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Multidimensional Poverty in Crisis: Lessons from Zimbabwe

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ABSTRACT *Zimbabwe experienced an acute social, political, and economic crisis from 2001 to 2008 and is now on a recovery path. This paper explores changes in poverty between 2001, 2007, and 2011–2012 using an Alkire–Foster multidimensional poverty index. Results indicate a large increase in poverty across multiple dimensions of household wellbeing between 2001 and 2007 (the start of the crisis peak), followed by a decrease in poverty between 2007 and 2011–2012, during the recovery period. Decomposition of the index shows significantly different trends in poverty dimensions over time with implications for short- and long-term social assistance policies.*

1. Introduction

During the first decade of the twenty-first century, Zimbabwe experienced a sharp social, political, and economic crisis, but is now on a recovery path (Besada & LaChapelle, 2011; Murithi & Mawadza, 2011). Among the most industrialised African economies at independence in 1980 and through the early 1990s, Zimbabwe experienced economic deterioration in the 1990s as a result of recurring drought and economic challenges. This situation evolved into a social and political crisis in the late 1990s, fuelled by controversies over land reform and rising political violence. From 1999 to 2007, Zimbabwe experienced negative economic growth and rising inflation along with the collapse of the commercial agriculture, tourism, and manufacturing sectors (Robertson, 2011). The crisis peaked in 2008 with hyperinflation reaching 231 million per cent (Makochekanwa & Kambarami, 2011).[1] As a response to the crisis, the economy was dollarised and a Global Political Agreement between the two main political parties was ratified in September 2008. Since February 2009, inflation has been under control and economic growth has returned, although the recovery is still regarded as fragile (Richardson, 2013).[2]

The macroeconomic causes and the economy-wide impact of the crisis have been documented (Hanke, 2012; Mashakada, 2013; Ndlela, 2011), along with the impact of land reform on the wellbeing of different household groupings (Scoones et al., 2010). However, the evolution of household well-being and its different dimensions during and after the crisis have not been fully investigated. It is unclear how the economic crisis and subsequent recovery impacted various dimensions of household wellbeing, such as access to education and public services, health, or income/consumption. This paper

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fills this gap by analysing changes in multidimensional indicators of poverty between 2001, 2007 and 2011–2012 using the nationally representative household Incomes, Consumption, and Expenditure Surveys (ICES) and Poverty, Income, Consumption, and Expenditure Survey (PICES). Zimbabwe is a particularly interesting case because it has consistent household surveys which enable the measurement and tracking of wellbeing during the crisis and recovery.

The increase in poverty in Zimbabwe was already a concern in the 1990s due to economic decline, severe drought, and ill-effects of social conflict (Marquette, 1997; Potts & Mutambirwa, 1998). Studies based on nationally representative household surveys (ICES of 1990–1991 and 1995–1996), conducted by the Central Statistical Office (CSO),[3] show an increase in poverty during the first half of the decade (CSO, 1998). Savings and household asset bases were negatively affected through their use as coping mechanisms in response to recurring economic and environmental stress (Ersado, Alderman, & Alwang, 2003). Limited safety nets and income diversification were not sufficient to help farmers cope with shocks in semi-arid areas, especially in remote and excluded areas (Bird & Shepherd, 2003). A decomposition of poverty increases between 1990 and 1996 shows that deterioration of the entire economy was the main driver, but household coping strategies partially offset the general decline in economic conditions (Alwang, Mills, & Taruvinga, 2002). A study based on the 2001 and 2007 ICES datasets shows increases in asset poverty in the 2000s (Larochelle, Alwang, & Taruvinga, 2014).

Most previous studies of poverty in Zimbabwe have used a unidimensional money-metric measure (ZIMSTAT, 2013). However, money-metric poverty measures do not reflect all factors affecting wellbeing (Duclos, Sahn, & Younger, 2006; Reddy & Pogge, 2009; Sen, 1999). Money-metric measures also face technical challenges with respect to the choice and construction of the poverty measure, particularly in terms of the proper deflator when making spatial and inter-temporal comparisons (Laderchi, Saith, & Stewart, 2003). The establishment of a money-metric poverty measure is particularly problematic in Zimbabwe because of hyperinflation, which makes the valuation of consumption expenditures impossible in 2007.

A multidimensional poverty index is an attractive alternative and complement to money-metric approaches. The literature increasingly recognises the multidimensional nature of poverty. Since the seminal capability approach work of Amartya Sen (1985, 1999), a large literature has emerged that considers poverty as a lack of capability to achieve critical 'functioning' in essential dimensions of wellbeing. These dimensions include food, health, education, electricity, human rights, and security. Households lacking capability in a given dimension are said to suffer from deprivation in that dimension. A wide range of dimensions have been considered: for instance, household expenditures and children's height-for-age have been used to compare three African countries (Duclos et al., 2006). A Multidimensional Poverty Index (MPI) was constructed for 104 countries from 10 indicators corresponding to three dimensions: education, health, and standard of living (Alkire & Santos, 2011). Results show that the poverty orderings of regions or countries based on multidimensional indices often contrast with orderings from unidimensional or money-metric measures.[4]

The purpose of this paper is to broaden understanding of changes in household welfare during the crises and recovery in two ways: by computing poverty changes in a context of hyperinflation when price data are unreliable, and by decomposing overall changes into changes in underlying deprivations. An MPI indicator for Zimbabwe using the MPI standard methodology, based on the 2006 and 2010–2011 demographic and health surveys (DHS), shows a decrease in poverty between the two periods (OPHI, 2013). This paper extends the MPI analysis in several ways. First, it provides a comparative multidimensional poverty measure before, during, and after the crisis. Second, it employs ICES/PICES datasets that allow examination of more deprivation dimensions than is possible with the DHS. Inclusion of additional dimensions enables construction of an index adapted to the Zimbabwean context. Third, the multidimensional poverty measure permits adjustment of deprivation thresholds to reflect the Zimbabwean reality, including urban and rural differences in poverty dimensions.

Multidimensional indices aggregate deprivations encountered by households – accounting for the number of individuals in households – to form a picture of the complex evolution of poverty from 2001 to 2011–2012.[5] The index employed in this paper, based on the Alkire–Foster (A–F) method (Alkire & Foster, 2011a), is decomposed by dimension and geographic area to identify key factors

affecting deprivation. Results show a clear increase in multidimensional poverty from 2001 to 2007, and then a decrease from 2007 to 2011–2012, leaving an ambiguous overall change in poverty from 2001 to 2011–2012. The results are robust to alternative specifications. Changes in individual dimensions do not always follow overall changes, highlighting different dynamics in poverty dimensions that should be considered in the design of poverty alleviation and recovery efforts. For instance, access to electricity and some human capital indicators actually improved through the 2000s. In contrast, health indicators and ownership of livestock in rural areas declined even in the recovery period, while access to services declined and then recovered.

The next section presents and justifies the choice of the main A–F multidimensional poverty index. Section 3 presents the data, the dimensions chosen, and the construction of the Zimbabwe A–F index. Section 4 presents results and compares them to a money-metric poverty measure. Section 5 explores index robustness. The last section summarises and discusses policy implications.

2. Multidimensional Indices

There is growing agreement regarding the multidimensional nature of poverty, but substantial debate persists about how to conceptualise and measure these dimensions (Alkire & Foster, 2011b; Atkinson, 2003; Ferreira & Lugo, 2013; Ravallion, 2011). The choice of measure matters and can change the characterisation of poverty (Deutsch & Silber, 2005; Laderchi et al., 2003). Reasons to employ a single multidimensional index rather than considering each dimension separately include simplicity and accounting for the joint distribution of deprivations. Decompositions of the multidimensional index allow identification of how changes in individual dimensions contribute to overall index change.

A large literature has emerged on multidimensional poverty. Theoretical studies have followed an axiomatic approach to generate indices with desirable properties (Bourguignon & Chakravarty, 2003; Tsui, 2002). Two issues must be addressed in empirical application: what the cut-off is, below which a person is said to be deprived; and how to aggregate deprivations to generate an overall picture of poverty. The latter decision usually involves either a 'union approach' (an individual is poor if deprived in any dimension) or an 'intersection approach' (an individual is poor if deprived in all dimensions). The 'counting approach' used in this paper and developed by Alkire and Foster (2011a) is an intermediate: it considers an individual as poor if deprived in k dimensions, with k between one (the union approach) and all dimensions (the intersection approach). All approaches entail normative judgments about dimensions, deprivation thresholds, and level of k in empirical application. Statistical methods, including Multiple Correspondence Analysis, have been explored to reduce perceived 'arbitrariness' (Asselin, 2002). Also, several indices can be used in parallel when making comparisons across countries or over time to demonstrate robustness of results (Deutsch & Silber, 2005; Duclos et al., 2006).

In general, poverty measurement consists of two steps: identification of poor individuals or households; and aggregation of the poor into an index. In the context of multidimensional poverty, the first step can be decomposed into: identifying deprivation of households in each dimension; and, given individual dimensional deprivations, identifying poor households (for instance those with a given number of deprivations).

The A–F approach focuses on a single measure, which is a generalisation of the counting approach and an adaptation of the Foster–Greer–Thorbecke (FGT) poverty index (Foster, Greer, & Thorbecke, 1984). The method uses a double cut-off during identification: household i is deprived in dimension j if its achievement y_{ij} is inferior to the threshold z_j. Household i is considered poor if the weighted sum of its deprived dimensions c_i is greater than the threshold k. The weight attached to each dimension is a normative assessment of the importance of that dimension to household wellbeing. If a household is identified as poor, all individuals within the household are considered poor. The A–F multidimensional poverty index M_0 is simply the product of the headcount ratio of poor individuals H and the average deprivation share among the poor A[6]:

$$M_0 = H * A. \quad (1)$$

Beyond the simple measure M_0, the A–F methodology defines a general class of multidimensional poverty measures M_α. In particular, M_1 is the multidimensional adjusted poverty gap, and M_2 is the multidimensional adjusted poverty severity. For $\propto > 0$, M_α takes into account the depth of deprivation, in the same way that P_α extends P_0 in the FGT methodology. For more details about the methodology, see the Online Appendix and Alkire and Foster (2011a).

The $M_\propto$ measure has several desirable features. First, it satisfies useful properties (see Alkire & Foster, 2011a) including: poverty focus, meaning that an improvement among the non-poor *i* does not affect $M_\propto$ (whether or not *i* is deprived in *j*); deprivation focus, meaning that improvement for *i* in a non-deprived dimension *j* does not affect $M_\propto$; and decomposability, which allows poverty decomposition by region or by group. Second, the approach (in particular M_0) is applicable to ordinal variables, crucial as deprivation variables frequently take an ordinal form (Bossert, Chakravarty, & D'Ambrosio, 2013). Third, it is intuitive and suits applications in which wellbeing is comprised of many dimensions. For these reasons, the counting approach was widely used before being formalised (Gordon, Nandy, Pantazis, Pemberton, & Townsend, 2004; Mack & Lansley, 1985). Recently, the A–F method has been applied to 122 countries with the MPI (Alkire & Santos, 2011), used for measuring child poverty (García & Ritterbusch, 2014), for measuring changes over time (Gallo & Roche, 2013), and for targeting (Alkire & Seth, 2013), among others.

3. Data and Empirical Approach

3.1. Data

The data come from three nationally representative household surveys conducted by ZIMSTAT: the ICES from January to December 2001 and from July to December 2007[7] and the PICES from June 2011 to May 2012. The ICES/PICES surveys are well suited to construct multidimensional poverty indices, because they include information at the household and individual level, and are collected in a consistent manner. The surveys were conducted in the eight provinces of Zimbabwe and in the cities of Harare and Bulawayo. The number of usable observations (households) is 19,941 in 2001 (12,806 rural, 7,135 urban), 13,667 in 2007 (11,456 rural, 2,211 urban), and 29,765 in 2011–2012 (25,914 rural, 3,851 urban). Survey weights and household size are employed to obtain national, provincial, and urban/rural representation. The questionnaires include modules on consumption expenditures, but the 2007 expenditures are unreliable because of hyperinflation during the period. All modules are virtually identical across the three years. They include information on household demographics, education, employment, healthcare, migration, housing characteristics, assets ownership, access to services, and agricultural activities.

3.2. Choice of Dimensions, Cut-Offs, and Weights

There is a substantial debate regarding the choice of dimensions and the assignment of weights to each dimension in the multidimensional poverty measurement literature (Alkire, 2007; Ravallion, 2011). In this paper, these choices are made normatively (Alkire & Santos, 2011; Gallo & Roche, 2013) so that deprivation variables reflect the Zimbabwean context and the different sources of deprivation in urban and rural areas (Table 1).[8] Eight dimensions (education, health, employment, housing conditions, living conditions, assets, agricultural assets, and access to services) are used because of their importance as capabilities (Alkire, 2007). For each dimension, one or several variables are employed, driven by their relevance as indicators of deprivation and data availability. Weights are assigned normatively to each dimension and each variable.[9] Thresholds are conservative, in that they correspond to very low levels of outcome (for example finishing primary school, having any type of toilet in rural areas). Robustness tests are conducted on the impact of the choice of variables, cut-offs, and weights (Section 5).

Table 1. Dimensions, variables, and weights for the A–F multidimensional poverty indices

Dimension	Dimension weight	Variable	Variable weight urban	Variable weight rural
Education	2	Nobody in the household completed primary school	1	1
		The household has one child between 6 and 12 not enrolled in school	1	1
Health	2	One member of the household is chronically ill	1	1
		One member of the household has been ill but did not get healthcare in the previous 30 days	1	1
Employment	1 urban	One member of the household was unemployed as main occupation in the last 12 months	1	–
Housing conditions	1 rural 1.5 urban	The house does not have electricity	1	0.5
		The house does not have toilets (pit, Blair, or flush toilets) in rural areas or flush toilets in urban areas	0.5	0.5
Living conditions	1	The source of water is an unprotected well (or worse) or is located farther than 1 km away in rural areas; the source of water is not piped water on premise in urban areas	0.5	0.5
		The household cooks with wood	0.5	0.5
Assets	1	The asset index of the household is below a given threshold	1	1
Agricultural assets	1.5 rural	The household has less than 0.25 hectares of land	–	0.5
		The animal index of the household is below a given threshold (<1 TLU)	–	0.5
		The household has no agricultural equipment	–	0.5
Access to services	1	The household is far from two essential services or more	1	1

Education and *health* are necessary to live a productive and fulfilling life. The weight of two is assigned to each of these dimensions to reflect their importance in household wellbeing and the importance given to these sectors by the Zimbabwean Government (Bird & Shepherd, 2003; ZIMSTAT, 2013). Education indicators, each receiving a weight of one, are the absence in the household of anyone who has completed primary education and the presence of a primary school-aged child in the household not being sent to school. These variables are directly related to poverty status (Larochelle & Alwang, 2012). Economic and social deprivations clearly impact health outcomes in Zimbabwe (Watts et al., 2007). Two variables were chosen to reflect the health dimension. The first one is: the presence of a chronically ill individual. The second one is: a member having been ill in the past 30 days without receiving healthcare (when necessary). In times of crisis, causes for changes in these health and education dimensions are likely to be found both on the demand and supply sides: for example, households may be unable to pay for healthcare or facilities may close.

Unemployment is associated with poverty in urban Zimbabwe and is given a dimension weight of one (Hamdok, 1999; Mpofu, 2011). An urban household is considered deprived in this dimension when any adult household member records 'unemployment' as his or her *main* occupation over the last 12 months. Because unemployment is less common and is more difficult to identify in rural areas (where the main economic activity, agriculture, is accessible to a majority of individuals and seasonal), it is not included in the rural measure.[10]

Housing and *living conditions* are direct reflections of wellbeing but also instrumental in contributing to improved health, work, and education.[11] For housing conditions, two variables are considered: access to electricity, and no toilet (in rural areas) or no flush toilet (in urban areas, where sanitation is more developed). Weights of 0.5 are given to rural residence lack of electricity and lack of toilet indicators underlying the dimension. In urban areas, where lack of electricity indicates a greater state of deprivation, a weight of one is attributed to electricity, while the lack of toilet indicator retains a weight of 0.5. Two variables reflect living conditions: source of water and cooking fuel, with a weight

of 0.5 for each. Rural households are considered to be deprived if their main source of water is an unprotected well, a river, or another unprotected source, or if the source of water is 1 km away or farther. In urban areas, because water infrastructure is more developed, deprivation is defined as not having access to piped water or communal water on premises (which affects only a small number of households). In rural and urban areas, households are deprived if they use wood or 'other' (not electricity, paraffin, gas, coal) as cooking fuel. These variables and the thresholds chosen are commonly used in the Millennium Development Goals (MDG) and multidimensional poverty literatures (Alkire & Santos, 2011).

Household physical assets are indicative of a higher level of wellbeing and are often prior condition for capability to function. They are given a dimension weight of one in both rural and urban areas. Household asset stocks across a variety of assets are accounted for through a physical asset index (P*AI*) and an asset deprivation (*D*) threshold as follows:

$$PAI = 2 * motor\ vehicle + motorcycle + bicycle + television + radio + fridge + landline\ phone$$

$$D = 1\ if\ PAI < 2.$$

Thus, households are *not* deprived if they own a car or if they have at least two of the other assets. This index is identical to the one used in the MPI (Alkire & Santos, 2011) and gives a simple and intuitive measure of physical asset deprivation. The asset index is robust to the use of an index based on different item weights and one constructed using Multiple Correspondence Analysis (MCA) to determine weights (see Booysen, Van Der Berg, Burger, Maltitz, & Rand, 2008, for details on MCA).

For rural households, agricultural assets are essential indicators of wellbeing and agricultural activity capabilities. The dimension weight is 1.5, with three component variables each given a weight of 0.5. The first variable is land, as lack of land is associated with poverty in rural Zimbabwe (Hamdok, 1999). The threshold used (0.25 hectares) is sufficiently low to represent effective deprivation. The second variable, livestock, measured in Tropical Livestock Units (TLU),[12] is an indicator of wealth that can be used to insulate households from the impact of shocks (Mushongah, 2009). A TLU deprivation threshold of one indicates very few livestock assets. The third variable is rural equipment. An agricultural equipment index (*AEI*) is created as follows:

$$AEI = plough + wheelbarrow + scotchcart + tractor + griding\_mill$$

$$D = 1\ if\ AEI < 1.$$

The agricultural asset dimension is not employed for urban areas.

The final dimension of wellbeing – with a weight of one – is geographic access to services, where remoteness indicates deprivation. Households are considered deprived if they are far from two or more of seven services available in the data. The distance thresholds employed are 5 km for a primary school, 15 km for a secondary school, 15 km for a hospital, 5 km for shops, 5 km for a hammer mill, 15 km for a post office, and 5 km for a bus stop. These distance thresholds are halved in urban areas, where services tend to be closer but distance still represents a barrier to access. In addition, the lack of essential services close to the household's residence indicates remoteness of the neighbourhood (or perhaps its neglect by the local government).

Modifications to the usual A–F method were made to account for the Zimbabwe context and data. First, in several cases, different variables are used in urban and rural areas or different weights are applied for the same variable to acknowledge the different nature of poverty in an urban or rural environment. Second, different thresholds are used for a few variables which are equally important in rural and urban areas but in which living standards diverge greatly (such as the type of toilet). Third, larger households are more likely to be deprived in individual dimensions, such as having a chronically ill member, because they include more members. Consequently, $M_\propto$ is adjusted so that household size does not mechanically increase or decrease the likelihood that a household is deprived in any

dimension.[13] Fourth, when possible, cardinal variables were generated from ordinal ones (creation of indices) to facilitate computation of M_1 and M_2. Fifth, as noted in Section 2, indicator variables (0/1) have a mechanically higher weight than ordinal variables in M_1 and M_2. Thus, weights are adjusted accordingly in the M_1 and M_2 measures to correspond to the original weights of indicator and non-indicator variables. The detail of these modifications is given in the Online Appendix and results are robust to the exclusion of these adjustments.

3.3. Descriptive Statistics

Four types of change occur between 2001, 2007, and 2011–2012, highlighting the variability of changes in indicators of wellbeing across dimensions (Table 2). First, unemployment and the lack of access to toilets are stable over the period. Second, several indicators are responsive to the crisis and the recovery: they worsen from 2001 to 2007, but rebound from 2007 to 2011–2012. Responsive indicators are: children not enrolled in school, use of wood as cooking fuel, rural agricultural equipment, and access to services. Third, some indicators decline over the entire period: the two health variables, access to protected water, and livestock ownership. Fourth, some indicators show improvement at each period: the proportion of individuals from households with members having achieved at least seven years of education, access to electricity, and physical assets.[14] Indicator time paths also vary by area. Access to electricity and toilet is relatively good in urban areas in 2001 and declines in 2007, while rural areas tended to continue a long-term improvement in electricity and toilets.

These changes in indicators are consistent with evidence from other sources. Schooling weathered the crisis relatively well (Larochelle et al., 2014) and improved in the recovery period (UNZ, 2012).

Table 2. Raw headcount ratios for the indicators used in 2001, 2007, and 2011–2012

	2001			2007			2011–2012		
Year	All	Rural	Urban	All	Rural	Urban	All	Rural	Urban
No one with seven or more years of education	**9.1%**	12.2%	1.9%	**6.3%***	8.0%*	1.5%	**5.8%‡**	6.7%**	3.1%**
Child not in school	**3.7%**	4.8%	1.3%	**5.0%***	6.1%*	1.7%	**2.5%****	2.8%**	1.7%
Chronically ill	**9.3%**	9.2%	9.6%	**13.9%***	15.0%*	10.8%	**16.4%****	18.2%**	10.8%
Did not get healthcare	**4.5%**	4.2%	5.1%	**6.7%***	7.5%*	4.5%	**11.2%****	11.8%**	9.2%**
Unemployed	–	–	**27.5%**	–	–	**25.8%**	–	–	**27.6%**
No electricity	**65.3%**	89.5%	10.5%	**64.0%***	80.8%*	15.9%*	**49.0%****	61.3%**	10.3%*
No toilets	**31.6%**	44.0%	3.5%	**32.1%**	40.8%*	7.4%*	**31.0%**	38.4%**	8.1%‡
Unprotected water	**22.8%**	31.2%	3.6%	**29.1%***	36.4%*	8.2%*	**36.0%****	39.9%**	23.7%**
Wood as cooking fuel	**72.1%**	97.2%	15.3%	**73.3%**	90.6%*	24.2%*	**72.0%***	89.3%**	17.6%**
Low asset index	**60.3%**	71.9%	34.0%	**60.2%**	71.5%	28.1%*	**56.0%****	65.5%**	26.2%‡
Small land	–	**14.6%**	–	–	**16.0%***	–	–	**14.0%****	–
Low TLU	–	**37.1%**	–	–	**41.2%***	–	–	**45.6%****	–
Low rural equipment	–	**29.3%**	–	–	**33.4%***	–	–	**31.4%****	–
Far from services	**28.5%**	36.8%	9.7%	**39.2%***	49.0%*	11.3%	**28.9%***	35.7%*	7.4%**
Observations	19610	12577	7033	12900	10848	2052	28201	24370	3831

Source: our calculations with 2001, 2007, and 2011–2012 ICES/PICES data. Headcounts ratios are the share of individuals deprived in each variable weighted using survey weights for observations without missing values (see Online Appendix). Sample weights are applied to household observations to obtain nationally representative figures at the individual level, presented in percentages of the population. The TLU index is computed as follows: TLU = 1∗(cows + bulls + oxen) + 0.8∗calves + 0.8∗ostriches + 0.5∗pigs + 0.25∗(sheeps + goats) + 0.1∗(geese + turkeys + ducks) + 0.05∗(chicken + pigeons + other poultry) + 0.5 ∗ donkey + 0.25∗other livestock

Notes: *significantly different (at 10%) from the previous period (Wald test); **significantly different (at 10%) from the two previous periods (Wald test); ‡significantly different (at 10%) from the first period only, for 2011 (Wald test). Bold are just the "all" column, or when there is no "all" column, the only column (rural or urban).

Recent reports have noted the need for access to clean water and sanitation (Makochekanwa & Kwaramba, 2010; OPHI, 2013; UNZ, 2012). The decline in access to protected water is noted to be particularly acute in urban areas with the deterioration of the water distribution system (Makochekanwa & Kwaramba, 2010; World Bank, 2011). Overall, rural households have increased land size over the period, partly due to redistribution of land in the former large-scale commercial farming areas (Moyo, 2011; Scoones et al., 2012). According to our data, the decrease in land deprivation was important in large-scale commercial farming areas, but land deprivation actually *increased* in communal and resettlement areas between 2001 and 2007.

An interesting finding is the large increase in the proportion of individuals far from essential services in 2007, followed by an improvement of the situation in 2011–2012. This finding suggests that some of these services closed between 2001 and 2007 and reopened during the recovery. While the magnitude of the change (the share of households far from services increased from 0.285 in 2001 to 0.392 in 2007) is striking for the rather short period, other accounts support the finding. Access to social services declined from 2000 to 2008 (Makochekanwa & Kwaramba, 2010; Nyazema, 2010), followed by improvement from 2009 to 2012 (Shamu, 2012; UNZ, 2012). The crisis also temporarily affected hammer mills (Zamora & De–Regil, 2014), and there is anecdotal evidence of shop closures and bus service interruptions.[15]

The fact that dimensions of wellbeing show different trends highlights the need for a multidimensional measure to capture overall poverty evolution and explore contributions of individual dimensions to the change.

4. Results

The nature and composition of changes in the incidence, depth, and severity of multidimensional poverty are explored in this section. Contributions to overall trends from changes in number of deprivations within households and changes in deprivation within each dimension are examined, along with urban–rural and regional changes. Multidimensional poverty trends are also compared to those derived from a money-metric poverty measure.

The main results come from the multidimensional poverty indices $M_{\propto}$, generated using the A–F methodology, and its different decompositions. The total number of deprivations is computed by summing the variable weights presented in Table 1, and individuals in households whose deprivation number is above a threshold k are considered as poor (see previous sections). Multidimensional incidence, depth, and severity of poverty are computed at the national level, based on deprivation thresholds $k = 1$ to $k = 4$ out of a weighted total of 9.5 possible deprivations (Table 3). For the incidence measure M_0, the multidimensional adjusted poverty headcount ratio for $k = 3$ is 0.180 in 2001, 0.217 in 2007, and 0.193 in 2011–2012.[16] For all levels of k, there is a clear and significant increase in multi-dimensional poverty between 2001 and 2007 (+20.8% for $k = 3$).[17] This is consistent with previous studies (Larochelle et al., 2014) and with the fact that 2007–2008 corresponds to the worst period of the crisis. Consistent with the recovery of the Zimbabwe economy after 2008, findings show a clear and significant decrease in poverty incidence between 2007 and 2011–2012 for all levels of k (−11.0% for $k = 3$). The multidimensional poverty incidence is higher in 2011–2012 than it was in 2001, and the change between the two periods is relatively small but statistically significant for all k (+7.5% for $k = 3$). This finding suggests that the recovery ameliorated the adverse effects of the economic crisis in aggregate across multiple dimensions, but the effect of the crisis on multidimensional poverty was still tangible three years into recovery.

An increase in multidimensional poverty incidence M_0 can be due to an increase of the proportion of poor individuals or to an increase of the average deprivation share of the poor. To disentangle these two effects, M_0 is decomposed into the headcount ratio H and the average deprivation share A, since $M_0 = H * A$ (Table 4). Results indicate that for all k the headcount ratio H increases between 2001 and 2007 and then decreases in 2011–2012 (to a level similar to 2001). The average deprivation share A also increases and then decreases, except for $k = 4$, where A also increases from 2007 to 2011–2012.

Table 3. A–F poverty multidimensional indices $\boldsymbol{M}_0$, $\boldsymbol{M}_1$, and $\boldsymbol{M}_2$, and percentage change, by year and deprivation count k

k	2001	2007	2011–2012	% change 2001–2007	% change 2007 to 2011–2012	% change 2001 to 2011–2012
$\boldsymbol{M}_0$						
1	0.264	0.291	0.277	10.3*	−4.8*	5.0*
2	0.241	0.269	0.251	11.6*	−6.8*	4.1*
3	0.180	0.217	0.193	20.8*	−11.0*	7.5*
4	0.097	0.131	0.109	34.9*	−16.2*	13.0*
$\boldsymbol{M}_1$						
1	0.158	0.180	0.167	13.7*	−7.3*	5.4*
2	0.145	0.165	0.150	14.2*	−9.3*	3.5*
3	0.110	0.134	0.116	22.4*	−14.0*	5.4*
4	0.060	0.081	0.065	35.1*	−20.1*	8.0*
$\boldsymbol{M}_2$						
1	0.131	0.150	0.138	15.0*	−7.9*	5.9*
2	0.119	0.138	0.124	15.3*	−9.9*	3.9*
3	0.090	0.111	0.095	23.5*	−14.0*	6.2*
4	0.049	0.067	0.054	36.4*	−19.7*	9.5*

Source: own calculations with 2001, 2007, and 2011–2012 ICES/PICES data. See text and Online Appendix for detail of the computation of M_α. Percentage changes are computed as $100 * (M_{\propto,t} - M_{\propto,t-a})/M_{\propto,t-a}$. Sample weights are applied to household observations to obtain nationally representative figures. Stars indicate significance of the changes at 5 per cent, computed following Yalonetzky (2011).

Table 4. Headcount ratio (H) and average deprivation share (A) in the A–F indices, by year and deprivation count k

	2001	2007	2011–2012	Change 2001–2007	Change 2007 to 2011–2012	Change 2001 to 2011–2012
H						
k = 1	0.861	0.877	0.873	0.016*	−0.004	0.012
k = 2	0.685	0.714	0.683	0.029**	−0.031**	−0.002
k = 3	0.434	0.504	0.450	0.070**	−0.053**	0.017
k = 4	0.195	0.257	0.210	0.062**	−0.047**	0.015**
A						
k = 1	0.307	0.332	0.318	0.025**	−0.014**	0.011**
k = 2	0.352	0.377	0.367	0.025**	−0.010**	0.015**
k = 3	0.415	0.432	0.429	0.016**	−0.002	0.014**
k = 4	0.496	0.509	0.521	0.012**	0.012**	0.024**

Source: our calculations with 2001, 2007, and 2011–2012 ICES/PICES data. See text for detail of the computation. Sample weights are applied to household observations to obtain nationally representative figures. Changes are percentage point differences between the pairs of years.
Notes: *significant at 5 per cent (Wald test); **significant at 1 per cent (Wald test).

In contrast to the headcount, A is higher in 2011–2012 than in 2001 for all levels of k. Thus, the proportion of multidimensional poor individuals has not increased between 2001 and 2011–2012, but the poor suffer from a higher average number of deprivations in 2011–2012. This higher number of deprivations drives the overall increase in the incidence of multidimensional poverty.

The overall trend of a limited recovery is confirmed by the analysis of the multidimensional poverty depth and severity, M_1 and M_2 (Table 3). Compared to M_0, M_1 accounts for the depth of each deprivation among the poor and M_2 emphasises deeper deprivations. For all k, the poverty depth M_1 increases between 2001 and 2007 (+22.4% for $k = 3$) but then falls (by a smaller amount) between

Table 5. Percentage contribution of each dimension to the A–F multidimensional poverty indices $\boldsymbol{M}_{\propto}$ for $k = 3$ (deprivation count), by year

	M0			M1			M2		
	2001	2007	2011–2012	2001	2007	2011–2012	2001	2007	2011–2012
Below seven years of education	3.6	2.3	2.2	3.2	2.0	1.6	2.1	1.2	0.8
Child does not go to school	1.5	1.9	1.0	2.9	3.5	1.8	3.1	3.7	1.8
Chronic illness	4.3	**6.2**	**8.6**	3.5	**5.0**	**7.2**	4.3	**6.1**	**8.8**
No health visit	2.9	4.2	**7.7**	2.4	3.4	**6.4**	3.0	4.2	**7.8**
Unemployed	2.2	1.5	1.3	2.7	1.8	1.6	3.3	2.2	2.0
Low assets	**22.8**	**22.0**	**21.1**	**29.5**	**30.1**	**28.1**	**31.3**	**33.0**	**29.7**
Far from services	**12.7**	**15.2**	**12.0**	**11.2**	**13.6**	**10.0**	**6.7**	**8.0**	**5.3**
No electricity	**12.1**	**11.6**	**9.8**	6.8	6.5	5.6	**8.3**	**7.9**	**6.7**
Wood as cooking fuel	**12.2**	**11.9**	**11.6**	**10.0**	**9.6**	**9.7**	**12.2**	**11.6**	**11.8**
Unprotected water source	**5.1**	**5.7**	**6.7**	**6.4**	**6.9**	**8.6**	4.7	**5.1**	**6.6**
No toilet	**7.1**	**6.7**	**6.5**	**5.9**	**5.8**	**5.6**	3.7	3.9	3.6
Small land	2.3	1.3	1.2	4.0	2.3	2.0	4.7	2.7	2.2
Low TLU	**6.1**	**5.2**	**6.1**	**9.1**	**7.5**	**9.6**	**9.6**	**7.8**	**10.3**
Rural equipment	**5.1**	4.3	4.2	2.5	2.1	2.1	3.1	2.6	2.6
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: our calculations with 2001, 2007, and 2011–2012 ICES/PICES data. Percentage contributions are computed following Equation (8) as $\frac{\mu\left(g^{\alpha}_{vj}(k)\right)/d}{M_{\propto}}$ (see Online Appendix). Sample weights are applied to household observations to obtain nationally representative figures.
Notes: Bold indicates percentages higher than 5 per cent.

2007 and 2011–2012 (−14.0% for $k = 3$). A similar trend is found for M_2. Thus, similar to multidimensional poverty incidence, poverty depth and severity are significantly higher in 2011–2012 than in 2001 for all k.[18]

It is possible to break down the incidence, depth, and severity measures by dimension and to decompose the percentage contribution of each dimension to the overall level of the poverty index (Table 5)[19]. Assets, distance to services, access to electricity, and the source of cooking fuel are the greatest contributors to the multidimensional incidence measure M_0 in all periods from 2001 to 2011–2012. Education, land, and unemployment have low contributions to the poverty measures nationally (pooling urban and rural individuals). Health and water source are not large contributors to multidimensional poverty in 2001, but become greater sources of deprivation in later periods. The results imply that deterioration in these areas have important impacts on household wellbeing.

The multidimensional incidence, depth, and severity measures show different trends when calculated separately for rural and urban areas. Poverty declines from 2007 to 2011–2012 are more pronounced in rural areas, while urban poverty does not significantly decrease after 2007 (Table A1, Online Appendix).[20] As a result, poverty significantly increased from 2001 to 2011–2012 in urban areas and did not change significantly in rural areas. Several dimensions improved in rural areas over the entire period (access to electricity, toilets, use of cooking fuel other than wood). In urban areas, households started to lose access to these same assets during the crisis. This suggests that deprivations brought on by the crisis have not dissipated as rapidly in urban areas as in rural areas.

Since the PICES is regionally representative, M_0 is decomposed by the eight provinces and two cities (Table A2, Online Appendix). Results show that changes in multidimensional poverty varied significantly across the country. From 2001 and 2007, poverty remained relatively constant in central-northern regions of Mashonaland (Central, East and West) and Midlands. The general rise in poverty during this period was driven by larger poverty increases in Harare and Matabeleland North and South, Manicaland, and Masvingo. From 2007 to 2011–2012, declines in poverty were greatest in regions in which increases were large during 2001–2007. The only area in which there was a large increase from 2007 to 2011–2012 is Bulawayo. Poverty decreased only slightly or increased moderately between

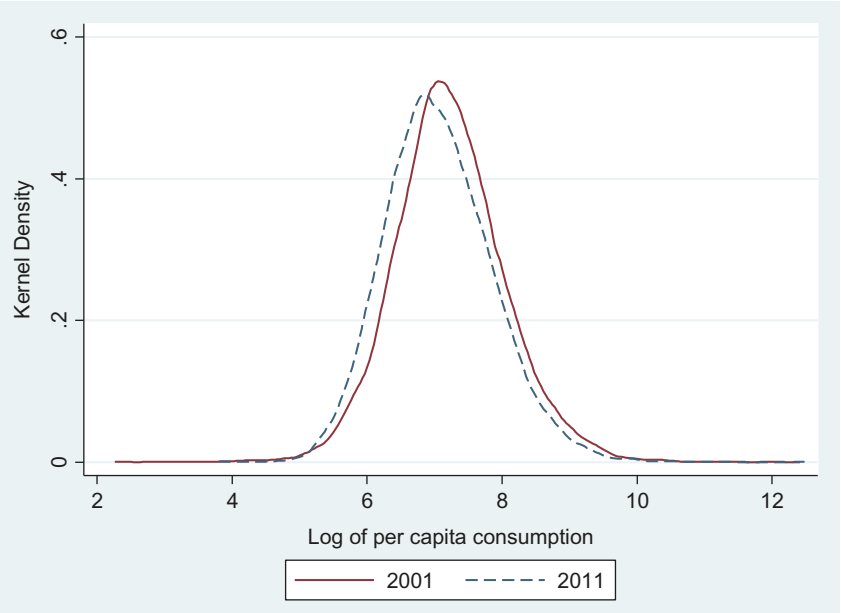

Figure 1. Smoothed density of log of per capita consumption, 2001 and 2011–2012.
Source: our calculations with 2001 and 2011–2012 ICES/PICES data. Sample weights are applied to household observations to obtain nationally representative figures at the individual level.

2001 and 2011–2012 in Mashonaland and Midlands; it increased more, during that period, in Matabeleland and Masvingo, where multidimensional poverty incidence remains high in 2011–2012. Decomposition by land use area shows that in 2001 rural poverty levels were higher in large-scale commercial farming (LSCF) areas compared to resettlement and communal areas. From 2001 to 2011–2012, poverty decreased in LSCF areas but increased in other areas. As a result, by 2011–2012 poverty levels are similar across land use areas.[21]

Money-metric poverty measures are computed for 2001 and 2011–2012 (this was not possible for 2007 because of hyperinflation) for comparison. Figure 1 shows clearly that the distribution of per capita consumption in 2011–2012 lies to the left of the distribution in 2001, indicating a broad-based decrease in wellbeing when measured in money-metric terms. This is confirmed by the computation of the incidence, depth, and severity (money-metric) poverty measures (Table 6). For the poverty line chosen,[22] the increase in poverty is large: a 6.3 percentage point increase in P_0, or a 9.6 per cent increase. Further, the result is not dependent on the threshold chosen, as the poverty incidence is higher for almost the entire range of possible poverty lines (Figure 2).[23] The money-metric poverty estimates are consistent with the multidimensional poverty measures in showing that poverty is higher in 2011–2012 than in 2001, although the measured increase in poverty is greater using the money-metric estimate. However, the decomposition by urban and rural areas contrasts with multidimensional poverty estimates: money-metric measures show an *increase* in rural poverty over the period and a *non-significant change* in urban poverty .[24]

The increase in money-metric poverty contrasts with the improvement in standards of living as manifested in greater access to electricity, good-quality sanitation, and other factors in rural areas. Consequently, in rural areas, consumption has been more severely impacted by the monetised adverse economic shock than long-term indicators such as education level, sanitation, and so forth. However, caution is warranted in making comparisons, because the money-metric poverty results may be influenced by the imprecise price deflator in the context of inflation and change of currency, and because the multidimensional poverty change between 2001 and 2011–2012 is not fully robust to differences in variables employed (see Section 5).

Table 6. FGT money-metric poverty indices in 2001 and 2011–2012

	Estimate	Std. Err.	[99% Conf.	Interval]
2001				
p0	0.685	0.005	0.673	0.697
p1	0.323	0.003	0.315	0.331
p2	0.189	0.002	0.183	0.195
2011				
p0	0.748	0.004	0.737	0.758
p1	0.385	0.003	0.378	0.392
p2	0.238	0.002	0.232	0.243
Change				
p0 change	6.3*	p0 % change	9.6*	
p1 change	6.2*	P1 % change	20.1*	
p2 change	4.9*	P2 % change	26.9*	

Source: our calculations with 2001 and 2011–2012 ICES/PICES data. See text for detail of the computation. Percentage changes are computed as $(\boldsymbol{P}_{\propto,t} - \boldsymbol{P}_{\propto,t-a})/\boldsymbol{P}_{\propto,t-a}$. Sample weights are applied to household observations to obtain nationally representative figures at the individual level.
Notes: *significant at 1 per cent level.

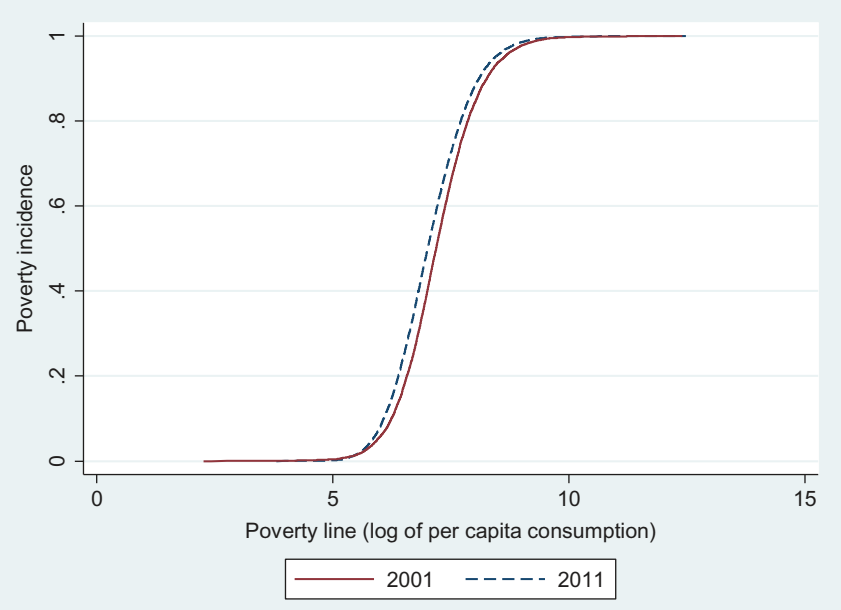

Figure 2. Money-metric poverty incidence as a function of the poverty line.
Source: our calculations with 2001 and 2011–2012 ICES/PICES data, using pov_robust.ado on Stata. Sample weights are applied to household observations to obtain nationally representative figures at the individual level.

Multidimensional and money-metric poor individuals are compared using a (money-metric) poverty line so that the same share of the population is poor under both poverty measures (corresponding to $k = 2$, which is 69% in 2001 and 68% in 2011–2012). The comparison shows that 78.5 per cent of the multidimensional poor individuals are also money-metric poor (and vice versa) in 2001, and 79.9 per cent in 2011–2012 (table available upon request). However, the divergence between the measures is greater in urban areas. In 2001 only 60.7 per cent (57.5% in 2011–2012) of multidimensional poor individuals in urban areas are also money-metric poor, whereas 34.2 per cent (43.4% in 2011–2012) of the money-metric poor are also multidimensional poor. The difference is due to the much

lower proportion of urban poor under the multidimensional measure (26.5% in 2001 and 27.5% in 2011–2012) compared to the money-metric measure (47% in 2001 and 36.4% in 2011–2012).

The profile of money-metric and multidimensional poor households also differs in some key aspects (Table 7). Multidimensional poor have a higher average number of deprivations, a higher share of deprived individuals in each dimension, and a higher per capita consumption than the money-metric poor.[25] Money-metric poor live in larger households than multidimensional poor, but have similar characteristics in terms of household head age, gender, education, and occupation. Differences in poverty profiles under the two measures suggest that money-metric poverty and multidimensional poverty are more dissimilar in urban areas and, thus, greater synergies may arise from complementary analysis using the two measures.

Finally, the results for M_0 are consistent with the MPI of Zimbabwe, based on the 2006 and 2010–2011 DHS (OPHI, 2013). The MPI has the equivalent of a weighted total of 10 possible deprivations and uses $k = 3.33$. It is composed of different variables than ours, categorised in three dimensions: education, health, and living conditions. For 2010–2011, the MPI analysis obtains $M_0 = 0.172$, $H = 0.391$, and $A = 0.440$ for $k = 3.33$, which compares to our result for 2011–2012 of $M_0 = 0.193$, $H = 0.450$, and $A = 0.429$ for $k = 3$. The MPI also shows a decrease in M_0 between 2006 and 2010–2011 (ranging from −4.4% to −19.4% depending on the adjustments made), consistent with the decrease found between 2007 and 2011–2012 of −11 per cent for $k = 3$. However, the

Table 7. Household characteristics for multidimensional (MD) and money-metric (M) poor, by year

	All		MD poor	M poor	MD poor	M poor
	2001	2011	2001	2001	2011	2011
Household size	5.765	5.625	5.833	6.271***	5.800	6.169***
Number of children	2.625	2.560	2.773	2.992***	2.767	2.980***
Male	0.667	0.669	0.631	0.649**	0.643	0.658**
Married	0.765	0.754	0.749	0.761	0.727	0.748***
Age	45.77	46.20	47.05	47.26	47.62	47.59
Primary education	0.525	0.403	0.585	0.581	0.481	0.472
Secondary education	0.337	0.495	0.245	0.258*	0.403	0.417**
Paid employee	0.263	0.172	0.183	0.178	0.0899	0.0910
Own account worker	0.520	0.558	0.654	0.627***	0.711	0.696*
No one with seven or more years of education	0.0928	0.0577	0.128	0.107***	0.0807	0.0669***
Child not in school	0.0376	0.0251	0.0506	0.0485	0.0351	0.0330
Chronically ill	0.0944	0.163	0.114	0.0999**	0.215	0.182***
Did not get healthcare	0.0443	0.111	0.0577	0.0507	0.154	0.129***
Unemployed	0.0818	0.0685	0.0619	0.0636	0.0515	0.0448
Far from services	0.291	0.288	0.389	0.311***	0.397	0.335***
Low asset index	0.609	0.557	0.807	0.693***	0.766	0.669***
No electricity	0.667	0.486	0.869	0.769***	0.677	0.604***
No toilets	0.324	0.314	0.448	0.395***	0.435	0.398***
Unprotected water	0.234	0.362	0.318	0.279***	0.465	0.419***
Wood as cooking fuel	0.737	0.716	0.921	0.838***	0.899	0.853***
Small land	0.101	0.0983	0.135	0.0826***	0.0968	0.0800***
Low TLU	0.261	0.332	0.357	0.281***	0.413	0.367***
Low rural equipment	0.206	0.227	0.286	0.218***	0.280	0.247***
Deprivation count	2.569	2.645	3.345	2.852***	3.488	3.049***
Log pc consumption	7.223	7.060	7.053	6.814***	6.828	6.630***
Observations	19044	28920	12750	11065	21627	19081

Source: our calculations with 2001, 2007, and 2011–2012 ICES/PICES data. Sample weights are applied to household observations to obtain nationally representative figures at the individual level.
Notes: *difference between the two groups (MD and M poor) significant at 10 per cent (Wald test); **difference between the two groups (MD and M poor) significant at 5 per cent (Wald test); ***difference between the two groups (MD and M poor) significant at 1 per cent (Wald test).

current analysis allows us to examine multidimensional poverty during the prior descent into crisis and across a greater range of dimensions, as well as identify pronounced differences in rural and urban conditions.

5. Robustness Checks

Because normative decisions are made in the construction of the measures, it is important to establish the robustness of the results to alternative specifications. The first series of tests consists of changing the dimensions and variables used to compute the poverty measure, the deprivation thresholds used, the weights for each variable, and the adjustments made to the A–F procedures (Table 8). These tests compute multidimensional poverty incidence M_0 for 2001, 2007, and 2011–2012 and the changes between periods (as in Table 3) for $k = 3$. The 25 tests or variants of the measures confirm the robustness of the results between 2001 and 2007 (increase in poverty in all variants) and between 2007 and 2011–2012 (decrease in poverty in all variants). The robustness tests also confirm the ambiguity of the overall change in poverty between 2001 and 2011–2012: while poverty increases in the main specification, in some variants poverty decreases or the change is not statistically significant (see Online Appendix; full results available upon request).

The next robustness checks involve the use of the Bourguignon and Chakravarty (2003) (B–C) multidimensional poverty index instead of the A–F measure (see Online Appendix). Results are similar to those of the A–F measure for $k = 1$ in terms of poverty levels and sign of change between each pair of periods, for $\propto = 0, 1, 2$ corresponding to the incidence, depth, and severity of poverty (Table 9). This confirms the increase in poverty from 2001 and 2007 and the decrease in poverty between 2007 and 2011–2012 in Zimbabwe. Also the B–C poverty index shows an insignificant difference between 2001 and 2011–2012, confirming the ambiguity of the change for the overall period.

The last robustness checks involve the fuzzy-set approach to multidimensional poverty to measure poverty changes in Zimbabwe (see Online Appendix, Equations (10)–(12)). A 'Totally Fuzzy Approach' (TFA) index is computed with two alternative sets of thresholds: the thresholds close to those used for the A–F and B–C indices, and the thresholds encompassing a wider range of values (details available upon request). Regardless of the thresholds used, TFA results

Table 8. Robustness tests performed on variables, weights, and thresholds of the A–F multidimensional poverty indices

Robustness checks	Number of tests
Variables	
Exclude each variable	14
Exclude all rural/urban variables	1
Different assets variable (MCA and alternative indices)	2
Weights	
Use weights of 1	1
Use PCA weights	1
Use MCA weights	1
Thresholds	
Use lower thresholds	1
Use higher thresholds	1
Same thresholds urban/rural	1
Adjustment	
Without household size adjustment	1
M1 and M2 without adjustment	1
Total	25

Note: list of the robustness tests performed on the A–F indices for $k = 3$. The alternative thresholds used are available upon request.

Table 9. Robustness tests: Bourguignon–Chakravarty (B–C) and Totally Fuzzy Approach (TFA) multidimensional poverty measures

	2001	2007	2011–2012	% Change 2001–2007	% Change 2007 to 2011–2012	% Change 2001 to 2011–2012
B–C measure						
P0	0.291	0.324	0.293	11.3*	−9.6*	0.7
P1	0.231	0.261	0.232	12.9*	−11.1*	0.4
P2	0.208	0.238	0.209	14.1*	−12.1*	0.3
FTA measures						
Regular thresholds	0.318	0.337	0.328	6.1*	−2.7*	3.3*
Alternative thresholds	0.358	0.375	0.372	4.7*	−0.9*	3.8*

Source: our calculations with 2001, 2007, and 2011–2012 ICES/PICES data. B–C indices are computed following Equation (9) and TFA indices following Equations (10)–(12) (see Online Appendix). Percentage changes are computed as $100 * (P_{\propto,t} - P_{\propto,t-a})/P_{\propto,t-a}$. The alternative thresholds generate a wider range of values for which deprivation is partial, and are available upon request. Sample weights are applied to household observations to obtain nationally representative figures at the individual level.
Notes: *5 per cent significance of the changes, computed following Yalonetzky (2011).

show that multidimensional poverty increased from 2001 to 2007 and then decreased from 2007 to 2011–2012 (Table 9). The change from 2001 to 2011–2012 is small but positive and significant.

6. Concluding Remarks

Between 2001 and 2012, Zimbabwe spiralled into an acute economic crisis and then slowly recovered. Our analysis shows that multidimensional poverty unambiguously increased in Zimbabwe from 2001 to 2007, and then decreased from 2007 to 2011–2012 during the economic recovery. The results are robust to a wide range of alternative specifications. However, the overall change from 2001 to 2011–2012 is ambiguous (not robust to alternative specifications) and not consistent across regions. In particular, multidimensional poverty increased from 2001 to 2011–2012 in urban areas, where standards of living (such as access to electricity, cooking fuel, toilets, and so forth) deteriorated during the crisis. But in rural areas, multidimensional poverty unambiguously decreased from 2001 to 2011–2012.

Multidimensional wellbeing was fluid during the period of analysis: long-term dimensions of wellbeing that are normally viewed as relatively fixed in the short to medium term changed relatively rapidly in Zimbabwe. Further, changes varied across different dimensions of wellbeing, illustrating the need to carefully examine the underlying components. Some dimensions appear to be resilient to the crisis, either remaining stable (access to toilets) or continuing long-term upward trends (educational attainment, access to electricity). Others deteriorated during the crisis and either recovered after 2007 (primary school enrolment, access to services) or continued to worsen through to 2011–2012 (chronic illness, access to healthcare and clean water). Thus, the effect of the crisis was felt in the short term through some dimensions and over the long term in others.

Changes in multidimensional poverty and its individual components are not consistent across regions. In particular, multidimensional poverty increases from 2001 to 2011–2012 in urban areas, where standards of living (such as access to electricity and sanitation) deteriorated during the crisis and failed to regain their 2001 level during the recovery. In rural areas, multidimensional poverty decreased from 2001 to 2011–2012, and several of the dimensions actually show improvements even as the economy spiralled downward from 2001 to 2007. By uncovering how dimensions of deprivation responded to the crisis and recovery, this paper provides insights into the design of poverty alleviation strategies; these strategies can vary by location and can be targeted toward specific contributing factors.

While some dimensions of wellbeing require rapid delivery of assistance to alleviate the immediate adverse effects of the crisis, others require long-term interventions to address lingering impacts on wellbeing. In particular, the experience from Zimbabwe demonstrates that social safety nets are needed in the short term to avoid asset depletion, removal of young children from school, and other harmful coping strategies, especially where households were hard-hit during the crisis in 2007: primary school enrolment (nationally), maintenance in rural areas of essential services, and access to electricity and cooking fuel use (in urban areas). The detected effects in urban areas are likely due to rural–urban migration-related crowding and public resources might be used to provide services in rapidly growing informal urban areas. During the crisis, food-for-work, in-kind transfers, and other safety net programmes might have been targeted to areas in which the multidimensional indices showed particular vulnerability in the 2001 data.

Other dimensions require long-term support, often in the form of infrastructure maintenance and investment, since health dimensions and access to clean water continued to decline after the crisis. Support for replenishment of household livestock assets and a focus on increasing school enrolments and education quality in rural areas may be needed. Well-structured social assistance programmes must, thus, address both the acute effect of the crisis when it happens and assist poor households in recovering from the crisis in the long term, while building resilience to future shocks.

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Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. Studies estimate that hyperinflation reached 65 followed by 107 zeros in mid-November 2008, which means that prices doubled every 24.7 hours (Hanke & Kwok, 2009).
2. GPD per capita (2005 constant USD) was 681 in 2001, 345 in 2008, and 431 in 2012; after seven years of negative growth, Zimbabwe's annual GDP growth was between 4.4 and 10.6 per cent between 2009 and 2012, but slowing down (http://data.worldbank.org/country/zimbabwe).
3. The CSO is called ZIMSTAT today.
4. For instance, an income-poor household in China has a 68 per cent probability of being multidimensionally non-poor; an income non-poor household in Chad has a 59 per cent probability of being multidimensionally poor (Alkire & Santos, 2011).
5. Multidimensional poverty is identified at the household level, and results are then aggregated across individuals within the household to generate aggregate poverty measures. Thus, households are either poor or not, and all individuals in poor households are considered to be poor. When aggregating poverty, we aggregate over individuals, not households.
6. A is the average number of deprivations of poor individuals divided by the total number of potential deprivations.
7. The 2007–2008 ICES survey was conducted from July 2007 to June 2008, but due to the economic crisis, most interviews planned in 2008 were not conducted.
8. Differences between urban and rural living standards in sub-Saharan Africa are well recognised (Sahn & Stifel, 2003). Ideally, we would have liked to employ a participatory approach in the choice of dimensions and weights (Alkire, 2007; García & Ritterbusch, 2014) or have access to data on what citizens consider necessary in order to live a decent life (Bossert, Chakravarty, & D'Ambrosio, 2009). When appropriate, variables and thresholds commonly used in the Millennium Development Goals (MDG) and multidimensional literatures are employed, as well as those of the MPI.

9. Variable weights are either 0.5 or one to facilitate the intuitive interpretation of the A–F indicator, following the recommendations of Atkinson, Cantillon, Marlier, and Nolan (2002).
10. Even in urban areas, this unemployment indicator does not fully reflect the changes which likely occurred in the labour market, including partial unemployment and forced transition to less remunerative occupations.
11. For instance, the use of wood as cooking fuel is considered as a major health threat, mostly because of associated respiratory illnesses (Ellegård, 1996; Rehfuess, Mehta, & Prüss-Üstün, 2006).
12. The TLU index is computed as follows: $TLU = 1 * (cows + bulls + oxen) + 0.8 * calves + 0.8 * ostriches + 0.5 * pigs + 0.25 * (sheeps + goats) + 0.1 * (geese + turkeys + ducks) + 0.05 * (chicken + pigeons + otherpoultry) + 0.5 * donkey + 0.25 * otherlivestock$
13. Not accounting for household size in the original A–F index is desirable for simplicity, generalisation (application to individual or child poverty), and due to data constraints (construction of the MPI for 122 countries). Since this application does not face such constraints, and because not adjusting for household size creates an undesirable increased probability of being poor in some dimensions with larger household size, the index is adjusted. See the Online Appendix for details.
14. Land ownership deprivation increased between 2001 and 2007 (but not significantly) and decreased significantly between 2007 and 2011–2012.
15. See, for instance, 'Zimbabwean bus drivers in cells, report says', 1 August 2007, *Deutsche Presse-Agentur* (http://www.zimbabwesituation.com/aug2_2007.html#Z18); 'Shops emptied as panic grips Zimbabwe', 4 July 2007, *The Guardian* (http://www.guardian.co.uk/world/2007/jul/05/zimbabwe.topstories3).
16. M_0 is usually much lower than poverty headcount ratios based on a money-metric measure (to which it does not compare directly) because it is the product of the average share of deprivations among poor households (lower or equal to one) and of the headcount ratio (which decreases when k increases; see Equation (1) and the Online Appendix).
17. The significance of the changes was computed following Yalonetzky (2011). Confidence intervals are available upon request.
18. The fact that the measures M_0, M_1, and M_2 follow a similar pattern of change over time indicates that the extent and severity of multidimensional poverty evolved in the same way that the headcount did. In other words, the M_0 results were not driven by some households falling just below the deprivation threshold while other poor households were improving their condition while remaining poor.
19. See the Online Appendix. The percentage contribution to $M_\propto$ is obtained by using the decomposition in Equation (14) and dividing by $M_\propto$, which means: $PCD_{jk}^{\propto} = \frac{\mu\left(g_{ij}^{\propto}(k)\right)/d}{M_{\propto k}}$. $PCD_j^{\propto}$ is computed for $k = 3$ and shows the average percentage contribution of each dimension for $\propto = 0, 1, 2$ (Table 5). Note that the percentage contribution differs from raw ratios of households suffering from each deprivation (Table 2) because it is based only on households whose deprivations count c_i is greater or equal to k, and is presented as a *percentage contribution* to $M_\propto$.
20. Rural areas contribute to more than 80 per cent of $M_\propto$ for all years.
21. Change in LSCF areas are probably due to the fact that the population surveyed in these areas changed between 2001 and 2011 in the context of the land reform. In 2001, the people surveyed were probably more likely to be poor tenants, whereas in 2011 they were probably mostly newly resettled farmers.
22. For comparison purposes, a poverty line is defined so that $P_0 = H$ for $k = 2$ in 2001.
23. This is also true for P_1 and P_2 and significant at the 1 per cent confidence level (results not shown). Consumption is higher in 2011 only for the extreme left tail of the distribution (Figure 1).
24. Results available upon request. In urban areas, the *decrease* in poverty severity is significant at the 5 per cent level.
25. These results are expected by construction of the two poverty measures. Households with a high number of deprivations cannot be multidimensional non-poor, but households with high per capita consumption can be multidimensional poor.

References

Alkire, S. (2007). *Choosing dimensions: The capability approach and multidimensional poverty* (Chronic Poverty Research Centre Working Paper No. 88). Oxford: University of Oxford.

Alkire, S., & Foster, J. (2011a). Counting and multidimensional poverty measurement. *Journal of Public Economics*, *95*(7–8), 476–487. doi:10.1016/j.jpubeco.2010.11.006

Alkire, S., & Foster, J. (2011b). Understandings and misunderstandings of multidimensional poverty measurement. *The Journal of Economic Inequality*, *9*(2), 289–314. doi:10.1007/s10888-011-9181-4

Alkire, S., & Santos, M. E. (2011). *Acute multidimensional poverty: A new index for developing countries*. Proceedings of the German development economics conference, Berlin, No. 3. Retrieved from http://hdl.handle.net/10419/48297

Alkire, S., & Seth, S. (2013). Selecting a targeting method to identify BPL households in India. *Social Indicators Research*, *112*(2), 417–446. doi:10.1007/s11205-013-0254-6

Alwang, J., Mills, B. F., & Taruvinga, N. (2002). Changes in well-being in Zimbabwe, 1990-6: Evidence using semi-parametric density estimates. *Journal of African Economics*, *11*(3), 326–364. doi:10.1093/jae/11.3.326

Asselin, L.-M. (2002). *Composite indicator of multidimensional poverty* (Multidimensional Poverty Theory). Montreal, QC: CECI.

Atkinson, A. B. (2003). Multidimensional deprivation: Contrasting social welfare and counting approaches. *The Journal of Economic Inequality*, *1*(1), 51–65. doi:10.1023/A:1023903525276

Atkinson, T., Cantillon, B., Marlier, E., & Nolan, B. (2002). *Social indicators: The EU and social inclusion*. Oxford: Oxford University Press.

Besada, H., & LaChapelle, J. (2011). Zimbabwe's recovery path: A conceptual framework. In H. Besada (Ed.), *Zimbabwe: Picking up the pieces*. New York, NY: Palgrave Macmillan.

Bird, K., & Shepherd, A. (2003). Livelihoods and chronic poverty in semi-arid Zimbabwe. *World Development*, *31*(3), 591–610. doi:10.1016/S0305-750X(02)00220-6

Booysen, F., Van Der Berg, S., Burger, R., Maltitz, M. V., & Rand, G. D. (2008). Using an asset index to assess trends in poverty in seven Sub-Saharan African countries. *World Development*, *36*(6), 1113–1130. doi:10.1016/j.worlddev.2007.10.008

Bossert, W., Chakravarty, S. R., & D'Ambrosio, C. (2009). *Multidimensional poverty and material deprivation*. Montreal, QC: Université de Montréal, Département de sciences économiques.

Bossert, W., Chakravarty, S. R., & D'Ambrosio, C. (2013). Multidimensional poverty and material deprivation with discrete data. *Review of Income and Wealth*, *59*(1), 29–43. doi:10.1111/roiw.2013.59.issue-1

Bourguignon, F., & Chakravarty, S. R. (2003). The measurement of multidimensional poverty. *The Journal of Economic Inequality*, *1*(1), 25–49. doi:10.1023/A:1023913831342

CSO. (1998). *Poverty in Zimbabwe*. Harare, Zimbabwe.

Deutsch, J., & Silber, J. (2005). Measuring multidimensional poverty: An empirical comparison of various approaches. *Review of Income and Wealth*, *51*(1), 145–174. doi:10.1111/roiw.2005.51.issue-1

Duclos, J.-Y., Sahn, D., & Younger, S. D. (2006). Robust multidimensional spatial poverty comparisons in Ghana, Madagascar, and Uganda. *The World Bank Economic Review*, *20*(1), 91–113. doi:10.1093/wber/lhj005

Ellegård, A. (1996). Cooking fuel smoke and respiratory symptoms among women in low-income areas in Maputo. *Environmental Health Perspectives*, *104*(9), 980–985. doi:10.1289/ehp.96104980

Ersado, L., Alderman, H., & Alwang, J. (2003). Changes in consumption and saving behavior before and after economic shocks: Evidence from Zimbabwe. *Economic Development and Cultural Change*, *52*(1), 187–215. doi:10.1086/edcc.2003.52.issue-1

Ferreira, F. H., & Lugo, M. A. (2013). Multidimensional poverty analysis: Looking for a middle ground. *The World Bank Research Observer*, *28*(2), 220–235. doi:10.1093/wbro/lks013

Foster, J., Greer, J., & Thorbecke, E. (1984). A class of decomposable poverty measures. *Econometrica: Journal of the Econometric Society*, *52*, 761–766. doi:10.2307/1913475

Gallo, C. R., & Roche, J. M. (2013, September 9-12). *The dimensions of poverty in Venezuela and changes over time between 1997 and 2010: A proposal of a multidimensional poverty measure*. Paper presented at the 10th annual conference of the HDCA, Managua.

García, S., & Ritterbusch, A. (2014). Child poverty in Colombia: Construction of a multidimensional measure using a mixed-method approach. *Child Indicators Research*, 1–23.

Gordon, D., Nandy, S., Pantazis, C., Pemberton, S., & Townsend, P. (2004). *The distribution of child poverty in the developing world* (Report to UNICEF). Bristol: Centre for International Poverty Research, Bristol University.

Hamdok, A. A. (1999). A poverty assessment exercise in Zimbabwe. *African Development Review*, *11*(2), 290–306. doi:10.1111/afdr.1999.11.issue-2

Hanke, S. H. (2012). *Zimbabwe: From hyperinflation to growth* (Development policy analysis no. 6). Washington, DC: CATO institute.

Hanke, S. H., & Kwok, A. K. (2009). On the measurement of Zimbabwe's hyperinflation. *The Cato Journal*, *29*(2), 353–364.

Hoddinott, J., & Kinsey, B. (2001). Child growth in the time of drought. *Oxford Bulletin of Economics and Statistics*, *63*(4), 409–436. doi:10.1111/obes.2001.63.issue-4

Laderchi, C. R., Saith, R., & Stewart, F. (2003). Does it matter that we do not agree on the definition of poverty? A comparison of four approaches. *Oxford Development Studies*, *31*(3), 243–274. doi:10.1080/1360081032000111698

Larochelle, C., Alwang, J., & Taruvinga, N. (2014). Inter-temporal changes in well-being during conditions of hyperinflation: Evidence from Zimbabwe. *Journal of African Economies*, *23*(2), 225–256.

Larochelle, C., & Alwang, J. R. (2012, August 12–14). *Schooling achievement amongst Zimbabwean children during a period of economic chaos, 2001–2007/8*. Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington.

Mack, J., & Lansley, S. (1985). *Poor Britain*. London: Allen & Unwin.

Makochekanwa, A., & Kambarami, P. (2011). Zimbabwe's hyperinflation: Can dollarization be the cure?. In H. Besada (Ed.), *Zimbabwe: Picking up the pieces* (pp. 107–128). New York, NY: Palgrave MacMillan.

Makochekanwa, A., & Kwaramba, M. (2010). *Dwindling access to basic services in Zimbabwe* (MPRA Paper No. 28271). Munich: MPRA.

Marquette, C. M. (1997). Current poverty, structural adjustment, and drought in Zimbabwe. *World Development*, *25*(7), 1141–1149.

Mashakada, T. L. J. (2013). *Macroeconomic consequences of fiscal deficits in developing countries: A comparative study of Zimbabwe and selected African countries (1980–2008)*. Stellenbosch: Stellenbosch University.

Moyo, S. (2011). Three decades of agrarian reform in Zimbabwe. *Journal of Peasant Studies*, *38*(3), 493–531.

Mpofu, B. (2011). Some perceptions on the poverty question in Zimbabwe. *Solidarity Peace Trust*. Retrieved from *http://wwwsolidaritypeacetrust*. org/1109/some-perceptions-on-the-poverty-question-in-zimbabwe/

Murithi, T., & Mawadza, A. (2011). *Zimbabwe in transition: A view from within*. Johanesburg: Jacana Media.
Mushongah, J. (2009). *Rethinking vulnerability: Livelihood change in Southern Zimbabwe, 1986–2006* (Doctoral dissertation). University of Sussex, Sussex, UK.
Ndlela, T. (2011). *Evolution of Zimbabwe's economic tragedy: A chronological review of macroeconomic policies and transition to the economic crisis* (MPRA Paper No. 32703). Munich: MPRA.
Nyazema, N. Z. (2010). The zimbabwe crisis and the provision of social services health and education. *Journal of Developing Societies*, *26*(2), 233–261.
OPHI. (2013). Country briefing: Zimbabwe. In O. C. B. 2013 (Ed.), *Multidimensional poverty index (MPI) at a glance*. Oxford: University of Oxford.
Potts, D., & Mutambirwa, C. (1998). "Basics are now a luxury": Perceptions of structural adjustment's impact on rural and urban areas in Zimbabwe. *Environment and Urbanization*, *10*(1), 55–76.
Ravallion, M. (2011). On multidimensional indices of poverty. *The Journal of Economic Inequality*, *9*(2), 235–248.
Reddy, S., & Pogge, T. (2009). *How not to count the poor. (Version 6.2)*. New York, NY: mimeo, Barnard College.
Rehfuess, E., Mehta, S., & Prüss-Üstün, A. (2006). Assessing household solid fuel use: Multiple implications for the millennium development goals. *Environmental Health Perspectives*, *114*(3), 373.
Richardson, C. (2013). *Zimbabwe: Why is one of the world's least-free economies growing so fast?* (Cato Institute Policy Analysis, no 722). Washington, DC: Cato Institute.
Robertson, J., & LaChapelle, J. (2011). Zimbabwe's recovery path: A conceptual framework. In H. Besada (Ed.), *Zimbabwe: Picking up the pieces*. New York, NY: Palgrave Macmillan.
Sahn, D. E., & Stifel, D. C. (2003). Urban–rural inequality in living standards in Africa. *Journal of African Economies*, *12*(4), 564–597.
Scoones, I., Marongwe, N., Mavedzenge, B., Mahenehene, J., Murimbarimba, F., & Sukume, C. (2010). *Zimbabwe's land reform: Myths & realities*. Oxford: James Currey Oxford.
Scoones, I., Marongwe, N., Mavedzenge, B., Murimbarimba, F., Mahenehene, J., & Sukume, C. (2012). Livelihoods after land reform in Zimbabwe: Understanding processes of rural differentiation. *Journal of Agrarian Change*, *12*(4), 503–527.
Sen, A. (1985). Well-being, agency and freedom: The Dewey lectures 1984. *The Journal of Philosophy*, *82*(4), 169–221.
Sen, A. (1999). *Development as freedom*. Oxford, UK: Oxford University Press.
Shamu, S. (2012). *Resource mobilisation for health under the Zimbabwe Investment Case* (EQUINET Discussion Paper Series 94). Harare: Training and Research Support Centre, EQUINET.
Tsui, K. (2002). Multidimensional poverty indices. *Social Choice and Welfare*, *19*(1), 69–93.
UNZ. (2012). *ZIMBABWE 2012* (Millennium Development Goals Progress Report). Harare: Author.
Watts, H., Gregson, S., Saito, S., Lopman, B., Beasley, M., & Monasch, R. (2007). Poorer health and nutritional outcomes in orphans and vulnerable young children not explained by greater exposure to extreme poverty in Zimbabwe. *Tropical Medicine & International Health*, *12*(5), 584–593.
World Bank. (2011). *Water supply and sanitation in Zimbabwe: Turning finance into services for 2015 and beyond*. An AMCOW country status overview. Washington, DC: World Bank Group.
Yalonetzky, G. (2011). *A note on the standard errors of the members of the Alkire foster family and its components* (OPHI Research in Progress no. 25). Oxford: OPHI.
Zamora, G., & De–Regil, L. M. (2014). Equity in access to fortified maize flour and corn meal. *Annals of the New York Academy of Sciences*, *1312*(1), 40–53.
ZIMSTAT. (2013). *Poverty and poverty Datum line analysis in Zimbabwe 2011/12*. Harare: Author.