WIDER Working Paper 2020/69

Evolution of multidimensional poverty in crisis-ridden Mozambique

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June 2020

Abstract: Mozambique experienced important reduction in the poverty rate until recently, before two major natural disasters hit and the country started suffering from a hidden debt scandal with associated economic slowdown. As the last available national household expenditure survey is from 2014/15, just before these crises unfolded, there is need for a poverty assessment based on alternative data sources, especially since the COVID-19 crisis is now hitting the country. In this paper, we study the evolution of multidimensional poverty in Mozambique using the Demographic and Health Surveys/Malaria Indicator Survey data. Using both the standard Alkire–Foster multidimensional poverty index and the first-order dominance (FOD) method, we find that the poverty reduction trend observed between 2009–11 and 2015 halted between 2015 and 2018. Meanwhile, the number of poor people increased, mainly in rural areas and in the central provinces. Importantly, the poorest provinces did not improve their rankings over time, and between 2015 and 2018, no progress took place for most areas and provinces, as measured by the FOD approach.

Key words: first-order dominance, Mozambique, multidimensional poverty, multidimensional poverty index

JEL classification: I32

Acknowledgements: The authors are grateful to the participants of the Inclusive Growth in Mozambique annual conference, Maputo, November 2019, for the comments and suggestions provided.

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This study has been prepared within the project on Inclusive growth in Mozambique—scaling-up research and capacity implemented in collaboration between UNU-WIDER, University of Copenhagen, University Eduardo Mondlane, and the Mozambican Ministry of Economics and Finance. The project is financed through specific programme contributions by the governments of Denmark, Finland, and Norway.

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ISSN 1798-7237 ISBN 978-92-9256-826-9

https://doi.org/10.35188/UNU-WIDER/2020/826-9

Typescript prepared by Ayesha Chari.

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The Institute is funded through income from an endowment fund with additional contributions to its work programme from Finland, Sweden, and the United Kingdom as well as earmarked contributions for specific projects from a variety of donors.

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1 Introduction

Prior to the 2014/15 Household Budget Survey, Mozambique managed to reduce both consumption and multidimensional poverty during a period of sustained economic growth that spanned different sectors of the economy (DEEF 2016). Strong economic recovery during the 1990s and into the 2000s from the extremely dismal conditions that prevailed following the war that tormented the country during previous decades forms part of the Mozambican experience. However, it is not the full story as gains from 2008 onwards show. However, there is reason to suggest that starting during the second half of 2015, the poverty reduction trend may have flattened out due to the various crises that started hitting the country, thwarting the hopes for continued progress. A key question addressed here is the extent to which this has occurred and whether poverty conditions may have even worsened.

A sharp drop in commodity prices, weakened international demand due to economic crises, a series of severe weather shocks, increasing violence against civilians in the northern region, and the hidden debt scandal[1] clearly resulted in a significant economic slowdown and a currency devaluation, all suggesting strong impacts on poverty. All of this occurred in a period of a few years just after the last poverty national assessment in 2014/15. While Mambo et al. (2018) employed a price simulation approach to assess plausible changes in consumption poverty, we wish to contribute to a more comprehensive and updated assessment, noting that the onset of the COVID-19 crisis adds further challenges.

Accordingly, in this paper, we attempt to measure changes in multidimensional poverty during this crisis-ridden period. We make use of the most recent nationally representative available household data, that is, the Demographic and Health Surveys/Malaria Indicator Survey 2018 (henceforth, DHS/MIS 2018) data. In contrast to Mambo et al. (2018), we measure the change in multidimensional poverty using actual data and employ as reference the Demographic and Health Surveys available from previous years. These data are not directly comparable to the 2014/15 Household Budget Survey data although some appraisals are feasible when due care is exercised. Moreover, with respect to the multidimensional measures, data issues regarding the individual indicators tend to be more straightforward than dealing with consumption data. Indeed, the indicators employed for multidimensional analyses are relatively easy to observe.

We proceed to calculate the multidimensional poverty index (MPI) following Alkire and Foster (2011) as well as employing the more recent first-order dominance (FOD) method (Arndt et al. 2016). The latter does not impose a specific threshold to define households as poor. Instead, it uses multiple comparisons to assess which sub-population is better off than another one.

Our findings suggest that poverty reduction did not only slow down during the 2015–18 period. In fact, both methods reveal that the poverty reduction trend observed between 2009–11 and 2015 decelerated rapidly, and the poorest provinces have generally not improved their rankings over time. Moreover, the percentage of people with zero deprivations only slightly increased between 2015 and 2018, whereas the percentage of people with the maximum number of deprivations reduced modestly at national level and it actually increased in urban areas, even if only slightly. Also, the estimated probability of advancement between 2015 and 2018, as measured by the temporal FOD approach, is practically zero for most areas and provinces. These results point to a troubling intensification of poverty when absolute numbers of people are considered. Due to the

[1] See MNRC (2017a, 2017b).

sustained population growth, we estimate that the number of multidimensionally poor people increased by approximately one million people in the period 2015–18, from about 21.3 to about 22.2 million people, mainly located in the rural areas of the central provinces.

Furthermore, we find that the changes in poverty are driven by changes in durable asset ownership. While housing characteristics or infrastructure such as electricity or sanitation are less likely to be removed, it appears that households own fewer durable assets leading to higher deprivation scores. This aligns with the literature showing how in times of crisis assets are more frequently or more easily depleted to sustain consumption (among others, see Dercon 2005; Tschirley et al. 2006; Ellis et al. 2009; Lawson and Kasirye 2013; Groover et al. 2015; Baez et al. 2018). We do not claim to have established strict causality from the economic crisis to the poverty estimates presented here. The complexity of the various factors contributing to the crisis and their variation in local or national impacts make that goal unrealistic at this point. However, establishing a set of updated poverty estimates (ex-ante from the perspective of the COVID-19 crisis) does contain suggestive implications for the difficulties faced in promoting an inclusive growth path in Mozambique and the indisputable need for policy focus.

The paper proceeds as follows. We describe the context in Section 2 before presenting the data in Section 3 and the methodology in Section 4; Section 5 contains the results; and Section 6 discusses the results and concludes.

2 Context

After emerging from a devastating and prolonged conflict during the 1980s and the early 1990s, Mozambique experienced sustained economic growth. This led the country to having one of the best economic performances in the region. The most recent 2014/15 poverty assessment available for Mozambique (DEEF 2016) presented positive results in terms of poverty reduction and welfare improvements over a period of about 20 years (1996/97–2014/15). In international comparative perspective, the gains registered by Mozambique over the 18-year span covered by the surveys in reference are notable. The consumption poverty headcount fell by about 25 points. International comparisons for the multidimensional measures are also very favourable.

Consumption poverty estimates from 2014/15 suggest that 46.1 per cent of the Mozambican population were poor from a consumption point of view, with huge differences depending on the province and urban/rural location. This represents a reduction compared with 2008/09, when 51.7 per cent of the Mozambican population were poor (DEEF 2016).

Likewise, the incidence of multidimensional poverty, calculated using the Alkire–Foster method for the period 1996/97–2014/15, followed a decreasing trend, as shown in Table 1. The multidimensional poverty incidence was 55 per cent in 2014/15, clearly at a lower level than in 2008/09 and 1996/97. The same table shows variations by areas/province, with multidimensional poverty being worse for the northern and central regions of the country and for rural areas (Table 1).[2]

[2] We estimated the consumption aggregate based on the cost of basic needs methodology, and the poverty measures belonging to the Foster et al. (1984) classes were subsequently applied. For multidimensional poverty, the Alkire–Foster method was applied, taking into account six well-being indicators, with equal weighting, grouped into four dimensions: (i) education, (ii) health determinants, (iii) housing conditions, and (iv) durable goods (DEEF 2016). For more information on the Alkire–Foster method, see Alkire and Foster (2011) and Alkire et al. (2015).

Table 1: Multidimensional poverty incidence, *H*, and multidimensional poverty index (MPI), M^0, 1996/97–2014/15

	H (%)				M^0			
	1996/97	2002/03	2008/09	2014/15	1996/97	2002/03	2008/09	2014/15
National	85.7	75.7	69.3	54.8	0.771	0.660	0.586	0.449
Urban	50.2	41.2	31.4	18.1	0.397	0.323	0.251	0.142
Rural	95.2	92.1	85.9	71.9	0.872	0.819	0.732	0.593
North	95.3	86.8	81.3	67.8	0.872	0.769	0.693	0.566
Centre	92.5	83.8	80.3	63.6	0.851	0.746	0.685	0.521
South	64.0	48.4	33.0	18.8	0.531	0.380	0.261	0.141
Niassa	94.6	89.1	76.8	72.8	0.870	0.774	0.631	0.598
Cabo Delgado	97.3	89.9	83.3	63.6	0.873	0.796	0.701	0.523
Nampula	94.7	84.8	81.8	67.9	0.872	0.756	0.709	0.572
Zambézia	96.2	92.3	87.6	74.7	0.905	0.842	0.764	0.627
Tete	94.5	89.1	85.3	67.5	0.872	0.792	0.709	0.550
Manica	89.1	69.9	75.6	49.7	0.794	0.595	0.624	0.387
Sofala	86.0	70.8	61.6	46.3	0.765	0.607	0.522	0.363
Inhambane	83.1	81.5	60.3	43.5	0.724	0.673	0.495	0.329
Gaza	79.4	52.3	47.1	22.8	0.660	0.406	0.366	0.169
Maputo Province	73.3	37.9	17.6	7.1	0.593	0.274	0.130	0.052
Maputo City	18.4	12.7	2.8	0.7	0.127	0.087	0.019	0.004

Note: the multidimensional poverty incidence (*H*) and the MPI (M^0) are computed using the Alkire–Foster method.

Source: authors' computation based on DEEF (2016).

The conclusion that poor households saw welfare improvements from 1996/97 to 2014/15 becomes stronger when we take account of the number of dimensions in which households are considered deprived for each of the surveys at the national level. Six indicators (education, water, sanitation, roofing, electricity, and possession of durable goods) are included and it appears that in 1996/97 nearly half the population lived in a household deprived in all dimensions. These households were characterized by (i) not one member having completed first-level primary school, (ii) no access to safe water, (iii) inadequate sanitation, (iv) grass roofing, (v) no electricity, and (vi) very limited possession of durable goods. Furthermore, only two per cent of the population lived in a household where all of these basics were present (zero deprivation). This dire situation consistently improved until 2014/15, where less than 15 per cent of the population was deprived in all dimensions and more than 15 per cent were in households with zero deprivation.

Following the years of favourable growth, various factors contributed to an economic downturn that started in 2015 just after the last national poverty assessment was complete. A few factors contributed to weakening the economy, including a reduction in the prices of some of the most important exported goods (e.g. coal and gas) in combination with weaker international demand resulting from the economic crises in Europe, South Africa, and other key trading partners. To this came a series of weather shocks that hit Mozambique after 2015, causing huge damage and distress in various areas of the country. Furthermore, violent attacks started occurring in the northern province of Cabo Delgado in late 2017, partially claimed by Islamist groups, with other unknown actors also involved. The attacks often target villages and thus create insecurity and displacement for the local population. Nonetheless, it is likely that the factor that most contributed to the intensification of the effects of the crisis was the issuance of the state-guaranteed hidden debt (MNRC 2017a).[3] As a consequence, (i) the International Monetary Fund suspended its support to the country; and (ii) foreign aid and direct state budget support by development partners—which had already been on a downward trajectory—were further reduced and

[3] Five loans were organized by the banks Credit Suisse and VTB: two issues of public bonds for EMATUM and three loans for MAM and PROINDICUS (MNRC 2017b).

suspended, creating significant problems for the management of public finances by drastically reducing the fiscal space (see World Bank 2018).

The combination of these factors led to deep deceleration in the gross domestic product growth rate, a first slowdown in 2015 and a second one, relatively bigger, in 2016 (see INE 2017; World Bank 2018). A rapid and significant depreciation of the national currency—the metical—followed with consequent increases in the prices of imported goods, causing an upsurge in domestic prices by around 40 per cent between August 2014 and December 2016 (INE 2017). This and the further reduction in foreign aid resulted in very limited fiscal space for price stabilization policies. Indeed, Mozambique is strongly dependent on imported goods, even those of first necessity (UNSD 2017). Moreover, the prices of food products, and especially basic food products, increased much more than the prices of non-food products. Mambo et al. (2018) analysed the consequences in terms of consumption poverty, suggesting a steep rise in consumption poverty resulted because of the food price spike. There is, however, no up-to-date analysis of actual data from more recent years to assess the potential impacts of the economic crises referred to on poverty.[4]

3 Data

In this study, we use four sets of Mozambican data, all obtained from the DHS data repository: (i) DHS/AIDS Indicator Survey (AIS) 2009, (ii) DHS 2011, (iii) DHS/AIS 2015, and (iv) DHS/MIS 2018. As the denomination makes clear, these databases focus on demographic and health indicators: the DHS is more general, the DHS/AIS focuses more on HIV/AIDS-related issues, whereas the DHS/MIS addresses malaria issues. The Ministry of Health (*Ministério da Saúde*, MISAU), the National Institute of Health (*Instituto Nacional de Saúde*, INS), the National Institute for Statistics (*Instituto Nacional de Estatística*, INE) and ICF International produce all this data (see MISAU et al. 2010, 2013, 2016; INS and ICF International 2019). Descriptive statistics for each of the four survey databases are in Table 2. All datasets are representative at the national and provincial levels, allowing for comparisons at these levels over time.

Table 2: Basic information on the survey data used in the analysis

Survey	Year	Households sample	Male sample	Female sample	Fieldwork
DHS/AIS	2009	6,097	All men Age: 15–64 years Sample size: 4,799	All women Age: 15–64 years Sample size: 6,413	June 2009–September 2009
DHS	2011	13,919	All men Age: 15–64 years Sample size: 4,035	All women Age: 15–49 years Sample size: 13,745	June 2011–November 2011
DHS/AIS	2015	7,169	All men Age: 15–59 years Sample size: 5,283	All women Age: 15–59 years Sample size: 7,749	May 2015–September 2015
DHS/MIS	2018	6,196	No male respondents	All women Age: 15–49 years Sample size: 6,184	April 2018–June 2018

Source: authors' computation based on DHS (2020).

The databases used in the present analysis do not provide information on consumption, so we cannot use them to directly estimate the evolution of consumption poverty. Yet, they do contain a great deal of information on various indicators of well-being. Therefore, they can be used to

[4] That is up until the onset of the COVID-19 crisis.

assess the evolution of multidimensional poverty over the period of interest applying the same method as in the 4th National Poverty Assessment (DEEF 2016).

4 Methodology

The methodology implemented here consists of four steps: (i) selection of the well-being indicators available in the four databases; (ii) analysis of the temporal trend of deprivation in each of the selected indicators; (iii) aggregation of the information in the form of a MPI, using the Alkire–Foster approach; and (iv) analysis of multidimensional poverty using an alternative methodology for multidimensional deprivation assessment, based on FOD. Each step is described in what follows

First, we made the selection of indicators based on the existing literature on multidimensional poverty assessment and on the availability of well-being indicators in the four surveys. With respect to the literature, we mainly used as a reference the welfare dimensions and indicators found in the global MPI (UNDP and OPHI 2019).[5] However, not all the indicators were available in the surveys mentioned. In particular, the indicators included by the Oxford Poverty and Human Development Initiative (OPHI) in the dimensions of health and education were not available in most of the surveys considered and as a consequence we ended up with a shorter list of indicators, corresponding to the dimension defined as "living standards" in the global MPI 2019. We thus selected cooking fuel, sanitation, drinking water, electricity, housing, and assets.

The definitions for these indicators closely reflect the definitions in UNDP and OPHI (2019), with very small changes due to the unavailability of a few variables in some or all of the surveys considered. Regarding cooking fuel, a household is considered deprived if it cooks with dung, agricultural crop, shrubs, wood, charcoal, or coal. With respect to sanitation, the household is deprived if its sanitation facility is not improved [according to sustainable development goal (SDG) guidelines] or if it is improved but shared with other households. A household is deprived with respect to drinking water if the household does not have access to improved drinking water (according to SDG guidelines) or safe drinking water is at least a 30-minute walk from home (as a roundtrip).[6] Moreover, a household is deprived in electricity if it has no electricity. Regarding housing, the household is considered as having inadequate housing if the floor is made of natural materials or the roof or walls are made of rudimentary materials. With respect to assets, the household is classified as deprived if it does not own more than one of the following assets: radio, television, telephone, computer, animal cart, bicycle, motorbike, or refrigerator, and does not own a car or truck.[7] The definitions for the indicators chosen and the weights assigned are in Table 3.

[5] For a more detailed and updated description of the indicator definitions, see Alkire et al. (2019a, 2019b)

[6] The variable with the time to drinking water facilities was not available in the 2009 survey, so we predicted the values for this variable using the 2011 DHS survey and regressing the time to water on a series of household and geographic characteristics (household head age and gender, household size, month of interview, province and urban/rural dummies, dummies for type of water source and type of roof, access to electricity, owning a car or a truck, owning a mobile phone, and owning a watch).

[7] In the original formulation by the Oxford Poverty and Human Development Initiative (OPHI), the household is classified as deprived with respect to assets if it does not own more than one of these assets: radio, television, telephone, computer, animal cart, bicycle, motorbike, or refrigerator, and does not own a car or truck. However, in the surveys considered, the information on possession of a computer is not consistently available, so we excluded this item from the analysis. The impact on the results will be minimal given the very low percentage of Mozambicans owning a computer, as recorded in other household surveys.

Table 3: Dimensions, indicators, deprivation definitions, and weights

Dimension of poverty	MPI indicator	Deprived if …	Weight
Living standards	Cooking fuel	A household cooks with dung, agricultural crop, shrubs, wood, charcoal, or coal	1/6
	Sanitation	A household's sanitation facility is not improved (according to SDG guidelines) or it is improved but shared with other households	1/6
	Drinking water	A household does not have access to improved drinking water (according to SDG guidelines) or safe drinking water is at least a 30-minute walk from home (as a roundtrip)	1/6
	Electricity	A household has no electricity	1/6
	Housing	A household has inadequate housing: the floor is made of natural materials or the roof or walls are made of rudimentary materials	1/6
	Assets	A household does not own more than one of these assets: radio, television, telephone, computer, animal cart, bicycle, motorbike, or refrigerator, and does not own a car or truck	1/6

Notes: MPI = multidimensional poverty index. A household is considered to have access to improved sanitation if it has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, provided they are not shared. A household has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring or rainwater; and safe drinking water is at most a 30-minute walk from home (as a roundtrip). A household is deprived in housing if the floor is made of mud/clay/earth, sand, or dung; or if the dwelling has no roof or walls or if either the roof or walls are constructed using natural materials such as cane, palm/trunks, sod/mud, dirt, grass/reeds, thatch, bamboo, sticks, or rudimentary materials such as carton, plastic/polythene sheeting, bamboo with mud/stone with mud, loosely packed stones, adobe not covered, raw/reused wood, plywood, cardboard, unburnt brick, or canvas/tent.

Source: authors' adaptation from Alkire et al. (2019b).

As noted, we apply two distinct methods for evaluating multidimensional poverty using the indicators identified. First, we apply the Alkire–Foster method for deriving an MPI (Alkire and Foster 2011). This approach applies weights to a series of binary welfare indicators where we divide the population into those considered deprived and those not deprived for each indicator. For example, in the analysis presented here, a household is deprived in its access to safe water if its source of drinking water is an unprotected well, a protected or unprotected spring, a river/dam/lake/pond/stream/canal or other unspecified sources. This indicator is given a weight of 1/6 (see last column in Table 3). Households that are deprived in indicators/dimensions whose weights sum to a value greater than a cut-off (0.40; i.e. three or more out of the six selected indicators) are considered poor.[8] This multidimensional poverty headcount is then combined with a measure of distance below the cut-off to account for the fact that households deprived in dimensions summing to a weight of 0.40 are worse off than those summing to a weight of 0.20. The product of the headcount and the distance measure is the Alkire–Foster MPI. There is no theoretical guidance on the weights and cut-offs to be applied. We chose equal weights for all indicators (1/6), and the 0.4 cut-off corresponds to being deprived in at least three out of the six indicators.[9]

Second, we apply a relatively recent method based on the concept of FOD.[10] This approach relies on the proposition that not being deprived is better than being deprived. With multiple binary indicators, it is possible to identify states that are demonstrably better (i.e. not deprived in all dimensions) and states that are demonstrably worse (i.e. deprived in all dimensions). Using

[8] We also present in Section 5.2 results with different cut-offs for robustness.

[9] The global MPI 2019 uses 33.3 per cent (or 1/3 of the weighted welfare indicators) as cut-off, but in Mozambique this cut-off appears very low given the widespread levels of deprivation. Multidimensional poverty results obtained using a cut-off of 33.3 per cent have been computed and are shown in Figure 6.

[10] For a description of the method and application to the Mozambican and other countries' cases, see Arndt et al. (2012, 2016) and Arndt and Tarp (2017).

bootstrap methods, it is possible to derive a probability that a population is trending towards unambiguously better states. These methods rely on essentially the same data in complementary ways. The Alkire–Foster method has been widely used across Sub-Saharan Africa and beyond and is simple to apply; however, as noted, it requires an explicit, arbitrarily assigned weight associated with each dimension as well as assumptions regarding cut-off point, which separates poor from non-poor households. The FOD approach has been less widely used and is somewhat less straightforward to apply/interpret; however, it does not require any assumptions with respect to the relative importance of the different dimensions of well-being.

As Arndt et al. (2016: 6) put it, 'the FOD criterion, in specific, corresponds to what in probability theory is referred to as the *usual* (*stochastic*) *order* (Lehmann 1955)'. This implies that the FOD approach does not depend on arbitrarily applying a weighting scheme and cut-offs (Arndt et al. 2012). It simply assumes that not being deprived is better than being deprived for any considered dimension.

To illustrate the intuition of FOD, let us suppose that we have data for five binary welfare indicators on populations A and B, and that we wish to determine whether population A is unambiguously better off than population B based on these indicators. The respective populations can be divided into $2^5=32$ different possible states corresponding to whether they are deprived or not deprived in the various dimensions. Obviously, those not deprived in any dimension are best off and those deprived in all dimensions are worst off. If we define 0 as deprived and 1 as not deprived, then the state (0,1,1,0,0) is unambiguously better than (0,0,1,0,0) because the former state is always at least equivalent and is better than the latter in one instance. However, the states (1,0,1,0,0) and (1,1,0,0,0) are indeterminate because each state is better than the other in one dimension, and the state (1,1,0,1,1) is not unambiguously better than the state (0,0,1,0,0) because no judgement is made as to the relative importance of dimension three versus all other dimensions. Formally, population A first-order dominates population B if one can generate the shares of the population in each state in population B by shifting probability mass within population A to states that are unambiguously worse (for a generalization of the methodology and a more formal presentation, see Arndt et al. 2012, 2016; Arndt and Tarp 2017). Following Copeland (1951), complete welfare rankings of regions can be generated by, for example, counting the number of times a given region dominates other regions and subtracting the number of times the same region is dominated by other regions generating a score in the interval [−99,99]. Regions can then be naturally ranked with higher scores superior to lower scores and a Copeland index can be defined where all scores are normalized to fall in the interval [−1,1].

To help overcome the issue of indeterminate comparisons, suppose that neither A nor B dominates the other, and that on net A dominates 20 other regions, while B dominates negative one (i.e. the total number of regions that dominate B is one larger than the number of regions that B dominates). Then, it is sensible to rank A above B as in the Copeland index. Moreover, and importantly, it is also possible to use the FOD criterion to determine whether welfare has unambiguously been improving through time. The comparison of each region with itself at a different point in time naturally yields only one comparison pair, but use of bootstrapping can help to mitigate the two disadvantages associated with the FOD approach through the generation of multiple comparisons (Arndt et al. 2012). Failure to advance through time implies that the distributional changes observed over time do not represent an unequivocal improvement over conditions that existed in the past. The FOD approach requires progress across all indicators and across the range of the welfare distribution (i.e. also progress for the poorest is required; for details see Arndt et al. 2012, 2016; Arndt and Tarp 2017).

It is important to highlight that consistency between the FOD and Alkire–Foster methods is not automatic. The FOD criteria are strict. While Alkire–Foster permits rapid progress in one indicator to overcome declines in another indicator, the FOD does not. The same is true for population subgroups. With Alkire–Foster, rapid progress near the 0.40 cut-off point can overcome welfare declines for poorer groups. This is not the case for FOD. To register progress, FOD demands progress in all indicators and across all population subgroups (defined by the distribution of deprivations).

Results from the FOD analysis contained in DEEF (2016) showed that at the national level, the probability of advance is one (or 100 per cent) for all period pairs considered with the notable exception of the 2002/03–2008/09 period where the probability of advance fell to 0.68. Due to the strict nature of the FOD criteria combined with the effects of sample size, probabilities of advance tend to decline when the data are disaggregated by zone or region (and the sample size is commensurately much smaller). In terms of distribution of gains, the FOD approach is focused on whether or not there exists unambiguous improvement. In what follows, we will see that the results with respect to probability of advancement during recent years is inferior to what was found in DEEF (2016) for the period 2008/09–2014/15.

5 Results

In this section, we present our main results regarding the temporal trends for each welfare indicator, the creation of the MPI following the Alkire–Foster approach, and the multidimensional deprivation results obtained using the FOD methodology.

5.1 Descriptive statistics

In Figure 1, we introduce the proportion of individuals not deprived in each welfare dimension and the underlying indicators. Some welfare indicators had relatively low deprivation levels already in 2009 (water, assets), whereas sanitation, electricity, housing, and especially cooking presented much higher deprivation levels: the proportion of individuals not deprived is around 0.15 and 0.20 in 2009 and around 0.25 and 0.35 in 2018 for sanitation, electricity, and housing, whereas it is always below 0.05 for cooking.

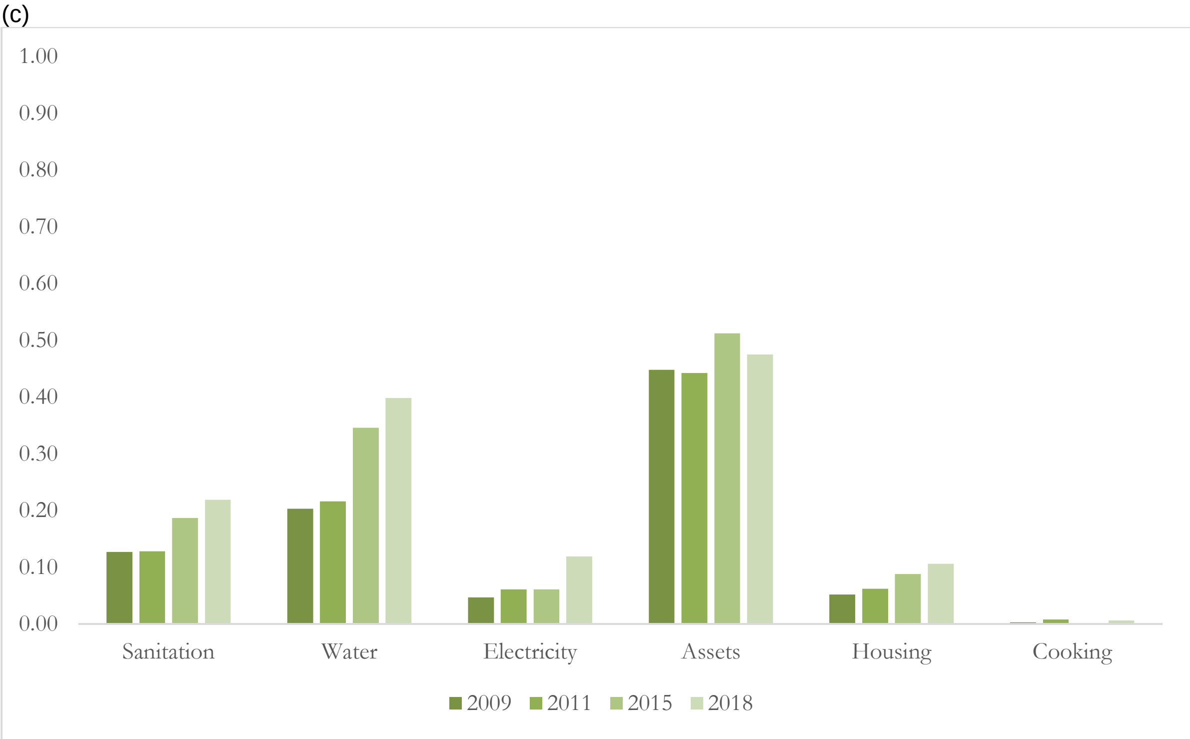
We observe improvement over time for most welfare indicators. However, the trends vary among the indicators. Access to safe water increased notably between 2011 and 2015, but improved only slightly in subsequent years. With respect to sanitation, electricity, and housing, deprivation in these indicators steadily decreased between 2009 and 2018. The assets indicator shows a modest improvement between 2009 and 2011 followed by a significant increase in 2015 and a decrease in the proportion of individuals not deprived in this indicator in 2018. Even though the proportion of individuals owning a car, a motorbike, a refrigerator, or a mobile phone increased, there was a decrease in the proportion of individuals owning a bike or a radio, which explains the slight decrease in assets in 2018. With respect to cooking, this is the welfare indicator showing the highest levels of deprivation. While the proportion of individuals not deprived in cooking doubled between 2009 and 2018, it did not exceed 0.05 at national level.

Figure 1: Proportion of non-deprived individuals for the selected welfare indicators: (a) national, (b) urban, and (c) rural levels, 2009–18

(a)

(b)

(c)



Note: population weights are applied.

Source: authors' computations.

Substantial differences also emerge when the deprivation indicators are broken down to the urban and rural levels. In particular, rural households are on average more deprived than urban ones in all the welfare indicators and differences are sometimes substantial. Moreover, the deprivation gap between rural and urban areas increased over time for all indicators, except for access to safe water and for electricity in more recent years (Figure 2). Even though urban areas are less deprived than rural ones, it is at urban level that we observe stagnating or slightly worsening conditions with respect to three out of six indicators in the period 2015–18 (water, electricity, and assets). Conversely, rural areas experienced a non-negligible improvement in sanitation, water, and electricity, either starting in 2015 or 2018. At regional level, we also observe large differences in all welfare indicators between the northern and central regions and the south. In particular, the north and the centre show much higher levels of deprivation in all indicators and in all years. Excluding sanitation, for all the other welfare indicators the gap between the south and the other two regions increases in the period 2015–18. We present urban–rural gaps and south–north and south–centre gaps in Figures 2 and 3, respectively.

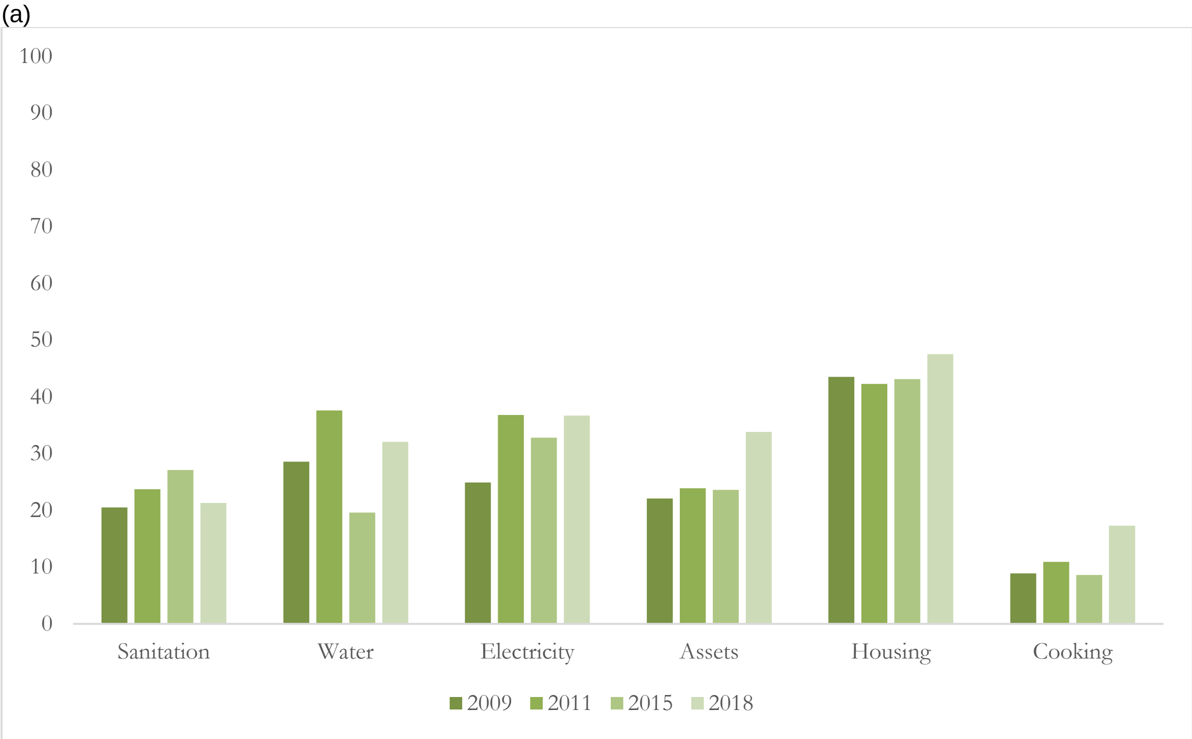
Figure 2: Urban–rural deprivation gap, percentage points, 2009–18

Note: population weights applied.

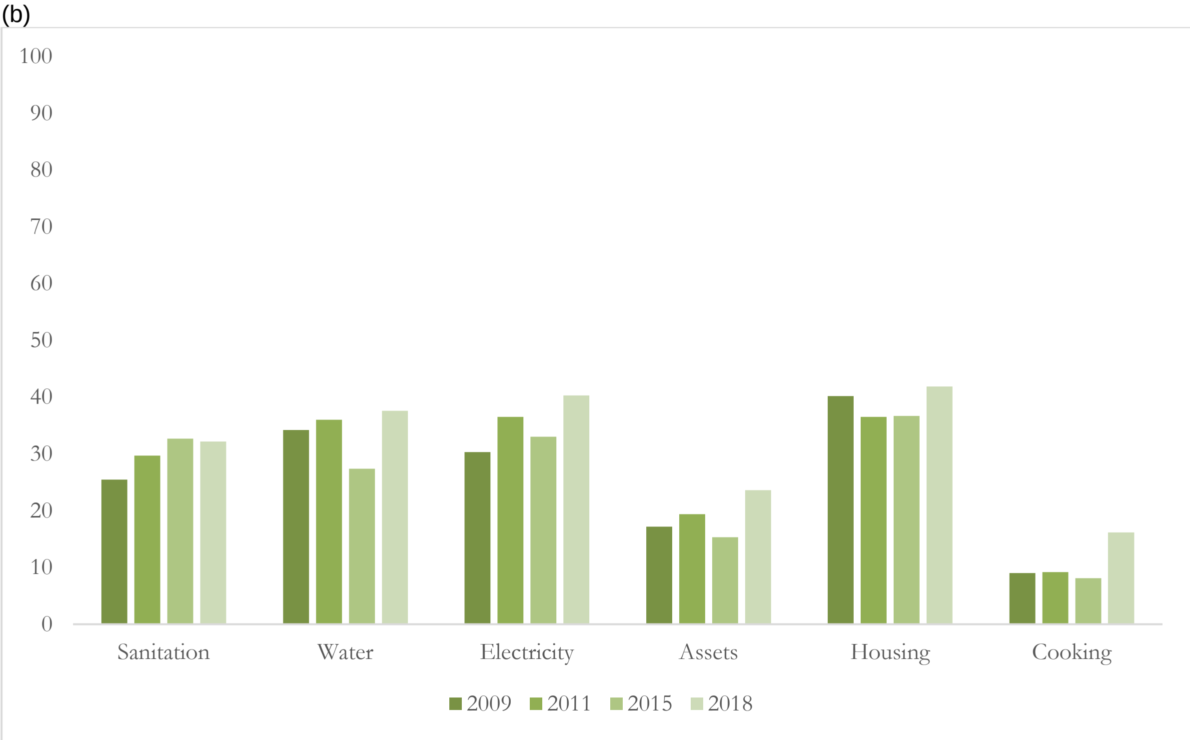
Source: authors' computations.

Figure 3: (a) South–north and (b) south–centre deprivation gaps, percentage points, 2009–18

(a)



(b)



Note: population weights applied.

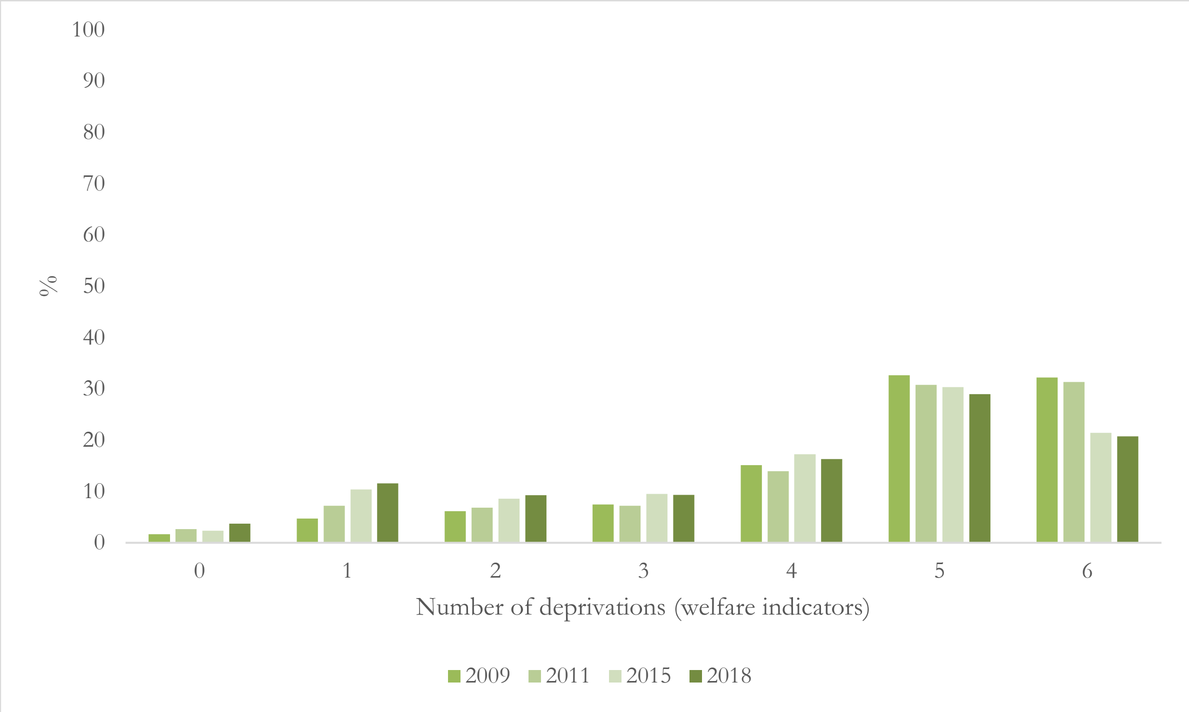
Source: authors' computations.

It is also interesting to show the percentage of individuals deprived in 0, 1,…, 6 indicators. Figure 4 shows this for the entire country and for rural and urban areas. First, it emerges that at national level, and especially in rural areas, the percentage of individuals who suffer no deprivation in the indicators selected is very limited. This percentage slightly increased over time, but it did not exceed four per cent at national level and it remained close to zero for rural areas. Conversely, the percentage of individuals deprived in only one of the six indicators steadily increased over time, from about five per cent to 12 per cent over the period considered. On the other hand, the percentage of individuals deprived in five out of six deprivation indicators gradually decreased from 2009 to 2018, from about 33 per cent to a level of about 29 per cent.

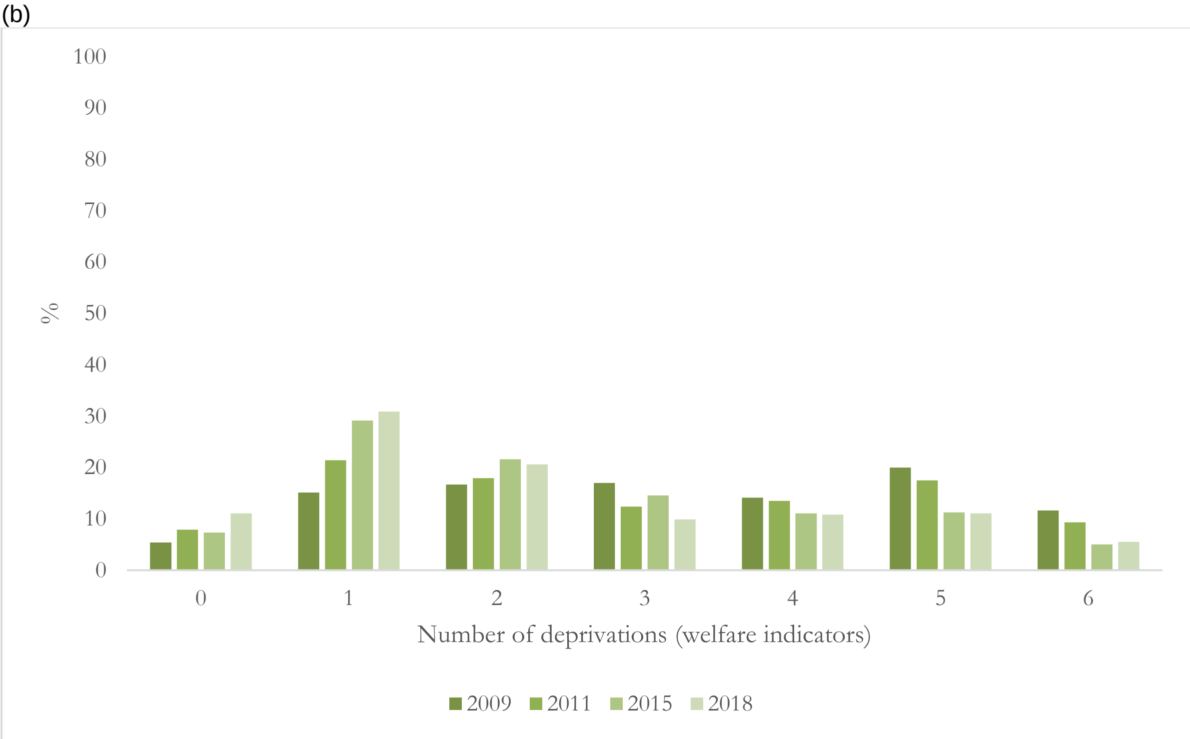
The percentage of individuals deprived in all the indicators is also a very important indicator of advancement and it shows a slight decrease between 2009 and 2011, a sharp drop between 2011 and 2015, and stagnation afterwards. Looking more thoroughly at urban–rural differences, we find that the percentage of individuals deprived in five out of six indicators in rural areas is mostly constant over time and high in absolute levels (slightly less than 40 per cent of the rural population). Instead, the percentage of individuals deprived in all indicators dropped between 2011 and 2015, but then remained mostly constant (from 29 to 28 per cent). In contrast, the improvement observed in urban areas with respect to households deprived in just one of the welfare indicators is impressive (from about 15–31 per cent in nine years). This is also reflected in the decreasing percentage of individuals deprived in five and six indicators, which is clearly observed up to 2015; conversely, in 2018, we notice a stagnation or reversal in both percentages.

Figure 4: Percentage of individuals deprived in 0, 1, 2, 3, 4, 5, or 6 welfare indicators, 2009–18: (a) national, (b) urban, and (c) rural samples

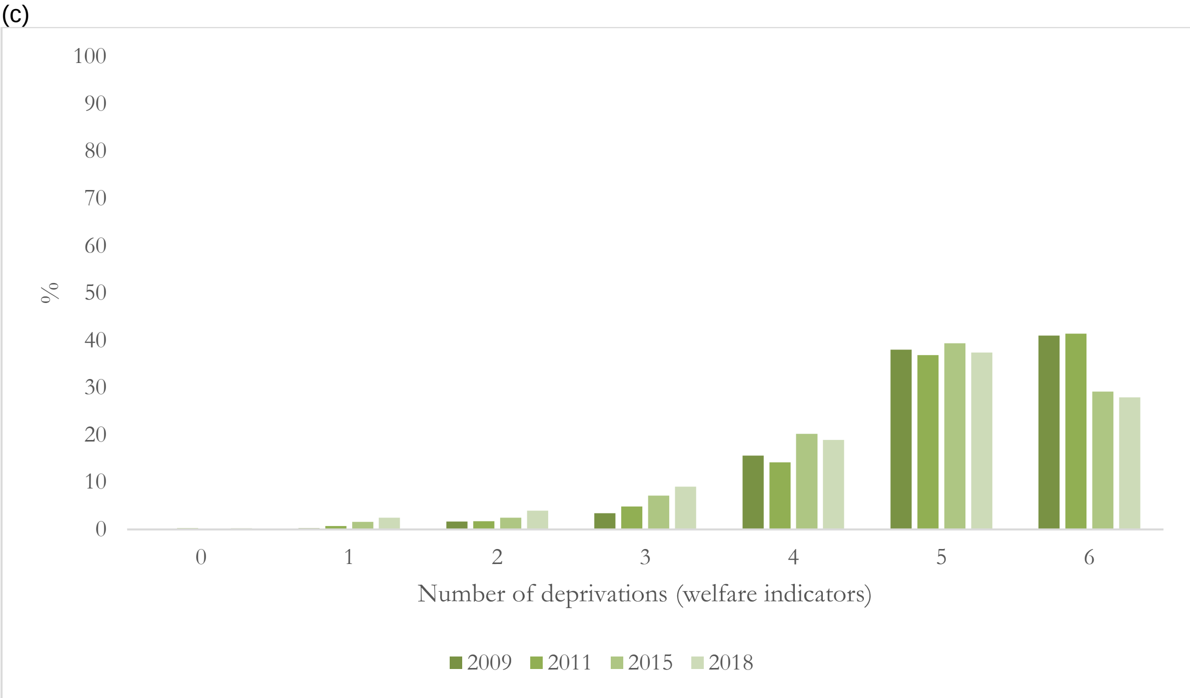
(a)



(b)



(c)



Note: population weights applied.

Source: authors' computations.

5.2 Multidimensional poverty results: Alkire–Foster method

We proceed to create an MPI using the Alkire–Foster approach. In particular, we first apply weights to our binary welfare indicators (sanitation, water, electricity, assets, housing, and cooking). Next, we establish a cut-off and households that are deprived in indicators whose weight sums to a value greater than the cut-off are considered poor. Finally, this multidimensional poverty headcount, or poverty incidence, indicated with H, is combined with a measure of distance below the cut-off, the poverty intensity, A, to create the MPI, M^0 (for details, among others, see Alkire and Foster 2011; Alkire et al. 2015).

In this analysis, we assign a weight of 1/6 to each of the six welfare indicators selected. This is in line with the global MPI (UNDP and OPHI 2019) that assigns the same weight to all the indicators contained in each individual dimension. Given that we only consider the dimension defined as 'living standards' in the global MPI, each indicator is assigned a weight of 1/6 (Table 3). The cut-off is as already explained set at 0.40 in the baseline analysis. A sensitivity analysis is subsequently performed with different cut-offs.

The results relative to poverty incidence, H, poverty intensity, A, and the MPI, M^0, are presented for the years 2009, 2011, 2015, and 2018 in Table 4, for the entire country, at rural–urban and regional levels. Since the poverty intensity stayed broadly constant over the period considered, the trend of MPI closely reflects what happened to poverty incidence. In general, multidimensional poverty levels remained high in Mozambique, even though a gradual improvement is noticeable over time. As for the trend observed for some of the underlying welfare indicators, the reduction in the MPI levels is more pronounced between 2009 and 2011 and between 2011 and 2015 than it is for the period 2015–18. The multidimensional poverty incidence (H) is found to be significantly different between 2009 and 2011 and between 2015 and 2011, but the difference is not statistically significant between 2015 and 2018. With respect to the MPI, M^0, only the difference between 2015 and 2011 is statistically significant, whereas the differences between 2011 and 2009 and between 2018 and 2015 are not statistically significant.[11]

According to the multidimensional poverty results, computed using the Alkire–Foster method, the gap between urban and rural areas is also wide and increasing over time. Furthermore, the gap between the southern region and the rest of the country is also significant, with respect to both the poverty incidence and the MPI. At the provincial level, we observe from Figure 5 that most provinces improved their situation with respect to MPI. However, it is also clear that the poorest provinces did not change their rankings much over time, so that the poorest provinces are still located in the centre–north, with MPI values substantially higher than provinces in the south.

Table 4: Poverty incidence, *H*, poverty intensity, *A*, and MPI, M^0, national, urban–rural, and regional levels, 2009–18

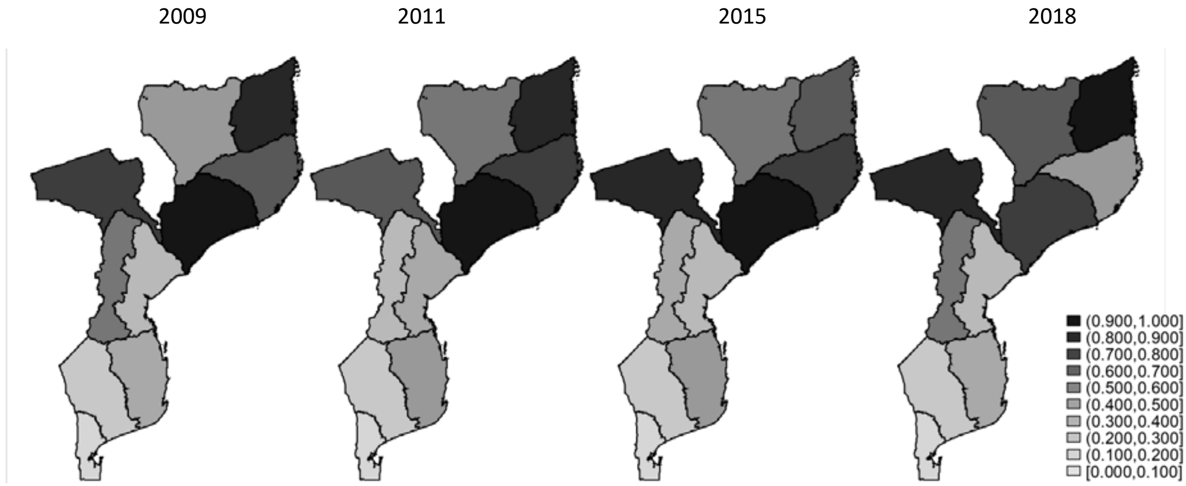
Level	Year	*H*	*A*	M^0	Observations
National	2009	0.874	0.837	0.732	25,752
	2011	0.833	0.839	0.699	61,842
	2015	0.786	0.802	0.63	32,550
	2018	0.754	0.802	0.605	28,723
Urban	2009	0.627	0.736	0.461	11,608
	2011	0.527	0.742	0.391	23,632
	2015	0.419	0.693	0.291	14,624
	2018	0.374	0.721	0.27	12,109
Rural	2009	0.98	0.864	0.847	14,144
	2011	0.973	0.863	0.84	38,210
	2015	0.958	0.824	0.79	17,926
	2018	0.933	0.817	0.762	16,614
North	2009	0.939	0.846	0.794	7,128
	2011	0.922	0.855	0.789	15,464
	2015	0.891	0.804	0.717	9,259
	2018	0.861	0.805	0.693	7,361
Centre	2009	0.942	0.857	0.807	9,796
	2011	0.915	0.848	0.776	23,815
	2015	0.862	0.821	0.708	11,493
	2018	0.851	0.819	0.697	10,920
South	2009	0.647	0.763	0.493	8,828
	2011	0.557	0.776	0.433	22,563
	2015	0.527	0.75	0.395	11,798
	2018	0.423	0.73	0.309	10,442

Note: population weights applied.

Source: authors' computations.

[11] A Wald test of means was performed, which allows to take care of the survey settings (e.g. see UCLA 2020).

Figure 5: MPI, M^0, at provincial level, 2009–18



Notes: population weights applied. In the figure key, brackets and parentheses represent closed and open intervals, respectively. Accordingly, [0.000,0.100] includes both 0.000 and 0.100, while (0.100,0.200] does not include 0.100. It only comprises numbers greater than 0.100, including 0.200 and so on.

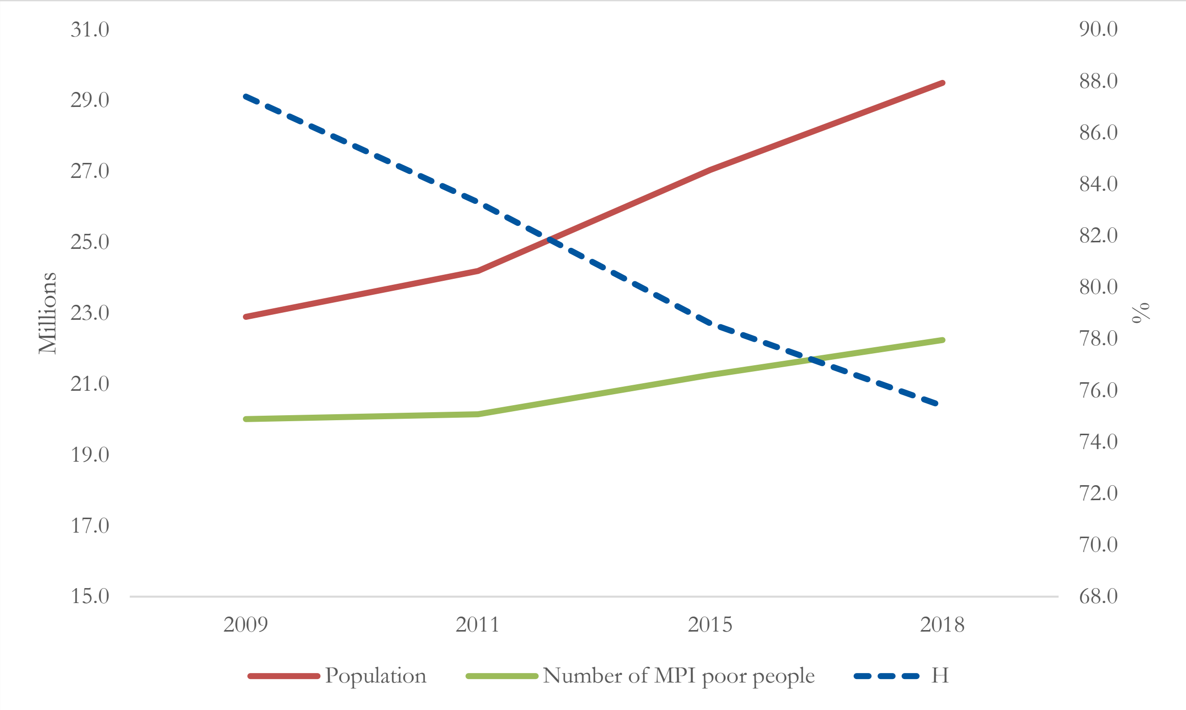
Source: authors' computations.

Given the above-mentioned multidimensional poverty results, we can also compute the number of multidimensionally poor people by multiplying the population in each given year[12] by the poverty incidence, *H*.[13] Results are presented in Figure 6. The absolute number of multidimensionally poor people remained constant between 2009 and 2011 (about 20 million individuals), but it increased afterwards. It reached about 21 million people in 2015, notwithstanding the big improvement observed between 2011 and 2015 in several welfare indicators, and it further went up to 22.2 million people in 2018. The number of multidimensionally poor people increased by approximately one million people in the period 2015–18, mainly located in the rural areas of the central provinces. Indeed, we estimate that in the same period the number of poor people in urban areas reduced by about 93,000 people and the number of poor people in the southern provinces reduced by about 770,000 people. This reflects the fast population growth experienced by the country in recent years, but it also shows the kind of challenges Mozambique is facing when trying to reduce poverty in its various dimensions. Generating modest or even fairly big improvements with respect to a few welfare indicators does not ensure that the number of multidimensionally poor people decreases; more so in crisis-ridden times like the ones studied in this analysis. These results certainly point to a troubling intensification of poverty.

[12] Population data are obtained from the World Population Prospects 2019 (see United Nations 2019).

[13] This is also the procedure followed by OPHI in the global MPI (for details, see the 'Data tables 2019' in OPHI 2019).

Figure 6: Multidimensional poverty incidence (*H*), population, and number of multidimensionally poor people (in millions), 2009–18



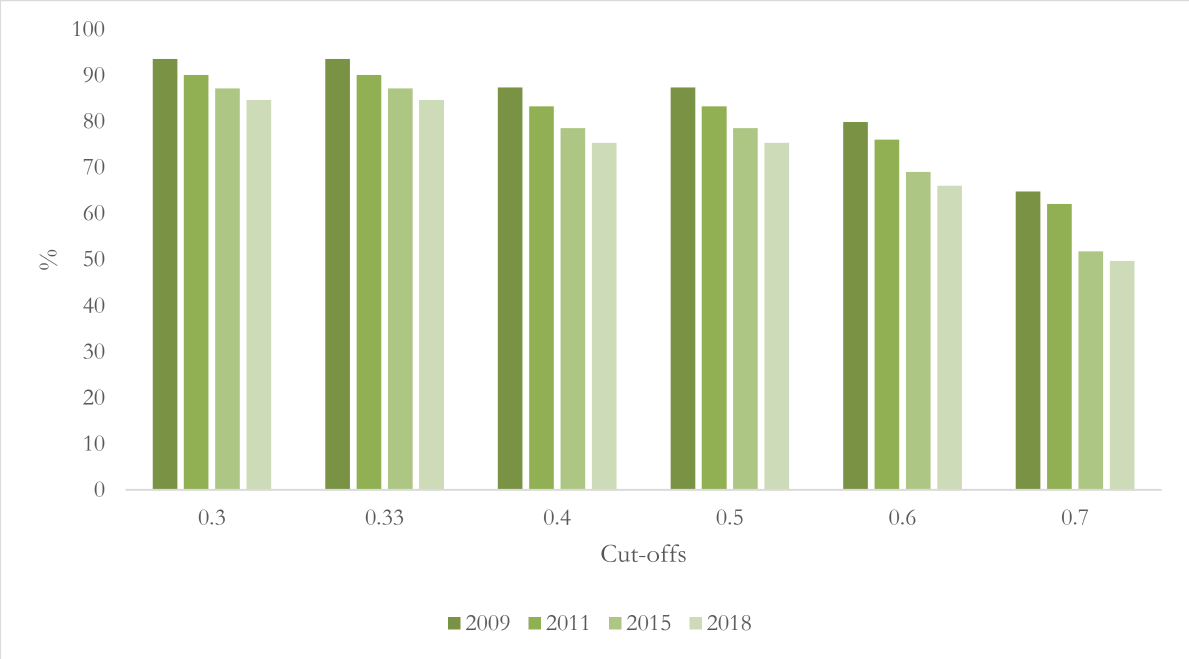
Notes: population and number of MPI poor people shown on the left axis (millions), the multidimensional poverty incidence, *H*, on the right axis (%). Population weights applied.

Source: authors' computations.

Figure 7 shows that the general trend observed in both the poverty incidence and the MPI with cut-off at 0.40 is not greatly affected by changes in the level of the cut-off. With higher cut-offs, the only noticeable differences are that the proportion of people considered poor decreases, the MPI levels are lower, and the difference between the poverty incidence and the MPI in 2015 and 2018 reduces.

Figure 7: (a) Poverty incidence, *H*, and (b) MPI, M^0, with different cut-offs, 0.30–0.70, 2009–18

(a)



(b)

Notes: poverty incidence, *H*, as a percentage of the population, and MPI, M^0, with different cut-offs: 0.30, 0.33, 0.40, 0.50, 0.60, and 0.70. Population weights applied.

Source: authors' computations.

5.3 Multidimensional poverty results: FOD method

We now turn to our main results regarding the spatial and temporal multidimensional poverty comparisons obtained using the FOD approach involving the six welfare indicators previously selected. As explained in Section 4, population A first-order dominates population B if one can generate the shares of the population in each state in population B by shifting probability mass within population A to states that are unambiguously worse (Arndt et al. 2012, 2016; Arndt and Tarp 2017). We can then count the number of times a given region dominates other regions (spatial FOD) and subtract the number of times the same region is dominated by other regions (net dominance), and normalize all scores to fall in the interval [−1,1]. This is indicated in the following tables as the probability of net dominance (i.e. the probability that a population dominates all other populations less the probability that a population is dominated by all other populations), interpreted as the cardinal measure of welfare. This provides the basis to rank populations (see Arndt and Tarp 2017). The latter index for different areas of Mozambique is displayed in Table 5 and we derive regional ranks as well. Comparisons include all provinces, urban and rural areas as a whole, and the national level.

Unsurprisingly, the capital city of Maputo dominates all the other regions, followed by the Province of Maputo, the urban areas as a whole, and the southern province of Gaza. These four areas appear in the first four positions in all the surveys considered. At the other end lie the northern–central regions of Nampula, Manica, Niassa, Tete, Cabo Delgado, the rural areas as a whole, and Zambézia. The change in rankings is minimal for most areas. In the last column, we show the change in ranking between 2009 and 2018, and, excluding Niassa, the other provinces did not move (either up or down) by more than two positions.

It is possible as well to use the FOD criterion to determine whether welfare has been improving through time in the same area/region (temporal FOD), using bootstrapping to mitigate the fact that the comparison of each region with itself at a different point in time naturally yields only one comparison pair. The results are again normalized to fall in the interval [−1,1] and are presented in Table 6.

Table 5: Spatial FOD multidimensional poverty comparisons, net dominance probabilities, and rankings of deprivation, 2009–18

Area	Probability of net domination 2009	Ranking 2009	Probability of net domination 2011	Ranking 2011	Probability of net domination 2015	Ranking 2015	Probability of net domination 2018	Ranking 2018	Change in ranking 2009–18
Maputo City	1.000	1	1.000	1	1.000	1	0.990	1	0
Maputo Province	0.704	3	0.804	2	0.773	2	0.811	2	–1
Urban	0.730	2	0.735	3	0.747	3	0.708	3	1
Gaza	0.045	4	0.060	4	0.150	4	0.190	4	0
Sofala	–0.082	6	0.046	5	0.012	6	0.039	5	–1
National	0.012	5	0.041	6	0.029	5	0.003	6	1
Inhambane	–0.149	8	–0.155	10	–0.122	7	–0.087	7	–1
Nampula	–0.197	9	–0.328	11	–0.280	10	–0.248	8	–1
Manica	–0.234	10	–0.025	7	–0.247	9	–0.252	9	–1
Niassa	–0.106	7	–0.135	9	–0.318	11	–0.291	10	3
Tete	–0.254	11	–0.119	8	–0.449	12	–0.449	11	0
Cabo Delgado	–0.541	14	–0.614	13	–0.242	8	–0.452	12	–2
Zambézia	–0.498	13	–0.790	14	–0.545	14	–0.477	13	0
Rural	–0.429	12	–0.519	12	–0.507	13	–0.485	14	2

Source: authors' computations.

Table 6: Temporal net FOD multidimensional poverty comparisons, 2009–18

Area	2011 FOD 2009	2015 FOD 2009	2015 FOD 2011	2018 FOD 2009	2018 FOD 2011	2018 FOD 2015
National	0.44	0.95	0.17	1	0.99	0.03
Rural	0.07	0.08		0.7	0.22	0.04
Urban	0.47	0.89	0.29	0.99	0.84	0.11
Cabo Delgado	0.06	0.8	0.4	0.28	0.01	–0.15
Gaza		0.43	0.46	0.6	0.52	0.05
Inhambane	0.01	0.14	0.04	0.31	0.4	0.01
Manica	0.37	0.06	–0.02	0.14	–0.01	0.02
Maputo City	0.01	0.13	0.08	0.63	0.31	
Maputo Province	0.26	0.71	0.12	0.94	0.89	0.22
Nampula	–0.02	0.17	0.14	0.16	0.49	0.09
Niassa	0.01	0.04		0.02		
Sofala	0.03	0.48	0.12	0.7	0.17	0.06
Tete	0.01	0.03				
Zambézia	–0.05	0.6	0.71	0.16	0.77	0.03

Notes: empty cells indicate that the comparison is indeterminate, which entails that the results provide no evidence of improvement for some year in some area/region. Net probabilities of temporal FOD are obtained via bootstrap.

Source: authors' computations.

The probabilities of advancement are larger on average when we compare 2015 and 2018 with 2009 and when 2018 is compared with 2011. Regional differences exist, but lower probabilities of advancement are obtained when 2015 is compared with 2011 and when 2011 is compared with 2009. However, the lowest probabilities of advancement clearly appear when 2018 is compared with 2015. In this case, most probabilities are around zero, the only ones above or below ten per cent being Maputo Province, with a probability of 22 per cent; the urban areas as a whole, with a probability of 11 per cent; and the province of Cabo Delgado, showing a sizeable negative probability of −15 per cent. This is likely linked with the ongoing insurgency in the region and possibly with some of the natural shocks experienced in the area. The results provide no evidence of improvement for some year in some area/region, as indicated by the blank cells in Table 6. Notably, there is no evidence of progress for the city of Maputo, for Niassa, and even for the coal-rich province of Tete between 2015 and 2018, and very little evidence of improvement at national level and for rural areas in the same period.[14] The lack of advancement is likely due to the declines in assets at national level and in asset and other indicators at urban/rural and regional level, as evidenced in Figure 1.

6 Discussion and conclusions

Using the most recently available household survey data in Mozambique, we asked whether and how poverty has changed in a period of socio-economic crises and natural shocks. Employing two methods of multidimensional poverty measurement, the Alkire–Foster MPI and the FOD method, we found that the poverty reduction experienced up to 2015 slowed down significantly in the crisis-ridden period. In terms of the MPI, we noticed a statistically significant reduction of 0.07 points between 2011 and 2015 in contrast to a non-statistically significant reduction of less than 0.03 points from 2015 to 2018. While the MPI is much higher in rural than in urban areas, this pattern of change over time is the same and the difference between 2015 and 2018 is not statistically significant in both areas.

Moreover, the number of multidimensionally poor people increased by approximately one million people in the period 2015–2018, from about 21.3 to about 22.2 million people. This points to an intensification of poverty, especially because most of the additional poor are located in the already vulnerable rural areas and in the central provinces.

We also found that poverty intensity, meaning the share of households living with relatively more deprivations, remained constant during the crisis period and it increased in urban areas. The regional differences in poverty reduction are comparable to those in past poverty assessments. The poorest provinces have remained the same over time. The FOD analysis and the percentage net deprivation at regional level confirm this.

The FOD analysis further reveals that the percentage of people with zero deprivation remained practically the same between 2015 and 2018—the difference is not statistically significant—and the same occurred with the percentage of people with six deprivations. The likelihood of an improvement in multidimensional deprivation in that period is practically zero.

[14] An additional temporal FOD analysis was performed including the three regions of Mozambique, north, centre, and south. In this case, we estimate a probability of advancement for the centre of only one per cent, we obtain no evidence of advancement for the north, and a sizeable positive probability of advancement for the south, 79 per cent.

We can, therefore, conclude that overall improvements in access to basic services, asset ownership, and housing conditions seem to have stalled in recent years explaining why we do not see a large increase in the share of households in the non-deprived category. At the same time, a large share of the population even lost some of their assets increasing their deprivation, which drives the rise in poverty intensity. The data show that this intensification is primarily due to an increase in households with asset deprivation. In contrast to housing characteristics and access to water, electricity, and sanitation, assets can be sold in times of dire need (among others, see Dercon 2005; Tschirley et al. 2006; Ellis et al. 2009; Lawson and Kasirye 2013; Groover et al. 2015; Baez et al. 2018; Newman and Tarp 2020). Whether this helped the affected households to maintain their consumption levels during the crisis will only be possible to assess when a household consumption survey is in hand.

Although we cannot claim to have established strict causal linkages in this study, it is very likely that our results reflect the main negative shocks during the 2015–18 period: economic crisis, hidden debt scandal, natural disasters, and armed attacks in Cabo Delgado. The upcoming fifth national poverty assessment will be able to shed more light on the dynamics involved and whether or not Mozambique is returning to its path of inclusive growth. The onset of the COVID-19 crisis and its potential impact stand out as another challenge for one of the poorest and most shock-prone countries in the world.

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