least one dimension ($k = 25\%$). However, only 1.34% of the Chilean population was needy in two or more dimensions by 2013. Nevertheless, the decreasing trend in poverty rates was coupled with an increase in the percentage of people vulnerable to fell into poverty. Indeed this percentage increased during the period from 17.9% in 1990 to 31.3% in 2013. This result reveals that a large proportion of the people that moved out of poverty were vulnerable to fall into poverty again.

Table 4.3: MPI results at national level, decomposition between H and A

Year	**MPI (HxA)**	**Percentage of poor people (H)**	**Intensity across the poor (A)**	**Vulnerable to Poverty (K=16.6%-25%)**	**In severe poverty (K=50%)**
1990	27.11%	70.80%	38.29%	17.94%	17.26%
1992	25.23%	67.92%	37.15%	18.83%	14.25%
1994	22.13%	63.90%	34.63%	20.87%	8.57%
1996	22.08%	63.39%	34.82%	21.07%	9.11%
1998	21.62%	62.13%	34.79%	21.59%	8.72%
2000	22.15%	64.18%	34.51%	21.25%	8.76%
2003	18.98%	57.84%	32.81%	26.30%	4.91%
2006	15.81%	49.82%	31.73%	29.47%	3.47%
2009	14.66%	47.11%	31.11%	29.79%	2.61%
2011	14.38%	46.69%	30.80%	30.26%	2.42%
2013	12.53%	41.88%	29.92%	31.31%	1.34%

Source: Own elaboration with Casen data

Regarding those people facing deprivation both by income and multidimensional approach, table A.16 shows that the levels of correlation between the MPI and FGT(0) were relatively small. This situation suggests that the multidimensional methodology added almost 4.5 millions of "new" poor at $k = 1$ measured by the headcount index (Table A.17). Therefore, this results provides evidence for MPI supporters who have claimed that this multidimensional poverty methodology allows tracking in more detail deprivations faced by the poor than the traditional Headcount index. Additionally, the MPI contributed with information regarding deprivations interconnections, information at different levels of decomposition, and was comparable to varying levels of K (Alkire, Sabina, 2014).

Table A.18 shows the correlations coefficients between income deprivation and the dimensions. In general, the degree of correlation with income was small for all the analyzed dimensions, health

presented the highest correlation ($\rho = 0.14$) and Dwelling Characteristics the lowest ($\rho = 0.05$). The correlation matrix shows that level of correlation between the MPI dimensions was relatively small during the period. Therefore, this situation provides evidence to support the use of a complementary methodology to measure poverty.

4.3.1 MPI decomposition

The decomposition of the MPI by gender shows that poverty rates between male and females have been equalizing over time, with practically the same levels of poverty for the years 2011 and 2013 (Figure A.9) However, the contribution of each group to the aggregate level shows that females contributed slightly more than males (Figure A.10 in the annex). The female contribution has been smoothly increasing over time due to an increase of female's population share at almost equal poverty rates between both genders.

Figure A.11 presents the poverty ordered by age ranges. The population under age 18 and young adults aged 18 to 29 showed higher levels of deprivations than adults and elders. However, poverty rates for all age groups have been decreasing since 1990. Child and young adults suffered a poverty reduction from 28.8% and 29.9% respectively in 1990 to 13.6% and 13.7% in 2013. Nevertheless, the contribution by age group to the aggregate level of poverty shows that the child group has reduce their proportion in the aggregate poverty levels while adults and elders have increased (Figure A.12 in the Annex). These results can be a consequence of the shift of Chile's demographic composition.

The race decomposition is shown in figure A.13. This chart indicates that indigenous population had a higher incidence of poverty than non-indigenous population, with deprivation rates of 16.4% and 12.2% respectively in 2013. However, deprivations levels of indigenous people have been declining from 1996 [8] with an overall reduction of 15.6% since 1996. Figure A.14 shows that contribution of indigenous people to the aggregate levels of poverty M_0, has been increasing during 1996-2013, which can be related to higher levels of multidimensional poverty, and an increment of the proportion of the indigenous population (Table A.19).

[8] Casen rounds of 1990, 1992, 1994, and 1998 do not present information related to the race of the households

The regional decomposition is shown in figure A.15. The poverty rates decreased in all regions since 1990, with poverty rates below 14% in all Chilean regions in 2013. La Araucania, Los Lagos, and Los Rios regions have been constantly the areas facing relatively higher levels of deprivation. The Metropolitan was the region with higher contribution to the aggregate levels of poverty followed by Bio-Bio, and Valparaiso, which is expected as these regions, concentrate the largest population in the country (Figure A.16).

4.3.2 Dimensional breakdown

The contribution of each dimension to the aggregate level of M_0 is shown in figure A.17. Education was the aspect having the largest contribution to the overall multidimensional poverty, followed by social security, health and living standards. Education average contribution to the aggregate level of poverty M_0 during the period was 49.4% while social security 23.4%, health 13.2%, and dwelling characteristics 13.8%.

Figure A.18 indicates that educational attainment and years of schooling are the sub-dimensions that had the largest contribution to the aggregate index, while the contribution of health insurance to overall deprivation has been diminishing, as well as access to drinking water and sanitation. The contribution of pensions to the MPI rose since 1990. These variations in dimensions contribution to the MPI could be explained by relatives changes over the respective headcount ratios $h_j(k)$ over time because the weights w_j have remained constant. Finally, the negative trend on health insurance could be related to "AUGE" health policy implemented during 2002-2003.

4.4 Multidimensional Inequality

Figure A.19 shows that the distribution of year of schooling by income quintiles has become almost as equal in the quintiles one to fourth. Furthermore, the two poorest quintiles were reaching higher levels of education since 2006, and the 75% percentile of the first two quintiles were facing similar levels of schooling than quintiles three and four. Additionally, the quintile gap, which measures

the difference of years of education of quintile one and five, shows that educational gap declined significantly since 2006. However by 2013, there was a large difference between years of schooling between quintile five and the rest quintiles. Whereas the fifth quintile presented a median of 12 years of education while the others quintiles ranged between 8 to 10 years.

Figure A.20 shows the concentration curves for years 1990, 1996, 2000, 2003, 2009, and 2013. These curves suggest small differences on schooling distribution across population ordered by income, but schooling distribution did not become more equal during the period. The concentration curves of the 90's decade show the same pattern than those from the 2000's. Similarly, the Gini index for years of schooling suggests a declining trend over time, however with periods of increasing and decreasing inequalities (Table A.20). For example, the Gini index increased between 1992 and 1994, and between 2003 and 2006, but those increases were relatively small, and the overall tendency supports a reduction of inequalities. The analysis between urban and rural areas indicates a declining trend of educational inequality for both urban and rural areas. During the 1990 - 2013 period there was an increment on years of schooling of 2 years, and the Gini index declined in 0.04. This situation suggests that even though inequality has been falling, still exist some room for making educational distribution more equal across quintiles.

Regarding Health, figure A.21 shows a reduction in inequalities measured by concentration curves. Health insurance distribution became more equal between 1990 and 1996. Indeed, since 1996 the access to health insurance has shown similar levels of access to universal health care for all the population. This situation could be related to the implementation of AUGE Health Care [9] and Fonasa A and B, which targets health assistance for the poorest sectors of the population.

Figure A.22 shows that enrollment in the retirement pension system[10] has become more equal, with wealthy and poor sectors having access to a retirement plan. However, this system does not guaranty an equitable pension amount. In this regards Table A.21, the Gini index for a social security index integrating employment condition, enrollment in the retirement system, and the amount of pension shows that inequality has remained constant ranging between 0.857 and 0.899.

[9] Universal health coverage for specific diseases such as cancer or diabetes

[10] Administradoras de Fondos (AFP) system in Chile

However, the Social Security and employment conditions shows that inequality has increased, with the Gini index growing from 0.098 to 0.108. The decomposition between urban and rural areas shows that inequality was higher in rural areas than urban areas from 1990 to 2013. These inequality differences were in the range of 0.031 on average, but the gap between urban and rural inequality decreased over time.

Figure A.23 presents the concentration curves for dwelling characteristics. Dwelling characteristics distribution became more equal over time, with poorest and richest quintiles presenting similar dwelling characteristics. The living standards index at the country level increased from 0.845 in 1990 to 0.951 in 2013, which was coupled with a reduction of the Gini index from 0.125 to 0.042 (Table A.22). These trends were found both for urban and rural areas, which could be caused by improvements in living standards due to public housing policies implemented by the government.

Table A.23 presents the results for multidimensional inequality by the Maasoumi index. Results from this index show that overall multidimensional inequality decreased at different levels of elasticity of substitution and inequality aversion. Similarly to Maasoumi results, Bourguignon index shows that overall multidimensional inequality declined at the various levels of β and ϵ (Table A.24). These suggest that inequality seems to be higher at higher levels of inequality aversion and lower elasticity substitution between attributes (column fourth Table A.24).

Both methodologies show that multidimensional inequality significantly declined during 1990-2013. Nevertheless, multidimensional inequality increased between 1994-1996. The trends for some particular specification of Maasoumi Atkinson index and Bourguignon index show that between 1990 and 1994 multidimensional inequality declined in three of the fourth specification (Figure A.23). Then, from 1994 to 1996 there was a slight increase. After 1996 multidimensional inequality continuously declined, showing low levels ranging between 0.1 and 0.07. Hence, these two approaches show that consistently with multidimensional poverty, multidimensional inequality has been falling as well.

4.5 Policy Simulations

The tax reform simulations are shown in figures A.25 and A.26, with a tax flat rate of 10% over the percentile 99 of the income distribution. This fiscal policy simulation slightly reduced the aggregate poverty (measured by the headcount index) but had a significant impact on the poverty gap and the squared poverty gap. The fiscal policy simulation had a larger impact on rural than in urban areas. Furthermore, table A.26 shows that the tax policy was able to reduce the aggregate levels of income inequality from 1990-1998. Similarly, the fiscal policy caused a fall of income inequality in rural areas that could be explained by the government transfers.

This situation suggests that the structure of the tax reform matters. A more progressive tax reform could be useful only if can target those groups more deprived. Moreover, the opportunity cost of this policy is an additional factor that needs to be taken into account, which is particularly relevant for Chile as the country already implemented a progressive tax structure, with richer people facing tax rates around 40%.

Thus, even though this policy simulation reduced aggregate poverty, and poverty and income inequality in rural areas, the overall effect could be considered not important. This result is consistent with previous findings, showing that tax reform and social programs are not efficient to reduce poverty and income inequality (Borzutzky, 2012). However or results lack a General equilibrium analysis and the effects of higher taxes on labor market conditions, savings, and investments. Therefore, it is likely that a higher tax rate could produce a decline in wages, and a contraction of private inversion (Mardones-Poblete, 2011). This dynamic was left constant under this analysis.

The education policy simulation had an effect on the MPI reducing deprivation on young employment. Figure A.25 shows that the levels of deprivations were lower in the scenario with the policy than without the policy. The M_0 declined on average in 0.32% at the national scale, 0.34% for urban areas and 0.23% for rural areas. Additionally, the subgroup contribution to aggregate levels of poverty changed (Figure A.26). This shift was explained mainly by the relatively higher M_0. Although the policy had a positive impact, the changes on M_0 and D_0 due to the policy may be

considered small every time that the fiscal cost per year of the educational plan was around 402.71 million dollars (Salas et al., 2014). Hence, from a policy perspective this policy did not have a significant impact on reducing multidimensional poverty, however in the long term should have a positive impact on income and years of schooling.

Finally, the analysis for the FONASA policy simulation is more straightforward because this plan aims to reduce the co-payment made by families with Fonasa C and D, from 10% and 20% [11] respectively to $0. As is shown in figure A.27 the policy had an important impact on years 1990 and 1992. Then from 1994 to 2013 the policy had a moderate effect on poverty. The differences in poverty rates between the base scenario and the policy scenario were 5.35% between 1990 to 1992, but then decreased to 1.69% between 1994 to 2013.

Regarding decomposition between urban and rural areas, Figure A.28 shows that urban contribution to aggregate levels increased while rural contribution decreased. Although there was a significant impact on poverty, the high expected fiscal cost per year of $4,708,000,000$[12] makes difficult to implement the policy due its high opportunity cost. Regarding the cost-benefit analysis, this plan presents "red" numbers when analyzing the impact on multidimensional poverty.

[11] AUGE diseases are covered 100% by the government on public hospitals

[12] Estimation based on the annual health benefits and the cost of those. Furthermore, this is associated with 10.95% of the population on Fonasa C, and 7.3% in Fonasa D, and median of 19 health benefit per person, and cost per benefit of US80 on average. This cost is estimated related to public hospital or institution.

4.6 Limitations

As was mentioned in chapter two, incomes from CASEN survey are submitted to corrections of the ECLAC to entrust them. Therefore, some authors have argued that income adjustments could affect revenues from the job, government transfers, and implicit rent. Although these corrections could generate a bias, the methodology used to perform those adjustment has not changed over time (Contreras, 2003). However, even though we were aware that income levels can be affected by these corrections and the highest wages of the income distribution are not reflected in CASEN (Bravo and Valderrama, 2011), we considered that this situation had a small impact in our study, because we focused mainly on the rate of changes. Hence, the results reported in this study should be able to grasp an accurate picture of the evolution of these measures from 1990 to 2013.

Chapter 5

Conclusion

The first goal of this study was to contribute to current knowledge by updating and complementing previous research related to poverty and inequality in Chile. The second was to suggest a multidimensional inequality index to conduct along with the newly adopted Multidimensional Poverty Index. Finally, the third goal was to determine the advantage of using the MPI and the income-based approaches to test the effectiveness of analyzed public policies.

Our results show that poverty measurements show a decline in both income and multidimensional approach, with a substantial decrease during periods of high economic growth. In addition, poverty decomposition suggests that poverty declined during 1990-2006 by both an increase in income and because income distribution became more equal while during 2006-2013 mainly by growth effect. Regarding income inequality, we found similar results to those of previous researchers who report mixed trends of inequality during 1990-2013. Income inequality experienced an overall decrease from 1990-2001, but Lorenz curves were crossing within the analyzed period. The inequality decomposition shows a within-group inequality as the primary factor to explain the overall income inequality while between-group inequality was relatively small. This situation suggests that public policies should focus on within-group (urban-urban or rural-rural) inequality to reduce overall income inequality.

Also, the newly adopted Multidimensional Poverty Index added almost 4.5 million of "new poor" to the traditional measures used by the Chilean government to track poverty (Headcount index). This result suggests that the MPI allowed to understand poverty in more detail than the traditional income measures, and establish a new baseline to talk about poverty. Furthermore, the low levels of correlation between income and the selected dimensions, suggest that incorporating the MPI to

complement poverty measures is a useful approach to determine overall poverty condition in Chile.

Further studies should consider the possibility of incorporating income as an MPI dimension and analyze the outcomes at several levels of poverty (k), weights (w), and different cutoff (z) for each particular dimension. For example, in the present study Education was the aspect that had the largest contribution to the aggregate levels of M_0, followed by Social Security, Health, and Dwelling characteristics. Therefore, policies aimed to increase the levels of educational attainment and years of schooling could be an effective strategy to alleviate overall levels of poverty. However, these policies will have a long-term effect because these dimensions are highly associated with a population that already moved to the labor force. Therefore, the policies should aim the population that are currently studying at schools and increase their likelihood to reach the education cutoff.

Chile should adopt a multidimensional attribute approach to be used along with the MPI. A multidimensional inequality approach focuses on an individual attribute and multiple attributes and provides robust results for estimating multidimensional inequality. Maasoumi and Bourguignon's indexes allow setting different levels of elasticity of substitution β and inequality aversion ϵ that could be useful for analyzing the evolution of inequality over time and by the various dimensions included in the MPI. Future studies may also focus on analyzing multidimensional inequality by decomposing between urban and rural areas, every time that these type of indexes are defined under GE family of measures. Information from these analyses could provide insightful geographical information for prioritizing fiscal resources.

Finally, the microsimulations offer an insightful analysis, suggesting that a multidimensional scope can be a useful tool for targeting public policies. However, the applicability of the analysis will depend on the objectives of each policy and the assumptions taken. Nevertheless, the decomposition structure of the MPI could be useful for analyzing different aspects of public policies that could affect incomes and several dimensions of the index.

The possibility to decompose by gender, race, age ranges, or municipalities allow to analyze the efficiency of the newly implemented *Registro Social de Hogares* and the former *Ficha de Proteccion Social* and *CAS* to target public policies. These forms have been used by the Ministry of Social

Development since 1987, but experts have criticized them because these surveys have excluded poor people from social programs benefits while some nonpoor people have been benefited. Hence, the MPI and the Multidimensional inequality index could be used to analyze the *Registro Social de Hogares* as a mechanism to target poverty alleviation and inequality policies, and also its impact by comparing it to the former mechanisms for targeting social policies.

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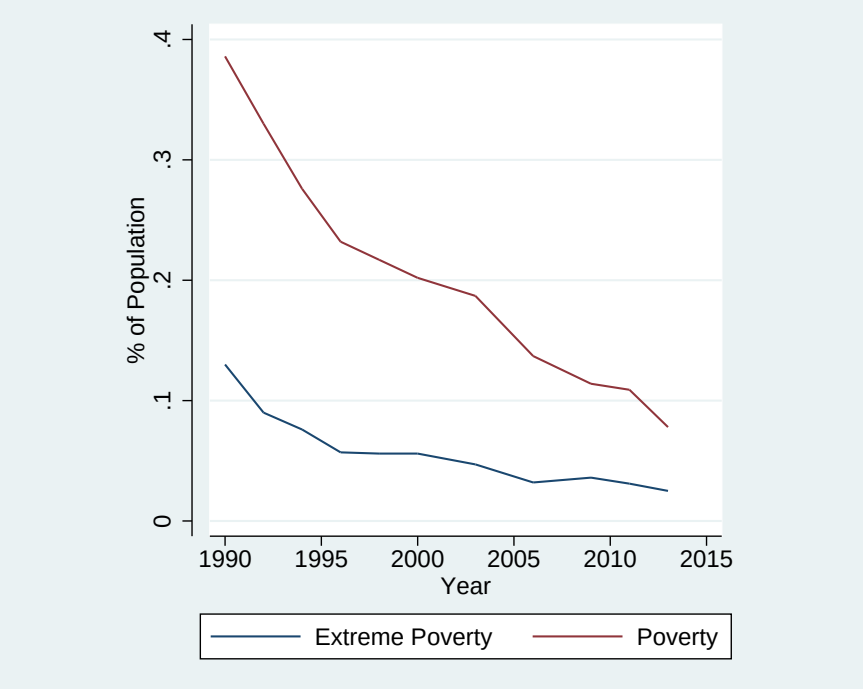
Appendix A

Annex

A.1 Past evidence

Figure A.1: Poverty trends 1990-2013



Source: MDS with Casen and CEPAL information

Table A.1: Poverty lines from 1990-2013 by Zone*

Poverty Line											
Year	1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013
Urban	18,594	25,750	30,100	34,272	37,889	40,562	43,712	47,099	64,134	72,098	79,450
Rural	12,538	17,362	20,295	23,108	25,546	27,328	29,473	31,756	43,242	48,613	53,569
Indigence Line											
Year	1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013
Urban	9,297	12,875	15,050	17,136	18,944	20,281	21,856	23,549	32,067	36,049	39,725
Rural	7,164	9,921	11,597	13,204	14,598	15,616	16,842	18,146	24,710	27,778	30,611

*Prices on Chilean pesos for November of each year

Source: Ministry of Social Development

Table A.2: GDP Average Growth and Poverty , 1990-2013

	$\Delta 1990-1996$	$\Delta 1996-2003$	$\Delta 2003-2011$
Headcount Index	-15.4%	-4.5%	-2.8%
GDP average	7.3%	4.8%	3.1%

Source: World Bank IBRD-IDA

Table A.3: Income distribution in Chile by Quantile, 1990-2013

Year	1st Q	2nd Q	3rd Q	4th Q	5th Q
1990	3.36	6.56	10.32	17.30	62.46
1992	3.85	7.17	10.98	17.86	60.14
1994	3.46	6.73	10.59	17.73	61.50
1996	3.65	7.06	10.97	18.22	60.10
1998	3.51	6.94	10.85	18.02	60.68
2000	3.68	7.06	10.93	17.79	60.55
2003	3.82	7.24	11.07	17.74	60.12
2006	4.24	7.86	11.81	18.65	57.43
2009	4.30	7.95	11.74	18.33	57.68
2011	4.52	8.20	11.86	18.42	56.99
2013	4.63	8.29	12.05	18.33	56.69

Source: World Bank IBRD-IDA

A.2 Multidimensional Poverty Cutoff

A. Education

1. Educational Attainment
   - Household's member within age $4-18$ is deprived if he/she is not attending to school and has not graduated yet.
   - Household's member within age $6-26$ is deprived if he/she has not attended to school for an extended period(permanent absence).
2. Educational Underachievement
   - Household's member 21 years old or younger is deprived if he/she is at least two years below his/her corresponding school level.
3. Years of Schooling
   - Household's member 18 years or older is deprived if has not met the minimum years of schooling. This means that Household's member is deprived if $Schooling < 12$

B. Health

1. Malnourished[1]
   - Household's member within age $0-6$ is deprived if they are malnourished. This means that child will be deprived if $weight \leq -2\ S.D.$
   - Household's member older than 6 years old will be malnourished if $Adult_{bmi} < 18.5$
2. Health System Coverage
   - Household's member is deprived if does not have any health insurance, neither public or private (Fonasa o Isapre) or any other private insurance.
3. Health System Usage
   - Household's member is deprived if he/she suffered a problem in the last 3 months and did not receive treatment, or
   - Household's member is deprived if he/she in the last 12 months has been receiving health treatment but have not been covered by the health system's warranty.

C. Social Security

1. Unemployment
   - Household's member older than 18 years old is deprived if unemployed and is looking for a job, and he/she is not studying.
2. Social Security
   - Household's members older than 15 years old is deprived if he/she is working but is not subscribed to a retirement plan.
3. Retirement System
   - Household's members older than 60 years old for women or 65 years old for men is deprived if he/she does not receive any income from his/her retirement saving or any other income such as rent, dividends, or interests.

D. Dwelling Characteristics

1. Overcrowding
   - The household will be deprived if the Household's members sharing a room is higher than 2.5 on average per room in the household.
2. House Components

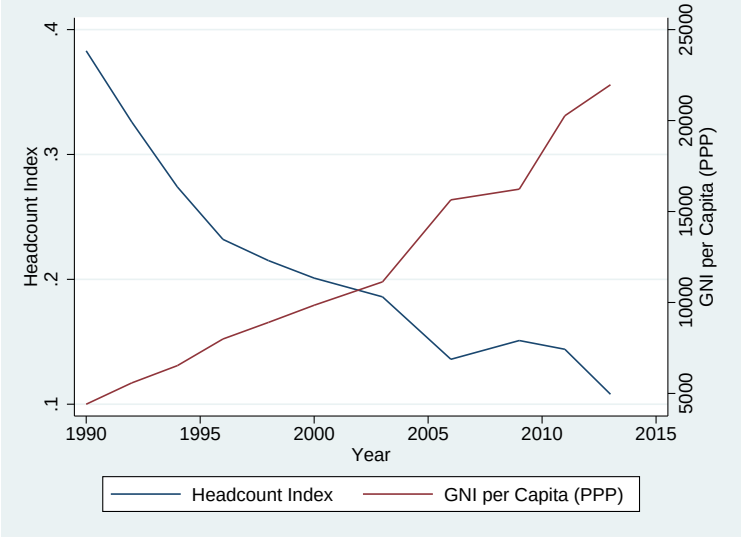
[1]These are standards suggested by World Health Organization

- The household is deprived if house's floor, walls, or roof are in bad shape. or
- The household is deprived if house's floor, walls, or roof present low-quality materials.

3. Drinking water and Sanitation
   - The household is deprived if house does not have access to a high-quality source of drinking water, or
   - The Household is deprived if the house does not have access to sewer.

A.3 Figures and Tables

Figure A.2: Poverty and Gross National Income evolution



Source: Own elaboration with World Bank IBRD-IDA and Casen Data

Table A.4: Poverty in Chile 1990-2013 by Zone*

Year	Zone	FGT0	FGT1	FGT2
1990	Country	0.383	0.148	0.079
	Urban	0.382	0.148	0.079
	Rural	0.386	0.147	0.080
1992	Country	0.326	0.114	0.056
	Urban	0.324	0.115	0.057
	Rural	0.337	0.111	0.052
1994	Country	0.274	0.097	0.049
	Urban	0.268	0.095	0.049
	Rural	0.308	0.103	0.051
1996	Country	0.232	0.078	0.038
	Urban	0.219	0.074	0.036
	Rural	0.303	0.101	0.049
1998	Country	0.215	0.074	0.037
	Urban	0.205	0.071	0.036
	Rural	0.274	0.090	0.043
2000	Country	0.201	0.069	0.036
	Urban	0.195	0.067	0.035
	Rural	0.237	0.082	0.043
2003	Country	0.186	0.062	0.031
	Urban	0.184	0.062	0.031
	Rural	0.199	0.064	0.032
2006	Country	0.136	0.043	0.021
	Urban	0.139	0.044	0.021
	Rural	0.122	0.038	0.019
2009	Country	0.151	0.050	0.026
	Urban	0.154	0.051	0.027
	Rural	0.129	0.046	0.025
2011	Country	0.144	0.045	0.021
	Urban	0.149	0.046	0.022
	Rural	0.107	0.035	0.018
2013	Country	0.108	0.033	0.015
	Urban	0.107	0.031	0.014
	Rural	0.115	0.043	0.023

*Estimations based on percapita Household income

Source: Own elaboration with Casen Data

Table A.5: Poverty in Chile 1990-2013 by Zone and Autonomous Income *

Year	Zone	FGT0	FGT1	FGT2
1990	Country	0.437	0.184	0.105
	Urban	0.438	0.185	0.105
	Rural	0.435	0.180	0.105
1992	Country	0.378	0.148	0.080
	Urban	0.375	0.148	0.080
	Rural	0.391	0.146	0.077
1994	Country	0.323	0.126	0.070
	Urban	0.313	0.123	0.069
	Rural	0.374	0.140	0.076
1996	Country	0.287	0.108	0.059
	Urban	0.272	0.101	0.055
	Rural	0.373	0.146	0.081
1998	Country	0.269	0.107	0.061
	Urban	0.255	0.100	0.057
	Rural	0.358	0.148	0.087
2000	Country	0.257	0.100	0.058
	Urban	0.249	0.096	0.055
	Rural	0.309	0.126	0.075
2003	Country	0.243	0.094	0.055
	Urban	0.236	0.090	0.052
	Rural	0.290	0.122	0.075
2006	Country	0.187	0.071	0.042
	Urban	0.185	0.069	0.040
	Rural	0.202	0.088	0.058
2009	Country	0.222	0.093	0.059
	Urban	0.220	0.089	0.056
	Rural	0.238	0.117	0.085
2011	Country	0.208	0.082	0.050
	Urban	0.210	0.081	0.047
	Rural	0.197	0.094	0.066
2013	Country	0.138	0.046	0.023
	Urban	0.135	0.043	0.021
	Rural	0.155	0.062	0.038

*Estimations based on percapita Household income

Source: Own elaboration with Casen Data

Table A.6: Transfers effects over Poverty of Total and Autonomous Income *

Year	Zone	Δ FGT0	Δ FGT1	Δ FGT2
1990	Country	-0.054	-0.036	-0.026
	Urban	-0.056	-0.037	-0.026
	Rural	-0.049	-0.033	-0.025
1992	Country	-0.052	-0.034	-0.024
	Urban	-0.051	-0.033	-0.023
	Rural	-0.054	-0.035	-0.025
1994	Country	-0.049	-0.029	-0.021
	Urban	-0.045	-0.028	-0.020
	Rural	-0.066	-0.037	-0.025
1996	Country	-0.055	-0.030	-0.021
	Urban	-0.053	-0.027	-0.019
	Rural	-0.070	-0.045	-0.032
1998	Country	-0.054	-0.033	-0.024
	Urban	-0.050	-0.029	-0.021
	Rural	-0.084	-0.058	-0.044
2000	Country	-0.056	-0.031	-0.022
	Urban	-0.054	-0.029	-0.020
	Rural	-0.072	-0.044	-0.032
2003	Country	-0.057	-0.032	-0.024
	Urban	-0.052	-0.028	-0.021
	Rural	-0.091	-0.058	-0.043
2006	Country	-0.051	-0.028	-0.021
	Urban	-0.046	-0.025	-0.019
	Rural	-0.080	-0.050	-0.039
2009	Country	-0.071	-0.043	-0.033
	Urban	-0.066	-0.038	-0.029
	Rural	-0.109	-0.071	-0.060
2011	Country	-0.064	-0.037	-0.029
	Urban	-0.061	-0.035	-0.025
	Rural	-0.090	-0.059	-0.048
2013	Country	-0.030	-0.013	-0.008
	Urban	-0.028	-0.012	-0.007
	Rural	-0.040	-0.019	-0.015

*Estimations based on percapita Household income

Source: Own elaboration with Casen Data

Table A.7: Poverty Decomposition*

	1990%	1992%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	38.34	32.62	-5.71	-3.81	-2.04	0.14
Poverty Gap	14.83	11.48	-3.35	-1.75	-1.61	0.01

	1992%	1994%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	32.62	27.47	-5.15	-0.68	-4.35	-0.11
Poverty Gap	11.48	9.70	-1.77	-0.31	-1.50	0.04

	1994%	1996%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	27.47	23.08	-4.38	-3.57	-1.09	0.28
Poverty Gap	9.70	7.81	1.89	-1.42	-0.48	0.01

	1996%	1998%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	23.08	21.56	-1.51	-3.00	1.44	0.04
Poverty Gap	7.81	7.44	-0.37	-1.17	0.83	-0.03

	1998%	2000%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	21.56	20.11	-1.45	-1.32	-0.10	-0.02
Poverty Gap	7.44	6.97	-0.47	-0.49	0.18	0.05

	2000%	2003%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	20.11	18.57	-1.53	1.07	-2.48	-0.12
Poverty Gap	6.97	6.26	-0.70	0.38	-1.05	-0.04

	2003%	2006%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	18.57	13.68	-4.88	-3.19	-1.55	-0.13
Poverty Gap	6.26	4.34	-1.92	-1.17	-0.84	0.09

	2006%	2009%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	13.68	15.11	1.42	-2.59	4.58	-0.56
Poverty Gap	4.34	5.06	0.72	-0.81	1.78	-0.25

	2009%	2011%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	15.11	14.42	-0.68	-1.66	1.09	-0.11
Poverty Gap	5.06	4.51	-0.55	-0.52	0.03	-0.06

	2011%	2013%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	14.42	10.88	-3.54	-2.95	-0.45	-0.14
Poverty Gap	4.51	3.33	-1.17	-0.96	-0.24	0.034

*Estimations based in real per capita income and results are shown over the base year

Source: Own elaboration with Casen Data

Table A.8: Poverty Decomposition by 1990, 1996, 2003, and 2011 *

	1990%	1996%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	38.34	23.08	-15.26	-8.42	-7.77	0.93
Poverty Gap	14.83	7.81	-7.02	-3.78	-3.89	0.65

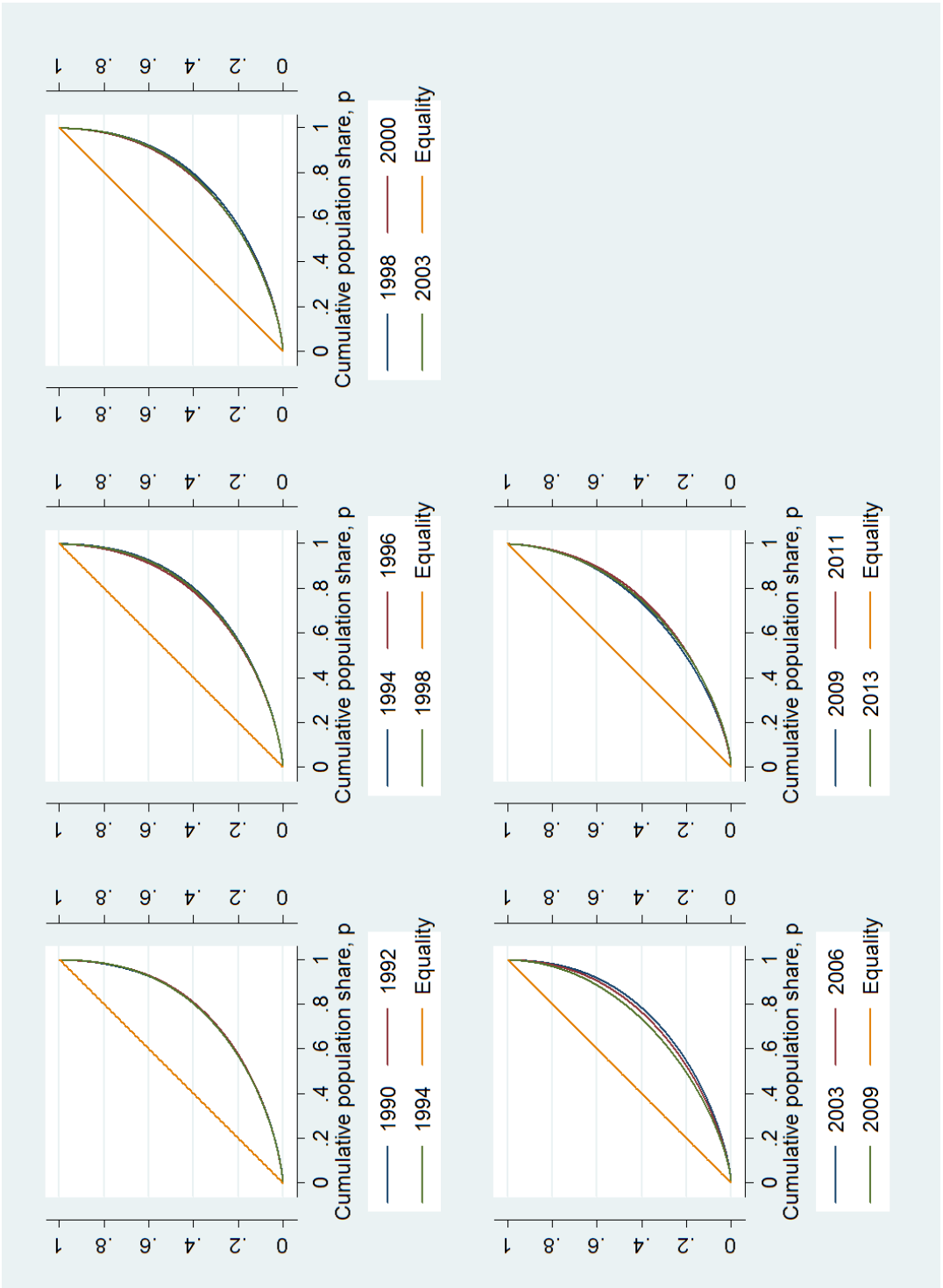
	1996%	2003%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	23.08	18.57	-4.50	-3.27	-1.15	-0.07
Poverty Gap	7.81	6.26	-1.55	-1.27	-0.36	0.07

	2003%	2011%	Total Change	Growth Effect	Distribution Effect	Residual
Headcount Index	18.57	14.42	-4.14	-7.35	5.55	-2.34
Poverty Gap	6.26	4.51	-1.75	-2.51	1.54	-0.79

*Estimations based in real per capita income and results are shown over the base year

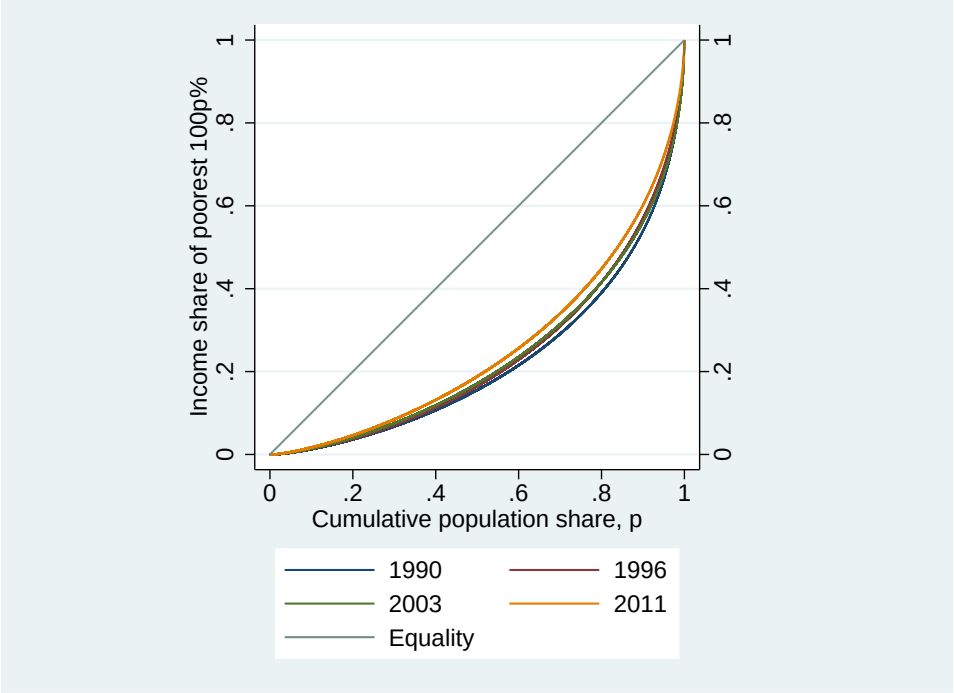
Source: Own elaboration with Casen Data

Figure A.3: Lorenz Curve for 1990-2013



Source: Own calculation with Casen Data

Figure A.4: Inequality Comparisons: 1990, 1996, 2003, and 2011



Source: Own calculation with Casen survey information

Table A.9: Income inequality in Chile with truncated income distribution*

Year	GE(0)	GE(1)	Gini
1990	0.438	0.454	0.497
1992	0.418	0.442	0.490
1994	0.423	0.447	0.491
1996	0.411	0.419	0.482
1998	0.405	0.416	0.479
2000	0.397	0.405	0.472
2003	0.380	0.395	0.465
2006	0.339	0.345	0.440
2009	0.305	0.303	0.414
2011	0.308	0.305	0.421
2013	0.335	0.316	0.428

*Truncated analysis of income distribution at historically 99%

Source: Own elaboration with Casen Data

Table A.10: Income inequality in Chile by Zones and sensitivity to inequality*

Year	Zone	A(0.5)	A(1)	A(2)
1990	All	0.264	0.432	0.678
1990	Urban	0.244	0.404	0.648
1990	Rural	0.296	0.455	0.662
2000	All	0.234	0.388	0.620
2000	Urban	0.225	0.377	0.617
2000	Rural	0.230	0.372	0.590
2011	All	0.219	0.367	0.574
2011	Urban	0.198	0.337	0.551
2011	Rural	0.204	0.335	0.536

*Analysis by zone does not include the weights

Source: Own elaboration with Casen Data

Table A.11: Income inequality in Chile without government transfers

Year	Income share p90-p10	Income share p75-p25	GINI	$\Delta\ Gini_{tot-aut}$ *
1990	10.22	3.30	0.572	-0.011
1992	9.47	3.26	0.567	-0.011
1994	10.08	3.34	0.569	-0.012
1996	10.28	3.31	0.557	-0.005
1998	10.51	3.31	0.578	-0.015
2000	9.66	3.14	0.583	-0.015
2003	9.18	3.11	0.566	-0.016
2006	9.01	3.04	0.539	-0.015
2009	8.68	3.03	0.545	-0.021
2011	8.47	2.98	0.534	-0.021
2013	7.80	2.85	0.495	-0.007

*Comparing Total Income with autonomous Income

Source: Own elaboration with Casen Data

Table A.12: Income inequality in Chile by HHs earnings

Year	Income share p90-p10	Income share p75-p25	GINI
1990	9.69	3.51	0.545
1992	10.39	3.54	0.556
1994	10.57	3.63	0.552
1996	11.61	3.33	0.548
1998	11.16	3.44	0.547
2000	10.06	3.32	0.552
2003	9.70	3.40	0.543
2006	9.16	3.22	0.511
2009	7.96	3.18	0.502
2011	7.99	3.18	0.504
2013	8.00	2.10	0.471

Table A.13: Inequality descomposition 1990-2013 by subgroup k*

Year	Zone	$GE(0)$	$GE_W(0)$	$GE_B(0)$	$GE(1)$	$GE_W(1)$	$GE_W(1)$
	Country	0.548	0.543	0.005	0.673	0.668	0.004
1990	Urban	0.518	-	-	0.618	-	-
	Rural	0.607	-	-	0.831	-	-
	Country	0.548	0.523	0.025	0.687	0.663	0.023
1992	Urban	0.544	-	-	0.661	-	-
	Rural	0.483	-	-	0.671	-	-
	Country	0.540	0.501	0.039	0.756	0.719	0.036
1994	Urban	0.540	-	-	0.764	-	-
	Rural	0.434	-	-	0.582	-	-
	Country	0.499	0.472	0.026	0.589	0.565	0.024
1996	Urban	0.486	-	-	0.569	-	-
	Rural	0.434	-	-	0.548	-	-
	Country	0.525	0.502	0.022	0.662	0.640	0.021
1998	Urban	0.519	-	-	0.631	-	-
	Rural	0.462	-	-	0.675	-	-
	Country	0.491	0.471	0.020	0.609	0.589	0.019
2000	Urban	0.474	-	-	0.570	-	-
	Rural	0.466	-	-	0.632	-	-
	Country	0.494	0.473	0.021	0.638	0.617	0.020
2003	Urban	0.498	-	-	0.629	-	-
	Rural	0.432	-	-	0.588	-	-
	Country	0.443	0.432	0.011	0.556	0.545	0.011
2006	Urban	0.432	-	-	0.526	-	-
	Rural	0.431	-	-	0.586	-	-
	Country	0.383	0.374	0.008	0.454	0.445	0.008
2009	Urban	0.380	-	-	0.445	-	-
	Rural	0.362	-	-	0.447	-	-
	Country	0.418	0.411	0.007	0.497	0.490	0.006
2011	Urban	0.412	-	-	0.482	-	-
	Rural	0.408	-	-	0.534	-	-
	Country	0.418	0.406	0.011	0.462	0.451	0.010
2013	Urban	0.403	-	-	0.448	-	-
	Rural	0.416	-	-	0.467	-	-

*Estimations based on percapita Household income

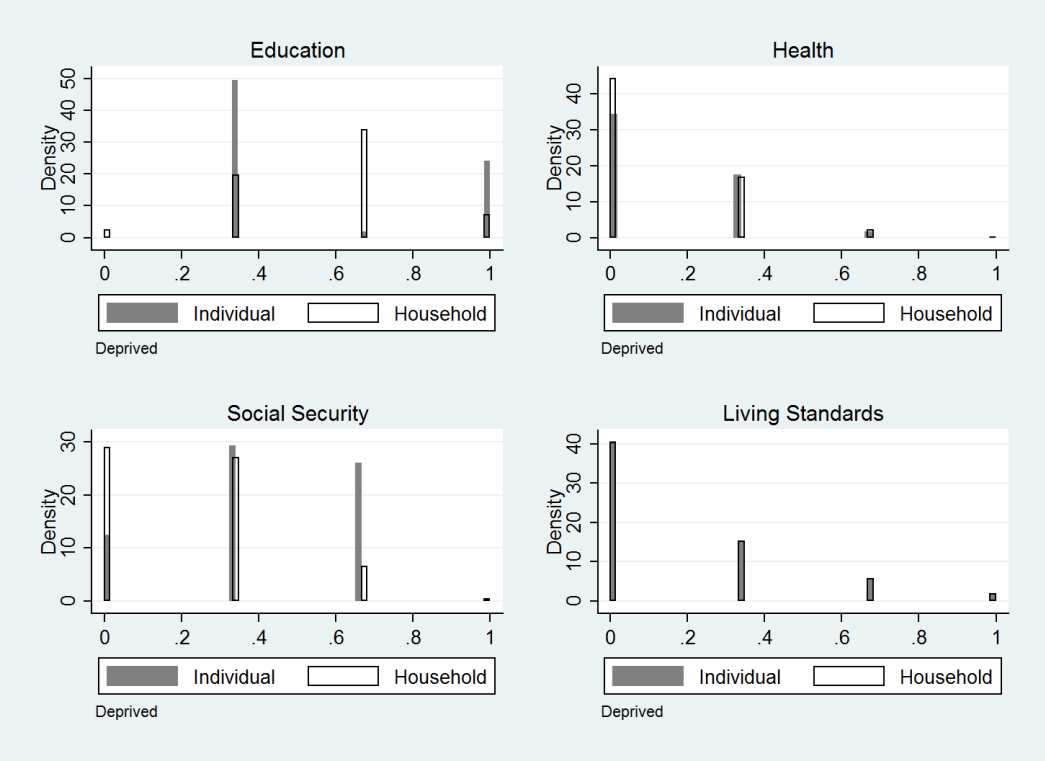
Source: Own elaboration with Casen Data

Table A.14: Summary statistics of Household dimensions, 1990-2013

Variable	Observations	Mean	Std. Dev.	Min.	Max.
HH_depattend	2193743	0.814	0.389	0	1
HH_lagschool	2193743	0.114	0.318	0	1
HH_notgraduated	2193743	0.797	0.402	0	1
HH_malnourished	2193743	0.076	0.265	0	1
HH_Health_ins	2193743	0.186	0.389	0	1
HH_healthaccess	2193743	0.072	0.258	0	1
HH_Unemployment	2193743	0.114	0.318	0	1
HH_LifeIns	2193743	0.327	0.469	0	1
HH_RetInc	2193743	0.216	0.411	0	1
HH_Room	2193743	0.149	0.356	0	1
HH_HouseCon	2193743	0.105	0.306	0	1
HH_BasicFacilities	2193743	0.252	0.434	0	1

Source: Own elaboration with Casen Data

Figure A.5: Multidimensional Poverty Dimensions 1990-2013



Source: Own elaboration with Casen data

Table A.15: Percentage of population deprived by Sub-Dimension and Years *

Year	S Attend	S lag	Schooling	Malnour	H Ins	H warr	Unemploy	SocialS	Pension	Overcrowding	House	Facilities
1990	86.03%	17.49%	84.03%	11.79%	53.60%	9.74%	11.23%	39.55%	10.36%	9.85%	14.97%	40.66%
1992	83.86%	18.62%	85.17%	9.86%	55.27%	2.96%	7.79%	44.38%	17.13%	9.53%	14.17%	39.70%
1994	82.68%	17.68%	84.87%	6.54%	14.01%	5.23%	9.21%	44.75%	17.87%	24.73%	15.45%	38.20%
1996	84.97%	14.97%	83.21%	8.42%	21.64%	3.00%	8.93%	44.63%	17.24%	25.38%	11.05%	30.51%
1998	84.35%	14.05%	82.65%	7.62%	22.50%	2.75%	13.96%	45.61%	18.33%	21.92%	11.37%	30.07%
2000	83.33%	13.33%	83.78%	7.50%	20.94%	13.91%	13.83%	48.50%	17.71%	19.86%	11.69%	33.92%
2003	82.51%	10.31%	82.20%	6.94%	15.67%	13.69%	13.00%	29.29%	20.74%	16.64%	10.02%	27.96%
2006	80.76%	8.33%	81.33%	5.39%	12.09%	4.58%	9.74%	25.98%	23.38%	12.56%	10.56%	20.96%
2009	77.83%	7.77%	78.52%	6.82%	7.48%	7.54%	13.75%	15.73%	28.64%	9.94%	10.09%	14.87%
2011	78.61%	6.90%	69.82%	8.60%	7.59%	6.21%	10.68%	18.98%	27.61%	8.41%	6.00%	10.57%
2013	75.78%	5.43%	65.67%	7.96%	7.21%	4.85%	10.53%	19.23%	28.22%	6.99%	4.13%2	7.17%
Total	81.42%	11.43%	79.68%	7.59%	18.56%	7.17%	11.42%	32.70%	21.59%	14.90%	10.46%	25.20%

*Dimensions at Household levels

Source: Own elaboration with Casen information

Table A.16: Correlation of Headcount index and MPI

Year	ρ	$FGT(0)$	MPI(H)	Pop.
1990	0.232*	38.3%	70.8%	12,957,503
1992	0.213*	32.6%	67.9%	13,458,623
1994	0.226*	27.4%	63.9%	13,894,631
1996	0.206*	23.2%	63.4%	14,386,031
1998	0.195*	21.5%	62.1%	14,765,419
2000	0.179*	20.1%	64.2%	15,112,659
2003	0.162*	18.6%	57.8%	16,639,785
2006	0.150*	13.6%	49.8%	16,152,353
2009	0.144*	15.1%	47.1%	16,607,007
2011	0.142*	14.4%	46.7%	16,962,515
2013	0.196*	10.8%	41.9%	17,273,117

Note: MPI counted as headcount index by K=1
* 99% of significance.
Source: Own elaboration with Casen Data

Table A.17: Distribution of Poor People by methodology, Headcount Index and MPI*

Methodology	1990	1992	1994	1996	1998	2000	2003	2006	2009	2011	2013
FTG(0)-MPI(H)	42.62%	36.62%	33.05%	28.22%	27.46%	25.35%	22.99%	18.51%	19.33%	18.43%	23.41%
FTG(0)	7.48%	7.71%	6.95%	6.00%	5.38%	4.56%	6.91%	7.03%	9.65%	9.52%	14.10%
MPI(H)	49.90%	55.67%	60.00%	65.78%	67.16%	70.09%	70.10%	74.46%	71.02%	72.04%	62.49%

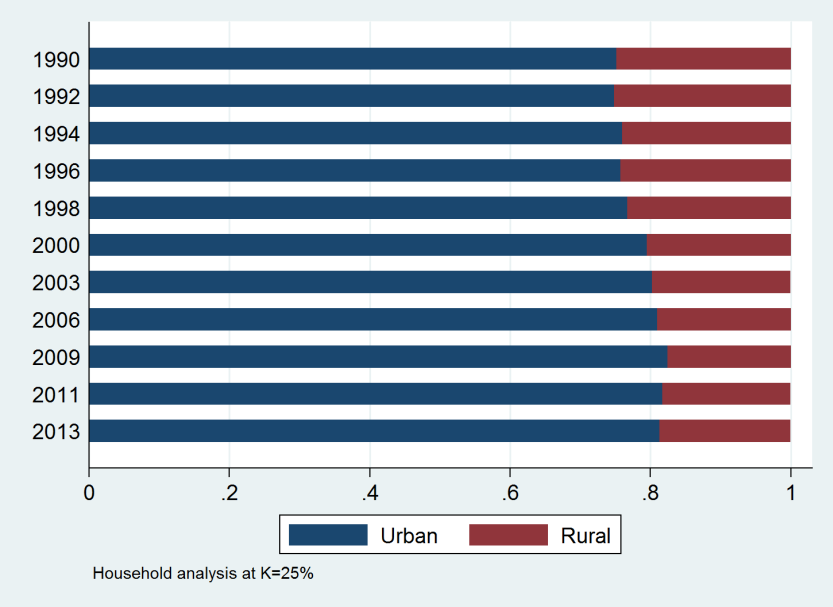
*MPI estimated by Headcount index
Source: Own elaboration with Casen

Table A.18: Correlation Matrix between income and MPI dimensions

	Income	Education	Health	Social Security	Dwelling Characteristics
Income	1				
Education	0.0968*	1			
Health	0.1376*	0.1308*	1		
Social Security	0.0550*	0.2657*	0.1094*	1	
Living Standards	0.0509*	0.2295*	0.0479*	0.2557*	1

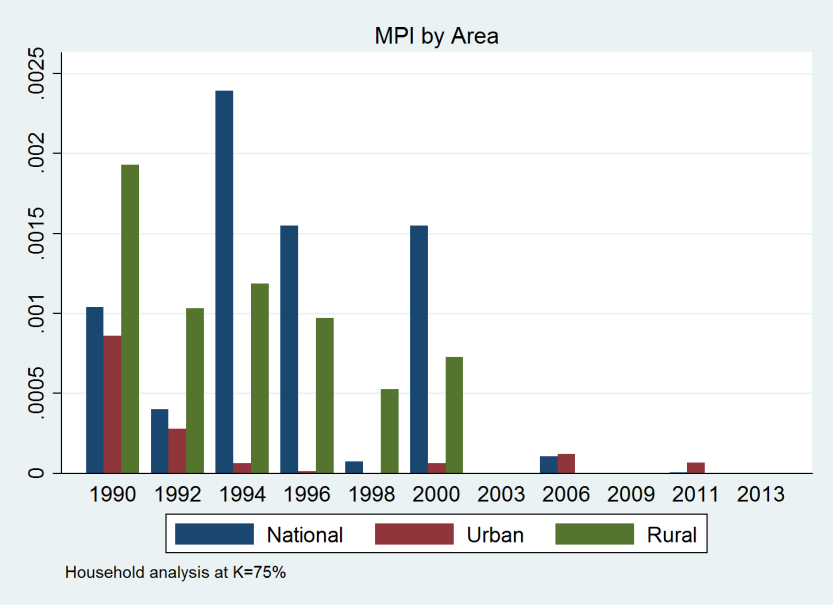
* Significance at 99% of confident
Source: Own elaboration with Casen

Figure A.6: M_0 decomposition by subgroup, Urban and Rural



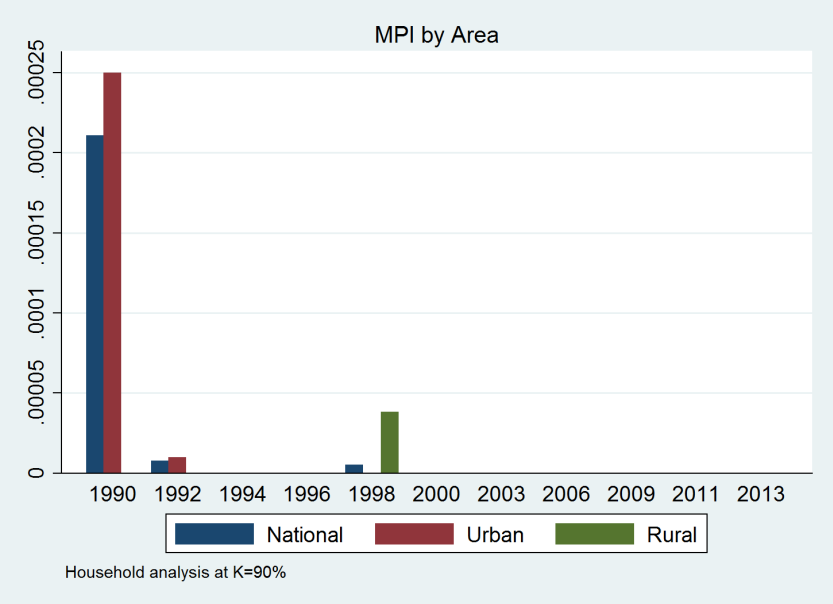
Source: Own elaboration with Casen data

Figure A.7: Multidimensional Poverty 1990-2013 by Zone



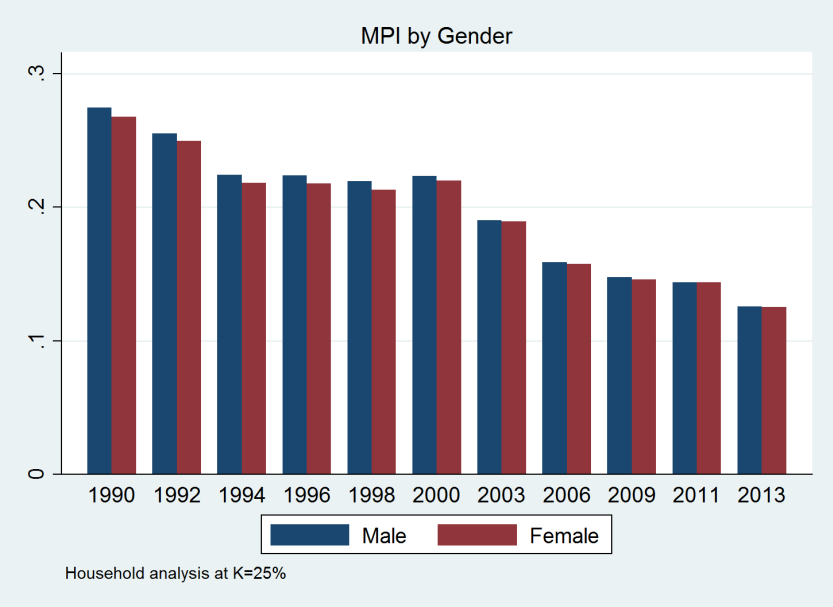
Source: Own elaboration with Casen data

Figure A.8: Multidimensional Poverty 1990-2013 by Zone



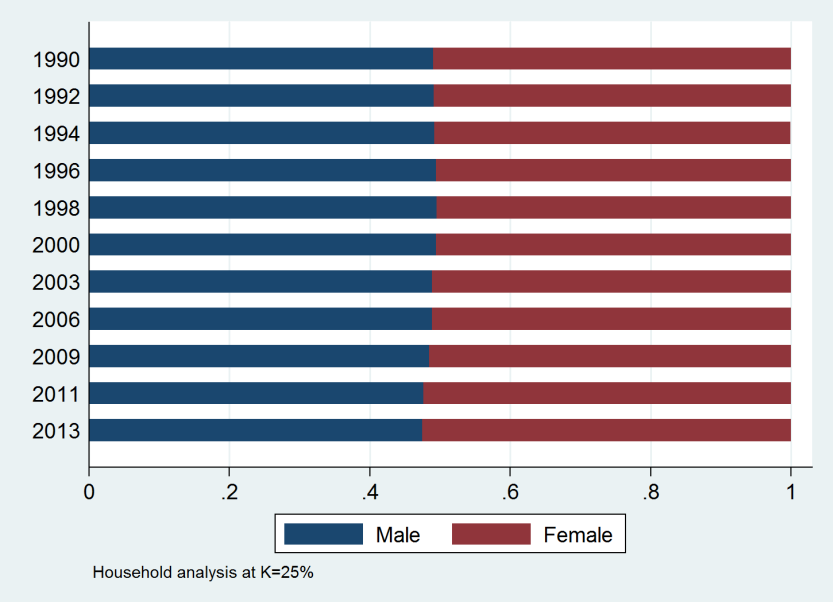
Source: Own elaboration with Casen data

Figure A.9: Multidimensional Poverty 1990-2013 by Sex



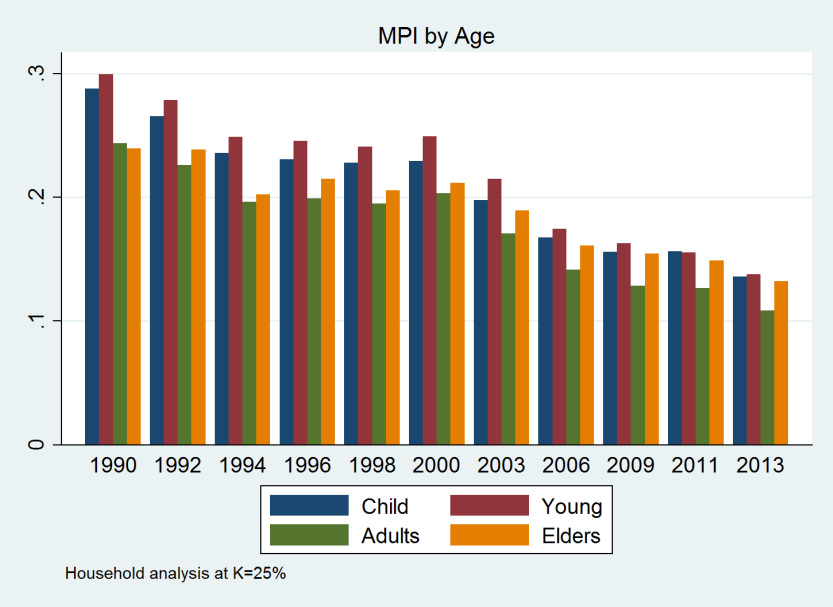
Source: Own elaboration with Casen data

Figure A.10: M_0 decomposition by subgroup, Male and Female contribution



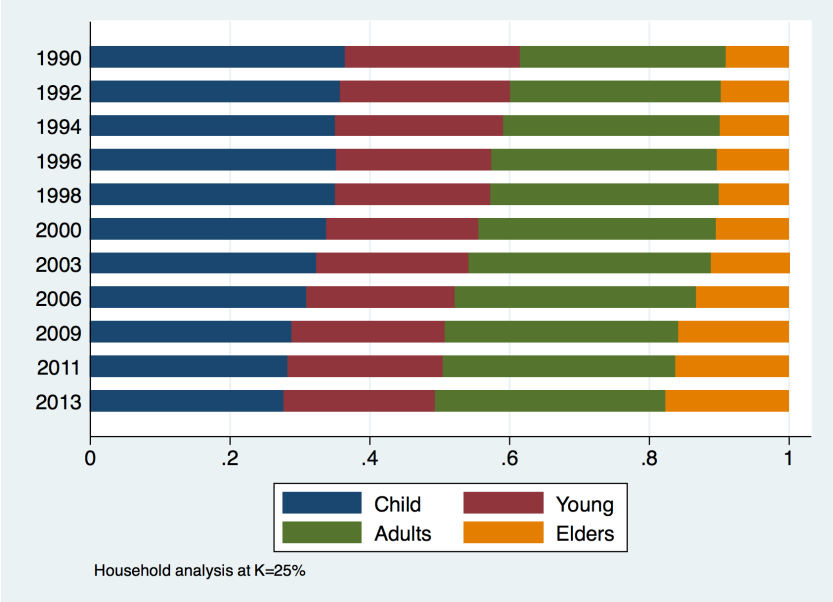
Source: Own elaboration with Casen data

Figure A.11: Multidimensional Poverty 1990-2013 by Age



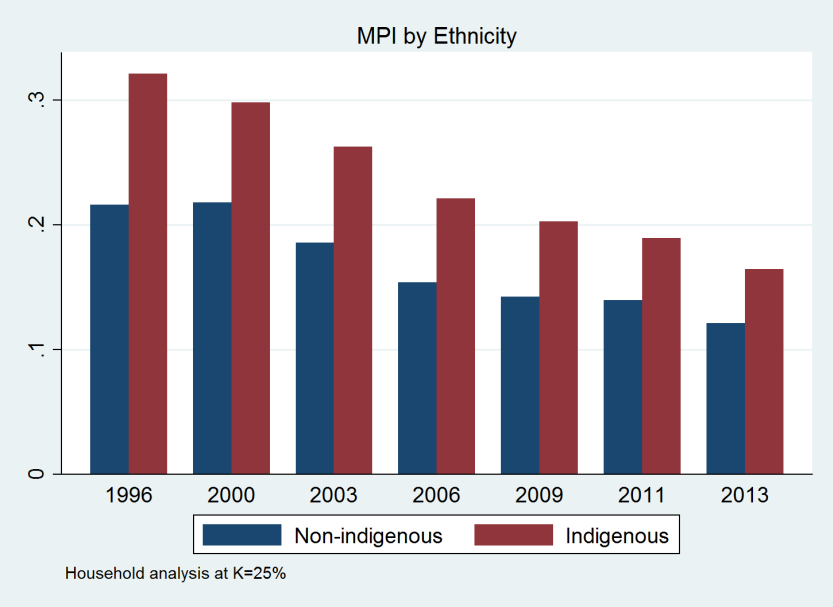
Source: Own elaboration with Casen data

Figure A.12: M_0 decomposition by subgroup, Age group contribution



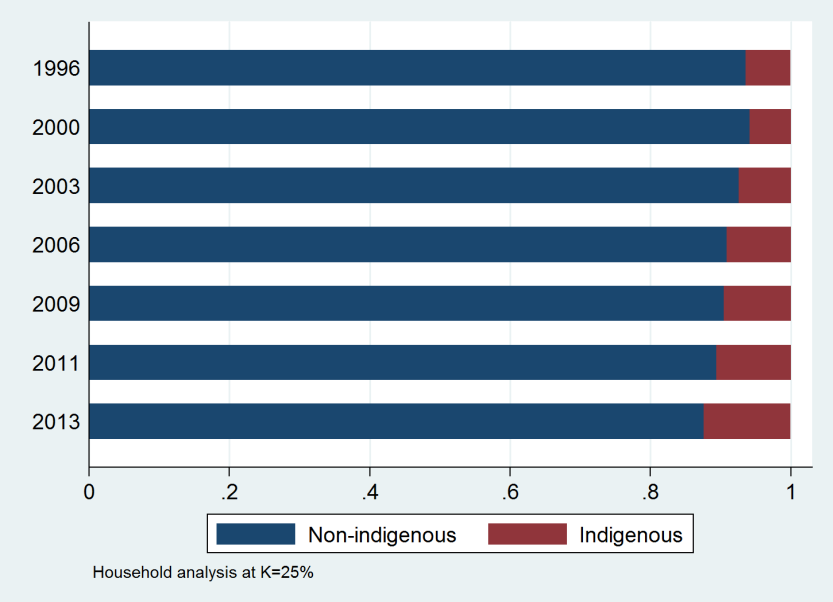
Source: Own elaboration with Casen data

Figure A.13: Multidimensional Poverty 1990-2013 by Ethnicity



Source: Own elaboration with Casen data

Figure A.14: M_0 decomposition by subgroup, Ethnicity contribution



Source: Own elaboration with Casen data

Table A.19: Percentage of Indigenous people by Region and Year *

Region	**1996**	**2000**	**2003**	**2006**	**2009**	**2011**	**2013**
I	9.91%	14.75%	13.42%	17.13%	12.60%	16.35%	17.98%
II	2.65%	2.26%	4.51%	7.42%	5.70%	7.54%	9.15%
III	2.38%	0.67%	2.13%	4.36%	7.52%	10.35%	14.80%
IV	0.54%	1.03%	1.26%	1.67%	1.74%	2.67%	4.57%
V	1.47%	0.65%	1.14%	2.15%	3.20%	3.11%	3.16%
VI	1.31%	0.70%	1.10%	1.30%	1.90%	4.02%	3.41%
VII	0.45%	1.01%	1.44%	1.52%	1.61%	2.31%	2.20%
VIII	2.95%	3.06%	2.29%	3.94%	3.87%	5.21%	5.43%
IX	18.03%	25.61%	30.21%	27.76%	30.08%	32.08%	32.28%
X	10.27%	9.04%	14.61%	18.53%	20.84%	23.69%	24.88%
XI	6.59%	8.17%	13.65%	12.53%	21.76%	23.71%	26.56%
XII	3.96%	6.30%	10.63%	15.39%	22.69%	20.58%	20.22%
R.M.	2.28%	2.71%	3.16%	4.38%	4.08%	4.97%	7.28%
XIV	-	-	-	-	16.73%	18.69%	22.23%
XV	-	-	-	-	25.43%	26.35%	31.74%

*Regions XIV and XV were created in 2007

Source: Own elaboration with Casen

Figure A.15: Multidimensional Poverty 1990-2013 by Region

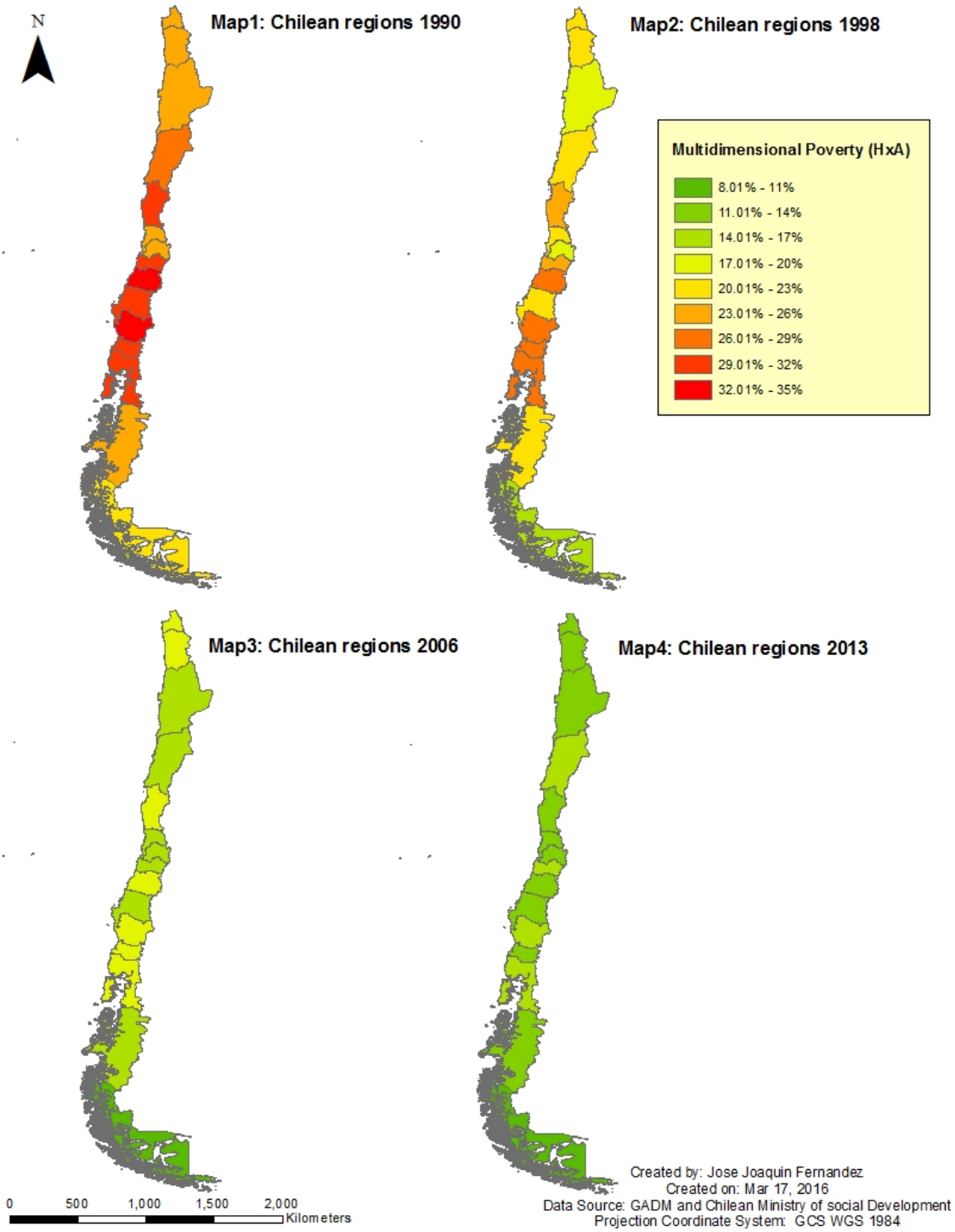
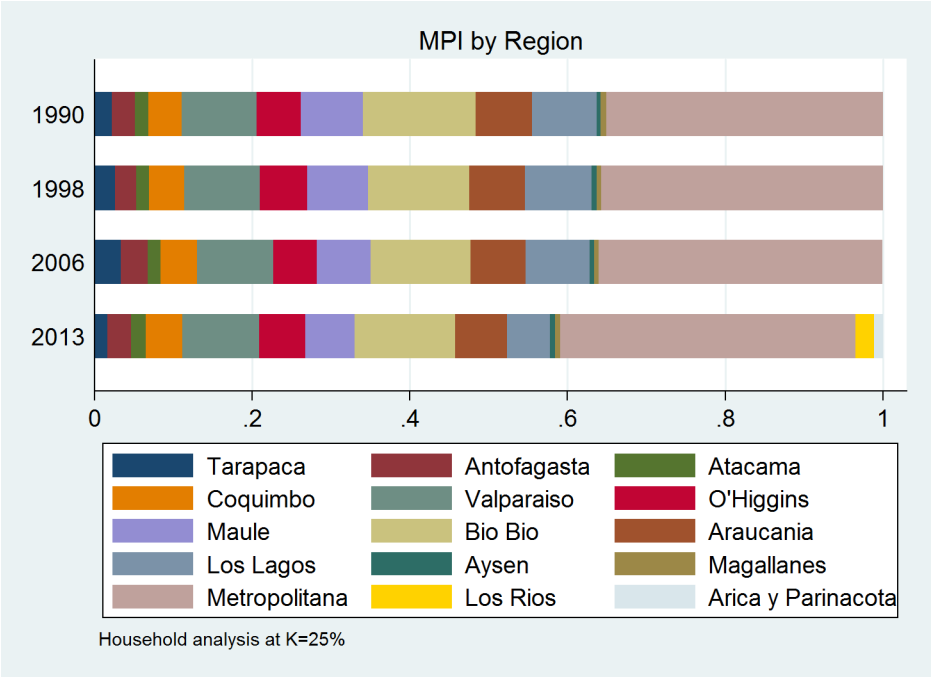
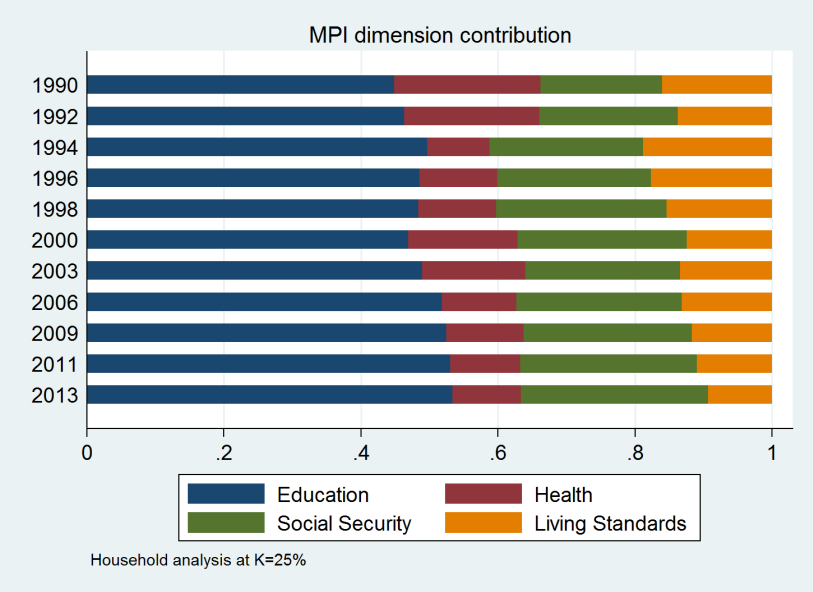


Figure A.16: M_0 decomposition by subgroup, Regions *



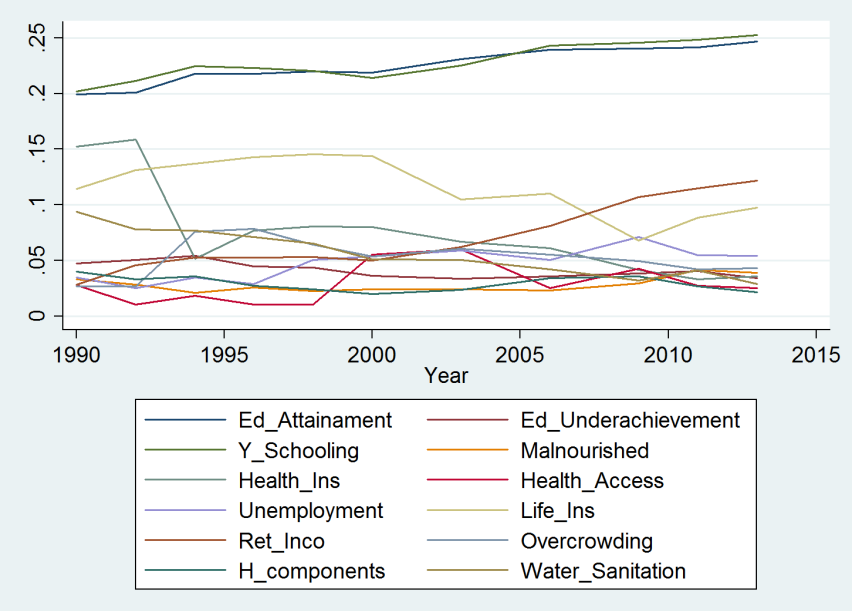
*Regions XIV and XV were created in 2007
Source: Own elaboration with Casen data

Figure A.17: Multidimensional Poverty 1990-2013, Dimensions Contributions



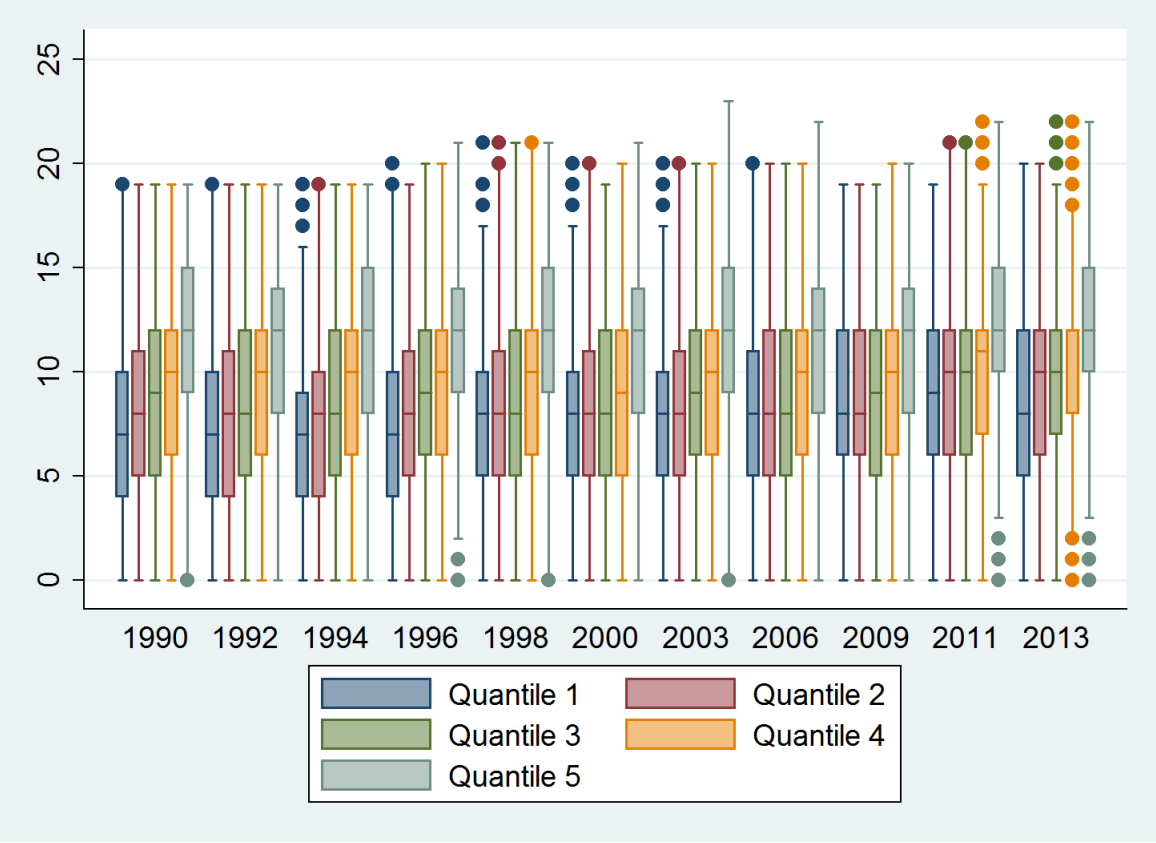
Source: Own elaboration with Casen data

Figure A.18: Multidimensional Poverty 1990-2013, Sub-dimensions Contributions



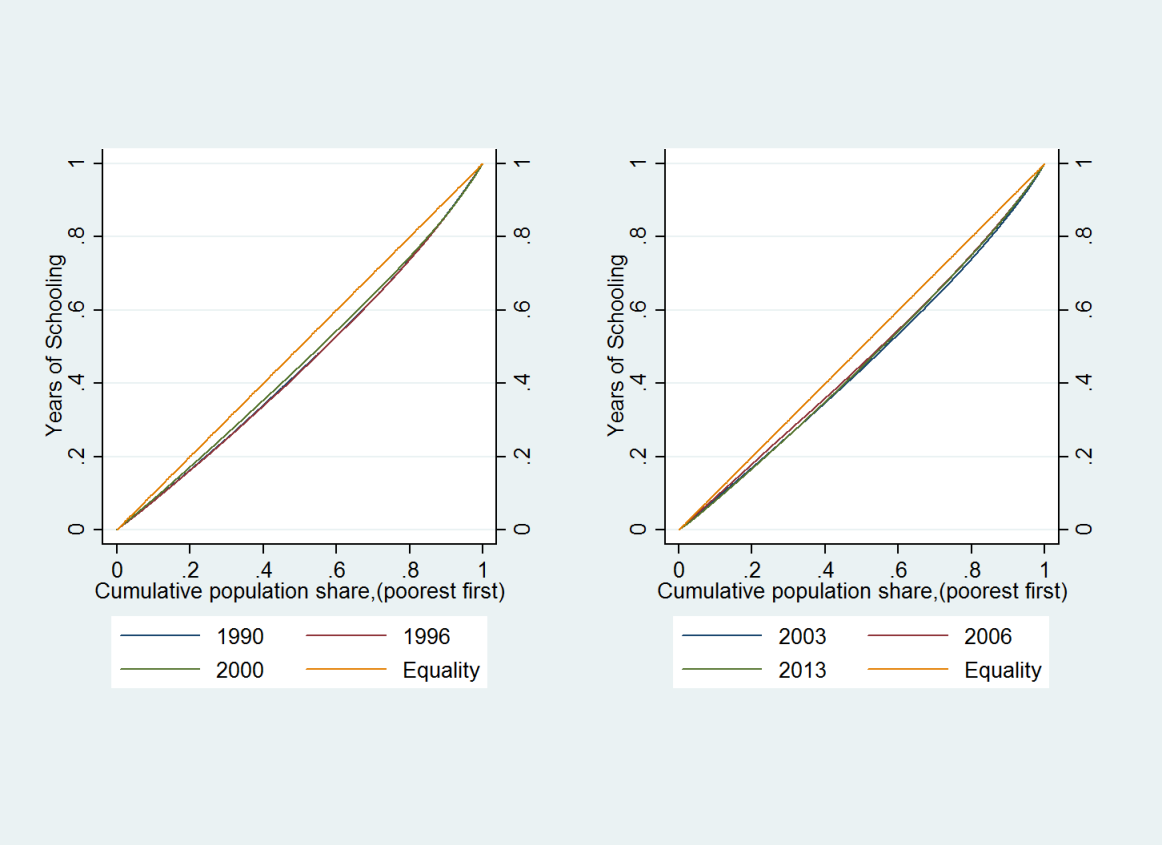
Source: Own elaboration with Casen data

Figure A.19: Schooling by Income Quantile



Source: Own elaboration with Casen data

Figure A.20: Concentration curve of Schooling



Source: Own elaboration with Casen data

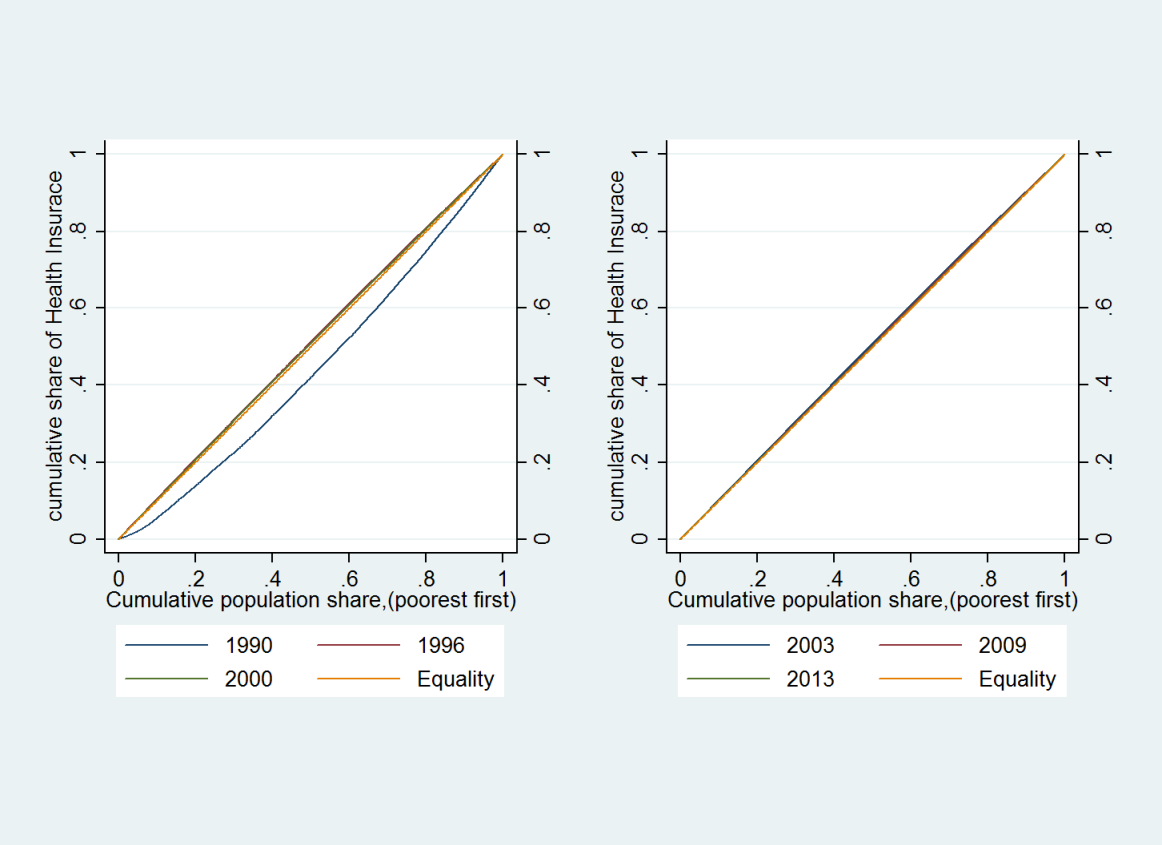
Table A.20: Education Inequality by Schooling *

Year	Zone	Mean	Gini
1990	Country	8.95	0.275
	Urban	9.42	0.257
	Rural	6.32	0.320
1992	Country	8.99	0.270
	Urban	9.46	0.252
	Rural	6.20	0.318
1994	Country	9.05	0.273
	Urban	9.47	0.258
	Rural	6.45	0.312
1996	Country	9.38	0.262
	Urban	9.89	0.242
	Rural	5.94	0.308
1998	Country	9.65	0.257
	Urban	10.14	0.237
	Rural	6.15	0.306
2000	Country	9.85	0.251
	Urban	10.33	0.232
	Rural	6.30	0.302
2003	Country	10.03	0.248
	Urban	10.50	0.230
	Rural	6.57	0.297
2006	Country	9.83	0.249
	Urban	10.23	0.234
	Rural	6.98	0.293
2009	Country	10.19	0.236
	Urban	10.57	0.222
	Rural	7.48	0.287
2011	Country	10.27	0.233
	Urban	10.65	0.220
	Rural	7.58	0.279
2013	Country	10.58	0.228
	Urban	11.02	0.213
	Rural	7.65	0.281

* Estimation by Head of the household

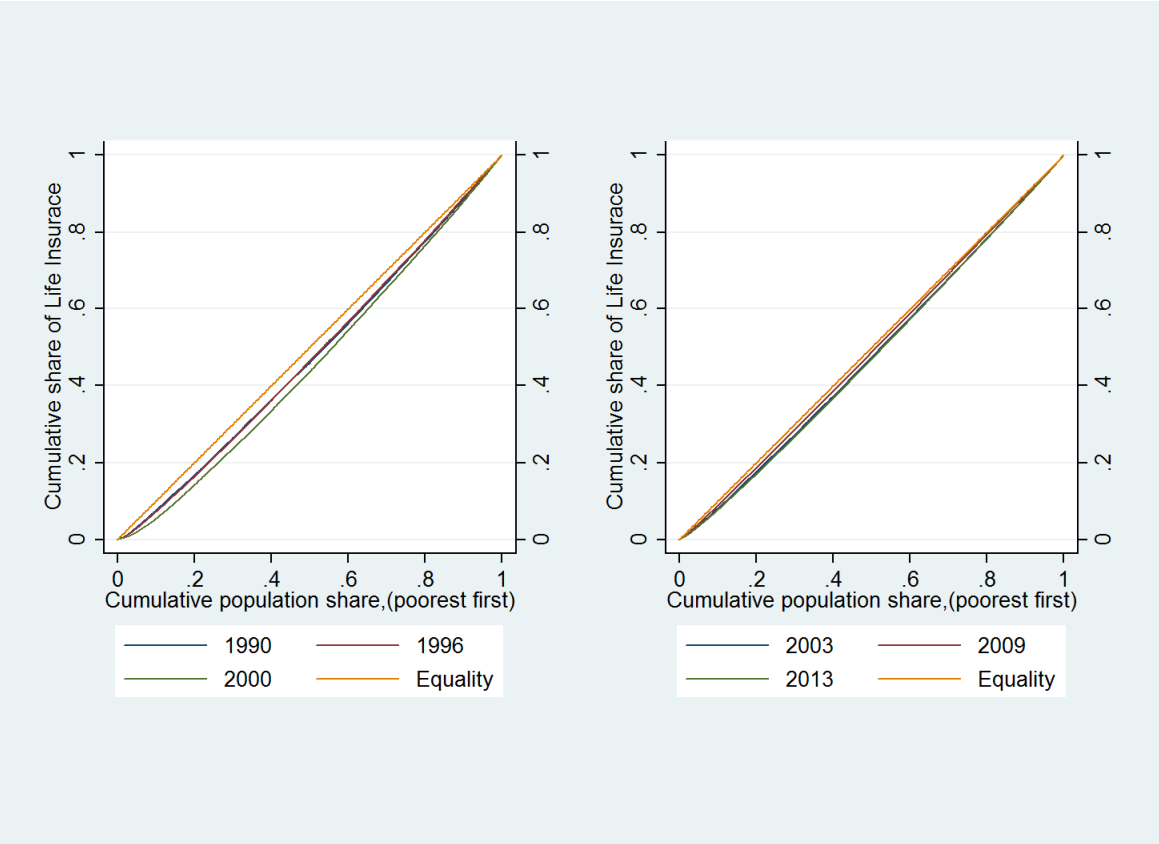
Source: Own elaboration with Casen Data

Figure A.21: Concentration curve of Health insurance



Source: Own elaboration with Casen data

Figure A.22: Concentration curve of Life insurance



Source: Own elaboration with Casen data

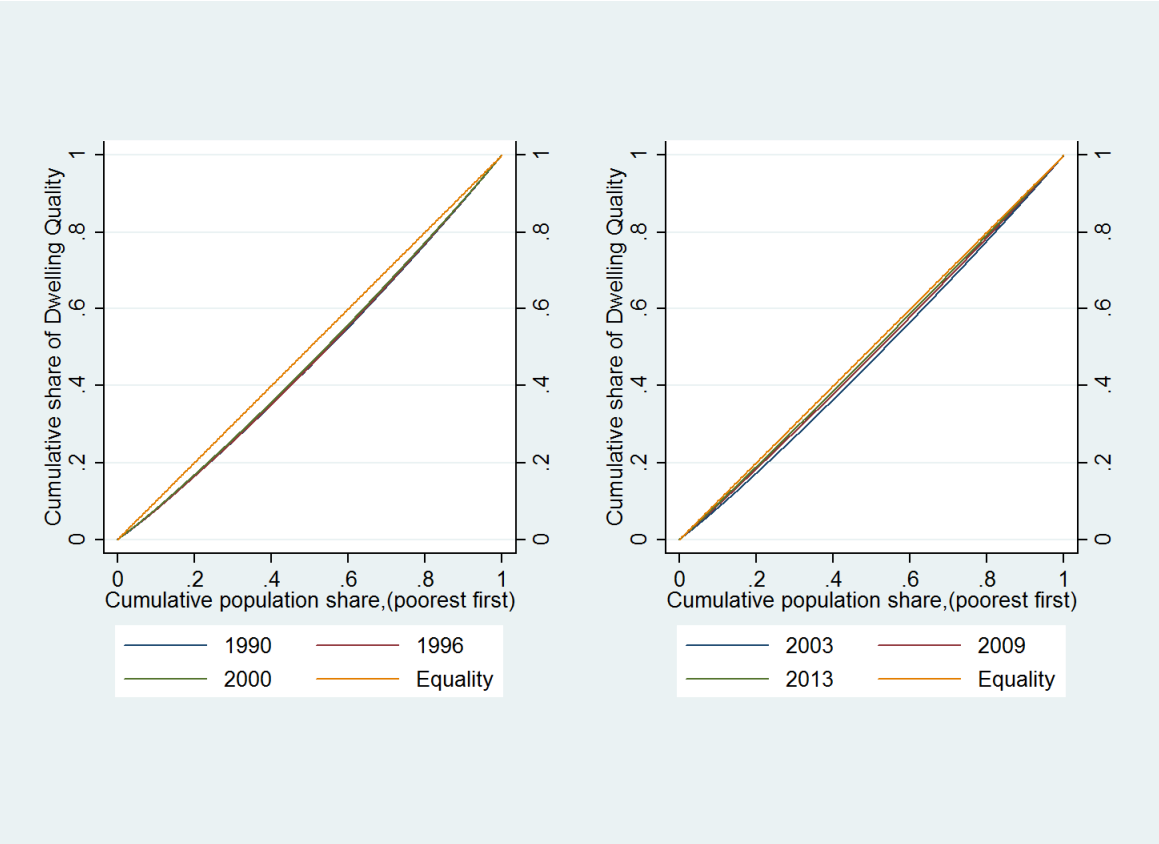
Table A.21: Social Security and Employment Inequality *

Year	Zone	Mean	Gini
1990	Country	0.887	0.098
	Urban	0.897	0.091
	Rural	0.836	0.132
1992	Country	0.863	0.116
	Urban	0.872	0.109
	Rural	0.814	0.144
1994	Country	0.864	0.115
	Urban	0.872	0.109
	Rural	0.818	0.143
1996	Country	0.863	0.115
	Urban	0.873	0.108
	Rural	0.804	0.150
1998	Country	0.857	0.119
	Urban	0.868	0.112
	Rural	0.794	0.155
2000	Country	0.860	0.117
	Urban	0.867	0.113
	Rural	0.817	0.144
2003	Country	0.898	0.090
	Urban	0.904	0.085
	Rural	0.857	0.120
2006	Country	0.899	0.089
	Urban	0.903	0.086
	Rural	0.869	0.112
2009	Country	0.894	0.093
	Urban	0.897	0.091
	Rural	0.873	0.108
2011	Country	0.887	0.098
	Urban	0.891	0.095
	Rural	0.860	0.117
2013	Country	0.874	0.108
	Urban	0.879	0.105
	Rural	0.841	0.129

* Social Security and employment index based on employment condition, life insurance, and pension range 0-1

Source: Own elaboration with Casen Data

Figure A.23: Concentration curve of Dwelling characteristics



Source: Own elaboration with Casen data

Table A.22: Living Standards Inequality *

Year	Zone	Mean	Gini
1990	Country	0.845	0.125
	Urban	0.883	0.097
	Rural	0.657	0.202
1992	Country	0.860	0.110
	Urban	0.896	0.084
	Rural	0.670	0.193
1994	Country	0.865	0.109
	Urban	0.899	0.084
	Rural	0.679	0.196
1996	Country	0.885	0.096
	Urban	0.919	0.069
	Rural	0.679	0.195
1998	Country	0.897	0.086
	Urban	0.928	0.061
	Rural	0.700	0.182
2000	Country	0.911	0.075
	Urban	0.940	0.052
	Rural	0.726	0.174
2003	Country	0.914	0.071
	Urban	0.936	0.054
	Rural	0.767	0.151
2006	Country	0.914	0.070
	Urban	0.932	0.056
	Rural	0.797	0.141
2009	Country	0.922	0.064
	Urban	0.936	0.053
	Rural	0.827	0.125
2011	Country	0.937	0.052
	Urban	0.949	0.042
	Rural	0.857	0.102
2013	Country	0.951	0.042
	Urban	0.960	0.034
	Rural	0.888	0.085

* Estimations based on quality and access index, range 0-1

Source: Own elaboration with Casen Data

Table A.23: Multidimensional Inequality by Maasoumi

	$\beta = -30$			$\beta = 0$			$\beta = 1$		
Year	$A(0.5)$	$A(1)$	$A(2)$	$A(0.5)$	$A(1)$	$A(2)$	$A(0.5)$	$A(1)$	$A(2)$
1990	0.060	0.129	0.293	0.393	0.616	0.580	0.027	0.059	0.136
1992	0.057	0.124	0.285	0.375	0.567	0.532	0.025	0.055	0.124
1994	0.066	0.139	0.303	0.164	0.156	0.125	0.010	0.021	0.047
1996	0.063	0.136	0.310	0.187	0.190	0.158	0.011	0.024	0.055
1998	0.060	0.129	0.297	0.197	0.206	0.176	0.012	0.025	0.057
2000	0.058	0.127	0.296	0.178	0.181	0.153	0.011	0.023	0.052
2003	0.057	0.125	0.293	0.149	0.145	0.121	0.008	0.017	0.038
2006	0.057	0.125	0.294	0.117	0.103	0.080	0.006	0.013	0.300
2009	0.051	0.113	0.268	0.113	0.098	0.076	0.006	0.012	0.027
2011	0.050	0.108	0.259	0.088	0.075	0.050	0.005	0.010	0.023
2013	0.049	0.107	0.261	0.089	0.070	0.049	0.005	0.011	0.023

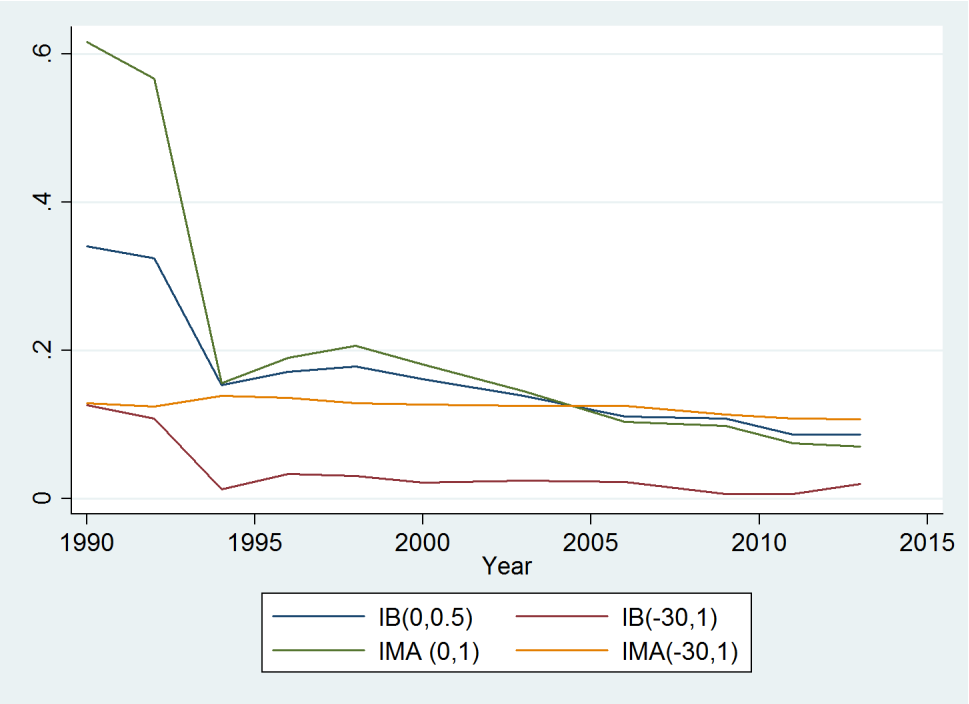
Note: Dimensions are equally weighted to be consistent with MPI
Source: Own elaboration with Casen Data

Table A.24: Multidimensional Inequality by Bourguignon

	$\beta = -30$			$\beta = 0$			$\beta = 1$		
Year	$A(0.5)$	$A(1)$	$A(2)$	$A(0.5)$	$A(1)$	$A(2)$	$A(0.5)$	$A(1)$	$A(2)$
1990	0.027	0.126	0.528	0.340	0.283	0.135	0.013	0.000	0.093
1992	0.020	0.108	0.468	0.324	0.269	0.128	0.013	0.000	0.088
1994	0.028	0.012	0.266	0.153	0.142	0.093	0.005	0.000	0.037
1996	0.016	0.033	0.298	0.171	0.154	0.095	0.005	0.000	0.040
1998	0.016	0.030	0.278	0.178	0.160	0.097	0.006	0.000	0.042
2000	0.020	0.021	0.249	0.161	0.145	0.089	0.005	0.000	0.038
2003	0.018	0.024	0.252	0.139	0.128	0.086	0.004	0.000	0.028
2006	0.019	0.022	0.248	0.111	0.106	0.074	0.003	0.000	0.023
2009	0.023	0.006	0.189	0.108	0.103	0.073	0.003	0.000	0.022
2011	0.022	0.006	0.181	0.086	0.084	0.060	0.002	0.000	0.019
2013	0.024	0.002	0.167	0.086	0.084	0.059	0.002	0.000	0.019

Note: Dimensions are equally weighted to be consistent with MPI
Source: Own elaboration with Casen Data

Figure A.24: Multidimensional inequality in Chile
Maasoumi and Bourguignon Indexes
Education, Health, Social Security and Living Standards



Source: Own elaboration with Casen data

Table A.25: Poverty after Tax Simulation

Year	Zone	FGT(0)	FGT(1)	FGT(2)	Pop_{share}
1990	Country	0.383	0.123	0.052	100%
	Urban	0.382	0.130	0.056	83%
	Rural	0.386	0.090	0.029	17%
1992	Country	0.325	0.092	0.035	100%
	Urban	0.324	0.099	0.039	84%
	Rural	0.332	0.058	0.016	16%
1994	Country	0.270	0.076	0.030	100%
	Urban	0.268	0.081	0.033	84%
	Rural	0.283	0.051	0.016	16%
1996	Country	0.222	0.058	0.021	100%
	Urban	0.219	0.060	0.023	85%
	Rural	0.238	0.043	0.014	15%
1998	Country	0.201	0.049	0.017	100%
	Urban	0.205	0.053	0.019	86%
	Rural	0.172	0.026	0.007	14%
2000	Country	0.193	0.056	0.024	100%
	Urban	0.195	0.057	0.024	86%
	Rural	0.180	0.046	0.019	14%
2003	Country	0.173	0.044	0.016	100%
	Urban	0.184	0.046	0.017	87%
	Rural	0.103	0.024	0.009	13%
2006	Country	0.129	0.026	0.010	100%
	Urban	0.139	0.028	0.010	87%
	Rural	0.062	0.014	0.005	13%
2009	Country	0.145	0.037	0.016	100%
	Urban	0.154	0.039	0.017	87%
	Rural	0.084	0.025	0.011	13%
2011	Country	0.131	0.024	0.008	100%
	Urban	0.144	0.026	0.008	87%
	Rural	0.043	0.011	0.004	13%
2013*	Country	0.173	0.045	0.017	100%
	Urban	0.181	0.046	0.018	87%
	Rural	0.116	0.036	0.016	13%

Note: Estimations based en Percapita Income after taxes and subsidy
* In 2013 the Income adjustment are do it by Panel Casen instead of ECLAC
Source: Own elaboration with Casen Data

Table A.26: Inequality after Tax Simulation

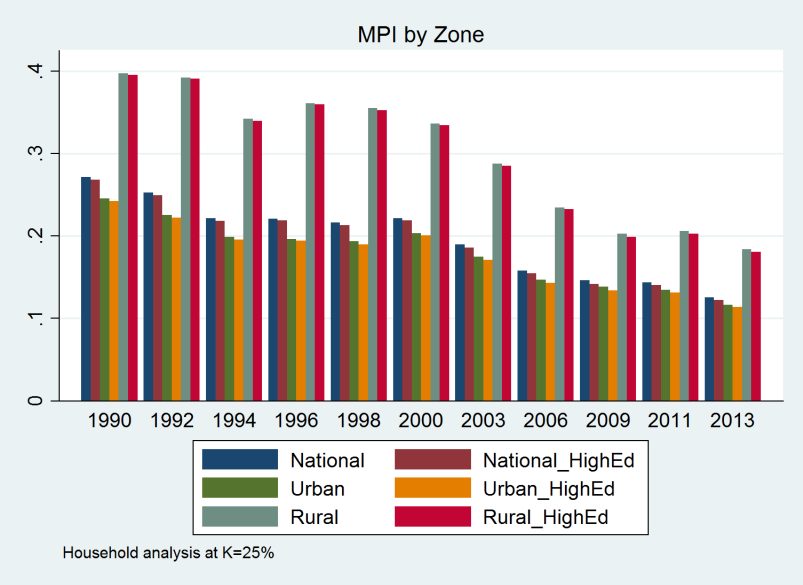
Year	Zone	GE(0)	GE(1)	Gini	Pop_{share}
1990	Country	0.514	0.651	0.549	100%
	Urban	0.498	0.612	0.540	83%
	Rural	0.546	0.864	0.564	17%
1992	Country	0.508	0.644	0.546	100%
	Urban	0.507	0.630	0.545	84%
	Rural	0.395	0.604	0.485	16%
1994	Country	0.525	0.731	0.550	100%
	Urban	0.519	0.719	0.546	84%
	Rural	0.394	0.606	0.483	16%
1996	Country	0.512	0.618	0.545	100%
	Urban	0.502	0.599	0.539	85%
	Rural	0.352	0.497	0.459	15%
1998	Country	0.531	0.652	0.555	100%
	Urban	0.523	0.631	0.550	86%
	Rural	0.356	0.553	0.461	14%
2000	Country	0.559	0.681	0.564	100%
	Urban	0.550	0.661	0.559	86%
	Rural	0.420	0.642	0.495	14%
2003	Country	0.510	0.662	0.544	100%
	Urban	0.506	0.651	0.541	87%
	Rural	0.394	0.586	0.483	13%
2006	Country	0.458	0.565	0.518	100%
	Urban	0.453	0.551	0.514	87%
	Rural	0.411	0.601	0.493	13%
2009	Country	0.468	0.583	0.520	100%
	Urban	0.470	0.581	0.521	87%
	Rural	0.348	0.454	0.452	13%
2011	Country	0.427	0.525	0.504	100%
	Urban	0.429	0.519	0.505	87%
	Rural	0.346	0.487	0.454	13%
2013*	Country	0.417	0.491	0.494	100%
	Urban	0.413	0.484	0.492	87%
	Rural	0.332	0.426	0.442	13%

Note: Estimations based en Percapita Income after taxes and subsidy

* In 2013 the Income adjustment are do it by Panel Casen instead of ECLAC

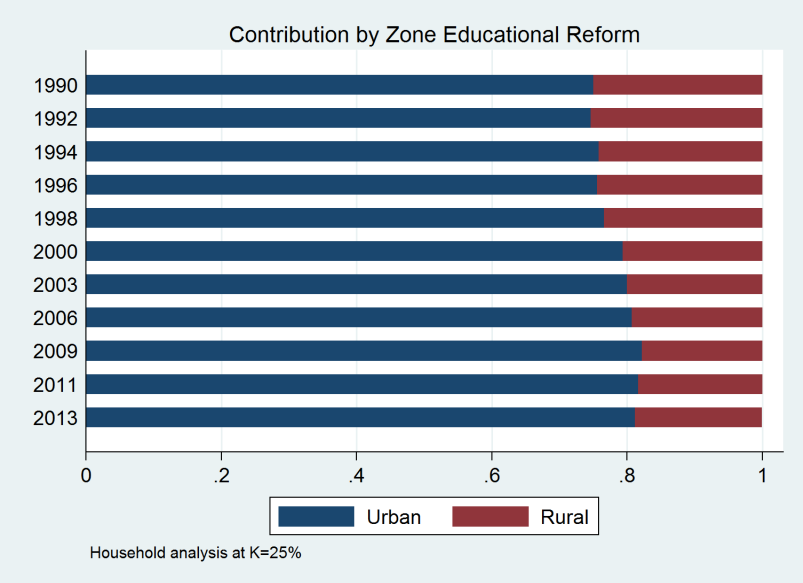
Source: Own elaboration with Casen Data

Figure A.25: Multidimensional Poverty by Zone after Educational Reform



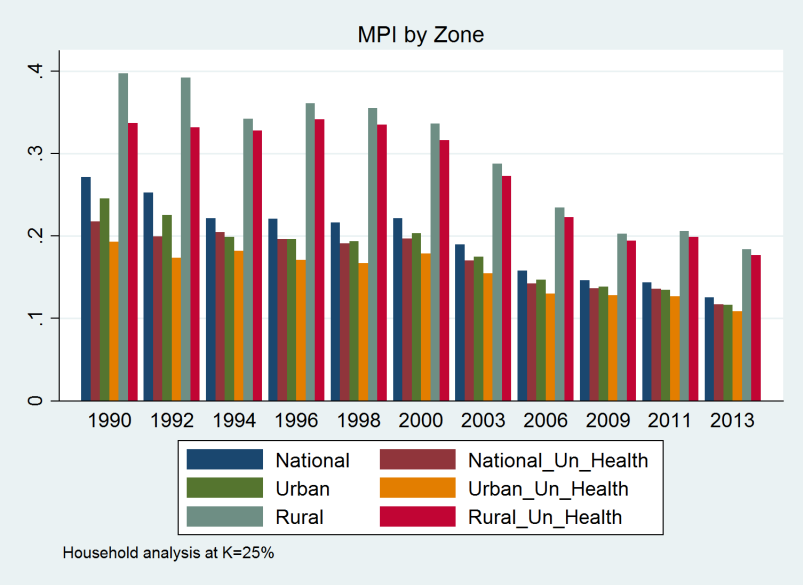
Source: Own elaboration with Casen data

Figure A.26: M_0 decomposition by Zone after Educational Reform



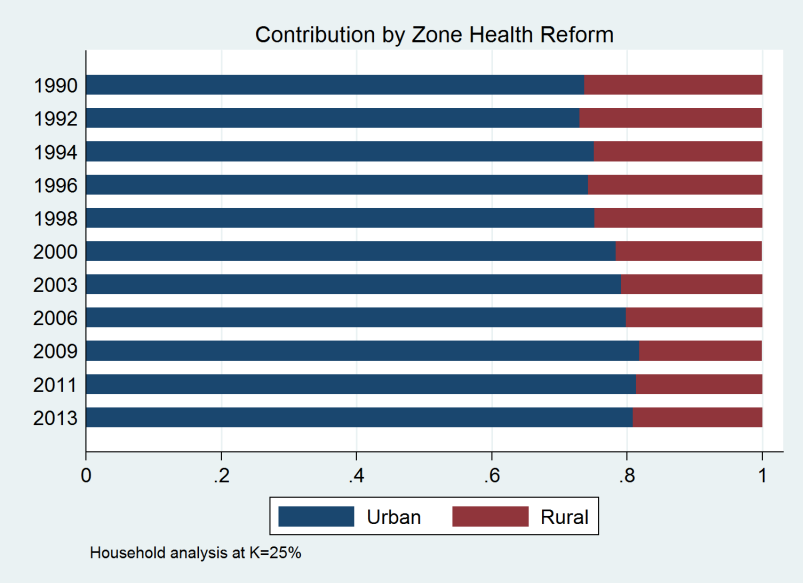
Source: Own elaboration with Casen data

Figure A.27: Multidimensional Poverty by Zone after Health Reform



Source: Own elaboration with Casen data

Figure A.28: M_0 decomposition by Zone after Health Reform



Source: Own elaboration with Casen data