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Welfare State Development, Individual Deprivations and Income Inequality: A Cross-Country Analysis in Latin America and the Caribbean

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Abstract Several scholars have confirmed the role that the welfare state (WS) plays in reducing poverty, promoting equality and ensuring the common wellbeing. One of the limitations of the scholarship has been the conceptualization and operationalization of the WS and poverty as one-dimensional variables. The purpose of this paper is to examine the relationship between welfare state development, single-dimensions deprivations and income inequality in Latin America and the Caribbean, before and after controlling for demographic and cyclical factors. The WS is operationalized as a one-dimensional variable, but also taking into account its multidimensional nature. Three individual deprivations suffered by people on poverty and two income inequality indicators are used as dependent variables. Three pooled time-series cross-section regression analyses with panel-corrected standard errors models were carried out on 18 countries in the region around 2000, 2005 and 2010. This paper shows that the development of social-welfare programs and institutions seems to be an effective way of tackling individual deprivations suffered by people on poverty in the region. On the other hand, the WS development didn't appear to be effective to reduce income inequality. The outcomes of welfare institutions appear to be the pivotal dimension to reduce income inequality and income deprivations in the region.

Keywords Welfare state development · Inequality · Poverty · Latin America and the Caribbean · Multidimensional welfare index · Redistribution

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1 Introduction

Over the last decades, several scholars have confirmed the role that the welfare state plays in reducing poverty, promoting equality through redistributive policies and ensuring the common wellbeing. Esping-Andersen (1990) and Mishra (1989) have highlighted the objective of ensuring a basic minimum of entitled social protection to the population rather than a public charity for a minority. Gough (1982) and Titmuss (1963) highlighted the role of satisfying social risks and improving the well-being and living conditions of the population. Barr (2012: 12) goes further by considering poverty reduction as one of the top 10 goals of the welfare state and along with redistribution, as the two main goals of the government.

There are multiple configurations of welfare policies and redistributive strategies to achieve poverty and income inequality reduction. Institutionalized social security schemes (retirement, disability, unemployment, etc.), cash transfer programs, universal basic income, progressive taxation, universal education and health care, are just some of the tools that may be used by the emerging welfare state[1] in Latin America and the Caribbean to reduce poverty and promote equality of opportunities.

"Welfare effort (social spending as a percentage of GDP) has conventionally been the preferred measure for comparisons in space and time of the level of development [between] welfare states" (Olaskoaga et al. 2013). Poverty is usually quantified using relative or absolute income poverty lines and income inequality using the Gini Index. Taking this into account, Caminada et al. (2012) and Kenworthy (1999), among other scholars, have shown the explanatory power of the social spending on the reduction of income poverty. Glomm and Kaganovich (2008) and Docquier and Paddison (2003) have confirmed the role of social spending—specifically government spending on social security- on the reduction of income inequality. It must however be asked if income poverty lines and social spending are the ideal indicators to measure poverty and welfare state development. What about non-monetary deprivations faced by individuals in poverty (i.e. deprivations that are not caused by the lack of income, such as deprivations in the areas of education and health)? Once the welfare state has been conceptualized and operationalized by its multidimensional reality, does it exhibits a significant explanatory power with income inequality and with individual deprivations (monetary and non-monetary) suffered by individuals on poverty?

The purpose of this paper is to examine the relationship between welfare state development –as a one-dimensional and multidimensional variable-, single-dimensions deprivations and income inequality in Latin America and the Caribbean, before and after controlling for demographic and cyclical factors. However, this paper does not assumes a causality between the variables considered and does not seek to explain poverty, rather it aims to demonstrate the relationship between variables across time (2000–2010) and space (18 cases in the region).

Three tests were performed in order to address the explanatory power of the welfare state development in Latin America and the Caribbean. Rather than operationalize the welfare state only by its social spending dimension, this paper will take into account its multidimensional nature by considering the coverage and outcomes as complementary dimensions. First, time-series cross-section pooled data for 2000, 2005 and 2010 were graphed in order to examine the relationship between the explanatory variable and the two

[1] Huber and Stephens (2012) coined this term to describe the welfare state systems in Latin America and the Caribbean.

dependent variables: individual deprivations and income inequality. Second, a pooled time series cross-section regression analysis was carried out before and after controlling for demographic and cyclical factors that may affect the levels of individual deprivations and income inequality, and measuring the explanatory variable using a one-dimensional and multidimensional perspective. In the third technique, further pooled time series cross-section regression analysis was carried out with the novelty of using the three dimensions of the welfare state as explanatory variable. Demographic and cyclical factors were incorporated also in this test. In addition, in the second model of the second and third test data was analyzed using Beck and Katz (1995) method of ordinary least square with panel-corrected standard errors models.

The paper is organized as follows. The next section briefly presents the methodology and results of the multidimensional welfare index, the indicator used to operationalize the explanatory variable. The two dependent variables, poverty and income inequality, are also addressed in the second section. Later on the paper presents the main results of the three tests examining the relationship degree among variables and the explanatory power of the welfare state development with the five selected individual deprivations and income inequality indicators. The article finalize with a general conclusion.

2 Quantifying the Variables: Welfare State Development, Poverty and Inequality

Before inquiring on the significance and the degree of relationship between poverty and income inequality with the development of the welfare state in Latin America, it is necessary to elaborate on the indicators to be used to operationalize the variables.

2.1 Explanatory Variable: Welfare State Development

According to Cruz-Martínez (2014), the concept 'welfare state development' refers to the progress and institutionalization of welfare programs that address the social risks of the population in order to assure a common well-being. The welfare state in Latin America and the Caribbean could be best described as an emerging welfare state (Huber and Stephens 2012), welfare state in transition (Esping-Andersen 1996) or developmental welfare state in the making (Riesco 2009), meaning that their welfare programs and institutions are not yet as developed as their counterparts in Europe. Even though pioneers countries such as Argentina, Chile, Uruguay and Brazil started to create their first welfare system back in the 1920–1930's (Mesa-Lago 1994), they are still underdeveloped. Large part of the public budget allocations are destined to remunerate public servants (Rezk 2006), there is an unequal redistribution according to the class and status of the individuals (Huber and Stephens, 2012; Huber 1996) and a relatively low tax burden –around 20 % GDP (CEPAL, n/d)- hampers the economic viability of universal reforms.

There is an ongoing debate on the role of left-of centre governments in reducing income poverty and income inequality in the region. Lustig and McLeod (2011) find that the so-called "social democratic" governments of Chile and Brazil where effective in reducing income poverty and income inequality, while the so-called "left populist" (e.g. Venezuela, Bolivia, Ecuador) where not. However, Montecino (2011) finds out the exact opposite results by using data from the Economic Commission for Latin America and the Caribbean (ECLAC). The latest Social Panorama publication from the ECLAC points out that income

poverty has been reduced from 48.4 % in 1990 to 29.2 % in 2015. There was also an income inequality reduction in the region –comparing the annual rate of change in the Gini coefficient between 2002–2010 and 2010–2014. Uruguay, Argentina and Ecuador have experienced the largest reductions in income inequality (all having left-of-centre governments), while Paraguay and Venezuela experienced an increase in income inequality.

Returning to the topic of the explanatory variable, we must begin to conceptualize the welfare state as a multidimensional variable. Using just social spending indicators is subject to criticism because of the over-riding importance given to this one dimension of the welfare state [see for example Segura-Ubiergo (2007) and (Huber and Stephens 2012)]. Cruz-Martínez (2014) was able to construct a composite multidimensional indicator that seeks to reflect the level of development among the emerging welfare state in Latin America and the Caribbean during the 1970–2000's. A similar methodology and indicators was used in this paper to calculate the multidimensional welfare index in three times in the period 2000–2010. Data availability allowed calculating the MWI around 2000, 2005 and 2010.

Using principal component analysis, eight indicators were reduced to three individual welfare indexes. For PCA, the function pca(x, cor = TRUE) under the library (labdsv) was used on R. Social spending as a percentage of gross domestic product (GDP), social spending as a percentage of public spending and social spending per capita are the three indicators used to build the social spending dimension index. The coverage dimension index is formed by the following three indicators: percentage of population over 65 years who receive a retirement pension, percentage of employees with retirement coverage, and the number of hospital beds for every ten thousand inhabitants. Lastly, the proportion of adults-in the age group of 25-65 years-with more than 13 years of formal education, and the improbability of children under 5 years suffering infant mortality are the indicators that represent the outcome dimension in the new index.[2] Data for the 8 indicators used[3] in this article are provided in the "Appendix".

The first principal component (PC1) accounts for as much variation in the data as possible (between 74.2 and 80.0 % for SSDI; between 75.0 and 79.5 % for CDI; between 59.1 and 68.3 % for ODI). Once normalized, the PC1 scores become the individual welfare indexes for each of the 18 cases.[4] These indexes represent three of the key dimensions of the welfare state: spending, coverage of welfare programs and outcomes of the interventions of welfare institutions. Through an arithmetic mean[5] each individual index is

[2] The outcomes dimension is included in the MWI because the outcomes of welfare institutions are considered to be a vital dimension of the welfare state. Even though some scholars might consider infant mortality rate and level of education as welfare outcomes, in this paper they are used to operationalize the outcomes of welfare institutions (i.e. health and education institutions). The quality of health and education institutions is considered relevant to reduce levels of individual deprivations and income inequality; therefore, they are included in the multidimensional indicator.

[3] The main reason behind the selection of these eight indicators is data availability. However, the justification of the indicators selected to present different dimensions of the emerging welfare state in the region has been addressed previously in Segura-Ubiergo (2007) –only the first 4- and in Cruz-Martínez (2014).

[4] Thanks to the high correlation between the indicators in each of the three dimensions it was possible to reduce the data to three individual indexes without loosing too much information. Two tests were necessary on each data set to assess the statistical relevance of the PCA and to confirm that the correlation between variables was high: the determinant of the correlation matrix and the Bartlett's sphericity test.

[5] Because the dimensions of individual welfare indexes were normalized (max = 1, min = 0) it was not possible to use the geometric mean as in the new HDI method. One of the limitations of using an arithmetic mean is the disadvantage of missing some information because of not being able to give more weight to outliers.

assigned the same weight in the construction of the multidimensional welfare index. See the formula below:

$$MWI_{ct} = \frac{(SSDI_{ct} + CDI_{ct} + ODI_{ct})}{3};$$

where the multidimensional welfare index of each country (c) at a specific time (t) is obtained by the arithmetic mean of the three dimensions' indexes (SSDI, CDI and ODI) for the country and time considered. The composite nature of this multidimensional welfare index rendered comparative analysis of the welfare state development in 18 Latin American and Caribbean countries possible. See Table 1 for the normalized PC1 scores (maximum equals 1, and minimum equals 0) of the three dimensions' indexes and multidimensional welfare index scores between 2000 and 2010.

2.2 Dependent Variables: Poverty and Income Inequality

According to Spicker (2002: 9–10) the definitions of poverty can be grouped into at least eleven different clusters of meaning. Among them, there are definitions that focus on the lack of material conditions (basic needs, deprivations, limited resources), on certain economic circumstances (low standard of living, economic inequality, class), on the disadvantage due to social relationships (social exclusion, dependency on benefits, lack of basic security) and on the normative side (material circumstances as morally unacceptable). There are plenty of definitions of poverty, but the important question is how to measure it. It is on this issue that the differences between supporters of the monetary and the capability approach begin to become evident. The same happens between those who perceive poverty as a relative or an absolute problem. What is to be poor? What deprivations and not covered social risks make an individual poor? Is poverty a multidimensional variable as well?

Advocates of the monetary approach, conceptualize poverty as income or consumption below a set monetary value (minimum threshold), usually represented by a poverty line. According to Ravallion (1992) poverty can be understood as a situation where certain people do not achieve a minimum level of material well-being to the standard of a given society. International organizations such as the World Bank, the Organisation for Economic Co-operation and Development (OECD) and the Economic Commission for Latin America and the Caribbean use monetary thresholds as the main indicator to measure poverty. However overcoming poverty is more than exceeding an income/consumption poverty line. Individuals on poverty suffer from multiple deprivations,[6] so the poverty rates based on income poverty lines does not present the whole picture of poverty. Poverty cannot be reduced to income poverty; an individual on income poverty suffers from one of the multiple deprivations a poor individual have.

Monetarism follows a utilitarian criterion that considers the poverty line as a good threshold to present the poverty of a population, since rational beings would always maximize their resources to satisfy their needs and ensure their well-being. The main problem with this hypothesis is the assumption that every individual act rationally at all

[6] A group of scholars have developed the Individual Deprivation Measure (IDM) to operationalize a multidimensional poverty index that is able to overcome one of the main limitations of poverty household data: not measuring individual deprivations by not considering intra-household inequalities. The IDM takes into account 15 areas of life to present individual deprivations suffered by people in poverty (e.g. food, water, shelter, energy, education, health deprivations). See Wisor et al. (2015) and Bessell (2015).

Table 1 The normalized principal component scores of the Multidimensional Welfare Index and the three dimensions' indexes (SSDI, CDI and ODI) around 2000, 2005 and 2010. Source: CEPAL (n/d), World Health Organization (2015), UNICEF (2014), Inter-American Development Bank (2012), CEDLAS & World Bank (2015)

	2000				2005				2010			
	SSDI	CDI	ODI	MWI	SSDI	CDI	ODI	MWI	SSDI	CDI	ODI	MWI
Argentina	1.000	1.000	1.000	1.000	0.908	1.000	1.000	0.969	1.000	1.000	1.000	1.000
Bolivia	0.312	0.209	0.134	0.218	0.219	0.259	0.116	0.198	0.137	0.243	0.331	0.237
Brasil	0.916	0.899	0.335	0.717	1.000	0.925	0.395	0.773	0.944	0.806	0.580	0.776
Chile	0.833	0.866	0.973	0.891	0.704	0.870	0.918	0.831	0.646	0.710	0.907	0.755
Colombia	0.520	0.361	0.577	0.486	0.511	0.405	0.572	0.496	0.487	0.364	0.557	0.469
Costa Rica	0.651	0.520	0.693	0.621	0.588	0.587	0.807	0.660	0.574	0.498	0.768	0.613
Dominican Republic	0.283	0.387	0.465	0.378	0.208	0.427	0.376	0.337	0.088	0.440	0.386	0.305
Ecuador	0.000	0.248	0.699	0.316	0.000	0.301	0.621	0.307	0.000	0.330	0.603	0.311
El Salvador	0.499	0.288	0.416	0.401	0.442	0.337	0.442	0.407	0.346	0.240	0.470	0.352
Guatemala	0.273	0.127	0.000	0.133	0.234	0.229	0.000	0.154	0.176	0.110	0.000	0.095
Honduras	0.277	0.000	0.139	0.139	0.286	0.000	0.138	0.141	0.244	0.000	0.201	0.148
Mexico	0.551	0.291	0.644	0.495	0.498	0.382	0.602	0.494	0.419	0.315	0.623	0.452
Nicaragua	0.262	0.134	0.185	0.194	0.304	0.214	0.249	0.256	0.280	0.183	0.280	0.248
Panama	0.210	0.676	0.823	0.570	0.144	0.645	0.735	0.508	0.139	0.620	0.718	0.493
Paraguay	0.217	0.212	0.394	0.274	0.186	0.233	0.444	0.288	0.200	0.237	0.434	0.290
Peru	0.337	0.254	0.346	0.312	0.341	0.342	0.657	0.447	0.207	0.348	0.718	0.424
Uruguay	0.961	0.853	0.751	0.855	0.864	0.965	0.826	0.885	0.965	0.711	0.689	0.788
Venezuela	0.671	0.400	0.726	0.599	0.771	0.479	0.714	0.654	0.683	0.407	0.692	0.594

MWI is a composite indicator formed by 8 indicators from 3 welfare dimensions and used to rank countries in terms of their relative welfare state development. SSDI refers to the social spending dimension index. CDI refers to the coverage dimension index. ODI refers to the outcomes dimension index. A score of 1 refer to a relatively more developed welfare state and 0 to a relatively less developed welfare state. Data is around 2000, 2005 and 2010

times. In addition monetarism presuppose as necessary, unrealistic assumptions in contemporary society such as equal prices for all consumers, availability of all consumer goods, and absence of public goods. Such assumptions, inherent to the economic analysis, based their theories on assumptions of a nonexistent and unrealistic society.

By contrast, in the capability approach poverty is conceptualized as the deprivation of basic capabilities (Sen 1999; Nussbaum 2000). "The capability approach contains three central concepts: functioning, capability and agency. A functioning is being or doing what people value and have reason to value. A capability is a person's freedom to enjoy various functionings—to be or do things that contribute to their well-being. Agency is a person's ability to pursue and realize goals she values and has reason to value" (Deneulin and Shahani 2009: 22). Individual deprivations hamper the process of transforming valuable functionings of resources/goods into capabilities.

Even though the capability approach does not prescribe a specific list of main basic capabilities, some scholars had argued in favor of such a list (See Clark 2005). Nussbaum (2003) argues in favor of a list of ten basic central capabilities, which according to her have an extensive cultural consensus. Nussbaum's list of basic capabilities actually makes reference to combined capabilities. Individuals with each of the central listed capabilities must have a proper development of internal capabilities combined with the ability to experience a favorable environment for the exercise of practical reasoning and other main functionings. On the contrary, Sen (2004) argues that a general discussion with society is needed in order to determine a list of basic capabilities. Only through public reasoning it will be possible to decide what should be included and why. In addition, Sen believes that it is practically impossible to list all the capabilities into a single list because of the particular differences existing among the various societies around the world.

The capabilities approach consists of making explicit the high relevance of capabilities and then move to recognize the enormous variability that exists in the supply of the satisfactory goods of capabilities (Sen 1983). According to Robeyns (2011) the freedom to achieve well-being should be understood in terms of the capabilities of people, i.e. of being and doing what they value. In brief, according to the capability approach an individual that is not able to do and be what they value is considered to be in poverty. Individual deprivations—as the ones considered in this paper- are limitations to people's functionings, and thus a limitation of their capabilities.

Inequality is also a widely debated topic (Okulicz-Kozaryn 2015). According to the OECD (2014: 110), "income inequality is an indicator of how material resources are distributed across society". In a recent publication by the IMF, Dabla-Norris et al. (2015: 4) argued that "widening income inequality is the defining challenge of our time". Widening the gap between the income perceived by the 'rich' and the 'poor' have negative consequences in almost every aspect of human life, from life expectancy to violence and illiteracy (Picket and Wilkinson 2010). Income inequality matters for the economy as it has significant implications for GDP growth and macroeconomic stability, and it also matters for the society as it hinders the equal opportunities to capabilities formation. This applies for low-, middle- and high-income countries.

The Gini index is one of the most used indicators, although there are other measures of income inequality such as the gap between the average income of the richest and the poorest 10 % of the population. With the popular slogan coined by the Occupy Movement 'We are the 99 %', complementary inequality indicators are being used to exhibit the wealth gap between the 'super rich' (1 %) and the rest of the world population (99 %). In 2015 OXFAM published a report stating that "in 2014, the richest 1 % of people in the world owned 48 % of global wealth, leaving just 52 % to be shared between the other

99 % of adults on the planet" (OXFAM 2015: 2). According to the organization, the widening of wealth inequality continues, the world's 62 richest individuals own the same wealth as halve of the population and the top 1 % owns more wealth than the remaining 99 % (Hardoon et al. 2016).

According to Bossi et al. (2013: 1199), there are multiplicities of programs under the welfare state in high-income industrialized countries that promotes redistribution and provides social insurance programs for the population. "Some programs are designed specifically to target inequalities between the rich and the poor, whereas others aim to cope with variations in income over the life cycle". Emerging welfare states in Latin America have experienced different trajectories and aren't still as developed as the welfare states in Europe (Navarro Ruvalcaba 2006; Cruz-Martínez 2015a), therefore it would be relevant to examine the relationship between a three-dimensional welfare state development composite variable and income inequality.

This paper uses 3 indicators of individual deprivations suffered by individuals on poverty and 2 indicators of income inequality as explanatory variables. Three deprivations experienced by individuals on poverty are operationalized as P1, P2 and P3. P1 refers to income deprivation (ratio of population with an income below the cost of the national basic basket of goods and services), P2 refers to undernourishment (ratio of population with food inadequacy)[7] and P3 refers to deprivation of hydration and hygiene facilities (ratio of population without access to improved water sources or sanitation facilities). P1 is considered as an individual deprivation from the monetary approach, while P2 and P3 refer to deprivations from the capability approach. Undernourishment (P2) is used to present deprivation of health capabilities and deprivation of hygiene and hydration facilities (P3) presents deprivations related to quality of life. Alkire and Santos (2010: 14) considers malnutrition/undernourishment as a direct indicator of functionings, and showed that it may have life-long effects in the cognitive and physical development of children, plus it may produce negative externalities reflected as other health disorders. In addition, these scholars considered deprivation of hydration and hygiene infrastructures as "means very closely connected to the end (functioning) they are supposed to facilitate". Safe drinking water satisfy the need of hydration and improved sanitation facilities promote hygiene (2010: 16). In Latin America and the Caribbean there are still around 20 % of the population with undernourishment and more than 14 % with deprivation of hydration and hygiene facilities.

In addition, two indicators of income inequality are considered: the ratio of population with an income below 50 % of the median income per capita (*In1*) and the Gini index[8] (*In2*). The OECD and the European Union have constantly used this last indicator as a relative poverty indicator, nevertheless this indicator measures income distribution rather than deprivation or lacking of material goods. Because income inequality refers to the

[7] According to the FAO (2013) "(…) it measures the percentage of the population that is at risk of not covering the food requirements associated with normal physical activity, and therefore including also those who, even though cannot be considered chronically undernourished, are likely being conditioned in their economic activity by insufficient food". It is not an indicator of insufficient income to purchase food –as the ECLAC poverty indicator- rather it represents the probability of selecting an undernourished individual in a population. So it does not consider the cause (food availability or income) of the undernourishment but the fact the individual is undernourished. An individual with food inadequacy will not be able to develop its basic capabilities, in turn limiting the achievement of freedom and well-being.

[8] It is a measure of the deviation of the distribution of income among individuals or households within a country from a perfectly equal distribution. A value of 0 represents absolute equality, a value of 1 absolute inequality (World Bank 2013).

unequal distribution of income among different groups in a population, *In2* is considered to be an income inequality indicator. Data for the 5 indicators operationalizing the explanatory variables are provided in the "Appendix".

3 Results

In order to examine the explanatory power of the welfare state development on the levels of poverty and inequality in the region, three regression analyses were carried out.

3.1 Ordinary Least Square Regression Analysis

The first of three research techniques used in this paper was an ordinary least-squares (OLS) regression with time-series cross-section data for 2000, 2005 and 2010. The formula of the linear regression model is: $Y_{ct} = \beta X_{ct} + A$; where Y refers to poverty or income inequality in country c and time period t, X refers to the multidimensional welfare index in country c and time period t, A is the intercept, while β represent the regression coefficient.[9] Five regressions were conducted, three with an indicator of individual deprivation and two with an indicator of income inequality. This technique sought to answer the following question. How strong is the relationship between the development of the welfare state and the level of poverty and income inequality in Latin America and the Caribbean?

Figure 1 illustrates five graphs with the pooled data results of MWI and five deprivations/inequality indicators for the 18 cases around 2000, 2005 and 2010. Looking at the slope of the regression line we can confirm the negative relationship between poverty and the MWI, as well as the null relationship between income inequality and the MWI (see the horizontal regression line in In1 and In2). The negative signs of the regression coefficients (β) and the significance level ratified what was stated above. In other words, countries with higher combinations of social spending, coverage of welfare programs, and better outcomes of welfare institutions appear to have lower levels of deprivations, but not necessarily lower levels of income inequality.

However, we cannot effectively confirm or predict the changes that occur in poverty and income inequality using a model with just one independent variable. Several variables could impact poverty and income inequality. In order to solve this limitation, three controls were incorporated in the next section into a pooled time series cross-section regression analysis during the 2000–2010 period.

3.2 Pooled Time Series Cross-Section Regression Analysis: 2000–2010

The second of the three research techniques used was a pooled time series cross-section regression analysis.[10] Focusing only on the bivariate relationship between the MWI and each

[9] One of the reviewers was worried about the problem of having welfare outcomes indicators as dependent and explanatory variables. However this is not the case, but is relevant to be clear about what the outcome dimension in the MWI is measuring. This third dimension is not measuring welfare outcomes, but outcomes of welfare institutions (i.e. outcomes of health and education institutions). Therefore, there are not welfare outcomes indicators in both side of the regression formula. There is a dimension in the MWI (explanatory variable) that measures outcomes of welfare institutions and there are two indicators as dependent variables (individual deprivations and income inequality) measuring two of the multiple welfare state objectives.

[10] This analysis presents the degree of correlation and significance between variables, but do not pretend to explain poverty/inequality levels and poverty/inequality structure in the region.

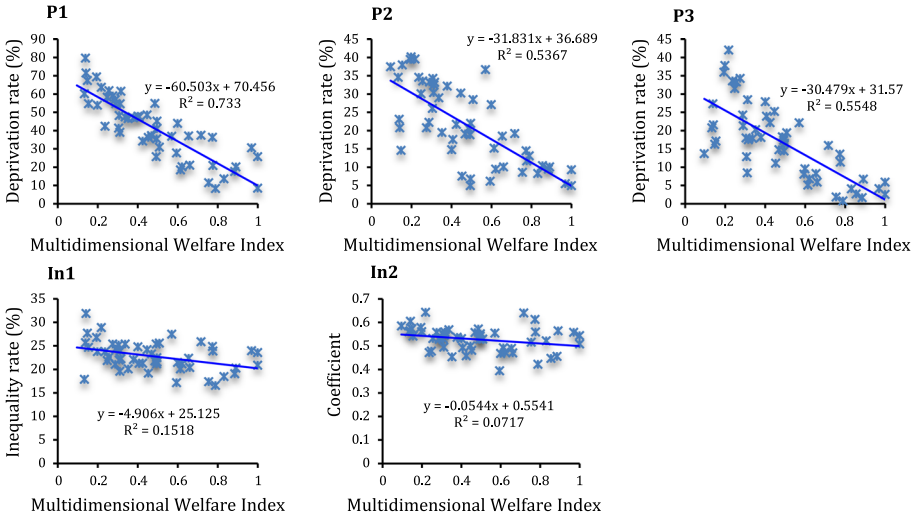

Fig. 1 Relationship between the multidimensional welfare index scores, deprivation rates and inequality rates around 2000, 2005 and 2010 in Latin America and the Caribbean. *Note* 18 countries from Latin America and the Caribbean were included in the analysis (see Table 1). The MWI scores are standardized. A score of 1 refer to a relatively more developed welfare state and 0 to a relatively less developed welfare state. In the upper part of the *Y*-axis is mentioned the dependent variable used. *P1*, *P2* and *Gini* indicators from Argentina refer to the urban zone. Data around 2000, 2005 and 2010 for the MWI, individual deprivations and income inequality indicator were used Source: CEPAL (n/d), FAO (2013), World Health Organization (2015), UNICEF (2014), Inter-American Development Bank (2012), CEDLAS and World Bank (2015)

of the five explanatory variables –as it was shown in the previous section- without controlling for other relevant variables may produce biased results and conclusions. Therefore the three indicators were included in a second model to control for demographic and cyclical effects. Why include controls to the regression model? Controls are included mainly to avoid implicit causality between variables with just a high correlation and to be sure that the relationship between a variable X and Y is not fraudulent (Díez Medrano 1992).

Following Caminada et al. (2012) and Gottschalk and Smeeding (2000) an analysis that explains the level and structure of poverty "should ideally be based on a theory that would have to address at least the following factors that could have an impact on the level of poverty [as well as on income inequality]: differences in labor markets that affect earnings of individual household members; demographic differences, such as the ageing of the population and growth of single-parent households, which affect both family needs and labor market decisions; and differences across countries in tax and transfers policies that not only affect family income directly but might also affect work and investment decisions" (2012: 117). For this reason, demographic and cyclical factors were incorporated into the regression analysis between the development of the welfare state, poverty and income inequality.

The first control variable used is the percentage of elderly population, which seeks to control for changes in pensions over time/country. The second one is the unemployment rate, which seeks to control for unemployment benefits. And the third control variable is gross domestic product per capita (GDPpc), which seeks to present an approximation of the wealth of countries. According to the academic literature (Caminada et al. 2012; Nolan and Marx 2009; OECD 2008; Cantillon et al. 2003) these three appear to be the most relevant control variables in a cross-country analysis.

Table 2 shows the results of three regression models. The first model is a simple ordinary least square bivariate analysis between the respective dependent variable (P1, P2, P3, In1 or In2) and the MWI. The second model is a pooled time series cross-section regression analysis including the three controls mentioned above. The third model is similar to the previous one, with the only exception of using the social spending dimension index to operationalize the welfare effort as a one-dimensional perspective. In the last two models, the data were analyzed using Beck and Katz (1995) method of ordinary least square with panel-corrected standard errors models.

The Bailey and Katz (2011) *pcse* function was used in the statistical software R to calculate the panel-corrected standard error of the model. According to Bailey and Katz (2011: 1) "time-series-cross-section data are characterized by having repeated observations over time on some set of units, such as states (…) [and] often show non-spherical errors because of contemporaneous correlation across the units and unit level heteroskedasity". The non-spherical errors produce incorrect standard errors from the ordinary least square regression. Following Beck and Katz (1995) these errors are fixed through a "sandwich type estimator of the covariance matrix of the estimated parameters, which they called panel-corrected standard errors".[11]

The formula of the pooled time series cross-section regression in model 2 is: $Y_{cp} = \beta X1_{ct} + \alpha X2_{ct} + \delta X3_{ct} + \varepsilon X4_{ct} + A$; where Y refers to poverty or income inequality in country c and time period t, $X1$ refers to the multidimensional welfare index (model 1 and 2) or social spending dimension index (model 3) in country c and time period t, $X2$ the percentage of the population over 65 years of age in country c and time period t, $X3$ the unemployment rate in country c and time period t, $X4$ the GDP per capita in country c and time period t, A is the intercept, while β, α, δ, ε represent the regression coefficients. The period considered in this analysis is the first decade of the XXI century. There is no sufficient data to calculate the MWI on a yearly basis; nevertheless the composite indicator was constructed for 3 years in this period: around 2000, 2005 and 2010. The dependent and control variables also make reference to these 3 years. Through this technique this paper sought to answer the following question. Does the explanatory variable maintain its strength and explanatory power, after incorporating controls in the regression model for the period 2000–2010?

Let's briefly discussed the explanatory power and degree of significance of the model 2, which includes controls for demographic and cyclical factors. As seen in Fig. 1 and model 1 of Table 2, MWI coefficients (β) showed negative values with the five dependent variables (P1, P2, P3, In1 and In2). Meanwhile, as shown in model 2, the inclusion of the three controls alters the coefficient signs of the MWI from negative to positive in the models with inequality indicators as dependent variables. The coefficient of determination results confirm that the explanatory power of the welfare state development is relatively high for models with individual deprivations suffered by population in poverty as dependent variables; however the explanatory power is minor for models with income inequality as the dependent variable.

After taking a closer look at the results of the regression analysis in Table 2, it is possible to confirm that indeed the MWI appears to have some significant explanatory power with the individual deprivations (P1, P2 and P3) as well as with one of the two indicators of income inequality (In1). Now, what if we controlled for demographic and cyclical factors that may independently affect the levels of poverty and income inequality? After including controls on the model, the MWI continues to exhibit explanatory powers with poverty (p value <0.01 for P1 and P2; p value <0.05 for P3), but not with income inequality (In1 or In2). However, it is important to mention that the explanatory power of

[11] Beck and Katz (1995) show in their article the usefulness of OLS for TSCS data, over the feasible generalized least square estimator suggested by Parks (1967) and popularized by Kmenta (1986).

Table 2 Panel data OLS regression between multidimensional welfare index, social spending dimension index, poverty and income inequality (around 2000, 2005 and 2010) using individual deprivations (P1. P2, P3), and income inequality (In1. In2) indicators in Latin America and the Caribbean. Source: CEPAL (n/d), Heston et al. (2012), FAO (2013), World Health Organization (2015), UNICEF (2014), Inter-American Development Bank (2012), CEDLAS & World Bank (2015)

	P1			P2			P3		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
MWI	−60.503*	−34.171*		−31.831*	−30.020*		−30.479*	−14.271**	
	(5.164)	(3.279)		(4.101)	(1.687)		(3.786)	(3.647)	
SSDI			−11.626**			−20.177*			−7.907**
			(2.758)			(0.935)			(2.023)
Population over 65 year (%)		−0.655	−1.873*		0.322	0.037		−0.606	−0.858
		(0.205)	(0.102)		(0.438)	(0.568)		(0.134)	(0.169)
Unemployment rate (%)		0.367	−0.069		0.626**	0.231		0.008	−0.183
		(0.091)	(0.069)		(0.132)	(0.117)		(0.167)	(0.218)
GDP per capita (I$)		−0.002*	−0.003*		−0.001**	−0.001*		−0.001*	−0.002*
		(0.0002)	(0.0004)		(0.0002)	(0.0002)		(0.0003)	(0.0004)
Intercept	70.456*	74.578*	79.065*	36.689*	35.022*	38.218*	31.570*	37.547*	39.212*
	(2.764)	(1.724)	(2.748)	(2.207)	(1.609)	(2.371)	(2.037)	(3.386)	(3.848)
R	0.856	0.944	0.911	0.733	0.809	0.821	0.745	0.834	0.829
R^2	0.733	0.891	0.830	0.537	0.655	0.674	0.555	0.696	0.687
Adjusted R^2	0.728	0.881	0.816	0.528	0.626	0.647	0.546	0.671	0.661
F-statistic	137.270	93.880	56.329	60.235	22.745	24.780	64.805	27.496	26.313
N × T	52	51	51	54	53	53	54	53	53

Table 2 continued

	In1			In2		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
MWI	−4.906*	0.351		−0.054	0.0562	
	(1.640)	(1.177)		(0.027)	(0.0423)	
SSDI			0.090			0.040
			(0.335)			(0.012)
Population over 65 year (%)		−0.309	−0.295		−0.010**	−0.009**
		(0.082)	(0.128)		(0.003)	(0.0009)
Unemployment rate (%)		0.114	0.119		0.0005	0.001
		(0.086)	(0.075)		(0.001)	(0.0009)
GDP per capita (I$)		−0.0004**	−0.0004**		−0.000005	−0.000004
		(0.0001)	(0.00008)		(0.000002)	(0.000002)
Intercept	25.125*	26.073*	26.025*	0.554*	0.5906*	0.585*
	(0.878)	(0.848)	(0.787)	(0.015)	(0.030)	(0.023)
R	0.390	0.564	0.564	0.268	0.499	0.505
R^2	0.152	0.318	0.318	0.072	0.249	0.255
Adjusted R^2	0.135	0.259	0.259	0.054	0.186	0.193
F-statistic	8.945	5.373	5.368	4.015	3.969	4.100
N × T	52	51	51	54	53	53

Model 1 is a simple OLS between the respective dependent variable (P1, P2, P3, In1 or In2) and the MWI. Model 2 incorporates the three controls for demographic and cyclical effects and correct the standard errors following Beck and Katz (1995). Model 3 substitutes MWI for the social spending dimension index, incorporates the three controls for demographic and cyclical effects and correct the standard errors following Beck and Katz (1995). Standard errors (Model 1) and panel corrected standard errors (Model 2) are in parenthesis. P1, P2 and Gini indicators from Argentina refer to the urban zone. 18 countries from Latin America and the Caribbean were included in the analysis: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela. Missing data for Guatemala 2010 (P1 and In1), Honduras 2000 (unemployment rate) and Uruguay 2000 (P1 and In1). MWI stands for multidimensional welfare index and SSDI for social spending dimension index

* Significant at the 0.01; ** Significant at the 0.05

the MWI declined after including demographic and cyclic controls. After including the controls, the regression coefficient of MWI halve in the model with P3 as dependent variable, reduced by 43.5 % in the model with P1 and by 5.7 % in the model with P2.

What is the importance of knowing the explanatory powers of the MWI on poverty and income inequality? Thanks to the analysis of the regression model and the respective regression coefficients it is possible to estimate the effect that increasing the MWI a unit would have on poverty and income inequality .[12] Here I will focus on analyzing the slope of the regression line. For example, according to the model for approximately each 0,1[13] unit increase in the MWI we are going to expect a 3.42 % reduction[14] of income deprivations, a 3 % reduction of undernourishment and a 1.43 % reduction of hydration and hygiene facilities deprivation, after holding the three controls constant to their respective means.

Population over 65 years of age and the unemployment rate shows a statistically significant relationship with only one variable; the former with the Gini coefficient (at the 0.05) and the latter with undernourishment (at the 0.05). Gross domestic product per capita (GDPpc) is the other variable in the model showing a statistically significant relationship with the 3 indicators of individual deprivation and the ratio of population below 50 % of the median income per capita. However, after analyzing the regression coefficients we can confirm that the significance of the GDPpc in the model is not accompanied by a substantial explanatory power on poverty and income inequality. For example, after holding constant the MWI and the other two controls, an increase of one dollar in the GDPpc of the region would approximately reduce the income deprivation (*P1*) in 0.002 %, the level of undernourishment (*P2*) in 0.0009 %, the deprivation of hydration and hygiene facilities (*P3*) in 0.001 % and the ratio of population with an income below 50 % of the median income per capita (*In1*) in 0.0004 %.

Although the explanatory powers of GDPpc on poverty and income inequality are statistically significant, the change/estimated effect it would have on the dependent variables are not very relevant. It would be necessary to increase the GDPpc by about $ 1000 dollars to expect a 0.4 % reduction in the In1 and a 0.9 % reduction in the P2. And it would be necessary to increase the GDPpc by $ 100 dollars to expect a 20 basis points change in the P1 (−0.2 %) and a 10 basis points change in the P3 (−0.1 %). After visualizing the regression line slopes in a graph, we can confirm that the MWI exhibited a steeper slopes than the GDPpc with P1, P2, In1 and In2.

The main result after comparing the outcomes of model 2 (multidimensional explanatory variable) and model 3 (one-dimensional explanatory variable) is that after controlling for demographic and cyclical factors, welfare effort (measured by the SSDI) and welfare state development (measured by the MWI) have a strong and significant relationship with the three individual deprivations considered, but not with income inequality. Therefore,

[12] The regression coefficient analysis is *ceteris paribus*, which means that we are going to examine how much a 1 unit change in X variable changes a Y variable after holding other X's constant. In this case, the paper examines the effect of 1 unit change in the MWI over poverty and inequality, after holding constant the elderly population, the unemployment rates and the gross domestic product per capita.

[13] How can a country increase the value of its MWI, so that it can have an effect on poverty and income inequality? As I mention before, the MWI is a composite index of three individual indexes referring to the three dimensions of the welfare state considered in this study. Each dimension arbitrarily contributes to one-third of the MWI score. Meanwhile the weights of the initial 8 indicators that form the individual indexes (SSDI, CDI, ODI) are assigned by the PCA. Looking at the loadings matrix (not shown here) we can have an idea of the 'importance' or 'explanatory power' each initial indicators have within the individual indexes. The component loadings show the correlation between the PC1 and the original indicators, so they tell us how much of the variation in the initial indicator is explained by the PC1.

[14] Here I don't refer to elasticity but rather a simple analysis of the slope. How does a 1-unit change in the MWI affect the poverty level (%).

both –one-dimensional and multi-dimensional- welfare state variables did not appear to have a significant relationship with income inequality during 2000–2010.[15]

A robustness test was performed using the Palma ratio –ratio of the income share of the top 10 % to that of the bottom 40 %. The result (not shown here) was reconfirmed: either using a multidimensional (MWI) or one-dimensional (social spending) indicator, there is no significant relationship between the welfare state development and income inequality.

3.3 Pooled Time Series Cross-Section Regression Analysis: MWI Dimensions

As was mentioned above, the multidimensional welfare index used to operationalize the explanatory variable is composed of three indexes. Each of these indexes refers to a dimension of the welfare state: social spending dimension, coverage dimension of welfare programs and the outcome dimension of welfare institutions. What if we consider each of the three dimensions as explanatory variables in the regression analysis? Would the three dimensions exhibit a significant a strong relationship with individual deprivations after controlling for demographic and cyclical factors? Does any dimension display significant explanatory power with income inequality? Which of the three dimensions exhibit greater explanatory power with poverty and income inequality, before and after incorporating the controls for demographic and cyclical factors?

To provide answers to these questions further pooled time series cross-section regression analysis were performed with the three dimensions as explanatory variables. The social spending dimension is operationalized by the social spending dimension index (SSDI). The dimension 'coverage of welfare programs' is operationalized by the coverage dimension index (CDI). Thirdly, the dimension 'outcomes of welfare institution' is operationalized by the outcomes dimension index (ODI). As it was mentioned above, these three indexes accounts for more than 74.2 % (SSDI), 75 % (CDI) and 59.1 % (ODI) of the initial data variance. So they could be considered good summary indexes of the three dimensions of the welfare state considered in the MWI.

By looking at Table 3, we can confirm that two regression models were conducted with each of the dependent variables (P1, P2, P3, In1, In2). The difference between model 1 and model 2 is that the latter includes the three controls used before in the previous section. The formula of the pooled time series cross-section regression in model 1 is: $Y_{cp} = \beta X1_{ct} + \alpha X2_{ct} + \delta X3_{ct} + A$; where Y refers to poverty or income inequality in country c and time period t, $X1$ refers to the social spending dimension index in country c and time period t, $X2$ the coverage dimension index in country c and time period t, $X3$ the outcome dimension index in country c and time period t, A is the intercept, while β, α, δ, represent the regression coefficients. The formula for model 2 is $Y_{cp} = \beta X1_{ct} + \alpha X2_{ct} + \delta X3_{ct} + \varepsilon X4_{ct} + \gamma X5_{ct} + \mu X6_{ct} + A$; where Y refers to poverty or income inequality in country c and time period t, $X1$ refers to the social spending dimension index in country c and time period t, $X2$ the coverage dimension index in country c and time period t, $X3$ the outcome dimension index in country c and time period t, $X4$ the percentage of the population over 65 years of age in country c and time period t, $X5$ the unemployment rate in country c and time period t, $X6$ the GDP per capita in country c and time period t, A is the intercept, while β, α, δ, ε, γ *and* μ represent the regression coefficients.

The results of the multiple regression analysis are shown in Table 3. Regression coefficients of the SSDI and the ODI have negative values in both models and with the five dependent variables (P1, P2, P3, In1 and In2), except on the model 2 with P1 as dependent

[15] In a previous paper, the strong and significant relationship between social spending per capita and individual deprivations was confirmed in a cross-country comparative analysis (21 cases) between 1990 and 2010 [See Cruz-Martínez (2015b)].

Table 3 Panel data OLS regression between the three dimensions of the multidimensional welfare index, poverty and income inequality (around 2000, 2005 and 2010) using individual deprivations (P1, P2, P3), and income inequality (In1, In2) indicators in Latin America and the Caribbean. Source: CEPAL (n/d), Heston et al. (2012), FAO (2013), World Health Organization (2015), UNICEF (2014), Inter-American Development Bank (2012), CEDLAS & World Bank (2015)

	P1		P2		P3		In1		In2	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
SSDI	−5.275	0.323	−28.091*	−24.709*	−11.140**	−8.006	−3.467	−2.252	−0.046	−0.024
	(6.222)	(2.503)	(4.673)	(2.375)	(4.986)	(1.797)	(1.985)	(0.911)	(0.031)	(0.021)
CDI	−27.848*	−25.373*	16.537**	14.968**	−2.371	2.321	4.674	6.391**	0.123*	0.177*
	(8.322)	(1.920)	(6.280)	(3.996)	(6.700)	(2.420)	(2.656)	(1.742)	(0.042)	(0.026)
ODI	−28.020*	−13.479*	−22.352*	−17.765*	−18.064*	−8.515	−6.967*	−4.343	−0.150*	−0.117*
	(6.604)	(1.928)	(4.864)	(2.072)	(5.189)	(2.694)	(2.107)	(1.819)	(0.033)	(0.016)
Population over 65 year (%)		−0.368		−0.059		−0.727		−0.437		−0.013*
		(0.298)		(0.496)		(0.155)		(0.082)		(0.001)
Unemployment rate (%)		0.649**		0.386		−0.026		0.098		0.001
		(0.083)		(0.223)		(0.146)		(0.075)		(0.001)
GDP per capita (I$)		−0.002*		−0.001**		−0.001*		−0.0003		−0.000002
		(0.0002)		(0.0002)		(0.0003)		(0.0001)		(0.000001)
Intercept	71.392*	71.287*	38.893*	39.213*	32.795*	38.590*	26.050*	27.076*	0.575*	0.609*
	(2.824)	(1.283)	(2.037)	(1.385)	(2.173)	(3.086)	(0.901)	(0.693)	(0.014)	(0.020)
R	0.878	0.955	0.818	0.865	0.759	0.840	0.516	0.639	0.560	0.705
R^2	0.771	0.912	0.669	0.748	0.576	0.705	0.266	0.408	0.314	0.498
Adjusted R^2	0.757	0.900	0.650	0.715	0.550	0.666	0.220	0.327	0.273	0.432
F-statistic	53.910*	76.266*	33.759*	22.764*	22.626*	18.313*	5.805*	5.056*	7.620*	7.594*
N × T	52	51	54	53	54	53	52	51	54	53

Model 1 is a multiple OLS between the respective dependent variable (P1, P2, P3, In1 or In2) and the three dimensions' indexes of the MWI, Model 2 incorporates the three controls for demographic and cyclical effects and correct the standard errors following Beck and Katz (1995). Standard errors (model 1) and panel corrected standard errors (model 2 and 3) are in parenthesis. P1, P2 and Gini indicators from Argentina refer to the urban zone. 18 countries from Latin America and the Caribbean were included in the analysis: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela, Missing data for Guatemala 2010 (P1 and In1), Honduras 2000 (unemployment rate) and Uruguay 2000 (P1 and In1)

* Significant at the 0.01; ** Significant at the 0.05

variable. Meanwhile, the CDI regression coefficient is negative only in both models with P1 as dependent variable, and in model 1 with P3 as the dependent variable. The positive signs shown in some of the coefficients are odd, but what's really important is the significance and explanatory variable of the dimensions with poverty and inequality, before and after controlling for demographic and cyclical effects.

Only one of the welfare state dimensions considered in this study appears to have some significant explanatory power with the three indicators of poverty (P1, P2 and P3) as well as with the two indicators of income inequality (In1, In2). The social spending dimension exhibits a significant relationship only with undernourishment (p value <0.01) and with the deprivation of hydration and hygiene facilities (p value <0.05). The coverage dimension exhibits a significant relationship only with income deprivation (p value <0.01), undernourishment (p value <0.05) and with income inequality measured by the Gini index (p value <0.05). Contrary to what was expected, the significant relationship between the coverage of welfare programs, undernourishment and Gini index is positive.[16] Nevertheless, an OLS between the CDI and these two dependent variables (not shown here) confirms the inverse relationship among variables.[17] The outcome of welfare institutions is then the only one who experienced a significant negative relationship with the three individual deprivations and the two income inequality indicators.

Now, what if we controlled for demographic and cyclical factors? After including controls on the model, the social spending dimension reduced the explanatory powers with undernourishment by 12 % and stop exhibiting a significant relationship with the deprivation of hydration and hygiene facilities. The coverage dimension continues to exhibit a significant relationship with income deprivation, undernourishment and income inequality (Gini index). The explanatory power with income deprivation and undernourishment was reduced by 8.9 and 9.5 % respectively. On the other hand, the explanatory power of the coverage dimension with the Gini index increased by 43.9 %. In addition, the coverage dimension gained significant explanatory power with the other income inequality indicator (ratio of population with an income below 50 % of the median income per capita; p value <0.05). The outcomes dimension continues to exhibit a significant relationship with income deprivation, undernourishment and income inequality (Gini index), but lost the degree of significance with the other two indicators (P3 and In1). The explanatory power with income deprivation, undernourishment and income inequality (Gini index) was reduced by 51.9, 20.5 and 22 % respectively.

What would be the estimate effect on poverty and income inequality after increasing the three dimension individual index (SSDI, CDI, and ODI) by one unit? Here we will focus again, on analyzing the slope of the regression line. According to the model 2 in Table 3 for approximately each 0.1 unit increase in the social spending dimension index we are going to expect a 2.47 % reduction[18] of undernourishment, after holding the three controls

[16] History matters as Mesa-Lago (1994) would argue, therefore the legacy of the bismarckian model in Latin American welfare programmes might shed some light over this puzzle. In the bismarckian model, the coverage and benefits of social welfare programmes are closely linked to class and status. Rather than creating unified welfare programmes, Latin American countries developed stratified programmes during the XX century, where public servants, the military and organized workers were able to enjoy better quality of coverage than the majority of the population (Barba Solano 2009, 2005). The main problem with this duality in the coverage of welfare programmes, is that the large majority of the population worked in the agriculture or the informal sector. This large majority was then relegated to stigmatized and scarce social assistance with low replacement rates. Further analysis should examine if the specific structure of coverage in each country (e.g. defined contribution or defined benefit, universal or stratified) might explain this puzzle.

[17] Although not significant with the In2 as dependent variable.

[18] Again, here I don't refer to elasticity but rather a simple analysis of the slope. How does a 1-unit change in the explanatory variables affect the poverty level (%), ceteris paribus.

and the other two indexes constant. For each 0.1 unit increase in the coverage dimension index we are going to expect a 2.54 % reduction of income deprivation, a 1.50 % increase of undernourishment, a 0.64 % increase in the ratio of population with an income below 50 % of the median income per capita, and a 0.018 points increase in the Gini Index, after holding the three controls and the other two indexes constant. At last, for each 0.1 unit increase in the outcome dimension index we are going to expect a 1.35 % reduction of income deprivation, a 1.78 % reduction of undernourishment, and a 0.012 points reduction in the Gini Index, after holding the three controls and the other two indexes constant.

There are two unexpected results in the previous paragraph: the positive and significant relationship between the coverage dimension and undernourishment, and between the coverage dimension and the ratio of the population with an income below 50 % of the median income per capita. How is it possible that, ceteris paribus, an increase in the coverage of welfare programs exhibited a positive relationship with these two indicators? One hypothesis could be that social protection programs considered in the CDI are associated to pension and health programs. If coverage of targeted programs such as the conditional cash transfer programs would have been considered, the relationship between the variables could have been different. According to a Save the Children's report, social protection can help address the malnutrition and undernourishment by increasing the consumption of the families through cash transfers. "Social protection has a positive effect on household aggregate consumption: a large proportion of cash transfers is spent on food, which has a clear impact on child nutrition" (Aston and Jones 2012: 4).[19] Considering Bolsa Familia, Chile Solidario and Oportunidades as examples, Soares and Zepeda (2007), confirms the effectiveness of the conditional cash transfer programs "transferring income to the poorest, thus reducing inequality". So maybe, it could be interesting to consider in a future research the coverage of conditional cash transfer programs as a fourth indicator in the coverage dimension index. Nevertheless, further analysis needs to be performed regarding this incongruent significant relationship.

Population over 65 years of age and the unemployment rate shows a statistically significant relationship with only one variable; the former with the Gini coefficient (at the 0.01) and the latter with income deprivation (at the 0.05). Gross domestic product per capita (GDPpc) is the only control variable in the model showing a statistically significant relationship with the 3 indicators of individual deprivation. However, after analyzing the regression coefficients we can confirm that the significance of the GDPpc is again not accompanied by a substantial explanatory power on poverty.

4 Conclusion

Poverty and inequality levels in Latin America and the Caribbean have steadily decline for almost a decade and a half, and are at one of its lowest levels ever recorded. Nevertheless, there are still millions of people in the region suffering from single or multiple deprivations and the region continues to be the most unequal region of the world (Tsounta and Osueke 2014). So, continuing reducing poverty and inequality continues to be an imperative in the region.

Poverty and inequality have many dimensions and determinants. But the results shown in this paper suggest that the development of social-welfare programs and institutions seems to be an effective way of tackling individual deprivations suffered by people on poverty in Latin America and the Caribbean. On the other hand, the welfare state

[19] See Table 1 on Aston and Jones (2012: 4) to understand how different types of social protection (social transfers, social insurance, social welfare services for marginalized groups and social equity) may improve child malnutrition.

development didn't appear to be effective to reduce income inequality. The first test confirmed the negative relationship between the three individual deprivations (P1, P2, and P3) and the MWI, as well as the null relationship between income inequality and the MWI. The second test introduced controls to avoid biased results because of the bivariate analysis in the first test. After including controls on the model, the welfare state variable continues to exhibit explanatory powers with individual deprivations suffered by people on poverty but not with income inequality. The use of a one-dimensional and multidimensional perspective to operationalize the welfare state variable displayed similar results. Population over 65 years of age, and the unemployment rate shows a statistically significant relationship with only one variable, and the gross domestic product per capita exhibited a statistically significant relationship with the 3 indicators of individual deprivation and the ratio of population below 50 % of the median income per capita. Although the explanatory power of GDPpc on poverty and income inequality is statistically significant, the estimated effect it would have on the individual deprivations and income inequality are not very relevant. Therefore, there is a low growth elasticity of poverty reduction (individual deprivations) in Latin America during the first decade of the XXI century.

In the third test, the explanatory power of the three welfare state dimensions was examined. The outcome of welfare institutions is the only welfare state dimension considered in this study that experienced a significant negative relationship with the three individual deprivations and the two income inequality indicators. Therefore, improving the outcomes of health and education institutions appears to be the most significant factors (of those considered in the multidimensional welfare index) behind changes in individual deprivations and income inequality. After including controls on the model, the social spending dimension reduced its explanatory powers with the deprivation indicators, the coverage dimension increased its explanatory power with the inequality indicators and the outcomes dimension reduced its explanatory variables with the five indicators. The significance of the GDPpc in this test is again not accompanied by a substantial explanatory power on the individual deprivations suffered by people on poverty.

The welfare state as an institution tends to promote equality, but this was not the case for Latin America and the Caribbean in the first decade of the XXI century. This doesn't mean that the institutionalization and development of the welfare state is not a solution for income inequality, rather that the actual scope, programs, infrastructures, coverage and social investments are not yet enough to promote significant income inequality reductions. Although the state may have an obligation to reduce poverty and inequality, the welfare state –measured by expenditure or by the MWI- is only one of the policy tools that may be used. According to the results shown in this paper, out of the three dimensions, the outcomes of welfare institutions should be the pivotal dimension to reduce income inequality and income deprivations in the region.

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Appendix

See Table 4.

Table 4 Data and descriptive statistics of the 8 initial indicators used for the Multidimensional Welfare Index, the 3 individual deprivations indicators, the 2 income inequality indicators and the 3 controls, across 18 countries around 2000, 2005 and 2010. Source: CEPAL (n/d), Heston et al. (2012), FAO (2013), World Health Organization (2015), UNICEF (2014), Inter-American Development Bank (2012), CEDLAS & World Bank (2015)

Country	Year	SS1	SS2	SS3	C1	C2	C3	O1	O2	P1	P2	P3	In1	In2	65y	Unem	GDPpc
Argentina	2000	21.4	63.5	1173.0	70.7	61.6	41.0	21.4	98.0	25.8	5.0	5.9	23.6	0.544	9.9	15.1	7903.2
Argentina	2005	20.0	62.4	1151.0	69.0	57.6	40.0	26.0	98.3	30.6	5.5	4.2	24.0	0.558	10.2	11.6	9670.7
Argentina	2010	27.8	64.3	1868.0	90.4	65.1	45.0	29.5	98.5	8.6	9.3	2.6	20.9	0.509	10.6	7.7	14512.1
Bolivia	2000	11.5	35.8	111.0	17.0	34.5	10.0	17.0	92.3	63.7	39.6	42.1	28.9	0.643	4.2	7.5	2599.4
Bolivia	2005	12.4	28.2	127.0	18.0	32.7	11.0	17.3	94.3	54.0	40.2	37.8	23.8	0.561	4.5	8.1	3312.7
Bolivia	2010	12.4	37.5	145.0	20.2	39.6	11.0	24.7	95.6	42.4	34.6	33.7	23.8	0.472	4.8	6.5	4432.8
Brazil	2000	21.2	62.5	932.0	85.4	64.8	26.0	8.8	96.7	37.5	19.2	16.0	25.9	0.64	5.5	7.1	6025.1
Brazil	2005	22.5	73.1	1067.0	86.2	66.7	24.0	10.0	97.7	36.4	14.5	13.6	24.9	0.613	6.2	9.8	7234.1
Brazil	2010	26.6	73.5	1402.0	84.7	75.6	24.0	15.1	98.4	20.9	11.7	11.4	23.9	0.559	6.9	6.7	9754.7
Chile	2000	15.0	68.8	984.0	65.3	76.4	26.0	18.0	98.9	20.2	10.1	6.8	20.3	0.564	7.2	9.7	7365.5
Chile	2005	12.9	66.9	982.0	60.7	79.8	23.0	19.8	99.1	13.7	8.3	4.1	18.5	0.522	8.0	9.2	11068.4
Chile	2010	14.8	67.1	1270.0	60.7	82.3	21.0	22.0	99.1	11.5	8.6	1.9	17.4	0.516	9.2	8.2	15960.8
Colombia	2000	10.2	68.3	312.0	19.0	58.5	11.0	12.4	97.5	54.9	20.7	18.4	21.8	0.572	4.7	17.3	5031.0
Colombia	2005	11.9	69.2	404.0	21.0	58.5	10.0	14.9	97.8	45.2	22.0	16.5	21.6	0.551	5.1	14.3	6491.0
Colombia	2010	13.8	69.6	542.0	23.5	56.0	14.0	15.8	98.1	37.3	19.1	14.8	23.3	0.557	5.6	12.4	8975.4
Costa Rica	2000	17.3	40.9	720.0	35.4	66.5	14.0	11.7	98.7	20.3	9.5	6.9	21.2	0.474	5.5	5.3	8276.4
Costa Rica	2005	17.3	35.4	798.0	41.2	67.8	13.0	16.9	99.0	21.1	10.1	5.9	20.4	0.47	5.9	6.9	9939.3
Costa Rica	2010	22.6	39.2	1211.0	44.9	70.7	12.0	17.8	99.0	18.5	15.2	5.1	20.1	0.492	6.5	7.1	12983.0
Dominican Republic	2000	6.1	47.0	199.0	11.6	46.7	21.0	14.4	95.9	47.1	32.2	18.2	22.1	0.537	5.2	13.9	6475.5
Dominican Republic	2005	7.5	40.4	269.0	12.3	46.7	20.0	15.2	96.5	47.5	29.0	17.9	25.4	0.569	5.7	17.9	7895.9
Dominican Republic	2010	7.3	37.9	344.0	15.3	74.7	16.0	17.7	96.9	41.4	26.1	18.0	25.2	0.554	6.0	14.3	11600.4
Ecuador	2000	2.9	14.0	75.0	13.8	33.0	15.0	18.2	96.6	61.6	33.2	17.6	22.3	0.559	5.1	9.0	4024.9
Ecuador	2005	4.7	21.8	141.0	15.4	33.1	15.0	19.7	97.1	48.3	34.3	12.9	22.0	0.531	5.6	8.5	5520.0

Table 4 continued

Country	Year	SS1	SS2	SS3	C1	C2	C3	O1	O2	P1	P2	P3	In1	In2	65y	Unem	GDPpc
Ecuador	2010	8.1	26.3	266.0	22.4	45.2	16.0	21.7	97.5	39.1	30.4	8.5	19.6	0.495	6.0	7.6	7345.7
El Salvador	2000	12.0	56.3	328.0	14.5	53.6	9.0	10.6	96.8	47.9	14.8	27.9	24.8	0.531	5.5	6.5	4766.4
El Salvador	2005	12.6	55.9	354.0	16.2	52.5	9.0	11.8	97.6	47.5	17.6	24.0	21.3	0.493	6.2	7.3	5888.4
El Salvador	2010	13.4	55.9	394.0	14.0	46.5	10.0	12.0	98.2	46.6	19.5	20.3	20.1	0.454	6.9	6.8	6828.0
Guatemala	2000	7.1	44.1	148.0	11.1	36.1	5.0	5.8	94.9	60.2	34.6	20.8	17.9	0.56	4.0	4.5	4806.8
Guatemala	2005	7.6	51.1	163.0	15.4	38.5	7.0	6.4	95.9	54.8	38.0	17.2	24.7	0.542	4.3	3.2	5588.8
Guatemala	2010	7.9	53.2	180.0	10.4	31.0	6.0	6.0	96.6	NA	37.5	13.7	NA	0.585	4.4	3.5	7071.2
Honduras	2000	7.8	45.0	97.0	5.4	6.2	10.0	5.5	96.2	79.7	23.1	27.4	25.7	0.564	3.9	NA	2768.6
Honduras	2005	9.8	52.2	138.0	5.0	6.2	7.0	5.7	96.9	71.5	20.8	21.6	31.9	0.605	4.1	6.5	3298.9
Honduras	2010	12.0	51.9	184.0	7.3	5.6	8.0	6.9	97.5	67.4	14.6	16.3	27.7	0.573	4.3	6.4	3803.4
Mexico	2000	8.6	60.7	654.0	19.0	45.6	11.0	14.2	97.4	41.1	6.8	18.0	22.5	0.542	5.0	3.4	9988.4
Mexico	2005	9.4	58.8	736.0	22.7	39.4	16.0	14.8	98.1	35.5	5.0	14.5	21.2	0.528	5.4	4.7	11641.9
Mexico	2010	11.3	55.9	911.0	25.3	37.2	17.0	17.0	98.3	36.3	7.6	11.1	19.2	0.481	6.1	6.4	13430.0
Nicaragua	2000	8.6	39.3	91.0	6.3	32.5	9.0	7.3	96.0	69.4	39.5	36.0	26.8	0.579	3.7	7.8	1885.1
Nicaragua	2005	11.2	49.7	129.0	12.2	33.9	9.0	9.6	96.8	61.9	33.6	33.4	22.6	0.532	4.1	7.0	2189.4
Nicaragua	2010	13.0	55.0	157.0	20.0	33.9	8.0	10.7	97.4	58.3	30.1	31.6	21.9	0.478	4.5	9.7	2592.9
Panama	2000	10.0	4.0	437.0	44.6	61.8	25.0	18.8	97.4	36.9	36.7	22.2	27.5	0.555	5.5	15.2	5818.2
Panama	2005	10.0	3.8	490.0	41.1	57.8	22.0	20.4	97.7	31.0	28.5	19.5	25.6	0.529	6.1	12.1	7786.0
Panama	2010	7.9	39.1	489.0	44.6	70.2	24.0	22.5	98.0	25.8	18.9	17.4	25.4	0.528	6.8	7.7	11495.7
Paraguay	2000	8.9	27.5	129.0	19.6	28.1	12.0	10.4	96.7	59.0	20.8	34.3	25.4	0.558	4.4	10.0	2955.6
Paraguay	2005	10.2	30.8	151.0	14.0	29.0	12.0	14.1	97.2	56.9	22.3	24.3	21.1	0.528	4.8	7.6	3435.4
Paraguay	2010	13.3	41.2	229.0	15.9	37.6	13.0	15.1	97.6	54.8	33.3	21.4	24.4	0.533	5.2	7.0	4851.2
Peru	2000	8.6	46.7	205.0	29.1	23.0	14.0	11.1	96.0	54.7	32.5	28.5	23.9	0.545	4.8	8.5	4082.8
Peru	2005	9.6	56.1	262.0	29.9	35.6	12.0	20.3	97.2	48.7	30.3	25.3	24.2	0.5	5.4	9.6	5561.5
Peru	2010	9.4	48.9	340.0	28.5	46.0	15.0	22.4	98.0	34.3	21.7	22.2	21.3	0.458	6.0	7.9	9009.6

Table 4 continued

Country	Year	SS1	SS2	SS3	C1	C2	C3	O1	O2	P1	P2	P3	In1	In2	65y	Unem	GDPpc
Uruguay	2000	20.7	67.1	1033.0	80.3	76.9	19.0	14.3	98.3	NA	10.4	2.7	NA	0.447	13.1	13.6	7844.0
Uruguay	2005	19.7	62.7	1028.0	86.3	73.8	24.0	19.3	98.6	17.7	9.5	1.7	19.1	0.456	13.5	12.2	8709.8
Uruguay	2010	24.2	75.4	1642.0	86.1	81.1	12.0	16.4	98.8	8.4	13.1	0.8	16.6	0.422	14.0	7.1	13671.2
Venezuela	2000	14.9	50.5	785.0	23.7	68.6	8.0	15.0	97.9	44.0	27.1	9.6	21.5	0.468	4.6	13.9	6160.1
Venezuela	2005	17.7	58.4	962.0	26.5	60.3	13.0	17.7	98.2	37.1	18.5	8.3	22.4	0.49	5.0	12.4	8920.9
Venezuela	2010	17.3	72.5	1042.0	41.6	60.9	9.0	19.0	98.4	27.8	6.2	8.1	17.2	0.394	5.6	8.7	11778.0

Data is around 2000, 2005 and 2010, SS1, SS2 and SS3 are the three indicators of the social spending dimension index. SS1 refers to social spending as a percentage of gross domestic product (GDP). SS2 refers to social spending as a percentage of public spending and SS3 refers to the social spending per capita are the three indicators used to build the social spending dimension index. C1, C2 and C3 are the three indicators of the coverage dimension index. C1 refers to the percentage of population over 65 years who receive a retirement pension, C2 refers to the percentage of employees with retirement coverage, and C3 refers to the number of hospital beds for every ten thousand inhabitants. O1 and O2 are the two indicators of the outcome dimension index, O1 refers to the proportion of adults, in the age group of 25–65 years, with more than 13 years of formal education, and O2 refers to the improbability of children under 5 years suffering infant mortality. P1, P2 and P3 are the three indicators of the individual deprivations, P1 refers to the ratio of population with an income below the cost of the national basic basket of goods and services, P2 refers to the ratio of population with food inadequacy, and P3 refers to the ratio of population without access to improved water sources or sanitation facilities. In addition, two indicators of income inequality are considered: the ratio of population with an income below 50 % of the median income per capita (In1) and the Gini index (In2). 65y, Unem and GDPpc were the three controls used in the regression analyses, 65y refers to the percentage of the population over 65 year, Unem refers to the unemployment rate (%), and GDPpc refers to the gross domestic product per capita in international dollars

NA data not available

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