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Spatial and temporal analyses of women's wellbeing in the Democratic Republic of the Congo

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WIDER Working Paper 2015/059

Spatial and temporal analyses of women's wellbeing in the Democratic Republic of the Congo

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Abstract: This paper sets out to investigate the wellbeing of women in the Democratic Republic of the Congo (DRC). It undertakes spatial and temporal comparisons of women's wellbeing using data from the Demographic and Health Survey and the Multiple Indicator Cluster Survey. Using the multidimensional first-order dominance approach, the results reveal mixed evidence of improvement and deterioration of women's welfare across the DRC over a three-year period (2007–10).

Keywords: poverty comparison, women, Democratic Republic of the Congo, wellbeing
JEL classification: J16, I32, O55, C81

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1 Introduction

The feminization of poverty, or the persistently high representation of women among the world's poorest, gained prominence as a priority development goal following the publication of the United Nations Development Programme's (UNDP 1995) report on gender and development, which asserted that 70 per cent of women were poor. The publication of this report sparked a multilayered debate on conceptual and measurement issues, and the homogeneity of samples. A focus of these debates was the use of per capita cash income as the main measure of household income, resulting in an underestimation of household welfare and rendering the estimation of individual poverty impossible (Quisumbing et al. 2001). This weakness can be addressed through imputed values of home production and consumption expenditures. However, the use of consumption expenditures is not without disadvantages such as its neglect of differences in the use of time by men and women.[1] From this debate emerges the need to find an alternative to monetary measures of poverty.

The seminal work of Sen (1985, 1992, 1993) on functionings and capabilities and the recognition that poverty is a multidimensional phenomenon gave rise to the need to redefine poverty in terms of wellbeing. Sen defines functionings as the state of a person, that is, what a person manages to be or do, and capabilities as the set of a person's functionings or a person's potential functionings. From this framework emerged a large literature seeking to investigate the impact of multidimensional poverty on women and to evaluate and measure multidimensional poverty. The Human Development Index (HDI), its inequality-adjusted counterparts, the Inequality Adjusted HDI and the Gender Inequality Index, and the Multidimensional Poverty Index (MPI) are examples of indices developed to measure multidimensional poverty.

This paper assesses women's wellbeing in the Democratic Republic of the Congo (DRC) where women have long suffered from discrimination both privately and publicly. In 2012, only 62 per cent of girls completed primary school compared to 83 per cent of boys and corresponding to literacy rates among female youth of only 53 per cent (World Bank 2014). Poor education and illiteracy limit women's economic and political participation. Of economically active women, 78 per cent are employed in the agricultural sector where they are vulnerable to declining agricultural productivity (FAO 2011). Furthermore, women constitute 70 per cent of participants in the informal sector (USAID 2014) and hold only 22 per cent of salaried positions in the non-agricultural formal sector (UNDP 2014a). Politically, women are under-represented. In the current government, women occupy less than 20 per cent of parliamentary seats (UNDP 2014a) and represent only six of the 36 cabinet members (USAID 2014). Legal and institutional frameworks reinforce inequity of women. For instance, married women are obligated to obtain their husbands' authorization to work (AFDB 2013) regardless of the fact that gender equality is enshrined in the 2006 constitution. This persistent culture of women's dependence on their husbands perpetuates vulnerability to rape, abuse, and conjugal sexual violence. The political, economic, and social constraints faced by women is captured in the DRC's gender inequality index score of 0.669, ranking the country 147th out of 151 countries (UNDP 2014b).

In this paper, women's wellbeing is defined on the basis of Sen's capability approach for three main reasons: its flexibility to be amenable to a particular context, its focus on functionings, and its incorporation of individualistic characteristics. Six functionings were chosen to provide a measure of basic welfare: being educated, being physically healthy, being sheltered, being

[1] For more information on time allocation, see Brown and Haddad (1995); Juster and Stafford (1991); and Quisumbing et al. (2001).

informed, being able to access clean water, and being able to access improved latrines. Each of these functionings is then translated to a deprivation indicator where a woman is categorized as deprived when she does not achieve that functioning.

The multidimensional first-order dominance (FOD) approach developed by Arndt et al. (2012) provides the methodological framework for this analysis. This approach, rooted in the theoretical literature on stochastic dominance (see Dyckerhoff and Mosler 1997), allows populations to be compared on the basis of multidimensional binary indicators without the imposition of weighting schemes or strong assumptions about the welfare function. The comparison of two populations A and B, made on the basis of the simple concept that it is better to be not deprived than to be deprived in any welfare dimension, yields three possible outcomes: A dominates B, B dominates A, or there is indeterminate domination.

This study undertakes spatial and temporal FOD comparisons of the wellbeing of women in each of the 11 provinces and three aggregate areas (national, urban, and rural areas) of the DRC using data from the 2007 Demographic and Health Survey (DHS) (Ministry of Planning and Macro International Inc. 2008) and the 2010 Multiple Indicator Cluster Survey (MICS) (National Institute of Statistics and UNICEF 2011). Through spatial FOD comparisons using 100 bootstrap samples, the 11 provinces and three aggregate areas are ordinally ranked on the basis of the probability that any area dominates or is dominated by any other area.

This paper contributes to the literature on women's poverty in two ways. First, the analysis provides a disaggregated view of women's welfare at the provincial level. Indeed, this is the first study shedding light on the welfare of women throughout the DRC. Second, multidimensional welfare comparisons can inform policy makers on the appropriate allocation of resources to tackle women's poverty, leading to sustainable and inclusive development.

The organization of this paper is as follows. Section 2 provides a brief literature review of the capability approach. Section 3 describes the analytical and conceptual frameworks. Section 4 presents the FOD approach. Section 5 describes the deprivation indicators, data sources, and descriptive statistics. The results of temporal and spatial static and bootstrap FOD comparisons, including area rankings, are reported in Section 6. Finally, Section 7 discusses the results including strong evidence of heterogeneity and disparity in the wellbeing of women in the DRC.

2 Capability approach: a brief literature review

The basic foundation of the capability approach rests on viewing human life as a set of 'doings and beings' (Sen 1985, 1993), also called functionings. A functioning is the state of a person in terms of what a person manages to be or do. Functionings can be elementary or complex. Examples of elementary functionings include being adequately nourished, being in good health, being sheltered, and being educated. Complex functionings involve deeper concepts such as achieving self-respect or being integrated in a community (Sen 1985, 1993). The capability of a person is the combination of functionings that a person can achieve. A person's capability is determined by how they are able to combine their functionings in order to achieve a certain quality of life. Functionings and capabilities are not commodities; rather commodities are tools for achieving a capability or functioning. For example, a person can have a book (commodity), but the person can acquire knowledge (capability) only if they can read (functioning).

Sen (1992) argues that a wellbeing assessment requires a clarification of the assessment purpose. This can be either a judgement on the person's overall achievement (wellbeing) or the achievement of more specific goals. Since functionings are elements of a person's being, a

person's wellbeing can be described as the quality of their set of functionings or capabilities. Thus, the capability approach stipulates that the evaluative space of a person's wellbeing is their capabilities as related to their set of functionings. Nevertheless, the capability approach does not determine which of the functionings is important or relevant in achieving wellbeing. Sen (1992) leaves this question unanswered.[2]

The works of Nussbaum (2000) and Robeyns (2003) provide examples of how Sen's capability approach can be applied to specific aspects of wellbeing. Nussbaum adapts the capability approach to a social justice theory through a moral–legal–political philosophy. Specifically, the approach draws on the political principle that a government should guarantee specific capabilities, which can also be seen as goals, to all its citizens. Therefore, in defining relevant capabilities, Nussbaum establishes a partial theory of justice aimed at guiding political principles, which she argues should be incorporated in all constitutions (Nussbaum 2000).

Robeyns (2003) argues that Sen's capability framework offers three advantages for studying gender inequality. First, the capability approach is an individualistic approach that considers a number of societal features such as social norms and discriminatory practices. Second, the capability approach considers the beings and doings of an individual in market and non-market settings. The non-market dimension considers the complexities and ambiguities in the distribution of women's wellbeing, that is, how other members of the household benefit from women's wellbeing. The third advantage acknowledges human diversity such as race, age, ethnicity, and gender.

Most relevant to the analysis conducted in this paper is that Sen's capability approach is the basis of the human development approach (HDA) adopted by the UNDP for its annual ranking of countries with the HDI. The HDA approach to monitoring human development involves two basic themes: evaluative and agency aspects of wellbeing. The former is concerned with evaluating improvement in human lives and explicit development objectives using human achievement as key indicators. The latter is concerned with what human beings can do to improve their conditions, particularly through policy and political changes. In practice, the HDI is a composite index of basic human capabilities including the capabilities to survive and be healthy, to be knowledgeable, and to enjoy a decent standard of living (Fukuda-Parr 2003).

3 Conceptual framework: from capabilities to deprivation

The conceptual framework used in the analysis builds upon Sen's capability approach. The adaptability of this approach is relevant to the present study on women's wellbeing in that it avoids several key pitfalls that arise in the conceptualization and measurement of the feminization of poverty. For instance, Sen's approach provides the framework and rationale for analysing individual women as opposed to entire households. Furthermore, in the capabilities framework, commodities and resources are important only as means to enhance and achieve individual wellbeing. Consequently, this study avoids the difficulties that arise in defining wellbeing in terms of monetary resources and, instead, focuses on measurable welfare outcomes. Finally, because the approach does not prescribe a particular set of outcomes, it allows for a vast range of achievements and outcomes most relevant to the context of persistent poverty in the DRC. Particularly, this study is able to focus on the most basic ability to avoid deprivation.

[2] Sen (1992) does not endorse one specific well-defined list of functionings or capabilities, arguing that a list should be made through a democratic process and not be drawn up by theorists.

Following Sen (1993), women's achievement of wellbeing is defined as an evaluation of the wellness of her state of being (i.e. achieved functionings). In this context, the study is interested in assessing a woman's most basic sense of wellbeing—her ability to avoid deprivations associated with poverty. Hence, six basic functionings are translated into measurable welfare indicators in the areas of education, physical health (the use of mosquito nets), shelter, information, clean water, and improved sanitation. These functionings are both intrinsically and instrumentally important at the most basic level, particularly in the evaluation of poverty. Note that these functionings have been universally recognized as important aspects of wellbeing by their inclusion in the United Nations' Millennium Development Goals (MDGs) and in the current debate on formulating post-2015 goals. This set of deprivation indicators parallels the Bristol indicators developed by Gordon et al. (2003a, b) as well as those adopted in other FOD studies (e.g. Arndt et al. 2012).

A large body of evidence demonstrates the importance of each of the chosen welfare indicators. Girls' and women's education is not only a prerequisite for gender equality and women's empowerment but the literature suggests that it is also a key component for achieving economic growth. In an analysis of the extent to which gender bias in education impacts growth, Klasen (1999) finds that the 0.56, 0.95, and 0.85 per cent differences in the annual growth between East Asia and sub-Saharan Africa (SSA), South Asia, and the Middle East and North Africa, respectively, can be explained by gender inequality in education. Dollar and Gatti (1999) also investigate the relationship between gender inequality, income, and growth in 127 countries over three decades (1975–90) and find strong evidence that gender inequality in secondary education impedes economic growth.

Quality of water and latrines and the use of mosquito nets all play an essential role in achieving good health. At the macroeconomic level, women's health is paramount for increasing women's participation in economic activities and for increasing human capital—for themselves as well as for their children. Good health, in turn, creates a positive impact on the economic development in the long term.

Economists have identified numerous direct and indirect links between health and a country's level of outputs (Weil 2005). Healthier people are better workers as they tend to work longer and harder. They display decreased absenteeism, improved cognitive functioning, and greater motivation to acquire education, all of which in turn lead to higher earnings (Weil 2005). McCarthy et al. (2000) investigate the impact of malaria morbidity and economic growth. Controlling for the bi-directional link of malaria morbidity and income per capita, they find that an increase in malaria morbidity leads to a decrease in SSAs growth rate by 0.6 per cent.

Bratt (2002) argues that housing is important for people's wellbeing. At the instrumental level, good housing is positively related to good mental and physical health. But housing also counts intrinsically as 'the physical space that is most intimately associated with one's identity' (Bratt 2002: 19, in Robeyns 2003), and thereby has a substantial impact on how one feels about oneself and even about one's personal empowerment.

4 Multidimensional FOD

This study evaluates the wellbeing of women in the DRC using the FOD approach to multidimensional welfare analysis developed by Arndt et al. (2012). FOD provides a method of comparing multidimensional welfare between population groups on the basis of a set of binary welfare indicators. This approach avoids many pitfalls that arise in multidimensional welfare comparisons such as the need to set arbitrary weighting schemes in aggregating welfare

outcomes. The FOD methodology simply requires that it is better to be not deprived than to be deprived in any welfare dimension.

A practical illustration of the FOD approach provides the best insight into this methodology (for a full discussion of the theoretical context and basis of the methodology, see Arndt et al. 2012). Suppose a set of three binary welfare indicators yielding eight possible outcomes, such that 0 indicates deprivation and 1 no deprivation (see the first four columns of Table 1). First, consider two individuals, 'a' and 'b'. Assume that individual 'a' has the outcome combination (1, 1, 1) while individual 'b' has (0, 0, 0). Obviously 'a', who is not deprived in any indicator, is better off than 'b', who is deprived in all indicators; 'a' first order dominates 'b'. Further, consider the outcomes (0, 1, 1) for 'a' and (0, 1, 0) for 'b'. Individual 'a' still dominates 'b' because it is better to be not deprived than to be deprived in the third outcome. However, if 'a' has the outcome (1, 1, 0) and 'b' has the outcome (0, 0, 1), it cannot be determined whether 'a' or 'b' dominates and these outcomes are deemed indeterminate. Because no assumptions are made about the value of being not deprived in any dimension, it is not possible to determine whether it is better to be not deprived in the first two dimensions than to be not deprived in only the last dimension.

Next, consider four populations of individuals (A, B, C, and D) with observable information on the set of indicators as well as on the number of households or individuals falling into each of the eight possible outcomes (columns A–D of Table 1). The FOD criterion can be defined as follows: population A first order dominates population B if B's outcome can be recreated by moving probability mass—shares of the population or individuals—in population A to unambiguously worse outcomes.

Table 1: Distributions and shares of population

Outcomes	Indicators			Populations				Shares (%)			
	1	2	3	A	B	C	D	I	II	III	IV
1	1	1	1	25	20	25	15	12.5	10	12.5	7.5
2	1	1	0	15	15	25	10	7.5	7.5	12.5	5
3	1	0	1	20	20	20	15	10	10	10	7.5
4	1	0	0	25	25	20	35	12.5	12.5	10	17.5
5	0	1	0	35	35	35	35	17.5	17.5	17.5	17.5
6	0	1	1	25	25	25	30	12.5	12.5	12.5	15
7	0	0	1	35	35	35	30	17.5	17.5	17.5	15
8	0	0	0	20	25	15	30	10	12.5	7.5	15
Total				200	200	200	200	100	100	100	100

Note: 0: deprived, 1: not deprived.

Source: Illustrative example created by authors.

Table 1 indicates that 25 individuals (or 12.5 per cent) of population A are not deprived in any indicator. Reading down the columns moves from individuals who are not deprived in any indicator to those who are deprived in all three indicators. Hence, there are 30 individuals (or 15 per cent) of population D that are deprived in all three indicators.

Comparing populations A and B reveals that A first order dominates B because population B's welfare distribution can be recreated by moving five individuals in population A from outcome (1, 1, 1) to outcome (0, 0, 0), that is, to an unambiguously worse outcome. Likewise, population C dominates population A because the distribution of A can be recreated from C by moving ten individuals from outcome (1, 1, 0). Five individuals are moved to outcome (1, 0, 0) and five are moved to outcome (0, 0, 0), where both outcomes are worse than (1, 1, 0). Turning to populations C and B, observe that population B can be created from C by moving five individuals from (1, 1, 1) to (1, 0, 0) and ten individuals from (1, 1, 0) to (0, 0, 0) such that all the moved individuals are worse off. Population C dominates population B. Note that, in general, if population C dominates A, and population A dominates B, then region C must dominate region

B. However, comparing D and C, FOD is indeterminate. Observe that C cannot be recreated from D and D cannot be created from C without moving individuals from worse to better outcomes, which violates the condition for FOD. The same conclusion applies to the comparison of D with A and B.

FOD results yield a method for ranking populations whereby each population is assigned an FOD score of 1 when it dominates another population, 0 if a comparison is indeterminate, and -1 if it is dominated. The sum of these scores—the net domination score—provides the criterion for ranking areas. Extending the above example, Table 2 illustrates the use and shortcomings of net domination scores. The sum of FOD scores for row populations compared to column populations gives the net domination score. In this example, with a small number of populations, ranking is problematic as it easily results in ties. However, this problem can be overcome with bootstrap sampling as discussed later.

Table 2: FOD results and net domination scores

Populations	A	B	C	D	Net domination score
C	1	1		0	2
A		1	−1	0	0
D	0	0	0		0
B	−1		−1		−2

Source: Illustrative example created by authors.

Because the FOD criteria are strict the method has associated disadvantages. As seen earlier, it is quite likely that comparisons between populations result in indeterminate outcomes, which is problematic both in comparing two populations and in ranking many populations. Furthermore, in the case of clear domination, FOD provides no indication of the extent of domination, that is, whether there are marginal or vast differences between the wellbeing of two populations.

Applying bootstrap sampling overcomes these constraints. With repeated sampling, the results of FOD comparisons indicate the probability of domination, and provide a measure of the extent of domination. Furthermore, bootstrap sampling decreases the likelihood of obtaining strictly indeterminate results in that dominance is now measured by the average domination outcome across all bootstrap samples. In the same regard, bootstrap sampling provides greater information allowing effective ranking of populations.

Empirically, a linear programming algorithm developed by Arndt at al. (2012) checks FOD conditions. The analysis involves two classes of comparisons: (1) the static comparison, a one-time comparison using the original survey data; and (2) the bootstrap comparison, the average FOD results across 100 bootstrap samples. As mentioned, FOD comparisons yield three possible outcomes; population A dominates population B, population B dominates population A, or there is indeterminate domination.

5 Deprivation indicators, data sources, and descriptive statistics

This study utilizes data from the 2007 DHS and the 2010 MICS, tabulated by the Ministry of Planning and Macro International Inc. (2008), and the National Institute of Statistics and UNICEF (2011), respectively. Both surveys are nationally representative household surveys that collect comparable data for a wide range of indicators in the areas of population, health, nutrition, child protection, and HIV/AIDS. The DHS collects data in phases and attempts to maintain a consistent questionnaire over time. MICS data allow for benchmarking and measuring

progress towards a set of agreed-upon goals such as the MDGs (MICS 3 and 4) and mid-decade goals set for the World Summit for Children (MICS 2).[3] This study used both the household and women surveys because four out of the six deprivation indicators capture household characteristics.

The unit of analysis is women in their reproductive age, that is, women between 15 and 49 years of age. Analysis is presented for a sample of married women[4] and a sample of all women (including married women). Recognizing that there is heterogeneity among women, ideally the study ought to also present samples of single, divorced, and widowed women. Unfortunately, samples sizes for these groups of women were insufficient for accurate analysis. The two datasets used in the analysis have a total sample size of 8718 and 12,630 women for 2007 and 2010, respectively, with 7884 and 8235 of these being classified as married (see Table 3). While discussion focuses on the all-women sample, highlights from the married-women sample are also presented.

For the purpose of this study, women's wellbeing is a set of six binary deprivation indicators resulting in two or 64 possible combinations of outcomes.[5] Deprivation in each indicator is defined as follows: where the indicator has the value 0 when a woman is deprived and 1 when she is not deprived:

1. Sanitation deprivation: No access to any kind of latrine or toilet.
2. Water deprivation: Access to only surface water for drinking or to a water source more than a 15-minute walking distance (one way) from the dwelling.
3. Shelter deprivation: Living in a dwelling with an unimproved flooring material (e.g. a mud floor).
4. Education deprivation: The inability to read at a basic level.
5. Information deprivation: No access to a television or a radio set.
6. Health deprivation: The lack of using a mosquito net the previous night.

The definitions of the six indicators do not capture gender inequality and the impact of the social, political, and economic institutions or gender roles and power differences in acquiring these functionings. First, this is because the study focuses only on women. Second, the nature of the data and the methodology used in this study do not allow us to examine such complexities. Finally, the study aims to evaluate women's poverty in terms of deprivations in the most basic needs.

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[3] For more information on the DHS and the MICS, visit http://www.unicef.org/statistics/index_24302.html and http://www.measuredhs.com/data/data-collection.cfm.

[4] Married women and women living with a man.

[5] Owing to the large number of outcomes, we are unable to report them here. However, they are available upon request.

Table 3: Women not deprived by indicator (%)

Area	Sample		Sanitation		Water		Shelter		Information		Health		Education	
	2007	2010	2007	2010	2007	2010	2007	2010	2007	2010	2007	2010	2007	2010
All women														
National	10,576	12,750	89.5	86.2	39.0	45.1	24.4	26.0	49.1	51.1	17.7	37.7	44.0	48.2
Rural	5498	7178	85.0	79.3	17.1	23.4	4.3	3.8	34.7	35.5	13.6	36.4	26.8	29.2
Urban	5078	5572	96.5	97.0	74.2	78.8	56.5	60.2	72.3	75.4	24.3	39.7	71.5	77.7
Bandundu	980	1195	88.1	84.3	15.3	16.7	12.3	4.8	37.1	35.2	14.3	39.9	42.0	49.9
Bas-Congo	768	987	81.9	75.6	43.1	37.2	29.0	30.2	66.0	64.5	39.2	30.5	51.0	51.3
Equateur	974	1102	90.7	83.7	11.0	13.0	6.2	5.3	30.7	26.7	21.6	51.2	31.1	30.1
Kasai Occidental	795	1138	72.9	57.3	25.5	12.0	8.0	3.9	44.9	27.8	11.4	19.2	36.7	32.5
Kasai Oriental	910	1103	91.4	84.4	42.7	40.6	18.1	15.5	52.2	38.5	7.5	12.4	48.3	49.4
Katanga	962	1243	85.3	81.0	55.2	51.0	26.2	16.2	49.4	48.2	26.4	32.3	43.5	38.5
Kinshasa	1798	1477	98.9	98.7	87.7	87.8	92.6	91.8	85.1	89.2	24.1	44.1	88.5	90.4
Maniema	906	1100	90.7	87.9	24.3	27.0	6.6	4.7	50.4	50.0	21.5	58.4	37.7	38.0
Nord-Kivu	827	1241	93.5	93.2	66.2	54.3	11.0	15.7	51.9	55.5	7.8	37.0	23.1	37.3
Orientale	826	1066	93.7	94.1	29.2	48.9	7.2	7.8	36.0	43.1	9.5	47.7	21.0	32.1
Sud-Kivu	830	1098	92.3	88.6	54.2	47.6	25.4	22.0	55.7	52.9	25.9	40.3	35.5	37.6
Married women														
National	6656	8328	89.0	85.3	34.0	40.8	18.6	20.9	46.9	49.5	21.4	43.3	39.2	42.9
Rural	3954	5194	85.4	79.7	16.3	22.8	3.8	3.7	35.0	36.7	16.9	42.9	25.3	26.6
Urban	2702	3134	96.3	96.5	70.1	76.3	48.9	54.8	71.0	74.9	30.6	44.2	67.7	75.0
Bandundu	598	712	89.8	83.3	15.1	16.6	13.0	4.0	37.8	37.7	19.3	50.8	42.7	49.5
Bas-Congo	476	598	81.1	76.1	37.6	32.7	21.7	27.1	63.8	70.1	49.3	37.5	46.8	46.9
Equateur	693	834	91.4	84.7	11.7	12.7	5.5	4.3	30.5	26.6	26.3	57.9	28.6	26.4
Kasai Occidental	599	860	71.5	55.8	22.0	11.9	7.0	2.8	45.7	26.6	14.7	22.0	36.2	30.1
Kasai Oriental	649	803	92.3	84.6	41.5	39.8	15.1	15.0	51.3	38.8	10.3	16.2	46.9	47.6
Katanga	642	888	82.4	81.5	49.0	50.5	21.9	14.3	46.6	48.8	28.6	38.1	37.5	35.8
Kinshasa	738	733	99.1	98.7	85.4	84.2	91.1	90.0	87.0	89.2	33.7	47.7	87.3	89.6
Maniema	681	796	88.7	88.1	22.4	24.4	5.4	3.9	50.1	47.6	25.2	61.9	34.9	32.3
Nord-Kivu	500	719	94.5	92.6	67.1	51.6	8.5	11.6	53.1	56.0	10.6	45.1	18.9	32.6
Orientale	568	688	93.9	95.4	25.0	46.3	6.2	7.5	35.9	45.6	9.8	53.1	18.6	26.9
Sud-Kivu	512	697	93.5	86.5	54.0	43.5	23.6	16.5	55.6	50.9	34.7	47.0	33.6	30.3

Source: Authors' computation using the 2007 DHS (Ministry of Planning and Macro International Inc. 2008) and the 2010 MICS (National Institute of Statistics and UNICEF 2011).

Table 3 reports the percentage of women not deprived in each indicator in the three aggregate areas (rural, urban, and national) and the 11 provinces in 2007 and 2010.[6] Note that low values imply that an area has a high share of women deprived in a given indicator. Beginning with the sample of all women, nationally there has been an increase in the number of women not deprived in five out of the six deprivation indicators. Specifically, water, shelter, information, health, and education improved by 6.1, 1.6, 2, 20, and 4.2 percentage points from 2007 to 2010, respectively. Urban women advanced in all six indicators, though only marginally in access to improved sanitation. Women not deprived in sanitation declined by 3.3 percentage points at the national level, this decline being driven by a 5.7 percentage point decline in rural areas. Advancement in the quality of flooring in urban areas led to improvements at the national level; however, rural areas experienced a decline in improved flooring. Both the direction and magnitude of change in the deprivation indicators is mirrored in the married women sample.

There is no consistent pattern of change in the deprivation indicators at the provincial level in either sample of women. Bed net usage is the only indicator that improved substantially in every province, with the exception of Bas-Congo. Although the provinces generally follow the national trends in each indicator, there are many exceptions. Only Orientale improved in more than four indicators, though marginally in sanitation and shelter. Orientale also achieved the greatest gains with double-digit percentage improvements in water, information, health, and education. Kasai Occidental experienced declines in the percentage of women not deprived in every indicator except health, with substantial deterioration in sanitation, water, shelter, and information.

Table 4 reports the share of married women and all women by number of welfare deprivations in the three aggregate areas and in each province. Moving down the columns, the number of deprivations increases from women who have no deprivations to women who are deprived in all six indicators. Focusing on the all-women sample, nationally there is an increase in the number of women not deprived in any indicator, from 4.6 per cent in 2007 to 8.3 per cent in 2010. However, there is also a small increase in the number of women deprived in all six indicators, from 4.8 per cent in 2007 to 5.4 per cent in 2010. In both years, Kinshasa had the lowest share of women deprived in all six indicators (0 per cent in 2010) and the highest share of women not deprived in any dimension (33.2 per cent in 2010). Over the three-year period in Kasai Occidental, the percentage of women deprived in all six indicators nearly doubled from 12.6 to 23.8 per cent.

[6] The new constitution of the Democratic Republic of the Congo adopted in 2006 divides the country into 25 provinces. These provinces are: Bas-Uele, Equateur, Haut-Lomami, Haut-Katanga, Haut-Uele, Ituri, Kasai, Kasai Oriental, Kongo Central, Kwango, Kwilu, Lomami, Lualaba, Lulua, Mai-Ndombe, Maniema, Mongala, Nord-Kivu, Nord-Ubangi, Sankuru, Sud-Kivu, Sud-Ubangi, Tanganyika, Tshopo, and Tshuapa. However, the implementation of the new constitution is still lacking. For this reason, we only consider the 11 provinces as organized by the old constitution.

Table 4: Women by number of deprivations (%)

No. deprivations	National		Rural		Urban		Bandundu		Bas-Congo		Equateur		Kasai Occidental	
	2007	2010	2007	2010	2007	2010	2007	2010	2007	2010	2007	2010	2007	2010
All women														
0	4.6	8.3	0.1	0.5	11.7	20.5	11.7	20.5	4.8	4.0	0.6	0.7	0.8	0.5
1	12.7	14.3	1.2	2.9	31.1	32.0	31.1	32.0	16.6	13.3	0.6	2.9	3.9	1.5
2	11.9	13.1	5.9	9.0	21.5	19.5	21.5	19.5	19.2	16.8	7.1	8.7	11.2	5.5
3	17.7	19.7	17.2	22.2	18.5	16.0	18.5	16.0	21.6	24.3	19.1	20.5	15.6	14.4
4	23.8	22.2	31.6	31.0	11.3	8.5	11.3	8.5	22.4	21.0	30.7	33.5	27.7	22.7
5	24.5	16.9	36.4	25.8	5.4	3.2	5.4	3.2	12.4	16.9	37.6	28.0	28.2	31.7
6	4.8	5.4	7.6	8.7	0.5	0.4	0.5	0.4	3.1	3.7	4.3	5.7	12.6	23.8
Married women														
0	4.4	7.3	0.2	0.5	13.1	20.7	2.6	0.6	5.3	3.9	0.5	0.8	1.1	0.4
1	9.1	11.7	1.2	3.1	25.1	28.5	4.1	3.9	12.6	10.1	0.6	2.7	3.7	1.4
2	11.1	13.3	5.9	9.5	21.5	20.9	9.2	15.0	18.8	20.4	8.7	8.5	10.8	5.2
3	18.4	20.7	17.3	23.1	20.7	16.1	18.1	28.2	22.0	26.2	17.3	20.5	15.5	13.9
4	25.6	23.4	31.6	30.4	13.4	9.6	29.9	26.5	26.1	19.7	32.1	36.3	26.7	22.0
5	26.5	18.2	36.7	25.7	5.6	3.6	30.3	20.6	12.6	17.2	37.4	25.8	29.2	33.4
6	5.0	5.3	7.1	7.7	0.6	0.5	5.6	5.1	2.7	2.6	3.5	5.4	13.1	23.8

	Kasai Oriental		Katanga		Kinshasa		Maniema		Nord-Kivu		Orientale		Sud-Kivu	
	2007	2010	2007	2010	2007	2010	2007	2010	2007	2010	2007	2010	2007	2010
All women														
0	0.5	1.6	10.8	6.1	18.6	33.2	0.8	1.3	1.1	5.0	1.0	2.6	3.5	7.6
1	8.0	7.8	16.3	10.0	52.4	44.8	4.1	7.1	4.1	11.7	4.0	8.9	13.5	14.7
2	15.1	10.7	10.8	14.0	19.5	14.5	11.5	18.3	15.7	15.0	6.5	15.4	17.4	12.3
3	29.6	25.9	12.5	20.0	7.1	5.5	25.0	25.5	29.1	25.7	14.3	27.3	21.5	17.9
4	24.6	25.9	16.1	22.7	1.9	1.7	30.9	28.4	30.0	27.2	31.4	25.9	24.9	24.6
5	18.8	20.0	26.8	19.0	0.4	0.1	23.1	16.3	16.9	13.1	38.9	18.4	16.7	18.1
6	3.4	8.1	6.7	8.2	0.2	0.0	4.6	3.1	3.3	2.3	3.9	1.6	2.6	4.9
Married women														
0	0.6	2.0	9.8	5.9	24.8	35.2	0.9	0.8	1.4	4.6	0.9	3.0	4.5	7.2
1	6.8	7.5	13.0	9.6	47.2	40.6	3.5	5.6	4.1	11.3	2.8	9.8	14.5	10.8
2	14.5	11.8	9.0	14.8	18.5	15.5	11.3	17.6	13.0	13.6	5.6	13.7	15.8	12.2
3	31.3	23.1	14.6	20.0	6.8	6.0	24.2	25.5	31.0	28.1	14.1	27.4	21.5	17.9
4	24.2	27.4	16.9	23.1	2.2	2.4	31.5	30.2	30.8	27.1	32.3	25.6	26.2	27.8
5	19.2	20.6	28.8	20.2	0.3	0.3	22.5	17.8	17.6	13.0	40.8	19.1	15.2	19.5
6	3.3	7.5	8.0	6.4	0.3	0.0	5.9	2.5	2.2	2.4	3.6	1.3	2.3	4.7

Source: Authors' computation using the 2007 DHS (Ministry of Planning and Macro International Inc. 2008) and the 2010 MICS (National Institute of Statistics and UNICEF 2011).

6 Results: Spatial and temporal FOD

6.1 Temporal static and bootstrap FOD

This section first presents the results of temporal FOD comparisons. In temporal comparisons, for a given area we compare the welfare in 2007 to that in 2010. Table 5 reports the probability of domination over 100 bootstrap draws, with values in bold indicating domination in static comparisons. A blank entry indicates the results are indeterminate. Specifically, given the FOD criteria, it cannot be determined whether 2007 dominates 2010 or vice versa.

Table 5: Temporal bootstrap FOD comparisons

	All women		Married women	
	2007 FOD 2010	2010 FOD 2007	2007 FOD 2010	2010 FOD 2007
National				
Rural				0.00
Urban		**0.28**		**0.19**
Bandundu		0.01		0.02
Bas-Congo	0.08			
Equateur				
Kasai Occidental	0.01		0.03	
Kasai Oriental				
Katanga	0.02		0.01	0.01
Kinshasa		0.09		0.01
Maniema		0.01		
Nord-Kivu		0.07		
Orientale		**0.13**		**0.48**
Sud-Kivu			0.01	

Note: Values indicate probability of domination across bootstrap samples, where a '1' indicates that all 100 bootstrap comparisons resulted in domination. An empty cell indicates no domination. Bold values indicate domination in the static case.

Source: Authors' computation using the 2007 DHS (Ministry of Planning and Macro International Inc. 2008) and the 2010 MICS (National Institute of Statistics and UNICEF 2011).

The analysis presented in Table 5 provides only limited evidence of welfare advancement between 2007 and 2010. For the samples of all women and married women, static FOD comparisons suggest that 2010 dominates 2007 in urban areas and in the province of Orientale, an outcome evident in the descriptive statistics. Consistent with the static results, temporal bootstrap FOD comparisons also provide evidence of welfare advancement in urban areas and in Orientale province for both samples. Although there are slight probabilities of advancement and regression in other provinces, these probabilities are extremely low. It is possible that an alternative 100 bootstrap draws could result both in indeterminate outcomes in some of these areas as well as in different areas displaying very low probabilities of advancement or regression.

6.2 Spatial static and bootstrap FOD

Spatial FOD comparisons were conducted across the provinces and the three aggregate areas for 2007 and 2010. Tables 6 and 7 report results for all women and Tables 8 and 9 report results for married women. This discussion focuses on the sample of all women. Values in the tables indicate the bootstrap probabilities that the row (column) province dominates (is dominated by) the column (row) province. An empty cell indicates that domination is indeterminate in all bootstrap draws. Bold values indicate domination in the static FOD comparison.

Row (column) averages signify the probability that a province dominates (or is dominated by) all other provinces. Therefore, provinces with higher (lower) welfare have larger (smaller) row (column) averages. The relationship between the averages and welfare is also captured by the probability of net domination, which is the difference between the row and column average for a given area. Hence, positive net domination suggests that the province dominates more provinces than it is dominated by and is relatively better off, and vice versa for provinces with negative net domination. Net domination forms the basis for ranking and is explored in Tables 10 and 11.

The province of Kinshasa stands out with the highest row averages of 72 per cent in 2007 (Table 6) and 76 per cent in 2010 (Table 7), reflecting Kinshasa's high probability of dominating most other provinces and aggregate areas. Furthermore, no other area dominates. Thus FOD comparisons suggest that women in Kinshasa have higher welfare than women in any other area in both 2007 and 2010. Row averages of 65 per cent in 2007 and 58 per cent in 2010 indicate that on average urban areas also dominate most other areas, though fewer in 2010 than in 2007. In contrast, Kasai Occidental and rural areas never dominate any other areas and have the highest column averages. While the column average in rural areas remains steady at 39 and 42 per cent in 2007 and 2010, respectively, Kasai Occidental deteriorates relative to other areas with column averages increasing from 31 per cent in 2007 to 60 per cent in 2010. Bas-Congo and Katanga also are dominated to a greater degree in 2010.

Consistent with temporal results, Orientale achieves the greatest gains in relative welfare in 2010 by dominating rural areas and Kasai Occidental, by no longer being dominated by urban areas, and by being dominated by Kinshasa to a much lesser degree. Though temporal results also suggest welfare advancement in urban areas, spatial FOD does not suggest an improvement relative to other areas. In fact, urban areas dominate to a lesser degree in 2010.

Like temporal results, there is a high degree of indeterminate spatial outcomes. In both 2007 and 2010, virtually all static dominations or higher probabilities of domination in bootstrap comparisons are the result of either Kinshasa or urban areas dominating other areas or rural areas and Kasai Oriental being dominated by other areas. This is true to an even greater extent in 2010. The high degree of indeterminacy suggests that the distribution of populations among welfare outcomes differs greatly between areas.

Tables 8 and 9 present the spatial FOD results for the sample of married women. As with the sample of all women, Kinshasa and urban areas stand out with high probabilities of dominating most other areas; urban areas are only dominated by Kinshasa. Furthermore, Kasai Occidental and rural areas have the highest probabilities of being dominated, with this probability worsening between 2007 and 2010 for Kasai Occidental.

Table 6: 2007 Spatial bootstrap FOD comparisons for all women

	NAT	RUR	URB	BDD	BCG	ETR	KOC	KOT	KTG	KSS	MNM	NKV	ORT	SKV	AVG
National		**1**		**0.44**			**0.54**				0.01		0.02		0.15
Rural															0.00
Urban	**1**	**1**		**0.99**		**0.69**	**1**	**0.99**	0.21		**0.78**	**0.72**	**0.94**	0.15	0.65
Bandundu		0.17				0.05	**0.04**						0.02		0.02
Bas-Congo	0.02	0.22		0.08		0.02	0.79				0.02				0.09
Equateur				0.01											0.00
Kasai Occidental															0.00
Kasai Oriental															0.00
Katanga		0.16		0.09			0.28				0.01	0.02			0.04
Kinshasa	**0.99**	**1**	0.42	**0.98**		**0.66**	**1**	**1**	0.35		**0.72**	**0.98**	**1**	0.31	0.72
Maniema		**0.54**		0.08			0.04						0.01		0.05
Nord-Kivu		0.01													0.00
Orientale		0.02													0.00
Sud-Kivu	0.02	**0.93**		0.19		**0.20**	0.34	0.01			0.07	0.07	0.26		0.16
Average	0.16	0.39	0.03	0.22	0.00	0.12	0.31	0.15	0.04	0.00	0.12	0.14	0.17	0.04	0.14

Note: Bold values indicate domination in the static case. Values indicate probability of domination across bootstrap samples, where a '1' indicates that all 100 bootstrap comparisons resulted in domination. An empty cell indicates no domination. Row averages show the probability an area is dominated by other areas and column averages show the probability an area is dominated by other areas. Abbreviations in column heads correspond to the row heads.

Source: Authors' computation using the 2007 DHS (Ministry of Planning and Macro International Inc. 2008) and the 2010 MICS (National Institute of Statistics and UNICEF 2011).

Table 7: 2010 Spatial bootstrap FOD comparisons for all women

	NAT	RUR	URB	BDD	BCG	ETR	KOC	KOT	KTG	KSS	MNM	NKV	ORT	SKV	AVG
National		**0.93**		0.06			**1**	0.11	0.16						0.17
Rural							0.07								0.01
Urban	**0.93**	**0.93**		0.56	**1**	0.01	**1**	**1**	**1**			**0.70**	0.02	0.45	0.58
Bandundu		0.01					**0.25**								0.02
Bas-Congo							0.95								0.07
Equateur							0.03								0.00
Kasai Occidental															0.00
Kasai Oriental							0.01								0.00
Katanga		0.02					**0.86**								0.07
Kinshasa	**0.96**	**0.97**	**0.96**	**0.81**	**1**	0.16	**1**	**1**	**0.99**		0.02	**0.89**	0.28	**0.78**	0.76
Maniema		**0.46**				0.10	**0.48**								0.08
Nord-Kivu		**0.62**					**0.82**	0.02	0.10					0.03	0.12
Orientale		**0.70**				0.04	0.43	0.01			0.01				0.09
Sud-Kivu	0.01	**0.83**		0.02		0.01	**0.89**	0.03	0.16						0.15
Average	0.15	0.42	0.07	0.11	0.15	0.02	0.60	0.17	0.19	0.00	0.00	0.12	0.02	0.10	0.15

Note: Bold values indicate domination in the static case. Values indicate probability of domination across bootstrap samples, where a ‘1’ indicates that all 100 bootstrap comparisons resulted in domination. An empty cell indicates no domination. Row averages show the probability an area is dominated by other areas and column averages show the probability an area is dominated by other areas. Abbreviations in column heads correspond to the row heads.

Source: Authors’ computation using the 2007 DHS (Ministry of Planning and Macro International Inc. 2008) and the 2010 MICS (National Institute of Statistics and UNICEF 2011).

Table 8: 2007 Spatial bootstrap FOD comparisons for married women

	NAT	RUR	URB	BDD	BCG	ETR	KOC	KOT	KTG	KSS	MNM	NKV	ORT	SKV	AVG
National		**1**		0.15			0.36		0.01		0.02				0.12
Rural															0.00
Urban	**1**	**1**		**0.92**		**0.71**	**0.99**	**0.91**	**0.62**		**0.95**	**0.50**	**0.90**	0.07	0.66
Bandundu		0.33				0.08	0.07						0.02		0.04
Bas-Congo		0.09		0.01			**0.64**		0.03		0.03				0.06
Equateur				0.02											0.00
Kasai Occidental															0.00
Kasai Oriental													0.02		0.00
Katanga		0.04					0.12								0.01
Kinshasa	**1**	**1**	**0.74**	**0.99**		**0.89**	**1**	**1**	**0.85**		**0.99**	**0.94**	**1**	0.42	0.83
Maniema		**0.3**		0.03			0.02								0.03
Nord-Kivu													0.05		0.00
Orientale															0.00
Sud-Kivu	0.01	**0.95**		0.14		0.27	0.29		0.01		0.21	0.10	0.37		0.18
Average	0.15	0.36	0.06	0.17	0.00	0.15	0.27	0.15	0.12	0.00	0.17	0.12	0.18	0.04	0.14

Note: Bold values indicate domination in the static case. Values indicate probability of domination across bootstrap samples, where a ‘1’ indicates that all 100 bootstrap comparisons resulted in domination. An empty cell indicates no domination. Row averages show the probability an area is dominated by other areas and column averages show the probability an area is dominated by other areas. Abbreviations in column heads correspond to the row heads.

Source: Authors’ computation using the 2007 DHS (Ministry of Planning and Macro International Inc. 2008) and the 2010 MICS (National Institute of Statistics and UNICEF 2011).

Table 9: 2010 Spatial bootstrap FOD comparisons for married women

	NAT	RUR	URB	BDD	BCG	ETR	KOC	KOT	KTG	KSS	MNM	NKV	ORT	SKV	AVG
National		**0.70**					**1**	0.05	0.02					0.01	0.14
Rural							0.07								0.01
Urban	**0.70**	**0.70**		0.06	**0.79**	0.01	**1**	**1**	**0.96**			0.37	0.01	0.36	0.46
Bandundu		0.01					0.44								0.03
Bas-Congo		0.01					**0.98**								0.08
Equateur							0.02								0.00
Kasai Occidental															0.00
Kasai Oriental							0.06								0.00
Katanga		0.04					**0.92**								0.07
Kinshasa	**0.88**	**0.88**	**0.81**	0.39	**0.97**	0.02	**1**	**1**	**0.97**			**0.65**	0.14	**0.56**	0.64
Maniema		0.12					0.37								0.04
Nord-Kivu		**0.65**				0.01	**0.74**		0.02					0.08	0.12
Orientale		**0.48**				0.01	0.21								0.05
Sud-Kivu		**0.50**				0.01	**0.51**		0.05						0.08
Average	0.12	0.31	0.06	0.03	0.14	0.00	0.56	0.16	0.16	0.00	0.00	0.08	0.01	0.08	0.12

Note: Bold values indicate domination in the static case. Values indicate probability of domination across bootstrap samples, where a '1' indicates that all 100 bootstrap comparisons resulted in domination. An empty cell indicates no domination. Row averages show the probability an area is dominated by other areas and column averages show the probability an area is dominated by other areas. Abbreviations in column heads correspond to the row heads.

Source: Authors' computation using the 2007 DHS (Ministry of Planning and Macro International Inc. 2008) and the 2010 MICS (National Institute of Statistics and UNICEF 2011).

Tables 10 and 11 present the three aggregate areas and the 11 provinces on the basis of their net domination, ranks, and rank changes over the three-year period. The results for all women and married women are quite similar. The ranking is based on the probability of net domination, that is, the bootstrap row average minus the column average for each area. Ranking allows us to compare not only the aggregate areas and provinces in a given year but also their relative wellbeing over time. A negative ranking change indicates an improvement in rank and wellbeing relative to other areas.

Table 10: 2007 and 2010 Area rankings by probability of net domination for all women

Area	2007		Area	2010		Change
	Domination	Rank		Domination	Rank	
Kinshasa	0.72	1	Kinshasa	0.76	1	0
Urban	0.62	2	Urban	0.51	2	0
Sud-Kivu	0.13	3	Maniema	0.08	3	-4
Bas-Congo	0.09	4	Orientale	0.07	4	-7
Katanga	0.00	5	Sud-Kivu	0.05	5	2
National	0.00	6	National	0.03	6	0
Maniema	-0.07	7	Nord-Kivu	0.00	7	-2
Equateur	-0.12	8	Equateur	-0.02	8	0
Nord-Kivu	-0.14	9	Bas-Congo	-0.08	9	5
Kasai Oriental	-0.15	10	Bandundu	-0.09	10	-2
Orientale	-0.17	11	Katanga	-0.12	11	6
Bandundu	-0.20	12	Kasai Oriental	-0.17	12	2
Kasai Occidental	-0.31	13	Rural	-0.42	13	-1
Rural	-0.39	14	Kasai Occidental	-0.60	14	1

Note: Rankings within shaded groups are highly sensitive to small perturbations and should be interpreted with caution.

Source: Authors' computation using the 2007 DHS (Ministry of Planning and Macro International Inc. 2008) and the 2010 MICS (National Institute of Statistics and UNICEF 2011).

Table 11: 2007 and 2010 Area rankings by probability of net domination for married women

Area	2007		Area	2010		Change
	Domination	Rank		Domination	Rank	
Kinshasa	0.83	1	Kinshasa	0.64	1	0
Urban	0.60	2	Urban	0.40	2	0
Sud-Kivu	0.14	3	Orientale	0.04	3	-9
Bas-Congo	0.06	4	Maniema	0.04	4	-5
National	-0.04	5	Nord-Kivu	0.04	5	-2
Katanga	-0.10	6	National	0.02	6	1
Nord-Kivu	-0.11	7	Sud-Kivu	0.00	7	4
Bandundu	-0.14	8	Bandundu	0.00	8	0
Maniema	-0.14	9	Equateur	0.00	9	-2
Kasai Oriental	-0.15	10	Bas-Congo	-0.06	10	6
Equateur	-0.15	11	Katanga	-0.08	11	5
Orientale	-0.18	12	Kasai Oriental	-0.15	12	2
Kasai Occidental	-0.27	13	Rural	-0.31	13	-1
Rural	-0.36	14	Kasai Occidental	-0.56	14	1

Note: Rankings within shaded groups are highly sensitive to small perturbations and should be interpreted with caution.

Source: Authors' computation using the 2007 DHS (Ministry of Planning and Macro International Inc. 2008) and the 2010 MICS (National Institute of Statistics and UNICEF 2011).

It is worth noting that differences between net domination scores are often not sufficiently large to distinguish robustly between differences in welfare outcomes and variation introduced through random bootstrapping. To avoid misinterpreting rankings within the tables, shading and lines identify clusters with similar net domination scores. Within these clusters, ranks cannot be established with confidence.

The first and second rankings of Kinshasa and urban areas, respectively, are consistent over the three-year period, though urban areas dominate to a lesser degree in 2010. Consistency is also maintained among the lowest-ranked provinces, with Kasai Occidental and rural areas respectively ranked 13th and 14th in 2007. Kasai Occidental's net domination deteriorates substantially between 2007 and 2010 and the rankings are reversed in 2010. Given years of on-going conflict, it is remarkable that Sud-Kivu is ranked third among all areas in 2007 and Maniema and Orientale are ranked third and fourth in 2010.

Results in Table 10 indicate that rank changes in several areas between 2007 and 2010. Notably, the province of Orientale is ranked 11th in 2007 and 4th in 2010. Even accounting for close domination scores, it is likely that Orientale improved relative to other provinces. It appears that Maniema also rose in rank in 2010; however, this relative improvement may not be robust to bootstrapping variations. The notable advancement in Orientale and Maniema suggests rapid recovery from decades of conflict and warrants further investigation. The provinces of Bas-Congo and Katanga experience relative welfare deteriorations over the three-year period, falling five and six places, respectively—changes that are likely robust.

7 Conclusion

This paper sets out to investigate the wellbeing of women in the DRC. The study defines wellbeing using the capability approach of Sen (1985, 1992, 1993) and undertakes spatial and temporal comparisons of women's wellbeing using data from the DHS and the MICS. The methodology of choice is the multidimensional FOD approach (Arndt et al. 2012).

FOD comparisons reveal mixed evidence of improvement and deterioration of women's welfare across the DRC and over a three-year period from 2007 to 2010. Women in Kinshasa and urban areas consistently fare the best, whereas women in Kasai Occidental and rural areas lag behind. Nevertheless, the results reveal that the provinces of Sud-Kivu, Maniema, and Orientale fare relatively well despite being affected the most by the two-decade civil war.

Overall, the results of this study are in line with the results of an earlier FOD analysis on children's welfare carried out by Nanivazo (2014). Both studies find similar results in terms of the best- and worst-performing provinces—Kinshasa and Kasai Occidental—in 2007.[7] These results are reflective of the geographical, economic, and political contexts of the DRC. Kinshasa is the capital of the DRC and the centre of economic and financial activities, which lends the province a privileged status in terms of resources and access to health services and education. Kinshasa's population enjoys a higher standard of living than the rest of the country.

Kasai Occidental's poor performance can be explained in two ways. First, Kasai Occidental is a primarily rural province with only two urban centres—the towns of Kananga and Tshikapa. The majority of Kasai Occidental's population lives in rural areas where towns and villages are built around traditional diamond mines. Though Kasai Occidental is richly endowed, villages and towns have not harnessed this wealth effectively and lack resources that would enable them to provide appropriate and decent social services to local inhabitants. Furthermore, most revenue from the exploitation of diamonds is lost through illegal mining and tax evasion.[8] Second, the

[7] Nanivazo's (2014) study referred to here is a FOD spatial analysis of child wellbeing in 2007.

[8] The province receives one per cent of the revenue from the legal exploitation of diamond.

lower welfare of Kasai Occidental can be attributed to the fiscal organization of the DRC as a whole. The 2006 constitution gives each province a partially autonomous status (see National Assembly 2005). Indeed, the central government retains authority over the establishment of income taxes and business taxes, while maintaining exclusive control over the public finances of provinces. In practice, this translates to provinces collecting and sending tax revenue to the central government in Kinshasa, where the central government allocates 40 per cent of this revenue to the provinces in the form of budgets. In reality, provinces receive less than the 40 per cent mandated by the constitution, making it difficult for a province such as Kasai Occidental to maintain or reach a basic level of welfare. In a book relating the difficulties of governing the province of Kasai Occidental, governor Katulondi (2013) states that the province is practically in the pre-industrial age. Schools and hospitals are worn out and the province has almost no infrastructure (roads, water treatment plants, hydroelectric dams). Kasai Occidental's economy is primarily agrarian and the industrial sector is non-existent; this, coupled with a culture of corruption at the national and provincial levels, renders the goal of welfare improvement a seemingly impossible mission.

The relatively high welfare of women in Maniema, Sud-Kivu, and Orientale and evidence of welfare gains in Maniema and Orientale is surprising. Population movement from rural to urban areas (within and across provinces) during the civil wars could possibly explain these results. Indeed, most fighting in these provinces occurred in rural villages and small towns, forcing the population to seek refuge in large towns. This forced migration might have enabled women to access services and resources that were not available in rural areas. However, this claim is yet to be tested. A second possible explanation involves the substantial foreign aid allocated to war-torn areas. During the period 2002–12, humanitarian aid to the DRC has increased from US$150 million (6.6 per cent of total official development assistance (ODA)) to US$425 million (14.38 per cent of total ODA). The DRC is the second-largest recipient of foreign aid, with the bulk of this aid focused on the eastern provinces (OECD–DAC 2013). Further research is required to ascertain this claim because an increase of foreign aid does not necessarily translate into effectiveness, particularly in the context of the DRC.

For future research, this study shall be extended to examine gender equality including defining deprivation indicators to capture gender inequality. The future study shall consider two years: 2007 and 2013.

References

AFDB (2013). *African Development Fund: Democratic Republic of Congo 2013–2017 Country Strategy Paper*. Tunis: African Development Bank (AFDB).

Arndt, C., R. Distante, M.A. Hussain, L.P. Østerdal, P.L. Huong, and M. Ibraimo (2012). 'Ordinal Welfare Comparisons with Multiple Discrete Indicators: A First Order Dominance Approach and Application to Child Poverty'. *World Development*, 40(11): 2290–301.

Bratt, R. (2002). 'Housing and Family Wellbeing'. *Housing Studies*, 14(1): 13–26.

Brown, L.R., and L.J. Haddad (1995). *Time Allocation Patterns and Time Burdens: A Gendered Analysis of Seven Countries*. Washington, DC: International Food Policy Research Institute.

Dollar, D., and R. Gatti (1999). 'Gender Inequality, Income, and Growth: Are Good Times Good for Women?'. *Policy Research Report on Gender and Development*. Working Paper Series 1. Washington, DC: World Bank. Available at: http://www.ccee.edu.uy/ensenian/catgenyeco/Materiales/2011-08-10%20M4%20-

%20DollaryGatti(1999)GenderInequalityIncomeAndGrowth.pdf (accessed 15 December 2014).

Dyckerhoff, R., and K. Mosler (1997). 'Orthant Orderings of Discrete Random Vectors'. *Journal of Statistical Planning and Inference*, 62(2): 193–205.

Fukuda-Parr, S. (2003). 'The Human Development Paradigm: Operationalizing Sen's Ideas on Capabilities'. *Feminist Economics*, 9(2–3): 301–17.

FAO (2011). *The State of Food and Agriculture 2010–2011. Women in Agriculture: Closing the Gender Gap for Development*. Rome: Food and Agriculture Organization of the United Nations (FAO). Available at: http://www.fao.org/docrep/013/i2050e/i2050e.pdf (accessed 15 December 2014).

Gordon, D., S. Nandy, C. Pantazis, S. Pemberton, and P. Townsend (2003a). *Child Poverty in the Developing World*. Bristol: The Policy Press.

Gordon, D., S. Nandy, C. Pantazis, S. Pemberton, and P. Townsend (2003b). 'Using Multiple Indicator Cluster Survey (MICS) and Demographic and Health Survey (DHS) Data to Measure Child Poverty'. Paper presented at the *UNICEF MICS Conference*, 22 October. London: London School of Economics.

Juster, F.T., and F.P. Stafford (1991). 'The Allocation of Time: Empirical Findings, Behavioral Models, and Problems of Measurement'. *Journal of Economic Literature*, 29(2): 471–522.

Katulondi, K.B. (2013). *Governing a Province in the Democratic Republic of Congo: Kasai Occidental. In the Clutches of the Kabila Regime*. Johannesburg: Global Unbuntu Publications.

Klasen, S. (1999). 'Does Gender Inequality Reduce Growth and Development? Evidence from Cross-Country Regressions'. *Policy Research Report on Gender and Development*. Working Paper Series 7. Washington, DC: World Bank. Available at: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2000/08/26/000094946_0008120532279/Rendered/PDF/multi_page.pdf (accessed 15 December 2014).

McCarthy, D.F., H. Wolf, and Y. Wu (2000). 'The Growth Costs of Malaria'. NBER Working Paper 7541. Cambridge, MA: National Bureau of Economic Research (NBER). Available at: http://www.nber.org/papers/w7541.pdf (accessed 15 December 2014).

Ministry of Planning and Macro International Inc. (2008). 'Democratic Republic of the Congo Demographic and Health Survey 2007: Key Findings'. *An EDS-RDC Report*. Calverton, MD: Ministry of Planning and Macro International Inc. Available at: http://dhsprogram.com/pubs/pdf/SR141/SR141.pdf (accessed 15 December 2014).

Nanivazo, M. (2014). 'First Order Dominance Analysis: Child Wellbeing in the Democratic Republic of Congo'. UNU-WIDER Working Paper 2014/25. Helsinki: UNU-WIDER. Available at: http://www.wider.unu.edu/publications/working-papers/2014/en_GB/wp2014-025/ (accessed 15 December 2014).

National Assembly (2005). *Constitution of the Democratic Republic of the Congo*. Available at: http://www.constitutionnet.org/files/DRC%20-%20Congo%20Constitution.pdf (accessed March 2014).

National Institute of Statistics and UNICEF (2011). *Democratic Republic of Congo Multiple Indicator Cluster Survey MICS-2010. Monitoring the Situation of Children and Women: A Summary Report*. National Institute of Statistics and United Nations Children's Fund (UNICEF): Kinshasa DRC. Available at: http://www.childinfo.org/files/MICS-RDC_2010_Summary_Report_EN.pdf (accessed 15 December 2014).

Nussbaum, M.C. (2000). *Women and Human Development: The Capabilities Approach*. Cambridge, UK: Cambridge University Press.

OECD–DAC (2013). 'Aid Statistics: Total DAC Flows at a Glance'. Democratic Republic of the Congo: Organisation for Economic Co-operation and Development—Development Assistance Committee (OECD–DAC). Available at: http://www.oecd.org/dac/stats/totaldacflowsataglance.htm (accessed: March 2014).

Quisumbing, A.R., L. Haddad, and C. Peña (2001). 'Are Women Overrepresented Among the Poor? An Analysis of Poverty in 10 Developing Countries'. *Journal of Development Economics*, 66(1): 225–69.

Robeyns, I. (2003). 'Sen's Capability Approach and Gender Inequality: Selecting Relevant Capabilities'. *Feminist Economics*, 9(2–3): 61–92.

Sen, A.K. (1985). *Commodities and Capabilities (Professor Dr. P. Hennipman Lectures in Economics: Theory, Institutions, Policy)*, vol. 7. New York: North-Holland.

Sen, A.K. (1992). *Inequality Reexamined*. Oxford: Clarendon Press.

Sen, A.K. (1993). 'Capability and Wellbeing'. In M.C. Nussbaum and A.K. Sen (eds), *The Quality of Life* (pp. 30–54). Oxford: Oxford University Press.

United Nations (2014). 'We Can End Poverty: Millennium Development Goals and Beyond 2015)'. Available at: http://www.un.org/millenniumgoals/ (accessed 15 December 2014).

UNDP (1995). *Human Development Report 1995*. New York: Oxford University Press, for United Nations Development Programme (UNDP). Available at: http://hdr.undp.org/sites/default/files/reports/256/hdr_1995_en_complete_nostats.pdf (accessed 12 December 2014).

UNDP (2014a). *Democratic Republic of Congo: Millennium Development Goals Status Report, 2012*. Kinshasa: United Nations Development Programme (UNDP).

UNDP (2014b). *Human Development Report 2014*. New York: United Nations Development Programme (UNDP).

USAID (2014). *Country Development Cooperation Strategy: Democratic Republic of the Congo, 2015–2019* Washington, DC: United States Agency International Development (USAID). Available at: http://www.usaid.gov/sites/default/files/documents/1860/USAID%20DRC%20CDCS%202014%20Final%20Public%20Version%20new%20Cover.pdf (accessed 26 June 2015).

Weil, D. (2005). 'Accounting for the Effect of Health on Economic Growth'. NBER Working Paper 11455. Cambridge, MA: National Bureau of Economic Research. Available at: http://www.nber.org/papers/w11455.pdf (accessed 15 December 2014).

World Bank (2014). *World Development Indicators Database*. Available at: http://data.worldbank.org/data-catalog/world-development-indicators (accessed 18 May 2014).