# Multi-dimensional poverty among adults in Central America and gender differences in the three I's of poverty: Applying inequality sensitive poverty measures with ordinal variables

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## Abstract

The Alkire and Foster (2011) methodology, as the mainstream approach to the measurement of multi-dimensional poverty in the developing world, is insensitive to inequality among the multi-dimensionally poor individuals and does not consider simultaneously the concepts of efficiency and distributive justice. Moreover, the vast majority of empirical indices of multi-dimensional poverty in the literature overlook intra-household inequalities, an issue that is crucial to a better understanding of gender inequalities, because they equate the poverty status of the household with the poverty status of all individuals in the household. Consequently, using the general framework proposed by Silber and Yalonetzky (2013) and Rippin's ideas on multi-dimensional poverty measurement (2013, 2017), we propose in this paper to depart somehow from the mainstream approach and take an individual-based and inequality sensitive view of multi-dimensional poverty when only ordinal (dichotomized) variables are available. We use such an approach to estimate multi-dimensional poverty among individuals aged 18 and 59 years living in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, shedding thus some light on gender differences in poverty and inequality in those countries. Overall, we find that individuals living in Guatemala have the highest probability of being multi-dimensionally poor, followed by the ones from Nicaragua; people living in Costa Rica, by contrast, have by far the lowest probability of being poor. In the middle appears Honduras and El Salvador, Hondurans having a larger probability of being multi-dimensionally poor than the Salvadorians. Regarding the gender gaps, the overall estimates suggest that the incidence and the intensity of multi-dimensional poverty in Central America are higher among females; inequality, however, is somewhat higher among males.

**JEL Codes:** I3, I32, D1, D13, D6, D63, O5, O54

**Keywords:** multi-dimensional poverty measurement, inequality, gender inequality, Latin America, Central America

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## 1. Introduction

The removal of poverty remains one of the most important aims of economic policy in many countries of the world (Chakravarty, 2018; Chakravarty & Lugo, 2016; Chakravarty & Silber, 2008); it continues to be one of the greatest global challenges and is an essential "requirement for sustainable development" (UN, 2017, p. 1). In consequence, given that there is no meaningful development without the elimination of that source of unfreedom (Sen, 2000a), Goal 1 of the Sustainable Development Goals (SDGs) calls for ending "poverty in all its forms everywhere" (UN, 2015, p. 15). In this context, specifying how poverty is characterized, what its determinants are, and finding appropriate poverty measures become crucial elements for the design and assessment of policies aimed at the alleviation of this social problem (Ray, 1998).

As argued by Stiglitz, Sen, and Fitoussi (2009a), the well-being of a population is multi-dimensional. Poverty therefore may be considered as a manifestation of the insufficiency of accomplishments in different domains of well-being (Chakravarty, 2006, 2018; Chakravarty & Lugo, 2016). It is a multi-dimensional phenomenon characterized by deprivations in multiple dimensions of the individuals' well-being (Ferreira, 2011). As observed by Sen (2000b, p. 18), "human lives are battered and diminished in all kinds of different ways". As a result, nowadays, the multi-dimensional nature of poverty enjoys a widespread consensus (Chakravarty, 2018; Kakwani & Silber, 2008a; Silber & Yalonetzky, 2014; Stiglitz, Sen, & Fitoussi, 2009a, 2009b), grounded, mainly, on the capability approach proposed by Sen (1985, 1992, 1997, 2000a, 2010), which is regarded as the most comprehensive approach to grasp the concept of poverty (Thorbecke, 2008). Such a consensus is reflected in Target 1.2 of the SDGs, which demands by 2030, the reduction "at least by half of the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions" (UN, 2015, p. 15).

In this regard, multi-dimensional approaches to the measurement of poverty[1], as well as multi-dimensional poverty indices, have become increasingly popular in recent years (Duclos & Tiberti, 2016). Currently, the most influential and dominating methodology in developing countries, particularly in Latin America and the Caribbean, is the counting

[1] See, for instance, Alkire & Foster, 2011; Alkire, et al., 2015; Atkinson, 2003; Bourguignon & Chakravarty, 2003; Brandolini and Aaberge, 2014; Chakravarty, 2018; Chakravarty, Deutsch, & Silber, 2008; Deutsch & Silber, 2005; Duclos, Sahn, & Younger, 2008; Kakwani & Silber, 2008b; Klasen, 2000; Lemmi & Betti, 2006, 2013; Rippin, 2013, 2016, 2017; Tsui, 2002.

approach proposed by Alkire and Foster (2011) (AF hereafter). It is an axiomatic family of multi-dimensional poverty measures that employs a "dual cutoff method" for the identification of the poor (Alkire & Foster, 2011, p. 478), and it has been applied in a considerable number of studies (Duclos & Tiberti, 2016)[2]. The most famous application of this approach is the household-based multi-dimensional poverty index or "global MPI" (Alkire et al., 2015, p. 177). Developed originally by the Oxford Poverty and Human Development Initiative (OPHI) in collaboration with the United Nations Development Program (UNDP) (Alkire & Santos, 2010, 2014), the global MPI has been included in the Human Development Report since 2010 (UNDP, 2010) and has become very popular (Duclos & Tiberti, 2016, p. 696).

More recently, Duryea and Robles (2017), as part of the report "Social Pulse in Latin America and the Caribbean 2017", published by the Inter-American Development Bank (IDB), and Santos and Villatoro (2018), who proposed a multi-dimensional poverty index for Latin America (MPI-LA, hereafter), have also suggested adopting the AF method to estimate household-based multi-dimensional poverty in Latin America and the Caribbean. Likewise, several Governments, especially from Latin American countries, for instance Chile (Ministerio de Desarrollo Social, 2016), Colombia (DANE-DIMPE, 2014), Costa Rica (INEC, 2015), Ecuador (Castillo & Jácome, 2015), El Salvador (STPP & MINEC-DIGESTYC, 2015), Honduras (SCGG-INE, 2016), Mexico (CONEVAL, 2011), and Panama (MEF, 2017), have adopted such an approach to produce their official multi-dimensional poverty measure.

The AF methodology has certainly the advantage of simplicity, flexibility, and clarity when compared to other multi-dimensional approaches, which is indeed what makes it extremely appealing (Silber, 2011; Thorbecke, 2011); it has also a number of attractive properties (see Alkire & Foster, 2011; Alkire et al., 2015). Yet, this approach has also several methodological shortcomings that have often been ignored in the literature (see, Duclos & Tiberti, 2016). Let us focus on two of them, perhaps the most critical weaknesses of the methodology.

Firstly, the identification method of the AF methodology assumes implicitly that up to the second (intermediate) cutoff ($k$), which is used to identify the multi-dimensionally poor

[2] A summary of studies that have applied the AF method can be found in Alkire et al. (2015, p. 178-181).

(Alkire & Foster, 2011), the variables (attributes) are “perfect substitutes”, whereas the same variables are “perfect complements” from such a cutoff onwards (Rippin, 2017, p. 37), an assumption difficult to justify theoretically. Choosing between substitutability and complementarity between attributes when there are more than two of them is certainly not an easy task. This issue, however, is of great significance within a dynamic framework and cannot be ignored (Thorbecke, 2008), would it be only because of its important policy implications (Silber, 2011; Thorbecke, 2011)[3].

Secondly, as emphasized by Rippin (2013, 2017), any index based on the AF approach is completely insensitive to inequality among the multi-dimensionally poor, particularly with ordinal or dichotomized variables (attributes), a serious shortcoming according to Sen (1976, 1979). In addition, the AF approach does not satisfy the strongest as well as the weakest form of the axiom of “Sensitivity to Inequality Increasing Switch (SIIS)” (Rippin, 2013, p. 26), a property that is assumed to capture the interaction between allocation efficiency and distributive justice (see, Sen, 1992)[4]. For instance, an inequality increasing switch that reduces the weighted deprivation score of the less multi-dimensionally poor individual below the threshold $k$ will always lead to a reduction of the poverty rates, no matter what the relationship between the variables (attributes) is (Rippin, 2017). Such a flaw may lead to biased assessments of the extent of poverty and hence have an impact on social policies, and targeting.

Another issue that has generally been ignored in the literature is that in the vast majority of studies, empirical indices of multi-dimensional poverty have been computed at the level of the household (Bessell, 2015; Chiappori, 2016; Pogge & Wisor, 2016). In other words, these studies used the household as the unit of analysis to determine who is multi-dimensionally poor and who is not, equating the poverty condition of the household with the

[3] “For instance, for a poverty analysis in the dimensions of education and nutritional status of children, there are production complementarities because better-nourished children learn better. If this complementarity is strong enough, it may overcome the usual ethical judgement that favors the multiply-deprived, so that overall poverty would decline by more if we were to transfer education from poorly nourished to the better nourished, despite the fact that it increases the correlation of the two measures of well-being. Similarly, one might argue that human capital should be granted to those with a higher survival probability (because these assets would vanish following their death). Increasing the correlation of deprivations, and increasing the incidence of multiple deprivations, would then be good for poverty reduction” (Duclos, Sahn, & Younger, 2006, p. 950).

[4] The considerations behind SIIS have been clearly stated by Rippin (2017, p. 33-34): “Poverty measures can even decrease in the face of increasing inequality if and only if the degree of complementarity between poverty dimensions is so strong that the gains in allocation efficiency outweigh the sacrifices on the side of distributional justice. In other words, changes in poverty measures ought not to be reduced to considerations of who gains and who loses from redistributions (distributive justice) but should also take into account how efficient resources are distributed among the poor (allocation efficiency)”.

poverty condition of all individuals belonging to the household (Espinoza-Delgado & Klasen, 2018). Such an assumption, however, disregards intra-household inequalities that are known to exist[5], and it may also hide inequalities between different generations living in the household (Atkinson, Cantillon, Marlier, & Nolan, 2002), leading thus to biased estimates of poverty and inequality in society (Deaton, 1997; Espinoza-Delgado & Klasen, 2018; Rodríguez, 2016). Given that the ultimate objective of poverty analysis is the welfare of individuals (Chiappori, 2016) and that poverty is a characteristic of individuals, not households (Deaton, 1997), limiting the empirical analysis to the household level "is simply unacceptable" (Chiappori, 2016, p. 840).

It is also worth noting that a gender analysis cannot be conducted by using household-based multi-dimensional poverty measures that are incapable of revealing gender differences within the household since they are gender-blind (Bessell, 2015; Espinoza-Delgado & Klasen, 2018; Pogge & Wisor, 2016). Gender equality, however, is an objective of global development as well (ECLAC, 2016, 2018a), as required by Goal 5 of the SDGs ("Achieve gender equality and empower all women and girls") (UN, 2015, p. 14). Individual-based poverty measures are therefore indispensable to track progress in reaching Goals 1 (especially Target 1.2) and 5 of the SDGs.

This is why, adopting the general framework proposed by Silber and Yalonetzky (2014)[6] and Rippin's methodology (2013, 2017), we propose in this paper to use an inequality sensitive multi-dimensional poverty approach, with ordinal (dichotomized) variables, that overcomes the problems discussed previously[7]. The approach suggested is based on a "fuzzy" identification function that specifies explicitly the kind of relationship existing between the ordinal variables considered in the analysis, eliminating thus the ambiguity of the AF approach. The class of multi-dimensional poverty measures that is adopted has the advantage of taking into account efficiency and distributive justice considerations (Rippin, 2013, 2017), and it can be decomposed into the three I's of poverty, incidence, intensity, and inequality (Jenkins & Lambert, 1997). We implement such an approach by looking at poverty data in five Central American countries, namely Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica. Note that the first four countries are

[5] See, for instance, Asfaw, Klasen, & Lamanna, 2010; Bradshaw, 2002, 2013; Bradshaw, Chant, & Linneker, 2017a, 2017b; Chant, 2008; Klasen & Wink, 2002; 2003; Rodríguez, 2016.
[6] Some of the ideas raised by Silber and Yalonetzky (2014) appear already in Yalonetzky (2012, 2014).
[7] Such an approach has been used recently by Bérenger (2016, 2017).

among the five multi-dimensionally poorest countries in Latin America and the Caribbean (Duryea & Robles, 2017; Santos & Villatoro, 2018). Our approach allows us estimating multi-dimensional poverty among adults in that region, shedding some light on gender differences in multi-dimensional poverty and inequality, testing whether there are discrepancies between these countries regarding the impact of gender on multi-dimensional poverty and exploring the determinants of multi-dimensional poverty in Central America on the basis of logit regression models.

As far as we know, there is no study of individual-based multi-dimensional poverty in the literature similar to this. The rest of the paper is organized as follows. Section 2 explains the framework proposed to measure multi-dimensional poverty; section 3 introduces the data and justifies the dimensions, indicators, and deprivation cuttoffs, as well as the weighting structure used; section 4 discusses the main results and displays the results of the logit regression models while section 5 provides some concluding remarks.

## 2. A framework for the measurement of multi-dimensional poverty

Notations and definitions:

Let $\mathbf{N} = \{1, \dots, n\} \subset \mathbb{N}$ denote the set of $n$ individuals, and let $\mathbf{D} = \{1, \dots, d\} \subset \mathbb{N}$ represent the set of $d$ ordinal variables measuring various aspects of individual well-being. Let $\mathbf{X} = [x_{ij}]$ be the $n \times d$ attainments matrix, where $x_{ij}$ ($\in \mathbb{N}_{++}$) represents the attainment of the $i$th individual for the $j$th variable. In this matrix, each row vector $\mathbf{x}_{i.} = (x_{i1}, \dots, x_{id})$ gives the achievements of the $i$th individual, while each column vector $\mathbf{x}_{.j} = (x_{1j}, \dots, x_{nj})$ provides the distribution of the $j$th variable across the population. Let $\mathbf{z} = (z_1, \dots, z_d)$ be a row vector defining the variable-specific deprivation thresholds and $\mathbf{w} = (w_1, \dots, w_d)$ the vector of variable-specific weights with $w_j > 0 \; \forall j \in [1, d]$ and $\sum_{j=1}^{d} w_j = 1$. Finally $k$ denotes the real-valued scalar cutoff, with $0 \leq k \leq 1$. $k$ is the minimal deprivation score an individual needs to have in order to be considered as multi-dimensionally poor ("the poverty cutoff") (Alkire & Foster, 2011, p. 478).

### 2.1. The individual multi-dimensional poverty function

The construction of the individual multi-dimensional poverty function entails two steps. The first step checks for each well-being dimension $j$ whether the individual is deprived by comparing the individual's achievement $(x_{ij})$ with the deprivation threshold $(z_j)$. If $x_{ij} < z_j$, individual $i$ is said to be deprived in variable $j$. From the **X** matrix and the **z** vector, a dichotomous deprivation matrix $\mathbf{g^0}[g_{ij}^0]$ is obtained, such that $g_{ij}^0 = 1$ if $x_{ij} < z_j$, and $g_{ij}^0 = 0$ if $x_{ij} \geq z_j$, for all $j = 1, \dots, d$ and for $i = 1, \dots, n$. A weighted deprivations score $(c_i)$ is then computed for each individual as the weighted sum of the deprivations suffered by each of them. This score is called the "(real-valued) counting function" (Silber & Yalonetzky, 2014, p. 11) and represents the final output of the first step. Formally, the individual's counting function is defined as $c_i(x_i; z; w) = \sum_{j=1}^{d} g_{ij}^0 w_j \equiv \sum_{j=1}^{d} \mathbb{I}(x_{ij} < z_j)\, w_j$. When individual $i$ does not suffer from any deprivation, $c_i = 0$; conversely, when the $i$th individual is deprived in all the variables considered in the analysis $c_i = 1$.

2.1.1. The identification function

The focus of the second stage of the analysis is on the identification of the multi-dimensionally poor individuals. Here the counting function $c_i$ is compared with the poverty cutoff $k$. If $c_i \geq k$, then the individual $i$ is considered as multi-dimensionally poor. The choice of $k$ is evidently arbitrary and Alkire and Foster (2011) propose to use an "intermediate cutoff" that lies somewhere between 0 and 1 (p. 478). Let $\psi^{AF}(x_i; z; w; k)$ be the identification function suggested by Alkire and Foster (2011), then:

$$\psi^{AF}(x_i; z; w; k) = \begin{cases} 1 \; if \; c_i \geq k \\ 0 \; if \; c_i < k \end{cases} \qquad (1)$$

Note that $\psi^{AF}$ is a discrete identification function; consequently, it violates the continuity axiom: A small change in $c_i$ or in $k$ can change from 0 to 1 or from 1 to 0 the contribution of any individual to the overall multi-dimensional poverty (Duclos & Tiberti, 2016). Note also that the $\psi^{AF}$ comprises as particular cases the two conventional methods of identification introduced by Atkinson (2003) in the context of multi-dimensional poverty analysis: the union and the intersection approaches. Under the union approach, individuals are considered to be multi-dimensionally poor if they suffer from deprivation in at least one variable: In other words, $k \leq \min\{w_1, w_2, \dots, w_d\}$. Such an approach leads clearly to a high proportion of multi-dimensionally poor people but it has been widely adopted in the literature on multi-dimensional poverty (Silber & Yalonetzky, 2014). The other extreme case is that of the intersection method of identification, where individuals are identified as multi-dimensionally poor if they are deprived in each variable ($k = 1$). This approach considers as poor only "the most indigent" individuals in the society and yields evidently the lowest poverty rate. These two approaches to identification are extreme cases based on a strong assumption regarding the relationship between the variables (attributes). The former assumes that the variables are perfect complements while the latter supposes that the variables are perfect substitutes (Rippin, 2013, 2017)[8]. This is why Alkire and Foster (2011, p. 478) proposed an intermediate approach as "a natural alternative" to the two extreme methods of identification. However, as emphasized by Rippin (2013, 2017), the AF approach not only implies an arbitrary selection of the intermediate poverty cutoff $k$; it also implicitly supposes that up to $k$ the variables are perfect substitutes while beyond $k$ they are perfect complements, a questionable and rather hard to justify assumption.

In this paper, we prefer to adopt the "fuzzy" identification function, suggested by Rippin (2013, 2017), that makes explicit the relationship between the variables (attributes) considered in the analysis and does not introduce any kind of discontinuities when identifying the multi-dimensionally poor individuals. Let $\gamma$ be an indicator of inequality aversion, a parameter describing the relationship between the attributes (Rippin, 2013, p. 27). The fuzzy identification function is then defined as

$$\psi^{fuzzy}(x_i; z; w; k) = [c_i]^\gamma \qquad (2)$$

where $[c_i]^\gamma$ satisfies the conditions of being non-decreasing in $c_i$ and of having a non-decreasing (non-increasing) marginal if the variables are assumed to be substitutes (complements) (Rippin, 2013, 2017)[9].

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[8] Here, the concepts of "substitutability" and "complementarity" follow the Auspitz-Lieben-Edgeworth-Pareto (ALEP) definition and not the well-known approach proposed by Hicks and Allen (1934a, 1934b) (Silber, 2007, p. 59). The ALEP definition considers that two attributes are substitutes (complements) if their second cross-partial derivatives are larger (less) than zero and independent if they are equal to zero (Rippin, 2013, 2017). Intuitively, on the basis of the ALEP definition, if two attributes are substitutes, poverty will decrease less with a rise in attribute 1 for individuals with larger quantities of attribute 2. The contrary is evidently true when the two attributes are supposed to be complements (Silber, 2007). For instance, assuming that income and education are substitutes, the reduction in poverty due to a unit increase in income is less important for individuals who have an educational level close to the education deprivation cutoff than for individuals with very low education. Conversely, the drop in poverty would be more substantial for individuals with a larger level of education if income and education were considered to be complements (Bourguignon & Chakravarty, 2003).

[9] "A function $f(x)$ has a non-decreasing marginal if $f(x_g + 1) - f(x_g) \geq f(x_h + 1) - f(x_h)$ whenever $x_g \geq x_h$" (Rippin, 2017, p. 61). The conditions that have to be satisfied by $[c_i]^\gamma$ are based on the "Theorem 1" proposed by Rippin (2013, p. 27). The proof of the Theorem can be found in Rippin (2017, p. 62-64).

Therefore, instead of dichotomizing the distribution of the weighted deprivations scores, as proposed by Alkire and Foster (2011), the fuzzy identification function distinguishes between the multi-dimensionally non-poor, on one hand, and "different degrees of poverty severity", on the other hand (Rippin, 2017, p. 42). Hence, it is considered to be fuzzy, because unless $c_i = 1$ or $c_i = 0$, each individual is "somewhat" multi-dimensionally poor (Silber & Yalonetzky, 2014, p. 13): Individuals suffer different degrees of multi-dimensional poverty severity, depending on i) the number of variables (attributes) in which they are simultaneously deprived, and ii) the type of relationship that exists among these variables. The shape of the function depends on the value of $\gamma$. If $\gamma$ is between 0 and 1, the curve describing $c_i$ has a concave shape, while if $\gamma$ is greater than 1, this curve has a convex shape. The choice between these two options depends on whether it is assumed that the variables (attributes) are substitutes or complements. If they are considered as complements, the increase in poverty severity is marginally decreasing in $c_i$ as the loss in even one variable (attribute) can hardly be compensated (Rippin, 2013). In other words, as soon as an individual suffers from deprivation in one variable, he/she must suffer from some degree of poverty. If the variables are perfect complements, there is no compensation, and we obtain the union case; but if they are imperfect complements, we get the more general case approximated by a concave identification function. If, on the contrary, the variables are substitutes, there is compensation, and then the shortage in only one variable leads to a rather low degree of poverty severity as other variables can compensate for the deprivation. However, overall, the compensation capacity decreases as the number of deprivation increases; consequently, the poverty severity level is marginally increasing in $c_i$. Therefore, if they are imperfect substitutes, we obtain the more general case of a convex identification function; but, if they are perfect substitutes, there is full compensation: as long as an individual is not deprived in all variables his/her overall score will be equal to zero, which corresponds to the intersection case discussed previously.

Selecting a particular relationship between the variables is certainly not a simple task. There does not seem to be an algorithm by which we can ascertain the degree of substitutability and/or complementarity between them. It is hard to determine such degree on a pair-wise basis, a fortiori among combinations of $n$ variables taken 3, 4, up to $n$ at a time. Furthermore, the variables may be substitutes in the short term but complements in the long term (Thorbecke, 2008). This issue may have very significant policy implications (Silber, 2011) and it is "so conceptually important that it cannot be rationalized away" (Thorbecke, 2011, p. 486). This why in this paper, we assume different degrees of substitutability ($\gamma = 1.25, 1.50, 1.75, 2.00$) and complementarity ($\gamma = 0.25, 0.50, 0.75$) among the variables when estimating multi-dimensional poverty in Central America. We then test the robustness of our conclusions to these assumptions.

### 2.1.2. The function defining the multi-dimensional poverty breadth

In line with the poverty measurement literature, the individual multi-dimensional poverty function must not only identify the multi-dimensionally poor people but also capture the intensity of the multi-dimensional poverty experience (Silber & Yalonetzky, 2014). However, since with ordinal (binary or dichotomized) variables the multi-dimensional poverty depth cannot be estimated as no poverty gap between the individual achievement in a given variable and the deprivation threshold for this variable may be calculated (Bérenger, 2017), to consider the poverty breadth we make the individual multi-dimensional poverty function depend on the number of deprivations. The individual multi-dimensional poverty function is then defined as the product of the identification function introduced previously and a function that captures the breadth of multi-dimensional poverty. Let $g(x_i; z; w)$ be the function that measures the multi-dimensional poverty breadth. The individual multi-dimensional poverty is then expressed as

$$p_i(x_i; z; w; k) = \psi^{Fuzzy}(x_i; z; w; k) g(x_i; z; w) \qquad (3)$$

where $g(x_i; z; w)$ is a real-valued function that maps into the interval $[0,1]$. This function $g(x_i; z; w)$ is assumed not to rise when any achievement (e.g., $x_{i1}$) increases and it is strictly decreasing when a rise, $\varepsilon > 0$, in a given variable cancels the deprivation in this variable, i.e., $x_{ij} + \varepsilon > z_j > x_{ij}$ (Silber & Yalonetzky, 2014). As multi-dimensional poverty breadth function we adopted the one proposed by Alkire and Foster (2011):

$$g(x_i; z; w) = c_i \qquad (4)$$

## 2.2. The social multi-dimensional poverty function

In the last stage of the analysis we derive a social multi-dimensional poverty function by aggregating the individual multi-dimensional poverty functions. In the literature there are different ways of performing that aggregation, but we simply define the social multi-dimensional poverty function as the average of the individual poverty functions (Silber & Yalonetzky, 2014). Let $P(X; z; w; k)$ be the social multi-dimensional poverty function. Then

$$P(X; z; w; k) = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{d} p_i(x_i; z; w; k) = \frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{d} \psi^{Fuzzy}(x_i; z; w; k)g(x_i; z; w) \quad (5)$$

which leads to the "Multi-dimensional Correlation-Sensitive Class of Poverty Measures" with ordinal (dichotomized) variables proposed by Rippin (2017, p. 46)

$$P_{CS}^{\gamma} = \frac{1}{n}\sum_{i=1}^{n} c_i^{\gamma+1} \quad (6)$$

This class of multi-dimensional poverty indices satisfies the following axioms: Anonymity (AN), Monotonicity (MN), Principle of Population (PP), Strong Focus (SF), Normalization (NM), Subgroup Decomposability (SD), Factor Decomposability (FD), and Sensitivity to Inequality Increasing Switches (SIIS) (Rippin, 2013, 2017). It is the only one in the literature that satisfies not only SD and FD but also SIIS (Bérenger, 2016, 2017; Rippin, 2013, 2017).

Following Bérenger (2017, p. 148), the Multi-dimensional Correlation-Sensitive Class of Poverty Measures may be decomposed into the three I's of multi-dimensional poverty (Jenkins & Lambert, 1997):

$$P_{CS}^{\gamma} = HA^{\gamma+1}\left\{1 + [(\gamma+1)^2 - (\gamma+1)]\left[\frac{1}{[(\gamma+1)^2-(\gamma+1)]}\left(\frac{1}{q}\frac{\sum_{i=1}^{q} c_i^{\gamma+1}}{A^{\gamma+1}} - 1\right)\right]\right\} \quad (7.1)$$

$$P_{CS}^{\gamma} = HA^{\gamma+1}\{1 + [(\gamma+1)^2 - (\gamma+1)]\, GE_{\gamma+1}(c)\} \quad (7.2)$$

where $H = q/n$ (the multi-dimensional headcount ratio) measures the incidence of multi-dimensional poverty, $A = \left[\sum_{i=1}^{q} c_i\right]/q$ ("the average deprivation score across the poor") (Alkire et al., 2015, p. 157) the multi-dimensional poverty intensity, and $GE_{\gamma+1}(c)$ ("the generalized entropy inequality index among the poor") (Bérenger, 2017, p. 148) the inequality among the multi-dimensionally poor people.

It is worth mentioning that the adjusted headcount ratio ($M_0$) proposed by Alkire and Foster (2011) and adopted by the global MPI (Alkire & Santos, 2014; UNDP, 2010), and the MPI-LA (Santos & Villatoro, 2018), as well as, officially, by several countries in Central America (e.g., Honduras, El Salvador, and Costa Rica), can be computed as the product of the incidence ($H$) and the intensity ($A$) of multi-dimensional poverty. As a consequence, the measure $P_{CS}^{\gamma}$ can also be expressed as

$$P_{CS}^{\gamma} = M_0 A^{\gamma}\{1 + [(\gamma+1)^2 - (\gamma+1)]\, GE_{\gamma+1}(c)\} \qquad (8)$$

Therefore, $A^{\gamma}\{1 + [(\gamma+1)^2 - (\gamma+1)]\, GE_{\gamma+1}(c)\}$ represents substantive information that measures based on $M_0$ disregard. Such complementary information is particularly important in the context of the SDGs, and its targets, and for gender inequality assessments. In other words, the neglect of such information may lead to wrong conclusions concerning multi-dimensional poverty and its trend in a country or region, especially when inequality is an important issue.

## 3. Data sources, deprivation dimensions, indicators and cut-offs, and weighting structure

### 3.1. Data

The data used in this paper are drawn from the most recent available household surveys, in the Central American countries under scrutiny, that have been conducted by the corresponding National Institutes of Statistics. Table 1 shows for each country the name and the year of the survey, which is nationally representative, the sample size, and the estimated population size, computed by employing the sample weights of the survey. In our assessment, the unit of analysis is the individual. These individuals are between 18 and 59 years old, were considered as household members and completed a full interview. The age limits selected follow the definition of children in the Convention on the Rights of the Child: "Every human being below the age of eighteen years" (UN, 1989, p. 2) and the general practice in Latin America and the Caribbean to define "older people" as those individuals aged 60 or more (Gasparini et al., 2010, p. 177). In other words in this paper, we focus on the adult members of the households, males and females, of working and reproductive ages, when "gender tensions" are the largest (ECLAC, 2016, p. 127). It is worth mentioning that in Central America, this age group represents more than 50% of the population (from a low of 47.7% in Honduras up to a maximum of 59.3% in El Salvador).

**Table 1.** Surveys used, samples size, and estimated population.
*Source*: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

| Country | Survey | Year | Sample Size (Individuals aged 18-59) | | | Estimated population (Individuals aged 18-59) | | |
|---|---|---|---|---|---|---|---|---|
| | | | Individuals | Males | Females | Individuals | Males | Females |
| Guatemala | Encuesta Nacional de Condiciones de Vida (GUA-ENCOVI2014) | 2014 | 26,664 | 12,480 | 14,184 | 7,848,739 | 3,665,370 | 4,183,369 |
| El Salvador | Encuesta de Hogares de Propósitos Múltiples (ELS-EHPM2016) | 2016 | 40,842 | 18,646 | 22,196 | 3,553,224 | 1,613,439 | 1,939,785 |
| Honduras | Encuesta Permanente de Hogares de Propósitos Múltiples (HON-EPHPM2013) | 2013 | 15,760 | 7,273 | 8,487 | 4,070,318 | 1,891,495 | 2,178,824 |
| Nicaragua | Encuesta Nacional de Hogares sobre Medición de Nivel de Vida (NIC-EMNV2014) | 2014 | 15,730 | 7,328 | 8,402 | 3,309,715 | 1,567,202 | 1,742,513 |
| Costa Rica | Encuesta Nacional de Hogares (CR-ENAHO2016) | 2016 | 21,760 | 10,482 | 11,278 | 2,891,584 | 1,392,354 | 1,499,230 |
| Central America | Encuestas Nacionales | Around 2015 | 120,756 | 56,209 | 64,547 | 21,673,580 | 10,129,860 | 11,543,721 |

### 3.2. Dimensions, indicators, and deprivation cut-offs

Overall, the choice of the dimensions and indicators for the individual-based multi-dimensional poverty index is grounded on the Sustainable Development Goals (SDGs) and targets (UN, 2015, 2017) to be considered as a kind of normative framework with international consensus, and it is strongly conditioned by the availability of comparable (individual) data across the countries covered in our study. The five deprivation dimensions selected (education, employment, water and sanitation, energy and electricity, and the quality of the dwelling) are certainly among the most significant aspects of an individual well-being (Stiglitz et al., 2009a, 2009b). These dimensions may also be considered as "relevant for gender inequality analysis" (Robeyns, 2003, p. 76). The specific indicators chosen for each of the five dimensions and the corresponding deprivation cut-offs are presented in Table 2.

#### 3.2.1. Education

There are quite a few reasons why education should be included in a multi-dimensional poverty analysis. As Drèze and Sen (2002, p. 38) observed, education can be considered to be valuable to the freedom of an individual in distinct ways, it has instrumental and intrinsic importance (Robeyns, 2006). Educational accomplishments are not only valuable achievements in themselves but also contribute, for instance, to an individuals' empowerment and play a distributive role, which can help reducing "gender-based inequalities" (Drèze and Sen, 2002, p. 39). In the context of the SDGs and targets, the inclusion of education is justified by Goal 4, and its targets, that calls for ensuring "inclusive and equitable quality education and promote lifelong learning opportunities for all" (UN, 2015, p. 17).

The ordinal educational indicator selected (schooling achievement) takes into account the information available on the schooling level attained by the individuals to assess whether they suffer from deprivation in education. We set the lower secondary school as a normative target, which is approximately equivalent to 9 years of formal schooling so that an individual who did not complete this educational level will be considered as educationally deprived. It is worth mentioning that our deprivation threshold is more demanding than the one proposed by the global-MPI ("5 years of education") (Alkire & Santos, 2010, p. 254) and the official index of Honduras, which uses "6 years of schooling" as deprivation threshold for individuals aged between 15 and 49 years of age (SCGG-INE, 2016, p. 32). It is however similar to the one required by the MPI-LA for people aged between 20 and 59 years (Santos & Villatoro, 2018, p. 59) and in tune with what is set by the official MPI of Costa Rica for people aged between 36 and 57 years (INEC, 2015, p. 39) and of El Salvador for people between 18 and 64 years of age (STPP & MINEC-DIGESTYC, 2015, p. 35).

### 3.2.2. Employment

The inclusion of employment as a dimension of multi-dimensional poverty in Central America is based on its instrumental significance and considerable intrinsic importance (Atkinson, 2002; Klasen, 2000; Sen, 2000; Stiglitz et al., 2009a, 2009b). The lack of employment (to be unemployed) involves costs for people, that go beyond the loss of income (Atkinson, 2000; Stiglitz et al., 2009a, 2009b). It causes deprivations of other kinds that have serious effects on individuals' lives: "psychological harm, loss of work motivation, skill and self-confidence, increase in ailments and morbidity (and even mortality rates), disruption of family relations and social life, hardening of social exclusion and accentuation of racial tensions and gender asymmetries" (Sen, 2000, p. 94). In addition, labor market participation is considered to be "an important means of social integration" (Atkinson et al., 2002, p. 137). The SDGs and targets call for promoting "full and productive employment and decent work for all" (Goal 8) (UN, 2015, p. 19), which is crucial in Central America countries, where the share of informal employment in total employment is estimated to be higher than 70%, with the exception of Costa Rica (ILO, 2018, p. 18).

The ordinal indicator we defined takes into account the employment status of the individual but also unpaid care work and domestic work. This is in line with target 5.4 of the SDGs: "Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate" (UN, 2015, p. 18). The indicator (employment status) distinguishes two groups of individuals, among those who reported that they did not work the week preceding the survey: 1) individuals whose main activity was to do domestic work and/or unpaid care work (hereafter unpaid care and domestic workers), and 2) individuals who were not involved in those activities. We consider three scenarios in order to shed some light on the consequences, in terms of multi-dimensional poverty and gender differences in poverty, of incorporating into the analysis unpaid care work and domestic work which are "commonly left out of policy agendas" (Ferrant, Pesando, & Nowacka, 2014, paragraph 1).

**Table 2.** Dimensions, indicators, weights, and deprivation cut-offs

| Dimensions | Indicators | Weights (%) | Deprivation indicators: He / She is deprived if He / She… |
|---|---|---|---|
| 1. Education (Goal 4 of the SDGs) | 1.1. Schooling achievement | 20.0 | has not completed lower secondary school (9 years of schooling approximately) |
| 2. Employment (Goal 8 of the SDGs) | 2.1. Employment status | 20.0 | *Scenario 1* (does not consider domestic workers and unpaid care workers): is unemployed, employed without a pay, or a discouraged worker (hidden unemployment) |
| | | 20.0 | *Scenario 2* (considers Scenario 1 plus domestic workers and unpaid care workers who reported that they "did not have a job" but were available to work): is unemployed, employed without a pay, or a discouraged worker (hidden unemployment) |
| | | 20.0 | *Scenario 3* (considers Scenario 2 plus domestic workers and unpaid care workers who reported that they "did not have a job" but were not looking for and were not available to work because of unpaid care and/or domestic chores): is unemployed, employed without a pay, or a discouraged worker (hidden unemployment), or is unemployed, but is not looking for a job and is not available to work because of he/she has to take care of his/her children and/or a relative (s) and/or has to do domestic work |
| 3. Water & sanitation (Goal 6 of the SDGs) | 3.1. Improved water source | 12.6 | does not have access to an improved water source or has access to it, but out of the house and yard/plot |
| | 3.2. Improved sanitation | 7.4 | only has access to an unimproved sanitation facility (a toilet or latrine without treatment or a toilet flushed without treatment to a river or a ravine) or to a shared toilet facility |
| 4. Energy & electricity (Goal 7 of the SDGs) | 4.1. Type of cooking fuel | 5.4 | is living in a household which uses wood and/or coal and/or dung as main cooking fuel |
| | 4.2. Access to electricity | 14.6 | does not have access to electricity |
| 5. Quality of dwelling (Goal 11 of the SDGs) | 5.1. Housing materials | 4.9 | is living in a house with dirt floor and/or precarious roof (waste, straw, palm and similar, other precarious material) and/or precarious wall materials (waste, cardboard, tin, cane, palm, straw, other precarious material) |
| | 5.2. People per bedroom | 2.9 | has to share bedroom with two or more people |
| | 5.3. Housing tenure | 7.5 | is living in an illegally occupied house or in a borrowed house |
| | 5.4. Assets | 4.7 | does not have access to more than one durable good of a list that includes: Radio, TV, Refrigerator, Motorbike, Car |

In the first scenario, deprivation is assumed to concern only individuals from the second group. These individuals are assumed to be deprived in employment if they are (i) unemployed (openly unemployed), (ii) employed without a pay, or (iii) discouraged workers (hidden unemployment). This first scenario considers therefore the first group as "non-deprived" in employment. The second scenario makes the same assumption as scenario 1 for the second group. But it also includes those individuals in the first group who reported not to have a job but were available to work. Finally, the third scenario identifies as deprived in employment the same individuals as those considered as such in the second scenario. But it also includes as deprived individuals those whose activity is unpaid care and domestic work and who reported that they were not looking for a job and were not available to work, due to the fact that they "had" to do those activities. Here we make the strong assumption that unpaid care work and domestic work are mandatory activities for the individual in the household, but that might not be true (Robeyns, 2003).

#### 3.2.3. Water & sanitation

Water and sanitation are also of considerable instrumental and intrinsic importance (Klasen, 2000; Mara & Evans, 2018; Sorenson, Morssink, & Campos, 2011). An "adequate sanitation, together with good hygiene and safe water, are fundamental to good health and to social and economic development" (Mara, Lane, Scott, & Trouba, 2010, p. 1). This dimension includes two indicators, improved water source and improved sanitation, which can be assumed to be related to Goal 6 and its targets of the SDGs: "Ensure availability and sustainable management of water and sanitation for all" (UN, 2015, p. 18). An individual is hence considered to be water deprived if he/she does not have access to drinking water in his/her house or yard/plot and he/she is deemed to be deprived in sanitation if he/she only has access to unimproved sanitation facility or to a shared toilet one. Both deprivation cut-offs are similar to the ones used by Costa Rica and El Salvador's official MPIs (INE, 2015, p. 39; STPP & MINEC-DIGESTYC, 2015, p. 36).

#### 3.2.4. Energy & electricity

The dimension energy and electricity emphasizes Goal 7 of the SDGs, which demands ensuring "access to affordable, reliable, sustainable and modern energy for all" (UN, 2015, p. 19). This dimension is measured via two indicators named type of cooking fuel and access to electricity. Both are important indicators of well-being because of their intrinsic and instrumental significance (Klasen, 2000; Santos, 2013). For instance, indoor air pollution has adverse effects on health and can increase the risk of many diseases and death (Duflo, Greenstone, & Hanna, 2008a, 2008b, 2016; Kaplan, 2010). It has also been considered to be "a global health threat, particularly for women and young children" (Duflo, et al., 2008a, p. 7). Having access to electricity, on the other hand, can help improving the living conditions of individuals by allowing them to be independent from sunlight as well as by contributing to a clean environment (Santos, 2013). Accordingly, individuals are considered to be energy deprived if they use wood and/or coal and/or dung as main cooking fuel and deprived in electricity if they do not have access to such facility.

#### 3.2.5. Quality of dwelling

Finally, the individual-based multi-dimensional poverty index includes also a dimension that accounts for the quality of dwelling, an important well-being dimension for instrumental and intrinsic reasons (Klasen, 2000; Shaw, 2004), which occupies "a central position in poverty research and policy" (Atkinson et al., 2002, p. 158). The dwelling quality can affect directly or indirectly the individuals' health and be an important factor (e.g., overcrowding) in the transmission of diseases (Elender, Bentham, & Langford, 1998). This dimension is included in Goal 11 of the SDGs: "Make cities and human settlements inclusive, safe, resilient and sustainable" (UN, 2015, p. 21). To measure the quality of dwelling, we use four indicators: Housing materials, people per bedroom, housing tenure, and assets; the first three indicators are used by the MPI-LA to assess the housing dimension (Santos and Villatoro, 2018, p. 59), while the fourth one is similar to the asset indicators employed by the global-MPI (Alkire & Santos, 2010, p. 254). The corresponding deprivation cut-offs are specified in Table 2 and are the same as those used by the indices mentioned previously.

Note that the indicators included in the last three dimensions are considered to be non-rival and non-excludable goods, that is, they are regarded as public goods, accessible equally to every individual within the household (Espinoza-Delgado & Klasen, 2018; Klasen & Lahoti, 2016; Vijaya, Lahoti, & Swaminathan, 2014).

### 3.3. Weighting structure

The selection of a weighting structure implies a "value judgment" on the tradeoffs between the dimensions (indicators) (Decancq & Lugo, 2013, p. 9). Such a weighting scheme represents another normative decision to be taken when estimating a multi-dimensional poverty index (Alkire et al., 2015). We opt for using a hybrid weighting scheme that combines a normative approach (among dimensions) with a data-driven one (among indicators). We attach an equal weight to each of the five dimensions (20%), but for a given dimension, following Cerioli and Zani (1990), the weight of an indicator $j$ is defined as

$$w_j = 0.20\left(\frac{log\frac{1}{f_j}}{\sum_{j=1}^{d} log\frac{1}{f_j}}\right) \qquad (9)$$

where $f_j$ denotes the relative frequency of individuals deprived in the $j$th indicator (in this dimension), considering Central America as a whole. It can be observed that the weight ($w_j$) assigned to an indicator for a given deprivation dimension is an inverse function of the frequency of the deprivation related to this indicator. In other words, the lower the frequency of deprivation for a given indicator, the larger the weight given to this indicator (Deutsch & Silber, 2005). Such a weighting scheme implies therefore that deprivation is essentially a relative matter (Cerioli & Zani, 1990).

## 4. Results

### 4.1. Aggregate deprivation by indicator

Before estimating multi-dimensional poverty among adults in Central America, we conduct a "dashboard" approach in order to know the average degree of deprivation in the population according to the deprivation threshold defined for each of the ten indicators included in our analysis (see Table 2) (Ravallion, 2011, p. 236). Figure 1 presents, in the form of bar graphs, estimates of the percentage of adults deprived in each indicator, "the uncensored headcount ratio" (Alkire et al., 2015, p. 167), for Central America as a whole and for Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica. The confidence intervals at 95% are shown in Table A1 in Appendix. Overall, the results show that Central America still suffers substantial deprivations in several well-being indicators (e.g., education, energy, people per bedroom, and sanitation); but, at the same time, it has made good progress in reducing deprivation in some others (e.g., housing tenure and electricity).

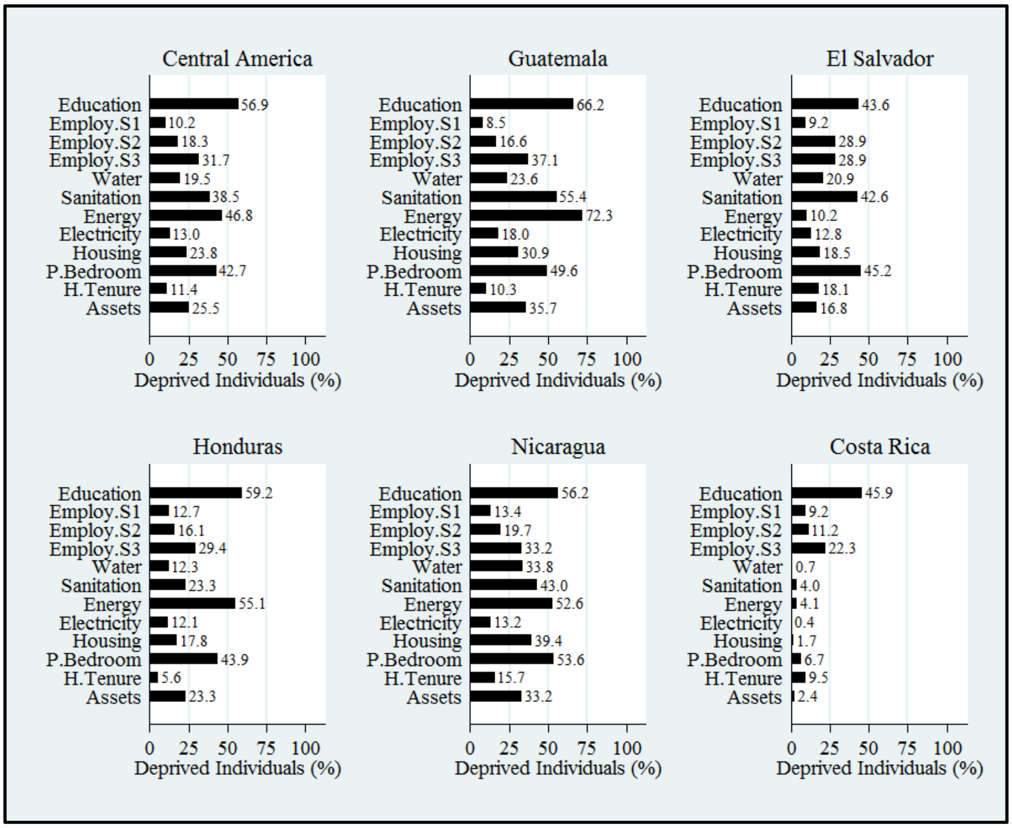


**Fig. 1.** Percentage of individuals aged between 18 and 59 years deprived in several indicators.
*Source*: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.
*Notes*: Employ.S1: Employment, scenario 1; Employ.S2: Employment, scenario 2; Employ.S3: Employment, scenario 3. In the case of El Salvador, the survey (ELS-EHPM2016) does not provide the information needed to determine whether the individuals considered as "unpaid care and domestic workers" are available to work or are not; accordingly, the deprivation rate in employment is the same under scenarios 2 and 3 (28.9%).

Figure 1 reveals that education is the biggest challenge for Central America. Almost six in ten Central American adults have not yet achieved the lower secondary school level (approximately 9 years of schooling), which limits dramatically their possibilities to get better jobs and have better lives (ECLAC, 2015, 2016, 2018a, 2018b) and, overall, affects negatively their individual and communal empowerment (Trommlerová, Klasen, & Leßmann, 2015). The second major challenge for the region is to continue fostering the use of clean energy for cooking. This is so because approximately five out of ten Central American adults remain directly or indirectly exposed to indoor air pollution from cooking fuels, that may induce respiratory problems and eventually chronic illnesses, if not death (Duflo et al., 2008a, 2008b, 2016; Gall, Carter, Earnest, & Stephens, 2013; ECLAC, 2017). According to Figure 1, the next challenges for the region are to reduce overcrowding in the home, as it is estimated that more than four in ten Central Americans aged between 18 and 59 years (approx. 9.3 million people) share the bedroom with two or more people, and to increase the provision of improved sanitation facilities. Four out of ten adults do not have access to such facilities, and if they have, they share them with people who belong to another household. Note that Figure 1 shows that deprivation in employment ranges from 10.2% (employment S1, first scenario) to 31.7% (employment S3, third scenario), which means that in Central America, the percentage of adults who "do not have a paid job" but are involved in unpaid care work and/or domestic work is estimated to be 21.5% (approximately 4.7 million people).

Looking at country specific results, we observe that Guatemala, Honduras, and Nicaragua are the countries with the highest deprivation rates (above 55%) in education. These findings are consistent with the recent work by Duryea and Robles (2017). They suggested (p. 20), on the base of the microdata of the 2012 and 2014 Latinobarómetro (LAPOP), that, as far as people aged between 25 and 65 years are concerned, these countries have the lowest average number of years of schooling (below 7.5 years) in Central America and, even, in Latin America and the Caribbean. Guatemala exhibits, on the other hand, the largest percentage of adults not having a paid job but doing unpaid care work and/or domestic work (28.6%), followed by El Salvador and Nicaragua (19.7%). Concerning the other dimensions and the corresponding indicators, excluding the case of housing tenure, Guatemala (for sanitation, energy, electricity, and assets) and Nicaragua (for water, housing, and people per bedroom) have the greatest deprivation rates while Costa Rica has the lowest ones. Note that Costa Rica is close to eliminating deprivation in water, electricity, housing, and assets. One may then argue that for this country, a relative, rather than an absolute, approach to defining deprivation would be more relevant.

### 4.2. Estimating multi-dimensional poverty among adults

We firstly illustrate empirically how the fuzzy identification function described in Section 2 performs, considering Central America as a whole and only the first deprivation cutoff for employment (the first scenario). Figure 2 draws such function assuming different levels of "inequality aversion" (Rippin, 2013, p. 28), that is, using diverse values of $\gamma$: from 0.05 to 10.0. The solid curves both at the top and at the bottom of the figure approximate the cases in which the attributes are supposed to be perfect complements ($\gamma = 0.05$) and perfect substitutes ($\gamma = 10.00$), respectively; the solid line in the middle (the 45$^{o}$ degree line) assumes, in turn, that the attributes are independent ($\gamma = 1.00$).

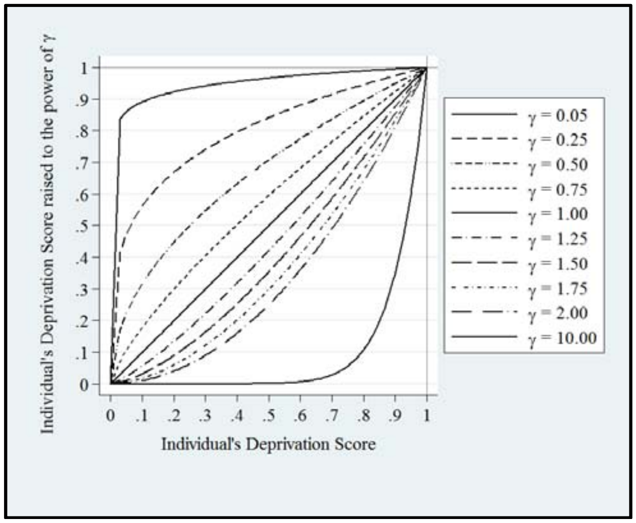


**Fig. 2.** Fuzzy identification function for several values of γ.
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Figure 2 makes clear that the marginal increase in an individual's poverty severity is larger, the lower the substitutability between indicators (moving from $\gamma = 10.00$ to $\gamma = 0.05$), and that an individual's poverty level is higher, the harder the compensation of deprivation in one attribute. The degree of poverty of individuals depends thus not only on their weighted deprivation scores but also on the way in which these deprivations are correlated (Rippin, 2013, 2017). This is an important issue that has been overlooked by the vast majority of empirical works concerned with multi-dimensional poverty analysis, despite the fact that "it may have very important policy implications" (Silber, 2011, p. 479). As a result, multi-dimensional poverty in society as a whole depends also on the degree of inequality aversion adopted and its estimate is sensitive to such an assumption. Therefore, since we do not know any algorithm through which we can accurately determine the degree of "inequality aversion", we propose, in this paper, to use a battery of measures to assess multi-dimensional poverty, as opposed to employing a specific one.

The overall estimates of multi-dimensional poverty among adults in Central America as a region, as well as in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, considering the three scenarios discussed in Table 2 (three deprivation cutoffs for employment) and several values of γ, are displayed graphically in Figure 3. The point estimates and their bootstrapped confidence intervals at 95% are presented in Table A2 in Appendix.

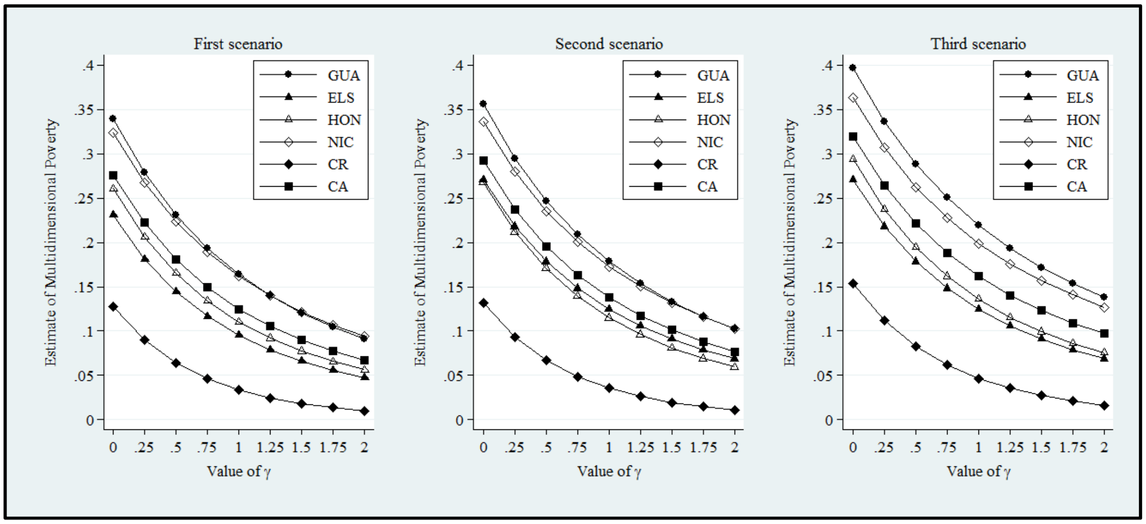


**Fig. 3.** Estimates of overall multi-dimensional poverty in Central America (CA) as a whole and in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), considering three scenarios and several degrees of inequality aversion (γ).

*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

*Note:* In the case of El Salvador, the multi-dimensional poverty estimates corresponding to the second and third scenarios are the same, as the deprivation rates in employment are identical. This is because the survey (ELS-EHPM2016) does not provide the information needed to determine whether the individuals considered as "unpaid care and domestic workers" were available to work or were not (see Table 2).

Figure 3 shows that, regardless of the scenario adopted, multi-dimensional poverty among adults in Central America, as well as in the countries included in the analysis, decreases as $\gamma$ increases: The estimated multi-dimensional poverty is lower, the higher the degree of inequality aversion (or substitutability among the indicators) (Rippin, 2013, 2017). This is in line with our previous discussion. The largest estimates of multi-dimensional poverty are obtained when the indicators are assumed to be perfect complements ($\gamma = 0$), that is, when a union approach is applied to identify the multi-dimensionally poor adults. In this particular case, our estimates are identical to those obtained when using the adjusted headcount ratio ($M_0$ index) proposed by Alkire and Foster (2011) (see Section 2). Note also that each of the resulting curves moves upwards as the threshold used to determine deprivation in employment becomes more demanding (from the first scenario to the third one). In other words multi-dimensional poverty rises when including unpaid care work and domestic work into the analysis. Figure 3 suggests that multi-dimensional poverty among adults is highest in Guatemala, followed by Nicaragua, except under the first scenario when γ takes a value of 1.50, 1.75, and 2.00 (notice in Figure 3 that Guatemala's curve intersect that of Nicaragua from above; see also Table A2 in Appendix), and, by contrast, it is the lowest in Costa Rica. Honduras and El Salvador appear in the middle but below the regional averages (CA curve). Note also that under the third scenario, the differences in multi-dimensional poverty between Guatemala and Nicaragua become more substantial than the ones observed under the other scenarios, because Guatemala has a larger percentage of unemployed adults who do unpaid care work and/or domestic work than Nicaragua. In general, the resulting multi-dimensional poverty ranking is quite similar to the one suggested by recent empirical evidence on Latin America and the Caribbean region, which is grounded on household-based measures (see, e.g., Santos & Villatoro, 2018, p. 75; Duryea & Robles, 2017, p. 165); therefore, it seems to be a robust finding.

To obtain a more revealing picture of the estimated multi-dimensional poverty among adults and its distribution that considers also Goal 10 of the SDGs ("Reduce inequality within and among countries") (UN, 2015, p. 21), we computed the average multi-dimensional poverty of adults in each percentile. We then ranked these adults by decreasing values of their individual multi-dimensional poverty function, and drew a curve on the base of these 100 "observations". We followed here the idea of the three "I"s of poverty curve proposed by Jenkins and Lambert (1997). Figures 4, 5, and 6 show the resulting curves for Central America as a whole, as well as for Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, considering three representative levels of "inequality aversion" (0.50, 1.00, and 1.50) and the three scenarios under analysis[10]. For each curve, the overall estimated multi-dimensional poverty among adults is given by the height of the curve (the vertical intercept at the 100th percentile). The multi-dimensional poverty incidence is that percentile at which the curve becomes horizontal, in other words, it is summarized by the length of the non-horizontal section of the curve; and the inequality among the multi-dimensionally poor adults is approximated by the concavity degree of the non-horizontal section of the curve.

[10] Under each scenario, the pattern of the curves considering the other levels of inequality aversion (0.25, 0.75, 1.25, 1.75, and 2.00) is similar; such curves are available upon request.

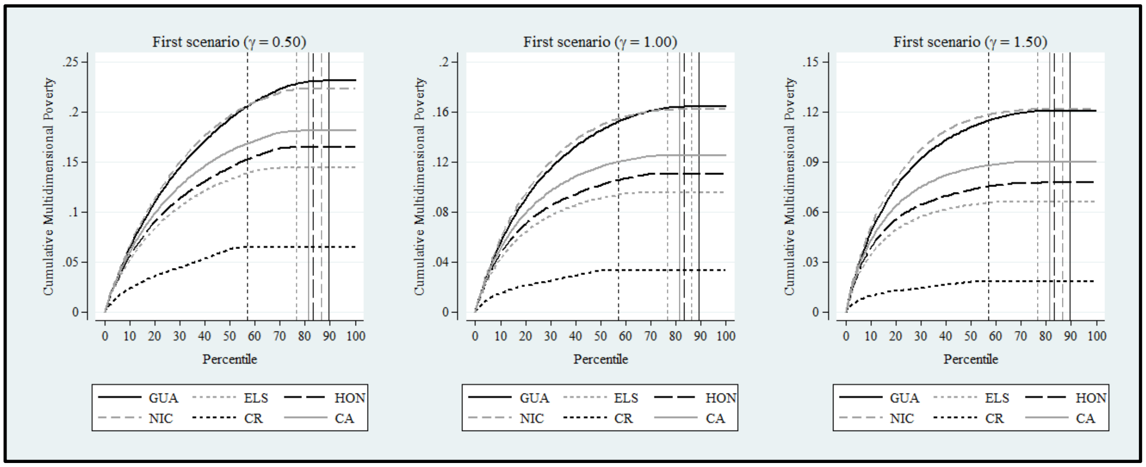


**Fig. 4.** Cumulative multi-dimensional poverty among adults by population percentile, ordered from the poorest to the richest, in Central America as a whole and in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR).
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.
*Notes:* In each case, the overall estimated multi-dimensional poverty (see Table A2 in Appendix) corresponds to the height of the curve: the vertical intercept at 100th percentile. The incidence of multi-dimensional poverty (the headcount ratio or the proportion of multi-dimensionally poor people) corresponds to the length of the non-horizontal section of the curve, that is, the percentile at which the curve becomes horizontal. For each country, we drew a vertical line at such a percentile (headcount ratio). The average multi-dimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the vertical line intercept the curve. Inequality among the multi-dimensionally poor individuals is represented by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

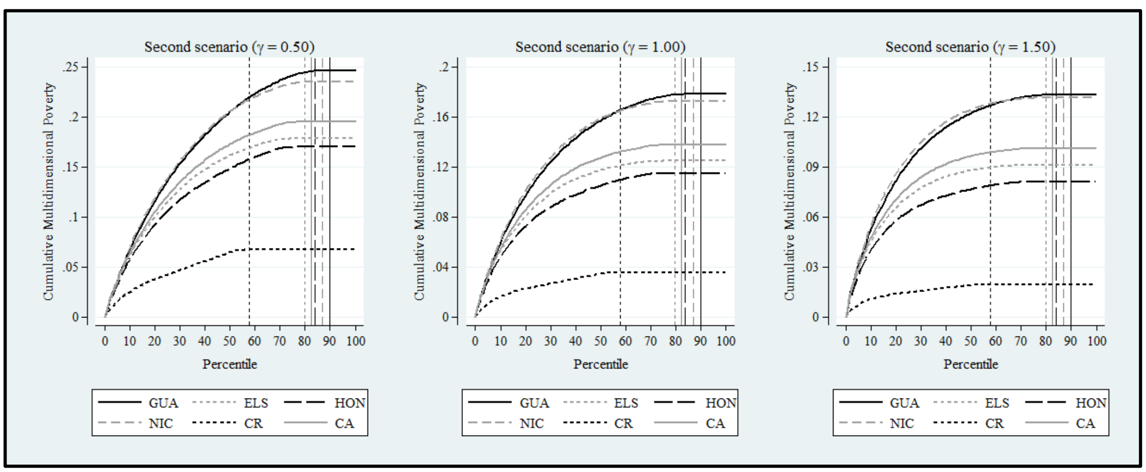


**Fig. 5.** Cumulative multi-dimensional poverty among adults by population percentile, ordered from the poorest to the richest, in Central America as a whole and in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR).
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.
*Notes:* In each case, the overall estimated multi-dimensional poverty (see Table A2 in Appendix) corresponds to the height of the curve: the vertical intercept at 100th percentile. The incidence of multi-dimensional poverty (the headcount ratio or the proportion of multi-dimensionally poor people) corresponds to the length of the non-horizontal section of the curve, that is, the percentile at which the curve becomes horizontal. For each country, we drew a vertical line at such a percentile (headcount ratio). The average multi-dimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the vertical line intercept the curve. Inequality among the multi-dimensionally poor individuals is represented by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

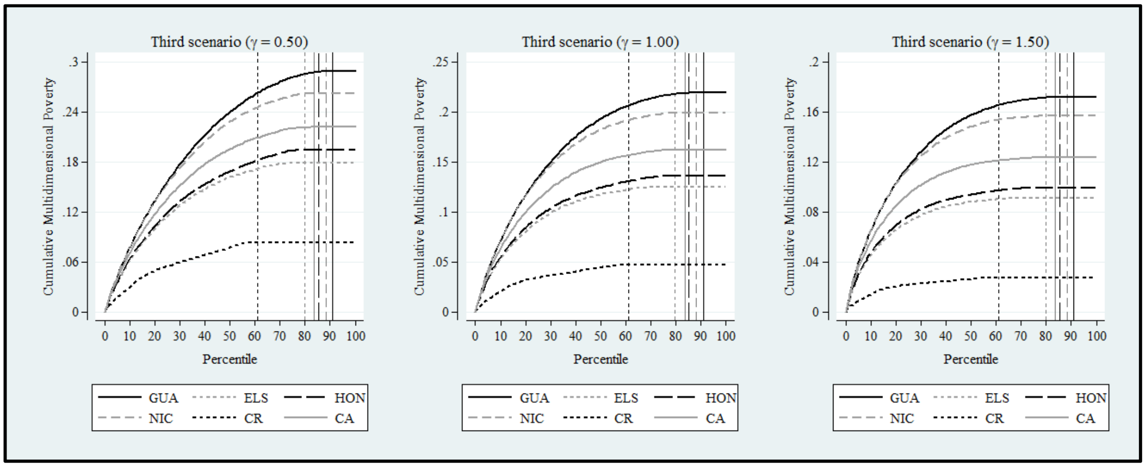


**Fig. 6.** Cumulative multi-dimensional poverty among adults by population percentile, ordered from the poorest to the richest, in Central America as a whole and in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR).

*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

*Notes:* In each case, the overall estimated multi-dimensional poverty (see Table A2 in Appendix) corresponds to the height of the curve: the vertical intercept at 100th percentile. The incidence of multi-dimensional poverty (the headcount ratio or the proportion of multi-dimensionally poor people) corresponds to the length of the non-horizontal section of the curve, that is, the percentile at which the curve becomes horizontal. For each country, we drew a vertical line at such a percentile (headcount ratio). The average multi-dimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the vertical line intercept the curve. Inequality among the multi-dimensionally poor individuals is represented by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

Figures 4, 5, and 6 allow us to conclude unambiguously that whatever the percentile considered, multi-dimensional poverty among adults is always, by far, lower in Costa Rica than in the "Northern Square" of Central America (Guatemala, El Salvador, Honduras, and Nicaragua); and, conversely, it is always larger in Guatemala and Nicaragua. Note that although multi-dimensional poverty is, as a whole, higher in Guatemala than in Nicaragua, it is not higher among Guatemalan adults up to approximately the 50th percentile, considering both the first and the second scenarios, and up to around the 20th percentile, considering the third scenario. These findings suggest that multi-dimensional poverty among adults is more unequally distributed in Nicaragua than in Guatemala. Therefore, based on such findings, we can conclude that in the Central American region, the poorest adults of the poorest ones live in Nicaragua.

Figures 4, 5, and 6 show also that Guatemala is the country with the highest incidence of multi-dimensional poverty in Central America, followed by Nicaragua, Honduras, El Salvador, and Costa Rica, respectively. The point estimates of the incidence of multi-dimensional poverty, as well as their bootstrapped confidence intervals at 95%, are given in

Table A3 in Appendix. Such a Table suggests that in Central America, on average, the multi-dimensional poverty incidence among adults increases by 3% as a result of incorporating unpaid care and domestic work into the assessment. Table A3 gives also the estimates of the intensity of multi-dimensional poverty among adults in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, as well as in Central America as a whole, considering the three scenarios under study (S1, S2, and S3). Table A3 reveals that the average deprivation share (A) experienced by the multi-dimensionally poor adults in Central America is larger in countries with higher multi-dimensional poverty rates (Guatemala and Nicaragua). This is consistent with the international evidence (see, e.g., Alkire & Santos, 2014; Santos & Villatoro, 2018). Overall, the average deprivation share (A) exceeds 30%, which means that, on average, the multi-dimensionally poor adults in Central America are deprived in more than three indicators. Finally, Table A3 shows that in Central America, the overall impact on the intensity of multi-dimensional poverty, of considering unpaid care workers and domestic workers as employment deprived, is estimated to be 12%.

As discussed in Section 2, the multi-dimensional poverty measures used in this paper are sensitive to inequality among the multi-dimensionally poor adults and can be decomposed into the three I's of multi-dimensional poverty (incidence, intensity, and inequality) (Jenkins & Lambert, 1997). Therefore, to complement the previous results, Figure 7 presents graphically estimates of the inequality among poor adults, measured via the Generalized Entropy Inequality Index. This is done for each of the countries and for Central America as a whole, for each of the three scenarios and for several levels of inequality aversion. Point estimates and their bootstrapped confidence intervals at 95% are given in Table A4 in Appendix.

Figure 7 is interesting. It shows clearly that in the Central American region, El Salvador and Honduras have the largest inequality among the multi-dimensionally poor adults. These two countries however do not have the highest levels of multi-dimensional poverty, nor the highest incidence and intensity of multi-dimensional poverty in that region. Such an observation indicates that the distribution of the deprivation scores of the adults in these two countries is more unequal than that in Nicaragua, Guatemala, and Costa Rica. In other words, El Salvador and of Honduras have a larger percentage of multi-dimensionally poor adults who have large deprivations than the one observed in Nicaragua, Guatemala, and Costa Rica. Given that the official multi-dimensional poverty measure of El Salvador and of

Honduras is insensitive to inequality among the multi-dimensionally poor, it does not capture the feature that was just mentioned. Needless to say, such an omission may lead to wrong poverty alleviation policies and programs. Figure 7 makes it also clear that this inequality is larger in Nicaragua than in Guatemala, confirming thus previous findings obtained on the base of Figures 4, 5, and 6, and lowest in Costa Rica.

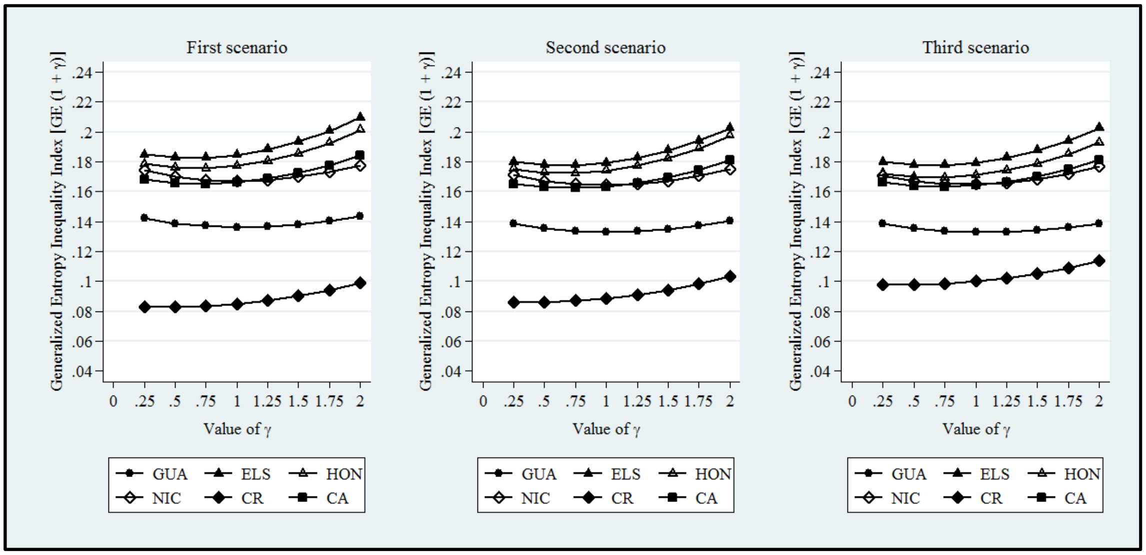


**Fig. 7.** Inequality among the multi-dimensionally poor adults in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), as well as in Central America (CA) as a whole, considering three scenarios and several levels of inequality aversion (values of γ).
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.
*Note:* In the case of El Salvador, the inequality among the multi-dimensionally poor adults, corresponding to the second and the third scenario, is the same. This is so because the deprivation rates in employment are identical, given that the survey (ELS-EHPM2016) does not provide the information needed to determine whether the adults considered as “unpaid care and domestic workers” were available for work or not (see Table 2).

### 4.3. Shedding some light on gender gaps in multi-dimensional poverty in Central America

Table 3 shows the ratio of women’s multi-dimensional poverty estimates to men’s multi-dimensional poverty estimates in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, as well as in Central America as a whole, considering the three scenarios and several degrees of inequality aversion. Tables A5, A6, A7, and A8 in Appendix give the corresponding estimates of multi-dimensional poverty among adults by gender and their bootstrapped standard errors, as well as the absolute gender differences in multi-dimensional poverty and their statistical significance. In general, we find that there are statistically significant gender gaps in multi-dimensional poverty among adults in the countries under analysis, but, as expected, the size and the direction of such gaps depend on the deprivation threshold used for employment and, therefore, on the information incorporated into the analysis (the scenarios).

Table 3 shows that overall, the size of the gender gaps in multi-dimensional poverty becomes larger as the degree of inequality aversion rises: The greater the value of γ, the larger the size of the gender gap. We will analyze below what drives such gaps (incidence, intensity, or inequality). Meanwhile, note that when $\gamma = 0$ (second column of Table 3), the multi-dimensional poverty index $P_{CS}^{\gamma}$, defined previously, is equal to $HA$. Therefore the ratio $\left(P_{CS}^{\gamma}/P_{CS}^{0}\right)$ is equal to product of the multi-dimensional poverty intensity $(A)$ raised to the power γ (that is, $A^{\gamma}$) and the inequality component $\left\{1 + [(\gamma+1)^2 - (\gamma+1)]GE_{\gamma+1}(c)\right\}$ [see equation (8) in Section 2]. Such a ratio estimates therefore what the AF measure $M_o$ (with $M_0 = H * A$) overlooks.

Our "artificial" base scenario, the one that does not consider unpaid care workers and domestic workers (scenario 1, Panel I of Table 3) suggests that multi-dimensional poverty among adults in Guatemala, El Salvador, Honduras, and Nicaragua is more often poverty among males, while in Costa Rica multi-dimensional poverty seems to be gender neutral. The results of the more relevant second scenario, however, do not, as expected, confirm such conclusions (Panel 2 of Table 3). Assuming that unpaid care and domestic workers who reported "not having a job" but "were available to work" are also employment deprived, raises substantially female multi-dimensional poverty, while male poverty remains almost unchanged (see Tables A5 and A6 in Appendix). This is particularly true for Guatemala, El Salvador, and Costa Rica, where the ratio of female over male multi-dimensional poverty increases significantly (above 5%), as can be observed by comparing Scenarios 1 and 2 in Table 3. Multi-dimensional poverty in these countries is now unambiguously female poverty. Note also that in these countries, multi-dimensional poverty is higher among women in every percentile of the distribution (see Figures A1, A2, and A3 in Appendix). We also observe in Scenario 2 of Table 3 that Honduras is the only country in Central America where multi-dimensional poverty among adults is not female poverty (see also Figure A.4. in Appendix). Nicaragua, on the other hand, has the smallest gender gaps: multi-dimensional poverty as a whole seems now to be gender-neutral, although it is higher among women up to around the 20th poorest percentile (see Figure A.5. in Appendix). This clearly indicates that multi-dimensional poverty among women is not equally distributed in this country. For Central

America as a whole multi-dimensional poverty is feminized, but gender-neutral for around the first 20 poorest percentiles (see Figure A.6. in Appendix).

**Table 3.** Ratio of women's multi-dimensional poverty estimates to men's multi-dimensional poverty estimates in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), as well as in Central America as a whole, considering three scenarios and several degrees of inequality aversion.
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Panel I: Scenario 1

| Country | Value of $\gamma$ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **0.00** | **0.25** | **0.50** | **0.75** | **1.00** | **1.25** | **1.50** | **1.75** | **2.00** |
| **GUA** | 0.98 | 0.97 | 0.95 | 0.94 | 0.93 | 0.91 | 0.90 | 0.89 | 0.88 |
| **ELS** | 0.97 | 0.95 | 0.94 | 0.93 | 0.92 | 0.91 | 0.89 | 0.88 | 0.87 |
| **HON** | 0.87 | 0.84 | 0.82 | 0.80 | 0.78 | 0.75 | 0.74 | 0.72 | 0.70 |
| **NIC** | 0.90 | 0.89 | 0.88 | 0.87 | 0.87 | 0.86 | 0.86 | 0.85 | 0.85 |
| **CR** | 0.98 | 0.99 | 0.99 | 0.99 | 1.00 | 1.00 | 1.01 | 1.01 | 1.01 |
| **CA** | 0.94 | 0.93 | 0.92 | 0.91 | 0.89 | 0.88 | 0.87 | 0.86 | 0.84 |

Panel II: Scenario 2

| Country | Value of $\gamma$ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **0.00** | **0.25** | **0.50** | **0.75** | **1.00** | **1.25** | **1.50** | **1.75** | **2.00** |
| **GUA** | 1.06 | 1.06 | 1.07 | 1.07 | 1.07 | 1.08 | 1.08 | 1.08 | 1.08 |
| **ELS** | 1.27 | 1.31 | 1.36 | 1.40 | 1.45 | 1.49 | 1.54 | 1.59 | 1.63 |
| **HON** | 0.90 | 0.88 | 0.86 | 0.85 | 0.83 | 0.82 | 0.80 | 0.79 | 0.77 |
| **NIC** | 0.97 | 0.97 | 0.97 | 0.98 | 0.98 | 0.99 | 1.00 | 1.01 | 1.02 |
| **CR** | 1.04 | 1.05 | 1.07 | 1.08 | 1.10 | 1.12 | 1.14 | 1.15 | 1.17 |
| **CA** | 1.04 | 1.05 | 1.05 | 1.06 | 1.06 | 1.07 | 1.07 | 1.08 | 1.08 |

Panel III: Scenario 3

| Country | Value of $\gamma$ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **0.00** | **0.25** | **0.50** | **0.75** | **1.00** | **1.25** | **1.50** | **1.75** | **2.00** |
| **GUA** | 1.27 | 1.33 | 1.39 | 1.45 | 1.50 | 1.56 | 1.62 | 1.68 | 1.74 |
| **ELS** | 1.27 | 1.31 | 1.36 | 1.40 | 1.45 | 1.49 | 1.54 | 1.59 | 1.63 |
| **HON** | 1.07 | 1.08 | 1.10 | 1.12 | 1.13 | 1.15 | 1.17 | 1.19 | 1.21 |
| **NIC** | 1.12 | 1.15 | 1.19 | 1.22 | 1.27 | 1.31 | 1.36 | 1.41 | 1.46 |
| **CR** | 1.36 | 1.44 | 1.53 | 1.62 | 1.72 | 1.83 | 1.93 | 2.04 | 2.15 |
| **CA** | 1.21 | 1.26 | 1.30 | 1.35 | 1.39 | 1.44 | 1.49 | 1.54 | 1.59 |

*Notes:* Survey weights used; a ratio greater than one means that multi-dimensional poverty is larger among adult women than among adult men. In the case of El Salvador, the ratios corresponding to the second and third scenarios are the same because the deprivation rates in employment are identical in both cases (the survey (ELS-EHPM2016) does not provide the information needed to determine whether the adults considered as "unpaid care and domestic workers" were available to work or were not) (see Table 2).

Finally, as expected, the results for the third scenario (Panel 3 of Table 3) reinforce the previous findings. The gender gaps become much more substantial, revealing unambiguously that in Central America, adult women are more likely than adult men to be multi-dimensionally poor.

Table 3 therefore confirms that unpaid care work and/or domestic work in Central America has a much larger negative impact on women's well-being than on that of men. Nevertheless, the observed estimated gaps should be interpreted with some caution. First, the third scenario is based on the strong assumption that unpaid care work and domestic work are “mandatory” activities and “have to be done for extended periods” (Robeyns, 2003, p. 80). The gender gaps observed in each country may therefore be overstated. Second, since not all surveys have a time use module, we consider as non-deprived in employment those individuals that have a paid work as well as an unpaid care work and/or a domestic work. Such an assumption is likely to underestimate female deprivation levels and, as a consequence, gender gaps (see, e.g., Bradshaw et al., 2017b).

We have also decomposed multi-dimensional poverty among adult women and men into the three I’s of multi-dimensional poverty in order to find out what drives the gender gaps observed in Table 3: the incidence, the intensity, or the inequality of poverty. Table 4 displays the gender differences, in relative terms, in the incidence, intensity, and inequality component of multi-dimensional poverty in Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Central America as a whole, considering the three scenarios and several degrees of inequality aversion. Tables A9, A10, and A11 in Appendix show the estimates by gender of such “dimensions” of multi-dimensional poverty (Jenkins and Lambert, 1997, p. 317), as well as the corresponding gender gaps in absolute and relative terms and their statistical significance.

Table 4 suggests that both the incidence and the intensity of multi-dimensional poverty increase more among women than among men when unpaid care work and domestic work are taken into account. It appears, however, that the increase in the gender gap is higher for multi-dimensional poverty intensity than incidence. Nevertheless, the changes in these two poverty dimensions are not uniform across countries. In Guatemala, El Salvador, and Costa Rica the incidence of multi-dimensional poverty is higher among women than men while in Honduras and Nicaragua, it seems to be gender-neutral. Similar observations may be made for the intensity of multi-dimensional poverty in Guatemala, El Salvador, and Costa Rica, particularly under the second and the third scenario. But, the results for Nicaragua and Honduras are somewhat ambiguous, whatever scenario is considered. As far as the inequality component is concerned, it is clear that it is higher among women in Nicaragua and Costa Rica, implying that in those countries, the severity of multi-dimensionally poverty among females is much higher than that among males, the reverse being true for Guatemala and El Salvador. In Honduras, the inequality component seems to be gender-neutral.

For Central America as a whole, Table 4 shows that the gender gaps in the incidence and intensity of multi-dimensional poverty among adults is lower than 5%, except for the intensity of poverty under the third scenario (17%). We also observe that the inequality component is more important among men than women.

**Table 4.** Gender gaps in relative terms in the three I's of multi-dimensional poverty (ratio of women's to men's) in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), as well as in Central America as a whole, considering three scenarios and several degrees of inequality aversion.
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

| Country | Incidence (H) | Intensity (A) | Inequality component: $\{1+[(\gamma+1)^2-(\gamma+1)]GE_{\gamma+1}(c)\}$ (several values of γ) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Panel I: Scenario 1 | | | | | | | | | | | |
| | | | 0.00 | 0.25 | 0.50 | 0.75 | 1.00 | 1.25 | 1.50 | 1.75 | 2.00 |
| GUA | 1.01 | 0.97 | 1.00 | 1.00 | 0.99 | 0.99 | 0.98 | 0.97 | 0.97 | 0.96 | 0.95 |
| ELS | 0.99 | 0.97 | 1.00 | 1.00 | 0.99 | 0.98 | 0.98 | 0.97 | 0.97 | 0.96 | 0.96 |
| HON | 0.97 | 0.89 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.01 | 1.01 | 1.01 | 1.01 |
| NIC | 0.97 | 0.93 | 1.00 | 1.01 | 1.01 | 1.02 | 1.03 | 1.05 | 1.06 | 1.07 | 1.09 |
| CR | 0.98 | 1.00 | 1.00 | 1.00 | 1.01 | 1.01 | 1.01 | 1.02 | 1.02 | 1.02 | 1.03 |
| CA | 0.99 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| Panel II: Scenario 2 | | | | | | | | | | | |
| Country | Incidence (H) | Intensity (A) | Inequality component: $\{1+[(\gamma+1)^2-(\gamma+1)]GE_{\gamma+1}(c)\}$ (several values of γ) | | | | | | | | |
| | | | 0.00 | 0.25 | 0.50 | 0.75 | 1.00 | 1.25 | 1.50 | 1.75 | 2.00 |
| GUA | 1.02 | 1.04 | 1.00 | 0.99 | 0.99 | 0.98 | 0.98 | 0.97 | 0.96 | 0.95 | 0.95 |
| ELS | 1.07 | 1.19 | 1.00 | 0.99 | 0.98 | 0.97 | 0.96 | 0.95 | 0.94 | 0.92 | 0.91 |
| HON | 0.98 | 0.92 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.01 | 1.01 | 1.01 |
| NIC | 0.98 | 0.99 | 1.00 | 1.00 | 1.01 | 1.02 | 1.03 | 1.04 | 1.05 | 1.06 | 1.08 |
| CR | 1.00 | 1.04 | 1.00 | 1.00 | 1.01 | 1.02 | 1.02 | 1.03 | 1.04 | 1.04 | 1.05 |
| CA | 1.01 | 1.03 | 1.00 | 1.00 | 1.00 | 0.99 | 0.99 | 0.99 | 0.98 | 0.98 | 0.98 |
| Panel III: Scenario 3 | | | | | | | | | | | |
| Country | Incidence (H) | Intensity (A) | Inequality component: $\{1+[(\gamma+1)^2-(\gamma+1)]GE_{\gamma+1}(c)\}$ (several values of γ) | | | | | | | | |
| | | | 0.00 | 0.25 | 0.50 | 0.75 | 1.00 | 1.25 | 1.50 | 1.75 | 2.00 |
| GUA | 1.04 | 1.23 | 1.00 | 0.99 | 0.99 | 0.98 | 0.96 | 0.95 | 0.94 | 0.93 | 0.91 |
| ELS | 1.07 | 1.19 | 1.00 | 0.99 | 0.98 | 0.97 | 0.96 | 0.95 | 0.94 | 0.92 | 0.91 |
| HON | 1.00 | 1.07 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| NIC | 1.01 | 1.11 | 1.00 | 1.00 | 1.01 | 1.02 | 1.02 | 1.03 | 1.04 | 1.05 | 1.06 |
| CR | 1.11 | 1.23 | 1.00 | 1.01 | 1.01 | 1.02 | 1.03 | 1.04 | 1.05 | 1.05 | 1.05 |
| CA | 1.04 | 1.17 | 1.00 | 1.00 | 0.99 | 0.99 | 0.98 | 0.98 | 0.97 | 0.97 | 0.96 |

*Notes:* Survey weights used; a ratio greater than one means that the incidence (the intensity or the inequality component) of multi-dimensional poverty is larger among women than among men. For El Salvador, the ratios corresponding to the second and the third scenario are identical because the deprivation rates in employment are the same. The reason is that the survey (ELS-EHPM2016) does not provide the information needed to determine whether the adults considered as "unpaid care and domestic workers" were available to work or were not (see Table 2). Each ratio in Table 3 can be computed as follows: $ratio(H) * ratio(A) * [ratio(A)]^{\gamma} * ratio(inequality\_component)$.

### 4.4. Results of logit regression models

The descriptive results presented previously show that, in Central America, there are differences between the countries with respect to the size and direction of the gender gaps in multi-dimensional poverty. We now turn to a more econometric analysis. Following Wiepking and Mass (2005, p. 193), we estimate two logit regressions, for Central America as a whole, where the endogenous variable is equal to 1 if the individual is multi-dimensionally poor, to 0 otherwise, and take into account the three scenarios mentioned previously.

In the first model (M1) the explanatory variables are the sex of the individual (dummy variable equal to 1 for females) and country fixed effects, Costa Rica being the country of reference. In the second model (M2) we add a set of interaction terms between the sex and the country.

The results are presented in Table 5, separately for each of the three scenarios. They corroborate the main findings of the descriptive analysis. Adults living in Guatemala have the highest probability of being multi-dimensionally poor, followed by those of Nicaragua, while the lowest probability is observed for adults living in Costa Rica. Model M2 seems to slightly better fit the dataset (higher Wald $\chi$ square and Pseudo R-square), suggesting that in the Central America region, there are, to some extent, country-specific gender differences with respect to multi-dimensional poverty. Table 5 shows also that the results of Model M2 are similar in all three scenarios, as far as the direction of the gender gap in each of the five countries is concerned. For instance, in the second scenario, adult women living in Honduras and Nicaragua have a lower probability of being multi-dimensionally poor, but the reverse is true for Guatemala and El Salvador. And in Costa Rica multi-dimensional poverty seems to be gender neutral. For the third scenario, we observe that females are more likely to be poor and that the size of the gender gap observed is smaller in Honduras and Nicaragua than in the other countries, a result that was already stressed in the descriptive analysis.

**Table 5.** Odds ratios of being multi-dimensionally poor by sex and country of residence, considering the three scenarios

| | Scenario 1 | | | | Scenario 2 | | | | Scenario 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Poverty | M1 | | M2 | | M1 | | M2 | | M1 | | M2 | |
| Explanatory variables | Odds Ratio | Robust SE | Odds Ratio | Robust SE | Odds Ratio | Robust SE | Odds Ratio | Robust SE | Odds Ratio | Robust SE | Odds Ratio | Robust SE |
| *Sex* | | | | | | | | | | | | |
| Male (ref.) | 1.0000 | … | 1.0000 | … | 1.0000 | … | 1.0000 | … | 1.0000 | … | 1.0000 | … |
| Female | 0.9443*** | 0.0203 | 0.9589 | 0.0272 | 1.0675*** | 0.0234 | 1.0078 | 0.0286 | 1.2713*** | 0.0282 | 1.2975*** | 0.0375 |
| *Country* | | | | | | | | | | | | |
| Costa Rica (ref.) | 1.0000 | … | 1.0000 | … | 1.0000 | … | 1.0000 | … | 1.0000 | … | 1.0000 | … |
| Guatemala | 6.3301*** | 0.2195 | 5.9818*** | 0.2975 | 6.5274*** | 0.2320 | 5.9993*** | 0.2992 | 6.4492*** | 0.2371 | 6.0236*** | 0.3016 |
| El Salvador | 2.4742*** | 0.0591 | 2.4498*** | 0.0859 | 2.8826*** | 0.0717 | 2.4497*** | 0.0859 | 2.5130*** | 0.0628 | 2.4358*** | 0.0855 |
| Honduras | 3.7665*** | 0.0948 | 4.0635*** | 0.1528 | 3.8096*** | 0.0969 | 4.1373*** | 0.1564 | 3.7178*** | 0.0977 | 4.1937*** | 0.1593 |
| Nicaragua | 4.8147*** | 0.1494 | 5.2369*** | 0.2446 | 4.9053*** | 0.1548 | 5.2582*** | 0.2463 | 4.7677*** | 0.1540 | 5.2461*** | 0.2461 |
| *Interaction* | | | | | | | | | | | | |
| Female (Guatemala) | … | … | 1.1118 | 0.0771 | … | … | 1.1791** | 0.0839 | … | … | 1.1594** | 0.0858 |
| Female (El Salvador) | … | … | 1.0172 | 0.0487 | … | … | 1.3697*** | 0.0682 | … | … | 1.0639 | 0.0533 |
| Female (Honduras) | … | … | 0.8713*** | 0.0441 | … | … | 0.8610*** | 0.0440 | … | … | 0.7902*** | 0.0415 |
| Female (Nicaragua) | … | … | 0.8575** | 0.0537 | … | … | 0.8789** | 0.0557 | … | … | 0.8253*** | 0.0533 |
| *Constant* | 1.3681*** | 0.0247 | 1.3572*** | 0.0278 | 1.3203*** | 0.0240 | 1.3602*** | 0.0279 | 1.3821*** | 0.0253 | 1.3680*** | 0.0281 |
| Observations | 120756 | | 120756 | | 120756 | | 120756 | | 120756 | | 120756 | |
| Wald chi2 | 5718.17 | | 5729.86 | | 5871.92 | | 5919.91 | | 5413.38 | | 5455.76 | |
| Degrees of freedom | (5) | | (9) | | (5) | | (9) | | (5) | | (9) | |
| Prob. > chi2 | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | |
| Pseudo R2 | 0.0675 | | 0.0678 | | 0.0685 | | 0.0696 | | 0.0695 | | 0.0702 | |

*Notes*: Survey weights used; outcome (Poverty): dummy equal to 1 if the individual is multi-dimensionally poor, for each of the three scenarios. *Significance levels*: *p < 0.1.; **p < 0.05; ***p < 0.01.

**Table 6.** Odds ratios of being multi-dimensionally poor by sex, age, household size, area and country of residence, and marital status, considering the three scenarios

| | Scenario 1 | | Scenario 2 | | Scenario 3 | |
|---|---|---|---|---|---|---|
| Poverty | M3 | | M3 | | M3 | |
| Explanatory variables | Odds Ratio | Robust SE | Odds Ratio | Robust SE | Odds Ratio | Robust SE |
| *Sex* | | | | | | |
| Male (ref.) | 1.0000 | … | 1.0000 | … | 1.0000 | … |
| Female | 0.7782*** | 0.0296 | 0.7653*** | 0.0294 | 0.9152** | 0.0355 |
| *Age* | -0.0039*** | 0.0006 | -0.0042*** | 0.0005 | -0.0049*** | 0.0005 |
| *Age sq.* | 0.0001*** | 0.0000 | 0.0001*** | 0.0000 | 0.0001*** | 0.0000 |
| *Household size* | -0.0225*** | 0.0025 | -0.0211*** | 0.0023 | -0.0188*** | 0.0021 |
| *Household size sq.* | 0.0038*** | 0.0003 | 0.0036*** | 0.0002 | 0.0033*** | 0.0002 |
| *Area of residence* | | | | | | |
| Urban (ref.) | 1.0000 | … | 1.0000 | … | 1.0000 | … |
| Rural | 5.4221*** | 0.1124 | 5.3645*** | 0.1150 | 5.4571*** | 0.1220 |
| *Marital status* | | | | | | |
| Single (ref.) | 1.0000 | … | 1.0000 | … | 1.0000 | … |
| Married | 1.1157*** | 0.0341 | 1.1286*** | 0.0347 | 1.1400*** | 0.0352 |
| Unmarried | 2.1083*** | 0.0701 | 2.1237*** | 0.0709 | 2.1377*** | 0.0717 |
| Divorced | 1.4631*** | 0.0758 | 1.4804*** | 0.0768 | 1.5146*** | 0.0788 |
| Widow(er) | 2.1677*** | 0.4273 | 2.1965*** | 0.4332 | 2.2030*** | 0.4350 |
| *Country* | | | | | | |
| Costa Rica (ref.) | 1.0000 | … | 1.0000 | … | 1.0000 | … |
| Guatemala | 4.9466*** | 0.2034 | 4.9361*** | 0.2033 | 4.9443*** | 0.2048 |
| El Salvador | 2.9120*** | 0.0880 | 2.9070*** | 0.0878 | 2.8817*** | 0.0873 |
| Honduras | 2.5024*** | 0.0987 | 2.5410*** | 0.1006 | 2.5645*** | 0.1024 |
| Nicaragua | 3.6196*** | 0.1428 | 3.6201*** | 0.1431 | 3.6004*** | 0.1428 |
| *Interaction (Sex - Union status)* | | | | | | |
| Female (Married) | 1.3037*** | 0.0515 | 1.4877*** | 0.0602 | 1.8504*** | 0.0766 |
| Female (Unmarried) | 1.2327*** | 0.0556 | 1.4061*** | 0.0654 | 1.7658*** | 0.0851 |
| Female (Divorced) | 1.2848*** | 0.0786 | 1.3243*** | 0.0822 | 1.3685*** | 0.0853 |
| Female (Widow) | 1.1447 | 0.2407 | 1.1988 | 0.2540 | 1.2932 | 0.2755 |
| *Interaction (Sex - Country)* | | | | | | |
| Female (Guatemala) | 1.1221** | 0.0633 | 1.1996*** | 0.0690 | 1.1099* | 0.0665 |
| Female (El Salvador) | 1.0628 | 0.0442 | 1.4498*** | 0.0619 | 1.0923** | 0.0471 |
| Female (Honduras) | 1.0290 | 0.0552 | 1.0288 | 0.0558 | 0.9509 | 0.0532 |
| Female (Nicaragua) | 0.8656*** | 0.0461 | 0.9013* | 0.0486 | 0.8132*** | 0.0450 |
| *Constant* | 1.5237*** | 0.1507 | 1.7072 | 0.1718 | 2.0039*** | 0.2050 |
| | | | | | | |
| Observations | 120756 | | 120756 | | 120756 | |
| Wald chi2 | 16132.39 | | 16264.02 | | 15338.95 | |
| Degrees of freedom | (22) | | (22) | | (22) | |
| Prob. > chi2 | 0.0000 | | 0.0000 | | 0.0000 | |
| Pseudo R2 | 0.1768 | | 0.1831 | | 0.1821 | |

*Notes:* Survey weights used; for age and household size variables, the marginal effects are reported; outcome (Poverty): dummy equal to 1 if individual is multi-dimensionally poor, for each of the three scenarios. *Significance levels*: *p < 0.1.; **p < 0.05; ***p < 0.01.

To shed some light on the determinants of the multi-dimensional poverty of adults in each country, we also estimate a third logit regression model (Model M3). In M3 we add information on the age of the individuals, their marital status: married, bachelor, divorced, widow(er), the size of the household, the region of residence (urban, rural), and some interaction terms between the sex of the individual and his/her marital status. The results are given, separately for each scenario, in Table 6. It appears that model M3 fits generally better the data, so that individual characteristics have also an impact on multi-dimensional poverty in Central America. For each of the three scenarios the pure gender effect is statistically significant and favors women, but the final impact (size and direction) of the gender on the probability of being multi-dimensionally poor depends, ceteris paribus, on the marital status of the individual and the country in which he/she lives.

Table 6 also indicates that in Central America, regardless of the scenario considered, there is, ceteris paribus, a U-shaped relationship between the age of the individual and the probability that he/she will be multi-dimensionally poor. The same non-linear relationship is observed for the size of the household. It also appears that, ceteris paribus, adults living in rural areas have a much larger probability of being multi-dimensionally poor, this being true for all scenarios. Such a result was emphasized previously in the literature (see, for instance, Alkire & Santos, 2014; Battiston, Cruces, López-Calva, Lugo, & Santos, 2013; ECLAC, 2013; Espinoza-Delgado & Klasen, 2018; Santos & Villatoro, 2018). In other words, multi-dimensional poverty in Central America still largely remains a rural phenomenon, an observation that has evidently important policy implications (Espinoza-Delgado & Klasen, 2018). Finally, note that the marital status of an individual and the corresponding interaction terms have a significant impact on the probability of being multi-dimensionally poor.

## 5. Concluding remarks

The AF methodology, as the mainstream approach to the measurement of multi-dimensional poverty in the developing world, is insensitive to inequality among the multi-dimensionally poor individuals and does not consider simultaneously the concepts of efficiency and distributive justice. Additionally, the vast majority of empirical studies of multi-dimensional poverty equate the poverty status of the household with that of all individuals in the household, thus disregarding intra-household inequalities, an issue crucial to a better understanding of gender inequalities. In this paper, we proposed individual-based inequality sensitive multi-dimensional poverty measures that take into account both efficiency and distributive justice. We applied our approach to an analysis of multi-dimensional poverty among adults (18 to 59 years old) in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, and were thus able to shed some light on gender differences in poverty and inequality in these countries.

It appears that multi-dimensional poverty among adults is highest in Guatemala and Nicaragua and lowest in Costa Rica. Such findings are quite in tune with the MPI-LA, which shows, for instance, that Guatemala and Nicaragua are the multi-dimensionally poorest countries in Latin America (Santos & Villatoro, 2018, p. 75), and with the recent work of Duryea and Robles (2017), who also suggest that these two countries are the multi-dimensionally poorest ones in Latin America and the Caribbean region (p. 165).

We also decomposed our multi-dimensional poverty measure into the three I's of poverty and found that Guatemala and Nicaragua have the highest and Costa Rica the lowest incidence and intensity of multi-dimensional poverty in Central America. El Salvador and Honduras, however, have the greatest levels of inequality.

Our study also indicated that there are statistically significant gender gaps in multi-dimensional poverty among adults in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica. The size and direction of such gaps depend on the deprivation threshold used for employment, that is, on the information incorporated into the analysis. For the incidence of multi-dimensional poverty, the gender gap is in most cases lower than 5%. In Guatemala, El Salvador and Costa Rica the female poverty incidence rate is higher than that of the males, while no significant gender gap in poverty incidence exists for Honduras and Nicaragua. The female multi-dimensional poverty intensity seems also to be higher in Guatemala, El Salvador, and Costa Rica, while the results for Nicaragua and Honduras are ambiguous. Finally, inequality among the multi-dimensionally poor women is clearly higher in Nicaragua (above 8%) and Costa Rica (above 7%), suggesting that in these countries, the multi-dimensionally poor women are living in very intense poverty when compared to the multi-dimensionally poor men. The opposite is true for Guatemala and El Salvador. In Honduras, there does not appear to be gender related differences in inequality among the multi-dimensionally poor adults. In short, in Central America the incidence and intensity of multi-dimensional poverty are higher among females, while the inequality of poverty is somewhat higher among males.

Finally, the logit regression models corroborate the main findings of our descriptive analysis. *Ceteris paribus*, adults in Guatemala and Nicaragua have the highest and those living in Costa Rica the lowest probability of being multi-dimensionally poor. These regressions also show in Central America, there are country- as well as individual-specific gender differences in multi-dimensional poverty. It also appears that the total impact of gender is statistically significant, but *ceteris paribus*, it depends also on the marital status of the individuals and the country in which they live.

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## Appendix

**Table A1.** Percentage of individuals deprived in the domains represented by the different indicators (uncensored headcount ratio); confidence intervals at 95%.
*Source*: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

| | | **Central America** | | | **Guatemala** | | | **El Salvador** | | | **Honduras** | | | **Nicaragua** | | | **Costa Rica** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dimension** | **Indicator** | Lb | **h%** | Ub | Lb | **h%** | Ub | Lb | **h%** | Ub | Lb | **h%** | Ub | Lb | **h%** | Ub | Lb | **h%** | Ub |
| **Education** | **Schooling achievement** | 56.6 | **56.9** | 57.3 | 65.5 | **66.2** | 66.9 | 43.0 | **43.5** | 44.1 | 58.5 | **59.2** | 59.9 | 55.3 | **56.2** | 57.2 | 45.3 | **45.9** | 46.5 |
| **Employment** | **Employment status (1)** | 10.0 | **10.2** | 10.5 | 8.0 | **8.5** | 8.9 | 8.8 | **9.2** | 9.6 | 12.2 | **12.7** | 13.3 | 12.7 | **13.4** | 14.2 | 8.8 | **9.2** | 9.5 |
| | **Employment status (2)** | 18.0 | **18.3** | 18.6 | 16.0 | **16.6** | 17.2 | 28.4 | **28.9** | 29.4 | 15.5 | **16.1** | 16.7 | 18.8 | **19.7** | 20.5 | 10.8 | **11.2** | 11.6 |
| | **Employment status (3)** | 31.4 | **31.7** | 32.1 | 36.4 | **37.1** | 37.8 | 28.4 | **28.9** | 29.4 | 28.7 | **29.4** | 30.1 | 32.2 | **33.2** | 34.0 | 21.7 | **22.3** | 22.8 |
| **Water & sanitation** | **Improved water source** | 19.3 | **19.5** | 19.8 | 23.1 | **23.6** | 24.0 | 20.5 | **20.9** | 21.3 | 11.8 | **12.3** | 12.8 | 33.1 | **33.8** | 34.5 | 0.6 | **0.7** | 0.8 |
| | **Improved sanitation** | 38.3 | **38.5** | 38.8 | 54.9 | **55.4** | 56.0 | 42.2 | **42.6** | 43.1 | 22.6 | **23.3** | 24.0 | 42.2 | **43.1** | 43.9 | 3.8 | **4.0** | 4.3 |
| **Energy & electricity** | **Type of cooking fuel** | 46.6 | **46.8** | 47.0 | 71.8 | **72.3** | 72.8 | 9.9 | **10.2** | 10.5 | 54.5 | **55.1** | 55.7 | 52.2 | **52.6** | 53.1 | 3.8 | **4.1** | 4.3 |
| | **Access to electricity** | 12.8 | **13.0** | 13.2 | 17.6 | **18.0** | 18.5 | 12.5 | **12.8** | 13.2 | 11.6 | **12.1** | 12.6 | 12.6 | **13.2** | 13.9 | 0.3 | **0.4** | 0.5 |
| **Quality of dwelling** | **Housing materials** | 23.5 | **23.8** | 24.1 | 30.3 | **30.9** | 31.5 | 18.1 | **18.5** | 18.8 | 17.2 | **17.8** | 18.3 | 38.6 | **39.4** | 40.3 | 1.5 | **1.7** | 1.9 |
| | **People per bedroom** | 42.3 | **42.7** | 43.0 | 48.9 | **49.6** | 50.2 | 44.7 | **45.2** | 45.8 | 43.2 | **43.9** | 44.6 | 52.7 | **53.6** | 54.5 | 6.4 | **6.8** | 7.1 |
| | **Housing tenure** | 11.2 | **11.4** | 11.6 | 9.8 | **10.3** | 10.7 | 17.6 | **18.1** | 18.5 | 5.2 | **5.6** | 6.0 | 15.0 | **15.7** | 16.5 | 9.1 | **9.5** | 9.9 |
| | **Assets** | 25.2 | **25.4** | 25.7 | 35.1 | **35.7** | 36.3 | 16.4 | **16.8** | 17.2 | 22.6 | **23.3** | 23.9 | 32.3 | **33.2** | 34.1 | 2.3 | **2.4** | 2.6 |

*Notes:* Survey weights used; Lb: Lower bound; h: Uncensored headcount ratio; Ub: Upper bound. The confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

**Table A2.** Multi-dimensional poverty in Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica, as well as in Central America as a whole, assuming several degrees of inequality aversion; confidence intervals at 95%.
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Panel I: Scenario 1

| | **Central America** | | | **Guatemala** | | | **El Salvador** | | | **Honduras** | | | **Nicaragua** | | | **Costa Rica** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Gamma** | Lb | **MPI** | Ub | Lb | **MPI** | Ub | Lb | **MPI** | Ub | Lb | **MPI** | Ub | Lb | **MPI** | Ub | Lb | **MPI** | Ub |
| **0.00** | 0.2750 | **0.2762** | 0.2774 | 0.3370 | **0.3394** | 0.3418 | 0.2291 | **0.2311** | 0.2331 | 0.2579 | **0.2607** | 0.2639 | 0.3207 | **0.3238** | 0.3270 | 0.1261 | **0.1278** | 0.1294 |
| **0.25** | 0.2209 | **0.2220** | 0.2232 | 0.2761 | **0.2784** | 0.2807 | 0.1793 | **0.1812** | 0.1831 | 0.2030 | **0.2058** | 0.2085 | 0.2638 | **0.2670** | 0.2701 | 0.0889 | **0.0902** | 0.0914 |
| **0.50** | 0.1800 | **0.1810** | 0.1821 | 0.2288 | **0.2310** | 0.2331 | 0.1426 | **0.1444** | 0.1460 | 0.1627 | **0.1651** | 0.1675 | 0.2205 | **0.2235** | 0.2267 | 0.0633 | **0.0642** | 0.0652 |
| **0.75** | 0.1486 | **0.1496** | 0.1505 | 0.1919 | **0.1938** | 0.1958 | 0.1154 | **0.1167** | 0.1181 | 0.1320 | **0.1342** | 0.1364 | 0.1863 | **0.1891** | 0.1923 | 0.0454 | **0.0462** | 0.0470 |
| **1.00** | 0.1241 | **0.1250** | 0.1259 | 0.1621 | **0.1640** | 0.1659 | 0.0941 | **0.0955** | 0.0968 | 0.1084 | **0.1104** | 0.1126 | 0.1589 | **0.1618** | 0.1647 | 0.0328 | **0.0335** | 0.0341 |
| **1.25** | 0.1047 | **0.1056** | 0.1064 | 0.1383 | **0.1402** | 0.1419 | 0.0778 | **0.0790** | 0.0801 | 0.0900 | **0.0920** | 0.0940 | 0.1369 | **0.1397** | 0.1425 | 0.0240 | **0.0245** | 0.0250 |
| **1.50** | 0.0891 | **0.0900** | 0.0908 | 0.1189 | **0.1206** | 0.1224 | 0.0649 | **0.0661** | 0.0672 | 0.0756 | **0.0774** | 0.0791 | 0.1189 | **0.1215** | 0.1240 | 0.0177 | **0.0181** | 0.0185 |
| **1.75** | 0.0766 | **0.0774** | 0.0782 | 0.1030 | **0.1046** | 0.1061 | 0.0548 | **0.0558** | 0.0568 | 0.0640 | **0.0657** | 0.0675 | 0.1038 | **0.1064** | 0.1090 | 0.0132 | **0.0135** | 0.0139 |
| **2.00** | 0.0664 | **0.0671** | 0.0678 | 0.0897 | **0.0913** | 0.0928 | 0.0465 | **0.0475** | 0.0485 | 0.0549 | **0.0563** | 0.0579 | 0.0913 | **0.0939** | 0.0962 | 0.0099 | **0.0102** | 0.0105 |

Panel II: Scenario 2

| | **Central America** | | | **Guatemala** | | | **El Salvador** | | | **Honduras** | | | **Nicaragua** | | | **Costa Rica** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Gamma** | Lb | **MPI** | Ub | Lb | **MPI** | Ub | Lb | **MPI** | Ub | Lb | **MPI** | Ub | Lb | **MPI** | Ub | Lb | **MPI** | Ub |
| **0.00** | 0.2912 | **0.2924** | 0.2937 | 0.3533 | **0.3559** | 0.3586 | 0.2684 | **0.2705** | 0.2726 | 0.2645 | **0.2673** | 0.2702 | 0.3330 | **0.3362** | 0.3395 | 0.1302 | **0.1318** | 0.1336 |
| **0.25** | 0.2362 | **0.2373** | 0.2386 | 0.2920 | **0.2944** | 0.2968 | 0.2161 | **0.2181** | 0.2202 | 0.2093 | **0.2119** | 0.2145 | 0.2760 | **0.2794** | 0.2827 | 0.0922 | **0.0936** | 0.0948 |
| **0.50** | 0.1943 | **0.1955** | 0.1966 | 0.2443 | **0.2465** | 0.2487 | 0.1768 | **0.1786** | 0.1806 | 0.1680 | **0.1705** | 0.1729 | 0.2321 | **0.2354** | 0.2387 | 0.0660 | **0.0671** | 0.0681 |
| **0.75** | 0.1620 | **0.1631** | 0.1641 | 0.2065 | **0.2087** | 0.2109 | 0.1467 | **0.1483** | 0.1501 | 0.1369 | **0.1391** | 0.1416 | 0.1974 | **0.2005** | 0.2038 | 0.0477 | **0.0485** | 0.0493 |
| **1.00** | 0.1367 | **0.1377** | 0.1387 | 0.1763 | **0.1783** | 0.1803 | 0.1232 | **0.1247** | 0.1262 | 0.1128 | **0.1149** | 0.1172 | 0.1699 | **0.1727** | 0.1758 | 0.0348 | **0.0354** | 0.0361 |
| **1.25** | 0.1165 | **0.1174** | 0.1184 | 0.1515 | **0.1535** | 0.1554 | 0.1045 | **0.1060** | 0.1074 | 0.0941 | **0.0960** | 0.0981 | 0.1471 | **0.1501** | 0.1532 | 0.0256 | **0.0261** | 0.0267 |
| **1.50** | 0.1002 | **0.1011** | 0.1021 | 0.1316 | **0.1333** | 0.1351 | 0.0897 | **0.0911** | 0.0925 | 0.0792 | **0.0810** | 0.0828 | 0.1286 | **0.1316** | 0.1346 | 0.0190 | **0.0195** | 0.0199 |
| **1.75** | 0.0869 | **0.0878** | 0.0887 | 0.1148 | **0.1166** | 0.1184 | 0.0776 | **0.0789** | 0.0803 | 0.0674 | **0.0691** | 0.0709 | 0.1131 | **0.1160** | 0.1189 | 0.0142 | **0.0146** | 0.0150 |
| **2.00** | 0.0760 | **0.0768** | 0.0777 | 0.1010 | **0.1026** | 0.1043 | 0.0676 | **0.0689** | 0.0703 | 0.0577 | **0.0594** | 0.0611 | 0.1001 | **0.1031** | 0.1060 | 0.0108 | **0.0111** | 0.0115 |

*Notes:* Survey weights used; Lb: Lower bound; Ub: Upper bound. The confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

**Table A2**-(*continued*)

Panel III: Scenario 3

| | **Central America** | | | **Guatemala** | | | **El Salvador** | | | **Honduras** | | | **Nicaragua** | | | **Costa Rica** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Gamma** | Lb | **MPI** | Ub | Lb | **MPI** | Ub | Lb | **MPI** | Ub | Lb | **MPI** | Ub | Lb | **MPI** | Ub | Lb | **MPI** | Ub |
| **0.00** | 0.3180 | **0.3192** | 0.3206 | 0.3939 | **0.3967** | 0.3994 | 0.2684 | **0.2705** | 0.2726 | 0.2909 | **0.2940** | 0.2970 | 0.3602 | **0.3633** | 0.3666 | 0.1520 | **0.1539** | 0.1557 |
| **0.25** | 0.2627 | **0.2640** | 0.2652 | 0.3339 | **0.3364** | 0.3389 | 0.2161 | **0.2181** | 0.2202 | 0.2345 | **0.2374** | 0.2401 | 0.3030 | **0.3065** | 0.3099 | 0.1111 | **0.1124** | 0.1138 |
| **0.50** | 0.2203 | **0.2215** | 0.2227 | 0.2862 | **0.2887** | 0.2911 | 0.1768 | **0.1786** | 0.1806 | 0.1915 | **0.1946** | 0.1975 | 0.2588 | **0.2624** | 0.2661 | 0.0818 | **0.0830** | 0.0842 |
| **0.75** | 0.1871 | **0.1883** | 0.1895 | 0.2479 | **0.2502** | 0.2527 | 0.1467 | **0.1483** | 0.1501 | 0.1592 | **0.1617** | 0.1644 | 0.2240 | **0.2273** | 0.2305 | 0.0609 | **0.0619** | 0.0630 |
| **1.00** | 0.1607 | **0.1619** | 0.1630 | 0.2167 | **0.2191** | 0.2216 | 0.1232 | **0.1247** | 0.1262 | 0.1336 | **0.1360** | 0.1385 | 0.1957 | **0.1990** | 0.2022 | 0.0458 | **0.0466** | 0.0474 |
| **1.25** | 0.1396 | **0.1406** | 0.1417 | 0.1909 | **0.1933** | 0.1955 | 0.1045 | **0.1060** | 0.1074 | 0.1132 | **0.1156** | 0.1180 | 0.1725 | **0.1759** | 0.1793 | 0.0348 | **0.0355** | 0.0362 |
| **1.50** | 0.1222 | **0.1233** | 0.1244 | 0.1694 | **0.1717** | 0.1739 | 0.0897 | **0.0911** | 0.0925 | 0.0971 | **0.0994** | 0.1016 | 0.1531 | **0.1566** | 0.1603 | 0.0267 | **0.0272** | 0.0278 |
| **1.75** | 0.1080 | **0.1091** | 0.1102 | 0.1514 | **0.1536** | 0.1558 | 0.0776 | **0.0789** | 0.0803 | 0.0841 | **0.0862** | 0.0883 | 0.1372 | **0.1407** | 0.1440 | 0.0206 | **0.0211** | 0.0216 |
| **2.00** | 0.0961 | **0.0971** | 0.0981 | 0.1362 | **0.1382** | 0.1404 | 0.0676 | **0.0689** | 0.0703 | 0.0733 | **0.0754** | 0.0774 | 0.1238 | **0.1271** | 0.1302 | 0.0161 | **0.0165** | 0.0169 |

Notes: Survey weights used; Lb: Lower bound; Ub: Upper bound. The confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

**Table A3.** The incidence (H) and intensity (A) of multi-dimensional poverty in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), as well as in Central America (CA) as a whole; confidence intervals at 95%.
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Panel I: The incidence of multi-dimensional poverty (H%): The multi-dimensional headcount ratio

| | **Scenario 1 (S1)** | | | **Scenario 2 (S2)** | | | **Scenario 3 (S3)** | | | **Dif.: S2-S1** | | **Dif.: S3-S2** | | **Dif.: S3-S1** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Country** | Lb | **H (%)** | Ub | Lb | **H (%)** | Ub | Lb | **H (%)** | Ub | Abs. | Rel. | Abs. | Rel. | Abs. | Rel. |
| **GUA** | 88.9 | **89.4** | 89.8 | 89.5 | **89.9** | 90.4 | 90.5 | **91.0** | 91.4 | 0.55*** | 1.01 | 1.06*** | 1.01 | 1.62*** | 1.02 |
| **ELS** | 76.1 | **76.6** | 77.2 | 79.2 | **79.8** | 80.3 | 79.2 | **79.8** | 80.3 | 3.12*** | 1.04 | 0.00 | 1.00 | 3.12*** | 1.04 |
| **HON** | 82.8 | **83.3** | 83.8 | 83.4 | **83.9** | 84.5 | 84.9 | **85.3** | 85.8 | 0.57*** | 1.01 | 1.43*** | 1.02 | 2.00*** | 1.02 |
| **NIC** | 86.0 | **86.5** | 86.9 | 86.6 | **87.0** | 87.5 | 87.7 | **88.2** | 88.6 | 0.55*** | 1.01 | 1.14*** | 1.01 | 1.69*** | 1.02 |
| **CR** | 56.4 | **57.0** | 57.7 | 57.1 | **57.7** | 58.4 | 60.4 | **61.0** | 61.6 | 0.70*** | 1.01 | 3.24*** | 1.06 | 3.94*** | 1.07 |
| **CA** | 81.2 | **81.4** | 81.6 | 82.1 | **82.4** | 82.6 | 83.4 | **83.6** | 83.9 | 1.00*** | 1.01 | 1.26*** | 1.02 | 2.25*** | 1.03 |

Panel II: The intensity of multi-dimensional poverty (A): The average deprivation share

| | **Scenario 1 (S1)** | | | **Scenario 2 (S2)** | | | **Scenario 3 (S3)** | | | **Dif.: S2-S1** | | **Dif.: S3-S2** | | **Dif.: S3-S1** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Country** | Lb | **A (%)** | Ub | Lb | **A (%)** | Ub | Lb | **A (%)** | Ub | Abs. | Rel. | Abs. | Rel. | Abs. | Rel. |
| **GUA** | 37.8 | **38.0** | 38.2 | 39.3 | **39.6** | 39.8 | 43.4 | **43.6** | 43.9 | 1.58*** | 1.04 | 4.05*** | 1.10 | 5.62*** | 1.15 |
| **ELS** | 30.0 | **30.2** | 30.4 | 33.7 | **33.9** | 34.1 | 33.7 | **33.9** | 34.1 | 3.75*** | 1.12 | 0.00*** | 1.00 | 3.75*** | 1.12 |
| **HON** | 31.0 | **31.3** | 31.6 | 31.6 | **31.9** | 32.2 | 34.2 | **34.5** | 34.8 | 0.59*** | 1.02 | 2.59*** | 1.08 | 3.18*** | 1.10 |
| **NIC** | 37.1 | **37.5** | 37.8 | 38.3 | **38.6** | 39.0 | 40.8 | **41.2** | 41.6 | 1.19*** | 1.03 | 2.57*** | 1.07 | 3.76*** | 1.10 |
| **CR** | 22.2 | **22.4** | 22.6 | 22.7 | **22.8** | 23.0 | 25.1 | **25.2** | 25.4 | 0.45*** | 1.02 | 2.40*** | 1.10 | 2.84*** | 1.13 |
| **CA** | 33.8 | **33.9** | 34.1 | 35.4 | **35.5** | 35.6 | 38.0 | **38.2** | 38.3 | 1.55*** | 1.05 | 2.68*** | 1.08 | 4.23*** | 1.12 |

*Notes:* Survey weights used; Lb: Lower bound; H: The multi-dimensional headcount ratio; A: The average deprivation share among the multi-dimensionally poor individuals; Ub: Upper bound; the confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145). *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

**Table A4.** Inequality among the multi-dimensionally poor individuals in Guatemala (GUA), EL Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), as well as in Central America as a whole; confidence intervals at 95 percent.
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

Panel I: Scenario 1

| | $\gamma$ = 0.25 | | | $\gamma$ = 0.50 | | | $\gamma$ = 0.75 | | | $\gamma$ = 1.00 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Country** | Lb | **GE (1 +$\gamma$)** | Ub | Lb | **GE (1 +$\gamma$)** | Ub | Lb | **GE (1 +$\gamma$)** | Ub | Lb | **GE (1 +$\gamma$)** | Ub |
| **GUA** | 0.1392 | **0.1421** | 0.1451 | 0.1358 | **0.1388** | 0.1419 | 0.1343 | **0.1371** | 0.1401 | 0.1335 | **0.1362** | 0.1391 |
| **ELS** | 0.1819 | **0.1851** | 0.1884 | 0.1797 | **0.1830** | 0.1863 | 0.1796 | **0.1828** | 0.1858 | 0.1812 | **0.1847** | 0.1878 |
| **HON** | 0.1749 | **0.1789** | 0.1827 | 0.1726 | **0.1764** | 0.1804 | 0.1718 | **0.1757** | 0.1797 | 0.1734 | **0.1774** | 0.1813 |
| **NIC** | 0.1703 | **0.1742** | 0.1784 | 0.1658 | **0.1699** | 0.1738 | 0.1640 | **0.1678** | 0.1719 | 0.1630 | **0.1670** | 0.1710 |
| **CR** | 0.0799 | **0.0828** | 0.0856 | 0.0801 | **0.0829** | 0.0856 | 0.0806 | **0.0834** | 0.0862 | 0.0818 | **0.0850** | 0.0882 |
| **CA** | 0.1667 | **0.1685** | 0.1702 | 0.1644 | **0.1661** | 0.1677 | 0.1638 | **0.1655** | 0.1672 | 0.1646 | **0.1665** | 0.1684 |
| | $\gamma$ = 1.25 | | | $\gamma$ = 1.50 | | | $\gamma$ = 1.75 | | | $\gamma$ = 2.00 | | |
| **Country** | Lb | **GE (1 +$\gamma$)** | Ub | Lb | **GE (1 +$\gamma$)** | Ub | Lb | **GE (1 +$\gamma$)** | Ub | Lb | **GE (1 +$\gamma$)** | Ub |
| **GUA** | 0.1337 | **0.1367** | 0.1401 | 0.1348 | **0.1381** | 0.1414 | 0.1372 | **0.1405** | 0.1439 | 0.1403 | **0.1437** | 0.1472 |
| **ELS** | 0.1849 | **0.1883** | 0.1918 | 0.1899 | **0.1936** | 0.1975 | 0.1968 | **0.2007** | 0.2047 | 0.2054 | **0.2098** | 0.2142 |
| **HON** | 0.1762 | **0.1806** | 0.1850 | 0.1811 | **0.1857** | 0.1901 | 0.1877 | **0.1927** | 0.1977 | 0.1957 | **0.2014** | 0.2068 |
| **NIC** | 0.1636 | **0.1678** | 0.1723 | 0.1654 | **0.1699** | 0.1745 | 0.1684 | **0.1732** | 0.1776 | 0.1730 | **0.1777** | 0.1828 |
| **CR** | 0.0837 | **0.0872** | 0.0907 | 0.0867 | **0.0902** | 0.0936 | 0.0900 | **0.0939** | 0.0978 | 0.0944 | **0.0988** | 0.1029 |
| **CA** | 0.1670 | **0.1689** | 0.1707 | 0.1706 | **0.1727** | 0.1747 | 0.1759 | **0.1779** | 0.1801 | 0.1824 | **0.1847** | 0.1871 |

Panel II: Scenario 2

| | $\gamma$ = 0.25 | | | $\gamma$ = 0.50 | | | $\gamma$ = 0.75 | | | $\gamma$ = 1.00 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Country** | Lb | **GE (1 +$\gamma$)** | Ub | Lb | **GE (1 +$\gamma$)** | Ub | Lb | **GE (1 +$\gamma$)** | Ub | Lb | **GE (1 +$\gamma$)** | Ub |
| **GUA** | 0.1357 | **0.1385** | 0.1413 | 0.1323 | **0.1354** | 0.1385 | 0.1309 | **0.1338** | 0.1368 | 0.1300 | **0.1331** | 0.1360 |
| **ELS** | 0.1772 | **0.1801** | 0.1832 | 0.1752 | **0.1781** | 0.1810 | 0.1747 | **0.1778** | 0.1806 | 0.1763 | **0.1795** | 0.1827 |
| **HON** | 0.1714 | **0.1753** | 0.1793 | 0.1689 | **0.1729** | 0.1770 | 0.1687 | **0.1726** | 0.1767 | 0.1699 | **0.1741** | 0.1779 |
| **NIC** | 0.1672 | **0.1711** | 0.1753 | 0.1632 | **0.1671** | 0.1709 | 0.1610 | **0.1650** | 0.1691 | 0.1603 | **0.1643** | 0.1683 |
| **CR** | 0.0832 | **0.0859** | 0.0887 | 0.0834 | **0.0860** | 0.0887 | 0.0843 | **0.0869** | 0.0897 | 0.0856 | **0.0885** | 0.0914 |
| **CA** | 0.1636 | **0.1653** | 0.1669 | 0.1614 | **0.1631** | 0.1649 | 0.1609 | **0.1625** | 0.1643 | 0.1617 | **0.1635** | 0.1652 |
| | $\gamma$ = 1.25 | | | $\gamma$ = 1.50 | | | $\gamma$ = 1.75 | | | $\gamma$ = 2.00 | | |
| **Country** | Lb | **GE (1 +$\gamma$)** | Ub | Lb | **GE (1 +$\gamma$)** | Ub | Lb | **GE (1 +$\gamma$)** | Ub | Lb | **GE (1 +$\gamma$)** | Ub |
| **GUA** | 0.1307 | **0.1335** | 0.1363 | 0.1320 | **0.1350** | 0.1380 | 0.1343 | **0.1373** | 0.1404 | 0.1371 | **0.1405** | 0.1439 |
| **ELS** | 0.1793 | **0.1828** | 0.1863 | 0.1843 | **0.1876** | 0.1911 | 0.1904 | **0.1942** | 0.1980 | 0.1986 | **0.2026** | 0.2068 |
| **HON** | 0.1731 | **0.1773** | 0.1813 | 0.1776 | **0.1825** | 0.1873 | 0.1842 | **0.1890** | 0.1940 | 0.1921 | **0.1976** | 0.2029 |
| **NIC** | 0.1610 | **0.1652** | 0.1695 | 0.1627 | **0.1672** | 0.1718 | 0.1662 | **0.1707** | 0.1752 | 0.1702 | **0.1754** | 0.1805 |
| **CR** | 0.0878 | **0.0910** | 0.0941 | 0.0910 | **0.0941** | 0.0972 | 0.0945 | **0.0981** | 0.1017 | 0.0988 | **0.1030** | 0.1073 |
| **CA** | 0.1640 | **0.1659** | 0.1678 | 0.1676 | **0.1696** | 0.1717 | 0.1727 | **0.1747** | 0.1769 | 0.1789 | **0.1812** | 0.1835 |

*Notes:* Survey weights used; Lb: Lower bound; GE: The generalized entropy inequality index; Ub: Upper bound; the confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

**Table A4**-(*continued*).

Panel III: Scenario 3

| | γ = 0.25 | | | γ = 0.50 | | | γ = 0.75 | | | γ = 1.00 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Country** | Lb | **GE (1 +γ)** | Ub | Lb | **GE (1 +γ)** | Ub | Lb | **GE (1 +γ)** | Ub | Lb | **GE (1 +γ)** | Ub |
| **GUA** | 0.1360 | **0.1388** | 0.1418 | 0.1326 | **0.1356** | 0.1384 | 0.1307 | **0.1336** | 0.1365 | 0.1298 | **0.1328** | 0.1355 |
| **ELS** | 0.1772 | **0.1801** | 0.1832 | 0.1752 | **0.1781** | 0.1810 | 0.1747 | **0.1778** | 0.1806 | 0.1763 | **0.1795** | 0.1827 |
| **HON** | 0.1682 | **0.1723** | 0.1762 | 0.1661 | **0.1699** | 0.1737 | 0.1660 | **0.1696** | 0.1733 | 0.1672 | **0.1711** | 0.1750 |
| **NIC** | 0.1672 | **0.1708** | 0.1747 | 0.1634 | **0.1672** | 0.1709 | 0.1616 | **0.1652** | 0.1690 | 0.1612 | **0.1649** | 0.1687 |
| **CR** | 0.0950 | **0.0975** | 0.1001 | 0.0952 | **0.0976** | 0.1000 | 0.0961 | **0.0985** | 0.1009 | 0.0975 | **0.1000** | 0.1027 |
| **CA** | 0.1647 | **0.1662** | 0.1679 | 0.1624 | **0.1640** | 0.1656 | 0.1618 | **0.1634** | 0.1650 | 0.1626 | **0.1643** | 0.1661 |
| | γ = 1.25 | | | γ = 1.50 | | | γ = 1.75 | | | γ = 2.00 | | |
| **Country** | Lb | **GE (1 +γ)** | Ub | Lb | **GE (1 +γ)** | Ub | Lb | **GE (1 +γ)** | Ub | Lb | **GE (1 +γ)** | Ub |
| **GUA** | 0.1302 | **0.1329** | 0.1359 | 0.1312 | **0.1340** | 0.1371 | 0.1330 | **0.1359** | 0.1388 | 0.1357 | **0.1387** | 0.1418 |
| **ELS** | 0.1793 | **0.1828** | 0.1863 | 0.1843 | **0.1876** | 0.1911 | 0.1904 | **0.1942** | 0.1980 | 0.1986 | **0.2026** | 0.2068 |
| **HON** | 0.1702 | **0.1742** | 0.1781 | 0.1747 | **0.1788** | 0.1834 | 0.1806 | **0.1852** | 0.1898 | 0.1881 | **0.1930** | 0.1982 |
| **NIC** | 0.1621 | **0.1659** | 0.1701 | 0.1644 | **0.1683** | 0.1726 | 0.1673 | **0.1718** | 0.1760 | 0.1723 | **0.1770** | 0.1817 |
| **CR** | 0.0995 | **0.1023** | 0.1050 | 0.1026 | **0.1053** | 0.1081 | 0.1059 | **0.1090** | 0.1123 | 0.1104 | **0.1136** | 0.1172 |
| **CA** | 0.1647 | **0.1666** | 0.1683 | 0.1681 | **0.1702** | 0.1721 | 0.1732 | **0.1751** | 0.1772 | 0.1793 | **0.1814** | 0.1835 |

*Notes:* Survey weights used; Lb: Lower bound; GE: The generalized entropy inequality index; Ub: Upper bound; the confidence intervals at 95% were computed using the bootstrap percentile method with 1,000 stratified bootstrap replications (Efron, 1981, p. 145).

**Table A5.** Multi-dimensional poverty by gender in Guatemala (GUA), EL Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), for scenario 1 and with various degrees of inequality aversion.
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

| **Country** | **Gender/Gender gap** | Value of γ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **0.00** | **0.25** | **0.50** | **0.75** | **1.00** | **1.25** | **1.50** | **1.75** | **2.00** |
| **GUA** | Male | 0.3438 | 0.2836 | 0.2369 | 0.2000 | 0.1705 | 0.1469 | 0.1273 | 0.1111 | 0.0976 |
| | | (0.0018) | (0.0017) | (0.0016) | (0.0016) | (0.0015) | (0.0015) | (0.0014) | (0.0013) | (0.0013) |
| | Female | 0.3358 | 0.2738 | 0.2259 | 0.1883 | 0.1584 | 0.1344 | 0.1149 | 0.0988 | 0.0856 |
| | | (0.0017) | (0.0015) | (0.0014) | (0.0013) | (0.0012) | (0.0012) | (0.0011) | (0.0010) | (0.0010) |
| | Absolute gap | *-0.0080**** | *-0.0098**** | *-0.0110**** | *-0.0118**** | *-0.0121**** | *-0.0125**** | *-0.0124**** | *-0.0123**** | *-0.0120**** |
| | Relative gap | *0.98* | *0.97* | *0.95* | *0.94* | *0.93* | *0.91* | *0.90* | *0.89* | *0.88* |
| **ELS** | Male | 0.2357 | 0.1859 | 0.1491 | 0.1213 | 0.1000 | 0.0833 | 0.0701 | 0.0597 | 0.0511 |
| | | (0.0015) | (0.0014) | (0.0012) | (0.0011) | (0.0010) | (0.0010) | (0.0009) | (0.0008) | (0.0008) |
| | Female | 0.2274 | 0.1773 | 0.1405 | 0.1128 | 0.0917 | 0.0755 | 0.0626 | 0.0526 | 0.0445 |
| | | (0.0014) | (0.0012) | (0.0011) | (0.0010) | (0.0009) | (0.0008) | (0.0007) | (0.0007) | (0.0006) |
| | Absolute gap | *-0.0082**** | *-0.0085**** | *-0.0086**** | *-0.0085**** | *-0.0083**** | *-0.0079**** | *-0.0075**** | *-0.0071**** | *-0.0067**** |
| | Relative gap | *0.97* | *0.95* | *0.94* | *0.93* | *0.92* | *0.91* | *0.89* | *0.88* | *0.87* |
| **HON** | Male | 0.2807 | 0.2249 | 0.1827 | 0.1506 | 0.1255 | 0.1059 | 0.0901 | 0.0774 | 0.0672 |
| | | (0.0022) | (0.0021) | (0.0019) | (0.0018) | (0.0017) | (0.0016) | (0.0015) | (0.0015) | (0.0014) |
| | Female | 0.2432 | 0.1894 | 0.1498 | 0.1200 | 0.0974 | 0.0799 | 0.0663 | 0.0555 | 0.0469 |
| | | (0.0019) | (0.0017) | (0.0015) | (0.0014) | (0.0013) | (0.0012) | (0.0011) | (0.0010) | (0.0010) |
| | Absolute gap | *-0.0375**** | *-0.0355**** | *-0.0329**** | *-0.0306**** | *-0.0281**** | *-0.0260**** | *-0.0239**** | *-0.0219**** | *-0.0203**** |
| | Relative gap | *0.87* | *0.84* | *0.82* | *0.80* | *0.78* | *0.75* | *0.74* | *0.72* | *0.70* |
| **NIC** | Male | 0.3411 | 0.2830 | 0.2381 | 0.2026 | 0.1739 | 0.1506 | 0.1313 | 0.1153 | 0.1020 |
| | | (0.0023) | (0.0023) | (0.0023) | (0.0022) | (0.0022) | (0.0022) | (0.0021) | (0.0020) | (0.0019) |
| | Female | 0.3083 | 0.2529 | 0.2104 | 0.1772 | 0.1510 | 0.1298 | 0.1125 | 0.0984 | 0.0864 |
| | | (0.0023) | (0.0022) | (0.0022) | (0.0021) | (0.0020) | (0.0019) | (0.0019) | (0.0018) | (0.0017) |
| | Absolute gap | *-0.0328**** | *-0.0301**** | *-0.0277**** | *-0.0254**** | *-0.0229**** | *-0.0208**** | *0.0188**** | *0.0170**** | *0.0156**** |
| | Relative gap | *0.90* | *0.89* | *0.88* | *0.87* | *0.87* | *0.86* | *0.86* | *0.85* | *0.85* |
| **CR** | Male | 0.1288 | 0.0908 | 0.0645 | 0.0463 | 0.0335 | 0.0245 | 0.0181 | 0.0135 | 0.0101 |
| | | (0.0012) | (0.0009) | (0.0007) | (0.0006) | (0.0004) | (0.0004) | (0.0003) | (0.0003) | (0.0002) |
| | Female | 0.1267 | 0.0896 | 0.0639 | 0.0460 | 0.0334 | 0.0245 | 0.0182 | 0.0136 | 0.0103 |
| | | (0.0012) | (0.0009) | (0.0007) | (0.0005) | (0.0004) | (0.0004) | (0.0003) | (0.0003) | (0.0002) |
| | Absolute gap | *-0.0021**** | *-0.0012**** | *-0.0006**** | *-0.0003**** | *0.0000*** | *0.0001**** | *0.0001**** | *0.0001**** | *0.0001**** |
| | Relative gap | *0.98* | *0.99* | *0.99* | *0.99* | *1.00* | *1.00* | *1.01* | *1.01* | *1.01* |

*Notes:* Survey weights used; standard errors (in parentheses) were estimated following the bootstrap estimate of the standard error proposed by Bradley Efron with 1000 stratified bootstrap replications (Efron, 1981, p. 139-143). *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

**Table A6.** Multi-dimensional poverty by gender in Guatemala (GUA), EL Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), for scenario 2, with various degrees of inequality aversion.
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

| Country | Gender/Gender gap | Value of γ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **0.00** | **0.25** | **0.50** | **0.75** | **1.00** | **1.25** | **1.50** | **1.75** | **2.00** |
| **GUA** | Male | 0.3451 | 0.2848 | 0.2380 | 0.2011 | 0.1715 | 0.1475 | 0.1280 | 0.1118 | 0.0984 |
| | | (0.0018) | (0.0017) | (0.0017) | (0.0016) | (0.0015) | (0.0014) | (0.0014) | (0.0013) | (0.0013) |
| | Female | 0.3652 | 0.3028 | 0.2540 | 0.2152 | 0.1840 | 0.1588 | 0.1380 | 0.1208 | 0.1064 |
| | | (0.0018) | (0.0017) | (0.0016) | (0.0016) | (0.0014) | (0.0014) | (0.0013) | (0.0013) | (0.0012) |
| | Absolute gap | *0.0202**** | *0.0180**** | *0.0161**** | *0.0142**** | *0.0125**** | *0.0113**** | *0.0101**** | *0.0090**** | *0.0080**** |
| | Relative gap | *1.06* | *1.06* | *1.07* | *1.07* | *1.07* | *1.08* | *1.08* | *1.08* | *1.08* |
| **ELS** | Male | 0.2361 | 0.1863 | 0.1494 | 0.1215 | 0.1003 | 0.0835 | 0.0703 | 0.0598 | 0.0513 |
| | | (0.0016) | (0.0014) | (0.0012) | (0.0011) | (0.0011) | (0.0009) | (0.0009) | (0.0008) | (0.0007) |
| | Female | 0.2993 | 0.2446 | 0.2029 | 0.1706 | 0.1451 | 0.1247 | 0.1082 | 0.0948 | 0.0836 |
| | | (0.0016) | (0.0014) | (0.0013) | (0.0013) | (0.0012) | (0.0012) | (0.0011) | (0.0011) | (0.0010) |
| | Absolute gap | *0.0632**** | *0.0583**** | *0.0535**** | *0.0490**** | *0.0448**** | *0.0412**** | *0.0379**** | *0.0350**** | *0.0322**** |
| | Relative gap | *1.27* | *1.31* | *1.36* | *1.40* | *1.45* | *1.49* | *1.54* | *1.59* | *1.63* |
| **HON** | Male | 0.2823 | 0.2262 | 0.1839 | 0.1515 | 0.1264 | 0.1065 | 0.0907 | 0.0780 | 0.0676 |
| | | (0.0022) | (0.0021) | (0.0020) | (0.0018) | (0.0017) | (0.0016) | (0.0016) | (0.0015) | (0.0014) |
| | Female | 0.2543 | 0.1996 | 0.1589 | 0.1285 | 0.1050 | 0.0869 | 0.0726 | 0.0613 | 0.0523 |
| | | (0.0019) | (0.0017) | (0.0016) | (0.0015) | (0.0014) | (0.0013) | (0.0012) | (0.0012) | (0.0011) |
| | Absolute gap | *-0.0280**** | *-0.0266**** | *-0.0250**** | *-0.0231**** | *-0.0214**** | *-0.0197**** | *-0.0181**** | *-0.0167**** | *-0.0152**** |
| | Relative gap | *0.90* | *0.88* | *0.86* | *0.85* | *0.83* | *0.82* | *0.80* | *0.79* | *0.77* |
| **NIC** | Male | 0.3416 | 0.2837 | 0.2384 | 0.2029 | 0.1742 | 0.1508 | 0.1315 | 0.1157 | 0.1022 |
| | | (0.0024) | (0.0024) | (0.0023) | (0.0023) | (0.0022) | (0.0021) | (0.0022) | (0.0020) | (0.0019) |
| | Female | 0.3315 | 0.2756 | 0.2324 | 0.1985 | 0.1714 | 0.1494 | 0.1314 | 0.1164 | 0.1038 |
| | | (0.0025) | (0.0025) | (0.0025) | (0.0024) | (0.0024) | (0.0023) | (0.0023) | (0.0022) | (0.0022) |
| | Absolute gap | *-0.0101**** | *-0.0081**** | *-0.0060**** | *-0.0044**** | *-0.0028**** | *-0.0014**** | *-0.0002** | *0.0007**** | *0.0016**** |
| | Relative gap | *0.97* | *0.97* | *0.97* | *0.98* | *0.98* | *0.99* | *1.00* | *1.01* | *1.02* |
| **CR** | Male | 0.1292 | 0.0911 | 0.0648 | 0.0465 | 0.0337 | 0.0246 | 0.0182 | 0.0135 | 0.0102 |
| | | (0.0012) | (0.0009) | (0.0007) | (0.0006) | (0.0005) | (0.0004) | (0.0003) | (0.0003) | (0.0002) |
| | Female | 0.1343 | 0.0959 | 0.0691 | 0.0504 | 0.0371 | 0.0275 | 0.0207 | 0.0156 | 0.0120 |
| | | (0.0013) | (0.0010) | (0.0007) | (0.0006) | (0.0005) | (0.0004) | (0.0003) | (0.0003) | (0.0002) |
| | Absolute gap | *0.0051**** | *0.0049**** | *0.0043**** | *0.0038**** | *0.0034**** | *0.0030**** | *0.0025**** | *0.0021**** | *0.0017**** |
| | Relative gap | *1.04* | *1.05* | *1.07* | *1.08* | *1.10* | *1.12* | *1.14* | *1.15* | *1.17* |

*Notes:* Survey weights used; standard errors (in parentheses) were estimated following the bootstrap estimate of the standard error proposed by Bradley Efron with 1000 stratified bootstrap replications (Efron, 1981, p. 139-143). *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

**Table A7.** Multi-dimensional poverty by gender in Guatemala (GUA), EL Salvador (ELS), Honduras (HON), Nicaragua (NIC), and Costa Rica (CR), for scenario 3, with various degrees of inequality aversion.
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

| **Country** | **Gender/Gender gap** | Value of γ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **0.00** | **0.25** | **0.50** | **0.75** | **1.00** | **1.25** | **1.50** | **1.75** | **2.00** |
| **GUA** | Male | 0.3465 | 0.2862 | 0.2393 | 0.2022 | 0.1726 | 0.1486 | 0.1290 | 0.1127 | 0.0991 |
| | | (0.0019) | (0.0018) | (0.0017) | (0.0016) | (0.0015) | (0.0015) | (0.0014) | (0.0013) | (0.0013) |
| | Female | 0.4407 | 0.3803 | 0.3319 | 0.2924 | 0.2596 | 0.2322 | 0.2091 | 0.1894 | 0.1725 |
| | | (0.0021) | (0.0020) | (0.0020) | (0.0019) | (0.0019) | (0.0019) | (0.0018) | (0.0017) | (0.0016) |
| | Absolute gap | *0.0942**** | *0.0941**** | *0.0926**** | *0.0901**** | *0.0870**** | *0.0836**** | *0.0801**** | *0.0767**** | *0.0734**** |
| | Relative gap | *1.27* | *1.33* | *1.39* | *1.45* | *1.50* | *1.56* | *1.62* | *1.68* | *1.74* |
| **ELS** | Male | 0.2361 | 0.1863 | 0.1494 | 0.1215 | 0.1003 | 0.0835 | 0.0703 | 0.0598 | 0.0513 |
| | | (0.0016) | (0.0014) | (0.0012) | (0.0011) | (0.0011) | (0.0009) | (0.0009) | (0.0008) | (0.0007) |
| | Female | 0.2993 | 0.2446 | 0.2029 | 0.1706 | 0.1451 | 0.1247 | 0.1082 | 0.0948 | 0.0836 |
| | | (0.0016) | (0.0014) | (0.0013) | (0.0013) | (0.0012) | (0.0012) | (0.0011) | (0.0011) | (0.0010) |
| | Absolute gap | *0.0632**** | *0.0583**** | *0.0535**** | *0.0490**** | *0.0448**** | *0.0412**** | *0.0379**** | *0.0350**** | *0.0322**** |
| | Relative gap | *1.27* | *1.31* | *1.36* | *1.40* | *1.45* | *1.49* | *1.54* | *1.59* | *1.63* |
| **HON** | Male | 0.2835 | 0.2271 | 0.1846 | 0.1520 | 0.1268 | 0.1069 | 0.0911 | 0.0783 | 0.0679 |
| | | (0.0022) | (0.0020) | (0.0019) | (0.0018) | (0.0017) | (0.0016) | (0.0015) | (0.0014) | (0.0014) |
| | Female | 0.3030 | 0.2464 | 0.2032 | 0.1700 | 0.1439 | 0.1232 | 0.1065 | 0.0930 | 0.0818 |
| | | (0.0022) | (0.0022) | (0.0020) | (0.0019) | (0.0018) | (0.0017) | (0.0017) | (0.0016) | (0.0016) |
| | Absolute gap | *0.0195**** | *0.0192**** | *0.0186**** | *0.0180**** | *0.0171**** | *0.0163**** | *0.0155**** | *0.0147**** | *0.0140**** |
| | Relative gap | *1.07* | *1.08* | *1.10* | *1.12* | *1.13* | *1.15* | *1.17* | *1.19* | *1.21* |
| **NIC** | Male | 0.3423 | 0.2841 | 0.2390 | 0.2033 | 0.1746 | 0.1512 | 0.1319 | 0.1159 | 0.1024 |
| | | (0.0024) | (0.0024) | (0.0023) | (0.0023) | (0.0022) | (0.0022) | (0.0022) | (0.0019) | (0.0019) |
| | Female | 0.3822 | 0.3268 | 0.2835 | 0.2489 | 0.2211 | 0.1980 | 0.1790 | 0.1630 | 0.1494 |
| | | (0.0026) | (0.0027) | (0.0026) | (0.0027) | (0.0026) | (0.0027) | (0.0026) | (0.0026) | (0.0027) |
| | Absolute gap | *0.0399**** | *0.0427**** | *0.0445**** | *0.0457**** | *0.0466**** | *0.0468**** | *0.0472**** | *0.0471**** | *0.0470**** |
| | Relative gap | *1.12* | *1.15* | *1.19* | *1.22* | *1.27* | *1.31* | *1.36* | *1.41* | *1.46* |
| **CR** | Male | 0.1298 | 0.0916 | 0.0652 | 0.0468 | 0.0339 | 0.0248 | 0.0184 | 0.0137 | 0.0103 |
| | | (0.0012) | (0.0009) | (0.0007) | (0.0006) | (0.0005) | (0.0004) | (0.0003) | (0.0003) | (0.0002) |
| | Female | 0.1763 | 0.1317 | 0.0995 | 0.0759 | 0.0584 | 0.0453 | 0.0355 | 0.0280 | 0.0222 |
| | | (0.0015) | (0.0012) | (0.0010) | (0.0008) | (0.0007) | (0.0006) | (0.0005) | (0.0004) | (0.0004) |
| | Absolute gap | *0.0464**** | *0.0401**** | *0.0343**** | *0.0290**** | *0.0245**** | *0.0205**** | *0.0171**** | *0.0143**** | *0.0119**** |
| | Relative gap | *1.36* | *1.44* | *1.53* | *1.62* | *1.72* | *1.83* | *1.93* | *2.04* | *2.15* |

*Notes:* Survey weights used; standard errors (in parentheses) were estimated following the bootstrap estimate of the standard error proposed by Bradley Efron with 1000 stratified bootstrap replications (Efron, 1981, p. 139-143). *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

**Table A8.** Multi-dimensional poverty by gender in Central America as a whole, for each of the three scenarios and various degrees of inequality aversion.
*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

| Panel I: Scenario 1 | | | | | | |
|---|---|---|---|---|---|---|
| | **Male** | | **Female** | | **Sex ratio** | |
| **Gamma** | **MPI** | **SE** | **MPI** | **SE** | **Absolute** | **Relative** |
| **0.00** | 0.2849 | 0.0009 | 0.2688 | 0.0008 | -0.0161*** | 0.94 |
| **0.25** | 0.2305 | 0.0009 | 0.2145 | 0.0008 | -0.0160*** | 0.93 |
| **0.50** | 0.1893 | 0.0008 | 0.1737 | 0.0007 | -0.0155*** | 0.92 |
| **0.75** | 0.1575 | 0.0008 | 0.1426 | 0.0006 | -0.0149*** | 0.91 |
| **1.00** | 0.1326 | 0.0007 | 0.1184 | 0.0006 | -0.0142*** | 0.89 |
| **1.25** | 0.1128 | 0.0007 | 0.0992 | 0.0006 | -0.0136*** | 0.88 |
| **1.50** | 0.0969 | 0.0007 | 0.0840 | 0.0005 | -0.0129*** | 0.87 |
| **1.75** | 0.0838 | 0.0006 | 0.0717 | 0.0005 | -0.0121*** | 0.86 |
| **2.00** | 0.0732 | 0.0006 | 0.0617 | 0.0005 | -0.0115*** | 0.84 |
| Panel II: Scenario 2 | | | | | | |
| | **Male** | | **Female** | | **Sex ratio** | |
| **Gamma** | **MPI** | **SE** | **MPI** | **SE** | **Absolute** | **Relative** |
| **0.00** | 0.2858 | 0.0009 | 0.2981 | 0.0009 | 0.0124*** | 1.04 |
| **0.25** | 0.2313 | 0.0009 | 0.2425 | 0.0009 | 0.0112*** | 1.05 |
| **0.50** | 0.1900 | 0.0008 | 0.2002 | 0.0008 | 0.0101*** | 1.05 |
| **0.75** | 0.1582 | 0.0008 | 0.1674 | 0.0007 | 0.0092*** | 1.06 |
| **1.00** | 0.1332 | 0.0007 | 0.1416 | 0.0007 | 0.0084*** | 1.06 |
| **1.25** | 0.1133 | 0.0007 | 0.1210 | 0.0007 | 0.0077*** | 1.07 |
| **1.50** | 0.0973 | 0.0007 | 0.1044 | 0.0007 | 0.0071*** | 1.07 |
| **1.75** | 0.0843 | 0.0006 | 0.0909 | 0.0006 | 0.0066*** | 1.08 |
| **2.00** | 0.0736 | 0.0006 | 0.0797 | 0.0006 | 0.0062*** | 1.08 |
| Panel III: Scenario 3 | | | | | | |
| | **Male** | | **Female** | | **Sex ratio** | |
| **Gamma** | **MPI** | **SE** | **MPI** | **SE** | **Absolute** | **Relative** |
| **0.00** | 0.2867 | 0.0009 | 0.3478 | 0.0010 | 0.0611*** | 1.21 |
| **0.25** | 0.2322 | 0.0009 | 0.2919 | 0.0009 | 0.0597*** | 1.26 |
| **0.50** | 0.1908 | 0.0008 | 0.2485 | 0.0010 | 0.0577*** | 1.30 |
| **0.75** | 0.1588 | 0.0008 | 0.2141 | 0.0009 | 0.0554*** | 1.35 |
| **1.00** | 0.1338 | 0.0007 | 0.1866 | 0.0009 | 0.0528*** | 1.39 |
| **1.25** | 0.1138 | 0.0007 | 0.1641 | 0.0008 | 0.0503*** | 1.44 |
| **1.50** | 0.0978 | 0.0007 | 0.1457 | 0.0008 | 0.0480*** | 1.49 |
| **1.75** | 0.0847 | 0.0007 | 0.1304 | 0.0008 | 0.0457*** | 1.54 |
| **2.00** | 0.0739 | 0.0007 | 0.1175 | 0.0008 | 0.0436*** | 1.59 |

*Notes:* Survey weights used; standard errors (in parentheses) were estimated following the bootstrap estimate of the standard error proposed by Bradley Efron with 1000 stratified bootstrap replications (Efron, 1981, p. 139-143). *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

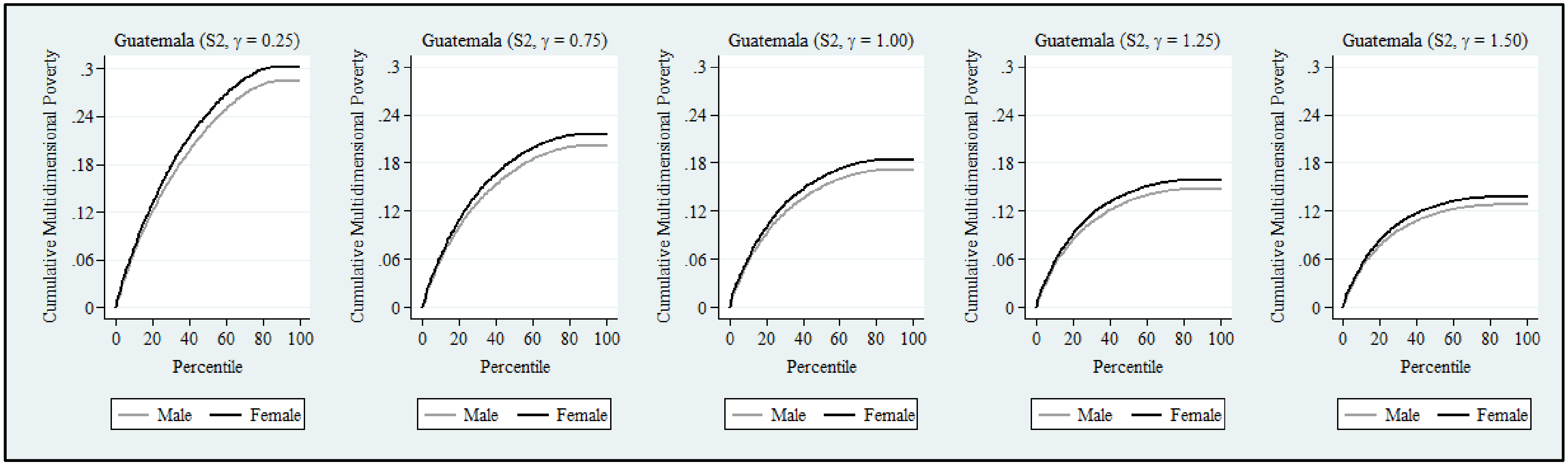


**Fig. A1.** Cumulative multi-dimensional poverty among adults in Guatemala by gender and population percentile (the latter ordered from the poorest to the richest).
*Source:* Authors' estimates based on GUA-ENCOVI2014.
*Notes:* S2: Scenario 2. In each case, the overall estimated multi-dimensional poverty corresponds to the height of the curve at the vertical intercept at the 100th percentile. The incidence of multi-dimensional poverty corresponds to the length of the non-horizontal section of the curve (the percentile at which the curve becomes horizontal). The average multi-dimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the curve becomes horizontal. Inequality among the multi-dimensionally poor individuals is represented by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

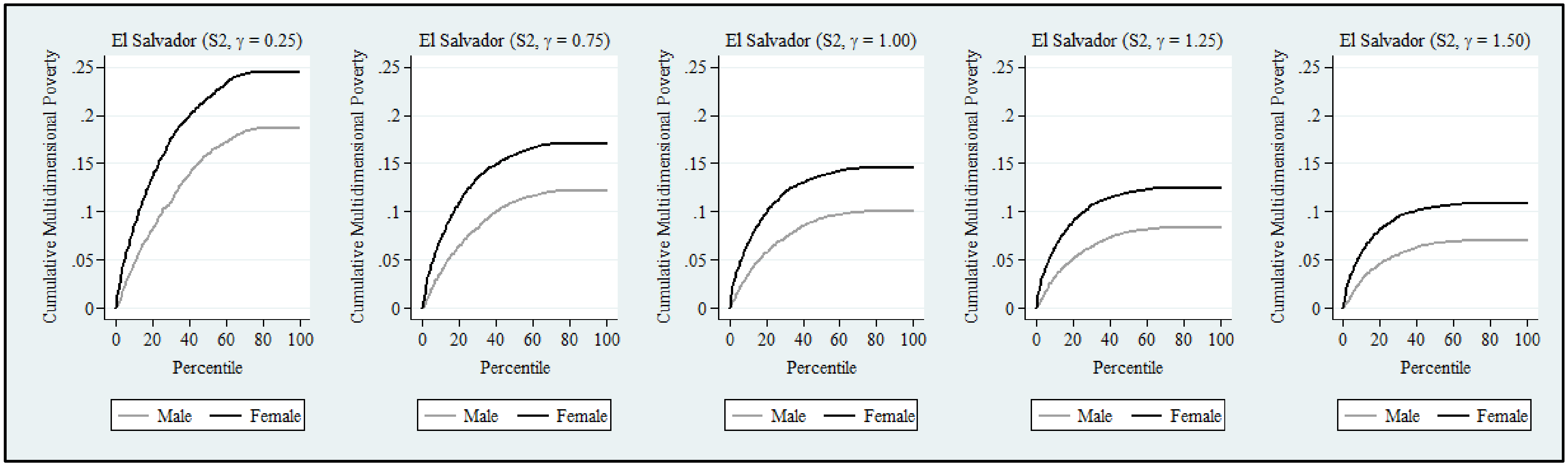


**Fig. A2.** Cumulative multi-dimensional poverty among adults in El Salvador by gender and population percentile (the latter ordered from the poorest to the richest).
*Source:* Authors' estimates based on ELS-EHPM2016.
*Notes:* S2: Scenario 2. In each case, the overall estimated multi-dimensional poverty corresponds to the height of the curve at the vertical intercept at the 100th percentile. The incidence of multi-dimensional poverty corresponds to the length of the non-horizontal section of the curve (the percentile at which the curve becomes horizontal). The average multi-dimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the curve becomes horizontal. Inequality among the multi-dimensionally poor individuals is represented by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

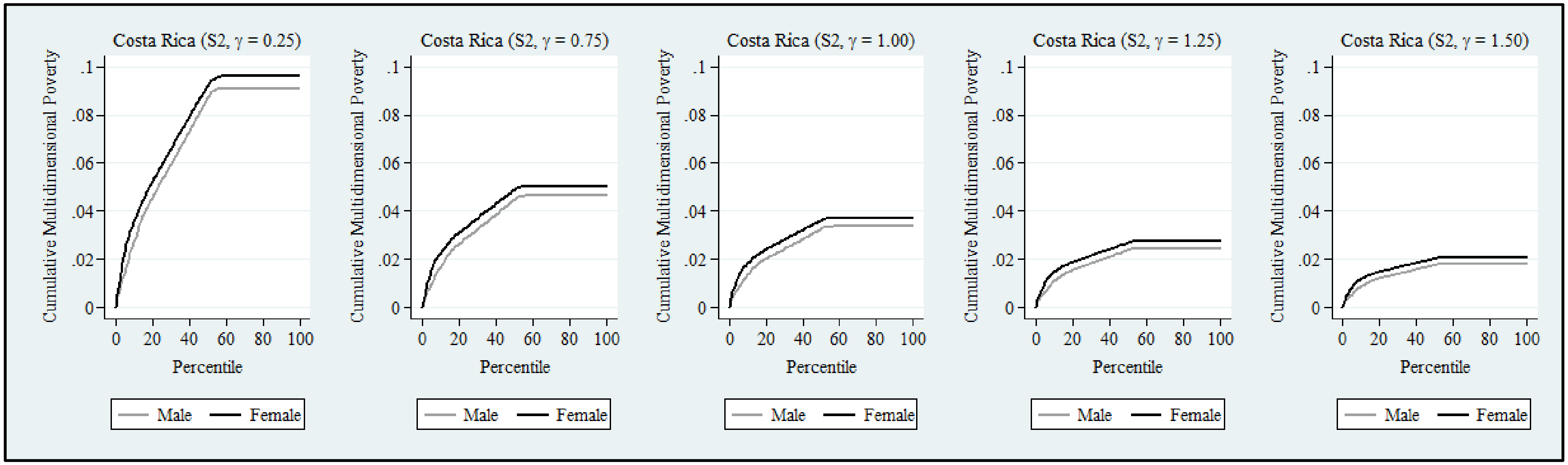


**Fig. A3.** Cumulative multi-dimensional poverty among adults in Costa Rica by gender and population percentile (the latter ordered from the poorest to the richest).
*Source:* Authors' estimates based on CR-ENAHO2016.
*Notes:* S2: Scenario 2. In each case, the overall estimated multi-dimensional poverty corresponds to the height of the curve at the vertical intercept at the 100th percentile. The incidence of multi-dimensional poverty corresponds to the length of the non-horizontal section of the curve (the percentile at which the curve becomes horizontal). The average multi-dimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the curve becomes horizontal. Inequality among the multi-dimensionally poor individuals is represented by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

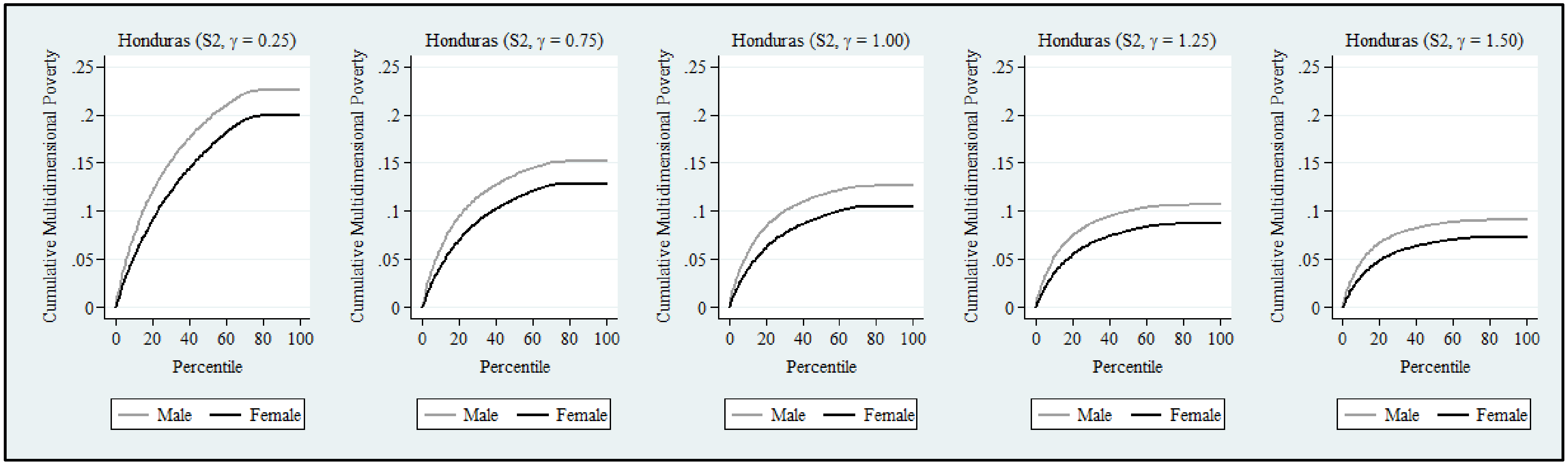


**Fig. A4.** Cumulative multi-dimensional poverty among adults in Honduras by gender and population percentile (the latter ordered from the poorest to the richest).
*Source:* Authors' estimates based on HON-EPHPM2013.
*Notes:* S2: Scenario 2. In each case, the overall estimated multi-dimensional poverty corresponds to the height of the curve at the vertical intercept at the 100th percentile. The incidence of multi-dimensional poverty corresponds to the length of the non-horizontal section of the curve (the percentile at which the curve becomes horizontal). The average multi-dimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the curve becomes horizontal. Inequality among the multi-dimensionally poor individuals is represented by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

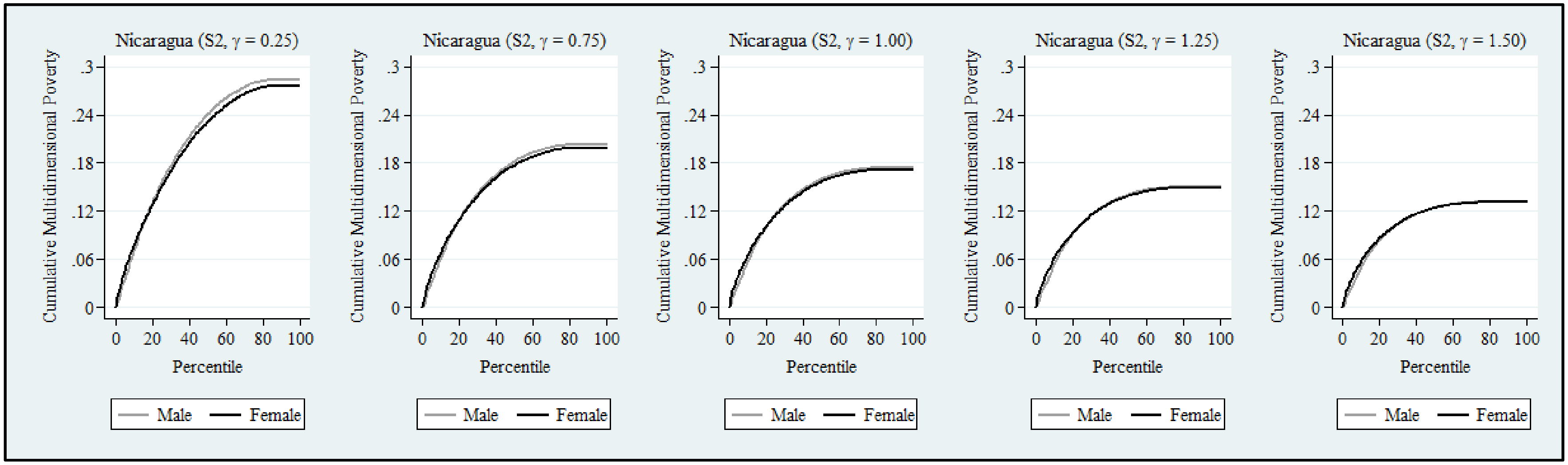


**Fig. A5.** Cumulative multi-dimensional poverty among adults in Honduras by gender and population percentile (the latter ordered from the poorest to the richest).
*Source:* Authors' estimates based on NIC-EMNV2014.
*Notes:* S2: Scenario 2. In each case, the overall estimated multi-dimensional poverty corresponds to the height of the curve at the vertical intercept at the 100th percentile. The incidence of multi-dimensional poverty corresponds to the length of the non-horizontal section of the curve (the percentile at which the curve becomes horizontal). The average multi-dimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the curve becomes horizontal. Inequality among the multi-dimensionally poor individuals is represented by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

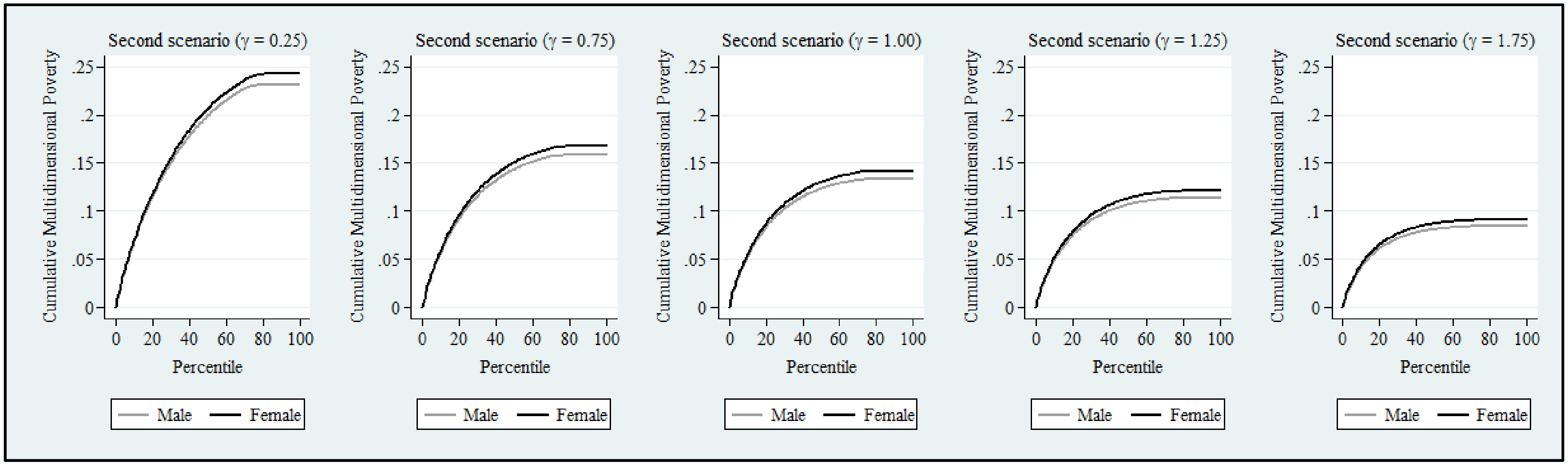


**Fig. A6.** Cumulative multi-dimensional poverty among adults in Central America as a whole, by gender and population percentile (the latter ordered from the poorest to the richest).

*Source:* Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

*Notes:* S2: Scenario 2. In each case, the overall estimated multi-dimensional poverty corresponds to the height of the curve at the vertical intercept at the 100th percentile. The incidence of multi-dimensional poverty corresponds to the length of the non-horizontal section of the curve (the percentile at which the curve becomes horizontal). The average multi-dimensional poverty among the poor is equal to the slope of the ray from (0, 0) to the point at which the curve becomes horizontal. Inequality among the multi-dimensionally poor individuals is represented by the degree of concavity of the non-horizontal section of the curve (Jenkins & Lambert, 1997).

**Table A9.** The three I's of multi-dimensional poverty by gender in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), Costa Rica (CR), and Central America (CA) as a whole, and gender differences, considering Scenario 1 and various degrees of inequality aversion.
*Source*: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

| **Country** | **Gender/Gap** | **Incidence** | **Intensity** | **Inequality component**: $\{1+[(\gamma+1)^2-(\gamma+1)]GE_{\gamma+1}(c)\}$ (several values of γ) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **H (%)** | **A (%)** | **0.25** | **0.50** | **0.75** | **1.00** | **1.25** | **1.50** | **1.75** | **2.00** |
| | Male | 89.1 | 38.6 | 1.0464 | 1.1088 | 1.1879 | 1.2850 | 1.4022 | 1.5421 | 1.7087 | 1.9056 |
| | Female | 89.7 | 37.4 | 1.0425 | 1.0998 | 1.1722 | 1.2605 | 1.3667 | 1.4937 | 1.6434 | 1.8183 |
| **GUA** | Absolute gap | *0.60**** | *-1.16**** | *-0.0038**** | *-0.0091**** | *-0.0158**** | *-0.0245**** | *-0.0355**** | *-0.0484**** | *-0.0653**** | *-0.0874**** |
| | Relative gap | *1.01* | *0.97* | *1.00* | *0.99* | *0.99* | *0.98* | *0.97* | *0.97* | *0.96* | *0.95* |
| | Total | 89.4 | 38.0 | 1.0444 | 1.1041 | 1.1799 | 1.2724 | 1.3846 | 1.5178 | 1.6763 | 1.8622 |
| | Male | 76.9 | 30.6 | 1.0602 | 1.1428 | 1.2499 | 1.3844 | 1.5511 | 1.7556 | 2.0057 | 2.3117 |
| | Female | 76.4 | 29.8 | 1.0556 | 1.1320 | 1.2310 | 1.3555 | 1.5089 | 1.6975 | 1.9277 | 2.2082 |
| **ELS** | Absolute gap | *-0.45**** | *-0.88**** | *-0.0046**** | *-0.0109**** | *-0.0189**** | *-0.0289**** | *-0.0422**** | *-0.0581**** | *-0.0779**** | *-0.1035**** |
| | Relative gap | *0.99* | *0.97* | *1.00* | *0.99* | *0.98* | *0.98* | *0.97* | *0.97* | *0.96* | *0.96* |
| | Total | 76.6 | 30.2 | 1.0578 | 1.1372 | 1.2400 | 1.3693 | 1.5295 | 1.7260 | 1.9658 | 2.2591 |
| | Male | 84.7 | 33.2 | 1.0550 | 1.1300 | 1.2269 | 1.3481 | 1.4975 | 1.6797 | 1.9034 | 2.1737 |
| | Female | 82.2 | 29.6 | 1.0556 | 1.1317 | 1.2298 | 1.3530 | 1.5056 | 1.6939 | 1.9235 | 2.2017 |
| **HON** | Absolute gap | *-2.49**** | *-3.57**** | *0.0006**** | *0.0016**** | *0.0029**** | *0.0050**** | *0.0081**** | *0.0142**** | *0.0201**** | *0.0280**** |
| | Relative gap | *0.97* | *0.89* | *1.00* | *1.00* | *1.00* | *1.00* | *1.01* | *1.01* | *1.01* | *1.01* |
| | Total | 83.3 | 31.3 | 1.0559 | 1.1323 | 1.2306 | 1.3548 | 1.5079 | 1.6963 | 1.9274 | 2.2082 |
| | Male | 87.7 | 38.9 | 1.0510 | 1.1193 | 1.2054 | 1.3107 | 1.4373 | 1.5879 | 1.7668 | 1.9765 |
| | Female | 85.4 | 36.1 | 1.0575 | 1.1350 | 1.2336 | 1.3549 | 1.5033 | 1.6813 | 1.8956 | 2.1510 |
| **NIC** | Absolute gap | *-2.28**** | *-2.79**** | *0.0064**** | *0.0157**** | *0.0282**** | *0.0442**** | *0.0660**** | *0.0934**** | *0.1289**** | *0.1745**** |
| | Relative gap | *0.97* | *0.93* | *1.01* | *1.01* | *1.02* | *1.03* | *1.05* | *1.06* | *1.07* | *1.09* |
| | Total | 86.5 | 37.5 | 1.0545 | 1.1274 | 1.2202 | 1.3341 | 1.4719 | 1.6373 | 1.8335 | 2.0661 |
| | Male | 57.6 | 22.4 | 1.0245 | 1.0589 | 1.1042 | 1.1619 | 1.2339 | 1.3240 | 1.4358 | 1.5698 |
| | Female | 56.6 | 22.4 | 1.0272 | 1.0650 | 1.1146 | 1.1774 | 1.2553 | 1.3514 | 1.4683 | 1.6119 |
| **CR** | Absolute gap | *-1.03**** | *0.04**** | *0.0026**** | *0.0061**** | *0.0103**** | *0.0155**** | *0.0214**** | *0.0273**** | *0.0325**** | *0.0421**** |
| | Relative gap | *0.98* | *1.00* | *1.00* | *1.01* | *1.01* | *1.01* | *1.02* | *1.02* | *1.02* | *1.03* |
| | Total | 57.0 | 22.4 | 1.0259 | 1.0621 | 1.1095 | 1.1699 | 1.2451 | 1.3382 | 1.4518 | 1.5927 |
| | Male | 81.7 | 34.8 | 1.0532 | 1.1258 | 1.2193 | 1.3362 | 1.4796 | 1.6536 | 1.8636 | 2.1172 |
| | Female | 81.1 | 33.2 | 1.0519 | 1.1228 | 1.2141 | 1.3279 | 1.4678 | 1.6379 | 1.8431 | 2.0900 |
| **CA** | Absolute gap | *-0.67**** | *-1.69**** | *-0.0012**** | *-0.0030**** | *-0.0052**** | *-0.0083**** | *-0.0118**** | *-0.0156**** | *-0.0206**** | *-0.0272**** |
| | Relative gap | *0.99* | *0.95* | *1.00* | *1.00* | *1.00* | *0.99* | *0.99* | *0.99* | *0.99* | *0.99* |
| | Total | 81.4 | 33.9 | 1.0526 | 1.1246 | 1.2172 | 1.3329 | 1.4749 | 1.6475 | 1.8562 | 2.1081 |

*Notes:* Survey weights used; H: The multi-dimensional headcount ratio; A: The average deprivation share. *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

**Table A10.** The three I's of multi-dimensional poverty by gender in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), Costa Rica (CR), and Central America (CA) as a whole, and gender differences, considering Scenario 2 and various degrees of inequality aversion.
*Source*: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

| **Country** | **Gender/Gap** | **Incidence** | **Intensity** | **Inequality component**: $\{1+[(\gamma+1)^2-(\gamma+1)]GE_{\gamma+1}(c)\}$ (several values of γ) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **H (%)** | **A (%)** | **0.25** | **0.50** | **0.75** | **1.00** | **1.25** | **1.50** | **1.75** | **2.00** |
| | Male | 89.1 | 38.7 | 1.0461 | 1.1082 | 1.1867 | 1.2830 | 1.4001 | 1.5392 | 1.7048 | 1.8998 |
| | Female | 90.7 | 40.3 | 1.0408 | 1.0960 | 1.1659 | 1.2519 | 1.3555 | 1.4785 | 1.6244 | 1.7960 |
| **GUA** | Absolute gap | *1.58**** | *1.53**** | *-0.0053**** | *-0.0122**** | *-0.0208**** | *-0.0310**** | *-0.0446**** | *-0.0607**** | *-0.0805**** | *-0.1038**** |
| | Relative gap | *1.02* | *1.04* | *0.99* | *0.99* | *0.98* | *0.98* | *0.97* | *0.96* | *0.95* | *0.95* |
| | Total | 89.9 | 39.6 | 1.0433 | 1.1015 | 1.1756 | 1.2661 | 1.3755 | 1.5063 | 1.6607 | 1.8430 |
| | Male | 76.9 | 30.7 | 1.0602 | 1.1425 | 1.2495 | 1.3837 | 1.5501 | 1.7542 | 2.0034 | 2.3087 |
| | Female | 82.1 | 36.4 | 1.0520 | 1.1233 | 1.2154 | 1.3305 | 1.4721 | 1.6445 | 1.8530 | 2.1041 |
| **ELS** | Absolute gap | *5.22**** | *5.74**** | *-0.0082**** | *-0.0192**** | *-0.0341**** | *-0.0531**** | *-0.0780**** | *-0.1097**** | *-0.1504**** | *-0.2046**** |
| | Relative gap | *1.07* | *1.19* | *0.99* | *0.98* | *0.97* | *0.96* | *0.95* | *0.94* | *0.92* | *0.91* |
| | Total | 79.8 | 33.9 | 1.0563 | 1.1335 | 1.2334 | 1.3591 | 1.5142 | 1.7035 | 1.9347 | 2.2155 |
| | Male | 84.9 | 33.3 | 1.0545 | 1.1288 | 1.2246 | 1.3445 | 1.4923 | 1.6742 | 1.8940 | 2.1614 |
| | Female | 83.0 | 30.7 | 1.0545 | 1.1290 | 1.2255 | 1.3467 | 1.4979 | 1.6833 | 1.9114 | 2.1891 |
| **HON** | Absolute gap | *-1.92**** | *-2.63**** | *0.0001* | *0.0002*** | *0.0009**** | *0.0021**** | *0.0057**** | *0.0091**** | *0.0175**** | *0.0277**** |
| | Relative gap | *0.98* | *0.92* | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* | *1.01* | *1.01* | *1.01* |
| | Total | 83.9 | 31.9 | 1.0548 | 1.1297 | 1.2266 | 1.3482 | 1.4986 | 1.6842 | 1.9096 | 2.1858 |
| | Male | 87.8 | 38.9 | 1.0508 | 1.1187 | 1.2046 | 1.3096 | 1.4355 | 1.5861 | 1.7637 | 1.9737 |
| | Female | 86.4 | 38.4 | 1.0558 | 1.1311 | 1.2275 | 1.3460 | 1.4907 | 1.6653 | 1.8760 | 2.1241 |
| **NIC** | Absolute gap | *-1.39**** | *-0.53**** | *0.0050**** | *0.0125**** | *0.0229**** | *0.0364**** | *0.0551**** | *0.0792**** | *0.1123**** | *0.1504**** |
| | Relative gap | *0.98* | *0.99* | *1.00* | *1.01* | *1.02* | *1.03* | *1.04* | *1.05* | *1.06* | *1.08* |
| | Total | 87.0 | 38.6 | 1.0535 | 1.1253 | 1.2166 | 1.3286 | 1.4645 | 1.6270 | 1.8216 | 2.0521 |
| | Male | 57.6 | 22.4 | 1.0247 | 1.0592 | 1.1048 | 1.1626 | 1.2351 | 1.3249 | 1.4366 | 1.5729 |
| | Female | 57.8 | 23.2 | 1.0286 | 1.0689 | 1.1217 | 1.1885 | 1.2721 | 1.3745 | 1.4998 | 1.6522 |
| **CR** | Absolute gap | *0.18**** | *0.80**** | *0.0040**** | *0.0097**** | *0.0169**** | *0.0259**** | *0.0370**** | *0.0496**** | *0.0633**** | *0.0793**** |
| | Relative gap | *1.00* | *1.04* | *1.00* | *1.01* | *1.02* | *1.02* | *1.03* | *1.04* | *1.04* | *1.05* |
| | Total | 57.7 | 22.8 | 1.0268 | 1.0645 | 1.1140 | 1.1769 | 1.2558 | 1.3529 | 1.4721 | 1.6181 |
| | Male | 81.8 | 34.9 | 1.0529 | 1.1252 | 1.2183 | 1.3343 | 1.4769 | 1.6501 | 1.8596 | 2.1109 |
| | Female | 82.9 | 36.0 | 1.0505 | 1.1197 | 1.2089 | 1.3204 | 1.4574 | 1.6235 | 1.8248 | 2.0662 |
| **CA** | Absolute gap | *1.04**** | *1.05**** | *-0.0024**** | *-0.0055**** | *-0.0095**** | *-0.0140**** | *-0.0195**** | *-0.0266**** | *-0.0349**** | *-0.0447**** |
| | Relative gap | *1.01* | *1.03* | *1.00* | *1.00* | *0.99* | *0.99* | *0.99* | *0.98* | *0.98* | *0.98* |
| | Total | 82.4 | 35.5 | 1.0517 | 1.1223 | 1.2133 | 1.3270 | 1.4666 | 1.6361 | 1.8409 | 2.0874 |

*Notes:* Survey weights used; H: The multi-dimensional headcount ratio; A: The average deprivation share. *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.

**Table A11.** The three I's of multi-dimensional poverty by gender in Guatemala (GUA), El Salvador (ELS), Honduras (HON), Nicaragua (NIC), Costa Rica (CR), and Central America (CA) as a whole, and gender differences, considering Scenario 3 and various degrees of inequality aversion.
*Source*: Authors' estimates based on GUA-ENCOVI2014, ELS-EHPM2016, HON-EPHPM2013, NIC-EMNV2014, and CR-ENAHO2016.

| **Country** | **Gender/Gap** | **Incidence** | **Intensity** | **Inequality component**: $\{1+[(\gamma+1)^2-(\gamma+1)]GE_{\gamma+1}(c)\}$ (several values of γ) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **H (%)** | **A (%)** | **0.25** | **0.50** | **0.75** | **1.00** | **1.25** | **1.50** | **1.75** | **2.00** |
| **GUA** | Male | 89.2 | 38.9 | 1.0459 | 1.1076 | 1.1859 | 1.2821 | 1.3976 | 1.5360 | 1.7007 | 1.8948 |
| | Female | 92.5 | 47.6 | 1.0390 | 1.0913 | 1.1570 | 1.2367 | 1.3316 | 1.4438 | 1.5744 | 1.7266 |
| | Absolute gap | *3.36**** | *8.78**** | *-0.0068**** | *-0.0163**** | *-0.0289**** | *-0.0454**** | *-0.0660**** | *-0.0923**** | *-0.1264* | *-0.1682**** |
| | Relative gap | *1.04* | *1.23* | *0.99* | *0.99* | *0.98* | *0.96* | *0.95* | *0.94* | *0.93* | *0.91* |
| | Total | 91.0 | 43.6 | 1.0434 | 1.1017 | 1.1754 | 1.2655 | 1.3739 | 1.5026 | 1.6539 | 1.8322 |
| **ELS** | Male | 76.9 | 30.7 | 1.0602 | 1.1425 | 1.2495 | 1.3837 | 1.5501 | 1.7542 | 2.0034 | 2.3087 |
| | Female | 82.1 | 36.4 | 1.0520 | 1.1233 | 1.2154 | 1.3305 | 1.4721 | 1.6445 | 1.8530 | 2.1041 |
| | Absolute gap | *5.22**** | *5.74**** | *-0.0082**** | *-0.0192**** | *-0.0341**** | *-0.0531**** | *-0.0780**** | *-0.1097**** | *-0.1504**** | *-0.2046**** |
| | Relative gap | *1.07* | *1.19* | *0.99* | *0.98* | *0.97* | *0.96* | *0.95* | *0.94* | *0.92* | *0.91* |
| | Total | 79.8 | 33.9 | 1.0563 | 1.1335 | 1.2335 | 1.3590 | 1.5140 | 1.7036 | 1.9343 | 2.2148 |
| **HON** | Male | 85.2 | 33.3 | 1.0542 | 1.1282 | 1.2234 | 1.3429 | 1.4902 | 1.6705 | 1.8898 | 2.1558 |
| | Female | 85.4 | 35.5 | 1.0532 | 1.1261 | 1.2207 | 1.3391 | 1.4857 | 1.6649 | 1.8833 | 2.1486 |
| | Absolute gap | *0.28**** | *2.18**** | *-0.0010**** | *-0.0021**** | *-0.0028**** | *-0.0039**** | *-0.0044**** | *-0.0056**** | *-0.0064**** | *-0.0073**** |
| | Relative gap | *1.00* | *1.07* | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* |
| | Total | 85.3 | 34.5 | 1.0538 | 1.1274 | 1.2226 | 1.3423 | 1.4898 | 1.6706 | 1.8914 | 2.1582 |
| **NIC** | Male | 87.8 | 39.0 | 1.0506 | 1.1183 | 1.2037 | 1.3080 | 1.4331 | 1.5831 | 1.7601 | 1.9678 |
| | Female | 88.5 | 43.2 | 1.0547 | 1.1288 | 1.2230 | 1.3393 | 1.4807 | 1.6508 | 1.8542 | 2.0956 |
| | Absolute gap | *0.72**** | *4.20**** | *0.0041**** | *0.0105**** | *0.0193**** | *0.0313**** | *0.0475**** | *0.0678**** | *0.0941**** | *0.1278**** |
| | Relative gap | *1.01* | *1.11* | *1.00* | *1.01* | *1.02* | *1.02* | *1.03* | *1.04* | *1.05* | *1.06* |
| | Total | 88.2 | 41.2 | 1.0534 | 1.1254 | 1.2168 | 1.3298 | 1.4667 | 1.6310 | 1.8268 | 2.0620 |
| **CR** | Male | 57.8 | 22.5 | 1.0248 | 1.0595 | 1.1053 | 1.1635 | 1.2367 | 1.3264 | 1.4403 | 1.5757 |
| | Female | 64.0 | 27.6 | 1.0315 | 1.0751 | 1.1315 | 1.2016 | 1.2872 | 1.3901 | 1.5131 | 1.6578 |
| | Absolute gap | *6.21**** | *5.10**** | *0.0066**** | *0.0156**** | *0.0263**** | *0.0381**** | *0.0504**** | *0.0637**** | *0.0729**** | *0.0821**** |
| | Relative gap | *1.11* | *1.23* | *1.01* | *1.01* | *1.02* | *1.03* | *1.04* | *1.05* | *1.05* | *1.05* |
| | Total | 61.0 | 25.2 | 1.0305 | 1.0732 | 1.1292 | 1.2000 | 1.2878 | 1.3950 | 1.5246 | 1.6819 |
| **CA** | Male | 81.9 | 35.0 | 1.0527 | 1.1248 | 1.2175 | 1.3334 | 1.4753 | 1.6477 | 1.8559 | 2.1069 |
| | Female | 85.1 | 40.8 | 1.0498 | 1.1177 | 1.2048 | 1.3130 | 1.4453 | 1.6044 | 1.7954 | 2.0238 |
| | Absolute gap | *3.20**** | *5.86**** | *-0.0030**** | *-0.0071**** | *-0.0127**** | *-0.0204**** | *-0.0300**** | *-0.0433**** | *-0.0604**** | *-0.0830**** |
| | Relative gap | *1.04* | *1.17* | *1.00* | *0.99* | *0.99* | *0.98* | *0.98* | *0.97* | *0.97* | *0.96* |
| | Total | 83.6 | 38.2 | 1.0519 | 1.1230 | 1.2145 | 1.3286 | 1.4684 | 1.6383 | 1.8429 | 2.0885 |

*Notes:* Survey weights used; H: The multi-dimensional headcount ratio; A: The average deprivation share. *Significance levels:* *p < 0.1; **p < 0.05; ***p < 0.01.