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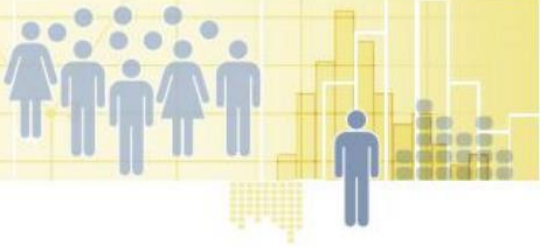

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Measuring Social Welfare Gains in Social Assistance Programs: An Application to European Countries

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Abstract

This paper aims to provide a framework for a complete assessment of the overall welfare gains resulting from social assistance programs. We make use of a social welfare function that satisfies several properties that must be considered when measuring the protection provided by these programs. We propose measuring the welfare gains that a society derives from these programs by summing up them in a way that is consistent with the standard value judgements in the income inequality literature. We also propose analytical tools that accumulate the welfare gains that, apart from having the advantage of being easy to interpret, allow the ranking of different scenarios and have an associated dominance criterion. To illustrate the possibilities of our approach, we measure the welfare gains caused by social assistance schemes in countries in the European Union.

Keywords: social welfare, welfare gains, social assistance, minimum income programs

JEL: D31, D63, I38

1. INTRODUCTION

The guarantee of a minimum level of resources is a corner-stone of the social model in OECD countries. In most Western welfare states, benefits targeted to low-income or poor populations that act as a last economic safety net are a key feature. Over the last few years, a range of reforms concerning these benefits have taken place. Many countries have put restrictive reforms into effect, limiting the increase in benefit levels, establishing stricter time limits and imposing more onerous obligations upon recipients. The main goal of these reforms has been to foster transitions from welfare to work. Nevertheless, there is no doubt that the major topic of public concern regarding these programs is whether they improve the welfare levels of the corresponding society through lower levels of poverty.

Despite the potential effects of social assistance programs on social welfare, which raise numerous interesting questions and are without doubt a major focus of policy research, we still have relatively little insight into how to measure these effects. While many studies have examined how the reforms of these programs have affected poverty incidence and intensity, far less research has examined how these results translate into possible gains or losses in terms of social welfare.

The recent reforms have motivated an extensive amount of research on the overall outcomes of these policy changes. As a result, a rapidly expanding literature has focused on alternative measures that allow the quantification of the protection provided by social assistance benefits. Usually, these measures focus on one dimension, either adequacy or coverage. As far as we know, there is a measure that combines both dimensions to assess the level of protection provided by minimum income programs. Ayala and Bárcena-Martín (2018) proposed an index that allows the measurement of the level of social welfare achieved through different schemes. However, there is a paucity of studies about the unexplored question of what the welfare gain is derived from the implementation of these type of protection schemes.

The assessment of the impact of social assistance benefits on social welfare requires the measurement of the change in welfare derived from the implementation of the scheme, rather than measuring the final level of social welfare achieved. The implementation of certain protection schemes could help some countries or jurisdictions to achieve high

levels of social welfare with very small changes, while other countries or jurisdictions might reach lower levels but higher social welfare gains.

In this paper, we aim to narrow this gap in the literature by building a framework in which the social welfare gains of a country or jurisdiction resulting from the implementation of a social assistance scheme can be determined by a welfare function such as the one proposed in Ayala and Bárcena-Martín (2018). This welfare function combines adequacy and coverage, gives more weight to the poorest recipients, and considers that, given a group of people with the same income level, small improvements for many individuals are preferred to a large improvement in one individual. Then, we propose assessing the welfare gains caused by these benefits in a society by summing up the welfare gains in different jurisdictions in a way that is consistent with the value judgements conducted in the literature on economic inequality. The way we aggregate these gains goes beyond the proposed simple average measures that satisfy normative properties usually accepted in that literature.

We propose measures based on the well-known FGT poverty indices (Foster et al. 1984). In this sense, and following Del Río and Alonso-Villar (2018), the welfare gains for a society that result from their social assistance programs can be assessed in terms of the notion of income gaps usually considered in poverty studies (Sen 1976; Atkinson 1987; Foster and Shorrocks 1988; Spencer and Fischer 1992; Jenkins and Lambert 1993), the employment gaps of unemployment analyses (Paul 1992; Sengupta 2009; Shorrocks 2009), the wage gaps analyzed in the literature on wage discrimination (Jenkins 1994; Del Río et al. 2011), the welfare losses in segregation studies (Del Río and Alonso-Villar, 2018) or the income losses studied in mobility literature (Bárcena-Martín and Cantó, 2018). Finally, we propose the design of analytical tools, or curves, that accumulate the welfare gains associated with social assistance benefits in the different jurisdictions which, apart from having the advantage of being easy to interpret, allow the ranking of different scenarios and have an associated dominance criterion.

To illustrate the possibilities of our approach, we focus on the different minimum income programs in the European Union member states. We use the EU-SILC data for the years 2004 and 2015 to approximate the possible welfare gains in the EU at two moments in time, establishing a dominance criterion. Our empirical illustration shows

that the economic crisis reduced the positive impact of these benefits on social welfare in EU countries.

The remainder of this paper is organized as follows. In section 2, we briefly introduce the general notion of social welfare in minimum income programs. In section 3, we propose a methodology that allows the evaluation of the changes in social welfare derived from the development of these programs. In section 4, we introduce a dominance criterion for the assessment of these welfare gains. In section 5, we illustrate the applicability of this methodology for analyzing the social welfare gains caused by minimum income programs in European Union countries. The paper ends with a brief list of conclusions.

2. THEORETICAL FRAMEWORK

The literature on social assistance benefits has paid little attention to the measurement of the impact of these benefits on social welfare. One exception is Ayala and Bárcena-Martín (2018), where a framework is proposed for the measurement of the protection provided by minimum income programs using a social welfare approach. As an extension of that paper, we propose defining the welfare gains in a set of countries or jurisdictions resulting from the implementation of these benefits taking as the starting point the social welfare function proposed there. We use this insight to answer the question of how to construct a measure of these gains that satisfies normative properties usually accepted in the literature on economic inequality.

The unit used in the analysis of those social welfare gains is a geographical area -for instance, a country- that can be decomposed into mutually exclusive areas, e.g., regions, that have implemented alternative designs of minimum income programs (MIP). Following Ayala and Bárcena-Martín (2018), let $\aleph = \{1,2,\dots,N\}$ be a country or jurisdiction composed of N individuals with $x = (x_i)_{i\in\aleph} = (x_1, x_2, \dots, x_N)$ income distribution. MIPs aim to provide an adequate level of economic security (B) to individuals in the lower tail of the income distribution. Therefore, B can be considered as the level of guaranteed income. The income received from an MIP by an individual with income x_i is $(B - x_i)$. Let us denote by $\wp = \{1,2,\dots,R\}$ the group of MIP recipients and by $\mathcal{L} = \{1,2,\dots,L\}$ the target group or potential claimants on which we will focus, with $\wp \subset \mathcal{L}$. We consider that potential claimants are defined in terms of a

level of income. The social welfare associated with the income distribution is defined as the social welfare corresponding to the potential claimants.

The Social Welfare Function (SWF) is assumed to be (Lambert, 1993; Cowell, 1995) *individualistic, additively separable, a strictly increasing function of income, symmetric* and *independent of the incomes of individuals who are not in the target group* (nonpotential claimants). That is, our SWF depends on individuals' utilities and on nothing else; it can be expressed as the summation of individuals' utilities, and increases when, ceteris paribus, any potential claimant's income rises. The only thing that matters is income, and only potential claimants' utilities are considered.

Because of these properties, the SWF can be written as the average of individuals' utilities using an increasing social utility function, which is shared by all of them and depends only on the individuals' own incomes (Cowell, 1995), as follows:

$$W(y) = \frac{1}{L}\sum_{i=1}^{L} U(y_i)$$

We impose strict concavity and constant elasticity of the social marginal utility on U(.). We also assume that the level of protection provided by a MIP is essentially a relative concept and is independent of the absolute magnitude of the income notion.

The elasticity of the social marginal utility is given by the parameter $\alpha - 1$. This brings us to the following family of social utility functions (Cowell, 1995):

$$U_\alpha\left(\frac{y_i}{z}\right) = \begin{cases} a_1 + b_1 \dfrac{\left(\frac{y_i}{z}\right)^\alpha}{\alpha} & 0 \neq \alpha < 1 \\ a_2 + b_2 ln\left(\frac{y_i}{z}\right) & \alpha = 0 \end{cases} \qquad [1]$$

where a_1 and a_2 are arbitrary constants and $b_1 > 0$ and $b_2 > 0$. α reflects how sharply curved the utility function is, and therefore it can be considered an inequality aversion parameter. In this framework, inequality stems from not all potential participants receiving the guaranteed income.

By using a common normalization of the parameters, the SWF takes the following form:

$$W(y|z,\alpha) = \frac{1}{\alpha}\sum_{i=1}^{L}\frac{\left(\frac{y_i}{z}\right)^{\alpha}}{L}, 0 \neq \alpha < 1, \quad [2]$$

and

$$W(y|z,0) = \frac{1}{L}\sum_{i=1}^{L} ln\left(\frac{y_i}{z}\right), \ when\ \alpha = 0. \quad [3]$$

The lower α, the more the social welfare function takes the lower incomes into account. We restrict to $0 \leq \alpha \leq 1$.[1]

In a general setting in which a MIP provides an income level B to the recipients, and no changes occur in the original income of the potential claimants that are not recipients, $y_i = x_i$ for $i \notin R \cap i \in \mathcal{L}$, this expression can be decomposed into the following:

$$W(y|z,\alpha) = \frac{1}{\alpha}\sum_{i\in R}\frac{\left(\frac{B}{z}\right)^{\alpha}}{L} + \frac{1}{\alpha}\sum_{\substack{i\notin R \\ i\in\mathcal{L}}}\frac{\left(\frac{y_i}{z}\right)^{\alpha}}{L} = \left(\frac{B}{z}\right)^{\alpha}\frac{R}{L}\frac{1}{\alpha} + \frac{1}{L}\sum_{\substack{i\notin R \\ i\in\mathcal{L}}}\frac{\left(\frac{y_i}{z}\right)^{\alpha}}{\alpha}, 0 \neq \alpha < 1, \quad [4]$$

and

$$W(y|z,0) = \frac{R}{L} ln\left(\frac{B}{z}\right) + \frac{1}{L}\sum_{\substack{i\notin R \\ i\in\mathcal{L}}} ln\left(\frac{y_i}{z}\right) \ , \ when\ \alpha = 0. \quad [5]$$

In expressions [4] and [5], we can clearly observe that the lower α, the higher is the sensitivity of social welfare to lower incomes, that is, those potential claimants that do not receive the guaranteed minimum income. In sum, the protection provided by an MIP depends on the level of adequacy $\left(\frac{B}{z}\right)$ and coverage $\left(\frac{R}{L}\right)$ as well as on the level of income of the potential claimants that are not recipients.

3. THE MEASUREMENT OF SOCIAL WELFARE GAINS

Let us denote by K the number of jurisdictions into which the geographical area under study is divided. L_k is the number of potential claimants in jurisdiction k and R_k the number of recipients in the jurisdiction, such that $\sum_{k=1}^{K} L_k = L$ and $\sum_{k=1}^{K} R_k = R$. Let us assume a common poverty line z. In the general case summarized in [4], the welfare

[1] See Ayala and Bárcena-Martín (2018).

change of jurisdiction k associated with the implementation of an MIP can be defined as the gap between the welfare of the jurisdiction before and after implementing the MIP, as follows:

$$\Phi^k = W^k_{after}(y^k|z,\alpha) - W^k_{before}(y^k|z,\alpha) = \frac{1}{\alpha L_k}\sum_{i\in R_k}\left(\frac{B_k}{z}\right)^\alpha + \frac{1}{\alpha L_k}\sum_{\substack{i\notin R_k \\ i\in L_k}}\left(\frac{y_i^k}{z}\right)^\alpha - \frac{1}{\alpha L_k}\sum_{i=1}^{L}\left(\frac{y_i^k}{z}\right)^\alpha = \frac{1}{\alpha}\left(\frac{B_k}{z}\right)^\alpha \frac{R_k}{L_k} - \frac{1}{\alpha}\frac{1}{L_k}\sum_{\substack{i\in R_k \\ i\in L_k}}\left(\frac{y_i^k}{z}\right)^\alpha. \quad [6]$$

The welfare change in jurisdiction *k* depends on the coverage and adequacy rate in that jurisdiction, the aversion parameter and the poverty line.

The measurement of the overall social welfare gains resulting from the implementation of different MIP schemes requires the aggregation of the corresponding welfare gain in different jurisdictions. We propose a measure that satisfies normative properties usually accepted in the economic inequality literature, which, in our case, are derived from the properties imposed on the SWF. Let us define $g = (g_1, \dots, g_i, \dots, g_K)$ as the vector resulting from giving each jurisdiction the maximum between the social welfare change in that jurisdiction and zero. In other words, the i component of vector g, denoted by g_i, is as follows:

$$g_i = \max\{\Phi^i, 0\}.$$

The dimension of vector g is equal to the total number of jurisdictions (K). We expect that the development of MIP in any jurisdiction does not lead to social welfare losses.

We adapt the family of poverty indices proposed by Foster et al. (1984) to construct an index of the overall social welfare gains from the gains in each jurisdiction. The proposed index is a function that aggregates these gains. In the same way as in the indices proposed by Foster et al. (1984), our index introduces a parameter that allows us to give different weights to the welfare gains, summarizing the sensitivity towards the distribution of the jurisdictions' social welfare gains. We propose the following index to measure the social welfare gains that the whole society experiences due to a MIP:

$$WC_\varepsilon(g) = \frac{1}{L}\sum_{i=1}^{K} g_i{}^\varepsilon L_i\ . \quad [7]$$

where L is the total number of potential claimants in the society, L_i the number of potential claimants in region i and g_i is the welfare gains in region i. Our index depends on ε and α from expression [6]. g_i depends on the aversion parameter, α, that penalizes the existence of potential claimants that do not receive the guaranteed minimum income, taking into account the most disadvantaged units (lower incomes of potential claimants that are not recipients) to a higher extent. Our index also depends on ε, which increases the value of the index as the gains in social welfare become greater. In this sense, the parameter ε, with $\varepsilon \geq 0$, can be interpreted as a measure of social welfare propensity: a larger ε gives greater emphasis to higher welfare gains. Therefore, the index is greater when there is an extra increase in the gains of those units with lower social welfare gains.

For $\varepsilon = 0$,

$$WC_0 = \frac{1}{L}\sum_{i=1}^{K} L_i = \frac{\tilde{L}}{L}, \qquad [8]$$

where $\tilde{L}$ is the number of potential claimants belonging to jurisdictions in which there is an increase in social welfare. Therefore, WC_0 is the share of the potential claimants in jurisdictions in which there is an increase in social welfare resulting from the implementation of the MIP. Consequently, WC_0 measures the incidence of social welfare gains. We expect WC_0 to be 1 as a signal that all the jurisdictions have social welfare gains. For $\varepsilon = 1$,

$$WC_1 = \frac{1}{L}\sum_{i=1}^{T} g_i L_i, \qquad [9]$$

gives the mean welfare gain per potential claimant. That is, the intensity of welfare gains.

For $\varepsilon > 1$, WC_ε is the average social welfare gain per potential claimant when the gains are weighted in a way that makes them satisfy normative properties usually accepted in the literature on economic inequality. Particularly, WC_2 is related to a well-known inequality measure. The variance of the social welfare gains in jurisdictions with social welfare gains greater than 0 is as follows:

$$Var(g_i) = \frac{1}{\tilde{L}}\sum_{i=1}^{K} {g_i}^2 L_i - \left(\frac{1}{\tilde{L}}\sum_{i=1}^{K} g_i L_i\right)^2.$$

Then,

$$WC_2 = WC_0[Var(g_i) + (WC_1)^2]. \quad [10]$$

Our index satisfies the properties *of symmetry, replication invariance, strict monotonicity, preference for equality,* and *focus*. These properties derive from the functional form of the index. The *symmetry* property indicates that our index is based only on social welfare gains no matter the jurisdiction that experiences them. *Replications invariance* implies that if we replicate the economy φ-times, the index does not change. This property allows comparisons of indices for different populations in which the number of jurisdictions is different. *Strict monotonicity* implies that the higher the value of the social welfare gains, the higher the index of overall social welfare gains. There is a preference for equality, or the index satisfies the transfer axiom. That is, if a disadvantaged jurisdiction, i.e., one with low social welfare gains, increases its social welfare gain while a less disadvantaged jurisdiction of equal social welfare increases its social welfare the same amount, the value of the index increases. Given that overall welfare gains are defined through the jurisdiction's gains, it also satisfies the *focus* property, which implies that it is not affected by the social welfare losses of jurisdictions since losses are transformed into zeros in vector g. That is, the welfare losses of some jurisdictions can never offset the social welfare gains in other jurisdictions. As mentioned above, we assume that losses are not expected following the implementation of a MIP.

Moreover, the WC_ε are *additively decomposable*. That is, the social welfare gain can be constructed by identifying the characteristics or factors that contribute to social welfare gains, and the contribution of a group to overall welfare gains can be estimated. If the society is composed of jurisdictions and they can be grouped into J, $J < K$, and these groups attend to certain characteristics, the social welfare gain can be expressed as follows:

$$WC_\varepsilon(g) = \frac{1}{L}\sum_{i=1}^{J} \hat{g}_i{}^{\varepsilon}\hat{L}_i, \quad [11]$$

where $\hat{g}_i{}^{\varepsilon} = \frac{1}{\hat{L}_j}\sum_{i=1}^{M_j} g_i{}^{\varepsilon}L_i$ is the social welfare gain of group j or the aggregation of the social welfare gains of the M_j jurisdictions that compose group j, and $\hat{L}_j$ is the number

of potential claimants in the group of jurisdictions j, that is $\hat{L}_j = \sum_{i=1}^{M_j} L_i$. Therefore, the contribution of group j to the social welfare gain is as follows:

$$C_j = \frac{\frac{1}{L}\hat{g}_i{}^{\varepsilon}\hat{L}_j}{\frac{1}{L}\sum_{i=1}^{T} g_i{}^{\varepsilon}L_i}. \quad [12]$$

WC_ε can also be decomposed in terms of the mutually exclusive components of the MIP. Assuming that social assistance protection is composed of Q different exclusive benefits in each of the K jurisdictions, the social welfare gain can be expressed as follows:

$$WC_\varepsilon(g) = \frac{1}{L}\sum_{i=1}^{K}\sum_{j=1}^{Q} g_{ij}{}^{\varepsilon}L_{ij} \quad [13]$$

where $g_{ij}{}^{\varepsilon}$ is the social welfare gain of jurisdiction i resulting from protection scheme j, and L_{ij} is the number of potential claimants of protection scheme j in jurisdiction i. Then, the contribution of scheme j to the social welfare gain is as follows:

$$C_j = \frac{\frac{1}{L}\sum_{i=1}^{K} g_{ij}{}^{\varepsilon}L_{ij}}{\frac{1}{L}\sum_{i=1}^{K}\sum_{j=1}^{Q} g_{ij}{}^{\varepsilon}L_{ij}}. \quad [14]$$

This property provides greater applicability to the index because it allows the linking of groups and overall social welfare gains.

4. SOCIAL WELFARE GAINS IN MIP: A DOMINANCE CRITERION

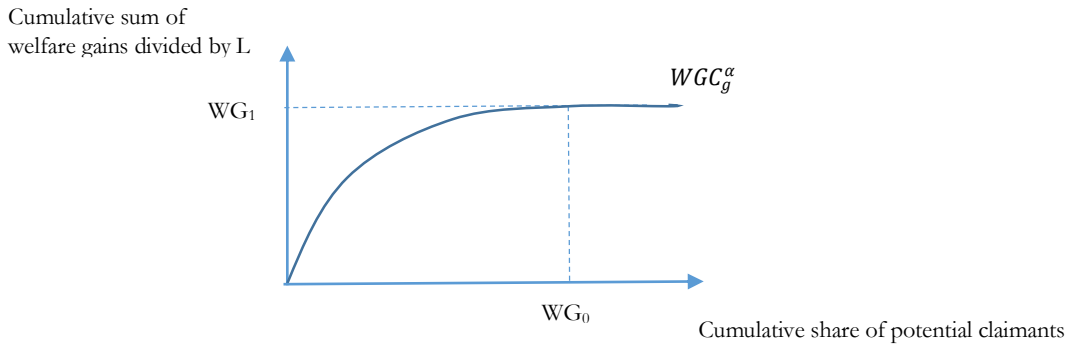
Under the assumption that vector g defined in the previous section is ordered in such a way that the jurisdictions are ranked from highest to lowest gains (i.e., $g_1 \geq g_2 \geq \ldots \geq g_K$), let us denote by $L^* \equiv (L_1, \ldots, L_K)$ the vector representing the potential claimants in the different jurisdictions and by $p^s = \frac{L_1+\cdots+L_s}{L}$, $(0 \leq p^s \leq 1)$ the share of potential claimants of the first s jurisdictions, where $s = 1, \ldots, K$.

Definition. We define the "*social welfare gain curve associated with MIP*", the WGC curve — denoted by $W_g^\alpha(p^s)$ — at point p^s, as the sum of the social welfare gains of the first S jurisdictions, each one weighted by its population share $(\frac{L_i}{L})$. Namely:

$$WGC_g^{\alpha}(p^s) = \sum_{i=1}^{s} \frac{L_i}{L} g_i, \qquad [15]$$

where α is the inequality aversion parameter used above to define the SWF in expression [1]. At intermediate points $(p \in (0,1)\ with\ p \neq p^s), WGC_g^{\alpha}(p)$ is determined by linear interpolation. The WGC curve accumulates social welfare gains, weighted by the share of potential claimants, from highest to lowest gains. Consequently, this curve is positive, increasing and concave.

Figure 1. Social welfare gain curve associated with MIP



The abscissa value at which the curve becomes horizontal, WC_0, stands for the share of potential claimants that belong to jurisdictions in which the MIP increases social welfare (i.e., those having social welfare gains). The maximum height of the curve, WC_1, indicates the per claimant average social welfare gain. Finally, the curvature of the WGC curve to point WC summarizes the inequality in social welfare gains in the jurisdictions where social welfare increases. A similar graphical device is used in the field of poverty through the use of TIP curves (Jenkins and Lambert 1997, 1998), where TIP stands for the three I's of poverty: Incidence, Intensity, and Inequality.

It must be noted that higher social welfare gains are preferred and that the social welfare gain curve associated with MIP shifts upwards if one or more of the welfare gains increases. Given a total amount of welfare gains, the curve moves downwards if welfare gains in the jurisdictions are more equally distributed.

As the social welfare gain has an upper bound, $\frac{1}{\alpha}$, when all potential claimants receive an income level equal to the poverty line, z, and the potential claimants have zero income, then the maximum gain profile or the line of maximum social welfare gain is as follows:

$$\ddot{WGC}_g^{\alpha}(p^s) = \sum_{i=1}^{S} \frac{L_i}{L} \frac{1}{\alpha} = \frac{1}{\alpha} p^s, \qquad p \in [0,1] \tag{16}$$

Definition. We say that vector (g, L^*) "dominates in social welfare gains associated with MIP" vector $(g', L^{*\prime})$ if $g \neq g'$ and the WGC curve of the former lies at no point below the latter and at some point above it. Namely, (g, L^*) dominates in social welfare gains $(g', L^{*\prime})$ if $g \neq g'$ and $W_g^{\alpha}(p) \geq W_{g'}^{\alpha}(p)$ for all $p \in [0,1]$ with at least one point of strict inequality.

Let us denote by $G \in R^m$ $(m \geq 2)$ the set of vectors g and by $\Psi^*: G \to R$ the class of functions that are *symmetric, replication-invariant, strictly monotonic and that increases when the distribution of welfare gains becomes relatively more unequal* (equivalent to the transfer axiom).

Result. Let us denote by (g, L^*) and $(g', L^{*\prime})$ two different economies. Vector (g, L^*) "dominates in social welfare gains associated with MIP" vector $(g', L^{*\prime})$ if and only if $\Psi(g) > \Psi(g')$ for all $\Psi \in \Psi^*$

Proof: As stated by Del Río and Alonso-Villar (2018), this result follows from Theorem 2 proposed by Shorrocks (1998) in the field of individual deprivation. Ψ has to be symmetric and replication invariant (apart from strictly monotonic and equally preferring) because, unlike Shorrocks (1998), who expressed Ψ in terms of the cumulative deprivation distribution function, in our case Ψ is directly expressed as a function of gains.

Consequently, this result is a powerful device to use in empirical studies because when the *social welfare gain curves associated with MIP* do not cross, one can implement a unanimous ranking of social welfare gains for a broad set of indices.

There are a number of possibilities for welfare gains indices. Some of them do not satisfy the requirements for membership of Ψ^*, such as WG_0, which is not strictly monotonic, or WG_1, which is not equality preferring. However, the indices WG_ε for $\varepsilon > 1$ do meet the requirements. There are other indices that weight areas beneath the social welfare gain curve, in continuous form, as follows:

$\Delta_\theta(F) = \int_0^1 \theta(p) WGC_g^\alpha(p)dp, \quad \theta(p) > 0 \quad and \quad p\epsilon[0,1].$

As the social welfare gain has an upper bound, $\frac{1}{\alpha}$, then the index can be normalized to take values in the interval [0,1] by setting the following:

$\overline{\Delta_\theta}(F) = \frac{\int_0^1 \theta(p) WGC_g^\alpha(p)dp}{\int_0^1 \theta(p)\frac{1}{\alpha}pdp}$.

When $\theta(p) = 1$,

$$\overline{\Delta_\theta}(F) = \frac{\int_0^1 WGC_g^\alpha(p)dp}{\int_0^1 \frac{1}{\alpha}pdp} = \frac{area\ below\ WGC_g^\alpha(p^s)}{area\ below\ the\ line\ of\ maximum\ welfare\ gain},$$

and may be interpreted in a similar way to the Gini coefficient.

5. AN EMPIRICAL ILLUSTRATION

In this section, we show the advantages of our approach for measuring the welfare gains resulting from MIP programs in the years 2004 and 2015 in 19 EU countries: Austria, Belgium, the Czech Republic, Estonia, France, Germany, Ireland, Latvia, Lithuania, Luxembourg, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, the Netherlands, and the United Kingdom.[2] During this time period, the economies of many EU countries underwent the deepest recession since the Great Depression. It stands to reason that a growing demand for benefits should have driven the number of recipients to considerably higher levels than before the economic downturn began.

We use the data on minimum income benefits in these countries for three types of families, namely, single person, a couple with two children and a single parent with two children, provided by the Mutual Information System on Social Protection (MISSOC) of the European Union. The MISSOC comparative tables contain detailed information on social protection in 32 countries structured into 12 main chapters, including guaranteed minimum resources. Each table is divided into numerous categories such as legal basis, field of application, conditions and benefit amount.

[2] The number of countries is limited by data availability on minimum income benefits in the Mutual Information System on Social Protection of the European Union and household income in EU-SILC (Eurostat).

To estimate the number of potential claimants, recipients and the poverty line in 2004 and 2015, we make use of the European Union Statistics on Income and Living Conditions (EU-SILC) cross sectional files for 2005 and 2016, because income data refers to the year preceding the survey.[3] The EU-SILC data set is the main source of information on living standards in the EU and is an instrument aimed at collecting timely and comparable cross-sectional and longitudinal multidimensional microdata on income, poverty, social exclusion and living conditions. The EU-SILC is built on a common framework with a common set of target variable definitions and rules. The EU-SILC dataset is based on a homogeneous conceptualization of income, for both household disposable income (i.e., the sum of all incomes from any source earned by all family members, net of personal taxes and gross of welfare cash benefits) and various sources (e.g., employment, self-employment, pensions, welfare benefits) and provides information on several individual and household features.

We estimate the poverty line as 60 percent of the contemporary median equivalent income of the country where the household is located. To adjust household income according to its size, we use the modified OECD equivalence scale[4]. We also adjust minimum income received according to family size and composition using the same equivalence scale.

We restrict the sample to individuals living in any of the three types of families considered. Then, we estimate recipients as those who receive social exclusion benefits and potential claimants as those who live in households with 0 income plus those who are recipients.[5] In doing this, we are also assuming that there is perfect take-up of the benefits, which is something that several authors have called into question (Bargain et al. 2012). We are not considering those households with positive incomes that are lower than the thresholds set in the corresponding national MIP among potential claimants. Although both restrictions limit the accuracy of the exercise performed, the idea is not so much to make an exact estimate of the effect of the programs but to show the possibilities for application of the proposed methodology.

[3] This applies to all countries except the UK (income reference periods refer to the period around the interview with income total converted to annual equivalents) and Ireland (income data refers to 12 months prior to the interview).
[4] A value of 1 is assigned to the first adult in the household, 0.5 to each remaining adult, and 0.3 to each member younger than 14.
[5] All estimates are obtained using individual sampling weights provided by Eurostat that are designed to adjust for attrition and non-response biases.

Once the number of potential claimants, recipients and poverty lines are estimated, we assess each country's social welfare gain and then we calculate the proposed index to measure the overall social welfare gain based on the corresponding countries' social welfare gains. Then, we plot welfare gain curves for the years 2004 and 2015.

Table 1. $WC_\varepsilon(g)$ for 21 European countries

	Year	L	WG_0 α=0.5	WG_1 α=0.5	WG_2 α=0.5	WG_0 α=1	WG_1 α=1	WG_2 α=1
TOTAL	2004	11,099,701	1.000	1.188	1.600	1.000	0.484	0.280
Single person	2004	4,351,438	1.000	0.793	0.691	1.000	0.304	0.107
Couple 2 children	2004	4,405,238	1.000	1.381	2.002	1.000	0.562	0.343
Single parent 2 children	2004	2,343,026	1.000	1.557	2.532	1.000	0.674	0.486
TOTAL	2015	12,384,440	1.000	0.953	1.146	1.000	0.357	0.172
Single person	2015	6,117,682	1.000	0.601	0.550	1.000	0.217	0.085
Couple 2 children	2015	3,906,462	1.000	1.240	1.582	1.000	0.455	0.219
Single parent 2 children	2015	2,360,296	1.000	1.392	1.972	1.000	0.557	0.321

Source: Own calculations based on EU-SILC 2005 and 2016, and MISSOC comparative tables.

Table 1 shows the values of the index $WC_\varepsilon(g)$ for $\varepsilon = 0, 1, 2$ and $\alpha = 0.5,1$. As we advanced in the previous section, $WC_0 = 1$ for all years, given that all the analyzed countries have a minimum income program. Regarding the intensity of the welfare gain (WG_1), it can be noted that, in 2004, the average welfare increase per potential claimant due to MIP was higher than in 2015, no matter the type of family analyzed nor the sensitivity parameter of the welfare function used. That is, this conclusion still holds when the social welfare gains of lower gainers are given more weight. WG_2, which accounts for incidence, intensity and inequality in the social welfare gain, was also greater in 2004 than in 2015 for all family types and sensitivity parameters.

Bearing in mind some of the caveats mentioned above related to the assumptions for the identification of potential claimants and given that the time period under analysis includes a significant change in macroeconomic conditions, it seems that the economic crisis reduced the effects of MIP on social welfare. On the one hand, the growth of unemployment and wage reductions caused an increase in the potential claimants of these benefits in many EU countries. On the other hand, the growth of social needs went

along with a growing constraint on the available resources in a number of countries, and there were increasing barriers to respond to the new situation of economic vulnerability.

When we compare the different family types, the greatest social welfare gain is in the case of single parents with two children. This is the smallest demographic group and has the lowest indices for single-person households for all years and sensitivity parameters. The welfare gain for couples with two children is more similar to that of single parents with two children than to single-person households. Differences in social welfare gains among the three demographic groups reduce when less emphasis is placed on lower gainers (greater values for α).

Table 2. Contribution of each type of family to the total welfare gain with different indices

	year	P_j	C_j WG_1 α=0.5	Cj/Pj WG_1 α=0.5	C_j WG_2 α=0.5	Cj/Pj WG_2 α=0.5	C_j WG_1 α=1	Cj/Pj WG_1 α=2	C_j WG_2 α=1	Cj/Pj WG_2 α=2
Total	2004	100%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Single person	2004	39.2%	26.2%	66.8%	16.9%	43.2%	24.6%	62.8%	14.9%	38.1%
Couple 2 children	2004	39.7%	46.1%	116.3%	49.7%	125.1%	46.0%	115.9%	48.5%	122.2%
Single parent 2 children	2004	21.1%	27.7%	131.1%	33.4%	158.3%	29.4%	139.1%	36.6%	173.2%
Total	2015	100%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Single person	2015	49.4%	31.2%	63.1%	23.7%	48.0%	30.0%	60.8%	24.3%	49.2%
Couple 2 children	2015	31.5%	41.0%	130.0%	43.5%	138.0%	40.2%	127.5%	40.1%	127.1%
Single parent 2 children	2015	19.1%	27.8%	146.0%	32.8%	172.0%	29.8%	156.1%	35.6%	186.8%

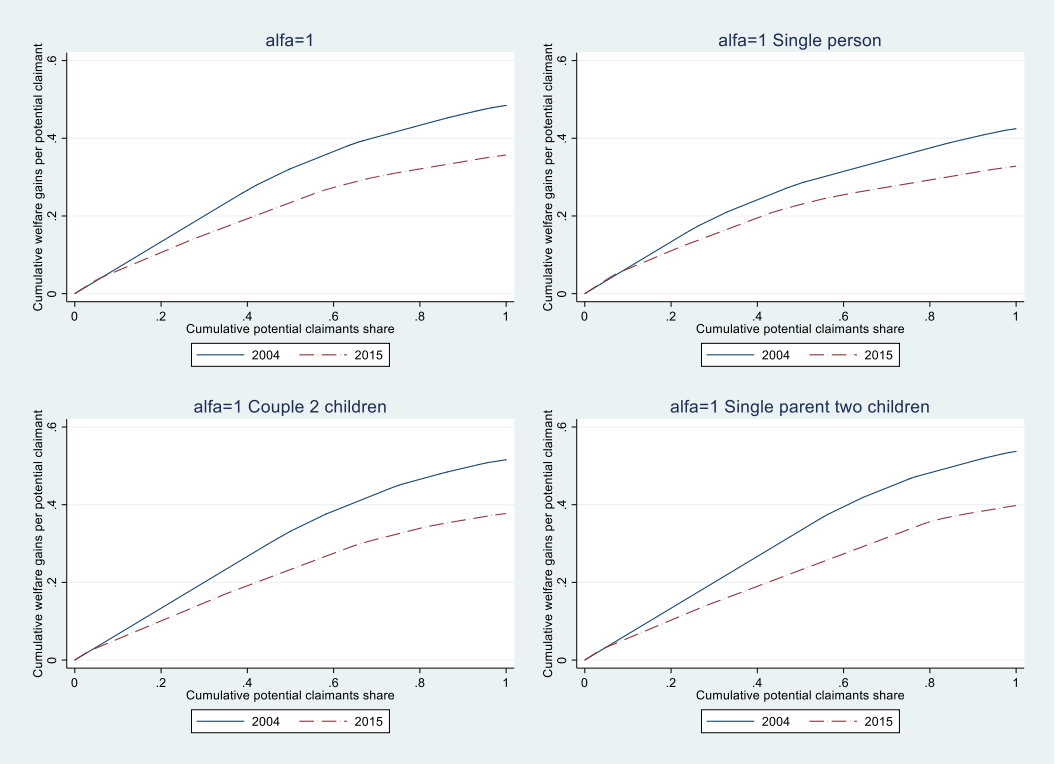
Note: P_j: % of sample in family type j; C_j: group j contribution to index WG_ε.; C_j / P_j: group j contribution to index WG_ε. relative to P_j.
Source: Own elaboration based on EU-SILC 2005 and 2016, and MISSOC comparative tables.

The additive decomposability property allows the estimation of the contribution of each type of family to the total social welfare gains with the different indices relative to the participation of each type of household in the population (Table 2). One key finding is that the relative contribution of single parent with two children families is higher than its expected value given the relatively lower demographic weight of this group. For instance, for α=0.5, this group's contribution to WG_1 in 2004 is 31.1 percent higher (46 percent in 2015) than its contribution to the population. If inequality in social welfare gains is considered, then this group's contribution to WG_2 in 2004 is 58.3 percent (72 percent in 2015) higher than its relative contribution to the total population. For α=1

these numbers are even higher. Therefore, it can be concluded that the contribution of single parents with two children is the greatest in all indices and under different value judgments.

Using the tools presented in section 4, Figure 2 shows the evolution of the social welfare gains curves associated with MIP with parameter α=1 for years 2004 and 2015. The first finding is the dominance of the 2004 curves over the 2015 curves, both for the overall population and each one of the demographic groups. This implies that the social welfare gain associated with MIP decreased in this period no matter the index used. In other words, there was a deterioration of the protection provided by the MIP according not only to these curves but also to a wide range of indices, all of which are consistent with the dominance criterion given by the curves, in particular FGT_{ε} with ε>1.

Figure 2. Welfare gains curve associated with MIP, α=1.



Source: Own elaboration based on EU-SILC 2005 and 2016 and MISSOC comparative tables.

This conclusion holds in all three types of households, with a marked worsening of the protection provided by the MIP for all family types. Moreover, according to the vertical distance between the curves, it is confirmed that the weakening of protection provided by the MIP mainly affected households other than single persons, though this

demographic group is the one with the lowest average social welfare gain per potential claimant (height of the curve) in both years. This conclusion also holds for α=0.5 (Figure A1 in the appendix).

Another possibility derived from the additive decomposability property is the estimation of the contribution of each country to the total social welfare gains with different indices, $-WG_{\varepsilon}(g)$ for $\varepsilon = 0, 1, 2$ and $\alpha = 0.5,1$ – relative to the participation of each country in the population (Table 3).

Luxembourg and the Netherlands have the highest contribution, and this contribution increased between 2004 and 2015. For instance, for α=0.5, Luxembourg's contribution to WG_1 in 2004 is 29.6 percent higher than its contribution to the population and 66.5 percent in 2015. In the Netherlands, the increase was more remarkable, going from 20 percent in 2004 to 131.5 percent in 2015. Slovakia, the Czech Republic and the United Kingdom had great contributions in 2004 but reduced them in 2015 in favor of Austria and Slovakia. On the other extreme, we have Estonia and Ireland, persistently showing the smallest contributions. For WG_1 with α=0.5, the values were 45 percent lower than their contribution to the population, while Spain had a small contribution in 2004 but a larger one in 2015, while the opposite took place in Germany.

Table 3. Contribution of each country to the total welfare gain with different indices

year	country	P_j	C_j WG_1 α=0.5	Cj/Pj WG_1 α=0.5	C_j WG_2 α=0.5	Cj/Pj WG_2 α=0.5	C_j WG_1 α=1	Cj/Pj WG_1 α=2	C_j WG_2 α=1	Cj/Pj WG_2 α=2
2004	AT	1.0%	0.9%	91.1%	0.7%	77.6%	0.9%	90.7%	0.7%	74.0%
2004	BE	2.3%	1.4%	59.7%	0.8%	33.7%	1.5%	65.0%	0.9%	38.3%
2004	CZ	2.0%	2.4%	120.4%	2.7%	138.3%	2.5%	127.6%	3.0%	150.5%
2004	DE	17.4%	13.6%	77.9%	9.9%	57.0%	12.1%	69.5%	7.8%	44.5%
2004	EE	0.2%	0.0%	6.1%	0.0%	0.7%	0.0%	4.6%	0.0%	0.4%
2004	ES	2.6%	1.2%	44.4%	0.5%	20.8%	1.1%	40.0%	0.5%	17.4%
2004	FR	13.4%	14.3%	106.3%	14.4%	106.9%	13.1%	97.2%	11.6%	86.3%
2004	IE	1.3%	0.7%	54.1%	0.4%	28.1%	0.7%	50.1%	0.3%	23.5%
2004	LT	0.6%	0.4%	58.5%	0.3%	39.2%	0.3%	53.6%	0.2%	34.6%
2004	LU	0.1%	0.1%	129.6%	0.1%	159.1%	0.1%	135.7%	0.1%	171.8%
2004	LV	0.6%	0.5%	73.4%	0.3%	51.2%	0.3%	50.6%	0.1%	23.4%
2004	NL	7.7%	9.2%	120.0%	10.9%	141.8%	9.1%	118.7%	10.5%	136.9%
2004	NO	1.2%	1.4%	110.9%	1.4%	115.2%	1.1%	92.3%	0.9%	76.3%
2004	PL	6.0%	4.3%	71.0%	2.9%	48.8%	3.9%	65.0%	2.6%	43.3%
2004	PT	0.7%	0.5%	60.5%	0.3%	37.4%	0.4%	56.4%	0.2%	31.9%
2004	SE	2.0%	1.5%	75.1%	1.1%	54.3%	1.3%	66.5%	0.8%	41.7%
2004	SI	0.7%	0.7%	94.8%	0.6%	85.4%	0.6%	80.5%	0.4%	59.1%
2004	SK	1.8%	2.3%	129.0%	2.9%	162.4%	2.4%	137.3%	3.2%	179.0%
2004	UK	38.3%	44.9%	117.3%	49.8%	130.0%	48.5%	126.8%	56.1%	146.5%
2015	AT	1.3%	2.2%	164.6%	2.6%	195.3%	2.5%	187.0%	2.9%	218.8%
2015	BE	1.8%	2.0%	109.3%	1.5%	82.7%	2.3%	127.9%	1.8%	97.4%
2015	CZ	1.3%	1.4%	103.8%	1.2%	88.3%	1.1%	86.4%	0.8%	58.3%
2015	DE	21.2%	12.6%	59.6%	7.6%	35.8%	11.5%	54.3%	6.6%	31.2%
2015	EE	0.2%	0.1%	44.3%	0.0%	22.0%	0.1%	32.4%	0.0%	13.4%
2015	ES	7.3%	6.5%	89.0%	4.7%	63.7%	6.6%	89.4%	4.3%	58.1%
2015	FR	20.5%	27.8%	135.8%	32.3%	157.8%	26.2%	128.3%	26.3%	128.3%
2015	IE	1.4%	0.7%	52.3%	0.4%	25.0%	0.8%	57.4%	0.4%	28.0%
2015	LT	1.5%	1.6%	109.0%	1.5%	103.2%	1.5%	101.9%	1.3%	89.9%
2015	LU	0.2%	0.3%	166.5%	0.3%	223.5%	0.3%	195.4%	0.4%	276.9%
2015	LV	0.5%	0.4%	88.7%	0.3%	59.7%	0.2%	52.0%	0.1%	18.7%
2015	NL	4.7%	10.9%	231.5%	19.2%	410.6%	13.3%	284.5%	25.7%	548.3%
2015	NO	1.1%	1.1%	100.9%	0.8%	74.6%	0.9%	79.9%	0.5%	40.8%
2015	PL	3.5%	2.7%	78.5%	1.6%	46.6%	2.1%	58.7%	0.8%	23.5%
2015	PT	1.1%	0.9%	79.2%	0.6%	50.1%	0.8%	68.9%	0.4%	33.7%
2015	SE	2.7%	2.1%	79.0%	1.4%	50.7%	1.8%	67.0%	1.0%	35.7%
2015	SI	0.7%	1.1%	164.1%	1.4%	213.2%	1.2%	177.1%	1.5%	225.8%
2015	SK	0.6%	0.6%	104.1%	0.5%	89.9%	0.6%	95.7%	0.4%	73.7%
2015	UK	28.5%	25.0%	87.6%	22.1%	77.5%	26.2%	92.0%	24.9%	87.4%

Note: P_j: % of sample in country j; C_j: country j contribution to index $WG_{\varepsilon.;}$ C_j / P_j: country j contribution to index $WG_{\varepsilon.}$ relative to $P_{j.}$

Note: AT: Austria; BE: Belgium; CZ: the Czech Republic; DE: Germany; EE: Estonia; ES: Spain; FR: France; IE: Ireland; LT: Lithuania; LU: Luxembourg; LV: Latvia; NL: the Netherlands; NO: Norway; PL: Poland; PT: Portugal; SE: Sweden; SI: Slovenia; SK: Slovakia; UK: the United Kingdom.

Source: Own elaboration based on EU-SILC 2005 and 2016, and MISSOC comparative tables.

6. CONCLUSION

Minimum income programs have undergone major changes in most OECD countries. The difficult balance between the emergence of new social needs stemming from a higher number of low-income households and the growing limits for budgetary resources has pushed many countries to introduce more restrictive reforms. As a result, recipients of these benefits must face more onerous obligations and lower benefit levels than those they could access before the economic crisis started.

There is no doubt that the possible effects of these reforms on poverty and social welfare are a major topic of public concern. However, most of the changes have been implemented without an accurate assessment of the possible effects in terms of the social welfare gains or losses to which they could lead. To have a precise picture of the effects that these type of changes to benefits may have on social welfare, it is necessary to have both an adequate social function and an index that allows the assessment of the quantitative impact of reforms.

In this paper, we have proposed a methodology to measure the social welfare gains derived from the implementation of different types of social assistance benefits. Drawing on a previous proposal for the measurement of the protection provided by a minimum income program (Ayala and Bárcena-Martín, 2018), we have defined a social welfare framework to measure these gains both in a specific program and in a country or other supranational entity composed of different territorial units. We contribute to the development of a more comprehensive concept of alternatives by setting up a robust framework for analyzing these gains through the development of specific indices and analytical tools. These allow the evaluation of specific programs and the aggregation of the outcomes of decentralized programs.

This paper advances knowledge in a number of respects. Empirical studies analyzing the effects of social assistance reforms have not addressed the issue of how to measure the corresponding social welfare gains or losses resulting from the reforms using social welfare criteria. The current study is the first that examines this issue in the case of specific minimum income programs. We address this issue based on a social welfare function and a system of indices in a way that is consistent with the literature on income

inequality. One of the methodological advances in this paper is a procedure to sum up the social welfare gains in the different jurisdictions of a country or a group of countries.

There are several reasons why this methodological proposal should interest policy makers and analysts. While existing findings for the results of these programs are subject to a great deal of uncertainty, the availability of specific indices to which different value judgments can be assigned can be a very useful tool for improving their design. This may be especially relevant in contexts in which these programs are decentralized, since the proposed methodology allows both the results of each jurisdiction to be aggregated and the contribution of a specific jurisdiction to the total social welfare gains to be identified.

As an example of the application possibilities of the proposed methodology, we have analyzed the welfare gains caused by minimum income programs in EU countries. With the caveats imposed by the strict assumptions used for the identification of the potential claimants of these benefits, our results yield some interesting results. First, given that all the indices – considering incidence, intensity and inequality in social welfare gains – are greater in 2004 than in 2015 for all family types and sensitivity parameters, it can be said that the economic crisis reduced social welfare gains caused by EU minimum income programs. Second, despite being the smallest demographic group among the three types considered, single parents with children are the household type where the social welfare gain derived from these benefits is the highest.

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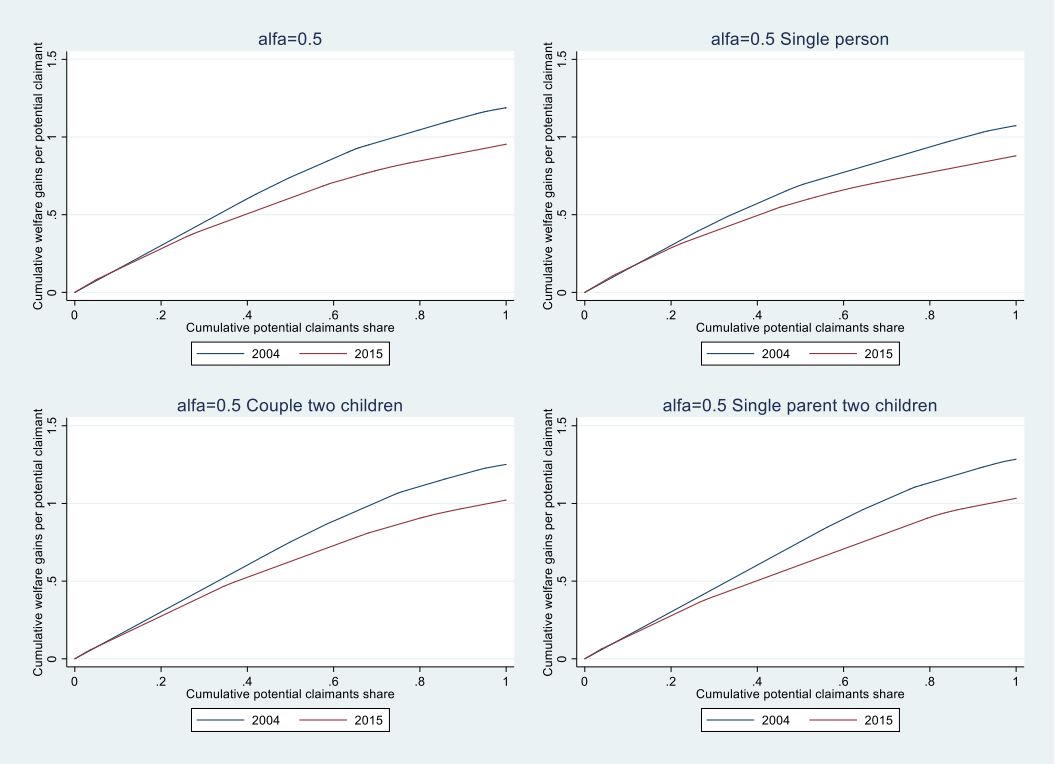
APPENDIX

Figure A1. Welfare gains curve associated with MIP, α=0.5.



Source: Own elaboration based on EU-SILC 2005 and 2016 and MISSOC comparative tables.

Table A1. Descriptives

		2004			2015		
Country	Family type	Quantity per equivalent individual	Recipients	Potential claimants	Quantity per equivalent individual	Recipients	Potential claimants
AT	Single person	6138.0	28469	62474	9934	83455	125493
AT	Couple 2 children	7424.0	30826	38561	8799	13603	13603
AT	Single parent 2 children	7540.5	5707	5707	8444	20916	26435
BE	Single person	7143.6	57182	188060	9809	75852	190462
BE	Couple 2 children	6462.9	15316	33185	8303	14335	21489
BE	Single parent 2 children	8380.5	9127	31193	8854	9407	12458
CZ	Single person	1512.0	40549	63884	1500	43085	73165
CZ	Couple 2 children	2005.7	128811	131114	2069	61471	64159
CZ	Single parent 2 children	1897.5	18594	25294	1935	24765	25912
DE	Single person	4104.0	576142	1287449	4788	438155	1963949
DE	Couple 2 children	6160.0	247034	333170	7389	359126	412905
DE	Single parent 2 children	6900.0	265198	316197	6998	220813	247110
EE	Single person	384.0	341	11875	1080	3376	16781
EE	Couple 2 children	840.0	166	3740	1954	4846	5836
EE	Single parent 2 children	907.5	616	2849	2138	184	184
ES	Single person	3888.0	30262	90613	5228	165088	400368
ES	Couple 2 children	2659.4	71074	172329	3468	330212	466655
ES	Single parent 2 children	3222.8	3849	29269	4166	23233	41089
FR	Single person	5014.8	394528	590749	6167	684870	797843
FR	Couple 2 children	5014.3	606263	651242	6166	1184741	1204181
FR	Single parent 2 children	5641.5	233208	249635	7323	519836	531900
IE	Single person	7008.0	11069	42541	9672	10832	70135
IE	Couple 2 children	6474.3	32290	56538	9171	27273	58247
IE	Single parent 2 children	5475.0	23953	47024	7980	23463	49052
LT	Single person	420.0	7576	34637	1224	37741	72908
LT	Couple 2 children	805.7	18679	23919	1865	83955	84185
LT	Single parent 2 children	795.0	8376	12632	1913	20957	25089
LU	Single person	11992.8	3106	4563	16178	6819	9104
LU	Couple 2 children	9605.1	325	404	12957	7104	7680
LU	Single parent 2 children	8859.0	1316	1316	11950	2291	2408
LV	Single person	336.0	24423	38234	598	27733	35385
LV	Couple 2 children	497.1	18856	23589	1008	13868	15629
LV	Single parent 2 children	442.5	4239	7551	950	3924	6224
NL	Single person	6620.4	234613	298736	11551	370719	392712
NL	Couple 2 children	6304.6	316911	361240	7858	96899	100943

NL	Single parent 2 children	5792.3	189474	190552	7220	86921	86921
NO	Single person	6048.0	63910	83462	7764	58482	96169
NO	Couple 2 children	8080.0	28272	30232	8966	12283	16555
NO	Single parent 2 children	7597.5	23025	23025	8528	17428	24408
PL	Single person	1044.0	125723	300588	1200	134500	272707
PL	Couple 2 children	497.1	222031	312921	571	99632	132686
PL	Single parent 2 children	652.5	33932	55439	750	22404	28362
PT	Single person	1821.6	2818	16102	2138	32949	67560
PT	Couple 2 children	2602.9	35349	56261	2138	27934	51813
PT	Single parent 2 children	2277.8	6338	10801	2138	12946	19968
SE	Single person	4428.0	54578	137935	5040	86935	232956
SE	Couple 2 children	6200.0	42100	50033	7457	57371	68674
SE	Single parent 2 children	6052.5	29733	33198	7365	29617	29617
SI	Single person	2292.0	11133	21756	4135	31303	39427
SI	Couple 2 children	2508.6	52171	52378	5219	36752	36988
SI	Single parent 2 children	2722.5	6877	6877	5631	5843	5843
SK	Single person	1224.0	47968	60335	1496	16678	29702
SK	Couple 2 children	1240.0	103484	113418	2245	33390	39167
SK	Single parent 2 children	1140.0	21804	22789	1610	1559	2313
UK	Single person	8400.0	570821	1017445	5282	312653	1230856
UK	Couple 2 children	8400.0	1815891	1960964	8548	878064	1105068
UK	Single parent 2 children	9307.5	1238604	1271679	9328	1023162	1195002

Note: AT: Austria; BE: Belgium; CZ: the Czech Republic; DE: Germany; EE: Estonia; ES: Spain; FR: France; IE: Ireland; LT: Lithuania; LU: Luxembourg; LV: Latvia; NL: the Netherlands; NO: Norway; PL: Poland; PT: Portugal; SE: Sweden; SI: Slovenia; SK: Slovakia; UK: the United Kingdom.