

REVIEW OF OPTIONS FOR REPORTING WATER, SANITATION AND HYGIENE COVERAGE BY WEALTH QUINTILE

MICS METHODOLOGICAL PAPERS

Paper No. 4, 2016



Data and Analytics Section
Division of Data, Research and Policy

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About MICS

The Multiple Indicator Cluster Surveys, MICS, is one of the largest global sources of statistically sound and internationally comparable data on children and women. MICS data are gathered during face-to-face interviews in representative samples of households. The surveys are typically carried out by government organizations, with technical support from UNICEF.

Since the mid-1990s, MICS has supported more than 100 countries to produce data on a range of indicators in areas such as health, education, child protection and HIVS/AIDS. MICS data can be disaggregated by numerous geographic, social and demographic characteristics.

As of 2016, five rounds of surveys have been conducted: MICS1 (1995-1999), MICS2 (1999-2004), MICS3 (2004–2009), MICS4 (2009–2012) and MICS5 (2012-2015). The sixth round of MICS (MICS6) is scheduled to take place in 2016–2018. Survey results, tools, reports, micro-data and information on the MICS programme are available at <mics.unicef.org>.

About the MICS Methodological Papers

MICS Methodological Papers are intended to facilitate exchange of knowledge and to stimulate discussion on the methodological issues related to the collection, analysis, and dissemination of MICS data; in particular, the papers document the background methodological work undertaken for the development of new MICS indicators, modules, and analyses. The findings, interpretation and conclusions do not necessarily reflect the policies of view of UNICEF.



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1

Summary

The World Health Organization (WHO)/United Nations Children's Fund (UNICEF) Joint Monitoring Program for Water Supply and Sanitation (JMP) uses household surveys and census data to derive country estimates for the population with access to improved and unimproved drinking water sources and sanitation facilities. The analysis presented in this report is intended to assist the JMP and UNICEF to gain a better understanding of how best to use the wealth index to help monitor inequalities in access to water, sanitation and hygiene in line with the Sustainable Development Goals. It focuses specifically on the classic wealth index, involving a single principal component analysis (PCA) estimate over the whole sample, leaving to further research such issues as the composite wealth index and the production of separate indices for urban and rural areas.

The classic wealth index includes variables such as a household's main source of drinking water and sanitation facility. Would a custom index, excluding these variables, be preferable to avoid concerns relating to tautology when reporting disaggregates for water and sanitation variables? How would such a custom index affect coverage and trend estimates? Would the potential benefits of using a custom index outweigh the additional effort required to produce it?

A short literature review indicates general agreement that it is conceptually undesirable to use water and sanitation variables in the construction of the wealth index when the outcome being analysed is water and sanitation coverage. However, it could be acceptable to use the precalculated wealth indices published in such surveys as the Demographic and Health Surveys (DHS) and the Multiple Indicator Cluster Surveys (MICS) if the effect of removing (or keeping) water and sanitation variables is small. This would be much simpler than building a custom index, and would also facilitate comparison with other indicators using the standard wealth index.

A total of 17 MICS4 and five DHS datasets were selected for the point-in-time analysis, based on the representativity of various regions of the world, the availability of the wealth index SPSS syntax (classic approach) used for the final MICS report, the availability in a selected number of cases of more than one dataset per country to allow for trend analysis, and knowledge of the country by some of the investigators. These surveys were implemented between 2010 and 2012 over four continents. They range in sample size from 1,718 to 35,701 households. The number of (dichotomized) variables included in the PCA for the wealth index calculations varies from 48 to 100, of which 4 to 17 are related to the main source of water used by the households for drinking, and 4 to 13 to the main type of sanitation facility used by household members (and if it is shared or not). This clearly demonstrates how wealth index calculations are implemented under very different conditions, from survey to survey.

Not only does the number of variables used in the PCA for the calculation of the wealth index vary widely, but the asset types and categories can also differ greatly from survey to survey. Overall, 234 different variables were used in the calculation of the wealth indices in these 17 surveys; 64 were common to 10 or more of the surveys, while only 10 were common to all 17 surveys. Only one water-related item was common to all surveys – water piped into dwelling – and only two sanitation-related items were common to all surveys – sanitation facility flushing to septic tank, or to pit (latrine).

The main text of this report presents the steps commonly followed to optimize a PCA in the process of generating a classic wealth index. The review of the 17 above-mentioned surveys showed that these steps are generally followed, even though some relatively minor differences were observed.

Removing only water-related or only sanitation-related sets of variables was shown to result in mostly small changes in the loadings of the first principal component (PC); removing both simultaneously had a somewhat larger effect. Even so, loadings nearly always kept the same sign and same order of magnitude. In none of the 17 datasets was it found necessary to adjust the PCA further by adding or removing other variables not related to water or sanitation. This finding suggests that it might be justified to adopt an almost mechanical approach to producing a custom wealth index, as long as the original wealth index syntaxes are of good quality. Even so, it is always prudent and advisable to take a close look at the changes before using the results.

The data from our 17 MICS4 datasets did not show any association between the number of variables and the percentage of agreement between the quintiles of a PCA with all original variables, as compared with one without water- and/or sanitation-related variables. There was no evidence that it would be possible to accurately predict the size of the effect of removing water- and/or sanitation-related variables from a PCA on water and sanitation outcomes by quintile.

This report goes on to discuss the differences in the estimates of water and sanitation coverage by wealth quintile when calculated with and without water- and/or sanitation-related variables in the PCA. We refer to the PCA without these variables as the ‘restricted’ PCA, while the PCA with all the original variables is referred to as the ‘unrestricted’ PCA. Three non-overlapping service-level categories were used in this analysis for water coverage: piped water onto premises, other-improved water sources, and unimproved water sources. Three categories were used for sanitation coverage: improved sanitation facilities (irrespective of whether shared or not), unimproved sanitation facilities excluding open defecation, and open defecation.

Given the three indicators of coverage and the five wealth quintiles, there are 15 coverage figures by dataset for each approach, for water as well as for sanitation. One summary statistic that was adopted was the largest absolute difference (LAD), in percentage points, between any of these 15 pairs of coverage figures; 5 percentage points or more was considered ‘large’. Three additional summary statistics also used in this analysis are the change in the gap (given in percentage points) between coverage figures for the poorest (first) quintile and the wealthiest (fifth) quintile (<Q1–Q5>) with respect to each one of the three coverage indicators, using different approaches.

Overall, in the 17 MICS4 datasets used in this analysis, when water-related variables are omitted from the PCA, the LAD ranges from 2 to 11 percentage points, and seven cases are 5 percentage points and above. When both water- and sanitation-related variables are omitted, the LAD is usually larger (10 cases are 5 percentage points and above). The LAD tends to be larger for urban and rural estimates, ranging from 1 to 50 percentage points. As for the <Q1–Q5>, values are nearly always negative, indicating that restricting the PCA almost systematically results in a narrower coverage gap between poorest and wealthiest. The narrowing of the gap can be large, in many cases by more than 10 percentage points, in several cases beyond 20 percentage points, up to 31 percentage points.

LADs for sanitation are on average smaller than for water, but even so, five cases in the overall category are 5 percentage points and above when sanitation-related variables are omitted from the PCA. We also find five such cases when both water- and sanitation-related variables are omitted, with a maximum of 13 percentage points. LADs tend to be on average slightly larger for urban and rural estimates, and can be as large as 30 percentage points. As is the case for water, the great majority of the <Q1–Q5> figures are negative, indicating that the coverage gap between poorest and wealthiest is usually narrowed when a restricted PCA is used, by as much as 30 percentage points.

For water and sanitation, the largest changes are often seen in the first quintile, while the changes in the fifth quintile (if any) are predominantly in an opposite direction to those in the first quintile, resulting mostly in a narrowing of the gap. But there are several cases where the LAD is found in quintiles others than the first. In some cases, there are important changes in only one or two of the quintiles, while in other cases, changes are spread more widely across all quintiles. Large changes are often seen in datasets where there are large differences in coverage between the first and fifth quintiles. For both water and sanitation coverage, nearly all datasets with piped water or improved sanitation coverage of 90 per cent or more have a LAD below 5 percentage points. There is obviously little scope for variation where access is nearly universal. An analysis of five DHS datasets suggests that the findings from the MICS datasets apply similarly to the DHS datasets, even though a larger study would be required to demonstrate this unequivocally.

The impact of using a restricted PCA on trend analysis was also measured. Five pairs of MICS3 to MICS4 datasets were used for this purpose. Measuring the impact of different PCA approaches on trends is more complex than measuring it on point-in-time estimates. Since coverage in water and sanitation tends to improve over time, and since it is generally intended that the gap between rich and poor should narrow, the analysis of the impact of a restricted PCA on trends was based on coverage improvement and gap reduction. The largest coverage improvement (LCI) within quintiles was calculated. In the case of water, LCI statistics reflect the largest quintile-level change in the coverage of piped water on premises and improved water sources from one survey to the next; in the case of sanitation, LCI is based on the quintile-level changes in the coverage of improved sanitation facilities only. The gap reduction between the poorest (first quintile) and the wealthiest (fifth quintile) for each one of the three coverage categories was also reported.

No clear direction of change in trends was observed when a restricted PCA was used instead of an unrestricted one. In some cases, improvements in coverage (LCI) were smaller, in others larger (markedly so in some instances). The situation was similar with respect to the <Q1–Q5> gap reduction, which was reduced (even inversed) in some instances, and increased in others. What is clear is that changes can sometimes be important. Similar findings were seen when comparing urban and rural areas, with LCI values tending to be larger in urban areas in the observed dataset pairs. Changes resulting from a restricted PCA tend to be somewhat smaller for sanitation than for water.

Recommendations:

- a. It seems reasonable that standard surveys as the MICS and DHS continue to use in their reports a single wealth index in which water- and sanitation-related variables are included, since they report on a large number of non-water and sanitation indicators. Nonetheless, it is important that syntaxes for the calculation of these indices be easily available to institutions and researchers who want to implement specific analyses for water and/or sanitation.
- b. While, ideally, reports focusing on either water or sanitation coverage and trends would both benefit from tailored wealth indices, such indices are more specifically recommended for reports on water coverage and trends.
- c. Tailored wealth indices can be easily constructed by simply removing water- or sanitation-related variables from good quality syntaxes implemented in surveys such as the MICS.

With respect to the time investment required to develop the syntax of a restricted PCA, if we start with a reliable unrestricted classic wealth index syntax, as we may assume to be nearly always the case with MICS and DHS datasets, it should usually be possible to accomplish this task within an hour or two for any given dataset (say, about five or six datasets a day), once the analyst is familiar with the method and already has model syntaxes at her or his disposal. The time requirement would be at least twice as much (about two or three datasets a day) when no syntax is available, and somewhere in between in the case of other types of wealth index syntaxes (e.g., a composite index syntax). This is according to the general experience of the writer and could vary to some extent between analysts and between datasets. There are yet other variants, such as the creation of a separate syntax for urban and rural areas, or other forms of restricted PCAs for other analyses of interest (e.g., of handwashing practices); the writer did not have much experience with these, but it seems likely that the time investment would be similar. Our recommendations refer to the classic approach to calculating a wealth index. The more recent approach used by the MICS and DHS (the composite wealth index) was not addressed in this study. Further analysis may be done, though we would expect similar findings.

2

Introduction

The WHO/UNICEF Joint Monitoring Program for Water Supply and Sanitation (JMP) uses household surveys and census data to derive the country estimates for the population with access to improved and unimproved drinking water sources and sanitation facilities. The JMP is preparing to monitor water, sanitation and hygiene (WASH) during the Sustainable Development Goals (SDGs) and will increasingly focus on tracking inequalities in access.

The Multiple Indicator Cluster Surveys (MICS) programme supports countries in implementing representative household surveys. Since its inception in 1995, nearly 300 surveys have been supported through MICS. The surveys typically include modules that collect data on households' use of drinking water sources and sanitation facilities, and more recently the availability of handwashing facilities with soap and water. The MICS are a key data source for the JMP: 10 per cent of all data on drinking water and sanitation coverage from surveys and censuses, and over 40 per cent of data on access to handwashing facilities with water and soap, come from MICS surveys.

Proposed SDGs and the Human Right to Water and Sanitation call for universal access to drinking water and sanitation – an ambitious target given the great number of people who have yet to gain access to improved facilities. Monitoring disparities will form an essential part of efforts to achieve universal access, providing the necessary tools to ensure progress is being achieved among the most disadvantaged.

One of the most pronounced disparities in WASH access is between rich and poor. In highlighting disparities, reliance has been placed primarily on the use of asset indices to measure socio-economic position. The JMP and MICS regularly report WASH coverage by wealth quintiles as well as other socio-economic characteristics. Comparative advantages of asset indices include ease of measuring asset ownership and, thus, availability in the majority of household surveys. Asset indices have proven a powerful tool for examining inequalities in health, but questions have been raised about the extent to which the use of different measures of socio-economic status (SES) – i.e., a different set of assets – affect the observed magnitude of inequalities (1).

The wealth index was developed at the World Bank starting with the work of Filmer and Pritchett (2, 3) and later in a series of methodological papers by Rutstein et al. (4, 5). It is based on ownership of durable goods, housing characteristics and basic services. Over the years the number of assets for which data are available has increased, and experience has helped the household survey programmes and implementing agencies' teams select questions that better reflect wealth in each country and are better able to discriminate between households. The basic approach is to select a basket of asset indicator variables and run a principal component analysis (PCA), a data reduction technique that typically requires optimisation

to identify which variables to include. Factor (wealth) scores are then based on the first component of the PCA, assumed to represent underlying wealth, and assigned to household members. The wealth scores can then be used to define wealth quintiles at the national level as well as for rural and urban areas. The index is meant to reflect long-term wealth and is expected to be conceptually different from income or consumption.

The standard wealth index includes variables such as a household's main source of drinking water and sanitation facility. It can be argued that a bespoke index for WASH-focused analyses, excluding these variables, may be preferable to avoid concerns relating to tautology. To date, a number of different approaches have been used, but it remains unclear how sensitive coverage and trend estimates are to the type of asset index used. Furthermore, creating a bespoke asset index for each survey is time consuming, especially if an optimisation process that takes into account specific conditions in a given country is necessary. There is a need to evaluate the alternative approaches and form recommendations for their use in different circumstances, including MICS final reports and other multi-sector reports, monitoring by the JMP (coverage, trends), as well as models drawing on data from multiple sectors (e.g., the Lives Saved Tool).

The objective of this analysis is to evaluate the technical correctness and practical feasibility of alternative approaches to measuring water and sanitation coverage across asset-based wealth quintiles, and to provide recommendations for monitoring by the JMP and reporting in MICS final reports.

3

Literature review

This chapter reviews published literature and various reports that are directly relevant to the analysis presented in this paper, relating to the impact on water and sanitation coverage and trends of including or excluding water and/or sanitation variables from the calculations of the classic wealth index. A summary of the most relevant papers is presented in Table 1. It is worth noting that this paper does not discuss issues related to the composite wealth index recently used by Demographic and Health Surveys (DHS) and MICS, or the computation of separate indices for urban and rural areas.

- 1) Houweling, Kunst, et al., 2003 (1): This study used 10 DHS datasets and compared the standard DHS/MICS wealth indices with three custom indices using a similar approach, but with fewer assets. One of these custom indices differed from the standard only by removing water and sanitation facilities. The health outcomes studied were under-five mortality and measles immunization. The authors conclude that the measure of SES used influences the observed magnitude of health inequalities, in some cases to an important extent, and that differences in health inequalities between countries or time periods may be an artefact of different wealth measures used. The study also shows that it is difficult to predict the size and direction of the changes produced as a result of using different sets of assets. The authors recommend using long rather than short lists of assets. They also argue that part of the measured inequalities can be attributed to the inclusion in the index of direct determinants of health rather than SES alone – e.g., water and sanitation with respect to under-five mortality – and that the inclusion of water, sanitation and housing items facilitates stratification of households at the lower end of the wealth ladder, especially when the list of assets is short.
- 2) Jacot-Guillarmod, 2011 (6): This analysis performed for the JMP group explores the distribution of water and sanitation access by wealth quintiles according to various approaches, including the exclusion of water and sanitation variables from the calculation of the wealth index. The paper expresses the concern that in the standard wealth index used by DHS and MICS, the variables to be explained (water and sanitation coverage) are also part of the explanatory variables (wealth quintiles). It presents the case of the Burkina Faso 2006 MICS, for which 20 per cent of individuals are classified into different quintiles according to the two approaches. The author argues that coverage figures for poor types of facilities among the poorest, and wealthy types of facilities among the wealthiest, are overestimated when the water and sanitation variables are included in the wealth index calculations. For example, 99.5 per cent of the poorest are found to practice open defecation when the water and sanitation variables are included, versus 92.1 per cent when these variables are excluded. The argument is that open defecation is given a heavy weight in the first principal component towards the identification of the poorest. The author emphasizes that this effect is largest

when fewer asset variables are used in the construction of the wealth index, and recommends excluding water and sanitation variables from the wealth index in equity analyses related to water and sanitation coverage. The author further emphasizes that sampling weights influence water and sanitation results; some surveys compile water and sanitation results based on household weights, while others do so on the basis of household member (population) weights – demonstrating a need for standardization.

- 3) Neville, 2012 (7): This is an exploratory analysis performed for the JMP group of 17 MICS, DHS and World Health Survey (WHS) datasets to investigate how removing water and/or sanitation variables affects the performance of the wealth index. These are surveys conducted over different years, with different sets of asset variables and different total numbers of variables. The study found that as the number of asset variables increases, the differences between wealth indices that include water and sanitation variables and those that exclude water variables are generally smaller; differences are even larger when sanitation analysis is involved. Similar results were found when removing both water and sanitation variables, although the overflow – i.e., the percentage of individuals changing wealth quintiles when some variables are omitted from the PCA – tends to be somewhat higher in that case. The amount of total variance explained by the first principal component is very similar with or without the exclusion of either water or sanitation variables, but slightly higher on average – as expected when fewer variables are used in a PCA. The impact of the different approaches on water and sanitation coverage indicates that the poorest and richest quintiles are the most affected by the exclusion of water or sanitation variables.
- 4) Yang, Bain, et al., 2013 (8): This study used survey data to calculate household SES indices in seven countries where national drinking-water quality surveys are available. These indices were used to assess inequalities in access as indicated by type of improved water source, use of ‘safe’ water (i.e., free from faecal or chemical contaminants), and a combination of these. A custom wealth index was calculated using a subset of variables common to all seven countries analysed, excluding water source type but including sanitation facilities. The study found that the use of a binary improved/unimproved categorization masks substantial inequalities. The article states that the custom indices were “highly correlated” with the precalculated DHS/MICS indices; however, some correlation indices (R^2) were as low as 0.64. The authors also found that the precalculated DHS/MICS indices tend to produce slightly larger concentration indices (CI) than the custom indices produced by the authors.
- 5) Rheingans, Anderson, et al., 2014 (9): This paper explores, among other issues, the potential confounding resulting from the inclusion of water and sanitation assets in water and sanitation disparity analyses. When considering changes over time, poor households that improve their sanitation are more likely to be reclassified as less poor, and to move into higher quintiles in subsequent surveys. This may particularly affect households on the border between the two lowest quintiles. If there are large improvements in coverage for the poor over time, this effect might be partly or completely missed due to this reclassification, making progress in water and sanitation difficult to monitor. Six DHS datasets are used in the analysis, which shows that wealth indices estimated with water and sanitation assets are highly correlated with indices excluding them, but can

overstate disparities in sanitation access. Further, the estimated level of disparity is somewhat greater (higher concentration index) for the asset index with water and sanitation included; this effect is most pronounced in countries where sanitation is particularly inequitable (high concentration index) and overall coverage is lower. The authors conclude that, while excluding water and sanitation from the asset index is required on purely theoretical grounds, the traditional measures provide reasonable approximations of the level of coverage and disparities, adding that the complexity of generating water- and sanitation-specific wealth indices is a disincentive for such analyses to be conducted.

- 6) Hossain, 2014 (10): This short working document prepared for the JMP group reviews the various options available with respect to analysing and reporting water and sanitation access, including removing water and sanitation variables from the wealth index calculations in order to avoid statistical dependency. The few examples given (Ethiopia 2011 DHS and Madagascar 2004 DHS) show the potential for large differences in coverage by wealth quintile between the two approaches. It indicates that for old surveys with fewer assets, water and sanitation variables are required for good quintile distribution, and one might have to choose between better quintile distribution or better factor scores.
- 7) Jacot-Guillarmod, 2014 (11): This working document, prepared for the JMP group, analyses 23 DHS and MICS datasets dating from 1991 to 2006 to gauge how removing water and sanitation variables from the wealth index affects the classification of households by quintile (overflow) and the reporting of water and sanitation access. It demonstrates that including water and sanitation asset variables as part of the wealth quintile analysis creates an imbalance, attributing lower improved facilities to the poor and higher improved facilities to the rich. The overflow can be large (up to 58 per cent) in older surveys with fewer assets, while it tends to decrease (as low as 10 per cent) with more recent surveys with a larger number of assets.

Table 1: Summary of key articles and reports reviewed

Article /report	Focus	SES measure	Outcome measures	Wealth index approach	Comparison measures	Main findings	Comments
Houweling, Kunst et al 2003 (1)	Effect of different sets of assets	PCA wealth indices following DHS/MICS approach but using different subsets of variables	<ul style="list-style-type: none"> - Under-five mortality - Measles coverage 	Compare custom and precalculated indices	<ul style="list-style-type: none"> - % variance explained - % change of quintiles (1q or 2+q) - RII - % change in outcome by quintile 	Choice of measure of SES influences observed magnitude of health inequalities. Difficult to predict size and direction of changes.	1q=change by a single quintile (e.g., from q4 to q3) 2+q=2+ quintiles (e.g., from q4 to q2) RII=relative index of inequality Author also mentions that different ways of using sampling weights may influence results.
Jacot-Guillarmod 2011 (6)	Effect of removing water and/or sanitation variables	PCA wealth indices following DHS/MICS approach but with or without water and sanitation variables	<ul style="list-style-type: none"> - Access to improved water source - Access to improved sanitation facilities 	Compare precalculated and custom indices without water and sanitation variables	<ul style="list-style-type: none"> - % change of quintiles (overflow) - % change in outcome by quintile 	Outcome by poorest and richest quintiles most affected. Recommends removing water and sanitation variables from wealth index.	
Neville 2012 (7)	Effect of removing water and/or sanitation variables	PCA wealth indices following DHS/MICS approach but with or without water and/or sanitation variables	<ul style="list-style-type: none"> - Access to improved water source - Access to improved sanitation facilities 	Compare precalculated and custom indices without water and/or sanitation variables	<ul style="list-style-type: none"> - % change of quintiles (overflow) - chi-2 - R - Spearman correlation - % variance explained - % change in outcome by quintile 	As number of assets increase, overflow from removing water and/or sanitation variables decreases. Outcome by poorest and richest quintiles most affected.	

Table 1: Summary of key articles and reports reviewed

Article /report	Focus	SES measure	Outcome measures	Wealth index approach	Comparison measures	Main findings	Comments
Yang, Bain et al. 2013 (8)	Water safety	PCA wealth index following DHS/MICS approach but using <u>sub-set of variables common to 7 countries analysed</u>	- Access to improved water source - Access to improved water source combined with measured water safety	Compare custom and precalculated indices	- R^2 - chi-2 - Conc. index - % change in outcome by quintile	Use of binary improved /unimproved categorization masks substantial inequalities.	Concentration index slightly greater with precalculated than custom index. $R^2 > 0.64$
Rheingans, Anderson et al. 2014 (9)	Effect of removing water and sanitation variables	PCA wealth indices following DHS/MICS approach using subset of variables <u>common to 6 countries analysed</u>	- Access to improved sanitation (not excluding shared facilities)	Compare indices with and without water and sanitation variables	- Spearman correlation - Kendall <i>tau-b</i> - % change in outcome by quintile - Concentration index	Wealth indices estimated with water and sanitation assets are highly correlated with indices excluding them, but can overstate disparities in sanitation access. Estimated level of disparity somewhat greater for asset index including water and sanitation variables.	The articles uses the term Pearson rank correlation test, which is equivalent to Spearman correlation.

In summary, there is general agreement that it is conceptually undesirable to use water and sanitation variables in the construction of the wealth index when the outcome being analysed is water and sanitation coverage. On the other hand, if retaining water and sanitation variables does not greatly influence coverage figures by wealth quintile, it could be acceptable to use the precalculated wealth index published in such surveys as the DHS and the MICS, as this would be a much simpler approach than building a custom index, and would also facilitate comparison with other indicators using the standard wealth index. Important issues include deciding on a sort of cut-off value above which the effect of retaining water and sanitation variables on equity analyses can be considered too large to be ignored, identifying surveys for which the effect is too large, and deciding what approach to adopt in such cases, if they are a minority, or whether to adopt a blanket approach, if such cases are a majority.

Some of the above-mentioned studies found that the effect of removing (or keeping) water and sanitation variables tends to be smaller the larger the number of assets used in the construction of the wealth index. One of the problems is that analyses of trends often require the use of older surveys with fewer assets as well as more recent ones with larger numbers of assets. Beside the potentially larger influence of water and sanitation variables on wealth indices based on a smaller number of assets, a comparison of coverage figures by quintile, when the wealth indices are based on very different sets of assets, is in itself problematic and could be considerably biased.

The analysis of equity in water and sanitation coverage within the context of this paper raises the following questions:

- Is it important (and when is it important) to exclude water- and/or sanitation-related variables from the PCA when analysing water and/or sanitation coverage by wealth quintiles?
- What is the impact of excluding these variables from the PCA on water and sanitation coverage figures and trends?
- Even if it is considered important to exclude these variables from the PCA, how feasible and practical is it to recalculate custom indices for a large number of datasets?
- One aspect of the previous question is concerned with the fact that PCA often requires customization for optimal results, a procedure that is to some extent subjective. Can customization be standardized and/or minimized to facilitate and harmonize the elaboration of a large number of custom indices?

These questions define the scope of this analysis with respect to the classic wealth index, the approach described in the original article by Filmer and Pritchett (3), which involves a single PCA estimate over the whole sample. A variant of this index exists in the form of the composite wealth index (5), used in recent years by the DHS and the MICS, and it is also possible to calculate entirely separate indices for urban and rural areas. How the previous questions relate to these variants is obviously of interest, but outside the scope of this analysis.

4

Methods

In order to assess the size of the effect of including or excluding water- and/or sanitation-related variables in the classic wealth index on the distribution of individuals between quintiles and, more importantly, on water and sanitation coverage by wealth quintile, the following key measures will be used:

- Kendall's *tau*-b, as a measure of rank correlation of household members from poorest to wealthiest.
- *Kappa*-statistic, as a measure of interrater agreement of households members between wealth quintiles. We set *a priori* a *kappa*-statistic of 0.60 or less as representing a difference in the distribution of individuals between the quintiles that is 'too large to be ignored'. This is in line with Landis and Koch's (12) classification of an interrater agreement that is less than 'substantial'.
- Percentage point difference in coverage of each service level by wealth quintile; changes greater than 5 per cent will be regarded as large, 2 to 5 per cent as moderate, and less than 2 per cent as small. For drinking water, service levels are defined as: piped water onto premises, improved sources (excluding piped water on premises), and unimproved sources (including surface water). For sanitation facilities, service levels are defined as: improved facilities (irrespective of whether shared or not), unimproved facilities (excluding open defecation), and open defecation.

We will also explore the possibility of using a proxy measure to the interrater agreement and change in coverage that would not require a complete recalculation of the outcomes by wealth quintile. One such potential measure assessed in this paper is the change in the rotation of the axis of the first principal component when water- and/or sanitation-related variables are removed from the construction of the wealth index; this can be estimated directly from the correlation matrix of the PCA.

Table 2: List of countries selected for the analysis			
Region	Country	Year(s)	Type of analysis (single/trend)
Central and Eastern Europe and the Commonwealth of Independent States	Bosnia and Herzegovina	MICS4 2011–2012 also MICS3 2006 also MICS2 2000	Single
Central and Eastern Europe and the Commonwealth of Independent States	Moldova, Republic of	MICS4 2012 also DHS 2005 also MICS2 2000	Single
Central and Eastern Europe and the Commonwealth of Independent States	Serbia	MICS4 2010	Single
Central and Eastern Europe and the Commonwealth of Independent States	Ukraine	MICS4 2012 also DHS 2007 also MICS3 2005	Single & trend
East Asia and the Pacific	Indonesia (Papua Selected Districts)	MICS4 2011	Single
East Asia and the Pacific	Indonesia (West Papua Selected Districts)	MICS4 2011	Single
East Asia and the Pacific	Lao People's Democratic Republic	MICS4 2011–2012 also MICS3 2006 also MICS2 2000	Single & trend
South Asia	India	NFHS 2005–2006 NFHS 1998–1999 NFHS 1992–1993	Single
Middle East and North Africa	Iraq	MICS4 2011 also MICS3 2006 also MICS2 2000	Single & trend
Middle East and North Africa	Palestine, State of	MICS4 2010	Single
Middle East and North Africa	Sudan	MICS4 2010	Single

Table 2: List of countries selected for the analysis

Region	Country	Year(s)	Type of analysis (single/trend)
Middle East and North Africa	Tunisia	MICS4 2011–2012	Single
Eastern and Southern Africa	Kenya (Nyanza Province)	MICS4 2011	Single
Eastern and Southern Africa	Madagascar (South)	MICS4 2012	Single
Eastern and Southern Africa	Somalia (Somaliland)	MICS4 2011	Single
West and Central Africa	Nigeria	MICS4 2011 also DHS 2008 also MICS3 2007	Single & trend
Latin America and Caribbean	Belize	MICS4 2011 also MICS3 2006	Single & trend
Latin America and Caribbean	Brazil	DHS 1996	Single
Latin America and Caribbean	Costa Rica	MICS4 2011	Single
Latin America and Caribbean	Saint Lucia	MICS4 2012	Single

The datasets that are being considered for analysis are presented in Table 2. They have been selected on the basis of the availability of MICS4 datasets (which are the datasets of reference for this analysis), the representativity of various regions of the world, the availability of the wealth index SPSS syntax (classic approach) used for the final MICS report, the availability in a selected number of cases of more than one dataset per country to allow for trend analysis, and knowledge of the country by some of the investigators. Brazil and India, for which no MICS4 datasets are available, are included due to their importance in the water and sanitation landscape, and we also run a small number of DHS datasets for comparison purposes.

Procedures used for the analysis of MICS4 datasets:

- a) For each country/dataset, run the original SPSS wealth syntax with two modifications:
 - add option '/print=correlation' to the 'factor' command, so that the correlation matrix of the PCA is produced; export the correlation matrix to Excel for later use (named 'cormtx_surveyname.xlsx'), without the variable labels for water and sanitation variables;
 - add a command line to save the 'wealth' dataset with all original variables, variables modified for PCA, wealth score and wealth index in STATA format for later use (named 'wealth.dta').
- b) Examine the SPSS original output (comments written to file 'wealth_SPSS_Output.pdf').
- c) Produce a STATA 'do' file (named 'watsanvar.do') with information on the full set of PCA variables, PCA water- and sanitation-related variables, and other survey characteristics for later used by other syntax files.
- d) Run 'pca_run.do' to produce PCAs without water, without sanitation, and without water-sanitation variables. Examine the results and decide about changes, if any, to the set of

variables to be used for the final analysis (results and comments saved to 'EigenVectors_*surveyname*.xlsx').

- e) Run 'wash_results.do' to batch-produce the outputs for the joint analysis (saved in 'results.dta').

5

Results

We will first present results for differences in coverage estimates, which will be followed by an analysis of differences in trends.

Differences in water and sanitation coverage estimates by wealth quintile with and without water and sanitation variables in the PCA

A total of 17 MICS4 datasets were used for this part of the analysis on the basis of the criteria presented above. The list of surveys is presented in Table 3 along with selected characteristics. As can be seen, these surveys were implemented between 2010 and 2012, in four continents. They range in sample size from 1,718 to 35,701 households. The number of (dichotomized) variables included in the PCA for the wealth index calculations varies from 48 to 100, of which 4 to 17 are related to the main source of water used by the households for drinking, and 4 to 13 to the main type of sanitation facility used by household members (and if shared or not). This clearly demonstrates how wealth index calculations are implemented under very different conditions from survey to survey.

MICS4 dataset	Abbreviation	Households	PCA var.	Water var.	Sanitation var.	Variance explained
Belize 2011	bel2011	4,424	74	10	10	13.8
Bosnia and Herzegovina 2011–12	bos201112	5,778	75	11	8	8.2
Costa Rica 2011	cri2011	5,561	52	4	4	10.9
Indonesia (select. dist. of Papua) 2011	indpsd2011	2,866	85	13	11	12.9
Indonesia (select. dist. W. Papua) 2011	indwps2011	2,816	84	13	12	8.7
Iraq 2011	ira2011	35,701	99	15	10	5.8
Kenya (Nyanza Province) 2011	kennya2011	6,828	78	15	11	9.5
Madagascar (South) 2012	madsou2012	2,968	64	12	6	13.4
Moldova, Republic of 2012	mol2012	11,354	89	10	12	10.0
Nigeria 2011	nig2011	29,077	96	15	12	10.0
Palestine (State of) 2010	pal2010	13,629	48	7	6	10.6
Serbia 2010	ser2010	6,392	85	11	9	7.1
Saint Lucia 2012	slu2012	1,718	60	8	9	13.2
Somalia (Somaliland) 2011	somsom2011	4,820	100	17	10	11.2
Sudan 2010	sud2010	14,778	85	11	13	9.3
Tunisia 2011–12	tun201112	9,171	81	14	11	9.3
Ukraine 2012	ukr2012	11,321	64	11	9	9.7
Mean (unweighted)		9,953	78	12	10	10.2

Not only does the number of variables used in the PCA for the calculation of the wealth index vary widely, but the asset types and categories can be very different as well from survey to survey. Overall, 234 different variables were used in the calculation of the wealth indices in these 17 surveys; 64 were

common to 10 or more of these surveys, but only 10 were common to all 17 surveys. Only one water-related item was common to all surveys – water piped into dwelling – and only two sanitation-related items were common to all surveys – sanitation facility flushing to septic tank, or to pit (latrine). Details of items and variables can be found in Annex A.

There are a number of commonly followed steps to optimize a PCA in the process of generating a classic wealth index (see text box for details). The review of the 17 above-mentioned surveys was an opportunity to observe similarities and differences in the wealth syntaxes in the context of MICS4.

While similar steps were generally followed in all these classic wealth index syntaxes, a number of variants were noted:

- a) Missing values were not always handled consistently. The standard approach is to assign a ‘mean’ value to missing observations (by the use of the ‘factor’ subcommand ‘meansub’ in SPSS). However, analysts sometime assigned a ‘zero’ value to missing observations instead.
- b) Response categories designated ‘other’ are usually left out of the PCA analysis, as they may represent a mix of various conditions. Some analysts included ‘other’ responses as distinct binary variables.
- c) Different analysts used different cut-offs for the number of cases below which a response category or variable is excluded from the PCA. Most analysts kept response categories with two or more cases, but some eliminated response categories with less than five cases (or even less than eight cases).
- d) Some analysts included variables related to ownership of dwelling, agricultural land, and/or livestock in the PCA, although the general recommendation is not to include these.
- e) Some answer categories – particularly customized (non-standard) answers – appear to have sometimes been left out of the analysis by mistake (rather than by choice).
- f) The use of the variable ‘shared sanitation facility’ was inconsistent. Some analysts used shared toilet facilities as a binary variable for the PCA, while others did not use it. Further, the coding of missing values for this variable was usually inconsistent with the general approach, according to which missing values are given an overall ‘average’ value during PCA computations. In this case, most syntaxes recoded missing values (i.e., cases where no answer was recorded where an answer was expected) as ‘not shared’ – rather than ‘missing’, which would later be transformed during PCA computations into an overall average. All syntaxes using a ‘shared’ variable recoded ‘system missing’ values (i.e., cases where no answer was expected) – which here specifically corresponds to cases of open defecation – as ‘not shared’, which some may find debatable. Are the open fields and gutters not a vast shared defecation space?
- g) Mistakes were occasionally found. Some of these were corrected before proceeding with the work presented in this report, while trying to keep the syntax as close as possible to that used to produce the official results.
- h) Some wealth index syntaxes result in PCAs that fall below the target of at least 10 per cent variance explained by the first PC.

Common steps used in optimizing a classic wealth index PCA

- a) All variables in the dataset considered relevant for inclusion in an asset-based wealth index are observed in terms of their frequency distribution and missing values.¹
- b) Variables that include various response categories are then dichotomized – e.g., each source of drinking water is assigned to a binary (yes/no) variable. Some response categories with very few cases may be eliminated at this stage (e.g., five cases or less). Numerical variables are also calculated at this stage, as necessary (e.g., number of persons per sleeping room).
- c) All relevant binary and numerical variables are once more observed in terms of their frequency distribution and missing values. Any variable with less than two cases is eliminated.
- d) A first PCA run is implemented with all relevant variables. Variables on ownership of dwelling, agricultural land and livestock are usually excluded de facto from the analysis due to their unreliable performance in the classic approach used to calculate the wealth index.²
- e) The results of the PCA are observed, including the percentage of the variance explained by the first principal component (PC), as well as the value and sign of the loadings allocated to each variable in the first principal component. Variables that seem to perform counter-intuitively (e.g., a negative loading for an asset that is expected to indicate wealth) may be removed by the analyst at this stage, and a new run of the PCA implemented. This operation is repeated as many times as necessary. This is the part of the process that involves more subjectivity (and experience). Further, if the variance explained by the first PC remains much below 10 per cent, the analyst may decide to remove additional variables that have little expression (loading near zero) in order to increase the proportion of the variance explained.
- f) Once the analyst is satisfied with the performance of the PCA, the scores are calculated for each household; each household member is then assigned the score of the household to whom she or he belongs. The next step is to assign household members to five equally distributed wealth quintiles, from the lowest scores (usually the poorest) to the highest scores (usually the wealthiest).
- g) The distribution of various outcomes by wealth quintile is observed to further assess the performance of the index; for example, poorer populations are generally expected to have lower education levels than wealthier populations. If, in rare instances, some of the results do not seem credible, the analyst may decide to make further changes to the variables included in the PCA to try improving its performance. Once the performance is judged satisfactory, the wealth scores and quintiles are merged with the relevant datasets. This approach ensures a balanced overall household population (20 per cent) in each quintile, but usually results in largely unequal distributions of the population between quintiles when urban and rural areas are analysed separately.

A key aspect of the analysis presented in this report is the change in the PCs brought about by removing water- and/or sanitation-related variables from the PCA. A detailed survey-by-survey review is presented in Appendix B. In summary, removing only water- or only sanitation-related sets of variables results in mostly small changes in the loadings of the first PC. While removing both simultaneously is seen to have a somewhat larger effect, the loadings are nearly always of the same sign and of the same order of magnitude. Fewer than 10 cases were found with a change of sign in the studied datasets – representing less than 1 per cent of the PCA variables overall – and all such cases are related to very small loadings near ‘zero’ value. While moderate changes in the size of the loadings (say, of 10 or 20 per cent) are common, large changes – more than doubling or halving the original loading values – are infrequent. We found only about 20 such cases in the studied datasets, representing less than 2 per cent of the PCA variables overall, most of which affect very small loadings near ‘zero’ value. There was only one case of a very large proportional change (see Appendix B, Ukraine, satellite dish) where an original loading of 0.003 passed to 0.075 (corresponding to a 25-fold increase), but still related to a very small original value. In no case was it found necessary to adjust the PCA further by adding or removing other variables not related to water or sanitation.

One concrete way of measuring the overall effect of the changes in the loadings resulting from removing water and/or sanitation variables from the PCA is to calculate the change in the angle of the first PC resulting from this operation. If we regard the n variables incorporated in a wealth index calculation as vectors in an Euclidian n -space (13), PCA can be conceived as effecting an orthonormal rotation of these vectors, the elements of the eigen-vectors (loadings) being the direction cosines of the rotation angles (14). Removing water and/or sanitation variables from the PCA affects the rotation, and it is easy to measure the resulting change in the rotation of the first PC – the dot product of the respective eigen-

¹ A word of caution with respect to the types of variables to include in a PCA in the context of an asset-based wealth index: It is important to remember that, contrary to what takes place in a regression analysis, for example, where there is a clearly defined outcome variable, there is nothing here to ‘tell’ the PCA that we are building an asset-based wealth index, except for the correlation (or shared variation) between the variables included in the PCA. The axis of the first PC will simply point at the direction that captures the largest amount of variation between all the variables included. It is thus of the greatest importance to only include variables that are good proxies for our underlying (unobserved, latent) variable: long-term asset-based wealth. If we do otherwise, the axis of the first PC might become attracted towards a different, less precisely defined concept of ‘wealth’. If we had wished to use an index representing a broader concept of wealth (not strictly asset-based), we would arguably have also included in the index other variables such as education, with the risk of ending up with an index representing something very broad and more difficult to interpret. Keeping with our current, more restricted concept of long-term asset-based wealth, the writer questions the inclusion in the wealth index, as is sometime seen, of such items as soap – a short-term consumable type of item – or the sharing of a toilet facility, related more to hygiene than ownership. In the same line of thought, the writer believes that it would be more consistent with the concept of an asset-based wealth index to include in the PCA only water and sanitation facilities that are located on premises. In terms of asset-based wealth, it is a completely different matter if a household has invested in the construction of, say, a latrine, than if the members of a household use the neighbour’s latrine. In the first instance, the latrine can be regarded as part of the long-term asset-based wealth of the household, but not so in the second instance. Further, the investment that the said neighbour made in constructing the latrine does not diminish because he had the generosity of letting less fortunate families share the facility. Because the current practice has been to include in the PCA water and sanitation facilities used by the household whatever their location, it is quite possible that the omission of such water- and/or sanitation-related assets from the PCA (for a restricted analysis) might in fact help bring the wealth index closer to a purer concept of long-term asset-based wealth.

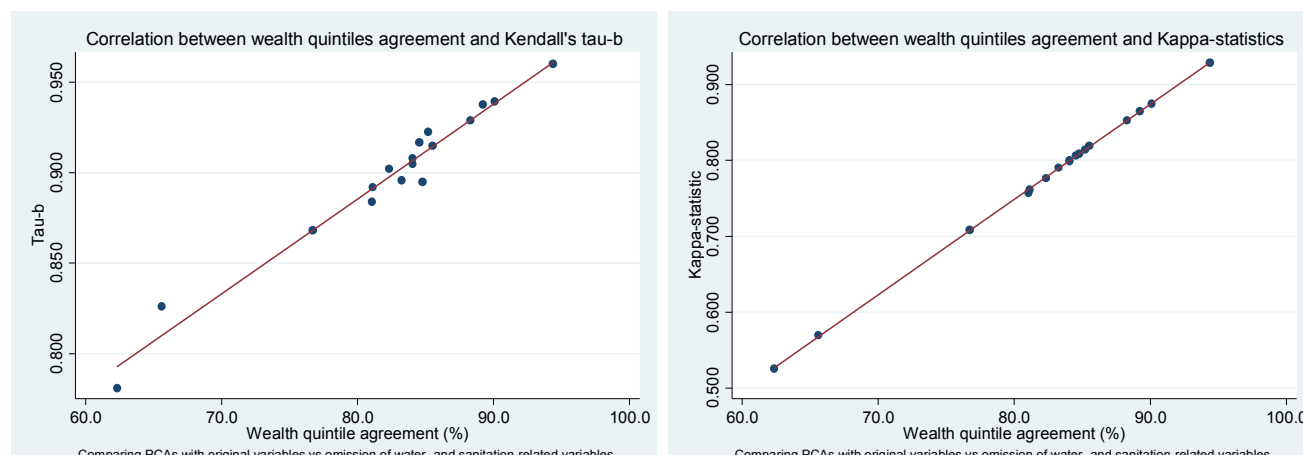
² Variables related to farm animals and agricultural lands generally get negative loadings in the classic wealth index. This is counter-intuitive, since one would expect that a (rural) household that owns farm animals ought to be wealthier (not poorer) than a household that does not. For this reason, DHS and MICS have generally omitted these variables in the calculations of the classic wealth index.

vectors being equal to the cosine of this angle (13). The wider the change in the angle of rotation, the larger the potential impact on the resulting scores and, ultimately, the water and sanitation coverage results. An example of such calculations is given at the bottom of Table 13 in Appendix B, demonstrating how the exclusion of water-related variables from the wealth index in the Belize dataset results in a relatively small, 14-degree change in the rotation of the first PC (corresponding to a cosine of 0.97). Omitting sanitation-related variables from the wealth index in the same dataset results in a similar (16-degree) change, while omitting both water- and sanitation-related variables results, as expected, in a somewhat larger, 22-degree change. Table 4 presents results for the 17 MICS4 datasets under consideration. Angle change is nearly always larger with the omission of sanitation-related than water-related variables, and consistently largest with both sets of variables omitted.

The table also present Kendall's *tau*-b estimates, as a measure of wealth score rank correlation of household members, the percentage of agreement between wealth quintiles, and the corresponding *Kappa*-statistic for household members. It is worth noting that the percentage of agreement presented here is the converse of the so-called 'overflow' statistics presented in other works discussed earlier in this report (e.g., 90 per cent agreement equals 10 per cent overflow). There is a very close correlation between the percentage of agreement between wealth quintiles, Kendall's *tau*-b, and *Kappa*-statistics as shown in Figure 1. The cut-off value of 0.6 for the *Kappa*-statistics cited in the Methods section of this report corresponds to about 70 per cent agreement in the wealth quintiles. We have two surveys that are below this cut-off: Serbia and Ukraine, when both water- and sanitation-related variables are omitted.

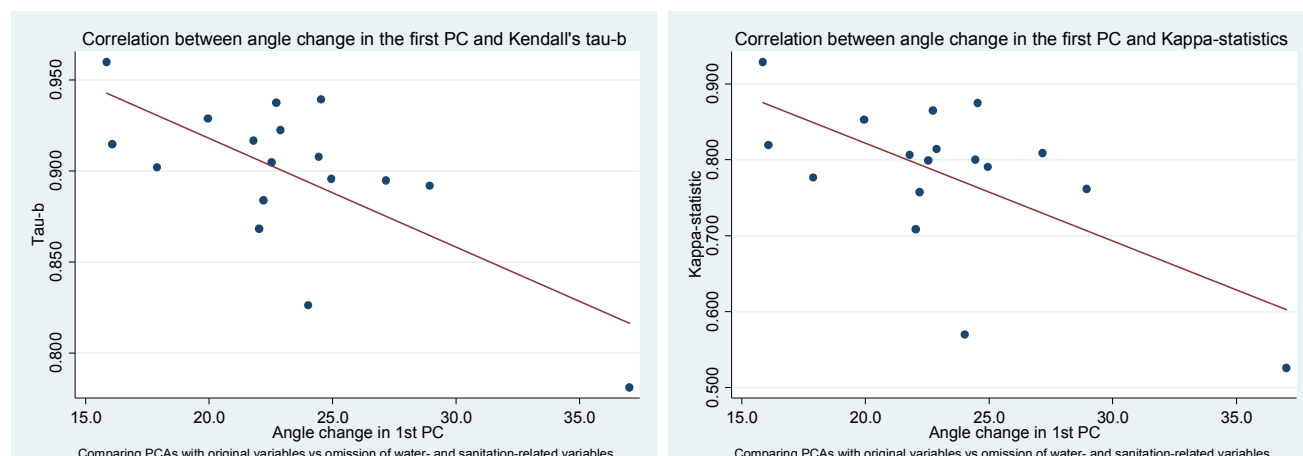
Table 4: Angle change in the direction of the first principal component, wealth score rank correlation (Kendall's tau-b) of household members, wealth quintile percentage of agreement of household members and corresponding Kappa-statistic, between PCAs with the original set of variables and those with water-related, sanitation-related or both sets of variables omitted, 17 MICS4 datasets														
	Angle change water	Angle change sanitation	Angle change both	Tau water	Tau sanit.	Tau both	Agreement water	Agreement sanitation	Agreement both	Kappa water	Kappa sanit.	Kappa both		
Belize 2011	14.3	16.1	21.8	0.95	0.95	0.92	91.1	89.1	84.5	0.89	0.86	0.81		
Bosnia and Herzegovina 2011–12	10.1	14.5	17.9	0.96	0.93	0.90	93.1	85.4	82.3	0.91	0.82	0.78		
Costa Rica 2011	11.2	11.0	15.9	0.97	0.99	0.96	95.3	98.0	94.4	0.94	0.98	0.93		
Indonesia (select. dist. of Papua) 2011	16.3	17.8	24.5	0.97	0.96	0.94	94.5	93.6	90.1	0.93	0.92	0.88		
Indonesia (select. dist. W. Papua) 2011	17.1	16.9	24.4	0.94	0.94	0.91	89.1	89.2	84.1	0.86	0.87	0.80		
Iraq 2011	14.5	16.3	22.2	0.93	0.93	0.88	86.3	89.1	81.1	0.82	0.86	0.76		
Kenya (Nyanza Province) 2011	13.9	16.7	22.0	0.94	0.91	0.87	89.4	82.4	76.7	0.87	0.78	0.71		
Madagascar (South) 2012	15.5	21.7	27.2	0.93	0.96	0.90	89.6	92.2	84.8	0.87	0.90	0.81		
Moldova, Republic of 2012	18.2	21.1	28.9	0.96	0.94	0.89	91.6	90.3	81.1	0.89	0.88	0.76		
Nigeria 2011	12.2	15.5	20.0	0.96	0.95	0.93	93.8	91.1	88.3	0.92	0.89	0.85		
State of Palestine 2010	10.2	13.2	16.1	0.92	0.92	0.92	81.5	83.9	85.5	0.77	0.80	0.82		
Serbia 2010	12.0	20.4	24.0	0.97	0.85	0.83	95.1	69.0	65.6	0.94	0.61	0.57		
Saint Lucia 2012	13.5	18.2	22.9	0.98	0.95	0.92	94.8	88.2	85.2	0.93	0.85	0.81		
Somalia (Somaliland) 2011	15.0	16.6	22.7	0.97	0.96	0.94	94.8	93.0	89.2	0.94	0.91	0.87		
Sudan 2010	17.5	17.2	25.0	0.94	0.92	0.90	88.7	86.8	83.3	0.86	0.84	0.79		
Tunisia 2011–12	13.5	17.7	22.5	0.96	0.94	0.91	93.9	87.7	84.1	0.92	0.84	0.80		
Ukraine 2012	23.0	26.2	37.0	0.92	0.89	0.78	84.2	80.1	62.3	0.80	0.75	0.53		
Mean (unweighted)	14.6	17.5	23.2	0.95	0.93	0.90	91.0	87.6	82.5	0.89	0.84	0.78		

Figure 1: Scatter plots of wealth quintile percentage agreement against Kendall's *tau*-b and *Kappa*-statistics, comparing PCAs with original variables with those in which water- and sanitation-related variables have been omitted, 17 MICS4 datasets



Further, there is generally an inverse relationship between the change in the angle of the first PC with both Kendall's *tau*-b and the *Kappa*-statistic. In other words, the wider the change in the angle, the smaller the value of Kendall's *tau*-b and of the *Kappa*-statistic (and of the agreement between quintiles). However, as seen in Figure 2, the correspondence is far from perfect. The data from our 17 MICS4 datasets do not suggest any association between the number of variables in the PCA and the percentage of agreement between quintiles, contrary to what some authors (7) have suggested (see Annex C).

Figure 2: Scatter plots of angle change in the first PC against Kendall's *tau*-b and *Kappa*-statistics, comparing PCAs with original variables with those in which water- and sanitation-related variables have been omitted, 17 MICS4 datasets



We now get to the core of the issue at hand: the differences in the estimates of water and sanitation coverage by wealth quintile, calculated with and without water- and/or sanitation-related variables in the PCA, which we will refer to as a 'restricted' PCA in this report; we will refer to the PCA with all the original variables as an 'unrestricted' PCA. There is potentially a very large number of statistics involved in such an analysis. As previously indicated in the Methods section, three non-overlapping service-level categories are used here for water coverage: piped water onto premises ('piped'), other-improved water sources

(‘impr.’), and unimproved water sources (‘unimp.’). The definitions of improved and unimproved water sources are the same as used in the various MICS reports of the datasets included in this analysis; these are fairly standard, but there are small variations between countries – for instance, rainwater collection is usually considered an improved source, but classified as unimproved in some reports. Three categories are also used for sanitation coverage: improved sanitation facilities (‘impr.’) irrespective of whether shared or not; unimproved sanitation facilities excluding open defecation (‘unimp.’); and open defecation (‘open d’). Given the three indicators of coverage and the five wealth quintiles, there are 15 coverage figures by dataset for each approach (with or without water- and/or sanitation-related variables), for water and for sanitation as well. One summary statistic adopted here is the largest absolute difference (LAD), in percentage points, between any of these 15 pairs of coverage figures. This is the statistic for which the Methods section of this report indicated that 5 percentage points or more would be considered “too large to be ignored.”

Three additional summary statistics also used here are the change in the gap (given in percentage points) between the poorest (first quintile) and the wealthiest (fifth quintile) coverage figures (shown as <Q1–Q5>) with respect to each one of the three coverage indicators, using different approaches. For example, piped water coverage in a given dataset might be 40 per cent in the first wealth quintile and 75 per cent in the fifth quintile, when the full set of variables is used in the PCA; this is a gap of 35 percentage points. When we omit water-related variables from the PCA, we may instead get 43 per cent in the first quintile and 73 per cent in the fifth quintile; this is now a gap of 30 percentage points. The <Q1–Q5> result in this case would be reported as ‘–5’, indicating that the gap has narrowed (hence the negative result) for this indicator because of the change in the approach to calculating the wealth index.

The overall LAD and <Q1–Q5> for water coverage for the 17 datasets under review are presented in Table 5, as well as for urban and rural areas. Cells with a dot instead of a figure represent instances with less than 25 (unweighted) household members in a particular quintile for which results have been suppressed. This is quite possible, since according to the classic approach, 20 per cent of the overall population is assigned to each quintile, which may result in largely unequal distributions of the population between quintiles when urban and rural areas are analysed separately. Because of the known urban bias of the classic wealth index (5, 15), which tends to under-represent poor urban and wealthy rural households, it is not infrequent to find relatively small samples in these two categories.

Overall, when water-related variables are omitted from the PCA, the LAD ranges from 2 to 11 percentage points, seven cases being 5 percentage points and above. When both water- and sanitation-related variables are omitted, the LAD is usually larger, but not invariably so, and we get 10 cases 5 percentage points and above. The LAD tends to be larger, but not invariably so, for urban and rural estimates, ranging from 1 to 50 percentage points.

Table 5: Largest absolute difference (LAD) and change in gap in water coverage between poorest and wealthiest with different wealth index approaches, by area, 17 MICS4 datasets

	Water-related var. omitted				Water- & sanit.-related var. omitted			
	LAD	Change in gap <Q1-Q5>			LAD	Change in gap <Q1-Q5>		
		Piped	Impr.	Unimp.		Piped	Impr.	Unimp.
OVERALL								
Belize 2011	2.3	-3.2	-2.6	-0.5	2.9	-3.5	-3.0	-0.5
Bosnia and Herzegovina 2011–12	3.9	-7.0	-6.7	-0.3	5.6	-10.0	-9.6	-0.3
Costa Rica 2011	2.6	-2.9	-2.7	-0.1	2.6	-2.9	-2.7	-0.2
Indonesia (select. dist. of Papua)	3.7	-2.6	1.3	-1.4	4.0	-4.4	2.1	-2.4
Indonesia (select. dist. W. Papua)	4.3	-2.1	-2.7	-4.8	6.0	-1.7	-5.3	-7.0
Iraq 2011	7.0	-11.6	-6.8	-4.8	7.8	-12.5	-6.2	-6.2
Kenya (Nyanza Province) 2011	5.1	-1.1	-5.5	-6.6	4.6	-1.7	-5.5	-7.2
Madagascar (South) 2012	3.0	0.0	-4.4	-4.3	4.2	0.0	-8.2	-8.2
Moldova, Republic of 2012	5.6	-5.1	-4.3	-0.8	7.2	-8.0	-6.6	-1.5
Nigeria 2011	4.5	-1.0	-3.1	-4.1	5.2	-1.5	-2.8	-4.4
State of Palestine 2010	9.1	-17.0	-2.8	-14.1	7.1	-12.2	-5.0	-7.2
Serbia 2010	3.5	-4.5	-4.5	0.0	6.4	-8.4	-8.3	-0.1
Saint Lucia 2012	3.2	-4.9	-4.4	-0.6	3.0	-4.7	-4.0	-0.7
Somalia (Somaliland) 2011	5.0	-5.0	-0.9	-4.1	5.2	-5.5	-1.2	-4.3
Sudan 2010	7.0	-5.4	-8.1	2.7	4.8	-4.9	-4.5	-0.5
Tunisia 2011–12	4.3	-7.1	-5.7	-1.4	7.1	-11.4	-9.0	-2.4
Ukraine 2012	11.3	-13.6	-12.6	-1.0	18.2	-22.5	-21.5	-1.0
Overall mean (unweighted)	5.0	-5.5	-4.5	-2.7	6.0	-6.8	-6.0	-3.2
URBAN								
Belize 2011	3.6	-4.4	-4.3	-0.1	2.0	-2.7	-2.6	0.0
Bosnia and Herzegovina 2011–12	7.4	-8.9	-8.9	-0.1	7.8	-8.5	-8.2	-0.3
Costa Rica 2011	0.3	-0.7	-0.6	-0.1	0.4	-0.7	-0.6	-0.1
Indonesia (select. dist. of Papua)	9.1	-2.2	1.5	-3.6	6.4	-3.5	1.7	-5.2
Indonesia (select. dist. W. Papua)	7.6	.	.	.	3.2	.	.	.
Iraq 2011	8.7	-13.0	-9.8	-3.1	8.2	-12.5	-8.4	-4.0
Kenya (Nyanza Province) 2011	5.1	-1.5	-5.5	-7.0	4.5	-2.1	-6.0	-8.2
Madagascar (South) 2012	1.0	.	.	.	1.8	.	.	.
Moldova, Republic of 2012	8.4	-10.3	-8.1	-2.2	13.9	-15.8	-11.9	-3.9
Nigeria 2011	7.2	-0.5	-5.6	-6.1	14.5	-0.8	-12.1	-12.9
State of Palestine 2010	9.9	-17.5	-2.6	-14.9	7.2	-12.0	-4.3	-7.8
Serbia 2010	1.4	-2.3	-2.2	-0.1	3.5	-4.4	-4.1	-0.3
Saint Lucia 2012	1.3	-1.3	-1.3	0.0	7.5	-7.5	-7.5	-0.1
Somalia (Somaliland) 2011	4.3	-4.3	1.6	-5.9	8.8	-8.7	3.0	-11.7
Sudan 2010	13.6	-10.6	-14.0	3.4	13.5	-12.4	-14.1	1.7
Tunisia 2011–12	7.3	-10.2	-9.5	-0.7	12.2	-16.6	-15.5	-1.2
Ukraine 2012	19.4	-21.5	-20.4	-0.2	27.6	-30.5	-29.4	-0.2
Urban mean (unweighted)	6.8	-7.3	-6.0	-2.7	8.4	-9.2	-8.0	-3.6
RURAL								
Belize 2011	4.1	-4.1	-3.6	-0.4	4.3	-4.6	-4.3	-0.4
Bosnia and Herzegovina 2011–12	6.3	-9.6	-8.8	-0.8	9.7	-14.8	-14.1	-0.7
Costa Rica 2011	5.7	-3.4	-3.3	-0.1	6.0	-3.5	-3.3	-0.1
Indonesia (select. dist. of Papua)	6.9	-7.0	2.3	-4.7	10.6	-10.2	9.1	-1.1
Indonesia (select. dist.) 2011	3.9	-1.9	-3.4	-5.3	5.8	-1.4	-6.3	-7.7
Iraq 2011	8.2	-13.0	-6.7	-6.4	9.5	-14.7	-7.7	-7.2
Kenya (Nyanza Province) 2011	11.3	.	.	.	14.3	.	.	.
Madagascar (South) 2012	3.0	-0.2	-3.7	-3.9	4.1	-0.4	-7.7	-8.1
Moldova, Republic of 2012	12.7	-9.7	-9.4	-0.3	18.4	-21.1	-19.5	-1.6
Nigeria 2011	4.4	-2.1	-3.9	-6.0	4.7	-2.7	-3.7	-6.4

Table 5: Largest absolute difference (LAD) and change in gap in water coverage between poorest and wealthiest with different wealth index approaches, by area, 17 MICS4 datasets

	Water-related var. omitted				Water- & sanit.-related var. omitted			
	Change in gap <Q1-Q5>				Change in gap <Q1-Q5>			
	LAD	Piped	Impr.	Unimp.	LAD	Piped	Impr.	Unimp.
State of Palestine 2010	7.2	-13.8	-7.3	-6.5	8.3	-14.4	-9.5	-4.8
Serbia 2010	6.1	-7.4	-7.4	0.0	11.7	-12.8	-12.3	-0.5
Saint Lucia 2012	3.7	-5.6	-5.0	-0.6	2.0	-4.0	-3.3	-0.7
Somalia (Somaliland) 2011	8.0	-8.0	-1.1	-1.6	8.9	-8.9	0.0	-1.5
Sudan 2010	6.8	-5.6	-9.2	3.6	4.9	-4.9	-5.0	0.1
Tunisia 2011–12	4.3	-5.9	-4.6	-1.3	9.1	-5.9	-3.0	-2.9
Ukraine 2012	27.4	.	.	.	49.9	.	.	.
Rural mean (unweighted)	7.6	-6.5	-5.0	-2.3	10.7	-8.3	-6.0	-2.9

Table 6: Largest absolute difference (LAD) and change in gap in sanitation coverage between poorest and wealthiest with different wealth index approaches, by area, 17 MICS4 datasets

	Sanitation-related var. omitted				Water- & sanit.-related var. omitted			
	Change in gap <Q1-Q5>				Change in gap <Q1-Q5>			
	LAD	Impr.	Unimp.	Open d.	LAD	Impr.	Unimp.	Open d.
OVERALL								
Belize 2011	0.4	-0.6	-0.6	0.0	0.6	-0.8	-0.7	-0.1
Bosnia and Herzegovina 2011–12	1.4	-1.8	-1.8	0.0	1.4	-1.7	-1.7	0.0
Costa Rica 2011	0.5	-0.6	-0.6	0.0	0.5	-0.6	-0.6	0.0
Indonesia (select. dist. of Papua)	3.5	-3.5	0.1	-3.5	3.1	-2.7	0.4	-3.1
Indonesia (select. dist.) 2011	9.2	-9.3	-3.7	-5.6	9.1	-10.2	-5.1	-5.1
Iraq 2011	1.2	-1.4	-1.1	-0.2	1.7	-1.8	-1.5	-0.3
Kenya (Nyanza Province) 2011	10.9	-15.3	-12.3	-3.1	11.0	-16.7	-14.3	-2.4
Madagascar (South) 2012	6.1	0.0	-9.1	-9.2	7.5	-0.3	-10.8	-11.1
Moldova, Republic of 2012	1.4	-0.3	-0.3	0.0	1.5	-0.1	-0.1	0.0
Nigeria 2011	3.9	-7.1	-0.8	-6.3	4.4	-8.5	-1.5	-7.0
State of Palestine 2010	0.5	-0.7	-0.6	-0.1	0.4	-0.6	-0.4	-0.1
Serbia 2010	1.2	-0.9	-0.9	0.0	1.1	-0.9	-0.9	0.0
Saint Lucia 2012	1.2	-1.2	0.0	-1.2	1.1	-1.1	-0.2	-0.9
Somalia (Somaliland) 2011	7.7	-6.7	-1.0	-7.7	9.0	-8.2	-0.8	-9.0
Sudan 2010	13.0	-8.4	5.1	-13.5	12.5	-8.1	4.8	-13.0
Tunisia 2011–12	0.6	-0.6	-0.2	-0.4	0.6	-0.6	-0.3	-0.4
Ukraine 2012	0.3	0.0	-0.1	0.1	0.5	-0.7	-0.7	0.1
Overall mean (unweighted)	3.7	-3.4	-1.6	-3.0	3.9	-3.7	-2.0	-3.1
URBAN								
Belize 2011	2.1	-2.1	-1.3	-0.7	3.0	-3.0	-2.1	-0.9
Bosnia and Herzegovina 2011–12	0.6	-0.6	-0.6	0.0	1.4	-0.6	-0.6	0.0
Costa Rica 2011	1.6	-1.6	-1.6	0.0	1.5	-1.5	-1.5	0.0
Indonesia (select. dist. of Papua)	6.0	-2.5	3.1	-5.6	4.7	-1.4	3.3	-4.7
Indonesia (select. dist.) 2011	6.5	.	.	.	3.0	.	.	.
Iraq 2011	1.4	-1.5	-1.1	-0.5	1.6	-1.7	-1.2	-0.5
Kenya (Nyanza Province) 2011	10.9	-18.0	-14.8	-3.2	11.0	-20.2	-17.6	-2.7
Madagascar (South) 2012	0.1	.	.	.	1.2	.	.	.
Moldova, Republic of 2012	3.3	0.8	0.8	0.0	5.8	-2.4	-2.4	0.0
Nigeria 2011	6.0	-5.5	1.9	-7.4	14.2	-16.8	-6.1	-10.6
State of Palestine 2010	0.4	-0.5	-0.4	-0.1	0.2	-0.4	-0.3	-0.1
Serbia 2010	0.6	-0.5	-0.3	-0.1	0.6	-0.5	-0.3	-0.2
Saint Lucia 2012	9.6	-9.6	-0.6	-9.0	8.8	-8.8	-1.5	-7.3

Table 4: Largest absolute difference (LAD) and change in gap in sanitation coverage between poorest and wealthiest with different wealth index approaches, by area, 17 MICS4 datasets

	Sanitation-related var. omitted				Water- & sanit.-related var. omitted			
	Change in gap <Q1-Q5>				Change in gap <Q1-Q5>			
	LAD	Impr.	Unimp.	Open d.	LAD	Impr.	Unimp.	Open d.
Somalia (Somaliland) 2011	15.1	-13.5	1.7	-15.1	30.0	-27.9	2.0	-30.0
Sudan 2010	20.6	-14.7	6.0	-20.7	20.8	-11.1	9.7	-20.9
Tunisia 2011–12	0.7	-0.7	-0.5	-0.2	0.8	-0.8	-0.6	-0.3
Ukraine 2012	0.2	0.0	-0.2	0.2	0.3	-0.4	-0.5	0.1
Urban mean (unweighted)	5.0	-4.7	-0.5	-4.2	6.4	-6.5	-1.3	-5.2
RURAL								
Belize 2011	0.6	-0.6	-0.8	0.2	0.6	-0.7	-0.8	0.2
Bosnia and Herzegovina 2011–12	2.2	-2.1	-2.1	0.0	2.0	-1.8	-1.8	0.0
Costa Rica 2011	0.2	-0.3	-0.3	0.0	0.3	-0.3	-0.3	0.0
Indonesia (select. dist. of Papua)	3.8	-3.7	-0.3	-3.4	4.3	-4.4	-1.4	-3.0
Indonesia (select. dist.) 2011	9.2	-9.2	-3.3	-5.9	8.9	-9.4	-4.2	-5.2
Iraq 2011	1.8	-1.1	-1.2	0.1	1.9	-1.0	-1.3	0.3
Kenya (Nyanza Province) 2011	16.5	.	.	.	17.8	.	.	.
Madagascar (South) 2012	9.0	0.0	-12.0	-12.1	10.2	-0.2	-13.7	-13.9
Moldova, Republic of 2012	3.1	-2.9	-2.9	0.0	4.2	-3.4	-3.4	0.0
Nigeria 2011	6.7	-9.9	-2.6	-7.3	8.4	-12.0	-3.5	-8.5
State of Palestine 2010	1.2	0.2	-0.8	1.0	1.2	-0.5	-0.7	0.2
Serbia 2010	2.2	-0.2	-0.2	0.0	2.0	-0.2	-0.2	0.0
Saint Lucia 2012	0.1	0.1	0.0	0.1	0.5	0.0	0.0	0.0
Somalia (Somaliland) 2011	10.1	-8.4	1.0	-7.4	13.4	-6.0	-1.3	-7.4
Sudan 2010	12.6	-10.6	3.5	-14.0	11.9	-10.3	2.9	-13.2
Tunisia 2011–12	1.1	1.4	1.1	0.3	1.3	1.5	1.1	0.5
Ukraine 2012	1.3	.	.	.	2.6	.	.	.
Rural mean (unweighted)	4.8	-3.2	-1.4	-3.2	5.4	-3.2	-1.9	-3.3

As for the <Q1–Q5>, values are nearly always negative, indicating that restricting the PCA almost systematically results in a narrower coverage gap between poorest and wealthiest. The narrowing of the gap can be impressive – in many cases, it narrows by more than 10 percentage points, in several by more than 20 percentage points, up to 31 percentage points.

Table 6 presents similar information with respect to sanitation coverage. LADs for sanitation are on average smaller than for water, but even so, five cases in the overall category are 5 percentage points and above when sanitation-related variables are omitted from the PCA, and we find five such cases as well when both water- and sanitation-related variables are omitted, with a maximum of 13 percentage points. LADs tend to be on average slightly larger for urban and rural estimates, and can be as large as 30 percentage points. As was the case for water, the great majority of the <Q1–Q5> figures are negative, indicating that the coverage gap between poorest and wealthiest is usually narrowed when a restricted PCA is used, and this can be by as much as 30 percentage points.

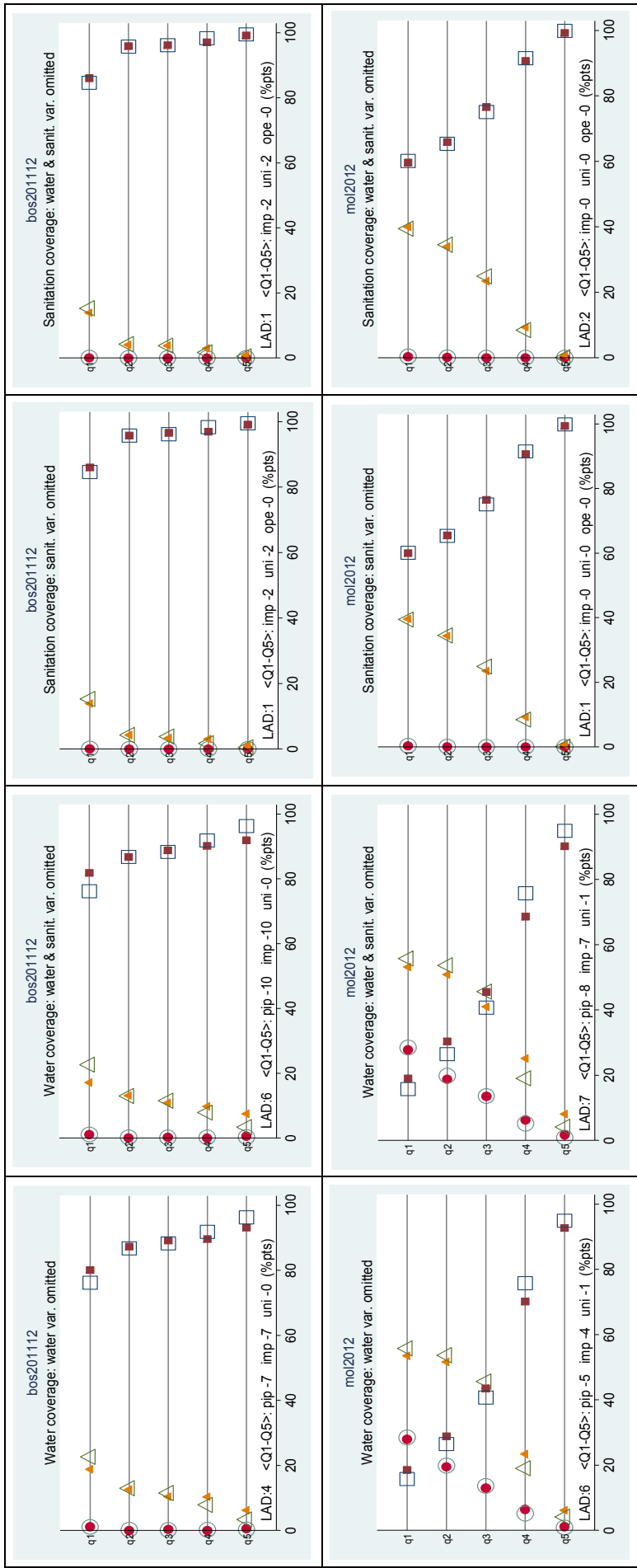
In order to get a more in-depth understanding of the changes in coverage that are brought about by the use of a restricted PCA, the previous overall results have been presented on dot graphs, with additional information by quintile (see Figure 3 for a few examples; all 17 datasets can be found in Annex D). There is one row per dataset, and four graphs per row, two for water and two for sanitation, each with a

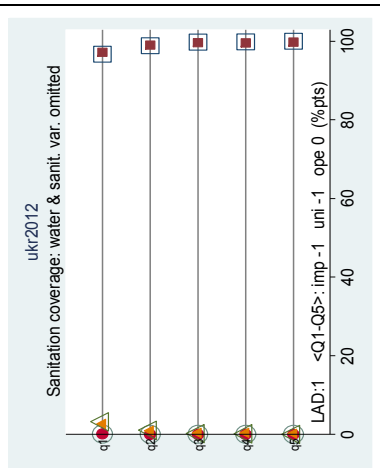
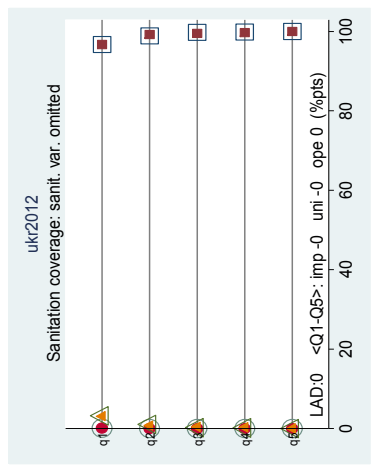
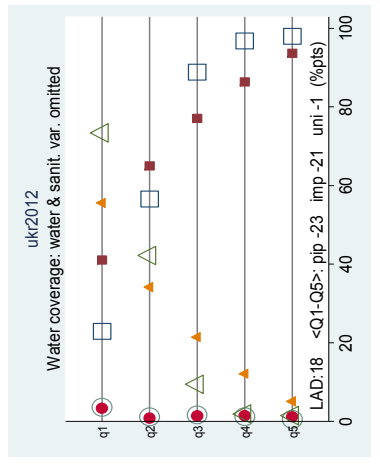
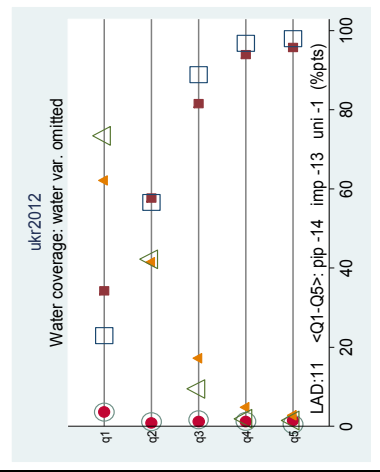
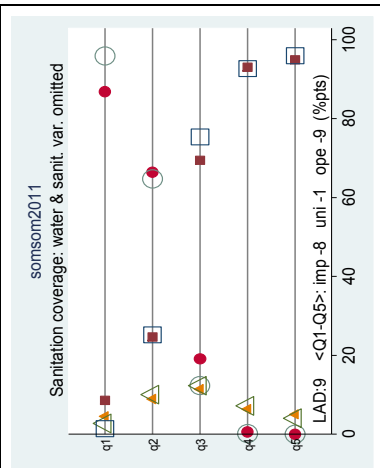
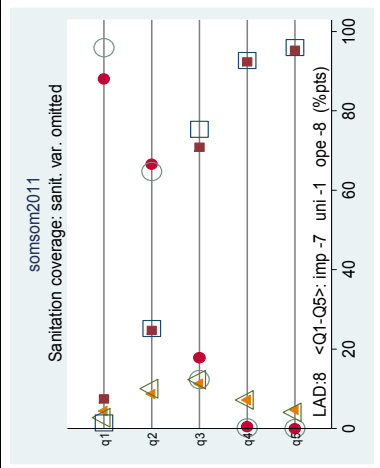
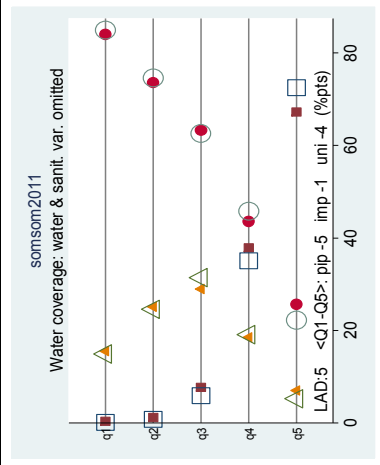
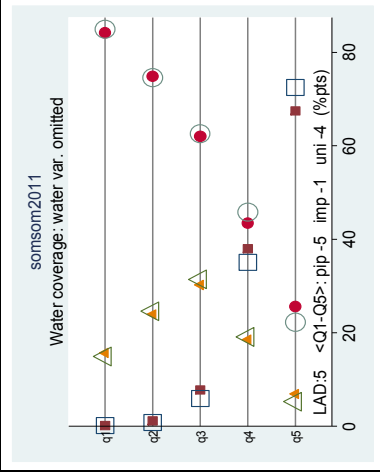
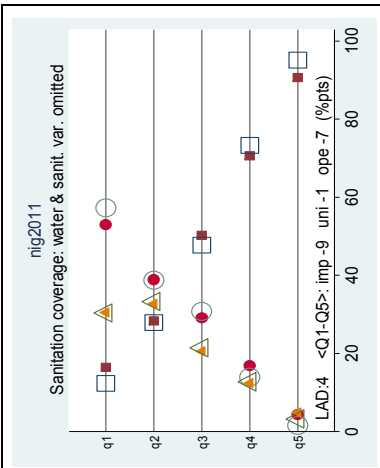
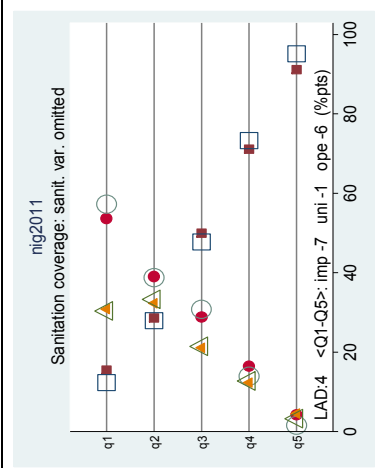
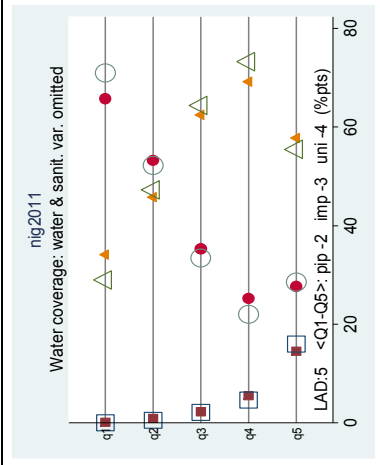
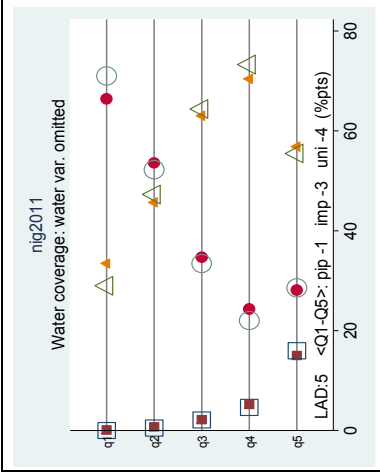
different PCA restriction. Each dot graph presents five horizontal lines representing the wealth quintiles, starting with the poorest (q1) at the top and the wealthiest at the bottom (q5). On each line, there are three pairs of symbols, one pair for each indicator. For water coverage, the large hollow square represents piped water coverage using an unrestricted PCA, while the smaller filled square represents piped water coverage using a restricted PCA, as indicated at the top of each graph; similarly, improved water sources are represented by triangles, and unimproved by circles. For sanitation, the squares stand for improved sanitation facilities, the triangles for unimproved, and, finally, the circles for open defecation.

Taking the first graph of the first row as an example (Bosnia and Herzegovina), we see that the small filled circles in each quintile stand right in the middle of the larger hollow circles, meaning that the coverage figures for unimproved water sources are similar with an unrestricted and a restricted PCA. We see, however, that the case is different for piped water, especially in the first quintile, where the small filled square lies slightly to the right of the large hollow square, contributing to the narrowing of the gap between the first and fifth quintile for this indicator, shown by the '–3' <Q1–Q5> result for 'pip' (piped) at the bottom of the graph. We can also see for the same indicator that there is a slight decrease in coverage for quintiles 4 and 5.

Figure 3: Changes in water/sanitation coverage by wealth quintile when water-/sanitation-related variables are omitted from the PCA (overall); selected datasets

LAD: largest absolute difference between coverage estimates from the two approaches; <Q1–Q5>: change in gap from the two approaches between poorest and wealthiest; WATER coverage: piped (square), improved (triangle), unimpr. (circle); SANITATION coverage: improved (square), unimpr. (triangle), open defecation (circle); larger hollow symbols for original set of PCA variables, smaller filled symbols for restricted set of variables; see text for details



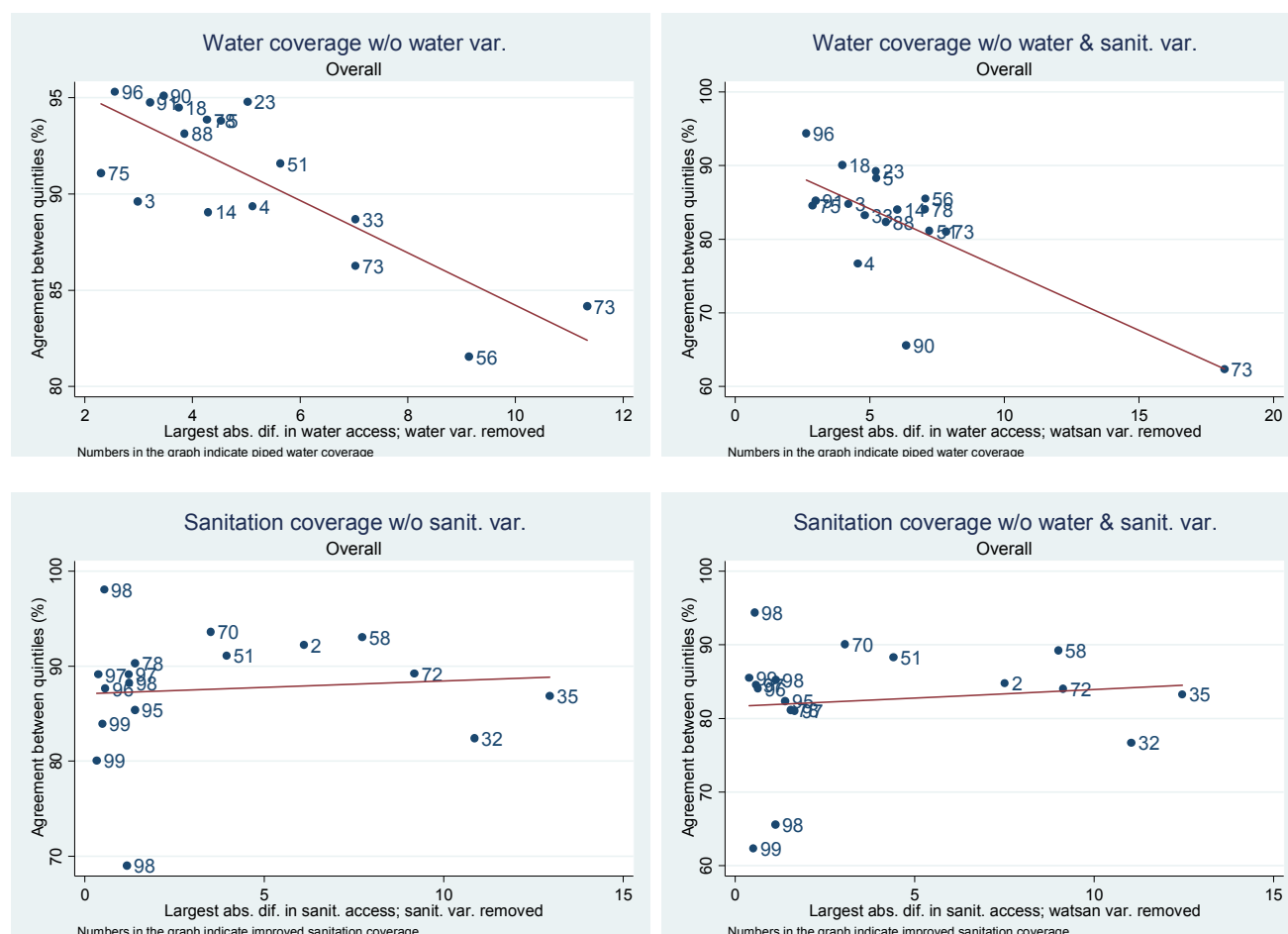


A glance at the various graphs (see Annex D) indicates that it is often in the first quintile that the largest changes are seen, and that the changes in the fifth quintile (if any) are predominantly in an opposite direction to those of the first quintile, resulting mostly in a narrowing of the gap. But there are several cases where the LAD is found in quintiles other than the first, such as the fourth (Republic of Moldova, water), or the fifth (Somalia, water). In some cases, important changes are in one or two of the quintiles only, while in others they are spread more widely over all quintiles (e.g., Ukraine, water). The graphs also permit us to see how large changes are often prevalent in datasets where there are large differences in coverage between the first and fifth quintiles – in other words, where there is more inequity with respect to access to water and/or sanitation. There is obviously little scope for variation where access is nearly universal (e.g., Ukraine, sanitation).

But are there any useful correlations between measures of agreement presented earlier in this section and changes in water and/or sanitation coverage brought about by the use of a restricted PCA? Agreement of less than 100 per cent will necessarily result in changes in coverage between quintiles, unless there is a perfect balance in the types of water and sanitation facilities used by households moving up and down the quintile ladder. It cannot be reasonably expected that this would generally be the case, and the amount of imbalance is likely to differ in different contexts.

We saw earlier that Kendall's *tau*, the percentage of agreement between quintiles, and the *Kappa*-statistic are all closely related. Here, we use the agreement between quintiles, because it is conceptually the easiest. Figure 4 presents four scatter graphs showing the association between the measure of agreement between quintiles and the LADs when water- and/or sanitation-related variables are omitted from the PCA. The numbers in the graph refer to piped water or improved sanitation coverage, as relevant. With respect to water coverage (the two graphs on the first row), it can be seen that the smaller the agreement between quintiles, the larger the LAD tends to be. Even so, one survey with a LAD over 5 (Republic of Moldova) shows an agreement between quintiles above 90 per cent. As for sanitation coverage (the two graphs on the second row), there seems to be no association between the agreement between quintiles and the LAD. However, for both water and sanitation coverage, it can be seen that datasets with piped water or improved sanitation coverage of 90 per cent or more (numbers shown near each dot) all have a LAD below 5 percentage points, except one case (Serbia) at 6 percentage points for water coverage when both water- and sanitation-related variables are omitted from the PCA.

Figure 4: Scatter graph of agreement between quintiles and largest absolute difference in coverage (LAD) when water- and/or sanitation-related variables are omitted from the PCA, 17 MICS4 datasets



The previous analysis has been based exclusively on MICS4 datasets. An additional five DHS datasets were also analysed to assess if the previous findings are applicable to another global survey. Basic characteristics for these five surveys are presented in Table 7. With such populous countries as India and Nigeria, the average sample size of the datasets tends to be large, but otherwise the remaining characteristics are comparable with those of the previously analysed MICS4 datasets. Changes in loadings related to the removal of water- and/or sanitation-related PCA variables in the five above-mentioned DHS datasets are presented in Annex G.

A few words should be said with respect to the wealth index syntaxes that were used for these five DHS datasets. While syntaxes were supplied by ICF Macro, Inc., most of them were very incomplete and required a substantial amount of work before they could be run. The only one that was complete (that of Ukraine, 2007) also had to be adjusted due to divisions by zero in one of the variables (persons per sleeping room). This suggests that the supplied syntaxes either were not the final versions, or else had been run on different (probably anterior) versions of the datasets. Nonetheless, these scripts were very useful, as they provided the list of dichotomized variables used in the original PCAs. While the overall

approach to calculating the wealth index in the DHS was generally found to be similar to that seen in the MICS scripts, some notable differences were also seen. In one DHS script, all variable categories had been kept in the PCA, including those with a single case, instead of being dropped as is usually done. In general, in the DHS scripts, dichotomized variables were assigned a value of zero (i.e., asset not present) when information was missing, while in the MICS scripts missing values are generally kept as missing and are later on assigned an average value through the use of the ‘factor’ subcommand ‘meansub’ in SPSS.

Another notable difference is that ‘other’ categories were dichotomized in the DHS scripts, while in the MICS scripts such categories are generally omitted. One of the DHS scripts showed several instances of two or more categories being merged into a single dichotomous variable, while this approach was not seen in the MICS scripts. Finally, in three of the five DHS scripts, the cut-off points of the scores for the definition of the wealth quintiles had been set manually instead being assigned automatically by the ‘rank’ command, as is usually done; however, observation showed that these manual cut-offs were very close to those that would have been assigned by the ‘rank’ command.

Table 7: List of the five DHS datasets used in the supplementary coverage analysis, and selected characteristics									
MICS4 dataset	Abbreviation	House-holds	PCA var.	Water var.	Sanitation var.	Variance explained	Agreement water	Agreement sanitation	Agreement both
Brazil 1996 (DHS-III)	bra1996	13,283	42	6	8	12.3	80.6	85.3	70.0
India 1998–99 (DHS-IV)	ind199899	92,486	77	13	8	15.7	94.0	92.6	88.9
India 2005–06 (DHS-V)	ind200506	109,041	126	27	12	8.2	88.6	92.0	83.8
Nigeria 2008 (DHS-V)	nig2008	34,070	83	19	14	10.5	92.0	92.8	89.1
Ukraine 2007 (DHS-V)	ukr2007	13,379	90	13	15	7.0	87.3	86.0	66.7
Mean (unweighted)		52,452	84	16	11	10.7	88.5	89.7	79.7

The overall LAD and <Q1–Q5> for water coverage for the five supplementary DHS datasets under review are presented in Table 8, as well as for urban and rural areas. Similar information for sanitation coverage is presented in Table 9. As previously, cells with a dot instead of a figure represent instances with less than 25 (unweighted) household members in a particular quintile for which results have been suppressed.

Table 8: Largest absolute difference (LAD) and change in gap in water coverage between poorest and wealthiest with different wealth index approaches, by area, 5 DHS datasets

	Water-related var. omitted				Water- & sanit.-related var. omitted			
	LAD	Change in gap <Q1-Q5>			LAD	Change in gap <Q1-Q5>		
		Piped	Impr.	Unimp.		Piped	Impr.	Unimp.
OVERALL								
Brazil 1996 (DHS-III)	9.8	-15.8	0.0	-15.8	13.1	-21.5	0.0	-21.5
India 1998–99 (DHS-IV)	3.3	-4.5	-3.2	-1.3	4.7	-5.9	-4.0	-1.9
India 2005–06 (DHS-V)	8.6	-10.6	-9.5	-1.1	9.6	-11.7	-10.1	-1.6
Nigeria 2008 (DHS-V)	7.8	-1.1	-8.1	-9.3	8.0	-1.4	-8.5	-9.9
Ukraine 2007 (DHS-V)	8.6	-8.4	-8.3	-0.2	14.8	-15.2	-14.9	-0.3
Overall mean (unweighted)	7.6	-8.1	-5.8	-5.5	10.0	-11.1	-7.5	-7.0
URBAN								
Brazil 1996 (DHS-III)	14.6	-19.2	0.0	-19.2	17.4	-23.3	0.0	-23.3
India 1998–99 (DHS-IV)	4.5	-5.4	-5.2	-0.2	7.1	-6.2	-3.2	-3.0
India 2005–06 (DHS-V)	9.2	-9.8	-8.6	-1.2	12.3	-11.2	-9.9	-1.3
Nigeria 2008 (DHS-V)	10.5	-0.8	-10.5	-11.3	10.5	-1.3	-10.2	-11.4
Ukraine 2007 (DHS-V)	12.4	-13.0	-12.9	0.0	21.3	-22.7	-22.4	-0.3
Urban mean (unweighted)	10.2	-9.6	-7.4	-6.4	13.7	-12.9	-9.1	-7.9
RURAL								
Brazil 1996 (DHS-III)	25.3	.	.	.	28.2	.	.	.
India 1998–99 (DHS-IV)	4.4	-5.6	-3.7	-1.9	6.2	-7.4	-5.3	-2.1
India 2005–06 (DHS-V)	13.6	-15.5	-13.7	-1.9	14.4	-16.3	-14.0	-2.3
Nigeria 2008 (DHS-V)	7.6	-1.0	-10.4	-11.4	7.9	-1.5	-11.0	-12.5
Ukraine 2007 (DHS-V)	22.7	.	.	.	42.8	.	.	.
Rural mean (unweighted)	14.7	-7.4	-9.3	-5.1	19.9	-8.4	-10.1	-5.6

Table 9: Largest absolute difference (LAD) and change in gap in sanitation coverage between poorest and wealthiest with different wealth index approaches, by area, 5 DHS datasets

	Sanitation-related var. omitted				Water- & sanit.-related var. omitted			
	LAD	Change in gap <Q1-Q5>			LAD	Change in gap <Q1-Q5>		
		Impr.	Unimp.	Open d.		Impr.	Unimp.	Open d.
OVERALL								
Brazil 1996 (DHS-III)	4.9	-6.5	-1.6	-4.9	8.3	-10.3	-2.9	-7.4
India 1998–99 (DHS-IV)	4.3	-5.2	-1.3	-6.5	5.3	-6.3	-1.3	-7.6
India 2005–06 (DHS-V)	4.5	-5.4	-0.5	-5.9	4.8	-5.9	-0.6	-6.6
Nigeria 2008 (DHS-V)	4.1	-6.8	-0.3	-6.6	4.9	-7.8	-0.3	-7.6
Ukraine 2007 (DHS-V)	0.7	0.6	0.6	0.0	0.7	0.4	0.4	0.0
Overall mean (unweighted)	3.7	-4.7	-0.6	-4.8	4.8	-6.0	-0.9	-5.8
URBAN								
Brazil 1996 (DHS-III)	8.3	-9.6	-1.8	-7.8	13.0	-14.6	-3.1	-11.5
India 1998–99 (DHS-IV)	12.1	-9.3	-3.8	-13.1	13.7	-10.6	-4.3	-14.9
India 2005–06 (DHS-V)	14.2	-11.7	3.5	-15.2	14.2	-12.9	2.2	-15.1
Nigeria 2008 (DHS-V)	4.5	-6.1	0.0	-6.1	6.2	-6.1	-1.0	-5.0
Ukraine 2007 (DHS-V)	0.9	0.9	0.9	0.0	0.9	0.2	0.1	0.0
Urban mean (unweighted)	8.0	-7.2	-0.2	-8.4	9.6	-8.8	-1.2	-9.3
RURAL								
Brazil 1996 (DHS-III)	7.5	.	.	.	14.4	.	.	.
India 1998–99 (DHS-IV)	9.5	-9.3	-2.5	-11.7	10.9	-10.2	-3.0	-13.2
India 2005–06 (DHS-V)	7.6	-9.8	0.2	-10.0	8.9	-11.1	0.2	-11.3
Nigeria 2008 (DHS-V)	6.7	-10.3	-1.0	-9.3	7.6	-11.9	-1.6	-10.4
Ukraine 2007 (DHS-V)	1.4	.	.	.	0.8	.	.	.
Rural mean (unweighted)	6.5	-9.8	-1.1	-10.3	8.5	-11.1	-1.5	-11.6

Overall, when water-related variables are omitted from the PCA, the LADs ranges from 3 to 10 percentage points, with four cases 5 percentage points and above. When both water- and sanitation-related variables are omitted, the LADs are larger. The LADs tend to be larger, but not invariably so, for urban and rural estimates, ranging from 4 to 43 percentage points.

LADs for sanitation are on average smaller than for water, and none in the overall category of these five datasets is 5 percentage points or above when sanitation-related variables are omitted from the PCA, but we find two such cases when both water- and sanitation-related variables are omitted, with a maximum of 8 percentage points. LADs tend to be larger for urban and rural estimates, and can be as large as 14 percentage points.

In both instances, the <Q1–Q5> figures are in great majority negative, indicating that the coverage gap between poorest and wealthiest is usually narrowed when a restricted PCA is used, by as much as 23 percentage points. Overall results have been displayed on dot graphs with additional information by quintile and can be seen in Annex H. These findings are generally compatible with those of the previously analysed MICS4 datasets.

It should be noted that the zero percentage point for ‘improved’ water sources in the case of the Brazil 1996 DHS, as seen in Table 8, is due to the peculiar categories of water sources used in this survey. As can

be seen in Annex G, six water source categories were defined in this survey: piped into residence, piped in yard/plot, well/spring inside the compound, well/spring outside the compound, bottled water, and other. The first two categories were obviously classified as ‘piped water on premises’, bottled water was classified accordingly to the main source of water for other uses besides drinking, other sources were classified as unimproved and, finally, well or spring were also classified as unimproved, since it could not be determined if they were protected or not. This left nothing for the ‘improved (excluding piped)’ category, hence the zero per cent results.

Differences in trends in water and sanitation coverage by wealth quintile with and without water and sanitation variables in the PCA

We will now complement the above study by estimating the impact that using a restricted PCA has on trend analysis. To this end, we will use a subset of the datasets listed in Table 2 based on the availability of a MICS4 dataset, the availability of a prior MICS3 dataset, a range of LADs, and representativeness of various regions of the world. The selected datasets are:

- Belize: MICS3 2006 and MICS4 2011
- Iraq: MICS3 2006 and MICS4 2011
- Lao People’s Democratic Republic: MICS3 2006 and MICS4 2011–2012
- Nigeria: MICS3 2007 and MICS4 2011
- Ukraine: MICS3 2005 and MICS4 2012

In the case of the Lao People’s Democratic Republic MICS4 2011–2012 dataset, the original wealth index syntax was run as a composite, not a classic, wealth index. Since this report addresses issues related to a restricted and unrestricted PCA for a classic (not composite) wealth index, a new classic syntax has been prepared, following closely on the variables used in the original syntax. The generally small differences in coverage, as well as LADs and <Q1–Q5> gaps between the two approaches, are reported in Annex E. The changes in loadings related to the removal of water- and/or sanitation-related PCA variables in the five above-mentioned MICS3 datasets are shown in Annex F together with some specific comments related to sign switching of the first PC axes in the case of Iraq and Ukraine (see Annex F for details).

Measuring the impact of different PCA approaches on trends is more complex than measuring it on point-in-time estimates. Since coverage in water and sanitation tends to improve over time, and since it is generally intended that the gap between rich and poor should narrow, the analysis of the impact of a restricted PCA on trends has here been based on coverage improvement and gap reduction. In the first instance, the largest coverage improvement (LCI) within quintiles has been calculated. In the case of water, LCI statistics reflect the largest among the quintile-level changes in the coverage of piped water on premises and improved water sources between two surveys; in the case of sanitation, it is based on the quintile-level changes in the coverage of improved sanitation facilities only (irrespective of whether shared or not). In the second instance, the gap reduction between the poorest (first quintile) and the wealthiest (fifth quintile) for each one of the three coverage categories is reported.

Table 10 presents these results in three blocks with respect to trends in water coverage. The first block (on the left) shows the values of the above-mentioned statistics when using an unrestricted PCA. The middle

block shows the changes in the values of the statistics reported in the first block (used as reference) when water-related variables are omitted from the PCA. A negative figure thus indicates that the new value is lower than the original one, a positive figure that it is higher, by the number of percentage points indicated. Finally, the third block of results (on the right) shows the changes that take place when both water- and sanitation-related variables are omitted from the PCA. Table 9 presents similar information with respect to trends in sanitation coverage.

Table 10: Largest water coverage improvement within quintiles (LCI) and water coverage gap reduction between poorest and wealthiest (<Q1–Q5>) when water- or water and sanitation-related variables are omitted from the PCA, for various drinking water source categories (piped water on premises, other improved water sources, and unimproved water sources), 5 pairs of MICS datasets (trend analysis)												
	Original values with all wealth index variables included				Observed changes in original values when water-related var. are omitted				Observed changes in original values when water- and sanit.-related var.			
	<Q1–Q5> gap reduction				<Q1–Q5> gap reduction				<Q1–Q5> gap reduction			
	LCI*	Piped	Impr.	Unimp.	LCI*	Piped	Impr.	Unimp.	LCI*	Piped	Impr.	Unimp.
OVERALL												
Belize 2006 MICS and 2011 MICS	10.3	8.5	2.7	5.7	-0.7	-3.1	-3.1	0.1	0.9	-1.3	-1.5	0.1
Iraq 2006 MICS and 2011 MICS	18.6	11.4	-5.7	17.5	-0.7	-1.8	4.8	-6.6	-1.1	-4.2	3.8	-8.0
Lao PDR 2006 MICS and 2011–12 MICS	14.4	-2.1	-1.6	-0.6	-0.4	-0.4	0.5	-0.9	0.1	-0.5	1.8	-2.3
Nigeria 2007 MICS and 2011 MICS	16.0	-0.2	23.9	23.7	1.9	-0.5	-5.2	-5.7	0.4	0.0	-5.7	-5.7
Ukraine 2005 MICS and 2012 MICS	7.1	6.8	10.2	-2.9	7.0	3.2	5.6	4.4	10.8	8.9	10.9	4.0
Overall mean (unweighted)	13.3	4.9	5.9	8.7	1.4	-0.5	0.5	-1.8	2.2	0.6	1.9	-2.4
URBAN												
Belize 2006 MICS and 2011 MICS	12.1	-4.0	-12.3	8.3	-6.1	3.9	4.2	-0.3	-6.5	6.2	5.9	0.2
Iraq 2006 MICS and 2011 MICS	21.0	-14.0	-12.1	-1.7	-1.6	2.3	7.4	-5.2	-2.0	1.2	5.5	-4.5
Lao PDR 2006 MICS and 2011–12 MICS	26.6	1.5	-23.0	24.5	-1.9	6.5	3.4	3.1	-4.2	7.5	5.7	1.9
Nigeria 2007 MICS and 2011 MICS	35.4	1.2	27.3	28.5	-10.8	-3.1	-11.9	-15.0	-9.7	-2.8	-2.2	-5.0
Ukraine 2005 MICS and 2012 MICS	18.7	14.8	11.0	3.8	6.7	6.4	8.8	-3.4	7.0	7.2	10.0	-3.6
Urban mean (unweighted)	22.8	-0.1	-1.8	12.7	-2.7	3.2	2.4	-4.1	-3.1	3.9	5.0	-2.2
RURAL												
Belize 2006 MICS and 2011 MICS	14.0	-4.8	-10.3	5.5	7.3	-7.8	-7.5	-0.3	6.5	-5.8	-5.8	0.0
Iraq 2006 MICS and 2011 MICS	12.9	7.1	-7.2	14.5	-0.8	-10.9	3.1	-13.9	1.1	-13.5	4.3	-17.6
Lao PDR 2006 MICS and 2011–12 MICS	28.6	-6.9	-4.3	-21.5	-0.5	-0.4	-1.3	1.4	-2.2	0.2	0.8	5.0
Nigeria 2007 MICS and 2011 MICS	16.1	-5.3	21.6	16.3	1.2	1.2	-7.5	-6.3	-0.6	1.5	-8.3	-6.8
Ukraine 2005 MICS and 2012 MICS	1.8	.	.	.	21.5	.	.	.	5.1	.	.	.
Rural mean (unweighted)	14.7	-2.5	0.0	3.7	5.8	-4.5	-3.3	-4.8	2.0	-4.4	-2.3	-4.9

* LCI: the largest water coverage improvement within quintiles is calculated with respect to piped water and improved water sources only (see text for details). Results based on less than 25 unweighted cases are omitted (shown as a point).

	Original values with all wealth index variables included					Observed changes in original values when sanitation-related var. are omitted					Observed changes in original values when water- and sanit.-related var. are omitted				
	<Q1–Q5> gap reduction					<Q1–Q5> gap reduction					<Q1–Q5> gap reduction				
	LCI*	Impr.	Unimp.	Open d.	LCI*	Impr.	Unimp.	Open d.	LCI*	Impr.	Unimp.	Open d.			
OVERALL															
Belize 2006 MICS and 2011 MICS	6.9	6.9	3.6	3.3	0.0	0.3	0.6	-0.4	0.3	-0.3	0.0	-0.3			
Iraq 2006 MICS and 2011 MICS	14.5	14.2	6.2	8.0	-1.5	-1.8	-0.8	-1.0	-2.6	-3.4	-1.7	-1.7			
Lao PDR 2006 MICS and 2011–12 MICS	27.0	3.2	-0.5	3.7	-0.3	-3.6	0.0	-3.7	-0.4	-3.4	0.5	-3.9			
Nigeria 2007 MICS and 2011 MICS	17.2	-12.3	5.4	-17.7	0.7	-0.9	-2.1	1.2	1.2	0.7	-1.1	1.7			
Ukraine 2005 MICS and 2012 MICS	10.5	10.5	10.6	-0.1	0.8	0.8	0.9	-0.1	0.8	1.0	1.0	-0.1			
Overall mean (unweighted)	15.2	4.5	5.0	-0.5	0.0	-1.1	-0.3	-0.8	-0.1	-1.1	-0.2	-0.9			
URBAN															
Belize 2006 MICS and 2011 MICS	20.4	20.4	12.7	7.7	4.7	4.7	3.2	1.5	5.1	4.9	3.7	1.2			
Iraq 2006 MICS and 2011 MICS	2.3	2.0	2.3	-0.3	-0.7	-0.9	-1.4	0.5	-0.9	-1.8	-2.1	0.4			
Lao PDR 2006 MICS and 2011–12 MICS	29.6	5.7	3.2	2.5	1.7	-0.5	-2.1	1.6	1.6	0.5	-1.8	2.3			
Nigeria 2007 MICS and 2011 MICS	23.9	-30.3	-8.4	-21.9	1.8	-16.5	-13.5	-3.0	2.8	5.6	2.5	3.2			
Ukraine 2005 MICS and 2012 MICS	42.6	42.6	42.6	0.0	-0.4	-0.4	-0.3	-0.2	-11.4	-11.2	-11.0	-0.1			
Urban mean (unweighted)	23.8	8.1	10.5	-2.4	1.4	-2.7	-2.8	0.1	-0.6	-0.4	-1.8	1.4			
RURAL															
Belize 2006 MICS and 2011 MICS	6.9	5.6	2.8	2.8	-1.4	0.1	0.8	-0.7	-1.6	-2.5	-1.9	-0.6			
Iraq 2006 MICS and 2011 MICS	14.9	14.5	5.7	8.9	-1.2	-2.5	-1.5	-1.0	-1.4	-4.4	-2.6	-1.7			
Lao PDR 2006 MICS and 2011–12 MICS	28.0	1.0	-0.9	1.9	-1.2	-5.0	0.2	-5.2	0.2	-5.0	0.8	-5.9			
Nigeria 2007 MICS and 2011 MICS	14.7	-15.2	7.1	-22.3	-1.8	0.0	-1.5	1.6	-1.8	1.3	-0.9	2.2			
Ukraine 2005 MICS and 2012 MICS	7.1	.	.	.	0.6	.	.	.	1.0	.	.	.			
Rural mean (unweighted)	14.3	1.5	3.7	-2.2	-1.0	-1.8	-0.5	-1.3	-0.7	-2.6	-1.1	-1.5			

* LCI: the largest sanitation coverage improvement within quintiles is calculated with respect to improved sanitation facilities (irrespective of whether shared or not) only (see text for details). Results based on less than 25 unweighted cases are omitted (shown as a point).

The example of Belize in Table 10 refers to water coverage trends between 2006 and 2011, as measured by two MICS surveys. The largest coverage improvement in piped water or improved water sources in any quintile between these two years is 10.3 percentage points – in the case of access to piped water in the second quintile between 2006 and 2011 (the table does not provide that level of detail). In the same period the <Q1–Q5> gap was reduced by 8.5 percentage points with respect to piped water, 2.7 percentage points with respect to improved water sources (excluding piped) and 5.7 percentage points with respect to unimproved water sources. All these figures are based on an unrestricted PCA. On the other hand, if a PCA without water-related variables is used, the LCI is 9.5 percentage points (0.7 smaller than the original value), the <Q1–Q5> gap reduction becomes 5.4 percentage points for piped water, –0.4 for improved water sources (=2.7–3.1, actually a small gap increase), and 5.8 for unimproved water sources.

An overall look at Table 10 shows no clear direction of change in trends when a restricted PCA is used instead of an unrestricted one. In some cases, improvements in coverage (LCI) are made smaller, in others they are made larger (markedly so in some instances). The situation is similar with respect to the <Q1–Q5> gap reduction, which is minimized (even inversed) in some instances, and maximized in others. What is clear is that changes can sometimes be important. Findings by type of area can be similarly interpreted, except for the fact that original LCI values tend to be larger in urban than in rural areas in the observed dataset pairs.

Table 11, with respect to trends in sanitation, leads to similar observations, although the changes that occur with a restricted PCA tend to be somewhat smaller than in the case of trends in water. While the tables do not provide that kind of information, the reader should be alert to the fact that sample sizes for poor urban (lowest quintiles) and wealthy rural households (highest quintiles) often tend to be small and should lead to some caution when interpreting urban and rural results. An extreme case is seen with the Ukraine datasets, where the <Q1–Q5> gap reduction could not be reliably estimated due to the very small representation of rural households in the fifth quintile.

6

Discussion

As mentioned earlier, this paper limits itself to the classic wealth index and does not address issues related to the composite wealth index, nor the computation of separate indices for urban and rural areas. The reason for restricting ourselves to the classic wealth index is above all simplicity, as contemplating two or three different unrestricted PCA approaches would have greatly complicated this analysis in terms of the number of datasets required, the elaboration of computer syntaxes and the presentation of results. Further, the computation of separate indices for urban and rural areas is not widely used, and while the composite wealth index has been the usual approach in recent years for both the DHS and the MICS, there are indications that results are generally very similar to those of the classic index, as previously mentioned in this paper.

Restricting a PCA by omitting water- and/or sanitation-related variables from the equation in the context of wealth index calculations has an impact on the PC loadings, the wealth ranking of individuals and, ultimately, the water and sanitation coverage estimates by wealth quintiles. This is in part a reflection of the fact that water and sanitation facilities are themselves assets, like many others, related to the overall wealth of the household.

A close examination of the first PC loadings from a restricted and unrestricted PCA has shown that removing only water- or sanitation-related variables did not have a major impact on the loadings, which nearly always kept the same sign and same order of magnitude. Removing both sets of variables was seen to have in most cases a larger effect on the loadings, but here, too, the great majority kept the same sign and order of magnitude. In none of the 17 MICS4 datasets used here for point-in-time analysis was it found necessary to make any other changes to the variables of the PCA after removing water- and/or sanitation-related variables. Assuming that the 17 MICS4 datasets used in the coverage analysis presented in this report are fairly representative of MICS4 datasets in general, this finding suggests that it might be justified to adopt an almost mechanical approach to restricting a PCA when one wishes to develop a custom wealth index unrelated to water and/or sanitation assets, as long as the original wealth index syntaxes are of good quality. Even so, it is always prudent and advisable to have a look at the PC loadings of the restricted PCA – including for potential sign switching – and the credibility of the new quintiles.

With respect to the time investment required for the development of the syntax of a restricted PCA, if we start with a reliable unrestricted classic wealth index syntax, as we may assume to be nearly always the case with MICS and DHS datasets, it should usually be possible to accomplish this task within an hour or two for any given dataset (say, about five or six datasets a day), once the analyst is familiar with the method and already has model syntaxes at her or his disposal. It will take at least twice as much time

(about two or three datasets a day) when no syntax is available, and somewhere in between in the case of other types of wealth index syntaxes (e.g., a composite index syntax). This is according to the general experience of the writer and could vary to some extent between analysts and between datasets. There are yet other variants, such as the creation of a separate syntax for urban and rural areas, or other forms of restricted PCAs for other analyses of interest (e.g., of handwashing practices); the writer did not have much experience with these, but it seems likely that the time investment would be similar.

Further, the change in the angle of the first PC gives an indication of the overall effect that restricting the PCA brings on the PC loadings. From the 17 MICS4 datasets used in this analysis, we have seen that omitting water-related variables brings about on average a 15-degree angle change (from 10 to 23 degrees), sanitation-related variables a 17-degree angle change (from 11 to 26 degrees), and omitting both, a 23-degree angle change (from 16 to 37 degrees). This is in keeping with the previous finding and suggests that there will be a larger impact on the wealth index if both water- and sanitation-related variables are omitted from the PCA instead of one set of variables only. While there is a negative correlation between the angle change and the percentage of agreement between quintiles, it is not so strong as to facilitate the prediction of one from the other.

We have also seen that measures such as Kendall's *tau*, the percentage of agreement between quintiles, and the *Kappa*-statistic are all closely related and provide similar information when it comes to assessing changes to the ranking of individuals from poorest to wealthiest resulting from a restricted PCA. Due to its conceptual and computational simplicity, the percentage of agreement between quintiles seems the most appropriate measure in this case and will be the focus of our discussion. We find on average 91 per cent agreement (from 84 to 95 per cent) between quintiles when only water-related variables are omitted from the PCA, 88 per cent agreement (from 69 to 98 per cent) when only sanitation-related variables are omitted, and 83 per cent agreement (from 62 to 94 per cent) when both sets of variables are omitted. This further reinforces the previous finding of a larger impact on the wealth index when both water- and sanitation-related variables are omitted from the PCA instead of one set of variables only.

In order to assess changes in water and sanitation outcomes by quintile resulting from restricting wealth index calculations to variables not directly related to water source and sanitation facilities, one summary statistic adopted in this analysis is the largest absolute difference (LAD), in percentage points, between any of 15 pairs of coverage figures (three indicators over five quintiles). As previously indicated, for water coverage, the three selected indicators are piped onto premises, other-improved water sources (excluding piped onto premises) and unimproved water sources; the definitions of improved and unimproved water sources are the ones used in the official MICS reports for the datasets under consideration. For sanitation, the three selected indicators are improved sanitation facilities (irrespective of whether shared or not), unimproved sanitation facilities (excluding open defecation) and open defecation.

For water, the LAD of the 17 MICS4 datasets analysed is 5 percentage points on average (from 2 to 11, with seven datasets over 5 percentage points) when only water-related variables are omitted, and somewhat larger (6 percentage points, with 10 datasets over 5 percentage points) when both water- and

sanitation-related variables are omitted. The LAD tends to be yet larger when results are given by urban and rural areas. The LAD for sanitation tends to be smaller than that for water, with 4 percentage points on average (from 0.3 to 13 percentage points, with five datasets over 5 percentage points) when only sanitation-related variables are omitted; it is similar when both water- and sanitation-related variables are omitted. If we consider a LAD of 5 per cent of more as important, it is clear that the effect of including variables related to water source and sanitation facilities in the wealth index has a rather large impact on coverage figures by quintile and cannot simply be ignored, especially in the case of water, where about half of datasets might be affected.

With increasing emphasis on equity and recognition of the need to leave no one behind, another statistic of great importance when examining questions related to water and sanitation coverage is the change in the gap between poorest and wealthiest brought about by restricting wealth index calculations to variables not directly related to water source and sanitation facilities. Our analysis has shown that a restricted PCA nearly always narrows the gap between poorest and wealthiest by 6, 5 and 3 percentage points on average (up to 17 per cent) for piped, improved and unimproved water source, respectively, when only water-related variables are omitted; and somewhat more (up to 23 per cent) when both water- and sanitation-related variables are omitted. In the case of sanitation, changes are more modest but not negligible. The gap between poorest and wealthiest narrows on average by 4, 3 and 2 percentage points (up to 15 percentage points) when only sanitation-related variables are omitted; and 4, 2 and 3 percentage points when both water- and sanitation-related variables are omitted.

In most cases, the largest changes take place in the first quintile, where we tend to find a more pessimistic outcome for the poorest when water- and/or sanitation-related variables are included in the PCA, as some authors had already suggested. This is logical because in that case, unimproved water sources or sanitation facilities enter into the very definition of asset-based 'poverty'. This leaves decision-makers with the complex question of deciding if water source and sanitation facilities should factor into such a definition or not, with important implications for the reporting of inequities in water and sanitation. It should be noted that the analysis of a few (five) DHS datasets suggests that the various findings that have been presented for the MICS datasets apply similarly to the DHS datasets, even though a larger study would be required to demonstrate this unequivocally.

Another question that has been analysed here is whether it is possible to predict to some extent the extent of change in water and sanitation outcomes that results from a restricted PCA. While it was shown that there is indeed a negative correlation between the agreement between quintiles and the LAD in the case of water, it is not so strong as to allow one to be predicted from the other. Further, such a correlation does not appear to exist in the case of sanitation. However, the results indicate that datasets with more than 90 per cent coverage in piped water or improved sanitation facilities can be expected to have a respective LAD of less than 5 percentage points.

Determining how the use of a restricted PCA might affect trend analyses is more complex. Changes brought about by restricting the PCA are likely to affect results in both the older and more recent datasets used in the trend analysis in directions that can be in some cases similar and in others opposite.

A further complication is that surveys that are implemented years apart are often performed under different conditions affecting sample size, the variables included in the wealth index, and other factors that may influence the results. Furthermore, as countries generally tend to reach better coverage over time, there might well be less scope (happily) for differences in coverage between rich and poor, and between approaches, in the more recent dataset, as compared to older ones.

It is consequently not surprising that the results have been mixed. Using a restricted PCA was shown to have the potential to modify estimates of improvement in coverage in either direction, sometimes importantly, although apparently somewhat less in the case of sanitation than water. Estimates of the reduction of the gap in coverage between the poorest and wealthiest are similarly affected, and may be minimized or maximized in an apparently unpredictable manner.

7

Conclusions and recommendations

There is general agreement that, while convenient from a computational point of view, it is conceptually incorrect to use water and sanitation variables in the construction of the wealth index when the outcome being analysed is water and sanitation coverage. This study has demonstrated that omitting water- and sanitation-related variables often influences coverage figures by wealth quintile in a non-negligible way, and that it tends to produce a narrower gap in coverage between the poorest and the wealthiest, as well as more optimistic coverage figures for the poorest, than when such variables are included in the PCA. These effects are generally more accentuated in water than in sanitation. Adopting a tailored wealth index affects trend analyses in water and sanitation in an apparently unpredictable way. Omitting water- or sanitation-related variables from the PCA appears to be a straightforward operation when the original classic wealth syntax is available, and seems to be preferable to omitting both sets of variables at the same time. Deciding whether to use tailored wealth indices when reporting water and sanitation coverage by wealth quintile is difficult and has major implications in terms of workload and comparability with other indicators.

Recommendations:

- a. It seems reasonable that such standard surveys as the MICS continue to use in their reports a single wealth index in which water- and sanitation-related variables are included, since these surveys report on a large number of indicators. Nonetheless, it is important that syntaxes for the calculation of these indices be easily available to institutions and researchers who want to implement specific analyses for water and/or sanitation.
- b. While, ideally, reports focusing on either water or sanitation coverage and trends would both benefit from tailored wealth indices, such indices are more specifically recommended for reports on water coverage and trends.
- c. Tailored wealth indices can be easily constructed by simply removing water- or sanitation-related variables from good quality syntaxes implemented in such surveys as the MICS and DHS. This recommendation refers to the classic approach to calculating a wealth index. The more recent approach used by the MICS and DHS (the composite wealth index) was not addressed in this study, even though it seems to perform very similarly to the classic approach.

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Annex A

Table 12: List of items included in the PCA for wealth index calculations, 17 MICS4 datasets

	bel 2011	bos 2011–12	cri 2011	ind psd 2011	ind wps 2011	ira 2011	ken nya 2011	mad sou 2012	mol 2012	nig 2011	pal 2010	ser 2010	slu 2012	som som 2011	sud 2010	tun 2011–12	ukr 2012	TOTAL
MAIN SOURCE DRINKING WATER																		
Piped into dwelling	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17
Piped into compound, yard or plot	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	16
Piped to neighbour	1	1		1	1	1	1	1	1	1		1	1	1		1	1	14
Water yard/hand pump															1			1
Public tap/Standpipe	1	1		1	1	1	1	1		1		1	1	1	1	1	1	14
Piped to water kiosk							1											1
Tube well, borehole	1	1	1	1	1	1	1	1	1	1	1	1		1		1	1	15
Protected well	1	1		1	1	1	1	1	1	1		1		1	1	1	1	14
Unprotected well	1	1		1	1	1	1		1	1		1		1	1	1	1	13
Protected spring		1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
Unprotected spring		1		1	1	1	1	1	1	1		1	1	1	1	1	1	14
Rainwater collection	1	1		1	1	1	1	1		1			1			1		10
Rain-fed cistern w/ internal pipes											1							1
Rainwater collection: Roof top														1				1
Rainwater collection: Berkad														1				1
Rainwater catchment: Bally Filtered (river, stream, dam, ...)														1				1
Tanker-truck				1	1	1	1	1	1	1	1	1		1		1	1	12
Tankers/carts from improved s.															1			1
Cart with small tank/drum						1	1	1		1				1		1		6
Surface water	1			1	1	1	1	1		1				1		1		9
Bottled water	1	1		1	1	1	1		1	1	1	1	1	1	1	1	1	15
Sachet/pure water										1								1
Purchased gallons											1							1
Reverse osmosis (RO)						1												1
Large tank near compound/village														1				1
'Other' water sources			1															1
MAIN SANITATION FACILITY																		
Flush to piped sewer system	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	15
Flush to septic tank	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17

Table 12: List of items included in the PCA for wealth index calculations, 17 MICS4 datasets

	bel 2011	bos 2011-12	cri 2011	ind psd 2011	ind wps 2011	ira 2011	ken nya 2011	mad sou 2012	mol 2012	nig 2011	pal 2010	ser 2010	slu 2012	som som 2011	sud 2010	tun 2011-12	ukr 2012	TOTAL
Flush to pit (latrine)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17
Flush to somewhere else		1		1	1	1	1		1	1	1	1		1	1	1		12
Flush to unknown place		1		1	1	1			1	1		1	1	1	1	1		11
Ventilated improved latrine (VIP)	1	1		1	1	1	1		1	1		1	1	1	1	1	1	14
Pit latrine with slab	1	1		1	1	1	1		1	1		1	1	1	1	1	1	14
Pit latrine with washable slab								1										1
Pit latrine with unwashable slab								1										1
Pit latrine without slab/open pit	1	1		1	1	1	1		1	1		1		1	1	1	1	13
Composting toilet						1	1		1	1					1		1	6
Bucket	1			1	1				1				1	1	1	1	1	9
Hanging toilet, hanging latrine					1				1	1					1	1		5
No facility, bush, field 'Other' sanitation fac.	1			1	1	1	1	1	1	1	1	1	1	1	1	1		14
Categories			1															1
Shared sanitation fac. (unspecif.)										1	1		1		1		1	5
Shared sanitation fac.: not public	1			1	1		1											4
Shared sanitation facility: public	1			1	1		1											4
MAIN FLOOR MATERIAL																		
Earth/sand	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1		15
Dung						1	1	1	1	1				1	1			7
Natural floor																	1	1
Rudimentary floor																	1	1
Wood planks	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1		15
Palm/bamboo				1	1	1		1		1				1	1			7
Plywood	1												1					2
Reeds						1												1
Mat								1										1
Parquet or polished wood	1	1		1				1	1	1		1	1	1		1	1	11
Vinyl or asphalt strips		1		1	1	1		1	1			1	1	1			1	10
Marley/linoleum													1					1
Ceramic tiles			1	1	1	1	1		1	1	1	1	1	1	1	1	1	14
Cement/concrete	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		16
Carpet		1		1	1	1	1	1	1	1			1	1	1	1	1	13
Plastic						1												1

Table 12: List of items included in the PCA for wealth index calculations, 17 MICS4 datasets

	bel 2011	bos 2011-12	cri 2011	ind psd 2011	ind wps 2011	ira 2011	ken nya 2011	mad sou 2012	mol 2012	nig 2011	pal 2010	ser 2010	slu 2012	som som 2011	sud 2010	tun 2011-12	ukr 2012	TOTAL
Bricks and stones										1								1
Mosaic, terrazzo			1															1
Laminate		1																1
MAIN ROOF MATERIAL																		
No roof							1			1		1		1	1	1		6
Thatch/palm leaf/bay leaf	1			1	1		1	1		1				1	1	1		9
Grass stems						1												1
Mud with dry hard straw						1												1
Sod					1			1		1				1	1			5
Rudimentary roofing																	1	1
Rustic mat						1				1				1	1			4
Palm/bamboo				1	1	1		1		1				1	1	1		8
Wood planks						1		1		1		1	1	1	1	1		8
Cardboard/ carton						1				1		1		1	1			5
Sacks/plastic sheets														1				1
Cloth/canvas /tent														1				1
Reeds/cane						1						1						2
Rubber rye	1																	1
Metal		1				1			1						1		1	5
Sheet metal/corrugated zinc	1		1	1	1	1	1	1		1		1	1	1		1		12
Tin cans							1											1
Wood						1		1	1	1		1		1	1	1	1	9
Calamine/cement fibre/asbestos		1		1	1		1		1	1		1		1	1	1	1	11
Ceramic tiles		1		1	1	1	1		1	1		1		1	1	1	1	12
Cement/concrete	1	1			1	1	1		1	1		1	1	1	1	1	1	13
Roofing shingles	1	1		1	1	1			1	1		1			1			9
Palmetto/wild cane/sticks	1																	1
Shelman (bricks & T-steel)						1												1
'Other' roof material categories			1							1								2
MAIN WALL MATERIAL																		
No walls						1				1				1	1			4
Cane/palm/trunks/ bamboo						1		1		1		1		1	1	1		7
Mud/dirt		1				1	1	1		1		1		1	1	1		9
Bark				1	1													2
Grass wall														1				1

Table 12: List of items included in the PCA for wealth index calculations, 17 MICS4 datasets

	bel 2011	bos 2011-12	cri 2011	ind psd 2011	ind wps 2011	ira 2011	ken nya 2011	mad sou 2012	mol 2012	nig 2011	pal 2010	ser 2010	slu 2012	som som 2011	sud 2010	tun 2011-12	ukr 2012	TOTAL
Shrubs and clothes														1				1
Bamboo with mud				1		1	1	1		1				1	1	1		8
Stone with mud		1				1	1	1	1	1		1		1	1		1	10
Cane, straw and mud												1						1
Uncovered adobe		1		1	1	1				1		1		1	1	1	1	10
Plywood	1	1		1	1	1				1		1	1	1	1			10
Cardboard/carton						1						1		1	1			4
Reused wood	1		1	1	1	1		1				1		1	1			9
Cloth/canvas/tent														1				1
Cement/concrete	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	16
Stone with lime/cement	1	1		1	1	1	1	1	1	1		1		1	1	1	1	14
Bricks	1	1		1	1	1	1	1	1	1		1		1	1	1	1	14
Clay bricks/clay blocks						1			1									2
Limestone bloc									1									1
Cement blocks	1	1	1	1	1	1	1		1	1		1	1	1	1	1	1	15
Plastered cement blocks													1					1
Covered adobe		1		1	1		1		1	1		1		1	1	1	1	11
Wood planks/shingles	1	1	1	1	1	1		1	1	1		1	1	1	1	1	1	15
Prefabricated			1															1
Wood and concrete	1																	1
Metal/Jenco/iron sheets						1								1				2
Stucco	1																	1
Fibro-cement			1															1
Soil block (taboq)						1												1
Facade (e.g., cement lime mortar)		1																1
'Other' wall material categories			1							1								2
MAIN FUEL FOR COOKING																		
Electricity	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1		15
Liquefied petroleum gas (LPG)	1	1	1	1	1	1	1		1		1	1	1	1	1	1	1	15
Natural gas		1	1				1		1	1		1				1	1	8
Biogas							1			1					1	1		4
Kerosene	1			1	1	1	1			1	1			1	1	1		10
Coal/lignite		1		1						1		1				1	1	6
Charcoal	1	1				1	1	1	1	1		1	1	1	1			11
Wood	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17

Table 12: List of items included in the PCA for wealth index calculations, 17 MICS4 datasets

	bel 2011	bos 2011-12	cri 2011	ind psd 2011	ind wps 2011	ira 2011	ken nya 2011	mad sou 2012	mol 2012	nig 2011	pal 2010	ser 2010	slu 2012	som som 2011	sud 2010	tun 2011-12	ukr 2012	TOTAL
Straw/shrubs /grass						1	1	1	1	1		1		1	1	1		9
Animal dung						1		1	1	1					1			5
Agricultural crop residue						1	1		1	1		1			1			6
No food cooked in household	1			1	1	1	1		1	1		1	1	1	1	1		12
VARIOUS ASSETS/ITEMS																		
Persons per room	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17
Electricity	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17
Radio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17
TV (conventional, colour)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17
Television (black and white)							1											1
Television (flat screen)			1														1	2
Cable TV			1	1	1								1					4
Satellite dish/digital receiver						1					1				1		1	4
Internet connection		1				1	1			1	1		1		1			7
Shared grid (external generator)						1												1
Own power generator						1				1								2
Non-mobile phone	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17
Refrigerator	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17
Deep freezer						1												1
Stove (gas stove)											1		1					2
Cooker (electric)		1										1						2
Charcoal stove/Jiko														1				1
LPG tube				1	1									1				3
Fan	1									1						1		3
Microwave oven	1		1						1							1	1	5
Blender, mixer, food processor							1			1						1		3
Sewing machine							1			1								2
Vacuum cleaner		1							1		1	1						4
Security alarm	1																	1
Clothes washing machine	1	1	1				1		1		1	1	1			1	1	10
Clothes dryer		1										1						2
Dishwasher		1									1					1		3
DVD player	1	1							1								1	4
VCR, VCD or DVD							1			1	1		1					4
MP3/MP4 player/audio device	1												1					2

Table 12: List of items included in the PCA for wealth index calculations, 17 MICS4 datasets

	bel 2011	bos 2011-12	cri 2011	ind psd 2011	ind wps 2011	ira 2011	ken nya 2011	mad sou 2012	mol 2012	nig 2011	pal 2010	ser 2010	slu 2012	som som 2011	sud 2010	tun 2011-12	ukr 2012	TOTAL
Bar-b-que grill	1																	1
Air conditioning unit	1	1		1	1	1	1			1		1	1			1	1	11
Split unit air conditioner						1												1
Cold box						1												1
Water cooler	1																	1
Central heating											1							1
Table								1	1				1					3
Chair								1										1
Table with chairs												1						1
Stool (Somali stool)														1				1
Sitting cushion/pillow														1				1
Bed		1						1				1	1					4
Sofa	1								1				1	1				4
Dining room table	1													1				2
Mat														1				1
Vacuum flask														1				1
Kerosene lamp														1				1
Photo camera (digital)		1							1									2
CCTV (video security system)		1										1						2
Clothes closet /wardrobe	1								1			1						3
Home library											1							1
Earthen water container						1												1
Shower with hot water			1															1
Jacuzzi		1										1						2
Hot water in whole house			1															1
Water (solar) heater/water tank				1	1		1		1	1	1					1		7
Water tank			1															1
Soap										1								1
Clock			1							1								2
Watch	1	1		1	1	1	1	1	1	1		1		1	1	1	1	14
Mobile telephone	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	16
Palestinian mobile											1							1
Cellular (Israeli)											1							1
Bicycle	1	1	1	1	1	1	1	1	1			1		1	1	1		13
Motorcycle or scooter	1	1	1	1	1	1	1	1	1	1		1		1	1	1		14
Animal drawn cart		1	1	1	1	1	1	1	1			1		1	1	1		12

Table 12: List of items included in the PCA for wealth index calculations, 17 MICS4 datasets

	bel 2011	bos 2011-12	cri 2011	ind psd 2011	ind wps 2011	ira 2011	ken nya 2011	mad sou 2012	mol 2012	nig 2011	pal 2010	ser 2010	slu 2012	som som 2011	sud 2010	tun 2011-12	ukr 2012	TOTAL
Car or truck	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	16
Private car			1								1							2
Boat with motor	1			1	1	1	1	1				1		1	1	1	1	11
Boat for livelihood													1					1
Boat for pleasure (yacht)													1					1
Tractor		1							1			1						3
Plough								1										1
Wheel barrow														1				1
Fishing rod	1																	1
Weight training machine	1																	1
Computer (desktop or unspecified)	1	1	1			1	1		1	1	1	1	1		1	1	1	13
Computer (laptop)			1														1	2
Tablet (computer)																	1	1
Bank account	1	1	1	1	1	1		1	1	1		1	1	1		1	1	14
Own house			1	1	1				1									4
Rent house			1	1	1				1									4
Free housing			1	1	1													3
House type: Villa											1							1
House type: House											1							1
House type: Apartment											1							1
House type: Separate room											1							1
House type: Tent											1							1
House type: Shanty house											1							1
Has agricultural land				1	1				1									3
Size of agricultural land				1	1													2
Has domestic animals				1	1													2
Cattle, milk cows, or bulls				1	1				1									3
Horses, donkeys, or mules				1					1									2
Goats				1	1				1									3
Sheep									1									1
Chickens				1	1				1									3
Other poultry									1									1
Pigs				1	1				1									3
Crocodiles				1														1
Deer					1													1
Rabbits									1									1

Table 12: List of items included in the PCA for wealth index calculations, 17 MICS4 datasets																		
	bel 2011	bos 2011–12	cri 2011	ind psd 2011	ind wps 2011	ira 2011	ken nya 2011	mad sou 2012	mol 2012	nig 2011	pal 2010	ser 2010	slu 2012	som som 2011	sud 2010	tun 2011–12	ukr 2012	TOTAL
TOTAL:	74	75	52	85	84	99	78	64	89	96	48	85	60	100	85	81	64	-

Annex B

Changes in loadings related to removal of water- and/or sanitation-related PCA variables 17 MICS4 datasets

The following tables show the changes in loadings (eigen vectors) of the first principal component (PC) following the removal of water-related variables ('nowat'), sanitation-related variables ('nosan'), or both water- and sanitation-related variables ('nobot'), in comparison with the original loadings obtained with all the variables ('alvar') included in original wealth index syntax used for the official final MICS report results. The second and third columns of the tables provide the description and name of each PCA variable, while the last column ('G/D') shows the proportional change in the size of the loadings with both water- and sanitation-related variables removed, compared with the original loadings ('nobot'/'alvar').

Table 13: Changes in loadings, Belize 2011 (MICS4)			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	ws1_11	0.003	0.000	0.000	0.000	-
	12 Piped into compound, yard or plot	ws1_12	-0.143	0.000	-0.145	0.000	-
	13 Piped to neighbour	ws1_13	-0.043	0.000	-0.045	0.000	-
	14 Public tap/standpipe	ws1_14	-0.062	0.000	-0.064	0.000	-
	21 Tube well, Borehole	ws1_21	-0.065	0.000	-0.068	0.000	-
	31 Protected well	ws1_31	-0.034	0.000	-0.033	0.000	-
	32 Unprotected well	ws1_32	-0.038	0.000	-0.038	0.000	-
	51 Rainwater collection	ws1_51	-0.019	0.000	-0.018	0.000	-
	81 Surface water	ws1_81	-0.015	0.000	-0.015	0.000	-
	91 Bottled water	ws1_91	0.166	0.000	0.170	0.000	-
Sanitation	11 Flush to piped sewer system	ws8_11	0.049	0.048	0.000	0.000	-
	12 Flush to septic tank	ws8_12	0.175	0.179	0.000	0.000	-
	13 Flush to pit (latrine)	ws8_13	-0.015	-0.016	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	ws8_21	-0.059	-0.059	0.000	0.000	-
	22 Pit latrine with slab	ws8_22	-0.156	-0.158	0.000	0.000	-
	23 Pit latrine without slab/Open pit	ws8_23	-0.036	-0.036	0.000	0.000	-
	41 Bucket	ws8_41	-0.022	-0.023	0.000	0.000	-
	95 No facility, bush, field	ws8_95	-0.094	-0.097	0.000	0.000	-
Shared	1 Other households only (not public)	ws10_1	-0.068	-0.070	0.000	0.000	-
	2 Public facility	ws10_2	-0.011	-0.010	0.000	0.000	-
	Persons per room	persroom	-0.132	-0.134	-0.134	-0.135	1.03
Floor	11 Earth/sand	hc3_11	-0.168	-0.172	-0.175	-0.179	1.06
	21 Wood planks	hc3_21	-0.021	-0.024	-0.026	-0.030	1.42
	23 Plywood	hc3_23	-0.014	-0.017	-0.016	-0.020	1.40
	31 Parquet or polished wood	hc3_31	0.012	0.012	0.011	0.012	1.00
	34 Cement	hc3_34	0.105	0.110	0.114	0.120	1.14
Roof	12 Thatch/bay leaf	hc4_12	-0.164	-0.166	-0.170	-0.172	1.05
	25 Rubber rye	hc4_25	-0.032	-0.032	-0.032	-0.032	1.00

Walls	31 Sheet metal/corrugated zinc	hc4_31	0.033	0.033	0.034	0.034	1.04
	35 Cement	hc4_35	0.080	0.082	0.082	0.084	1.05
	36 Roofing shingles	hc4_36	-0.002	-0.003	-0.002	-0.002	1.04
	12 Palmetto/wild cane/sticks	hc5_12	-0.057	-0.060	-0.056	-0.058	1.02
	24 Plywood	hc5_24	-0.021	-0.024	-0.024	-0.027	1.32
	26 Reused wood	hc5_26	-0.030	-0.031	-0.031	-0.032	1.09
	31 Cement	hc5_31	0.078	0.081	0.079	0.082	1.06
	32 Stone with lime/cement	hc5_32	0.004	0.005	0.005	0.006	1.36
	33 Bricks	hc5_33	0.010	0.010	0.010	0.010	1.00
	34 Cement blocks	hc5_34	0.106	0.108	0.111	0.113	1.07
	36 Wood planks/shingles	hc5_36	-0.110	-0.112	-0.113	-0.116	1.06
	37 Wood and concrete	hc5_37	-0.028	-0.027	-0.029	-0.028	0.99
	38 Stucco	hc5_38	-0.013	-0.014	-0.011	-0.011	0.83
	1 Electricity	hc6_1	0.006	0.006	0.005	0.005	0.83
Fuel	2 Butane	hc6_2	0.200	0.205	0.206	0.211	1.06
	5 Kerosene	hc6_5	-0.023	-0.025	-0.025	-0.027	1.18
	7 Charcoal	hc6_7	-0.006	-0.006	-0.006	-0.007	1.20
	8 Wood	hc6_8	-0.195	-0.198	-0.199	-0.201	1.03
	95 No food cooked in household	hc6_95	-0.060	-0.065	-0.066	-0.071	1.18
	Electricity	hc8a	0.185	0.192	0.193	0.201	1.09
	Radio	hc8b	0.119	0.126	0.125	0.133	1.12
	Television	hc8c	0.215	0.223	0.226	0.234	1.09
	Non-mobile phone	hc8d	0.132	0.138	0.137	0.144	1.09
	Refrigerator	hc8e	0.227	0.235	0.236	0.245	1.08
	Fan	hc8f	0.229	0.236	0.239	0.246	1.08
	Microwave oven	hc8g	0.198	0.205	0.204	0.211	1.07
	Security alarm	hc8h	0.050	0.052	0.052	0.055	1.10
	Washing machine	hc8i	0.223	0.229	0.233	0.240	1.08
	DVD player	hc8j	0.186	0.195	0.195	0.204	1.10
	Bar-b-que grill	hc8k	0.065	0.068	0.068	0.072	1.11
	Air conditioner	hc8l	0.100	0.103	0.104	0.108	1.07
	Water cooler	hc8m	0.088	0.092	0.093	0.097	1.10
	Sofa	hc8n	0.219	0.225	0.227	0.233	1.06
	Dining room table	hc8o	0.193	0.198	0.203	0.209	1.08
	Clothes closet	hc8p	0.192	0.198	0.203	0.209	1.09
	Watch	hc9a	0.120	0.125	0.126	0.132	1.10
	Mobile telephone	hc9b	0.178	0.185	0.187	0.193	1.08
	Bicycle	hc9c	0.044	0.048	0.049	0.054	1.23
	Motorcycle or scooter	hc9d	0.039	0.043	0.043	0.046	1.18
	Car or truck	hc9f	0.162	0.169	0.168	0.176	1.08
	Boat with motor	hc9g	0.053	0.056	0.055	0.059	1.11
	MP3/MP4 player	hc9h	0.123	0.128	0.129	0.133	1.08
	Fishing rod	hc9i	0.071	0.075	0.074	0.079	1.11

Weight training machine	hc9j	0.087	0.090	0.091	0.095	1.10
Computer	hc9k	0.170	0.175	0.175	0.181	1.07
Bank account	hc15	0.177	0.183	0.185	0.191	1.08

Table 14: Changes in loadings, Bosnia and Herzegovina 2011–2012 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.104	0.000	0.095	0.000	-
	12 Piped into compound, yard or plot	watpyd	-0.063	0.000	-0.058	0.000	-
	13 Piped to neighbour	watnei	-0.056	0.000	-0.054	0.000	-
	14 Public tap / standpipe	watptap	-0.032	0.000	-0.033	0.000	-
	21 Tube well, Borehole	watbore	-0.032	0.000	-0.027	0.000	-
	31 Protected well	watpwell	-0.075	0.000	-0.069	0.000	-
	32 Unprotected well	watuwell	-0.031	0.000	-0.029	0.000	-
	41 Protected spring	watpsprg	-0.037	0.000	-0.035	0.000	-
	42 Unprotected spring	watusprg	-0.032	0.000	-0.030	0.000	-
	51 Rainwater collection	watrain	-0.012	0.000	-0.008	0.000	-
	91 Bottled water	watbott	0.040	0.000	0.040	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	0.163	0.160	0.000	0.000	-
	12 Flush to septic tank	sanfsep	-0.068	-0.067	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	-0.025	-0.024	0.000	0.000	-
	14 Flush to somewhere else	sanfelse	-0.056	-0.058	0.000	0.000	-
	15 Flush to unknown place/not sure/DK where	sanfdk	-0.018	-0.019	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	sanvip	-0.047	-0.045	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	-0.120	-0.114	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	-0.096	-0.090	0.000	0.000	-
	Persons per room	persroom	-0.003	-0.002	-0.002	-0.002	0.80
Floor	11 Earth/sand	flres	-0.046	-0.044	-0.047	-0.045	0.98
	21 Wood planks	flrwd	-0.088	-0.091	-0.092	-0.095	1.08
	31 Parquet or polished wood	flrpq	0.157	0.158	0.154	0.154	0.98
	32 Vinyl or asphalt strips	flrvl	-0.061	-0.061	-0.060	-0.059	0.97
	34 Cement	flrcem	-0.070	-0.069	-0.070	-0.069	0.99
	35 Carpet	flrcpt	-0.130	-0.132	-0.133	-0.135	1.04
	36 Laminate	flrlam	0.058	0.061	0.066	0.069	1.19
Roof	31 Metal	roofmetl	0.072	0.072	0.067	0.067	0.93
	33 Calamine/cement fibre	rooffibr	0.038	0.037	0.033	0.033	0.87
	34 Ceramic tiles	roofcer	-0.100	-0.099	-0.088	-0.086	0.86
	35 Cement	roofcem	0.054	0.053	0.044	0.043	0.79
	36 Roofing shingles	roofshng	0.018	0.019	0.018	0.019	1.07
Walls	13 Dirt	walldirt	-0.040	-0.039	-0.039	-0.038	0.96
	22 Stone with mud	wallmud	-0.029	-0.030	-0.029	-0.029	1.00
	23 Uncovered adobe	wallunad	-0.026	-0.027	-0.027	-0.028	1.07
	24 Plywood	wallply	-0.007	-0.008	-0.009	-0.010	1.38
	31 Cement	wallcem	0.016	0.016	0.014	0.014	0.87
	32 Stone with lime/cement	wallstn	-0.033	-0.033	-0.031	-0.031	0.92
	33 Bricks	wallbrk	-0.098	-0.097	-0.096	-0.095	0.97

Fuel	34 Cement blocks	wallblk	-0.010	-0.013	-0.018	-0.022	2.11
	35 Covered adobe	walladob	-0.039	-0.039	-0.040	-0.040	1.03
	36 Wood planks/shingles	wallplnk	-0.030	-0.029	-0.031	-0.030	1.01
	37 Facade (for example, cement lime mortar)	wallfas	0.111	0.113	0.116	0.117	1.05
	1 Electricity	fuelelec	0.164	0.165	0.156	0.157	0.96
	2 Liquefied petroleum gas (LPG)	fuellpg	0.096	0.099	0.100	0.102	1.06
	3 Natural gas	fuelgas	0.055	0.055	0.051	0.050	0.92
	6 Coal/lignite	fuelcoal	-0.002	-0.001	-0.004	-0.002	0.82
	7 Charcoal	fuelchar	-0.009	-0.010	-0.012	-0.013	1.45
	8 Wood	fuelwood	-0.212	-0.215	-0.206	-0.207	0.97
	[A] Electricity?	elec	0.067	0.066	0.070	0.069	1.03
	[B] A radio?	radio	0.100	0.102	0.106	0.107	1.07
	[C] A television?	tv	0.139	0.137	0.143	0.141	1.02
	[D] A fixed telephone (non-mobile)?	phone	0.146	0.146	0.146	0.146	1.00
	[E] A refrigerator?	fridge	0.127	0.126	0.131	0.130	1.02
	[F] Bed?	bed	0.069	0.069	0.073	0.072	1.05
	[G] Electrical cooker?	elstove	0.174	0.174	0.175	0.175	1.00
	[H] Computer/laptop?	pc	0.266	0.275	0.281	0.288	1.08
	[I] Internet connection?	internet	0.262	0.271	0.277	0.284	1.08
	[J] Air-conditioning?	aircon	0.150	0.155	0.159	0.163	1.09
	[K] Digital camera?	digcam	0.250	0.257	0.263	0.269	1.07
	[L] Washing machine?	wmach	0.213	0.209	0.214	0.210	0.99
	[M] Clothes dryer?	clodry	0.108	0.113	0.113	0.116	1.07
	[N] Dishwasher?	dishwash	0.195	0.202	0.205	0.210	1.08
	[O] Vacuum cleaner	vacuum	0.218	0.219	0.223	0.223	1.02
	[P] DVD player?	dvd	0.242	0.247	0.256	0.260	1.08
	[Q] Jacuzzi bathtub?	jacuzzi	0.064	0.067	0.068	0.070	1.11
	[R] Video security system (CCTV)?	cctv	0.036	0.038	0.038	0.040	1.14
	[A] A watch?	watch	0.147	0.150	0.155	0.157	1.07
	[B] A mobile telephone?	mobile	0.190	0.196	0.205	0.210	1.10
	[C] A bicycle?	bike	0.128	0.137	0.143	0.151	1.18
	[D] A motorcycle or scooter?	moto	0.059	0.064	0.068	0.072	1.22
	[E] An animal-drawn cart?	cart	-0.036	-0.034	-0.032	-0.030	0.83
	[F] A car or truck?	car	0.221	0.228	0.240	0.245	1.11
	[G] A tractor?	tractor	-0.018	-0.016	-0.006	-0.004	0.21
	Bank account	bank	0.215	0.219	0.224	0.228	1.06

Table 15: Changes in loadings, Costa Rica 2011 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.138	0.000	0.130	0.000	-
	12 Piped into compound, yard or plot	watpyd	-0.049	0.000	-0.046	0.000	-
	21 Tube well, borehole	watbore	-0.054	0.000	-0.053	0.000	-
	All other water categories	watoth	-0.112	0.000	-0.103	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	0.054	0.054	0.000	0.000	-
	12 Flush to septic tank	sanfsep	0.048	0.042	0.000	0.000	-
	13 Flush to pit latrine	sanfpit	-0.134	-0.125	0.000	0.000	-
	All other sanitation categories	sanoth	-0.110	-0.103	0.000	0.000	-
	Persons per room	persroom	-0.145	-0.147	-0.146	-0.148	1.02
Floor	11 Earth/sand	flres	-0.092	-0.091	-0.084	-0.082	0.89
	21 Wood planks	flrwd	-0.121	-0.115	-0.116	-0.110	0.91
	33 Ceramic	flrcer	0.229	0.235	0.236	0.240	1.05
	35 Cement	flrcem	-0.190	-0.198	-0.200	-0.207	1.09
	36 Mozaic, terrazzo	flrmosa	0.048	0.046	0.046	0.044	0.93
Roof	31 Sheet metal/corrugated zinc	roofmetl	0.006	0.005	0.004	0.003	0.52
	All other roof categories	roofoth	-0.006	-0.006	-0.005	-0.004	0.62
Walls	26 Reused wood	wallre	-0.086	-0.087	-0.085	-0.085	0.99
	31 Cement	wallcem	0.133	0.134	0.134	0.134	1.01
	34 Cement blocks	wallblk	0.101	0.102	0.102	0.102	1.02
	36 Wood planks/shingles	wallplnk	-0.137	-0.131	-0.133	-0.127	0.93
	37 Prefabricated	wallprefab	-0.039	-0.042	-0.044	-0.046	1.16
	38 Fibro-cement	wallzoca	-0.072	-0.075	-0.075	-0.078	1.09
	All other wall categories	walloth	-0.064	-0.065	-0.063	-0.064	0.99
Fuel	1 Electricity	fuelelec	0.132	0.133	0.134	0.134	1.02
	2 LPG	fuellpg	-0.037	-0.040	-0.042	-0.045	1.21
	3 Natural gas	fuelgas	-0.009	-0.009	-0.010	-0.010	1.08
	8 Wood	fuelwood	-0.162	-0.159	-0.156	-0.152	0.94
	Electricity	elec	0.123	0.117	0.115	0.109	0.88
	Radio	radio	0.138	0.144	0.142	0.147	1.06
	Television conventional	tvconv	0.074	0.072	0.070	0.067	0.90
	Television flat screen	tvpanta	0.174	0.180	0.181	0.187	1.07
	Cable TV	tv cable	0.208	0.211	0.214	0.216	1.04
	Non-mobile phone	phone	0.230	0.235	0.236	0.240	1.04
	Fridge	fridge	0.205	0.206	0.203	0.202	0.98
	Washing machine	lavadora	0.202	0.202	0.201	0.200	0.99
	Private car	carro	0.242	0.252	0.252	0.260	1.08
	Microwave oven	microondas	0.263	0.268	0.269	0.273	1.04
	Shower with hot water	ducha	0.232	0.239	0.240	0.245	1.06
	Hot water in whole house	sistema	0.086	0.090	0.089	0.093	1.08
	Water tank	tanque	0.047	0.059	0.052	0.064	1.37

Clock	reloj	0.147	0.152	0.152	0.155	1.05
Mobile telephone	celular	0.117	0.120	0.119	0.121	1.03
Bicycle	bicicleta	0.029	0.031	0.029	0.031	1.05
Motorcycle or scooter	moto	0.041	0.043	0.042	0.045	1.10
Animal drawn cart	carreta	0.009	0.013	0.011	0.015	1.65
Car or truck	car	0.214	0.223	0.223	0.231	1.08
Desktop computer	compesc	0.214	0.221	0.222	0.227	1.06
Laptop computer	compport	0.210	0.218	0.219	0.225	1.07
Own house	hc10_1	0.146	0.153	0.154	0.160	1.09
Rent house	hc10_2	-0.047	-0.054	-0.054	-0.060	1.26
Free housing	hc10_3	-0.140	-0.143	-0.144	-0.145	1.04
Bank account	bank	0.161	0.165	0.165	0.168	1.04

Table 16: Changes in loadings, Indonesia (selected districts of Papua) 2011 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	ws1_11	0.083	0.000	0.087	0.000	-
	12 Piped into compound, yard or plot	ws1_12	0.008	0.000	0.002	0.000	-
	13 Piped to neighbour	ws1_13	0.004	0.000	0.002	0.000	-
	14 Public tap/standpipe	ws1_14	-0.039	0.000	-0.041	0.000	-
	21 Tube well, borehole	ws1_21	0.037	0.000	0.038	0.000	-
	31 Protected well	ws1_31	0.015	0.000	0.013	0.000	-
	32 Unprotected well	ws1_32	-0.031	0.000	-0.033	0.000	-
	41 Protected spring	ws1_41	-0.017	0.000	-0.019	0.000	-
	42 Unprotected spring	ws1_42	-0.068	0.000	-0.070	0.000	-
	51 Rainwater collection	ws1_51	-0.011	0.000	-0.015	0.000	-
	61 Tanker-truck	ws1_61	0.011	0.000	0.011	0.000	-
	81 Surface water	ws1_81	-0.165	0.000	-0.168	0.000	-
	91 Bottled water	ws1_91	0.188	0.000	0.201	0.000	-
Sanitation	12 Flush to septic tank	ws8_12	0.207	0.214	0.000	0.000	-
	13 Flush to pit (latrine)	ws8_13	0.022	0.025	0.000	0.000	-
	14 Flush to somewhere else	ws8_14	0.010	0.010	0.000	0.000	-
	15 Flush to unknown place/not sure/DK where	ws8_15	0.013	0.014	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	ws8_21	0.001	0.002	0.000	0.000	-
	22 Pit latrine with slab	ws8_22	-0.018	-0.016	0.000	0.000	-
	23 Pit latrine without slab/open pit	ws8_23	-0.027	-0.027	0.000	0.000	-
	41 Bucket	ws8_41	0.007	0.005	0.000	0.000	-
	95 No facility, bush, field	ws8_95	-0.220	-0.230	0.000	0.000	-
Shared	1 Other households only (not public)	ws10_1	0.013	0.014	0.000	0.000	-
	2 Public facility	ws10_2	0.011	0.011	0.000	0.000	-
	Persons per room	persroom	-0.036	-0.038	-0.039	-0.040	1.12
Floor	11 Earth/sand	hc3_11	-0.124	-0.129	-0.127	-0.133	1.07
	21 Wood planks	hc3_21	-0.032	-0.034	-0.034	-0.037	1.16
	22 Palm/bamboo	hc3_22	-0.084	-0.089	-0.087	-0.092	1.09
	31 Parquet or polished wood	hc3_31	0.008	0.008	0.008	0.009	1.14
	32 Vinyl or asphalt strips	hc3_32	0.084	0.086	0.089	0.091	1.09
	33 Ceramic tiles	hc3_33	0.140	0.145	0.150	0.157	1.13
	34 Cement	hc3_34	0.096	0.101	0.092	0.097	1.01
	35 Carpet	hc3_35	0.025	0.026	0.026	0.027	1.10
Roof	12 Thatch/palm leaf	hc4_12	-0.217	-0.226	-0.219	-0.229	1.06
	22 Palm/bamboo	hc4_22	-0.006	-0.007	-0.007	-0.008	1.24
	31 Metal	hc4_31	0.193	0.202	0.195	0.204	1.06
	33 Calamine/cement fibre	hc4_33	0.026	0.027	0.026	0.027	1.07
	34 Ceramic tiles	hc4_34	0.015	0.017	0.016	0.018	1.21
	36 Roofing shingles	hc4_36	-0.009	-0.010	-0.011	-0.012	1.35

Walls	14 Bark	hc5_14	-0.026	-0.029	-0.030	-0.034	1.31
	21 Bamboo with mud	hc5_21	-0.008	-0.008	-0.008	-0.008	1.01
	23 Uncovered adobe	hc5_23	0.026	0.027	0.023	0.024	0.91
	24 Plywood	hc5_24	0.036	0.037	0.037	0.038	1.07
	26 Reused wood	hc5_26	-0.054	-0.056	-0.056	-0.058	1.07
	31 Cement	hc5_31	0.176	0.183	0.188	0.196	1.11
	32 Stone with lime/cement	hc5_32	0.010	0.010	0.010	0.009	0.91
	33 Bricks	hc5_33	0.005	0.006	0.001	0.002	0.44
	34 Cement blocks	hc5_34	0.008	0.009	0.007	0.008	1.00
	35 Covered adobe	hc5_35	0.076	0.079	0.079	0.083	1.09
	36 Wood planks/shingles	hc5_36	-0.178	-0.185	-0.184	-0.193	1.08
Fuel	1 Electricity	hc6_1	0.011	0.011	0.012	0.012	1.04
	2 Liquefied petroleum gas (LPG)	hc6_2	0.033	0.035	0.037	0.039	1.16
	5 Kerosene	hc6_5	0.240	0.248	0.254	0.264	1.10
	6 Coal/lignite	hc6_6	-0.005	-0.006	-0.006	-0.006	1.19
	8 Wood	hc6_8	-0.244	-0.253	-0.259	-0.269	1.10
	95 No food cooked in household	hc6_95	0.017	0.016	0.018	0.017	1.00
	[A] ELECTRICITY?	hc8a	0.223	0.232	0.227	0.238	1.07
	[B] A RADIO?	hc8b	0.112	0.118	0.120	0.127	1.14
	[C] A TELEVISION?	hc8c	0.223	0.234	0.232	0.244	1.10
	[D] A NON-MOBILE TELEPHONE?	hc8d	0.091	0.096	0.100	0.106	1.16
	[E] A REFRIGERATOR?	hc8e	0.211	0.221	0.226	0.237	1.12
	LPG tube	hc8f	0.050	0.052	0.055	0.059	1.18
	AC	hc8g	0.100	0.105	0.109	0.116	1.16
	Cable TV	hc8h	0.193	0.201	0.207	0.216	1.12
	Water heater (electric/solar)	hc8i	0.036	0.038	0.039	0.042	1.14
	[A] A WATCH?	hc9a	0.157	0.164	0.167	0.175	1.12
	[B] A MOBILE TELEPHONE?	hc9b	0.196	0.204	0.207	0.217	1.11
	[C] A BICYCLE?	hc9c	0.084	0.089	0.091	0.097	1.16
	[D] A MOTORCYCLE OR SCOOTER?	hc9d	0.198	0.206	0.210	0.220	1.12
	[E] AN ANIMAL-DRAWN CART?	hc9e	0.011	0.012	0.012	0.014	1.26
	[F] A CAR OR TRUCK?	hc9f	0.094	0.099	0.103	0.108	1.15
	[G] A BOAT WITH A MOTOR?	hc9g	0.010	0.010	0.011	0.012	1.16
	Own house	hc10_1	-0.157	-0.163	-0.166	-0.173	1.10
	Rent house	hc10_2	0.112	0.114	0.118	0.120	1.07
	Free housing	hc10_6	0.099	0.104	0.104	0.111	1.12
	Has agricultural land	hc11	-0.200	-0.207	-0.211	-0.219	1.09
	Size of agricultural land	hc12	-0.057	-0.059	-0.060	-0.063	1.10
	Has domestic animals	hc13	-0.143	-0.148	-0.149	-0.154	1.07
	Bank account	hc15	0.196	0.205	0.206	0.217	1.11
	[A] CATTLE, MILK COWS, OR BULLS?	hc14a	-0.002	-0.001	-0.002	-0.001	0.34
	[B] HORSES, DONKEYS, OR MULES?	hc14b	0.003	0.004	0.003	0.005	1.73
	[C] GOATS?	hc14c	-0.001	0.000	-0.002	-0.001	1.29

[E] CHICKENS?	hc14e	-0.016	-0.017	-0.018	-0.019	1.15
[F] PIGS?	hc14f	-0.069	-0.072	-0.074	-0.078	1.14
[G] CROCODILES?	hc14g	0.001	0.000	0.001	0.001	0.81

Table 17: Changes in loadings, Indonesia (selected districts of West Papua) 2011 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	ws1_11	0.074	0.000	0.078	0.000	-
	12 Piped into compound, yard or plot	ws1_12	-0.051	0.000	-0.054	0.000	-
	13 Piped to neighbour	ws1_13	-0.012	0.000	-0.014	0.000	-
	14 Public tap/standpipe	ws1_14	-0.042	0.000	-0.044	0.000	-
	21 Tube well, borehole	ws1_21	0.053	0.000	0.053	0.000	-
	31 Protected well	ws1_31	-0.034	0.000	-0.035	0.000	-
	32 Unprotected well	ws1_32	-0.100	0.000	-0.104	0.000	-
	41 Protected spring	ws1_41	-0.022	0.000	-0.022	0.000	-
	42 Unprotected spring	ws1_42	-0.083	0.000	-0.082	0.000	-
	51 Rainwater collection	ws1_51	-0.040	0.000	-0.046	0.000	-
	61 Tanker-truck	ws1_61	0.012	0.000	0.014	0.000	-
	81 Surface water	ws1_81	-0.102	0.000	-0.107	0.000	-
	91 Bottled water	ws1_91	0.204	0.000	0.215	0.000	-
Sanitation	12 Flush to septic tank	ws8_12	0.189	0.202	0.000	0.000	-
	13 Flush to pit (latrine)	ws8_13	-0.005	-0.012	0.000	0.000	-
	14 Flush to somewhere else	ws8_14	0.015	0.014	0.000	0.000	-
	15 Flush to unknown place/not sure/DK where	ws8_15	0.017	0.017	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	ws8_21	0.007	0.009	0.000	0.000	-
	22 Pit latrine with slab	ws8_22	-0.014	-0.012	0.000	0.000	-
	23 Pit latrine without slab/open pit	ws8_23	-0.083	-0.088	0.000	0.000	-
	41 Bucket	ws8_41	-0.021	-0.023	0.000	0.000	-
	51 Hanging toilet, hanging latrine	ws8_51	-0.044	-0.046	0.000	0.000	-
	95 No facility, bush, field	ws8_95	-0.171	-0.178	0.000	0.000	-
Shared	1 Other households only (not public)	ws10_1	0.022	0.015	0.000	0.000	-
	2 Public facility	ws10_2	-0.094	-0.097	0.000	0.000	-
	Persons per room	persroom	-0.071	-0.074	-0.073	-0.078	1.10
Floor	11 Earth/sand	hc3_11	-0.092	-0.097	-0.093	-0.098	1.07
	21 Wood planks	hc3_21	-0.123	-0.133	-0.125	-0.136	1.10
	22 Palm/bamboo	hc3_22	-0.095	-0.099	-0.096	-0.100	1.06
	32 Vinyl or asphalt strips	hc3_32	0.048	0.047	0.049	0.048	1.00
	33 Ceramic tiles	hc3_33	0.211	0.223	0.221	0.235	1.12
	34 Cement	hc3_34	-0.032	-0.030	-0.041	-0.039	1.21
	35 Carpet	hc3_35	0.036	0.034	0.040	0.038	1.05
Roof	12 Thatch/palm leaf	hc4_12	-0.084	-0.089	-0.087	-0.092	1.10
	13 Sod	hc4_13	-0.031	-0.033	-0.031	-0.034	1.10
	22 Palm/bamboo	hc4_22	-0.024	-0.025	-0.024	-0.026	1.07
	31 Metal	hc4_31	0.049	0.052	0.054	0.057	1.15
	33 Calamine/cement fibre	hc4_33	0.024	0.026	0.023	0.026	1.08
	34 Ceramic tiles	hc4_34	0.034	0.036	0.034	0.035	1.05

Walls	35 Cement	hc4_35	0.000	-0.001	0.000	-0.001	1.62
	36 Roofing shingles	hc4_36	-0.015	-0.016	-0.015	-0.017	1.16
	14 Bark	hc5_14	-0.071	-0.076	-0.073	-0.078	1.10
	23 Uncovered adobe	hc5_23	0.002	0.001	0.003	0.001	0.54
	24 Plywood	hc5_24	0.019	0.017	0.021	0.018	0.92
	26 Reused wood	hc5_26	-0.016	-0.017	-0.014	-0.015	0.95
	31 Cement	hc5_31	0.191	0.206	0.197	0.214	1.12
	32 Stone with lime/cement	hc5_32	-0.010	-0.010	-0.011	-0.011	1.03
	33 Bricks	hc5_33	-0.009	-0.011	-0.013	-0.015	1.58
	34 Cement blocks	hc5_34	0.007	0.007	0.008	0.007	0.93
Fuel	35 Covered adobe	hc5_35	0.017	0.016	0.019	0.018	1.06
	36 Wood planks/shingles	hc5_36	-0.170	-0.181	-0.178	-0.190	1.11
	1 Electricity	hc6_1	0.012	0.011	0.013	0.012	0.95
	2 Liquefied petroleum gas (LPG)	hc6_2	0.078	0.083	0.085	0.092	1.17
	5 Kerosene	hc6_5	0.267	0.273	0.277	0.284	1.07
	8 Wood	hc6_8	-0.291	-0.297	-0.303	-0.310	1.07
	95 No food cooked in household	hc6_95	0.025	0.019	0.025	0.018	0.75
	[A] ELECTRICITY?	hc8a	0.175	0.183	0.182	0.191	1.09
	[B] A RADIO?	hc8b	0.102	0.111	0.106	0.117	1.15
	[C] A TELEVISION?	hc8c	0.211	0.225	0.221	0.237	1.12
	[D] A NON-MOBILE TELEPHONE?	hc8d	0.109	0.117	0.118	0.127	1.17
	[E] A REFRIGERATOR?	hc8e	0.245	0.260	0.256	0.274	1.12
	LPG tube	hc8f	0.106	0.114	0.115	0.124	1.17
	AC	hc8g	0.138	0.145	0.150	0.159	1.15
	Cable TV	hc8h	0.181	0.189	0.189	0.197	1.09
	Water heater (electric/solar)	hc8i	0.033	0.036	0.036	0.040	1.20
	[A] A WATCH?	hc9a	0.159	0.168	0.169	0.180	1.13
	[B] A MOBILE TELEPHONE?	hc9b	0.206	0.214	0.215	0.224	1.09
	[C] A BICYCLE?	hc9c	0.150	0.163	0.159	0.174	1.16
	[D] A MOTORCYCLE OR SCOOTER?	hc9d	0.222	0.235	0.232	0.246	1.11
	[E] AN ANIMAL-DRAWN CART?	hc9e	0.011	0.013	0.012	0.015	1.31
	[F] A CAR OR TRUCK?	hc9f	0.127	0.135	0.137	0.147	1.16
	[G] A BOAT WITH A MOTOR?	hc9g	-0.052	-0.052	-0.051	-0.051	0.99
	Own house	hc10_1	-0.115	-0.109	-0.118	-0.111	0.96
	Rent house	hc10_2	0.110	0.101	0.115	0.105	0.96
	Free housing	hc10_6	0.044	0.045	0.043	0.043	0.99
	Has agricultural land	hc11	-0.161	-0.162	-0.168	-0.170	1.06
	Size of agricultural land	hc12	0.014	0.014	0.013	-0.013	-0.93
	Has domestic animals	hc13	-0.041	-0.036	-0.045	-0.039	0.94
	Bank account	hc15	0.237	0.248	0.248	0.260	1.10
	[A] CATTLE, MILK COWS, OR BULLS?	hc14a	-0.021	-0.021	-0.024	-0.024	1.12
	[C] GOATS?	hc14c	-0.006	-0.004	-0.006	-0.005	0.85
	[E] CHICKENS?	hc14e	-0.023	-0.023	-0.026	-0.026	1.11

[F] PIGS?	hc14f	-0.052	-0.054	-0.053	-0.054	1.04
[H] DEERS?	hc14h	-0.010	-0.010	-0.010	-0.010	0.99

Table 18: Changes in loadings, Iraq 2011 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.154	0.000	0.154	0.000	-
	12 Piped into compound, yard or plot	watpyd	-0.055	0.000	-0.056	0.000	-
	13 Piped to neighbour	watnei	-0.018	0.000	-0.020	0.000	-
	14 Public tap/standpipe	watptap	-0.018	0.000	-0.019	0.000	-
	21 Tube well, borehole	watbore	-0.030	0.000	-0.030	0.000	-
	31 Protected well	watpwell	-0.043	0.000	-0.044	0.000	-
	32 Unprotected well	watuwell	-0.010	0.000	-0.010	0.000	-
	41 Protected spring	watpsprg	-0.031	0.000	-0.032	0.000	-
	42 Unprotected spring	watusprg	-0.019	0.000	-0.019	0.000	-
	51 Rainwater collection	watrain	-0.002	0.000	-0.002	0.000	-
	61 Tanker-truck	wattank	-0.112	0.000	-0.111	0.000	-
	71 Cart with small tank drum	watcart	-0.028	0.000	-0.030	0.000	-
	81 Surface water	watsurf	-0.120	0.000	-0.117	0.000	-
	91 Bottled water	watbott	0.046	0.000	0.052	0.000	-
	92 Reverse osmosis (RO)	watosmo	-0.025	0.000	-0.028	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	0.122	0.124	0.000	0.000	-
	12 Flush to septic tank	sanfsep	0.082	0.076	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	-0.145	-0.144	0.000	0.000	-
	14 Flush to somewhere else	sanfelse	-0.044	-0.044	0.000	0.000	-
	15 Flush to unknown place/not sure /DK where	sanfdk	-0.003	-0.004	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	sanvip	-0.003	-0.001	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	0.020	0.026	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	-0.093	-0.090	0.000	0.000	-
	31 Composting toilet	sancomp	-0.015	-0.016	0.000	0.000	-
	95 No facility, bush, field	sannone	-0.153	-0.157	0.000	0.000	-
	Persons per room	persroom	-0.108	-0.112	-0.113	-0.117	1.08
Floor	11 Earth/sand	flres	-0.170	-0.175	-0.169	-0.173	1.02
	12 Dung	flrclay	-0.152	-0.155	-0.153	-0.155	1.02
	21 Wood planks	flrwd	-0.001	-0.001	-0.002	-0.002	1.57
	22 Palm/bamboo	flrbam	0.001	0.001	0.001	0.000	0.64
	23 Reeds	flrcane	-0.011	-0.012	-0.012	-0.012	1.05
	32 Vinyl or asphalt strips	flrvl	0.000	0.000	0.000	-0.001	-1.86
	33 Ceramic tiles	flrcer	0.249	0.260	0.264	0.275	1.10
	34 Cement	flrcem	-0.120	-0.127	-0.134	-0.142	1.19
	35 Carpet	flrcpt	0.002	0.003	0.002	0.002	0.99
	36 Plastic	flrpla	0.001	0.002	0.000	0.001	2.86
Roof	12 Mud with dry hard straw	roofmud	-0.081	-0.082	-0.086	-0.087	1.07
	13 Grass stems	roofgrs	-0.023	-0.025	-0.023	-0.026	1.14
	21 Rustic mat	roofmat	-0.036	-0.040	-0.040	-0.044	1.23

Walls	22 Palm/bamboo	roofbam	-0.043	-0.045	-0.044	-0.046	1.07
	23 Wood planks	roofplnk	-0.136	-0.137	-0.138	-0.139	1.02
	24 Cardboard	roofcard	-0.004	-0.004	-0.004	-0.003	0.71
	25 Reeds	roofcane	-0.157	-0.161	-0.160	-0.163	1.04
	31 Metal	roofmetl	-0.012	-0.013	-0.013	-0.014	1.17
	32 Wooden	roofwood	-0.067	-0.067	-0.070	-0.070	1.04
	33 Metal sheets/jenco	roofjnc	-0.040	-0.040	-0.044	-0.044	1.08
	34 Ceramic tiles	roofcer	0.006	0.007	0.005	0.006	0.99
	35 Cement	roofcem	0.197	0.199	0.204	0.206	1.04
	36 Roofing shingles	roofshng	-0.046	-0.045	-0.048	-0.048	1.04
	37 Shelman (bricks & T-steel)	roofshel	0.035	0.037	0.036	0.037	1.07
	11 No walls	wallno	-0.060	-0.058	-0.058	-0.055	0.93
	12 Cane/palm/trunks	wallcane	-0.011	-0.012	-0.012	-0.013	1.15
	13 Mud	wallmud	-0.161	-0.168	-0.163	-0.169	1.05
	21 Bamboo with mud	wallbam	-0.011	-0.012	-0.011	-0.012	1.04
	22 Stone with mud	wallmst	-0.095	-0.096	-0.096	-0.097	1.01
	23 Uncovered adobe	wallunad	-0.073	-0.072	-0.072	-0.071	0.96
	24 Plywood	wallply	-0.002	-0.002	-0.003	-0.002	1.02
	25 Cardboard	wallcard	-0.005	-0.001	-0.006	-0.002	0.35
	26 Reused wood	wallre	-0.001	-0.002	-0.002	-0.002	1.75
	31 Cement	wallcem	0.062	0.064	0.064	0.067	1.08
	32 Stone with lime/cement	wallstn	0.026	0.027	0.030	0.031	1.16
	33 Bricks	wallbrk	-0.053	-0.055	-0.057	-0.059	1.11
	34 Cement blocks	wallblk	0.003	-0.002	-0.003	-0.009	-2.97
	35 Clay bricks	walladob	-0.093	-0.086	-0.098	-0.091	0.98
	36 Wood planks/shingles	wallplnk	-0.003	-0.004	-0.004	-0.005	1.60
	37 Metal/jenco	walljnc	0.000	0.000	0.000	0.000	-0.36
	38 Soil block (taboq)	walltbq	0.145	0.149	0.152	0.156	1.07
Fuel	1 Electricity	fuelelec	-0.005	-0.006	-0.006	-0.007	1.33
	2 Liquefied petroleum gas (LPG)	fuellpg	0.204	0.213	0.207	0.214	1.05
	5 Kerosene	fuelker	-0.108	-0.113	-0.113	-0.118	1.09
	7 Charcoal	fuelchar	-0.018	-0.019	-0.019	-0.020	1.10
	8 Wood	fuelwood	-0.112	-0.116	-0.111	-0.114	1.02
	9 Straw, shrubs, grass	fuelstrw	-0.120	-0.126	-0.120	-0.124	1.03
	10 Animal dung	fueldung	-0.065	-0.067	-0.064	-0.065	0.99
	11 Agricultural crop residue	fuelagre	-0.018	-0.019	-0.018	-0.018	1.01
	95 No food cooked in household	fuelnone	-0.018	-0.019	-0.019	-0.020	1.14
	[A] ELECTRICITY?	elec	0.137	0.138	0.135	0.134	0.98
	[B] A RADIO?	radio	0.099	0.104	0.107	0.112	1.12
	[C] A TELEVISION?	tv	0.138	0.146	0.144	0.152	1.10
	[D] A NON-MOBILE TELEPHONE?	phone	0.171	0.177	0.183	0.190	1.11
	[E] A REFRIGERATOR?	fridge	0.187	0.195	0.194	0.201	1.07
	[F] DISH/SATELLITE?	satel	0.139	0.148	0.146	0.155	1.11

[G] INTERNET NETWORK	intnet	0.139	0.146	0.152	0.161	1.16
[H] SHARED GRID (EXTERNAL GENERATOR)	shagri	0.216	0.213	0.219	0.213	0.99
[I] OWN POWER GENERATOR	gene	0.128	0.140	0.142	0.156	1.22
[J] DEEP FREEZER	deepfre	0.209	0.220	0.223	0.235	1.13
[K] SPLIT UNIT AIR CONDITIONER	splitun	0.217	0.231	0.231	0.246	1.13
[L] AIR COOLER	aircool	0.163	0.162	0.170	0.168	1.03
[M] COLD BOX	coldbox	-0.084	-0.082	-0.083	-0.079	0.93
[N] EARTHEN WATER CONTAINER	earthe	-0.114	-0.115	-0.111	-0.111	0.97
[A] A WATCH?	watch	0.162	0.171	0.173	0.183	1.13
[B] A MOBILE TELEPHONE?	mobile	0.110	0.117	0.118	0.126	1.14
[C] A BICYCLE?	bike	0.087	0.092	0.094	0.099	1.14
[D] A MOTORCYCLE OR SCOOTER?	moto	0.005	0.008	0.007	0.010	1.97
[E] AN ANIMAL-DRAWN CART?	cart	-0.016	-0.014	-0.015	-0.014	0.85
[F] A CAR OR TRUCK?	car	0.113	0.123	0.127	0.138	1.22
[G] A BOAT WITH A MOTOR?	boat	-0.008	-0.007	-0.007	-0.006	0.77
[H] COMPUTER?	compu	0.180	0.189	0.195	0.205	1.14
Bank account	bank	0.094	0.098	0.105	0.110	1.17

Table 19: Changes in loadings, Kenya (Nyanza Province) 2011 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.188	0.000	0.192	0.000	-
	12 Piped into compound, yard or plot	watpyd	0.087	0.000	0.089	0.000	-
	13 Piped to neighbor	watnei	0.011	0.000	0.011	0.000	-
	14 Piped to water kiosk	watkiosk	0.025	0.000	0.026	0.000	-
	15 Public tap/standpipe	watptap	0.020	0.000	0.021	0.000	-
	21 Tubewell/borehole	watbore	-0.007	0.000	-0.008	0.000	-
	31 Protected well	watpwell	-0.011	0.000	-0.011	0.000	-
	32 Unprotected well	watuwell	-0.020	0.000	-0.020	0.000	-
	41 Protected spring	watpsprg	-0.046	0.000	-0.047	0.000	-
	42 Unprotected spring	watusprg	-0.037	0.000	-0.037	0.000	-
	51 Rainwater collection	watrain	0.043	0.000	0.045	0.000	-
	61 Tanker-truck	wattanker	0.035	0.000	0.034	0.000	-
	71 Cart with small tank/drum	watcart	0.038	0.000	0.038	0.000	-
	81 Surface water	watsurface	-0.054	0.000	-0.056	0.000	-
	91 Bottled water	watbottle	0.044	0.000	0.045	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	0.152	0.151	0.000	0.000	-
	12 Flush to septic tank	sanfsep	0.156	0.156	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	0.016	0.017	0.000	0.000	-
	14 Flush to somewhere else	sanfelse	0.089	0.090	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	sanvip	0.091	0.096	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	0.047	0.050	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	-0.106	-0.109	0.000	0.000	-
	31 Composting toilet	sancomp	-0.013	-0.014	0.000	0.000	-
	95 No facilities or bush or field or ocean	sannone	-0.069	-0.072	0.000	0.000	-
	Shared - not public	ws8a_1	0.017	0.018	0.000	0.000	-
	Shares - public	ws8a_2	0.012	0.013	0.000	0.000	-
Floor	Persons per room	persroom	-0.050	-0.051	-0.051	-0.052	1.06
	11 Earth/sand	flres	-0.130	-0.135	-0.134	-0.138	1.06
	12 Dung	fldung	-0.088	-0.092	-0.093	-0.099	1.12
	33 Ceramic tiles	flrcer	0.187	0.186	0.192	0.191	1.02
	34 Cement	flrcem	0.189	0.198	0.197	0.207	1.10
Roof	35 Carpet	flrcpt	0.042	0.043	0.045	0.047	1.12
	11 No roof	roofno	-0.003	-0.003	-0.003	-0.004	1.29
	12 Grass/Thatch/Makuti	rooflf	-0.076	-0.080	-0.080	-0.085	1.11
	21 Corrugated iron (Mabati)	roofcorir	0.011	0.015	0.014	0.019	1.72
	22 Tin cans	roof tin	-0.004	-0.004	-0.003	-0.003	0.93
	31 Asbestos sheet	roofasbest	0.088	0.089	0.089	0.091	1.03
	32 Concrete	roofconc	0.137	0.137	0.138	0.138	1.01
	33 Tiles	roof tile	0.079	0.076	0.081	0.077	0.97

Walls	13 Dirt	walldirtetc	-0.003	-0.004	-0.004	-0.004	1.44
	21 Bamboo with mud	wallbam	-0.213	-0.222	-0.223	-0.232	1.09
	22 Stone with mud	wallmud	-0.015	-0.015	-0.015	-0.015	0.95
	31 Cement	wallcmnt	0.135	0.139	0.141	0.145	1.08
	32 Stone with lime/cement	wallstn	0.113	0.117	0.117	0.120	1.06
	33 Bricks	wallbrk	0.091	0.097	0.095	0.101	1.12
	34 Cement blocks	wallblk	0.085	0.089	0.090	0.094	1.11
	35 Covered adobe	walldob	0.034	0.037	0.036	0.039	1.14
Fuel	1 Electricity	fuelelec	0.031	0.032	0.032	0.034	1.10
	2 Liquid propane gas (LPG)	fuellpg	0.190	0.192	0.195	0.197	1.04
	3 Natural gas	fuelngas	0.079	0.081	0.084	0.087	1.10
	4 Biogas	fuelbio	0.055	0.057	0.057	0.059	1.08
	5 Kerosene	fuelksrn	0.049	0.050	0.050	0.050	1.02
	7 Charcoal	fuelchar	0.135	0.141	0.141	0.147	1.09
	8 Wood	fuelwood	-0.171	-0.176	-0.179	-0.184	1.07
	9 Straw/shrubs/grass	fuelstrw	-0.023	-0.025	-0.023	-0.025	1.06
	11 Agricultural crop residue	fuelcrop	-0.009	-0.010	-0.009	-0.010	1.14
	97 No food cooked in household	fuelnone	-0.002	-0.003	-0.002	-0.003	1.28
	A. ELECTRICITY?	elec	0.259	0.267	0.270	0.278	1.07
	B. RADIO?	radio	0.066	0.071	0.072	0.077	1.16
	C. COLOR TELEVISION?	tv	0.238	0.248	0.251	0.261	1.10
	D. B&W TELEVISION?	bwtv	0.040	0.043	0.043	0.047	1.17
	E. MOBILE TELEPHONE?	mobile	0.095	0.100	0.100	0.106	1.11
	F. NON-MOBILE TELEPHONE?	phone	0.058	0.060	0.062	0.064	1.10
	G. REFRIGERATOR?	fridge	0.250	0.255	0.260	0.265	1.06
	H. BLENDER OR MIXER?	blender	0.234	0.240	0.243	0.249	1.06
	I. WATER HEATER?	watheater	0.213	0.221	0.224	0.233	1.09
	J. WASHING MACHINE?	laundry	0.094	0.099	0.100	0.105	1.12
	K. COMPUTER?	cmptr	0.230	0.236	0.241	0.247	1.07
	L. INTERNET CONNECTION?	internet	0.205	0.211	0.215	0.221	1.08
	M. VCR, VCD OR DVD?	vcr	0.246	0.256	0.259	0.269	1.10
	N. AIR CONDITIONER?	ac	0.120	0.124	0.128	0.133	1.11
	O. SEWING MACHINE?	sewing	0.055	0.059	0.059	0.063	1.15
	A. A WATCH?	watch	0.097	0.102	0.103	0.109	1.12
	B. A BICYCLE?	bike	0.036	0.038	0.041	0.042	1.17
	C. A MOTORCYCLE OR SCOOTER?	moto	0.065	0.070	0.071	0.076	1.16
	D. AN ANIMAL-DRAWN CART?	cart	0.012	0.013	0.014	0.015	1.28
	E. A CAR OR TRUCK?	car	0.175	0.181	0.183	0.190	1.09
	F. A BOAT WITH A MOTOR?	boat	0.007	0.008	0.008	0.009	1.24

Table 20: Changes in loadings, Madagascar (South) 2012 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.100	0.000	0.108	0.000	-
	12 Piped into compound, yard or plot	watpyd	0.132	0.000	0.137	0.000	-
	13 Piped to neighbor	watnei	0.078	0.000	0.081	0.000	-
	14 Public tap/standpipe	watptap	0.154	0.000	0.156	0.000	-
	21 Tubewell/borehole	watbore	-0.028	0.000	-0.029	0.000	-
	31 Protected well	watpwell	-0.001	0.000	0.002	0.000	-
	41 Protected spring	watpsprg	-0.011	0.000	-0.013	0.000	-
	42 Unprotected spring	watusprg	-0.052	0.000	-0.057	0.000	-
	51 Rainwater collection	watrain	-0.003	0.000	-0.005	0.000	-
	61 Tanker-truck	wattank	0.009	0.000	0.008	0.000	-
	71 Cart with small tank/drum	watcart	0.049	0.000	0.052	0.000	-
	81 Surface water	watsurf	-0.088	0.000	-0.090	0.000	-
	11 Flush to piped sewer system	sanfsep	0.112	0.114	0.000	0.000	-
Sanitation	12 Flush to septic tank	sanvip	0.022	0.023	0.000	0.000	-
	13 Flush to pit (latrine)	sanupit	0.206	0.212	0.000	0.000	-
	24 Pit latrine with washable slab	sandale	0.078	0.078	0.000	0.000	-
	25 Pit latrine with unwashable slab	sanudale	0.079	0.081	0.000	0.000	-
	95 No facilities or bush or field or ocean	sannone	-0.261	-0.266	0.000	0.000	-
	Persons per room	persroom	-0.055	-0.056	-0.058	-0.059	1.08
Floor	11 Earth/sand	flres	-0.021	-0.022	-0.020	-0.021	1.01
	12 Dung	flrdng	-0.006	-0.006	-0.006	-0.005	0.90
	21 Wood planks	flrwd	0.019	0.021	0.024	0.027	1.46
	22 Palm/bamboo	flrbam	-0.017	-0.017	-0.017	-0.017	1.02
	23 Mat	flrmat	-0.166	-0.174	-0.185	-0.195	1.18
	31 Parquet	flrpq	0.030	0.031	0.031	0.032	1.08
	32 Vinyl/asphalt strips	flrvl	0.076	0.080	0.084	0.089	1.17
	34 Cement	flrcem	0.230	0.239	0.247	0.257	1.12
	35 Carpet	flrcpt	0.014	0.013	0.015	0.015	1.11
Roof	12 Thatch/palm leaves	rooflf	-0.092	-0.098	-0.104	-0.112	1.21
	13 Sod	roofsod	-0.092	-0.094	-0.097	-0.099	1.07
	22 Bamboo	roofbam	-0.003	-0.004	0.001	0.001	-0.15
	23 Wood planks	roofplnk	-0.016	-0.015	-0.016	-0.015	0.97
	31 Corrugated iron	roofmetl	0.237	0.247	0.256	0.267	1.12
	32 Wood	roofwood	0.001	0.002	0.001	0.002	2.29
Walls	12 Bamboo/cane/palm/truncks	wallcane	-0.081	-0.086	-0.090	-0.097	1.19
	13 Dirt	walldirt	-0.057	-0.058	-0.060	-0.061	1.08
	21 Bamboo and mud	wallbam	-0.023	-0.022	-0.021	-0.020	0.90
	22 Stones and mud	wallmud	-0.003	-0.003	-0.002	-0.002	0.56
	26 Recuperated wood	wallre	0.004	0.006	0.002	0.004	1.15

Fuel	31 Cement	wallcem	0.173	0.180	0.185	0.192	1.11
	32 Stone with lime/cement	wallstn	0.038	0.040	0.044	0.045	1.20
	33 Bricks	wallbrk	0.027	0.029	0.029	0.032	1.20
	36 Wood planks/shingles	wallplnk	0.073	0.076	0.082	0.086	1.18
	7 Charcoal	fuelchar	0.262	0.266	0.274	0.277	1.06
	8 Wood	fuelwood	-0.255	-0.260	-0.269	-0.272	1.07
	9 Straw/shrubs/grass	fuelstrw	0.004	0.005	0.006	0.008	2.03
	10 Dung	fueldung	0.002	0.003	0.004	0.005	2.14
	A. ELECTRICITY?	elec	0.277	0.285	0.293	0.299	1.08
	B. RADIO?	radio	0.141	0.150	0.155	0.166	1.18
	C. TELEVISION?	tv	0.261	0.271	0.279	0.289	1.11
	D. NON-MOBILE TELEPHONE?	phone	0.072	0.075	0.079	0.082	1.13
	E. REFRIGERATOR?	fridge	0.151	0.155	0.162	0.167	1.11
	F. TABLE?	table	0.172	0.182	0.192	0.205	1.19
	G. CHAIR?	chair	0.219	0.229	0.239	0.251	1.14
	H. BED?	bed	0.146	0.155	0.164	0.174	1.19
	A. A WATCH?	watch	0.164	0.174	0.180	0.193	1.18
	B. MOBILE TELEPHONE?	mobile	0.218	0.228	0.235	0.246	1.13
	C. A BICYCLE?	bike	0.133	0.142	0.150	0.161	1.21
	D. A MOTORCYCLE OR SCOOTER?	moto	0.127	0.133	0.139	0.145	1.14
	E. AN ANIMAL-DRAWN CART?	cart	0.005	0.009	0.014	0.020	4.26
	F. A CAR OR TRUCK?	car	0.123	0.129	0.134	0.141	1.15
	G. A BOAT WITH A MOTOR?	boat	0.011	0.011	0.013	0.014	1.26
	H. PLOUGH?	plough	0.010	0.015	0.019	0.026	2.46
	Bank account	bank	0.178	0.187	0.191	0.200	1.12

Table 21: Changes in loadings, Republic of Moldova 2012 (MICS4)

			Eigen vectors				G.D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.207	0.000	0.215	0.000	-
	12 Piped into compound, yard or plot	watpyd	-0.082	0.000	-0.083	0.000	-
	13 Piped to neighbour	watnei	-0.022	0.000	-0.024	0.000	-
	21 Tube well, Borehole	watbore	-0.010	0.000	-0.009	0.000	-
	31 Protected well	watpwell	-0.162	0.000	-0.168	0.000	-
	32 Unprotected well	watuwell	-0.100	0.000	-0.107	0.000	-
	41 Protected spring	watpsprg	-0.010	0.000	-0.010	0.000	-
	42 Unprotected spring	watusprg	-0.019	0.000	-0.021	0.000	-
	61 Tanker-truck	wattank	-0.014	0.000	-0.014	0.000	-
	91 Bottled water	watbott	0.098	0.000	0.102	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	0.272	0.280	0.000	0.000	-
	12 Flush to septic tank	sanfsep	0.022	0.023	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	0.009	0.009	0.000	0.000	-
	14 Flush to somewhere else	sanfelse	0.000	0.001	0.000	0.000	-
	15 Flush to unknown place/not sure /DK where	sanfdk	0.001	0.002	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	sanvip	-0.005	-0.004	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	-0.181	-0.185	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	-0.128	-0.135	0.000	0.000	-
	31 Composting toilet	sancomp	-0.002	-0.002	0.000	0.000	-
	41 Bucket	sanbuck	-0.038	-0.039	0.000	0.000	-
	51 Hanging toilet, hanging latrine	sanhang	-0.007	-0.008	0.000	0.000	-
	95 No facility, bush, field	sannone	-0.016	-0.018	0.000	0.000	-
	Persons per room	persroom	0.013	0.014	0.013	0.014	1.09
Floor	11 Earth/sand	flres	-0.055	-0.059	-0.063	-0.068	1.23
	12 Dung	flrdng	-0.032	-0.034	-0.037	-0.040	1.25
	21 Wood planks	flrwd	-0.147	-0.155	-0.155	-0.162	1.11
	31 Parquet or polished wood	flrpq	0.115	0.123	0.126	0.135	1.17
	32 Vinyl or asphalt strips	flrvl	0.081	0.084	0.083	0.084	1.04
	33 Ceramic tiles	flrcer	0.031	0.032	0.033	0.034	1.12
	34 Cement	flrcem	-0.058	-0.060	-0.060	-0.062	1.08
	35 Carpet	flrcpt	0.021	0.022	0.022	0.023	1.09
Roof	31 Metal	roofmetl	0.010	0.012	0.013	0.016	1.60
	32 Wood	roofwood	0.000	0.000	0.000	0.000	0.67
	33 Calamine/cement fibre	rooffibr	-0.219	-0.228	-0.218	-0.221	1.01
	34 Ceramic tiles	roofcer	-0.029	-0.031	-0.030	-0.031	1.07
	35 Cement	roofcem	0.241	0.250	0.239	0.241	1.00
	36 Roofing shingles	roofshng	0.017	0.017	0.018	0.018	1.06
Walls	22 Stone with mud	wallmud	-0.017	-0.018	-0.020	-0.021	1.21
	31 Cement	wallcem	-0.015	-0.015	-0.013	-0.013	0.91

Fuel	32 Stone with lime/cement	wallstn	0.041	0.042	0.038	0.037	0.90
	33 Bricks	wallbrk	-0.002	-0.002	-0.001	-0.002	0.84
	34 Cement blocks	wallblk	0.169	0.178	0.172	0.178	1.05
	36 Wood planks/shingles	wallplnk	-0.004	-0.004	-0.003	-0.004	1.02
	28 Clay blocks	wallclay	-0.044	-0.047	-0.049	-0.053	1.21
	37 Limestone bloc	walllime	0.080	0.081	0.076	0.073	0.91
	38 Covered adobe	wallplst	-0.145	-0.151	-0.143	-0.144	0.99
	1 Electricity	fuelElec	0.033	0.032	0.027	0.023	0.71
	2 Liquefied petroleum gas (LPG)	fuelLpg	-0.192	-0.197	-0.199	-0.201	1.04
	3 Natural gas	fuelgas	0.221	0.229	0.236	0.243	1.10
	7 Charcoal	fuelchar	-0.007	-0.008	-0.008	-0.009	1.18
	8 Wood	fuelwood	-0.081	-0.085	-0.091	-0.097	1.20
	9 Straw/shrubs/grass	fuelstrw	-0.027	-0.029	-0.031	-0.033	1.24
	10 Animal dung	fueldung	-0.007	-0.008	-0.008	-0.008	1.09
	11 Agricultural crop residue	fuelagre	-0.065	-0.069	-0.073	-0.079	1.21
	95 No food cooked in household	fuelnone	-0.015	-0.016	-0.018	-0.021	1.39
	[A] ELECTRICITY?	elec	0.036	0.040	0.045	0.051	1.39
	[B] A RADIO?	radio	-0.006	-0.003	0.002	0.010	-1.65
	[C] A TELEVISION?	tv	0.068	0.077	0.087	0.102	1.49
	[D] A FIXED TELEPHONE?	phone	0.097	0.105	0.117	0.132	1.36
	[E] A REFRIGERATOR?	fridge	0.137	0.148	0.160	0.176	1.29
	[F] A TABLE?	table	0.009	0.012	0.013	0.017	1.79
	[G] A SOFA?	sofa	0.021	0.024	0.027	0.031	1.52
	[H] A WARDROBE?	armoire	0.041	0.044	0.049	0.055	1.35
	[I] A WASHING MACHINE?	wmachine	0.148	0.162	0.176	0.197	1.32
	[J] A WATER HEATER/BOILER?	wheater	0.183	0.193	0.203	0.217	1.19
	[K] A VACUUM CLEANER?	vcleaner	0.202	0.217	0.230	0.251	1.24
	[L] A PHOTO CAMERA?	camera	0.168	0.184	0.194	0.215	1.28
	[M] A DVD PLAYER?	dvdplayer	0.125	0.139	0.148	0.168	1.34
	[N] A MICROWAVE?	microw	0.155	0.169	0.180	0.199	1.28
	[O] A COMPUTER?	computer	0.195	0.210	0.220	0.240	1.23
	[A] A WATCH?	watch	0.115	0.123	0.128	0.138	1.21
	[B] A MOBILE TELEPHONE?	mobile	0.162	0.175	0.186	0.205	1.26
	[C] A BICYCLE?	bike	0.006	0.012	0.021	0.033	5.31
	[D] A MOTORCYCLE OR SCOOTER?	moto	-0.011	-0.008	-0.002	0.004	-0.40
	[E] AN ANIMAL-DRAWN CART?	cart	-0.096	-0.101	-0.103	-0.107	1.12
	[F] A CAR OR TRUCK?	car	0.097	0.109	0.120	0.138	1.42
	[H] A TRACTOR?	tractor	-0.024	-0.023	-0.019	-0.015	0.65
	Dwelling- own	own	-0.054	-0.055	-0.053	-0.051	0.95
	Dwelling- rent	rent	0.070	0.071	0.066	0.061	0.87
	Agricultural land	agland	-0.196	-0.201	-0.194	-0.192	0.98
	Bank account	bank	0.160	0.171	0.176	0.188	1.17
Animals	Cattle	cattle	-0.107	-0.112	-0.109	-0.110	1.02

Horses	horses	-0.093	-0.098	-0.100	-0.104	1.12
goats	goats	-0.071	-0.074	-0.073	-0.075	1.06
Sheep	sheep	-0.066	-0.070	-0.066	-0.067	1.02
Chickens	chickens	-0.184	-0.189	-0.179	-0.178	0.97
Pigs	pigs	-0.094	-0.096	-0.092	-0.090	0.95
Other poultry	otherp	-0.132	-0.135	-0.130	-0.128	0.98
Rabbits	rabbits	-0.052	-0.052	-0.047	-0.043	0.84

Table 22: Changes in loadings, Nigeria 2011 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.064	0.000	0.065	0.000	-
	12 Piped into compound, yard or plot	watpyd	0.038	0.000	0.039	0.000	-
	13 Piped to neighbour	watnei	0.020	0.000	0.020	0.000	-
	14 Public tap/standpipe	watptap	0.034	0.000	0.036	0.000	-
	21 Tube well, borehole	watbore	0.056	0.000	0.056	0.000	-
	31 Protected well	watpwell	0.006	0.000	0.008	0.000	-
	32 Unprotected well	watuwell	-0.119	0.000	-0.125	0.000	-
	41 Protected spring	watpsprg	-0.004	0.000	-0.004	0.000	-
	42 Unprotected spring	watusprg	-0.026	0.000	-0.027	0.000	-
	51 Rainwater collection	watrain	0.008	0.000	0.009	0.000	-
	61 Tanker-truck	wattank	0.029	0.000	0.030	0.000	-
	71 Cart with small tank/drum	watcart	0.000	0.000	-0.001	0.000	-
	81 Surface water (river, stream, dam, ...)	watsurf	-0.083	0.000	-0.082	0.000	-
	91 Bottled water	watbott	0.042	0.000	0.043	0.000	-
	92 Sachet/pure water	sachwat	0.099	0.000	0.100	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	0.085	0.086	0.000	0.000	-
	12 Flush to septic tank	sanfsep	0.163	0.165	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	0.054	0.054	0.000	0.000	-
	14 Flush to somewhere else	sanfelse	0.004	0.004	0.000	0.000	-
	15 Flush to unknown place/not sure/DK where	sanfdk	-0.008	-0.009	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	sanvip	0.021	0.021	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	0.035	0.036	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	-0.075	-0.076	0.000	0.000	-
	31 Composting toilet	sancomp	-0.002	-0.001	0.000	0.000	-
	51 Hanging toilet, hanging latrine	sanhang	0.017	0.018	0.000	0.000	-
	95 No facility, bush, field	sannone	-0.138	-0.140	0.000	0.000	-
	Shared sanitation facility	sharedwc	0.090	0.091	0.000	0.000	-
	Persons per room	persroom	-0.019	-0.019	-0.021	-0.021	1.10
Floor	11 Earth/sand	flres	-0.216	-0.221	-0.226	-0.231	1.07
	12 Dung	flrdng	-0.034	-0.034	-0.035	-0.036	1.06
	21 Wood planks	flrwd	-0.006	-0.006	-0.007	-0.007	1.20
	22 Palm/bamboo	flrbam	-0.019	-0.020	-0.020	-0.020	1.05
	31 Parquet or polished wood	flrpq	-0.002	-0.002	-0.002	-0.002	1.05
	33 Ceramic tiles	flrcer	0.087	0.088	0.088	0.090	1.04
	34 Cement	flrcem	0.138	0.142	0.147	0.151	1.09
	35 Carpet	flrcpt	0.088	0.089	0.089	0.090	1.02
Roof	11 No roof	roofno	-0.017	-0.018	-0.018	-0.019	1.10
	12 Thatch/palm leaf	rooflf	-0.163	-0.167	-0.170	-0.174	1.07
	13 Sod	roofsod	-0.032	-0.033	-0.034	-0.035	1.10

Walls	21 Rustic mat	roofmat	-0.028	-0.028	-0.030	-0.030	1.05
	22 Palm/bamboo	roofbam	-0.042	-0.043	-0.045	-0.045	1.07
	23 Wood planks	roofplnk	-0.008	-0.008	-0.009	-0.009	1.15
	24 Cardboard/plastic sheeting	roofcard	0.010	0.010	0.010	0.010	1.04
	31 Metal/iron sheet/zinc	roofmetl	0.165	0.170	0.174	0.179	1.08
	32 Wood	roofwood	-0.013	-0.013	-0.013	-0.014	1.07
	33 Calamine/cement fibre	rooffibr	0.048	0.049	0.048	0.048	0.99
	34 Ceramic tiles	roofcer	0.008	0.008	0.008	0.009	1.12
	35 Cement	roofcem	0.031	0.032	0.032	0.032	1.02
	36 Roofing shingles	roofshng	0.011	0.012	0.011	0.012	1.01
	96 Other roof	otherroof	-0.060	-0.061	-0.064	-0.065	1.09
	11 No walls	wallno	-0.036	-0.038	-0.038	-0.039	1.08
	12 Cane/palm/trunks	wallcane	-0.064	-0.065	-0.066	-0.068	1.06
	13 Dirt	walldirt	-0.047	-0.048	-0.048	-0.049	1.06
	21 Bamboo with mud	wallbam	-0.078	-0.078	-0.081	-0.082	1.06
	22 Stone with mud	wallmud	-0.124	-0.127	-0.129	-0.132	1.06
	23 Uncovered adobe	wallunad	-0.046	-0.045	-0.046	-0.045	1.00
	24 Plywood	wallply	-0.003	-0.003	-0.004	-0.004	1.35
	31 Cement	wallcem	0.175	0.179	0.183	0.186	1.06
	32 Stone with lime/cement	wallstn	0.011	0.011	0.012	0.012	1.06
	33 Bricks	wallbrk	-0.024	-0.024	-0.024	-0.024	1.02
	34 Cement blocks	wallblk	0.089	0.090	0.092	0.093	1.05
	35 Covered adobe	walladob	-0.008	-0.008	-0.008	-0.007	0.85
	36 Wood planks/shingles	wallplnk	-0.001	-0.001	-0.002	-0.002	1.30
	96 Other wall	otherwall	-0.063	-0.064	-0.066	-0.067	1.07
Fuel	1 Electricity	fuelelec	0.041	0.041	0.042	0.042	1.03
	3 Natural gas	fuelgas	0.071	0.071	0.073	0.073	1.04
	4 Biogas	fuelbio	0.027	0.027	0.028	0.028	1.02
	5 Kerosene	fuelker	0.184	0.186	0.185	0.187	1.01
	6 Coal/lignite	fuelcoal	-0.005	-0.005	-0.004	-0.005	1.00
	7 Charcoal	fuelchar	0.035	0.035	0.037	0.037	1.07
	8 Wood	fuelwood	-0.179	-0.181	-0.179	-0.181	1.01
	9 Straw/shrubs/grass	fuelstrw	-0.032	-0.032	-0.034	-0.035	1.09
	10 Animal dung	fueldung	-0.017	-0.018	-0.018	-0.018	1.06
	11 Agricultural crop residue	fuelagre	-0.038	-0.039	-0.041	-0.042	1.09
	95 No food cooked in household	fuelnone	-0.008	-0.009	-0.009	-0.010	1.24
	[A] ELECTRICITY?	elec	0.229	0.233	0.236	0.240	1.05
	[B] A RADIO?	radio	0.104	0.109	0.111	0.116	1.12
	[C] A TELEVISION?	tv	0.256	0.264	0.268	0.275	1.07
	[D] A NON-MOBILE TELEPHONE?	phone	0.034	0.035	0.036	0.037	1.09
	[E] A REFRIGERATOR?	fridge	0.207	0.212	0.213	0.218	1.06
	[F] A VCR/VCD/DVD	vcdvd	0.250	0.257	0.261	0.269	1.07
	[G] SEWING MACHINE	smach	0.079	0.082	0.084	0.087	1.10

[H] CLOCK	clock	0.193	0.199	0.203	0.209	1.08
[I] GENERATOR	gen	0.188	0.194	0.197	0.204	1.09
[J] COMPUTER	compt	0.126	0.129	0.130	0.133	1.06
[K] INTERNET FACILITY	internet	0.092	0.094	0.095	0.097	1.05
[L] FAN	fan	0.259	0.265	0.268	0.275	1.06
[M] AIR CONDITIONER	ac	0.100	0.102	0.103	0.105	1.05
[N] BLENDER/MIXER/FOOD PROCESSOR	blender	0.155	0.159	0.160	0.163	1.05
[O] WATER HEATER	wheater	0.120	0.123	0.125	0.128	1.07
[A] A WATCH?	watch	0.127	0.132	0.133	0.138	1.09
[B] A MOBILE TELEPHONE?	mobile	0.183	0.189	0.193	0.199	1.08
[D] A MOTORCYCLE OR SCOOTER?	moto	0.031	0.034	0.038	0.042	1.35
[F] A CAR OR TRUCK?	car	0.144	0.148	0.150	0.154	1.07
Bank account	bank	0.213	0.219	0.221	0.227	1.06
Soap	soap	0.112	0.115	0.116	0.119	1.06

Table 23: Changes in loadings, State of Palestine 2010 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Dwelling unit	1 Villa	phc1_1	0.047	0.045	0.052	0.052	1.11
	2 House	phc1_2	-0.055	-0.070	-0.038	-0.054	0.98
	3 Apartment	phc1_3	0.100	0.116	0.078	0.098	0.98
	4 Separate room	phc1_4	-0.079	-0.082	-0.081	-0.086	1.08
	5 Tent	phc1_5	-0.147	-0.152	-0.132	-0.139	0.94
	6 Shanty house	phc1_6	-0.122	-0.126	-0.114	-0.121	0.99
Floor	Persons per room	persroom	-0.138	-0.136	-0.141	-0.140	1.02
	11 Earth/sand	hc3_11	-0.131	-0.136	-0.120	-0.128	0.98
	21 Wood planks	hc3_21	-0.010	-0.012	-0.009	-0.011	1.06
	33 Ceramic tiles	hc3_33	0.245	0.253	0.241	0.252	1.03
	34 Cement	hc3_34	-0.217	-0.223	-0.215	-0.225	1.03
	36 Bricks/stone	hc3_36	-0.029	-0.030	-0.030	-0.031	1.08
Fuel	1 Electricity	hc6_1	-0.017	-0.022	-0.017	-0.024	1.43
	2 Liquefied petroleum gas (LPG)	hc6_2	0.125	0.132	0.119	0.130	1.04
	5 Kerosene	hc6_5	-0.042	-0.043	-0.040	-0.042	1.01
	8 Wood	hc6_8	-0.176	-0.181	-0.164	-0.172	0.98
	A. Electricity	hc8a	0.187	0.193	0.174	0.183	0.98
	B. Radio/recorder	hc8b	0.165	0.161	0.177	0.174	1.05
	C. Television	hc8c	0.219	0.226	0.218	0.228	1.04
	D. Telephone line	hc8d	0.230	0.229	0.241	0.242	1.05
	E. Refrigerator	hc8e	0.224	0.227	0.224	0.231	1.03
	F. Dishwasher	hc8f	0.102	0.098	0.112	0.107	1.05
	G. Central heating	hc8g	0.108	0.103	0.118	0.113	1.05
	H. Vacuum cleaner	hc8h	0.233	0.224	0.251	0.242	1.04
	I. Home library	hc8i	0.192	0.188	0.207	0.204	1.07
	J. Gas stove	hc8j	0.091	0.100	0.082	0.095	1.05
	K. VCR/DVD	hc8k	0.183	0.172	0.202	0.191	1.04
	L. Palestinian mobile	hc8l	0.095	0.108	0.090	0.108	1.14
	M. Washing machine	hc8m	0.235	0.242	0.234	0.245	1.05
	N. Cellular (Israeli)	hc8n	0.088	0.073	0.108	0.089	1.01
	O. Computer	hc8o	0.245	0.246	0.258	0.262	1.07
	P. Satellite dish	hc8p	0.235	0.241	0.238	0.249	1.06
	Q. Internet services	hc8q	0.223	0.224	0.235	0.238	1.07
	R. Solar heater	hc8r	0.197	0.198	0.207	0.210	1.07
	S. Private car	hc8s	0.173	0.165	0.193	0.185	1.07
Water	11 Public water network connected to the house	ws1_11	0.120	0.000	0.145	0.000	-
	21 Tube well	ws1_21	-0.077	0.000	-0.071	0.000	-

Sanitation	41 Protected spring	ws1_41	-0.017	0.000	-0.014	0.000	-
	51 Rain-fed cistern with internal pipes	ws1_51	-0.034	0.000	-0.027	0.000	-
	61 Tankers	ws1_61	-0.043	0.000	-0.059	0.000	-
	91 Bottled mineral water	ws1_91	0.033	0.000	0.035	0.000	-
	92 Purchased gallons (quest. code 98)	ws1_92	-0.066	0.000	-0.090	0.000	-
	11 Flush to piped sewer system	ws8_11	0.110	0.126	0.000	0.000	-
	12 Flush to septic tank	ws8_12	-0.048	-0.060	0.000	0.000	-
	13 Flush to pit (latrine)	ws8_13	-0.043	-0.048	0.000	0.000	-
	14 Flush to somewhere else	ws8_14	-0.071	-0.075	0.000	0.000	-
	95 No facility, bush, field	ws8_95	-0.158	-0.165	0.000	0.000	-
	Shared sanitation facility	ws9	-0.019	-0.023	0.000	0.000	-

Table 24: Changes in loadings, Saint Lucia 2012 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	ws1_11	0.086	0.000	0.082	0.000	-
	12 Piped into compound, yard or plot	ws1_12	-0.139	0.000	-0.135	0.000	-
	13 Piped to neighbour	ws1_13	-0.077	0.000	-0.076	0.000	-
	14 Public tap/standpipe	ws1_14	-0.092	0.000	-0.095	0.000	-
	41 Protected spring	ws1_41	-0.006	0.000	-0.006	0.000	-
	42 Unprotected spring	ws1_42	-0.039	0.000	-0.041	0.000	-
	51 Rainwater collection	ws1_51	-0.068	0.000	-0.070	0.000	-
	91 Bottled water	ws1_91	0.083	0.000	0.086	0.000	-
Sanitation	11 Flush to piped sewer system	ws8_11	0.036	0.036	0.000	0.000	-
	12 Flush to septic tank	ws8_12	0.182	0.181	0.000	0.000	-
	13 Flush to pit (latrine)	ws8_13	-0.031	-0.032	0.000	0.000	-
	15 Flush to unknown place/not sure/DK where	ws8_15	0.009	0.010	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	ws8_21	-0.065	-0.066	0.000	0.000	-
	22 Pit latrine with slab	ws8_22	-0.160	-0.159	0.000	0.000	-
	41 Bucket	ws8_41	-0.037	-0.035	0.000	0.000	-
	95 No facility, bush, field	ws8_95	-0.114	-0.113	0.000	0.000	-
	Shared sanitation facility	ws9_1	-0.130	-0.131	0.000	0.000	-
	Persons per room	persroom	-0.016	-0.017	-0.018	-0.019	1.16
Floor	21 Wood planks	hc3_21	-0.068	-0.071	-0.073	-0.075	1.10
	23 Plywood	hc3_23	-0.128	-0.129	-0.130	-0.130	1.01
	31 Parquet or polished wood	hc3_31	0.013	0.013	0.012	0.012	0.92
	32 Vinyl tiles	hc3_32	0.025	0.024	0.022	0.020	0.81
	33 Ceramic tiles	hc3_33	0.193	0.199	0.198	0.204	1.06
	34 Concrete	hc3_34	-0.015	-0.016	-0.020	-0.022	1.48
	35 Carpet	hc3_35	0.001	0.001	0.002	0.002	1.61
	36 Marley/linoleum	hc3_36	-0.089	-0.092	-0.087	-0.090	1.00
Roof	23 Wood planks	hc4_23	-0.024	-0.025	-0.023	-0.024	1.02
	31 Metal (Galvanized iron/aluzinc)	hc4_31	-0.016	-0.015	-0.014	-0.012	0.76
	35 Concrete	hc4_35	0.025	0.024	0.023	0.021	0.85
Walls	24 Plywood	hc5_24	-0.156	-0.157	-0.152	-0.153	0.98
	31 Concrete	hc5_31	0.036	0.036	0.035	0.035	0.99
	34 Concrete blocks	hc5_34	0.034	0.034	0.030	0.029	0.83
	36 Wood (e.g., cedar)	hc5_36	-0.083	-0.086	-0.088	-0.092	1.10
	38 Plastered concrete blocks	hc5_38	0.153	0.156	0.157	0.160	1.05
Fuel	1 Electricity	hc6_1	0.012	0.012	0.011	0.011	0.88
	2 Liquefied petroleum gas (LPG)	hc6_2	0.189	0.195	0.206	0.212	1.12
	7 Charcoal	hc6_7	-0.146	-0.148	-0.158	-0.160	1.10

8 Wood	hc6_8	-0.107	-0.111	-0.115	-0.119	1.11
95 No food cooked in household	hc6_95	-0.084	-0.088	-0.092	-0.097	1.16
[A] ELECTRICITY?	elec	0.205	0.212	0.218	0.225	1.10
[B] A RADIO?	radio	0.139	0.145	0.147	0.153	1.10
[C] A TELEVISION?	tv	0.233	0.241	0.248	0.257	1.10
[D] A NON-MOBILE/FIXED LINE TELEPHONE?	phone	0.185	0.190	0.190	0.195	1.06
[E] A REFRIGERATOR?	fridge	0.232	0.238	0.245	0.251	1.09
[F] A TABLE?	table	0.130	0.134	0.136	0.140	1.08
[G] A BED?	bed	0.084	0.088	0.091	0.095	1.13
[H] A SOFA?	sofa	0.213	0.217	0.221	0.224	1.05
[I] A STOVE?	stove	0.199	0.205	0.215	0.222	1.12
[J] A WASHING MACHINE?	wash	0.233	0.239	0.244	0.249	1.07
[K] INTERNET SERVICE?	internet	0.217	0.225	0.229	0.236	1.08
[L] AN AIR CONDITION UNIT?	ac	0.091	0.096	0.098	0.102	1.12
[M] CABLE/ SATELLITE TV?	cable	0.228	0.236	0.243	0.251	1.10
[B] A MOBILE/CELLULAR PHONE?	mobile	0.148	0.152	0.162	0.166	1.12
[F] A CAR/TRUCK?	car	0.174	0.181	0.182	0.189	1.08
[G] A BOAT FOR LIVELIHOOD?	boatl	0.003	0.005	0.004	0.006	1.74
[H] A COMPUTER?	computer	0.224	0.232	0.236	0.243	1.08
[I] A STEREO OR CD PLAYER?	stereo	0.187	0.194	0.199	0.207	1.11
[J] A BOAT FOR PLEASURE (YACHT)?	boatp	0.013	0.013	0.012	0.012	0.97
[K] A PORTABLE AUDIO DEVICE (IPOD/MP3)?	ipod	0.122	0.127	0.132	0.138	1.13
Bank account	bank	0.148	0.154	0.160	0.166	1.12

Table 25: Changes in loadings, Serbia 2010 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.056	0.000	0.048	0.000	-
	12 Piped into compound, yard or plot	watpyd	-0.121	0.000	-0.124	0.000	-
	13 Piped to neighbour	watnei	-0.072	0.000	-0.077	0.000	-
	14 Public tap/standpipe	watptap	-0.069	0.000	-0.075	0.000	-
	21 Tube well, borehole	watbore	-0.030	0.000	-0.022	0.000	-
	31 Protected well	watpwell	-0.093	0.000	-0.084	0.000	-
	32 Unprotected well	watuwell	-0.036	0.000	-0.035	0.000	-
	41 Protected spring	watpsprg	-0.011	0.000	-0.005	0.000	-
	42 Unprotected spring	watusprg	-0.017	0.000	-0.016	0.000	-
	61 Tanker-truck	wattank	-0.006	0.000	-0.004	0.000	-
	91 Bottled water	watbott	0.062	0.000	0.064	0.000	-
	11 Flush to piped sewer system	sanfsew	0.213	0.215	0.000	0.000	-
	12 Flush to septic tank	sanfsep	-0.110	-0.114	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	-0.049	-0.049	0.000	0.000	-
	14 Flush to somewhere else	sanfelse	-0.047	-0.048	0.000	0.000	-
	15 Flush to unknown place/not sure/DK where	sanfdk	-0.012	-0.013	0.000	0.000	-
Sanitation	21 Ventilated improved pit latrine (VIP)	sanvip	-0.036	-0.035	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	-0.211	-0.210	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	-0.062	-0.061	0.000	0.000	-
	95 No facility, bush, field	sannone	-0.052	-0.050	0.000	0.000	-
	Persons per room	persroom	-0.036	-0.036	-0.035	-0.033	0.91
Floor	11 Earth/sand	flres	-0.139	-0.138	-0.150	-0.149	1.07
	21 Wood planks	flrwd	-0.119	-0.123	-0.127	-0.130	1.09
	31 Parquet or polished wood	flrpq	0.268	0.275	0.279	0.286	1.07
	32 Vinyl or asphalt strips	flrvl	-0.077	-0.080	-0.080	-0.084	1.09
	33 Ceramic tiles	flrcer	-0.038	-0.040	-0.037	-0.039	1.00
	34 Cement	flrcem	-0.182	-0.187	-0.188	-0.193	1.06
Roof	11 No roof	roofno	0.004	0.004	0.003	0.003	0.76
	22 Cane	cane	-0.015	-0.016	-0.018	-0.020	1.27
	23 Wood planks	roofplnk	-0.061	-0.060	-0.069	-0.068	1.12
	24 Carton	roofcard	-0.057	-0.062	-0.067	-0.072	1.27
	31 Metal/sheet	roofmetl	-0.002	0.000	-0.007	-0.006	2.86
	32 Wood	roofwood	-0.008	-0.009	-0.011	-0.011	1.27
	33 Calamine/cement fibre	rooffibr	0.008	0.008	0.009	0.009	1.21
	34 Ceramic tiles	roofcer	-0.105	-0.109	-0.084	-0.085	0.81
	35 Concrete	roofcem	0.121	0.125	0.102	0.104	0.86
	36 Roofing shingles	roofshng	-0.005	-0.004	-0.007	-0.006	1.31
Walls	12 Cane/trunks	wallcane	-0.005	-0.004	-0.004	-0.003	0.62
	13 Mud	walldirt	-0.058	-0.057	-0.063	-0.061	1.05

Fuel	21 Cane, straw and mud	wallbam	-0.095	-0.097	-0.098	-0.100	1.05
	22 Stone with mud	wallmud	-0.031	-0.030	-0.031	-0.030	0.98
	23 Uncovered adobe	wallunad	-0.041	-0.042	-0.042	-0.043	1.04
	24 Plywood	wallply	-0.029	-0.029	-0.032	-0.033	1.14
	25 Carton	wallcard	-0.051	-0.055	-0.059	-0.064	1.25
	26 Reused wood	wallre	-0.055	-0.057	-0.064	-0.067	1.21
	31 Concrete	wallcem	0.103	0.107	0.087	0.088	0.86
	32 Stone with lime/cement	wallstn	0.026	0.026	0.022	0.021	0.80
	33 Bricks	wallbrk	-0.030	-0.031	-0.015	-0.015	0.48
	34 Cement blocks	wallblk	0.006	0.005	0.010	0.009	1.54
	35 Covered adobe	walladob	-0.071	-0.073	-0.073	-0.076	1.08
	36 Wood planks/shingles	wallplnk	-0.035	-0.033	-0.039	-0.037	1.07
	1 Electricity	fuelelec	0.186	0.190	0.171	0.172	0.93
	2 Liquefied petroleum gas (LPG)	fuellpg	0.014	0.013	0.023	0.023	1.70
	3 Natural gas	fuelgas	0.014	0.014	0.020	0.020	1.43
	6 Coal/lignite	fuelcoal	-0.016	-0.017	-0.015	-0.016	0.97
	7 Charcoal	fuelchar	-0.032	-0.031	-0.035	-0.034	1.07
	8 Wood	fuelwood	-0.212	-0.215	-0.204	-0.205	0.97
	9 Straw/shrubs/grass	fuelstrw	-0.041	-0.040	-0.044	-0.043	1.04
	11 Agricultural crop residue	fuelagre	-0.033	-0.032	-0.030	-0.029	0.89
	95 No cooking in the household	fuelnone	-0.070	-0.072	-0.083	-0.085	1.20
	[A] Electricity?	elec	0.134	0.133	0.153	0.152	1.13
	[B] A radio?	radio	0.104	0.108	0.123	0.129	1.24
	[C] A television?	tv	0.144	0.147	0.167	0.169	1.17
	[D] A non-mobile telephone?	phone	0.207	0.211	0.222	0.226	1.09
	[E] A refrigerator?	fridge	0.183	0.183	0.204	0.204	1.11
	[F] An electric stove?	elstove	0.215	0.219	0.234	0.237	1.10
	[G] A bed?	bed	0.061	0.066	0.075	0.081	1.33
	[H] A table with chairs?	table	0.082	0.087	0.097	0.103	1.26
	[I] A vacuum cleaner?	cleaner	0.256	0.260	0.279	0.284	1.11
	[J] A PC/laptop?	pc	0.205	0.213	0.222	0.230	1.12
	[K] A closet?	closet	0.128	0.132	0.145	0.150	1.17
	[L] A washing machine?	wmachine	0.256	0.258	0.279	0.281	1.09
	[M] A drying machine?	dmachine	0.074	0.077	0.081	0.084	1.13
	[N] An air conditioner?	ac	0.166	0.172	0.171	0.176	1.06
	[O] Jacuzzi tub?	jacuzzi	0.028	0.029	0.031	0.033	1.15
	[P] Video monitoring system?	vms	0.034	0.035	0.036	0.037	1.10
	[A] A watch?	watch	0.158	0.165	0.171	0.178	1.13
	[B] A mobile telephone?	mobile	0.166	0.173	0.188	0.197	1.19
	[C] A bicycle?	bike	0.046	0.049	0.072	0.078	1.71
	[D] A motorcycle or scooter?	moto	0.012	0.014	0.031	0.035	2.81
	[E] An animal-drawn cart?	cart	-0.043	-0.043	-0.033	-0.031	0.72
	[F] A car or truck?	car	0.161	0.168	0.190	0.199	1.24

[G] A boat with motor?	boat	0.025	0.026	0.028	0.030	1.21
[H] A tractor?	tractor	-0.062	-0.060	-0.032	-0.027	0.44
Bank account	bank	0.199	0.205	0.213	0.219	1.10

Table 26: Changes in loadings, Somalia (Somaliland) 2011 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.169	0.000	0.179	0.000	-
	12 Piped into compound, yard or plot	watpyd	0.052	0.000	0.055	0.000	-
	13 Piped to neighbour	watnei	0.024	0.000	0.022	0.000	-
	14 Public tap/standpipe	watptap	0.006	0.000	0.003	0.000	-
	21 Tube well, Borehole	watbore	-0.034	0.000	-0.036	0.000	-
	31 Protected well	watpwell	-0.044	0.000	-0.046	0.000	-
	32 Unprotected well	watuwell	-0.098	0.000	-0.100	0.000	-
	41 Protected spring	watpsprg	-0.017	0.000	-0.016	0.000	-
	42 Unprotected spring	watusprg	-0.047	0.000	-0.048	0.000	-
	52 Rainwater collection: Roof top	watrain2	-0.015	0.000	-0.015	0.000	-
	53 Rainwater collection: Berkad	watrain3	-0.098	0.000	-0.102	0.000	-
	54 Rainwater catchment: Bally	watrain4	-0.044	0.000	-0.044	0.000	-
	61 Tanker-truck	wattank	0.072	0.000	0.073	0.000	-
	71 Cart with small tank/drum	watcart	0.031	0.000	0.030	0.000	-
	81 Surface water (river, stream, dam, lake, ...)	watsurf	-0.045	0.000	-0.044	0.000	-
	91 Bottled water	watbott	-0.005	0.000	-0.005	0.000	-
	93 Large tank near compound/village/section	watltnk	-0.007	0.000	-0.007	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	0.030	0.030	0.000	0.000	-
	12 Flush to septic tank	sanfsep	0.041	0.042	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	0.071	0.072	0.000	0.000	-
	14 Flush to somewhere else	sanfelse	0.005	0.005	0.000	0.000	-
	15 Flush to unknown place/not sure/DK where	sanfdk	0.007	0.007	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	sanvip	0.086	0.088	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	0.123	0.127	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	-0.004	-0.004	0.000	0.000	-
	41 Bucket	sanbuck	-0.002	-0.003	0.000	0.000	-
	95 No facility, bush, field	sannone	-0.227	-0.234	0.000	0.000	-
	Persons per room	persroom	-0.130	-0.136	-0.137	-0.143	1.10
Floor	11 Earth/sand	flres	-0.240	-0.249	-0.248	-0.258	1.07
	12 Dung	flrdng	-0.029	-0.030	-0.030	-0.031	1.04
	21 Wood planks	flrwd	0.007	0.008	0.008	0.008	1.05
	22 Palm/bamboo	flrbam	-0.028	-0.029	-0.028	-0.029	1.03
	31 Parquet or polished wood	flrpq	0.013	0.014	0.014	0.014	1.03
	32 Vinyl or asphalt strips	flrvl	0.021	0.022	0.021	0.022	1.07
	33 Ceramic tiles	flrcer	0.127	0.131	0.136	0.141	1.11
	34 Cement	flrcem	0.181	0.188	0.184	0.192	1.06
	35 Carpet (wall to wall)	flrcpt	0.012	0.012	0.013	0.013	1.13
Roof	11 No roof	roofno	-0.013	-0.013	-0.013	-0.013	1.02
	12 Thatch/palm leaf	rooflf	-0.078	-0.081	-0.080	-0.083	1.06

Walls	13 Sod (mud & grass)	roofsod	-0.047	-0.047	-0.047	-0.048	1.02
	21 Rustic mat	roofmat	-0.056	-0.058	-0.057	-0.059	1.05
	22 Palm/bamboo	roofbam	-0.057	-0.059	-0.059	-0.061	1.07
	23 Wood planks	roofplnk	0.012	0.013	0.013	0.013	1.06
	24 Cardboard	roofcard	0.003	0.003	0.004	0.004	1.04
	25 Sacks/plastic sheets	roofcard2	-0.147	-0.153	-0.151	-0.158	1.08
	26 Cloth/canvas/tent	roofcard3	-0.052	-0.054	-0.054	-0.056	1.08
	31 Metal/corrugated Iron Sheets	roofmetl	0.220	0.229	0.226	0.235	1.07
	32 Wood	roofwood	0.012	0.012	0.012	0.012	0.96
	33 Corrugated cement/asbestos/cement fibre	rooffibr	0.023	0.023	0.024	0.024	1.07
	34 Ceramic tiles	roofcer	0.025	0.025	0.026	0.027	1.09
	35 Cement	roofcem	0.024	0.024	0.025	0.025	1.05
	11 No walls	wallno	-0.024	-0.025	-0.025	-0.026	1.10
	12 Sticks/palm/trunks	wallcane	-0.095	-0.099	-0.097	-0.101	1.06
	13 Mud	walldirt	-0.032	-0.033	-0.033	-0.033	1.02
	21 Bamboo/sticks with mud	wallbam	-0.034	-0.035	-0.035	-0.036	1.06
	22 Stone with mud	wallmud	-0.003	-0.003	-0.003	-0.003	0.85
	23 Uncovered adobe	wallunad	-0.003	-0.003	-0.002	-0.002	0.68
	24 Plywood	wallply	0.003	0.003	0.003	0.003	1.20
	25 Cardboard/carton/tin/plastic/sacks	wallcard	-0.120	-0.126	-0.124	-0.130	1.08
	26 Reused wood	wallre	-0.048	-0.050	-0.049	-0.051	1.07
	27 Cloth/canvas/tent	wallcanvas	-0.076	-0.079	-0.078	-0.081	1.08
	31 Cement	wallcem	0.049	0.052	0.049	0.052	1.06
	32 Stone with lime/cement	wallstn	0.175	0.183	0.182	0.190	1.09
	33 Bricks	wallbrk	0.079	0.081	0.082	0.084	1.07
	34 Cement blocks	wallblk	0.011	0.012	0.012	0.012	1.12
	35 Covered adobe	walladob	-0.019	-0.020	-0.019	-0.019	0.99
	36 Wood planks/shingles	wallplnk	-0.028	-0.028	-0.028	-0.029	1.06
	37 Iron sheet wall	wallisheet	0.004	0.004	0.002	0.001	0.21
	39 Grass wall	wallgrass	-0.009	-0.010	-0.009	-0.010	1.01
	42 Shrubs and clothes	wallshrub	-0.004	-0.004	-0.004	-0.004	0.89
Fuel	1 Electricity	fuelelec	0.033	0.034	0.036	0.036	1.09
	2 Liquefied petroleum gas (LPG)	fuellpg	0.030	0.031	0.033	0.034	1.15
	5 Kerosene	fuelker	-0.007	-0.008	-0.008	-0.009	1.35
	7 Charcoal	fuelchar	0.234	0.240	0.241	0.247	1.05
	8 Wood	fuelwood	-0.241	-0.247	-0.248	-0.254	1.05
	9 Straw/shrubs/grass	fuelstrw	-0.016	-0.017	-0.016	-0.017	1.04
	95 No food cooked in household	fuelnone	-0.003	-0.004	-0.003	-0.004	1.12
	[A] ELECTRICITY?	elec	0.250	0.258	0.262	0.271	1.08
	[B] A RADIO?	radio	0.117	0.123	0.125	0.131	1.12
	[C] A TELEVISION?	tv	0.225	0.232	0.238	0.246	1.09
	[D] A NON-MOBILE TELEPHONE?	phone	0.153	0.158	0.164	0.170	1.11
	[E] A REFRIGERATOR?	fridge	0.121	0.126	0.131	0.137	1.13

[F] A CHARCOAL STOVE/JIKO?	hc8b_f	0.194	0.201	0.200	0.208	1.07
[G] A WHEEL BARROW?	hc8b_g	0.001	0.004	0.000	0.003	2.79
[H] A MAT?	hc8b_h	0.023	0.024	0.023	0.024	1.06
[I] A VACUUM FLASK?	hc8b_i	0.062	0.065	0.064	0.067	1.07
[J] A KEROSENE LAMP?	hc8b_j	-0.096	-0.100	-0.102	-0.107	1.11
[K] A FAN?	hc8b_k	0.109	0.113	0.117	0.122	1.12
[L] A BED?	hc8b_l	0.231	0.239	0.242	0.251	1.09
[M] A SOFA?	hc8b_m	0.182	0.190	0.195	0.203	1.12
[N] A SOMALI STOOL?	hc8b_n	0.179	0.187	0.188	0.196	1.09
[O] A SITTING CUSHION/PILLOW?	hc8b_o	0.175	0.182	0.186	0.194	1.11
[A] A WATCH?	watch	0.140	0.146	0.148	0.155	1.11
[B] A MOBILE TELEPHONE?	mobile	0.169	0.175	0.175	0.182	1.08
[C] A BICYCLE?	bike	0.055	0.057	0.059	0.062	1.13
[D] A MOTORCYCLE OR SCOOTER?	moto	0.011	0.011	0.011	0.012	1.09
[E] AN ANIMAL-DRAWN CART?	cart	-0.028	-0.029	-0.029	-0.029	1.04
[F] A CAR OR TRUCK?	car	0.113	0.118	0.121	0.127	1.13
[G] A BOAT WITH A MOTOR?	boat	0.010	0.011	0.011	0.011	1.08
Bank account	bank	0.059	0.062	0.065	0.068	1.14

Table 27: Changes in loadings, Sudan 2010 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.164	0.000	0.171	0.000	-
	12 Piped into compound, yard or plot	watpyd	0.183	0.000	0.191	0.000	-
	14 Public tap/standpipe	watptap	-0.015	0.000	-0.015	0.000	-
	21 Water yard/hand pump	watbore	-0.132	0.000	-0.142	0.000	-
	31 Protected/covered well	watpwell	-0.035	0.000	-0.035	0.000	-
	32 Unprotected well	watuwell	-0.091	0.000	-0.092	0.000	-
	41 Protected spring	watpsprg	-0.007	0.000	-0.007	0.000	-
	42 Unprotected spring	watusprg	-0.035	0.000	-0.034	0.000	-
	51 Filtered (river, stream, dam, hafir, lake, pond, ...)	watrain	-0.014	0.000	-0.015	0.000	-
	61 Transported by tankers/carts from improved source	wattank	-0.024	0.000	-0.026	0.000	-
	91 Bottled water	watbott	-0.005	0.000	-0.005	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	0.064	0.069	0.000	0.000	-
	12 Flush to septic tank	sanfsep	0.118	0.125	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	0.084	0.090	0.000	0.000	-
	14 Flush to somewhere else	sanfelse	0.053	0.058	0.000	0.000	-
	15 Flush to unknown place/not sure/DK where	sanfdk	0.015	0.016	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	sanvip	0.043	0.047	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	0.141	0.143	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	-0.033	-0.034	0.000	0.000	-
	31 Composting toilet	sancomp	-0.008	-0.008	0.000	0.000	-
	41 Bucket	sanbuck	0.001	0.001	0.000	0.000	-
	51 Hanging toilet, Hanging latrine	sanhang	-0.004	-0.004	0.000	0.000	-
	95 No facility, bush, field	sannone	-0.189	-0.198	0.000	0.000	-
	Shared sanitation facility	shared	0.031	0.032	0.000	0.000	-
Floor	Persons per room	persroom	-0.065	-0.068	-0.067	-0.071	1.10
	11 Earth/sand	flres	-0.190	-0.204	-0.201	-0.217	1.14
	12 Dung	flrdng	-0.011	-0.011	-0.010	-0.010	0.84
	21 Wood planks	flrwd	0.003	0.004	0.003	0.004	1.56
	22 Palm/bamboo	flrbam	-0.006	-0.006	-0.006	-0.006	1.03
	33 Ceramic tiles	flrcer	0.127	0.137	0.133	0.144	1.13
	34 Cement	flrcem	0.148	0.159	0.157	0.170	1.15
	35 Carpet	flrcpt	0.025	0.027	0.026	0.028	1.13
Roof	11 No roof	roofno	-0.014	-0.015	-0.015	-0.015	1.06
	12 Thatch/palm leaf	rooflf	0.052	0.048	0.053	0.048	0.91
	13 Sod	roofsod	-0.225	-0.231	-0.237	-0.244	1.09
	21 Rustic mat	roofmat	0.059	0.057	0.066	0.064	1.09
	22 Palm/bamboo	roofbam	0.037	0.036	0.038	0.036	0.96
	23 Wood planks	roofplnk	0.016	0.017	0.018	0.019	1.21

Walls	24 Cardboard	roofcard	-0.024	-0.026	-0.024	-0.025	1.03
	31 Metal	roofmetl	0.124	0.135	0.128	0.140	1.13
	32 Wood	roofwood	0.044	0.048	0.047	0.051	1.16
	33 Calamine/cement fibre	rooffibr	0.021	0.021	0.023	0.024	1.15
	34 Ceramic tiles	roofcer	0.014	0.015	0.014	0.016	1.13
	35 Cement	roofcem	0.107	0.115	0.111	0.121	1.13
	36 Roofing shingles	roofshng	0.024	0.025	0.025	0.027	1.13
	11 No walls	wallno	-0.101	-0.106	-0.100	-0.105	1.04
	12 Cane/palm /trunks	wallcane	-0.139	-0.142	-0.149	-0.152	1.10
	13 Dirt	walldirt	-0.004	-0.006	-0.004	-0.006	1.47
	21 Bamboo with mud	wallbam	-0.032	-0.033	-0.034	-0.035	1.10
	22 Stone with mud	wallmud	0.059	0.057	0.060	0.057	0.96
	23 Uncovered adobe	wallunad	0.013	0.011	0.015	0.012	0.90
	24 Plywood	wallply	-0.010	-0.009	-0.009	-0.008	0.81
	25 Cardboard	wallcard	-0.005	-0.005	-0.005	-0.005	1.04
	26 Reused wood	wallre	-0.003	-0.003	-0.004	-0.003	1.03
	31 Cement	wallcem	0.096	0.103	0.099	0.107	1.12
	32 Stone with lime/cement	wallstn	0.058	0.061	0.061	0.064	1.10
	33 Bricks	wallbrk	0.166	0.175	0.174	0.185	1.11
	34 Cement blocks	wallblk	0.060	0.066	0.061	0.068	1.13
Fuel	35 Covered adobe	walladob	0.066	0.064	0.069	0.067	1.01
	36 Wood planks/shingles	wallplnk	-0.024	-0.024	-0.023	-0.024	1.00
	1 Electricity	fuelelec	0.017	0.018	0.018	0.019	1.07
	3 Gas	fuelgas	0.267	0.275	0.280	0.289	1.08
	4 Biogas	fuelbio	0.014	0.014	0.014	0.015	1.07
	5 Kerosene	fuelker	0.006	0.006	0.006	0.006	1.00
	7 Charcoal	fuelchar	-0.002	-0.003	-0.003	-0.003	1.36
	8 Wood	fuelwood	-0.238	-0.245	-0.250	-0.258	1.08
	9 Straw/shrubs/grass	fuelstrw	-0.032	-0.033	-0.032	-0.033	1.02
	10 Animal dung	fueldung	-0.012	-0.014	-0.011	-0.013	1.07
	11 Agricultural crop residue	fuelagre	0.002	0.002	0.002	0.002	1.10
	95 No food cooked in household	fuelnone	-0.002	-0.002	-0.003	-0.003	1.22
	[A] ELECTRICITY?	elec	0.277	0.286	0.288	0.298	1.08
	[B] A RADIO?	radio	0.099	0.107	0.102	0.110	1.12
	[C] A TELEVISION?	tv	0.283	0.296	0.296	0.311	1.10
	[D] A NON-MOBILE TELEPHONE?	phone	0.119	0.127	0.125	0.134	1.13
	[E] A REFRIGERATOR?	fridge	0.270	0.282	0.283	0.297	1.10
	[A] A WATCH?	watch	0.074	0.081	0.075	0.084	1.14
	[B] A MOBILE TELEPHONE?	mobile	0.205	0.214	0.213	0.223	1.09
	[C] A BICYCLE?	bike	0.073	0.080	0.076	0.085	1.16
	[D] A MOTORCYCLE OR SCOOTER?	moto	0.056	0.061	0.057	0.063	1.13
	[E] AN ANIMAL-DRAWN CART?	cart	-0.011	-0.011	-0.012	-0.011	0.96
	[F] A CAR OR TRUCK?	car	0.143	0.154	0.152	0.164	1.15

[G] A BOAT WITH A MOTOR?	boat	0.018	0.019	0.019	0.020	1.11
[H] A COMPUTER?	computer	0.162	0.174	0.170	0.185	1.15
[I] INTERNET?	internet	0.112	0.122	0.119	0.130	1.16
[J] A DIGITAL RECEIVER?	receiver	0.270	0.284	0.283	0.299	1.11

Table 28: Changes in loadings, Tunisia 2011–2012 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.043	0.000	0.027	0.000	-
	12 Piped into compound, yard or plot	watpyd	-0.038	0.000	-0.037	0.000	-
	13 Piped to neighbour	watnei	-0.055	0.000	-0.055	0.000	-
	14 Public tap/standpipe	watptap	-0.079	0.000	-0.078	0.000	-
	21 Tube well, borehole	watbore	-0.009	0.000	-0.008	0.000	-
	31 Protected well	watpwell	-0.038	0.000	-0.037	0.000	-
	32 Unprotected well	watuwell	-0.052	0.000	-0.052	0.000	-
	41 Protected spring	watpsprg	-0.015	0.000	-0.015	0.000	-
	42 Unprotected spring	watusprg	-0.059	0.000	-0.059	0.000	-
	51 Rainwater collection/Majel/Fasquia	watrain	-0.073	0.000	-0.062	0.000	-
	61 Tanker-truck	wattank	-0.043	0.000	-0.040	0.000	-
	71 Cart with small tank/drum	watcart	-0.012	0.000	-0.012	0.000	-
	81 Surface water (river, stream, dam, lake, ...)	watsurf	-0.019	0.000	-0.019	0.000	-
	91 Bottled water	watbott	0.163	0.000	0.172	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	0.229	0.229	0.000	0.000	-
	12 Flush to septic tank	sanfsep	-0.047	-0.045	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	-0.074	-0.076	0.000	0.000	-
	14 Flush to somewhere else	sanfelse	-0.006	-0.006	0.000	0.000	-
	15 Flush to unknown place/not sure/DK where	sanfdk	-0.006	-0.007	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	sanvip	-0.048	-0.047	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	-0.103	-0.102	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	-0.059	-0.059	0.000	0.000	-
	41 Bucket	sanbuck	-0.009	-0.009	0.000	0.000	-
	51 Hanging toilet	sanhang	-0.001	-0.001	0.000	0.000	-
	95 No facility, bush, field	sannone	-0.121	-0.122	0.000	0.000	-
	Persons per room	persroom	-0.117	-0.120	-0.120	-0.123	1.05
Floor	11 Earth/sand	flres	-0.037	-0.040	-0.038	-0.042	1.15
	21 Wood planks	flrwd	0.000	0.000	0.000	-0.001	-2.97
	31 Parquet or polished wood	flrpq	0.000	0.000	-0.001	-0.001	-2.80
	33 Ceramic tiles	flrcer	0.262	0.268	0.266	0.273	1.04
	34 Cement	flrcem	-0.255	-0.261	-0.259	-0.265	1.04
	35 Carpet (wall to wall)	flrcpt	-0.008	-0.009	-0.008	-0.009	1.02
Roof	11 No roof	rooflf	-0.012	-0.012	-0.013	-0.013	1.12
	12 Thatch/palm leaf	roofmat	-0.003	-0.003	-0.004	-0.004	1.36
	22 Palm/bamboo	roofbam	-0.010	-0.011	-0.010	-0.011	1.11
	23 Wood planks	roofplnk	-0.028	-0.030	-0.031	-0.033	1.16
	31 Metal/corrugated Iron Sheets	roofmetl	-0.027	-0.027	-0.028	-0.028	1.05
	32 Wood	roofwood	-0.020	-0.023	-0.024	-0.026	1.30
	33 Corrugated cement/asbestos/cement fibre	rooffibr	-0.021	-0.021	-0.021	-0.021	1.01

Walls	34 Ceramic tiles	roofcer	-0.021	-0.022	-0.023	-0.023	1.11
	35 Cement	roofcem	0.053	0.056	0.058	0.060	1.12
	12 Sticks/palm/trunks	wallcane	-0.007	-0.007	-0.008	-0.008	1.09
	13 Mud	walldirt	-0.009	-0.009	-0.009	-0.009	1.09
	21 Bamboo/sticks with mud	wallmud	-0.034	-0.035	-0.035	-0.036	1.07
	23 Uncovered adobe	wallunad	-0.001	-0.002	-0.001	-0.002	1.46
	31 Cement	wallcem	-0.073	-0.074	-0.071	-0.071	0.97
	32 Stone with lime/cement	wallstn	0.010	0.010	0.011	0.011	1.08
	33 Bricks	wallbrk	0.097	0.097	0.095	0.095	0.99
	34 Cement blocks	wallblk	-0.041	-0.042	-0.044	-0.044	1.06
	35 Covered adobe	walladob	-0.018	-0.020	-0.021	-0.023	1.22
	36 Wood planks/shingles	wallplnk	-0.005	-0.005	-0.006	-0.007	1.47
Fuel	1 Electricity	fuellec	0.003	0.003	0.002	0.002	0.73
	2 Liquefied petroleum gas (LPG)	fuellpg	-0.146	-0.149	-0.151	-0.154	1.06
	3 Natural gas	fuelgas	0.164	0.167	0.170	0.173	1.06
	4 Biogas	fuelbio	0.003	0.003	0.003	0.002	0.73
	5 Kerosene	fuelker	0.001	0.001	0.000	0.000	0.06
	7 Coal/lignite	fuelchar	-0.028	-0.027	-0.029	-0.028	1.01
	8 Wood	fuelwood	-0.020	-0.020	-0.021	-0.021	1.02
	9 Straw/shrubs/grass	fuelstrw	-0.024	-0.024	-0.024	-0.024	1.02
	95 No food cooked in household	fuelnone	-0.021	-0.021	-0.022	-0.022	1.05
	[A] ELECTRICITY?	elec	0.069	0.070	0.071	0.072	1.04
	[B] A RADIO?	radio	0.160	0.167	0.171	0.178	1.11
	[C] A TELEVISION?	tv	0.119	0.122	0.125	0.128	1.07
	[D] A NON-MOBILE TELEPHONE?	phone	0.211	0.220	0.223	0.231	1.09
	[E] A REFRIGERATOR?	fridge	0.156	0.160	0.163	0.167	1.07
	[F] A FAN?	ventilator	0.155	0.161	0.167	0.173	1.12
	[G] A MIXER?	mixeur	0.250	0.258	0.266	0.274	1.10
	[H] A WATER HEATER?	chauffeau	0.269	0.277	0.283	0.291	1.08
	[I] A WASHING MACHINE?	lavelinge	0.252	0.260	0.263	0.270	1.07
	[J] A DISH WASHER?	lavevaise~e	0.076	0.079	0.083	0.085	1.12
	[K] A MICROWAVE OVEN?	microonde	0.212	0.219	0.226	0.233	1.10
	[L] AN AIR CONDITIONER?	clim	0.221	0.228	0.239	0.245	1.11
	[M] A COMPUTER?	ordint	0.233	0.241	0.249	0.257	1.10
	[A] A WATCH?	watch	0.201	0.207	0.213	0.219	1.09
	[B] A MOBILE TELEPHONE?	mobile	0.122	0.126	0.129	0.133	1.08
	[C] A BICYCLE?	bike	0.089	0.092	0.096	0.100	1.12
	[D] A MOTORCYCLE OR SCOOTER?	moto	0.035	0.036	0.038	0.040	1.14
	[E] AN ANIMAL-DRAWN CART?	cart	-0.068	-0.069	-0.064	-0.065	0.96
	[F] A CAR OR TRUCK?	car	0.179	0.187	0.197	0.205	1.15
	[G] A BOAT WITH A MOTOR?	boat	0.022	0.023	0.024	0.026	1.17
	Bank account	bank	0.200	0.207	0.212	0.219	1.09

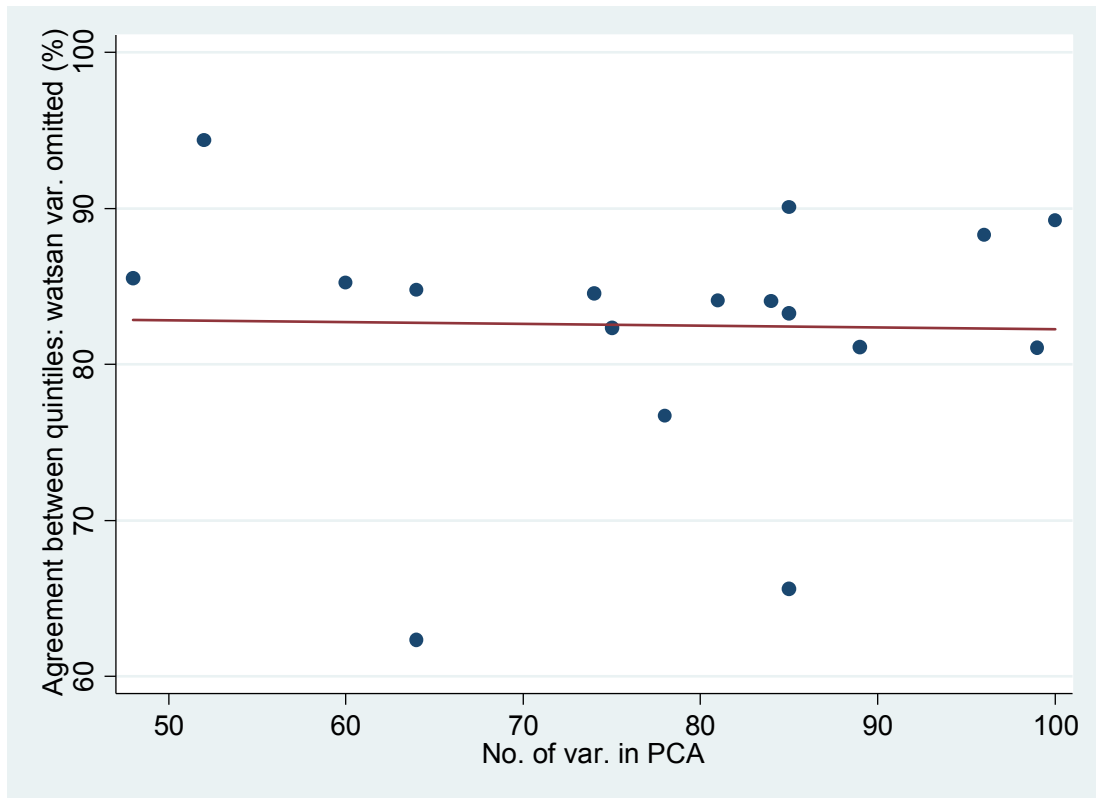
Table 29: Changes in loadings, Ukraine 2012 (MICS4)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.270	0.000	0.268	0.000	-
	12 Piped into compound, yard or plot	watpyd	-0.097	0.000	-0.098	0.000	-
	13 Piped to neighbour	watnei	-0.030	0.000	-0.035	0.000	-
	14 Public tap/standpipe	watptap	-0.038	0.000	-0.042	0.000	-
	21 Tube well, borehole	watbore	-0.069	0.000	-0.062	0.000	-
	31 Protected well	watpwell	-0.230	0.000	-0.231	0.000	-
	32 Unprotected well	watuwell	-0.042	0.000	-0.046	0.000	-
	41 Protected spring	watpsprg	-0.017	0.000	-0.017	0.000	-
	42 Unprotected spring	watusprg	-0.010	0.000	-0.013	0.000	-
	61 Tanker-truck	wattank	-0.023	0.000	-0.027	0.000	-
	91 Bottled water	watbott	0.066	0.000	0.073	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	0.319	0.324	0.000	0.000	-
	12 Flush to septic tank	sanfsep	-0.002	0.000	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	-0.032	-0.041	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	sanvip	-0.084	-0.081	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	-0.266	-0.267	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	-0.040	-0.042	0.000	0.000	-
	31 Composting toilet	sancomp	-0.033	-0.031	0.000	0.000	-
	41 Bucket	sanbuck	-0.041	-0.041	0.000	0.000	-
	Shared sanitation facility	toilet_sha~d	-0.013	-0.016	0.000	0.000	-
	Persons per room	persroom	0.057	0.073	0.077	0.098	1.71
Floor	11 Natural floor	flres	-0.030	-0.033	-0.037	-0.039	1.30
	21 Rudimentary floor	flrwd	-0.238	-0.253	-0.248	-0.249	1.05
	31 Parquet or polished wood	flrpq	0.049	0.058	0.060	0.071	1.44
	32 Vinyl or asphalt strips	flrvl	0.158	0.159	0.153	0.137	0.86
	33 Ceramic tiles	flrcer	0.022	0.025	0.026	0.030	1.40
	35 Carpet	flrcpt	0.074	0.086	0.084	0.096	1.31
Roof	23 Rudimentary roofing	roofplnk	-0.027	-0.030	-0.032	-0.035	1.29
	31 Metal	roofmetl	-0.042	-0.040	-0.041	-0.037	0.89
	32 Wood	roofwood	-0.017	-0.018	-0.019	-0.019	1.14
	33 Calamine/cement fibre	rooffibr	-0.227	-0.243	-0.226	-0.223	0.98
	34 Ceramic tiles	roofcer	-0.014	-0.009	-0.008	0.001	-0.07
	35 Cement	roofcem	0.276	0.291	0.274	0.265	0.96
Walls	22 Stone with mud	wallmud	-0.062	-0.071	-0.068	-0.076	1.23
	23 Uncovered adobe	wallunad	-0.041	-0.042	-0.045	-0.046	1.12
	31 Cement	wallcem	0.083	0.090	0.087	0.089	1.08
	32 Stone with lime/cement	wallstn	-0.036	-0.052	-0.042	-0.060	1.68
	33 Bricks	wallbrk	-0.006	0.001	0.006	0.023	-3.96
	34 Cement blocks	wallblk	0.170	0.180	0.170	0.163	0.96

Fuel	35 Covered adobe	walladob	-0.096	-0.099	-0.100	-0.097	1.01
	36 Wood planks/shingles	wallplnk	-0.138	-0.143	-0.150	-0.150	1.09
	2 Liquefied petroleum gas (LPG)	fuellpg	-0.154	-0.161	-0.162	-0.159	1.03
	3 Natural gas	fuelgas	0.185	0.194	0.202	0.201	1.09
	6 Coal/lignite	fuelcoal	-0.022	-0.028	-0.024	-0.030	1.38
	8 Wood	fuelwood	-0.130	-0.134	-0.146	-0.144	1.11
	[A] ELECTRICITY?	elec	0.030	0.035	0.040	0.046	1.51
	[B] A RADIO?	radio	-0.011	-0.014	-0.010	-0.012	1.07
	[C] A CRT/KYNESCOPE TV SET?	tv_crt	-0.109	-0.130	-0.140	-0.168	1.54
	[D] FLATSCREEN TV SET?	tv2	0.171	0.202	0.217	0.258	1.51
	[E] A NON-MOBILE TELEPHONE?	phone	0.183	0.200	0.202	0.213	1.17
	[F] A REFRIGERATOR?	fridge	0.090	0.100	0.109	0.119	1.32
	[G] DVD PLAYER?	dvd	0.134	0.165	0.181	0.224	1.67
	[H] AN AIR CONDITIONER?	air_condit~g	0.136	0.155	0.163	0.184	1.35
	[I] A SATELLITE DISH ANTENNE?	sat	0.003	0.020	0.040	0.075	24.95
	[J] A DESKTOP COMPUTER?	computer	0.177	0.202	0.215	0.244	1.38
	[K] A LAPTOP COMPUTER?	notebook	0.130	0.150	0.156	0.179	1.37
	[L] A TABLET COMPUTER?	tablet_pc	0.073	0.086	0.088	0.103	1.42
	[M] A WASHING MACHINE?	washing_ma~e	0.146	0.167	0.179	0.203	1.39
	[N] MICROWAVE OVEN?	microwave	0.187	0.216	0.231	0.268	1.43
	[A] A WATCH?	watch	0.095	0.106	0.111	0.122	1.28
	[B] A MOBILE TELEPHONE?	mobile	0.120	0.139	0.153	0.177	1.48
	[F] A CAR OR TRUCK?	car	0.107	0.134	0.152	0.192	1.80
	[G] A BOAT WITH A MOTOR?	boat	0.023	0.027	0.033	0.038	1.64
	Bank account	bank	0.171	0.199	0.209	0.241	1.41

Annex C

Figure 5: Scatter plot of the number of PCA variables against the percentage of agreement between quintiles, 17 MICS4 datasets



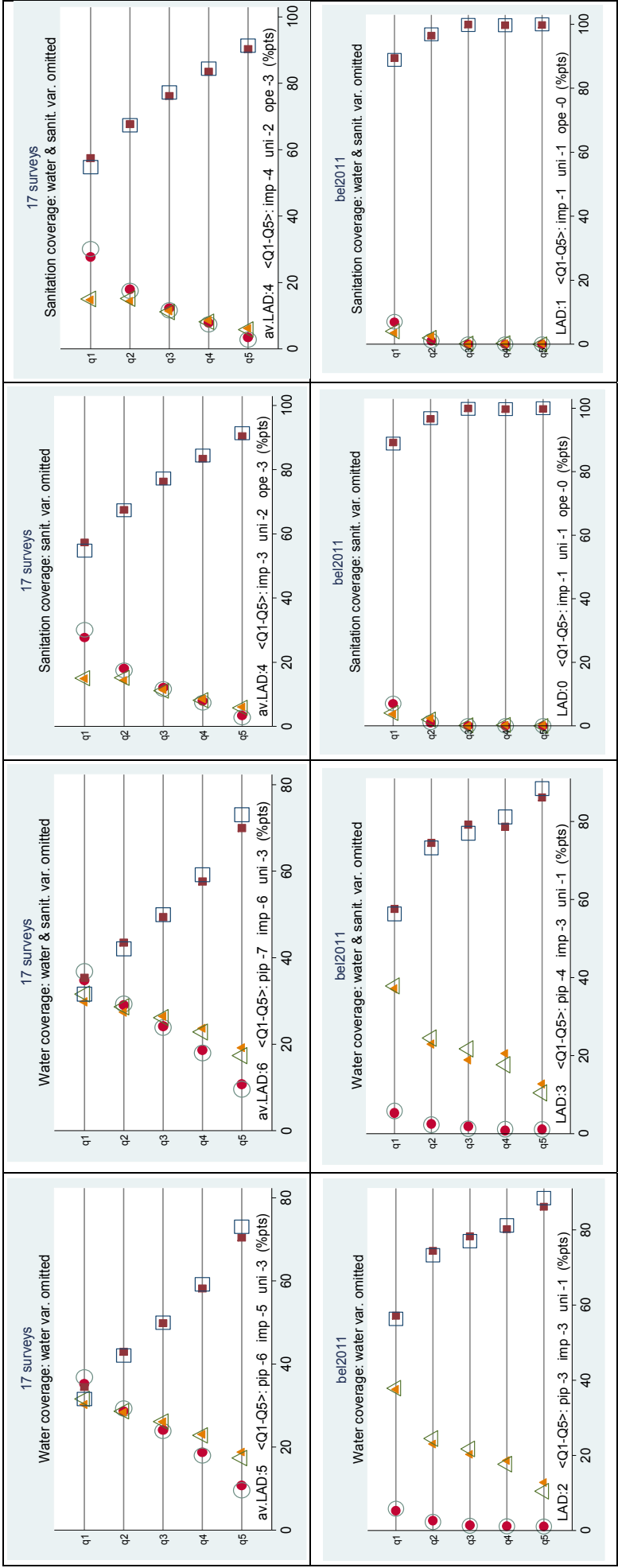
Annex D

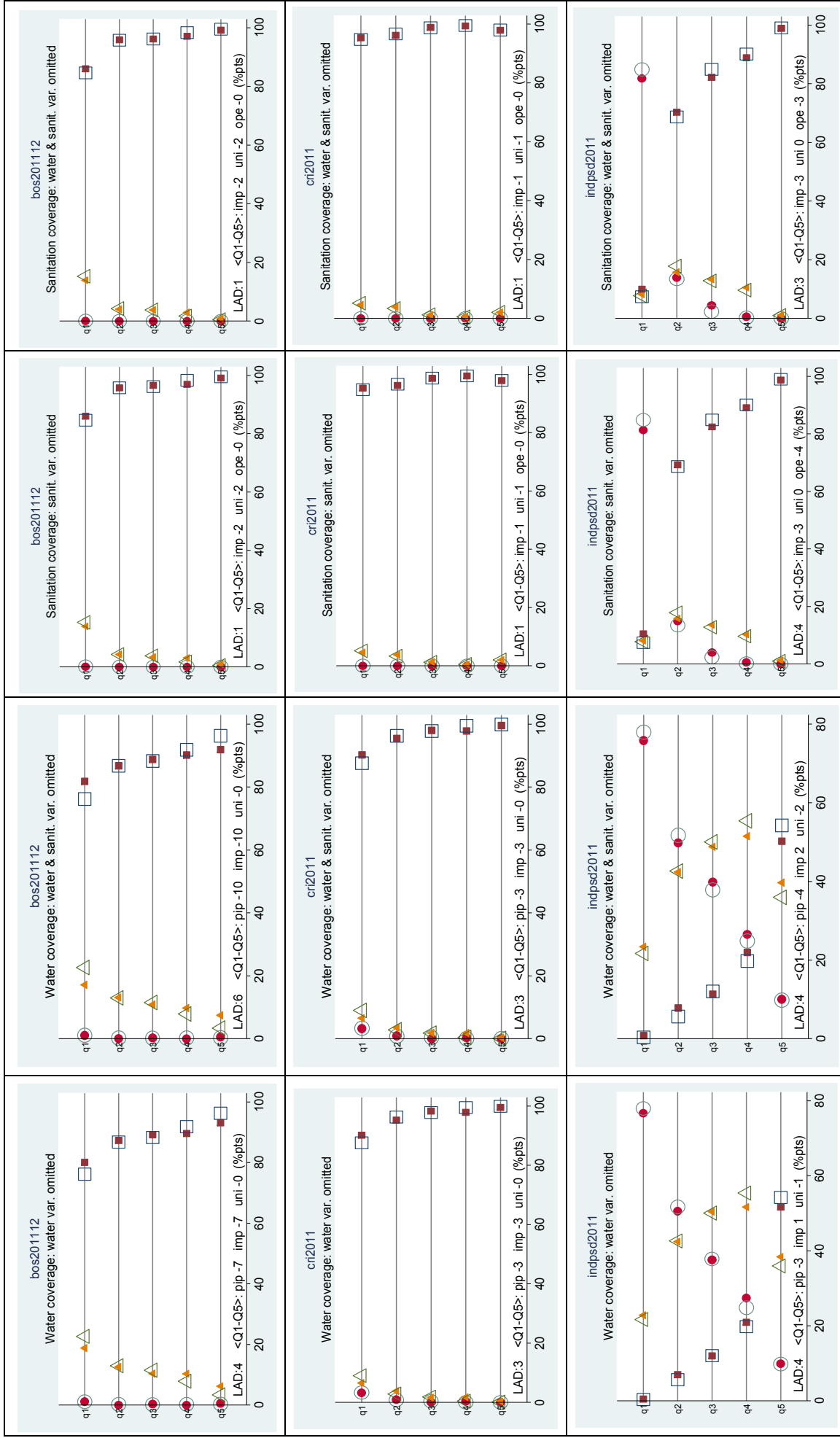
Changes in water/sanitation coverage by wealth quintile when water-/sanitation-related variables are omitted from the PCA, 17 MICS4 datasets

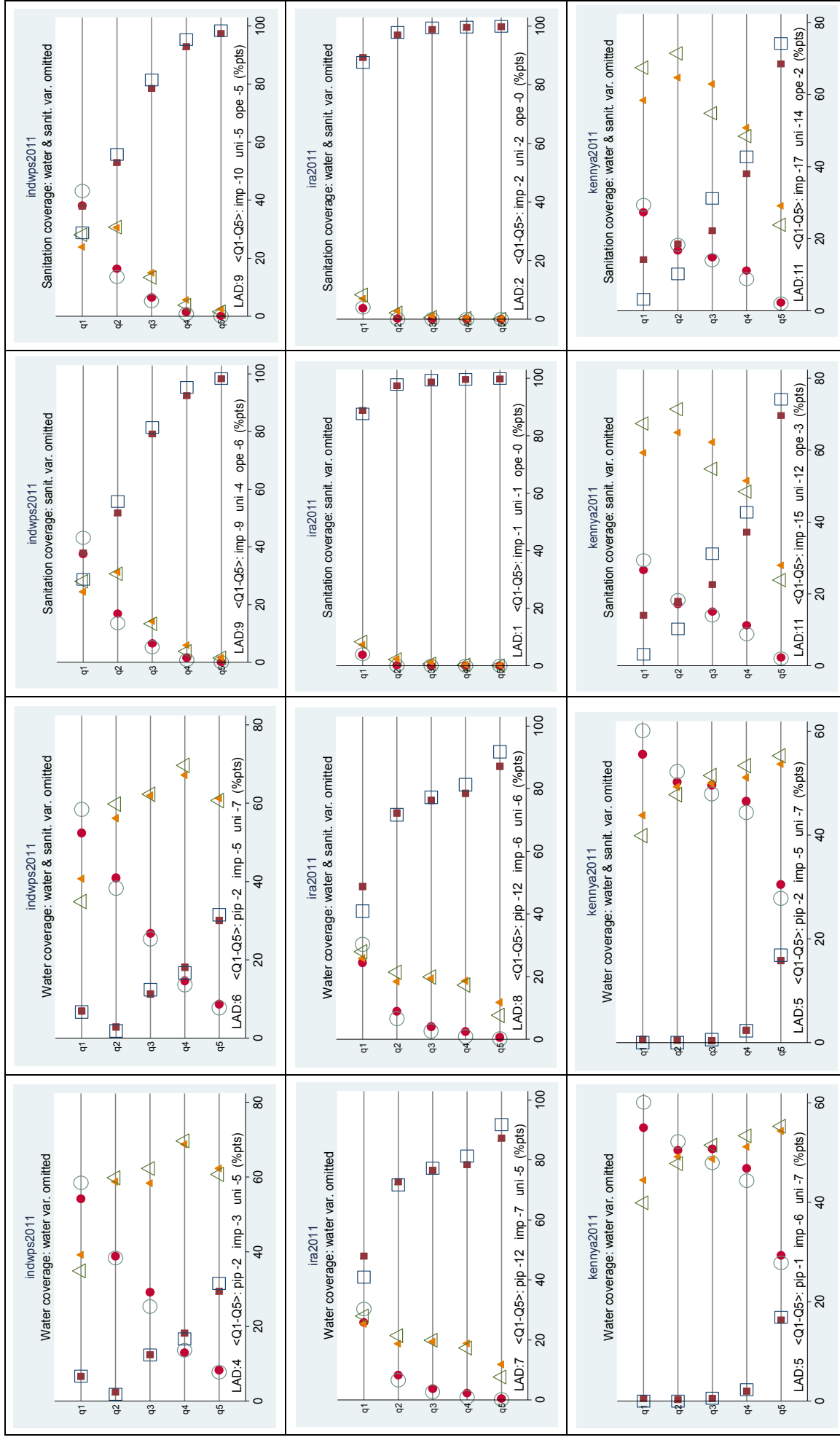
There are four graphs per row, two for water and two for sanitation, each with a different PCA restriction; there is one row per dataset, plus one row summarizing the 17 surveys on the top. Each dot graph presents five horizontal lines representing the wealth quintiles, starting with the poorest (q1) at the top and the wealthiest at the bottom (q5). On each line, there are three pairs of symbols, one pair for each indicator. For water coverage, the large hollow square represents piped water coverage using an unrestricted PCA, while the smaller filled square represents piped water coverage using a restricted PCA, as indicated at the top of each graph; similarly, improved water sources are represented by triangles. For sanitation, the squares stand for improved sanitation facilities, the triangles for unimproved, and the circles for open defecation.

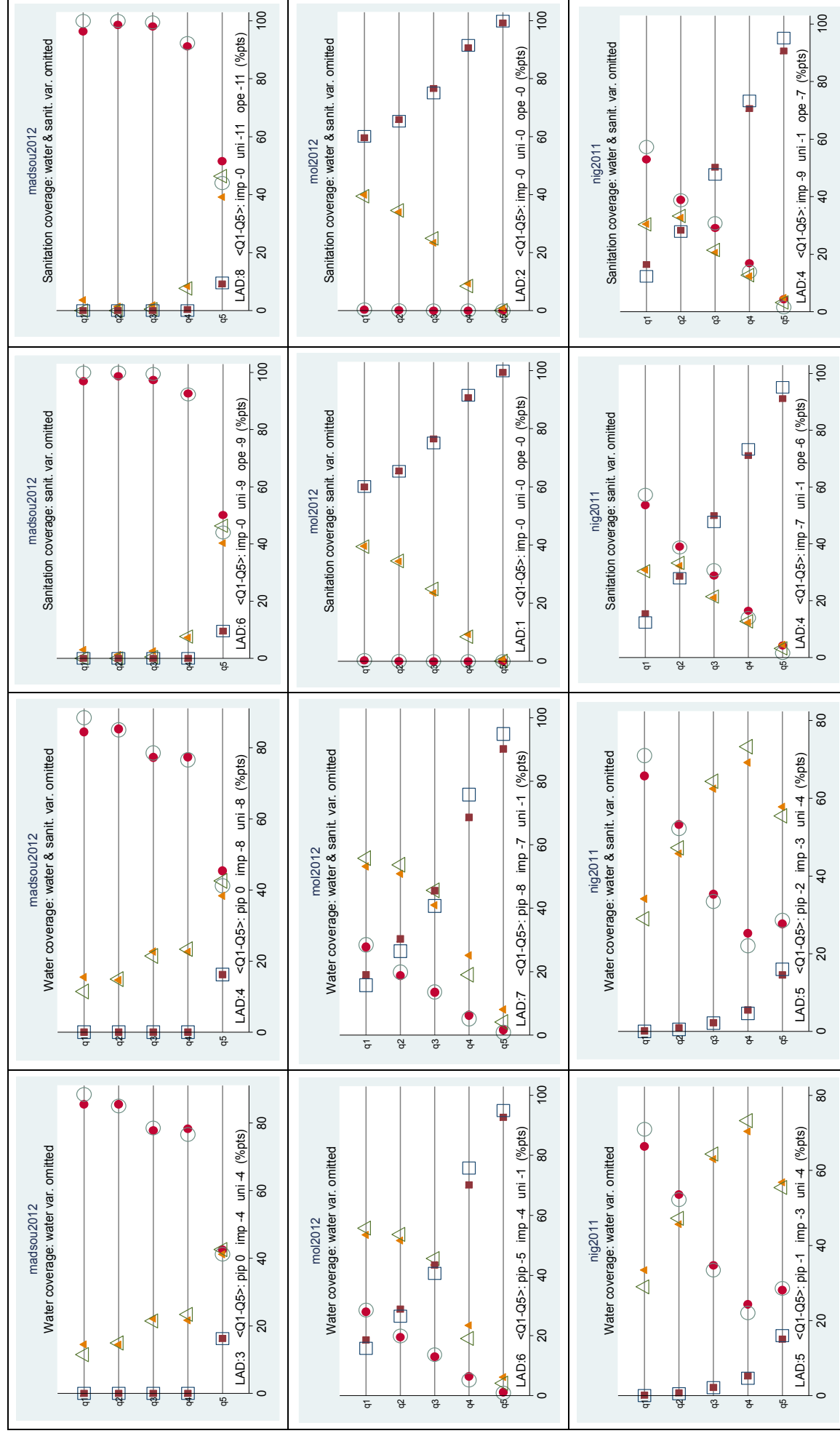
Figure 6: Changes in water/sanitation coverage by wealth quintile when water-/sanitation-related variables are omitted from the PCA (overall); 17 MICS4 datasets.

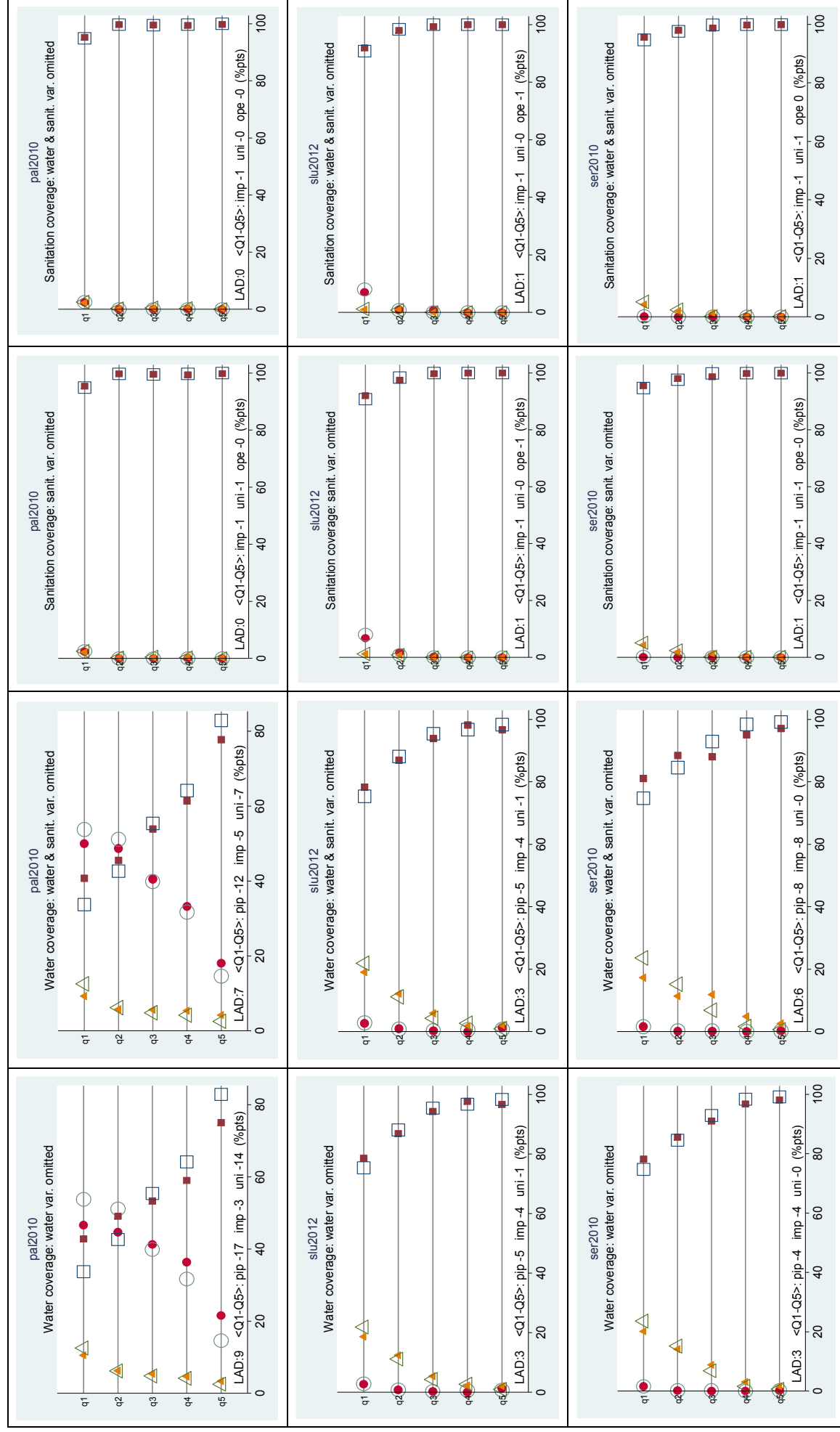
LAD: largest absolute difference between coverage estimates from the two approaches; <Q1-Q5>: change in gap from the two approaches between poorest and wealthiest; WATER coverage: piped (square), improved (triangle), unimpr. (circle); SANITATION coverage: improved (square), unimpr. (triangle), open defecation (circle); larger hollow symbols for original set of PCA variables, smaller filled symbols for restricted set of variables; see text for details

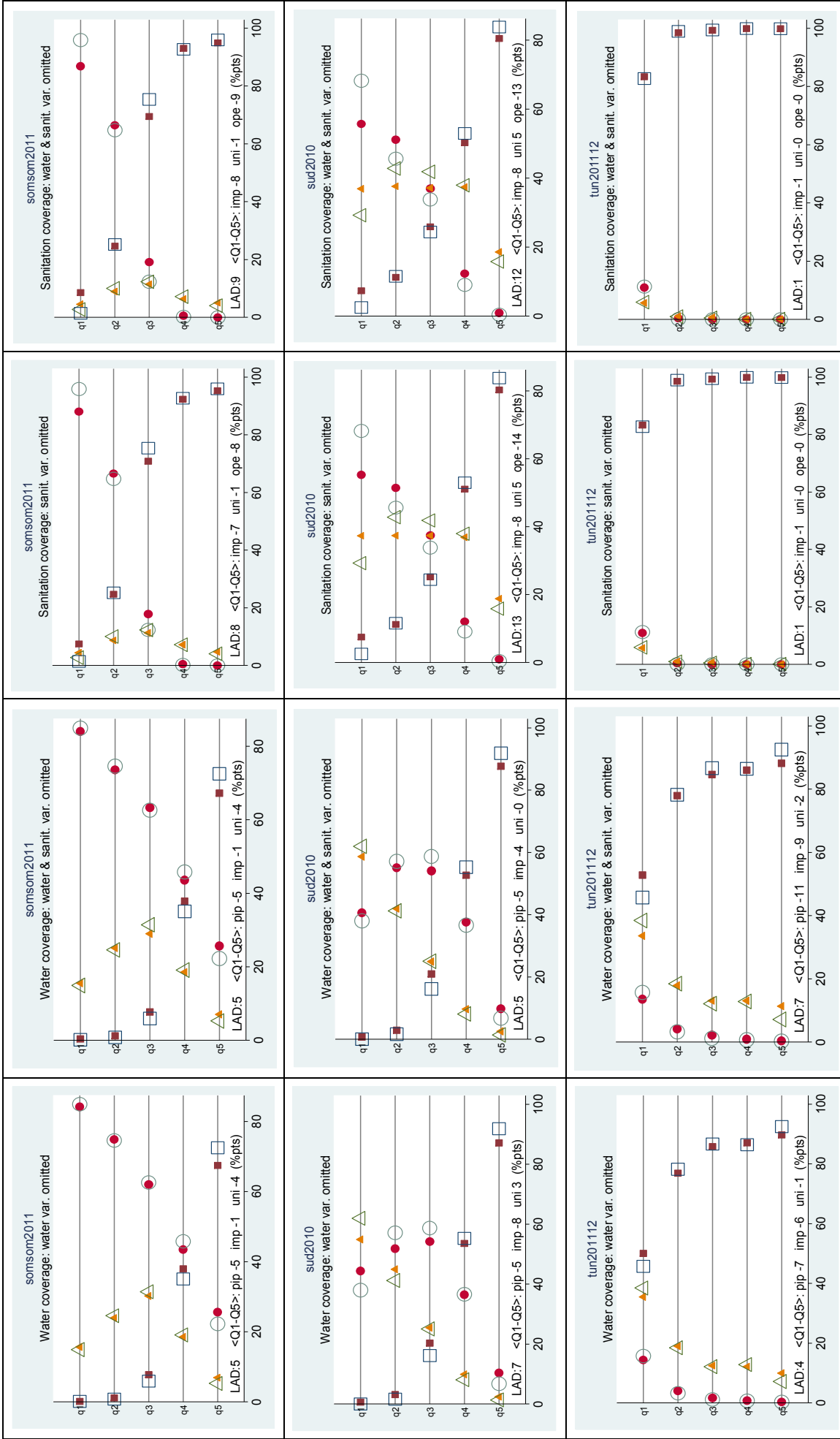


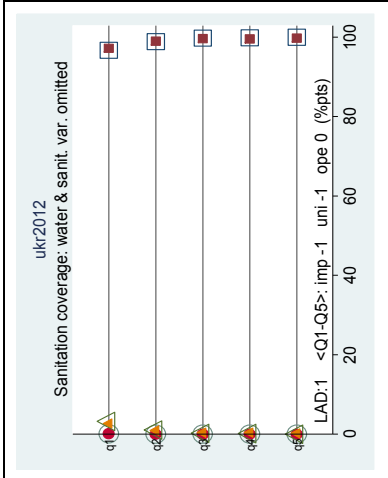
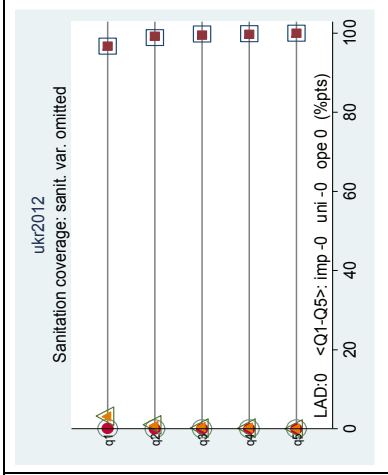
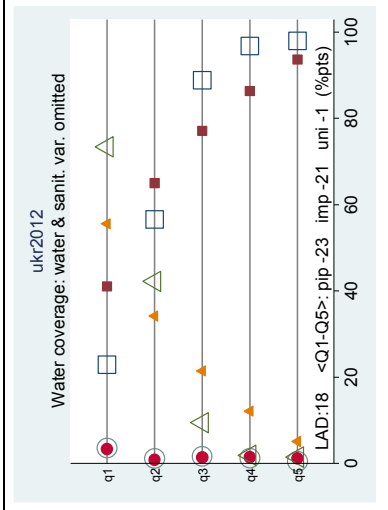
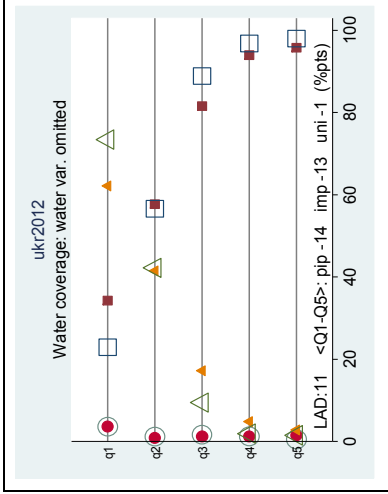








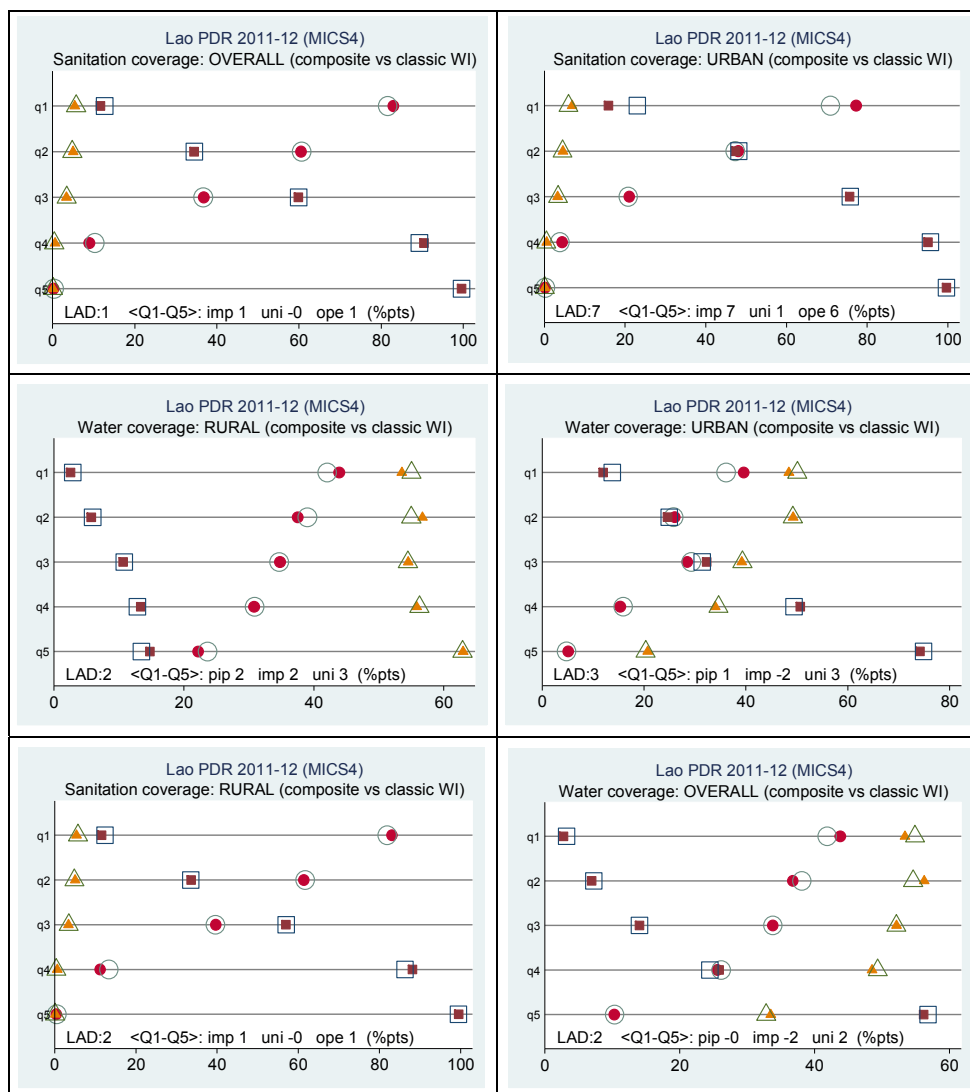




Annex E

Differences in coverage, LADs and <q1–q5> gap for Lao People’s Democratic Republic 2011–2012 datasets using a classic instead of a composite wealth index syntax

Figure 7: Differences in coverage, LADs and <Q1–Q5> gaps between a composite and classic approach to the calculation of the wealth index, by urban and rural areas, Lao People’s Democratic Republic 2011–2012 (MICS4)



Please refer to the paragraph above Figure 3 for explanations about how to read the graphs. In this case, large empty symbols are for coverage figures related to the composite wealth index approach, while the smaller filled figures are for the classic (recalculated) wealth index approach. It can be seen that the differences in coverage between the two approaches are generally small, of 3 percentage points or less, with the exception of sanitation coverage figures in urban areas, where improved sanitation facilities are 7 percentage points lower and open defecation is 6 percentage points higher in the first quintile. Further, usually small changes in the <Q1–Q5> gap are mixed and do not appear to favour either narrowing or widening.

Annex F

Changes in loadings related to removal of water- and/or sanitation-related PCA variables 5 MICS3 datasets

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.050	0.000	0.051	0.000	-
	12 Piped into yard or plot	watpyd	-0.151	0.000	-0.153	0.000	-
	13 Public tap/standpipe	watptap	-0.043	0.000	-0.045	0.000	-
	21 Tubewell/borehole	watbore	-0.146	0.000	-0.158	0.000	-
	31 Protected well	watpwell	-0.047	0.000	-0.047	0.000	-
	32 Unprotected well	watuwell	-0.055	0.000	-0.054	0.000	-
	51 Rainwater collection	watrain	-0.020	0.000	-0.020	0.000	-
	81 Surface water	watsurf	-0.084	0.000	-0.090	0.000	-
	91 Bottled water	watbott	0.186	0.000	0.193	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	0.090	0.089	0.000	0.000	-
	12 Flush to septic tank	sanfsep	0.209	0.217	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	-0.010	-0.011	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	sanvip	-0.102	-0.104	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	-0.176	-0.180	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	-0.051	-0.050	0.000	0.000	-
	41 Bucket	sanbuck	-0.025	-0.027	0.000	0.000	-
	95 No facilities or bush or field	sannone	-0.161	-0.170	0.000	0.000	-
	Persons per room	persroom	-0.175	-0.184	-0.183	-0.192	1.10
Floor	11 Earth/sand	flres	-0.226	-0.240	-0.245	-0.261	1.16
	21 Wood planks	flrwd	-0.036	-0.038	-0.042	-0.044	1.21
	23 Plywood	flrply	0.000	-0.002	0.001	0.000	0.00
	31 Parquet or polished wood	flrpq	0.013	0.013	0.009	0.008	0.64
	32 Marley/linoleum	flrvl	0.041	0.045	0.050	0.054	1.31
	33 Ceramic tiles	flrcer	0.148	0.154	0.156	0.160	1.08
	34 Cement	flrcem	-0.083	-0.084	-0.087	-0.088	1.06
	35 Carpet	flrcpt	0.053	0.054	0.054	0.055	1.05
Roof	12 Thatch/palm leaf	rooflf	-0.227	-0.240	-0.246	-0.260	1.14
	24 Rubber rye	roofrub	-0.032	-0.036	-0.033	-0.037	1.15
	31 Sheet Metal/corrugated zinc	roofmetl	0.096	0.104	0.109	0.119	1.23
	35 Cement	roofcem	0.049	0.049	0.047	0.046	0.94
	36 Roofing shingles	roofshng	0.011	0.012	0.009	0.009	0.83
Walls	11 No walls	wallno	-0.037	-0.038	-0.038	-0.040	1.08
	12 Cane/palm/trunks	wallcane	-0.043	-0.048	-0.042	-0.047	1.08
	24 Plywood	wallply	-0.007	-0.010	-0.010	-0.014	1.90
	26 Reused wood	wallre	-0.073	-0.077	-0.076	-0.080	1.09

Fuel	31 Cement	wallcem	0.138	0.146	0.139	0.147	1.07
	32 Stone with lime/cement	wallstn	-0.015	-0.014	-0.015	-0.015	1.04
	34 Cement blocks	wallblk	0.050	0.050	0.057	0.056	1.12
	36 Wood planks/shingles	wallplnk	-0.122	-0.125	-0.129	-0.131	1.08
	37 Wood & concrete	wallwc	0.031	0.033	0.033	0.035	1.13
	38 Stucco	wallstu	-0.069	-0.074	-0.067	-0.072	1.05
	1 Electricity	fuelelec	0.017	0.014	0.015	0.012	0.70
	2 Butane	fuelpg	0.274	0.288	0.293	0.308	1.13
	5 Kerosene	fuelker	-0.055	-0.058	-0.061	-0.065	1.18
	8 Wood	fuelwood	-0.282	-0.294	-0.298	-0.311	1.10
	ELECTRICITY?	elec	0.279	0.297	0.301	0.322	1.15
	A RADIO?	radio	0.169	0.181	0.187	0.201	1.19
	A TELEVISION?	tv	0.271	0.285	0.295	0.312	1.15
	A MOBILE TELEPHONE?	mobile	0.222	0.233	0.238	0.251	1.13
	A NON-MOBILE TELEPHONE?	phone	0.191	0.199	0.197	0.205	1.07
	A REFRIGERATOR?	fridge	0.281	0.297	0.301	0.319	1.13
	A WATCH?	watch	0.101	0.109	0.112	0.122	1.21
	A BICYCLE?	bike	0.037	0.041	0.049	0.055	1.48
	A MOTORCYCLE OR SCOOTER?	moto	0.055	0.059	0.058	0.062	1.14
	AN ANIMAL-DRAWN CART?	cart	-0.047	-0.050	-0.054	-0.058	1.24
	A CAR OR TRUCK?	car	0.168	0.178	0.179	0.191	1.14
	A BOAT WITH A MOTOR?	boat	0.057	0.062	0.056	0.062	1.09

Table 31: Changes in loadings, Iraq 2006 (MICS3)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	-0.264	0.000	-0.270	0.000	-
	12 Piped into yard or plot	watpyd	0.113	0.000	0.122	0.000	-
	13 Public tap/standpipe	watptap	0.071	0.000	0.074	0.000	-
	21 Tubewell/borehole	watbore	0.037	0.000	0.038	0.000	-
	31 Protected well	watpwell	0.065	0.000	0.066	0.000	-
	32 Unprotected well	watuwell	0.051	0.000	0.052	0.000	-
	41 Protected spring	watpsprg	0.031	0.000	0.033	0.000	-
	42 Unprotected spring	watusprg	0.059	0.000	0.062	0.000	-
	51 Rainwater collection	watrain	0.037	0.000	0.036	0.000	-
	62 Tanker-truck	wattank	0.091	0.000	0.090	0.000	-
	71 Cart with small tank/drum	watcart	0.052	0.000	0.052	0.000	-
	81 Surface water	watsurf	0.177	0.000	0.175	0.000	-
	91 Bottled water	watbott	-0.030	0.000	-0.032	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	-0.092	0.094	0.000	0.000	-
	12 Flush to septic tank	sanfsep	-0.168	0.172	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	0.148	-0.155	0.000	0.000	-
	14 Flush to somewhere else	sanfelse	0.049	-0.052	0.000	0.000	-
	15 Flush to unknown place/not sure/DK where	sanfdk	0.007	-0.007	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	sanvip	0.019	-0.014	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	0.048	-0.045	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	0.110	-0.110	0.000	0.000	-
	31 Composting toilet	sancomp	0.012	-0.011	0.000	0.000	-
	95 No facilities or bush or field	sannone	0.140	-0.144	0.000	0.000	-
	Persons per room	persroom	0.092	-0.098	0.097	-0.104	-1.13
Floor	11 Earth/sand	flres	0.169	-0.181	0.173	-0.184	-1.09
	12 Dung	flrdng	0.170	-0.179	0.172	-0.179	-1.05
	21 Wood planks	flrwd	0.003	-0.002	0.002	-0.001	-0.29
	23 Reeds	flrreed	0.021	-0.022	0.021	-0.021	-1.00
	32 Vinyl or asphalt strips	flrvl	-0.007	0.006	-0.006	0.005	-0.71
	33 Ceramic tiles	flrcer	-0.259	0.278	-0.276	0.293	-1.13
	34 Cement	flrcem	0.122	-0.132	0.136	-0.146	-1.20
	35 Carpet	flrcpt	-0.003	0.005	-0.004	0.006	-2.03
Roof	12 Thatch/palm leaf	rooflf	0.086	-0.088	0.092	-0.093	-1.08
	13 Sod	roofsod	0.033	-0.036	0.033	-0.037	-1.15
	21 Rustic mat	roofmat	0.067	-0.072	0.068	-0.071	-1.05
	22 Palm/bamboo	roofbam	0.048	-0.052	0.051	-0.054	-1.12
	23 Reeds	roofreed	0.176	-0.187	0.180	-0.189	-1.07
	24 Wood planks	roofplnk	0.125	-0.130	0.133	-0.136	-1.08
	31 Metal	roofmetl	-0.053	0.051	-0.059	0.055	-1.03

Walls	32 Wood	roofwood	0.102	-0.107	0.110	-0.115	-1.13
	33 Calamine/cement fiber	rooffibr	0.020	-0.021	0.021	-0.021	-1.05
	34 Ceramic tiles	roofcer	-0.002	0.002	-0.002	0.002	-0.71
	35 Cement	roofcem	-0.181	0.195	-0.186	0.200	-1.11
	36 Roofing shingles	roofshng	0.016	-0.016	0.019	-0.019	-1.20
	11 No walls	wallno	0.017	-0.017	0.016	-0.015	-0.85
	12 Cane/palm/trunks	wallcane	0.017	-0.018	0.017	-0.017	-1.02
	13 Dirt	walldirt	0.192	-0.203	0.197	-0.207	-1.08
	21 Bambo with mud	wallbam	0.020	-0.021	0.020	-0.021	-1.05
	22 Stone with mud	wallmud	0.083	-0.089	0.087	-0.092	-1.11
	23 Uncovered adobe	wallunad	0.090	-0.092	0.094	-0.095	-1.05
	24 Plywood	wallply	0.001	0.003	0.002	0.002	1.71
	31 Cement	wallcem	-0.001	-0.003	-0.002	-0.002	3.29
	32 Stone with lime/cement	wallstn	-0.011	0.009	-0.005	0.002	-0.14
	33 Bricks	wallbrk	-0.197	0.207	-0.207	0.216	-1.10
	34 Cement blocks	wallblk	0.038	-0.039	0.039	-0.040	-1.06
Fuel	35 Covered adobe	walladob	0.104	-0.108	0.109	-0.112	-1.08
	36 Wood planks/shingles	wallplnk	-0.001	0.001	-0.001	0.002	-1.89
	37 Chinku tin	wallchi	-0.005	0.005	-0.005	0.004	-0.70
	1 Electricity	fuelElec	-0.001	0.000	0.001	-0.001	2.00
	2 Liquid propane gas (LPG)	fuelpg	-0.249	0.269	-0.264	0.284	-1.14
	5 Kerosene	fuelker	0.141	-0.156	0.154	-0.171	-1.22
	6 Coal/lignite	fuelcoal	0.026	-0.027	0.027	-0.027	-1.05
	8 Wood	fuelwood	0.129	-0.135	0.136	-0.141	-1.10
	9 Straw/shrubs/grass	fuelstrw	0.133	-0.142	0.135	-0.143	-1.07
	10 Animal dung	fueldung	0.087	-0.092	0.087	-0.090	-1.03
	11 Agricultural crop residue	fuelagre	0.034	-0.037	0.037	-0.040	-1.16
	Electricity	elec	-0.135	0.142	-0.141	0.147	-1.09
	Electric network	elecn	-0.141	0.141	-0.140	0.137	-0.97
	Generator	elecgc	-0.105	0.128	-0.121	0.148	-1.42
	A radio?	radio	-0.138	0.159	-0.150	0.175	-1.27
	A television?	tv	-0.156	0.182	-0.171	0.200	-1.28
	A mobile telephone?	mobile	-0.189	0.214	-0.200	0.227	-1.20
	A non-mobile telephone?	phone	-0.175	0.189	-0.184	0.199	-1.14
	A satellite dish?	dish	-0.208	0.236	-0.227	0.259	-1.24
	A refrigerator?	fridge	-0.210	0.237	-0.225	0.254	-1.21
	A watch?	watch	-0.120	0.140	-0.129	0.152	-1.27
	A bicycle?	bike	-0.069	0.081	-0.074	0.086	-1.24
	A car or truck?	car	-0.096	0.120	-0.106	0.134	-1.40

This is an example of what is sometimes referred to as ‘sign switching’ in PCA. The first PC does not always point in the direction of ‘wealth’, although this is the most usual configuration. It may in some cases point towards ‘poverty’. Here, when all variables are included in the PCA, the first PC points towards

poverty, as can be recognized by largely negative loadings assigned to wealthy characteristics (e.g., floor with ceramic tiles) and largely positive loadings assigned to poor characteristics (e.g., earthen floor). In order to get the usual distribution of the quintiles, the analyst can either switch all the signs before assigning the quintiles, or else recode quintiles 1 to 5 in the opposite order. What is interesting in the case of the Iraq 2006 dataset is that when water-related variables are omitted from the PCA, the first PC assumes the usual direction (i.e., it points towards wealth); the same applies when both water- and sanitation-related variables are omitted. Sign switching is evident in this case when all variables are included, as well as when sanitation-related variables are omitted. This further supports the recommendation of having a close look at the PCA before producing the results.

Table 32: Changes in loadings, Lao People's Democratic Republic 2006 (MICS3)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	watpdw	0.088	0.000	0.090	0.000	-
	12 Piped into yard or plot	watpyd	0.001	0.000	-0.001	0.000	-
	13 Public tap/standpipe	watptap	-0.058	0.000	-0.065	0.000	-
	21 Tubewell/borehole	watbore	-0.024	0.000	-0.021	0.000	-
	31 Protected well	watpwell	0.013	0.000	0.013	0.000	-
	32 Unprotected well	watuwell	-0.031	0.000	-0.031	0.000	-
	41 Protected spring	watpsprg	-0.061	0.000	-0.065	0.000	-
	42 Unprotected spring	watusprg	-0.049	0.000	-0.049	0.000	-
	51 Rainwater collection	watrain	0.010	0.000	0.009	0.000	-
	81 Surface water	watsurf	-0.082	0.000	-0.082	0.000	-
	91 Bottled water	watbott	0.201	0.000	0.207	0.000	-
Sanitation	11 Flush to piped sewer system	sanfsew	0.071	0.072	0.000	0.000	-
	12 Flush to septic tank	sanfsep	0.165	0.169	0.000	0.000	-
	13 Flush to pit (latrine)	sanfpit	0.080	0.083	0.000	0.000	-
	14 Flush to somewhere else	sanfelse	0.003	0.004	0.000	0.000	-
	22 Pit latrine with slab	sanpitsl	-0.018	-0.018	0.000	0.000	-
	23 Pit latrine without slab/open pit	sanpit	-0.036	-0.037	0.000	0.000	-
	51 Hanging toilet/hanging latrine	sanhang	-0.009	-0.009	0.000	0.000	-
	95 No facilities or bush or field	sannone	-0.181	-0.187	0.000	0.000	-
Floor	Persons per room	persroom	-0.110	-0.115	-0.114	-0.119	1.08
	11 Earth/sand	flres	-0.068	-0.071	-0.070	-0.073	1.07
	12 Dung	flrdng	-0.009	-0.009	-0.010	-0.010	1.12
	21 Wood planks	flrwd	-0.057	-0.057	-0.056	-0.055	0.97
	22 Palm/bamboo	flrbam	-0.114	-0.120	-0.121	-0.127	1.11
	31 Parquet or polished wood	flrpq	0.026	0.027	0.027	0.028	1.08
	32 Vinyl or asphalt strips	flrvl	0.073	0.075	0.075	0.076	1.04
	33 Ceramic tiles	flrcer	0.153	0.159	0.159	0.165	1.08
	34 Cement	flrcem	0.130	0.133	0.133	0.136	1.05
	36 Mat	flrmat	-0.011	-0.012	-0.014	-0.015	1.29
Roof	12 Thatch/palm leaf	rooflf	-0.140	-0.147	-0.147	-0.155	1.11
	22 Palm/bamboo	roofbam	-0.054	-0.056	-0.059	-0.063	1.17
	23 Wood Planks	roofplnk	-0.027	-0.028	-0.028	-0.029	1.09
	31 Metal	roofmetl	0.056	0.059	0.062	0.066	1.18
	33 Calamine/cement fiber	rooffibr	0.122	0.127	0.125	0.131	1.07
	34 Ceramic tiles	roofcer	0.054	0.056	0.056	0.059	1.09
	35 Cement	roofcem	0.040	0.042	0.042	0.043	1.08
Walls	11 No walls	wallno	-0.010	-0.011	-0.010	-0.011	1.02
	14 Bamboo with dry leaf	wallbaml	-0.071	-0.075	-0.073	-0.076	1.06
	15 Bamboo lattice	walllat	-0.127	-0.134	-0.135	-0.143	1.13

Fuel	21 Bambo with mud/dirt	wallbam	-0.011	-0.011	-0.012	-0.012	1.13
	24 Plywood	wallply	0.002	0.002	0.002	0.002	0.78
	26 Reused wood	wallre	0.002	0.003	0.003	0.004	2.35
	31 Cement	wallcem	0.205	0.212	0.213	0.220	1.07
	33 Bricks	wallbrk	0.066	0.068	0.066	0.068	1.02
	34 Cement blocks	wallblk	0.032	0.033	0.033	0.034	1.04
	36 Wood planks/shingles	wallplnk	-0.010	-0.007	-0.007	-0.003	0.32
	1 Electricity	fuelelec	0.066	0.067	0.068	0.068	1.04
	2 Liquid propane gas (LPG)	fuellpg	0.066	0.069	0.070	0.073	1.10
	3 Natural gas	fuelgas	0.040	0.042	0.042	0.044	1.09
	6 Coal/lignite	fuelcoal	0.152	0.156	0.162	0.166	1.10
	7 Charcoal	fuelchar	0.033	0.034	0.034	0.036	1.11
	8 Wood	fuelwood	-0.186	-0.191	-0.197	-0.203	1.09
	9 Straw/shrubs/grass	fuelstrw	0.013	0.013	0.013	0.013	1.02
	Electricity?	elec	0.206	0.214	0.214	0.222	1.08
	A clock?	clock	0.188	0.195	0.195	0.203	1.08
	A radio/cassette?	radio	0.036	0.040	0.037	0.040	1.11
	A fan?	fan	0.240	0.248	0.249	0.257	1.07
	A mattress?	mat	0.085	0.089	0.088	0.092	1.09
	A TV?	tv	0.219	0.228	0.229	0.238	1.09
	A CD/VCR player?	dvd	0.229	0.238	0.238	0.248	1.08
	A water pump?	pump	0.139	0.144	0.143	0.148	1.06
	A bed?	bed	0.183	0.189	0.189	0.194	1.06
	A satellite disk/receiver?	dish	0.118	0.124	0.122	0.128	1.08
	A mobile telephone?	mobile	0.241	0.248	0.249	0.256	1.06
	A refrigerator?	fridge	0.252	0.259	0.260	0.268	1.06
	An air-conditioner?	aco	0.119	0.124	0.125	0.130	1.09
	A washing machine?	wm	0.160	0.166	0.167	0.173	1.08
	A sofa?	sofa	0.187	0.192	0.193	0.200	1.07
	A watch?	watch	0.113	0.119	0.117	0.123	1.08
	A bicycle?	bike	0.095	0.100	0.101	0.107	1.12
	A motorcycle or scooter?	moto	0.214	0.222	0.223	0.232	1.08
	An animal-drawn cart?	cart	0.023	0.024	0.024	0.025	1.09
	A car or truck?	car	0.141	0.146	0.147	0.152	1.08
	A boat with a motor?	boat	0.016	0.019	0.017	0.020	1.28
	A tuktuk or tak tak?	tuk	0.037	0.042	0.041	0.045	1.21

Table 33: Changes in loadings, Nigeria 2007 (MICS3)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11. Piped into dwelling	watpdw	0.080	0.000	0.080	0.000	-
	12. Piped into yard or plot	watpyd	0.063	0.000	0.064	0.000	-
	13. Public tap/standpipe	watptap	0.061	0.000	0.063	0.000	-
	21. Tubewell/borehole	watbore	0.079	0.000	0.081	0.000	-
	31. Protected well	watpwell	0.010	0.000	0.011	0.000	-
	32. Unprotected well	watuwell	-0.117	0.000	-0.122	0.000	-
	41. Protected spring	watpsprg	-0.004	0.000	-0.004	0.000	-
	42. Unprotected spring	watusprg	-0.027	0.000	-0.027	0.000	-
	51. Rainwater collection	watrain	0.005	0.000	0.005	0.000	-
	61. Tanker-truck	wattank	0.035	0.000	0.035	0.000	-
	71. Cart with small tank/drum	watcart	0.014	0.000	0.015	0.000	-
	81. Surface water(iver, stream,dam etc)	watsurf	-0.081	0.000	-0.082	0.000	-
	91. Bottled water	watbott	0.029	0.000	0.029	0.000	-
Sanitation	11. Flush to piped sewer system	sanfsew	0.116	0.118	0.000	0.000	-
	12. Flush to septic tank	sanfsep	0.135	0.138	0.000	0.000	-
	13. Flush to pit (latrine)	sanfpit	0.059	0.059	0.000	0.000	-
	14. Flush to somewhere else	sanfelse	0.002	0.002	0.000	0.000	-
	15. Flush to unknown place/not sure/DK	sanfdk	0.001	0.001	0.000	0.000	-
	21. Ventilated improved pit latrine (VIP)	sanvip	0.022	0.022	0.000	0.000	-
	22. Pit latrine with slab	sanpitsl	0.041	0.041	0.000	0.000	-
	23. Pit latrine without slab/open pit	sanpit	-0.086	-0.088	0.000	0.000	-
	31. Composting toilet	sancomp	-0.003	-0.003	0.000	0.000	-
	51. Hanging toilet/hanging latrine	sanhang	-0.003	-0.003	0.000	0.000	-
Floor	95. No facilities or bush or field	sannone	-0.100	-0.101	0.000	0.000	-
	Persons per room	persroom	0.000	0.000	0.001	0.001	-
	11 Earth/sand	flres	-0.211	-0.215	-0.219	-0.223	1.06
	12 Dung	flrdng	-0.034	-0.035	-0.035	-0.036	1.05
	21 Wood planks	flrwd	-0.007	-0.007	-0.007	-0.007	1.06
	22 Palm/bamboo	flrbam	-0.016	-0.016	-0.017	-0.017	1.05
	31 Parquet or polished wood	flrpq	0.002	0.002	0.001	0.001	0.67
	33 Ceramic tiles	flrcer	0.056	0.058	0.056	0.058	1.03
	34 Cement	flrcem	0.170	0.173	0.178	0.181	1.07
	35 Carpet	flrcpt	0.100	0.103	0.100	0.102	1.02
Roof	11 No roof	roofno	-0.013	-0.013	-0.013	-0.013	1.06
	12 Thatch/palm leaf	rooflf	-0.159	-0.161	-0.166	-0.168	1.06
	13 Sod	roofsd	-0.047	-0.048	-0.048	-0.049	1.04
	21 Rustic mat	roofmat	-0.024	-0.024	-0.025	-0.025	1.07
	22 Palm/bamboo	roofbam	-0.031	-0.032	-0.033	-0.034	1.08
	23 Wood planks	roofplnk	-0.030	-0.030	-0.030	-0.031	1.04
	24 Plastic sheeting	roofplas	-0.005	-0.005	-0.005	-0.006	1.08

Walls	31 Iron sheets/zinc	roofmetl	0.174	0.177	0.182	0.185	1.06
	32 Wood	roofwood	-0.012	-0.012	-0.013	-0.013	1.05
	33 Calamine/cement fiber	rooffibr	0.021	0.021	0.020	0.021	1.00
	34 Ceramic tiles	roofcer	0.014	0.014	0.014	0.014	1.01
	35 Cement	roofcem	0.030	0.030	0.030	0.031	1.01
	36 Roofing shingles	roofshng	0.004	0.004	0.005	0.004	0.96
	11 No walls	wallno	-0.040	-0.040	-0.041	-0.041	1.04
	12 Cane/palm/trunks	wallcane	-0.049	-0.050	-0.051	-0.052	1.05
	13 Dirt	walldirt	-0.039	-0.040	-0.041	-0.041	1.05
	21 Bambo with mud	wallbam	-0.061	-0.062	-0.063	-0.064	1.04
	22 Stone with mud	wallmud	-0.109	-0.111	-0.112	-0.114	1.05
	23 Uncovered adobe	wallunad	-0.033	-0.032	-0.034	-0.034	1.03
	24 Plywood	wallply	-0.001	-0.002	-0.002	-0.002	1.21
	26 Reused wood	wallre	-0.003	-0.004	-0.004	-0.004	1.24
	31 Cement	wallcem	0.147	0.149	0.153	0.154	1.05
Fuel	32 Stone with lime/cement	wallstn	0.002	0.002	0.002	0.002	0.75
	33 Bricks	wallbrk	-0.051	-0.051	-0.052	-0.053	1.04
	34 Cement blocks	wallblk	0.129	0.132	0.132	0.135	1.04
	35 Covered adobe	walladob	-0.015	-0.016	-0.016	-0.017	1.19
	36 Wood planks/shingles	wallplnk	-0.005	-0.004	-0.005	-0.004	0.89
	1 Electricity	fuelelec	0.036	0.036	0.036	0.036	0.99
	2 Liquid propane gas (LPG)	fuellpg	0.045	0.047	0.045	0.047	1.03
	3 Natural gas	fuelgas	0.047	0.048	0.047	0.048	1.04
	4 Biogas	fuelbio	0.027	0.028	0.027	0.029	1.05
	5 Kerosene	fuelker	0.193	0.196	0.195	0.198	1.03
	6 Coal/lignite	fuelcoal	0.007	0.007	0.007	0.007	1.00
	7 Charcoal	fuelchar	0.033	0.032	0.035	0.034	1.04
	8 Wood	fuelwood	-0.178	-0.180	-0.180	-0.182	1.02
	9 Straw/shrubs/grass	fuelstrw	-0.032	-0.031	-0.032	-0.032	1.01
	10 Animal dung	fueldung	-0.023	-0.023	-0.023	-0.024	1.07
	11 Agricultural crop residue	fuelagre	-0.026	-0.027	-0.026	-0.027	1.04
	Electricity	elec	0.238	0.240	0.244	0.247	1.04
	Radio	radio	0.120	0.125	0.127	0.132	1.10
	Television	tv	0.266	0.272	0.274	0.281	1.06
	VCR/VCD	vcr	0.244	0.251	0.252	0.259	1.06
	DVD	dvd	0.150	0.155	0.154	0.159	1.06
	Mobile telephone	mobile	0.245	0.251	0.252	0.258	1.05
	Land line telephone	phone	0.077	0.080	0.079	0.082	1.06
	Sewing Machine	sew	0.104	0.108	0.108	0.113	1.08
	Refrigerator	fridge	0.215	0.221	0.219	0.225	1.05
	Water Pump	pump	0.091	0.093	0.093	0.094	1.04
	Clock	clock	0.199	0.205	0.207	0.213	1.07
	Generator	gen	0.159	0.166	0.164	0.171	1.08

Computer	comp	0.100	0.103	0.101	0.105	1.05
Fan	fan	0.265	0.271	0.272	0.278	1.05
Air conditioner	aco	0.107	0.110	0.108	0.112	1.05
Blender/Mixer/food processor	mix	0.159	0.164	0.161	0.167	1.05
water heater	heat	0.187	0.192	0.191	0.197	1.05
Watch	watch	0.123	0.127	0.129	0.133	1.09
Motorcycle/scooter	moto	0.062	0.065	0.067	0.071	1.15
Car/truck	car	0.138	0.143	0.141	0.145	1.05
Engine boat with motor	boat	0.013	0.014	0.013	0.015	1.14

Table 34: Changes in loadings, Ukraine 2005 (MICS3)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11. Piped into dwelling	watpdw	-0.306	0.000	-0.332	0.000	-
	12. Piped into yard or plot	watpyd	0.107	0.000	0.115	0.000	-
	13. Public tap/standpipe	watptap	0.053	0.000	0.055	0.000	-
	21. Tubewell/borehole	watbore	0.059	0.000	0.066	0.000	-
	31. Protected well	watpwell	0.264	0.000	0.286	0.000	-
	32. Unprotected well	watuwell	0.039	0.000	0.044	0.000	-
	41. Protected spring	watpsprg	-0.005	0.000	-0.006	0.000	-
	61. Tanker-truck	wattank	-0.025	0.000	-0.025	0.000	-
	91. Bottled water	watbott	-0.032	0.000	-0.035	0.000	-
Sanitation	11. Flush to piped sewer system	sanfsew	-0.340	-0.364	0.000	0.000	-
	12. Flush to septic tank	sanfsep	0.016	0.027	0.000	0.000	-
	13. Flush to pit (latrine)	sanfpit	0.050	0.063	0.000	0.000	-
	21. Ventilated improved pit latrine (VIP)	sanvip	0.056	0.059	0.000	0.000	-
	22. Pit latrine with slab	sanpitsl	0.282	0.300	0.000	0.000	-
	23. Pit latrine without slab/open pit	sanpit	0.062	0.065	0.000	0.000	-
	31. Composting toilet	sancomp	0.035	0.030	0.000	0.000	-
	41. Bucket	sanbuck	0.074	0.076	0.000	0.000	-
	Persons per room	persroom	-0.027	-0.031	-0.030	-0.035	1.31
Floor	11 Earth/sand	flres	0.023	0.025	0.026	0.028	1.22
	12 Dung	flrdng	0.025	0.027	0.029	0.033	1.33
	21 Wood planks	flrwd	0.288	0.321	0.324	0.364	1.27
	31 Parquet or polished wood	flrpq	-0.127	-0.139	-0.143	-0.155	1.22
	32 Vinyl or asphalt strips	flrvl	-0.008	-0.010	-0.010	-0.013	1.66
	33 Ceramic tiles	flrcer	0.007	0.010	0.008	0.012	1.66
	34 Cement	flrcem	-0.007	-0.010	-0.008	-0.013	1.83
	35 Linoleum	flrcpt	-0.199	-0.224	-0.224	-0.255	1.28
Roof	12 Thatch/palm leaf	rooflf	0.025	0.028	0.030	0.034	1.37
	23 Wood planks	roofplnk	0.014	0.016	0.018	0.020	1.43
	31 Metal	roofmetl	0.098	0.103	0.105	0.107	1.09
	32 Wood	roofwood	0.025	0.027	0.030	0.031	1.24
	33 Calamine/cement fiber	rooffibr	0.244	0.276	0.278	0.320	1.31
	34 Ceramic tiles	roofcer	0.030	0.033	0.031	0.032	1.05
	35 Cement	roofcem	-0.301	-0.337	-0.341	-0.383	1.27
Walls	22 Stone with mud	wallmud	0.083	0.091	0.092	0.101	1.23
	23 Uncovered adobe	wallunad	0.055	0.059	0.059	0.060	1.09
	26 Reused wood	wallre	0.124	0.135	0.140	0.151	1.22
	31 Cement	wallcem	-0.093	-0.106	-0.104	-0.121	1.30
	32 Stone with lime/cement	wallstn	0.058	0.074	0.069	0.092	1.60
	33 Bricks	wallbrk	0.023	0.030	0.029	0.042	1.85

Fuel	34 Cement blocks	wallblk	-0.179	-0.206	-0.207	-0.245	1.37
	35 Covered adobe	walladob	0.071	0.077	0.080	0.086	1.22
	36 Wood planks/shingles	wallplnk	0.102	0.113	0.118	0.132	1.30
	1 Electricity	fuelElec	-0.034	-0.041	-0.032	-0.039	1.15
	2 Liquid propane gas (LPG)	fuelpg	0.125	0.141	0.142	0.161	1.28
	3 Natural gas	fuelgas	-0.212	-0.236	-0.246	-0.276	1.30
	6 Coal/lignite	fuelcoal	0.072	0.083	0.080	0.095	1.33
	7 Charcoal	fuelchar	0.024	0.025	0.026	0.025	1.03
	8 Wood	fuelwood	0.190	0.210	0.220	0.244	1.29
	Electricity	elec	-0.017	-0.021	-0.022	-0.027	1.58
	Radio	radio	-0.024	-0.027	-0.030	-0.035	1.47
	Television	tv	-0.047	-0.056	-0.059	-0.073	1.57
	Mobile telephone	mobile	-0.134	-0.149	-0.154	-0.173	1.30
	Land line telephone	phone	-0.177	-0.198	-0.202	-0.227	1.28
	Refrigerator	fridge	-0.094	-0.108	-0.112	-0.131	1.38
	Watch	watch	-0.036	-0.041	-0.043	-0.052	1.47
	Bicycle	bike	0.123	0.139	0.138	0.156	1.27
	Motorcycle/scooter	moto	0.122	0.137	0.139	0.157	1.29
	Animal-drawn cart	cart	0.139	0.153	0.160	0.178	1.28
	Car/Truck	car	-0.030	-0.034	-0.038	-0.045	1.50
	Engine boat with motor	boat	-0.020	-0.022	-0.021	-0.024	1.23

This is an another example of sign switching as described below Table 2, except that in this case all four variants of the PCA are affected.

Annex G

Changes in loadings related to removal of water- and/or sanitation-related PCA variables - 5 DHS datasets

Table 35: Changes in loadings, Brazil 1996 (DHS-III)			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into residence	h2oires	0.247	0.000	0.257	0.000	-
	12 Piped in yard /plot	h2oores	-0.093	0.000	-0.100	0.000	-
	21 Well/spring inside	h2oiwell	-0.122	0.000	-0.125	0.000	-
	22 Well/spring outside	h2oowell	-0.158	0.000	-0.166	0.000	-
	61 Bottled water	h2obtl	0.066	0.000	0.074	0.000	-
	96 Other	h2ooth	-0.121	0.000	-0.127	0.000	-
Sanitation	11 Toilet to sewer	fsewer	0.233	0.238	0.000	0.000	-
	12 Toilet to open space	fopnsewr	-0.045	-0.048	0.000	0.000	-
	13 Toilet to river/lake	friver	-0.009	-0.005	0.000	0.000	-
	21 Latrine to sewer	latsewr	0.071	0.071	0.000	0.000	-
	22 Latrine no-connected	latnsewr	0.011	0.015	0.000	0.000	-
	23 Traditional latrine	latpit	-0.086	-0.088	0.000	0.000	-
	31 No facility	latbush	-0.283	-0.292	0.000	0.000	-
	96 Other	latother	-0.010	-0.011	0.000	0.000	-
Assets	electricity	hv206	0.253	0.261	0.268	0.270	1.07
	radio	hv207	0.166	0.182	0.184	0.201	1.21
	television	hv208	0.310	0.333	0.336	0.360	1.16
	refrigerator	hv209	0.317	0.337	0.342	0.361	1.14
	car	hv212	0.221	0.249	0.248	0.281	1.27
	Persons per room	memsleep	-0.113	-0.129	-0.128	-0.147	1.30
Floor	11 Earth/sand	dirtfloo	-0.225	-0.238	-0.238	-0.247	1.10
	21 Wood planks	woodfloo	0.002	0.003	-0.001	0.001	0.39
	31 Polished wood	parqfloo	0.084	0.093	0.089	0.099	1.18
	32 Vinyl	vinfloo	0.031	0.035	0.034	0.038	1.22
	33 Ceramic tiles	tilefloo	0.222	0.244	0.249	0.275	1.24
	34 Cement	cemtfloo	-0.164	-0.186	-0.186	-0.215	1.31
	35 Carpet	carpfloo	0.077	0.085	0.084	0.093	1.20
	96 Other	othfloo	-0.019	-0.017	-0.018	-0.014	0.74
Walls	11 Palm, straw	natwall	-0.062	-0.066	-0.068	-0.071	1.13
	21 Mud unpolished	mudwall	-0.206	-0.220	-0.223	-0.235	1.14
	22 Raw wood	woodwall	-0.083	-0.093	-0.093	-0.105	1.26
	31 Alvenaria (cement)	alvewall	0.192	0.206	0.209	0.222	1.16
	32 Polished wood	plwdwall	-0.048	-0.050	-0.052	-0.054	1.12
	96 Other	othwall	-0.010	-0.010	-0.012	-0.012	1.25
Roof	11 Palm/straw	natroof	-0.137	-0.145	-0.150	-0.155	1.13

21 Raw wood	woodroof	-0.019	-0.022	-0.020	-0.023	1.19
31 Clay tiles	tileroof	-0.210	-0.231	-0.232	-0.257	1.23
32 Concrete	cemtroof	0.263	0.287	0.288	0.314	1.19
33 Zinc	zincroof	-0.040	-0.044	-0.042	-0.047	1.19
34 Polished wood	plwdroof	0.063	0.072	0.073	0.085	1.35
35 Eternit, amianto	eterroof	-0.015	-0.015	-0.017	-0.018	1.21
96 Other	othroof	-0.022	-0.024	-0.026	-0.027	1.22

Table 36: Changes in loadings, India 1998–1999 (DHS-IV)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into residence/yard/plot	h2ores	0.176	0.000	0.180	0.000	-
	12 Public tap	h2opub	-0.026	0.000	-0.027	0.000	-
	21 Handpump in residence/yard/plot	h2orpump	-0.002	0.000	-0.001	0.000	-
	22 Public handpump	h2oppump	-0.093	0.000	-0.095	0.000	-
	23 Well in residence/yard/plot	h2orwell	0.005	0.000	0.005	0.000	-
	24 Open well	h2opwell	-0.009	0.000	-0.010	0.000	-
	25 Public covered well	h2opcw	-0.016	0.000	-0.016	0.000	-
	26 Public open well	h2opow	-0.064	0.000	-0.064	0.000	-
	31 Spring	h2osprng	-0.019	0.000	-0.020	0.000	-
	32+33+34 River, lake, dam..	h2osurf	-0.030	0.000	-0.032	0.000	-
	41 Rainwater	h2orain	0.000	0.000	0.000	0.000	-
	51 Tanker truck	h2otruck	0.000	0.000	0.000	0.000	-
	96 Other	h2ooth	-0.004	0.000	-0.004	0.000	-
Sanitation	11 Own flush toilet	fpvt	0.194	0.197	0.000	0.000	-
	12 Shared flush toilet	fshar	0.031	0.031	0.000	0.000	-
	13 Public flush toilet	fpub	0.018	0.017	0.000	0.000	-
	21 Own pit toilet/latrine	pitpvt	0.020	0.021	0.000	0.000	-
	22 Shared pit toilet/latrine	pitshar	0.001	0.001	0.000	0.000	-
	23 Public pit toilet/latrine	pitpub	-0.002	-0.002	0.000	0.000	-
	31 No facility/bush/field	latbush	-0.194	-0.197	0.000	0.000	-
	96 Other	latother	-0.005	-0.005	0.000	0.000	-
Fuel	1 Wood	cookwood	-0.165	-0.167	-0.167	-0.169	1.03
	2 Crop residues	cookdreg	-0.049	-0.050	-0.051	-0.052	1.06
	3 Dung cakes	cookdung	-0.040	-0.040	-0.040	-0.040	1.02
	4 Coal/coke/lignite	cookcoal	0.003	0.004	0.002	0.002	0.79
	5 Charcoal	cookchar	0.001	0.001	0.001	0.001	0.75
	6 Kerosene	cookkero	0.028	0.028	0.026	0.025	0.87
	7 Electricity	cookelec	0.017	0.016	0.016	0.016	0.94
	8 Liquid petroleum gas	cooklpg	0.215	0.218	0.221	0.225	1.05
	9 Bio-gas	cookbiog	0.020	0.021	0.021	0.022	1.09
	96 Other	cookoth	-0.004	-0.004	-0.004	-0.005	1.31
Type of residence	1 Pucca	hpucca	0.191	0.194	0.196	0.200	1.05
	2 Semi-Pucca	hspucca	-0.055	-0.056	-0.055	-0.055	0.99
	3 Kachha	hkachha	-0.141	-0.144	-0.148	-0.151	1.07
Kitchenware	1 Clay	claypot	-0.015	-0.015	-0.015	-0.016	1.08
	2 Aluminum	alumpot	-0.089	-0.092	-0.095	-0.098	1.10
	3 Case iron	ironpot	-0.006	-0.006	-0.006	-0.006	1.13
	4 Brass/copper	brasspot	0.001	0.001	0.001	0.000	0.00

Lighting	5 Stainless steel	sspot	0.091	0.094	0.097	0.101	1.10
	6 Other	othpot	0.002	0.002	0.002	0.002	1.13
	1 Electricity	lightele	0.192	0.197	0.202	0.207	1.08
	2 Kerosene	lightker	-0.191	-0.196	-0.201	-0.206	1.08
	3 Gas	lightgas	-0.003	-0.003	-0.003	-0.004	1.09
	4 Oil	lightoil	-0.009	-0.009	-0.009	-0.009	1.06
	6 Other	lightoth	-0.008	-0.008	-0.008	-0.009	1.10
Assets	Persons per room (any room)	memsleep	-0.098	-0.102	-0.102	-0.105	1.07
	Electricity	hv206	0.192	0.197	0.202	0.207	1.08
	Radio	hv207	0.139	0.143	0.145	0.150	1.08
	Television	hv208	0.222	0.228	0.232	0.237	1.07
	Refrigerator	hv209	0.202	0.207	0.211	0.216	1.07
	Bicycle	hv210	0.064	0.068	0.070	0.074	1.16
	Motorcycle	hv211	0.162	0.166	0.169	0.174	1.08
	Car	hv212	0.098	0.101	0.103	0.107	1.09
	Telephone	hv221	0.178	0.183	0.186	0.191	1.07
	Separate room used as a kitchen	sh36	0.132	0.135	0.137	0.140	1.07
	Household own any agricultural land?	sh43	-0.062	-0.062	-0.060	-0.060	0.96
	Acres of land under cultivation (1 decimal)	sh44	0.004	0.005	0.006	0.007	1.75
	Acres of irrigated land under cultivation (1 decimal)	sh45	0.011	0.011	0.013	0.014	1.31
	Household owns livestock	sh46	-0.089	-0.090	-0.088	-0.088	0.99
	Mattress	sh47a	0.175	0.179	0.182	0.186	1.06
	Pressure cooker	sh47b	0.218	0.222	0.225	0.229	1.05
	Chair	sh47c	0.186	0.190	0.192	0.197	1.06
	Cot or bed	sh47d	0.080	0.083	0.086	0.089	1.10
	Table	sh47e	0.189	0.194	0.196	0.201	1.06
	Clock or watch	sh47f	0.169	0.173	0.176	0.181	1.07
	Fan	sh47g	0.209	0.214	0.219	0.225	1.08
	Bicycle	sh47h	0.064	0.068	0.070	0.074	1.16
	Sewing maching	sh47j	0.161	0.165	0.170	0.174	1.08
	Telephone	sh47k	0.178	0.183	0.186	0.191	1.07
	Refrigerator	sh47l	0.202	0.207	0.211	0.216	1.07
	Television (B/W)	sh47m	0.121	0.124	0.126	0.130	1.07
	Television (colour)	sh47n	0.183	0.188	0.191	0.195	1.06
	Car	sh47p	0.098	0.101	0.103	0.107	1.09
	Water pump	sh47q	0.066	0.069	0.071	0.075	1.13
	Bullock cart	sh47r	-0.016	-0.015	-0.013	-0.012	0.76
	Thresher	sh47s	0.008	0.010	0.011	0.012	1.44
	Tractor	sh47t	0.025	0.027	0.028	0.030	1.23

Table 37: Changes in loadings, India 2005–2006 (DHS-V)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Drinking water	11 Piped into dwelling	h2oires	0.179	0.000	0.188	0.000	-
	12 Piped to yard/plot	h2oyrd	0.054	0.000	0.054	0.000	-
	13 Public tap/standpipe	h2opub	-0.044	0.000	-0.046	0.000	-
	21 Tube well or borehole	h2iotube	-0.113	0.000	-0.115	0.000	-
	31 Protected well	h2opwell	0.017	0.000	0.017	0.000	-
	32 Unprotected well	h2ouwell	-0.063	0.000	-0.066	0.000	-
	41 Protected spring	h2opspg	-0.009	0.000	-0.010	0.000	-
	42 Unprotected spring	h2ouspg	-0.031	0.000	-0.033	0.000	-
	43 River/dam/lake/ponds/stream/canal...	h2orain	0.000	0.000	-0.001	0.000	-
	51 Rainwater	h2otruck	0.013	0.000	0.013	0.000	-
	61 Tanker truck	h2ocart	-0.004	0.000	-0.004	0.000	-
	62 Cart with small tank	h2osurf	-0.029	0.000	-0.031	0.000	-
	71 Bottled water	h2obottl	0.028	0.000	0.029	0.000	-
	96 Other	h2ooth	-0.003	0.000	-0.003	0.000	-
Other water	11 Piped into dwelling	h3oires	0.181	0.000	0.190	0.000	-
	12 Piped to yard/plot	h3oyrd	0.055	0.000	0.056	0.000	-
	13 Public tap/standpipe	h3opub	-0.043	0.000	-0.046	0.000	-
	21 Tube well or borehole	h3iotube	-0.112	0.000	-0.115	0.000	-
	31 Protected well	h3opwell	0.017	0.000	0.017	0.000	-
	32 Unprotected well	h3ouwell	-0.063	0.000	-0.065	0.000	-
	41 Protected spring	h3opspg	-0.009	0.000	-0.010	0.000	-
	42 Unprotected spring	h3ouspg	-0.031	0.000	-0.033	0.000	-
	51 Rainwater	h3orain	0.000	0.000	-0.001	0.000	-
	61 Tanker truck	h3otruck	0.014	0.000	0.014	0.000	-
	62 Cart with small tank	h3ocart	-0.004	0.000	-0.004	0.000	-
	43 River/dam/lake/ponds/stream/canal...	h3osurf	-0.029	0.000	-0.031	0.000	-
	96 Other	h3ooth	-0.002	0.000	-0.003	0.000	-
Sanitation	11 Flush to piped sewer system	flush	0.138	0.135	0.000	0.000	-
	12 Flush to septic tank	septic	0.132	0.145	0.000	0.000	-
	13 Flush to pit latrine	flpit	0.002	0.005	0.000	0.000	-
	14 Flush to somewhere else	floth	0.027	0.026	0.000	0.000	-
	15 Flush, don't know where	fldk	0.003	0.003	0.000	0.000	-
	21 Ventilated improved pit latrine (VIP)	latvip	0.005	0.006	0.000	0.000	-
	22 Pit latrine with slab	latpits	-0.020	-0.018	0.000	0.000	-
	23 Pit latrine without slab/open pit	latpit	-0.037	-0.038	0.000	0.000	-
	41 Composting toilet	latcmp	-0.003	-0.003	0.000	0.000	-
	44 Dry toilet	latdry	-0.013	-0.014	0.000	0.000	-
	31 No facility/bush/field	latbush	-0.209	-0.220	0.000	0.000	-
	96 other	latoth	-0.003	-0.004	0.000	0.000	-

Floor	11 Mud/clay/earth	dirtflo	-0.168	-0.174	-0.175	-0.181	1.08
	12 Sand	sandflo	-0.028	-0.030	-0.029	-0.031	1.12
	13 Dung	dungflo	-0.099	-0.107	-0.100	-0.107	1.09
	21 Raw wood planks	woodflo	-0.009	-0.010	-0.010	-0.012	1.39
	22 Palm, bamboo	palmflo	-0.025	-0.028	-0.027	-0.031	1.25
	23 Brick	brckflo	-0.002	-0.001	-0.001	0.000	0.13
	24 Stone	stonflo	0.009	0.007	0.009	0.005	0.56
	31 Parquet, polished wood	prqflo	0.005	0.005	0.004	0.003	0.69
	32 Vinyl, asphalt strips	vinlflo	0.028	0.030	0.030	0.031	1.11
	33 Ceramic tiles	tileflo	0.092	0.094	0.097	0.098	1.07
	34 Cement	cemtflo	0.101	0.111	0.103	0.114	1.13
	35 Carpet	cptflo	0.029	0.028	0.030	0.029	1.00
	36 Polished stone/marble/granite	psflo	0.115	0.118	0.121	0.125	1.09
	96 other	othflo	-0.001	-0.002	-0.001	-0.002	2.00
Walls	11 No walls	wallless	-0.008	-0.010	-0.009	-0.010	1.23
	12 Cane/palm/trunks	natwall	-0.048	-0.050	-0.053	-0.057	1.19
	13 Mud	dirtwall	-0.150	-0.160	-0.154	-0.165	1.10
	14 Grass/reeds/thatch	thatwall	-0.036	-0.039	-0.038	-0.041	1.15
	21 Bamboo with mud	bbwall	-0.041	-0.040	-0.045	-0.044	1.08
	22 Stone with mud	stonwall	-0.039	-0.043	-0.039	-0.044	1.12
	25 Unburnt brick	adobwall	-0.024	-0.026	-0.025	-0.026	1.10
	23 Plywood	plywall	-0.002	-0.002	-0.002	-0.003	1.65
	24 Cardboard	cartwall	0.000	0.000	0.000	-0.001	7.00
	26 Raw/reused wood	rwwall	0.000	-0.001	-0.001	-0.003	7.25
	31 Cement/concrete	cmntwall	0.188	0.199	0.196	0.208	1.11
	32 Stone with lime/cement	stlmwall	0.024	0.025	0.026	0.027	1.12
	33 Burnt bricks	brkwall	-0.039	-0.040	-0.040	-0.041	1.03
	34 Cement blocks	cbwall	0.022	0.023	0.023	0.024	1.09
	35 Wood planks/shingles	wpwall	-0.003	-0.004	-0.004	-0.005	1.59
	36 Gl/metal/asbestos sheets	mtlwall	-0.005	-0.006	-0.006	-0.007	1.44
Roof	96 Other	othwall	-0.006	-0.006	-0.007	-0.008	1.36
	11 No roof	roofless	-0.008	-0.008	-0.008	-0.009	1.13
	12 Thatch/palm leaf	natroof	-0.108	-0.115	-0.113	-0.121	1.13
	13 Mud	mudroof	-0.027	-0.029	-0.028	-0.030	1.08
	14 Sod/mud and grass mixture	sodroof	-0.032	-0.034	-0.033	-0.035	1.08
	15 Plastic/polythene sheeting	plasroof	-0.020	-0.022	-0.021	-0.023	1.17
	21 Rustic mat	matroof	-0.008	-0.009	-0.008	-0.009	1.18
	22 Palm/bamboo	bbroof	-0.040	-0.043	-0.041	-0.044	1.09
	23 Raw wood planks/timber	adobroof	-0.005	-0.006	-0.005	-0.006	1.10
	24 Unburnt bricks	woodroof	-0.017	-0.017	-0.016	-0.017	1.00
	25 Loosely packed stone	stonroof	-0.023	-0.024	-0.022	-0.023	1.02
	31 Metal/Gl	mtlroof	-0.023	-0.024	-0.028	-0.030	1.28
	32 Wood	wd2roof	-0.008	-0.010	-0.008	-0.010	1.16

Fuel	33 Calamine/cement fiber	calroof	0.013	0.012	0.013	0.013	1.01
	34 Asbestos sheets	asbroof	0.008	0.007	0.006	0.004	0.43
	35 RCC/RBC/cement/concrete	cmntroof	0.184	0.197	0.194	0.208	1.13
	36 Roofing shingles	shngroof	-0.081	-0.085	-0.082	-0.085	1.05
	37 Tiles	tileroof	-0.029	-0.032	-0.030	-0.033	1.13
	38 Slate	sltroof	-0.008	-0.010	-0.008	-0.009	1.13
	39 Burnt brick	brkroof	-0.010	-0.009	-0.009	-0.008	0.81
	96 Other	othroof	-0.013	-0.014	-0.014	-0.015	1.09
	1 Electricity	cookelec	0.016	0.014	0.016	0.014	0.87
	2 LPG, natural gas	cookgas	0.239	0.249	0.247	0.258	1.08
	4 Biogas	cookbio	0.014	0.016	0.014	0.017	1.23
	5 Kerosene	cookkero	0.009	0.006	0.004	-0.001	-0.13
	6 Coal, lignite	cookcoal	-0.006	-0.004	-0.007	-0.005	0.90
	7 Charcoal	cookchar	-0.003	-0.003	-0.004	-0.004	1.47
	8 Wood	cookwood	-0.183	-0.192	-0.188	-0.197	1.08
	9 Straw/shrubs/grass	cookstrw	-0.053	-0.055	-0.055	-0.057	1.07
	10 Agricultural crop	cookcrop	-0.025	-0.025	-0.026	-0.026	1.01
	11 Animal dung	cookdung	-0.056	-0.054	-0.056	-0.053	0.94
	96 Other	cookoth	0.002	0.001	0.001	-0.001	-0.52
Assets	House ownership	ownhouse	-0.035	-0.034	-0.032	-0.030	0.86
	Persons per room	memsleep	-0.081	-0.088	-0.085	-0.093	1.15
	Electricity	hv206	0.185	0.196	0.192	0.204	1.10
	Radio	hv207	0.101	0.111	0.107	0.118	1.16
	Refrigerator	hv209	0.209	0.220	0.221	0.233	1.11
	Bicycle	hv210	0.016	0.027	0.020	0.032	1.99
	Motorcycle/scooter	hv211	0.171	0.184	0.182	0.197	1.16
	Car	hv212	0.110	0.116	0.118	0.125	1.13
	Mattress	sh47b	0.170	0.183	0.177	0.191	1.13
	Pressure cooker	sh47c	0.230	0.244	0.239	0.254	1.10
	Chair	sh47d	0.196	0.213	0.205	0.223	1.14
	Cot/bed	sh47e	0.089	0.102	0.095	0.109	1.22
	Table	sh47f	0.199	0.216	0.208	0.227	1.14
	Electric fan	sh47g	0.207	0.222	0.216	0.232	1.13
	B&W television	sh47i	0.021	0.026	0.022	0.027	1.30
	Colour television	sh47j	0.226	0.239	0.237	0.251	1.11
	Sewing machine	sh47k	0.150	0.162	0.159	0.173	1.16
	Computer	sh47n	0.115	0.121	0.123	0.129	1.12
	Water pump	sh47u	0.078	0.089	0.085	0.097	1.24
	Thresher	sh47v	0.004	0.008	0.005	0.010	2.67
	Tractor	sh47w	0.015	0.020	0.017	0.024	1.66
	Has a mobile telephone	hv243a	0.199	0.210	0.209	0.222	1.12
	Has a watch	hv243b	0.138	0.151	0.144	0.159	1.15
	Has an animal-drawn cart	hv243c	-0.019	-0.017	-0.017	-0.014	0.72

Owns land usable for agriculture	hv244	-0.080	-0.080	-0.079	-0.078	0.98
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Table 38: Changes in loadings, Nigeria 2008 (DHS-V)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	h2oires	0.075	0.000	0.075	0.000	-
	12 Piped to yard/plot	h2oyard	0.041	0.000	0.041	0.000	-
	13 Public tap/standpipe	h2opub	0.053	0.000	0.056	0.000	-
	21 Tube well or borehole	h2otube	0.085	0.000	0.086	0.000	-
	31 Protected well	h2opwell	0.015	0.000	0.018	0.000	-
	32 Unprotected well	h2upwell	-0.118	0.000	-0.125	0.000	-
	41+42 Spring	h2spring	-0.031	0.000	-0.031	0.000	-
	43 River/dam/lake/ponds/stream/canal/...	h2osurf	-0.094	0.000	-0.095	0.000	-
	51 Rainwater	h2orain	0.003	0.000	0.005	0.000	-
	61 Tanker truck	h2otk	0.036	0.000	0.037	0.000	-
	62 Cart with small tank	h2otank	-0.006	0.000	-0.006	0.000	-
	71 Bottled water	h2obottl	0.073	0.000	0.074	0.000	-
	96 Other	h2ooth	0.039	0.000	0.040	0.000	-
Sanitation	11 Flush - to piped sewer system	flushs	0.103	0.105	0.000	0.000	-
	11 Shared: Flush - to piped sewer system	shflushs	0.064	0.065	0.000	0.000	-
	12 Flush - to septic tank	flushp	0.119	0.122	0.000	0.000	-
	12 Shared: Flush - to septic tank	shflushp	0.086	0.087	0.000	0.000	-
	13+14+15 Flush - not sewer/septic	flusho	0.036	0.036	0.000	0.000	-
	13+14+15 Shared: Flush - not sewer/septic	shflusho	0.055	0.056	0.000	0.000	-
	21 Pit latrine - ventilated improved pit (VIP)	latvip	-0.047	-0.048	0.000	0.000	-
	21 Shared: Pit latrine - ventilated improved pit (VIP)	shlatvip	0.025	0.025	0.000	0.000	-
	22 Pit latrine - with slab	latpits	0.020	0.021	0.000	0.000	-
	22 Shared: Pit latrine - with slab	slatpits	0.054	0.055	0.000	0.000	-
	23 Pit latrine - without slab/open pit	latpito	-0.064	-0.066	0.000	0.000	-
	23 Shared: Pit latrine - without slab/open pit	slatpito	-0.004	-0.004	0.000	0.000	-
	31 No facility	latbush	-0.138	-0.140	0.000	0.000	-
	41+42+43+96 Other	latother	-0.003	-0.001	0.000	0.000	-
Assets	Electricity	electric	0.248	0.252	0.257	0.262	1.06
	Radio	radio	0.127	0.132	0.134	0.139	1.10
	Television	tv	0.268	0.275	0.279	0.287	1.07
	Refrigerator	fridge	0.211	0.217	0.216	0.222	1.05
	Bicycle	bicycle	-0.067	-0.067	-0.069	-0.070	1.04
	Motorcycle/scooter	motobk	0.044	0.047	0.050	0.054	1.22
	Car/truck	car	0.144	0.148	0.147	0.152	1.06
	Cooking in separate room or building	sepkitch	0.047	0.051	0.048	0.052	1.09
	Has a mobile telephone	mphone	0.245	0.252	0.255	0.263	1.08
	Has an animal-drawn cart	cart	-0.049	-0.051	-0.052	-0.054	1.10
	Has a boat with a motor	boat	0.013	0.014	0.013	0.015	1.14
	Cable TV	cabletv	0.133	0.137	0.136	0.141	1.06

Floor	Generating set	generate	0.182	0.188	0.188	0.195	1.08
	Air conditioner	freezer	0.107	0.110	0.108	0.111	1.04
	Computer	computer	0.115	0.119	0.117	0.120	1.04
	Electric iron	eleciron	0.265	0.271	0.274	0.281	1.06
	Fan	fan	0.281	0.288	0.291	0.299	1.06
	Canoe	canoe	-0.017	-0.016	-0.017	-0.015	0.88
	Persons per room	memsleep	-0.016	-0.017	-0.017	-0.018	1.10
Walls	11 Earth, sand	dirtfloo	-0.229	-0.235	-0.240	-0.247	1.08
	12 Dung	dungfloo	-0.043	-0.044	-0.045	-0.046	1.08
	21 Wood planks	woodfloo	-0.010	-0.010	-0.010	-0.011	1.16
	22 Palm, bamboo	palmfloo	-0.021	-0.023	-0.022	-0.024	1.10
	31 Parquet, polished wood	parqfloo	-0.004	-0.004	-0.005	-0.005	1.14
	33 Ceramic tiles	cerafloo	0.081	0.083	0.081	0.083	1.02
	34 Cement	cemtfloo	0.093	0.096	0.101	0.105	1.13
	35 Carpet + 32 vinyl	carpfloo	0.172	0.176	0.176	0.181	1.05
	96 Other	othfloo	-0.003	-0.003	-0.003	-0.003	1.24
	11 No walls	nowall	-0.030	-0.031	-0.031	-0.033	1.12
	12 Cane/palm/trunks	grnwall	-0.090	-0.093	-0.095	-0.098	1.09
	13 Dirt	dirtwall	-0.167	-0.170	-0.174	-0.178	1.07
	21 Bamboo with mud	bamwall	-0.055	-0.057	-0.057	-0.059	1.06
	22 Stone with mud	stnwall	-0.050	-0.051	-0.052	-0.053	1.06
	23+24+25 Unc. adobe/plyw./cardb.	rwdwall	-0.006	-0.007	-0.006	-0.007	1.15
	31 Cement	cmtwall	0.192	0.197	0.201	0.206	1.07
	32 Stone with lime/cement	stncwall	0.008	0.009	0.009	0.010	1.14
	33 Bricks	brckwall	-0.025	-0.025	-0.025	-0.025	1.00
	34 Cement blocks	blckwall	0.101	0.103	0.106	0.107	1.07
Roof	35+36 Covered adobe/wood pl.	cadbwall	-0.008	-0.008	-0.009	-0.009	1.05
	96 Other	othwall	-0.014	-0.014	-0.014	-0.014	0.94
	11+12+13 No roof/thatch/sod	natroof	-0.177	-0.182	-0.186	-0.192	1.08
	21+22 Rustic mat/palm/bamboo	rudroof	-0.058	-0.061	-0.061	-0.065	1.13
	23 Wood planks	plnkrroof	-0.031	-0.033	-0.033	-0.036	1.15
	24 Cardboard	cdbdroof	0.015	0.015	0.015	0.015	1.00
	31 Metal	ironroof	0.188	0.194	0.200	0.207	1.10
	32 Wood	woodroof	-0.023	-0.023	-0.025	-0.026	1.14
	33+35 Calamine /cement fib./cem.	cemtroof	0.029	0.029	0.029	0.029	1.02
	34 Ceramic tiles	tileroof	0.029	0.030	0.030	0.030	1.02
	96 Other	othroof	-0.040	-0.039	-0.044	-0.044	1.11
Fuel	1 Electricity	cookelec	0.034	0.034	0.034	0.035	1.04
	2+3+4 LPG/nat. gas/biogas	cookgas	0.084	0.085	0.084	0.086	1.03
	5 Kerosene	cookkero	0.211	0.215	0.216	0.220	1.04
	6+7 Coal, lignite/charcoal	cookcoal	0.042	0.042	0.045	0.045	1.08
	8+9 Wood/straw	cookwood	-0.226	-0.229	-0.230	-0.234	1.04
	9+10+11 Straw/agric. crop/dung	cookstrw	-0.023	-0.023	-0.025	-0.025	1.10

96 Other	cookoth	-0.011	-0.012	-0.012	-0.013	1.17
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Table 39: Changes in loadings, Ukraine 2007 (DHS-V)

			Eigen vectors				G/D
			alvar	nowat	nosan	nobot	
Water	11 Piped into dwelling	h2oires	0.316	0.000	0.332	0.000	-
	12 Piped to yard/plot	h2oyrdr	-0.109	0.000	-0.113	0.000	-
	13 Public tap/standpipe	h2opub	-0.058	0.000	-0.062	0.000	-
	21 Tube well or borehole	h2otube	-0.053	0.000	-0.048	0.000	-
	31 Protected well	h2pbwell	-0.234	0.000	-0.251	0.000	-
	32 Unprotected well	h2powell	-0.043	0.000	-0.047	0.000	-
	41 Protected spring	h2pspng	-0.018	0.000	-0.019	0.000	-
	42 Unprotected spring	h2uspng	-0.008	0.000	-0.010	0.000	-
	43 River/dam/lake/ponds/stream/canal/...	h2osurf	-0.003	0.000	-0.005	0.000	-
	51 Rainwater	h2orain	-0.003	0.000	-0.005	0.000	-
	61 Tanker truck	h2otrk	-0.022	0.000	-0.020	0.000	-
	71 Bottled water	h2obtl	0.054	0.000	0.056	0.000	-
	96 Other	h2ooth	-0.006	0.000	-0.008	0.000	-
Sanitation	11 Flush - to piped sewer system	flush1	0.348	0.365	0.000	0.000	-
	12 Flush - to septic tank	flush2	-0.002	-0.006	0.000	0.000	-
	13 Flush - to pit latrine	flush3	-0.012	-0.019	0.000	0.000	-
	14 Flush - to somewhere else	flush4	-0.005	-0.005	0.000	0.000	-
	15 Flush - don't know where	flush5	0.000	0.002	0.000	0.000	-
	22 Pit latrine - with slab	latpit1	-0.321	-0.333	0.000	0.000	-
	23 Pit latrine - without slab/open pit	latpit2	-0.046	-0.053	0.000	0.000	-
	31 No facility	latbush	-0.014	-0.016	0.000	0.000	-
	41 Composting toilet	latcomp	-0.019	-0.016	0.000	0.000	-
	42 Bucket toilet	latpail	-0.026	-0.027	0.000	0.000	-
	96 Other	latoth	-0.002	-0.001	0.000	0.000	-
	Shared flush toilet	flushshr	0.047	0.050	0.000	0.000	-
	Shared slab latrine	latpit1s	-0.043	-0.050	0.000	0.000	-
	Shared no slab latrine	latpit2s	-0.014	-0.017	0.000	0.000	-
	Shared composting/bucket/hanging/other toilet	latoths	-0.005	-0.004	0.000	0.000	-
Assets	Has electricity	hv206	0.033	0.042	0.048	0.065	1.95
	Has radio	hv207	0.062	0.074	0.080	0.098	1.57
	Has television	hv208	0.084	0.103	0.118	0.154	1.83
	Has refrigerator	hv209	0.124	0.145	0.163	0.201	1.61
	Has bicycle	hv210	-0.108	-0.106	-0.093	-0.056	0.52
	Has motorcycle/scooter	hv211	-0.039	-0.036	-0.023	0.001	-0.02
	Has car/truck	hv212	0.076	0.097	0.119	0.171	2.26
	Has telephone	hv221	0.205	0.228	0.242	0.266	1.30
	Has a mobile telephone	hv243a	0.143	0.171	0.192	0.245	1.71
	Has an animal-drawn cart	hv243c	-0.067	-0.069	-0.073	-0.066	0.97
	Has a boat with a motor	hv243d	0.034	0.041	0.047	0.062	1.84

Floor	Owns a bank account	hv247	0.080	0.099	0.108	0.144	1.81
	DVD	sh111g	0.146	0.176	0.196	0.250	1.71
	Air conditioner	sh111h	0.094	0.114	0.123	0.156	1.65
	Satellite dish antenna	sh111i	0.038	0.053	0.070	0.110	2.89
	Computer	sh111j	0.165	0.194	0.213	0.260	1.57
	Washing machine	sh111k	0.107	0.130	0.149	0.197	1.84
	Sofa or bed	sh111l	0.021	0.026	0.030	0.039	1.85
	Own land usable for agriculture	hv244	-0.228	-0.242	-0.236	-0.221	0.97
	Persons per room	memsleep	0.053	0.063	0.059	0.069	1.30
	Dirt or dung floor	dirtfloo	-0.040	-0.046	-0.053	-0.066	1.63
	Rudimentary wood plank floor	woodfloo	-0.248	-0.276	-0.283	-0.299	1.20
	Parquet, polished wood floor	prqfloo	0.056	0.063	0.068	0.079	1.40
	Vinyl, asphalt strip floor	vinfloo	-0.005	-0.006	-0.007	-0.009	1.60
	Ceramic tile floor	tilefloo	0.008	0.011	0.012	0.018	2.30
	Cement floor	cemtfluo	-0.003	-0.004	-0.002	-0.002	0.77
	Carpeted floor	rugfloo	0.049	0.060	0.064	0.081	1.65
	Laminate floor	lamfloo	0.076	0.092	0.097	0.120	1.57
	Linoleum floor	linfloo	0.181	0.196	0.196	0.189	1.04
	Other type of flooring	othfloo	-0.004	-0.005	-0.004	-0.003	0.78
Walls	Dirt walls	mudwall	-0.024	-0.028	-0.033	-0.041	1.70
	Stone with mud walls	stmwall	-0.050	-0.051	-0.055	-0.053	1.06
	Uncovered adobe walls	adbwall	-0.045	-0.048	-0.054	-0.058	1.30
	Plywood walls	plywall	-0.007	-0.007	-0.008	-0.009	1.27
	Reused wood walls	rwwall	-0.011	-0.010	-0.012	-0.011	1.00
	Cement walls	cmtwall	0.095	0.105	0.106	0.108	1.15
	Stone/shells/concrete walls	stcwall	-0.070	-0.085	-0.074	-0.087	1.24
	Brick walls	brkwall	0.006	0.007	0.012	0.024	4.14
	Cement block walls	cmtbwall	0.185	0.205	0.202	0.205	1.11
	Covered adobe walls	cadbwall	-0.077	-0.083	-0.084	-0.088	1.14
	Wood walls	shngwall	-0.122	-0.132	-0.144	-0.152	1.25
	Cinder block walls	cinbwall	-0.033	-0.037	-0.035	-0.036	1.08
	Other type of walls	othwall	-0.013	-0.015	-0.018	-0.022	1.65
Roof	Thatch/straw roof	natroof	-0.017	-0.020	-0.022	-0.028	1.60
	Rustic mat roof	matroof	0.002	0.004	0.001	0.003	1.37
	Plywood roof	plyroof	-0.004	-0.004	-0.005	-0.006	1.43
	Metal roof	mtlroof	-0.055	-0.055	-0.058	-0.052	0.95
	Wood roof	woodroof	-0.011	-0.010	-0.011	-0.010	0.90
	Calamine/cement fiber roof	cmtfroo	0.050	0.057	0.058	0.064	1.28
	Ceramic tile roof	tileroof	-0.011	-0.010	-0.007	-0.004	0.36
	Cement roof	cmtroof	0.284	0.313	0.304	0.306	1.08
	Shingles roof	shngroof	-0.237	-0.264	-0.256	-0.262	1.11
	Other type of roof	othroof	0.036	0.037	0.036	0.032	0.91
Fuel	Electricity for cooking	cookelec	0.026	0.027	0.016	0.003	0.11

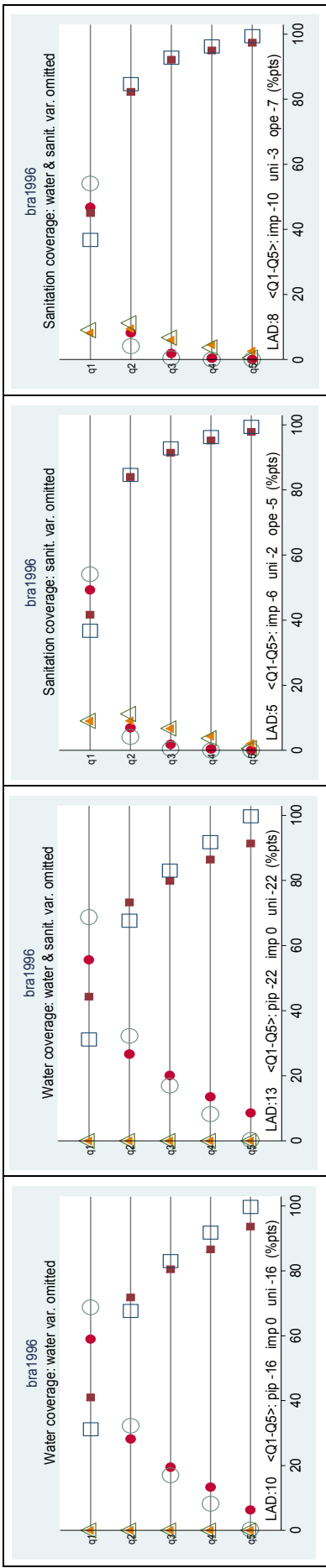
LPG, natural gas for cooking	cookgas	0.052	0.061	0.080	0.105	2.01
Biogas for cooking	cookbio	0.005	0.006	0.005	0.006	1.16
Kerosene for cooking	cookkero	-0.006	-0.008	-0.009	-0.012	1.92
Coal, lignite for cooking	cookcoal	-0.041	-0.046	-0.049	-0.057	1.40
Charcoal for cooking	cookchar	-0.015	-0.018	-0.018	-0.021	1.38
Wood, straw for cooking	cookwood	-0.104	-0.116	-0.133	-0.151	1.45
Does not cook	cooknot	-0.019	-0.025	-0.027	-0.039	2.11
Other fuel for cooking	cookoth	-0.008	-0.010	-0.012	-0.018	2.26

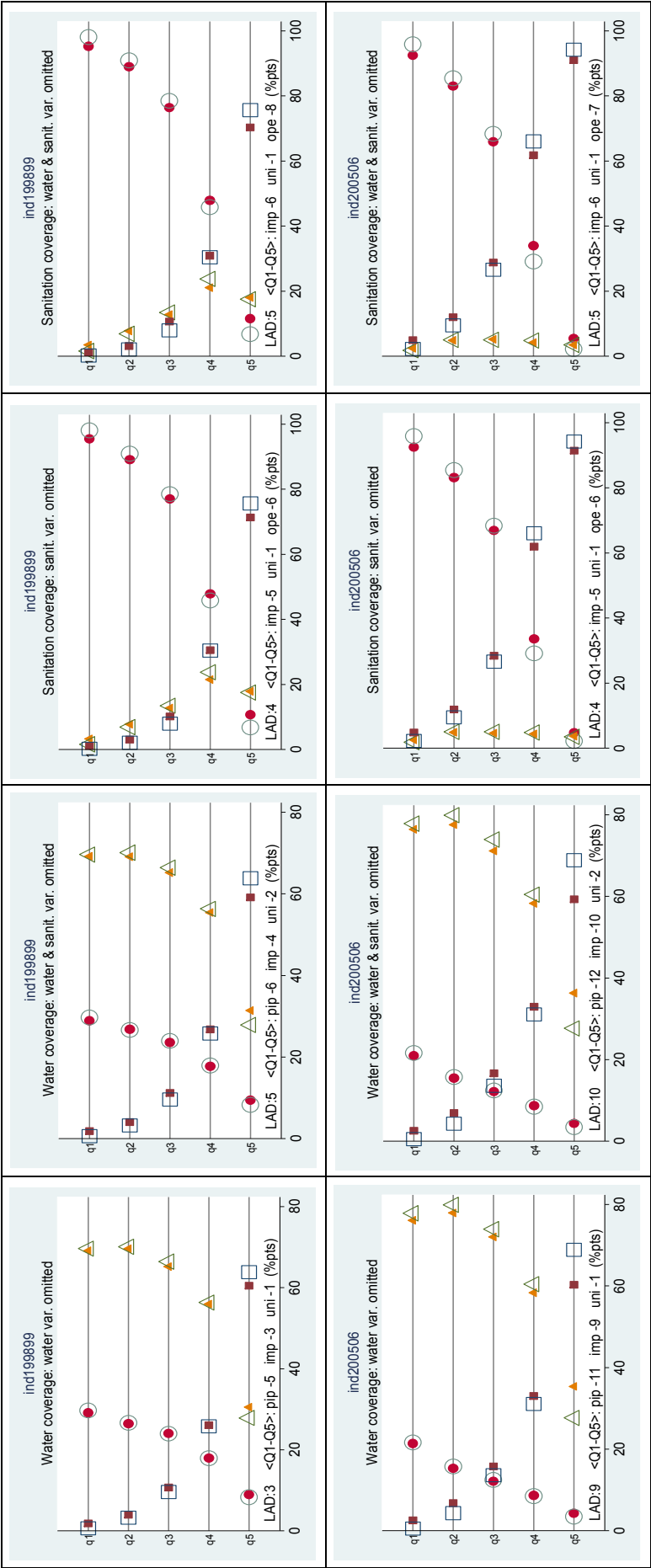
Changes in water/sanitation coverage by wealth quintile when water-/sanitation-related variables are omitted from the PCA, 5 DHS datasets

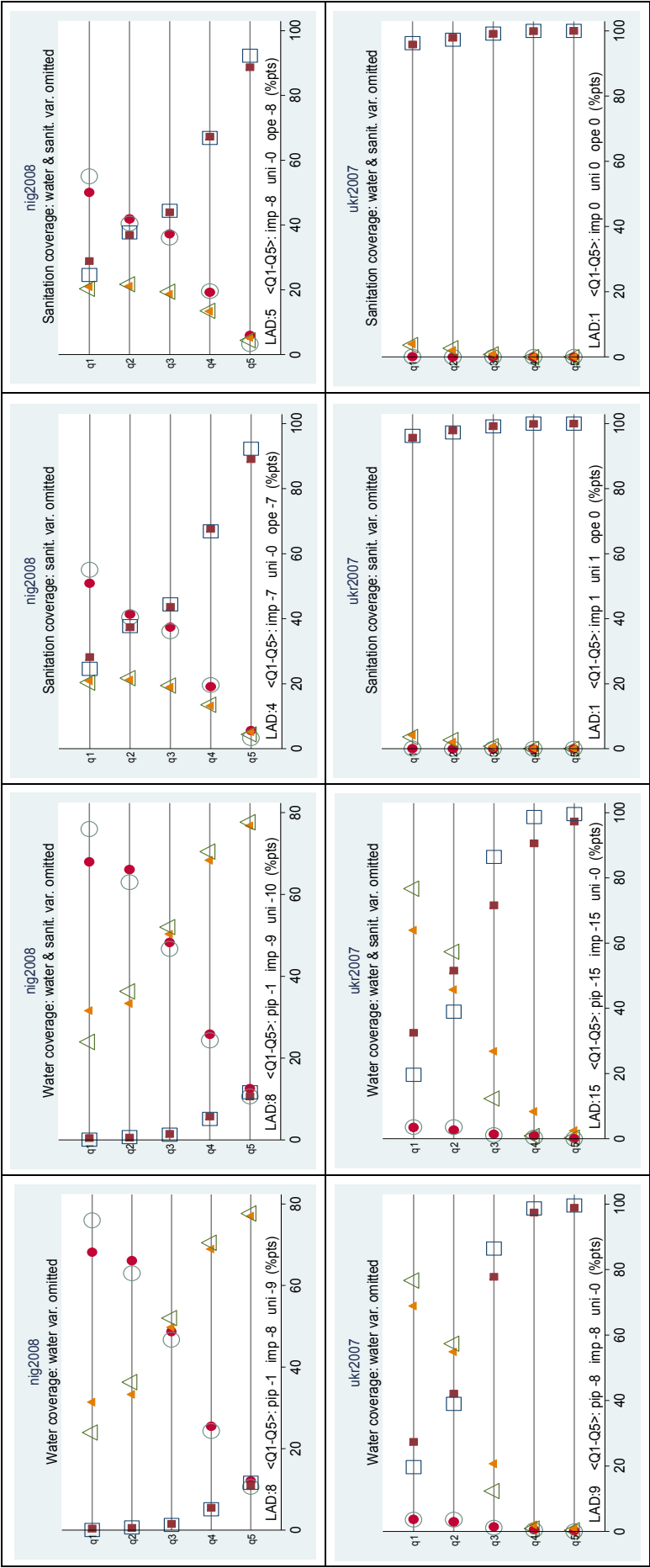
Figure 8: Changes in water/sanitation coverage by wealth quintile when water-/sanitation-related variables are omitted from the PCA (overall); 5 DHS datasets.

LAD: largest absolute difference between coverage estimates from the two approaches; <Q1–Q5>: change in gap from the two approaches between poorest and wealthiest; WATER coverage: piped (square), improved (triangle), unimpr. (circle); SANITATION coverage: improved (square), unimpr. (triangle), open defecation (circle); larger hollow symbols for original set of PCA variables, smaller filled symbols for restricted set of variables; see text for details

(See Annex D for details on how to read the graphs)







For information on the report, please contact:

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