Adjusting for Nonnumeric Responses Regarding Ideal Number of Children: Evidence from Sub-Saharan Africa[a]

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Abstract

Women's preferences for numbers of children are an important indicator of the demand for numbers of children. Preferences are indicated by responses to a question about the ideal number of children, and across countries, the mean values of responses to the question are highly correlated with observed total fertility rates. But those mean values are unable to take account of responses to the question that are not quantifiable – e.g., "up to God." Women who provide such nonnumeric responses are disproportionately likely to have never attended school, and women who never attended school almost invariably have the highest fertility rates of any education group. Hence, their absence from the calculation of mean ideal number of children introduces a downward bias – calculated means will likely understate the strength of preferences for numbers of children. In this paper, using a sample of 31 countries, we examine data on mean ideal number of children from women with numeric responses to impute predicted values for women with nonnumeric responses, based on numerous characteristics. These imputed values allow one to have an estimate of mean ideal number of children based on all women, without excluding the women with nonnumeric responses, and we argue that these estimates – higher than those based on numeric responses only – are superior to those conditional on a numeric response. The concluding section of the paper argues for policy initiatives seeking to ensure that all children have access to school, since even modest exposure to schooling is typically associated with a sharp decline in ideal number of children and fertility. We also emphasize the utility of this imputation procedure in analyzing trends in preferences for children as reflected in responses to the question on ideal number of children.

Key Words: Ideal Number of Children, Nonnumeric Responses, Women's Schooling and Fertility, Sample Selection Bias, Sub-Saharan Africa, Methodology

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I. Introduction

Women's preferences for numbers of children are an important indicator of the demand for numbers of children (Easterlin, 1975; Easterlin and Crimmins, 1985). Preferences are indicated by responses to a question about the ideal number of children, and across countries, the mean values of responses to the question are highly correlated with observed total fertility rates (TFRs) (Shapiro, 2018a). But those mean values are unable to take account of responses to the question that are not quantifiable, such as "up to God" or "undecided." Examination of data from more than 30 countries in sub-Saharan Africa, representing 86 percent of the region's population, shows that women who provide nonnumeric responses are disproportionately likely to have never attended school, or to have attended school for only a few years. And women who never attended school typically have the highest fertility rates of any education group, followed by women with only a few years of primary school at most (Gebreselassie and Shapiro, 2018). Hence, the absence of these women from the calculation of mean ideal number of children introduces a downward selection bias (Heckman, 1979) to that calculation as an indicator of the strength of preferences for numbers of children.

In addition, women with nonnumeric responses are, in most of the countries, disproportionately more likely to be from rural places. And fertility tends to be highest in rural areas, even after controlling for schooling (Gebreselassie and Shapiro, 2018). This adds to the downward bias in calculation of the mean ideal number of children as an indicator of the strength of preferences.

This paper introduces an imputation procedure that seeks to provide a more accurate gauge of women's preferences for numbers of children at the aggregate level, by including all women. Applying this procedure to 31 countries in sub-Saharan Africa, we use Demographic

and Health Survey (DHS) data on ideal number of children from respondents who provided numeric responses to impute "ideal" numbers of children for women with nonquantifiable responses, based on their schooling, place of residence, and numerous other characteristics. We then use the imputed values for these women to produce our adjusted aggregate measure of mean ideal number of children.

Strictly speaking, our adjusted measure is not a measure of ideal number of children, but rather an estimate of the demand for numbers of children and the likely implications for fertility of women's expressed preferences for children, assuming that they can realize those preferences, including for women with nonquantifiable preferences. This nearly always increases the magnitude of the mean ideal number of children, with the size of the increase depending on the frequency of nonnumeric responses, the frequency distribution by schooling group and of other characteristics of women with such responses, and on the differences in mean ideal number of children across education and other groups.

It bears noting also that, for the most part, the frequency of nonnumeric responses has been declining over time, and quite substantially for some countries (Frye and Bachan, 2017; Shapiro, 2018a). As van de Walle (1992) argued, building on Coale (1973), this decline appears to be a reflection, for increasing proportions of women, of reproduction becoming part of a "calculus of conscious choice."

In any case, the reduced frequency of nonnumeric responses means that the downward bias in calculation of the mean ideal number of children as an indicator of the strength of preferences for numbers of children due to nonquantifiable responses has diminished. This, in turn, complicates efforts to assess trends in preferences for numbers of children. The procedure proposed here, by largely correcting for the downward bias due to nonquantifiable responses,

provides a more accurate indication of trends in ideal number of children than that provided by calculating means that simply omit women with nonnumeric responses.

We compare our adjusted estimates of mean ideal number of children to the estimates conditional on a numeric response among the 31 countries included in the study, all of which have had at least two surveys, using data from the first and the most recent survey for each country. The concluding section of the paper discusses the implications of our findings for analyses of trends in ideal number of children, and argues for policy initiatives seeking to ensure that all children have access to school, since even modest exposure of girls to schooling is typically associated with notable declines in ideal number of children and fertility.

The next section of the paper first shows the strong association between ideal number of children and fertility, and then provides a descriptive overview of the basic data on ideal number of children, including both calculated mean ideal number of children for women with numeric responses and the frequency of nonnumeric responses. We also examine the schooling of women who provided nonquantifiable responses to the question on ideal number of children in the first and last DHS in their country, compared to the schooling of all women. Women with no schooling are, on average, distinctly more likely than any other group to provide such a response (they are not necessarily the largest group, but they are the most overrepresented group). In fact, this is true for each of the countries examined. We then look at the mean ideal number of children by women's schooling, for women who provide numerical responses. These means most frequently decline monotonically as schooling increases, although the general levels vary across countries.

In Section III, we generate estimates of "ideal" numbers of children that include the women who initially provided nonnumeric responses. For these women, we impute as their ideal

number of children a predicted value of the ideal number, where this predicted value is based on regression analysis of ideal number of children using the data from women who provided numerical responses to the question on ideal number of children. The predicted value takes account of women's schooling (in numerous narrowly-defined schooling groups), place of residence, and a number of other characteristics reflecting contraceptive and marital status, among other factors.

In the concluding section, we discuss the results and implications of the paper. Ongoing increases in women's education should, all other things equal, contribute to lower fertility as mean ideal numbers of children continue to decline (Frye and Bachan, 2017; Shapiro, 2018a). In addition, we argue for policy efforts to promote access to schooling for all children, not only for the desirability of this goal in and of itself, but also because attendance at school is associated with substantially lower levels of ideal number of children and of fertility. And we note that using this imputation procedure indeed shows that there is a downward bias in analysis of trends in the strength of preferences for numbers of children when only numeric data are considered.

II. Women's Ideal Number of Children and Nonnumeric Responses: A Descriptive Overview

In fertility surveys like the Demographic and Health Surveys, women are routinely asked about their ideal number of children.[1] Responses are numerical for the most part, but nonquantifiable responses, such as "up to God" or "undecided," have been common in sub-Saharan Africa (van de Walle, 1992). When data on ideal number of children are reported, observations without

[1] The DHS questions on ideal number of children differentiate women who have not yet had children from those who have had children. Women in the former group are asked "If you could choose exactly the number of children to have in your lifetime, how many would that be?" Respondents who had at least one living child were asked, "If you could go back to the time you did not have children and could choose exactly the number of children to have in your lifetime, how many would that be?" This second question represents an effort to reduce response bias due to a presumed tendency to validate past childbearing even in excess of the true ideal number by reporting an inflated number.

numeric responses are thus effectively dropped. Table 1 shows the mean ideal number of children in the first and last survey from each country. Since the duration between these two surveys varies from as little as five years to as much as 30 years, the table also shows the pace of decline per decade (declines being most common).

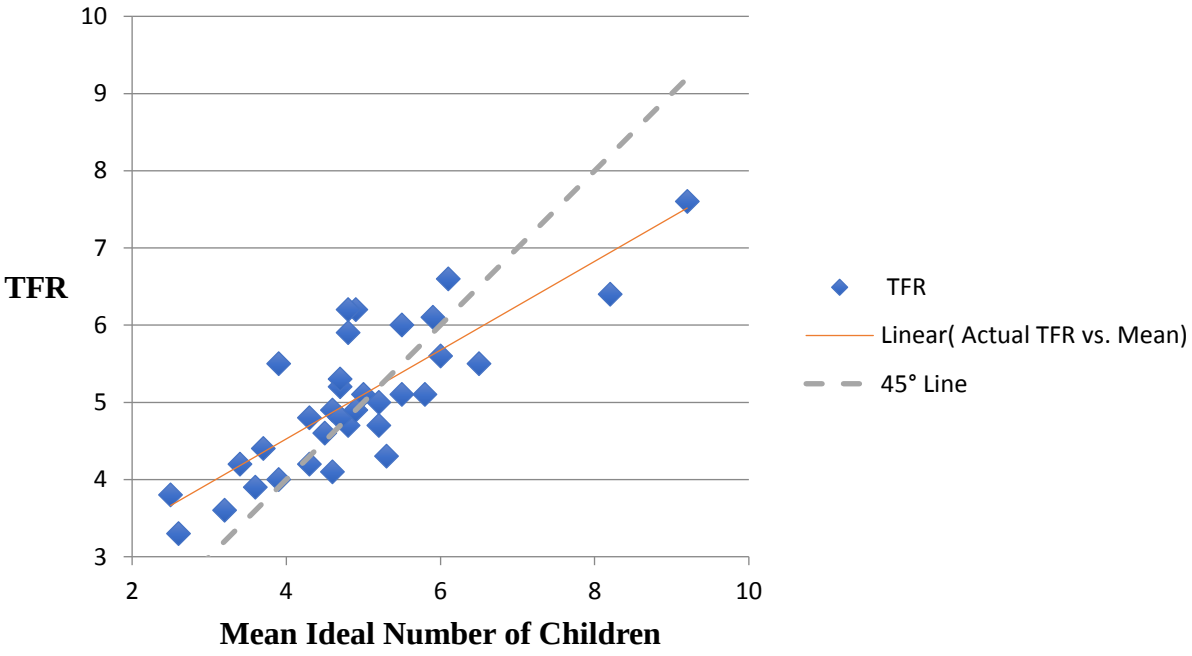
Table 1. Mean Ideal Number of Children, First and Last Survey, and Pace of Decline

Country	First survey	Year	Last survey	Year	Pace of decline[a]
Benin	5.54	1996	4.57	2011-12	0.626
Burkina	5.74	1993	5.54	2010	0.118
Burundi	5.34	1987	3.86	2016-17	0.502
Cameroon	6.82	1991	5.53	2011	0.645
Chad	8.30	1996-97	8.17	2014-15	0.072
Comoros	5.31	1996	5.32	2012	-0.006
Congo	5.09	2005	4.98	2011-12	0.169
Cote d'Ivoire	5.52	1994	5.25	2011-12	0.154
DRC	6.34	2007	6.10	2013-14	0.369
Ethiopia	5.26	2000	4.45	2016	0.506
Gabon	4.87	2000	4.59	2012	0.233
Ghana	5.26	1988	4.34	2014	0.354
Guinea	5.67	1999	5.76	2012	-0.069
Kenya	4.43	1989	3.61	2014	0.328
Lesotho	3.01	2004	2.64	2014	0.370
Liberia	5.98	1986	4.83	2013	0.426
Madagascar	5.52	1992	4.66	2008-09	0.521
Malawi	5.06	1992	3.66	2015-16	0.596
Mali	6.92	1987	5.86	2012-13	0.416
Mozambique	5.87	1997	4.85	2011	0.729
Namibia	5.01	1992	3.22	2013	0.852
Niger	8.23	1992	9.21	2012	-0.490
Nigeria	5.82	1990	6.53	2013	-0.309
Rwanda	4.24	1992	3.36	2014-15	0.391
Senegal	6.83	1986	5.21	2016	0.540
Sierra Leone	4.97	2008	4.90	2013	0.140
Tanzania	6.05	1991-92	4.74	2015-16	0.546
Togo	5.27	1988	4.32	2013-14	0.373
Uganda	6.49	1988-89	4.79	2016	0.618
Zambia	5.79	1992	4.66	2013-14	0.526
Zimbabwe	4.89	1988	3.95	2015	0.348
Averages	5.81[b]	1993.8	5.33[b]	2013.2	0.342

[a] Per decade.
[b] Population-weighted averages.

The table shows, first, that the predominant tendency is for the mean ideal number of children to decline over time. This is the case in 27 of the countries, with only Guinea, Niger, and Nigeria showing increases and Comoros having essentially no change. At the same time, there is clearly quite substantial variation across countries in the pace of change in the mean ideal number of children. A dozen countries have seen relatively rapid declines of half a child per decade or more, and two-thirds of these countries are from Eastern Africa. Nine countries have experienced either slow declines (less than 0.2 children per decade) or increases, and all but one of these countries are from West or Central Africa. Figure 1, with data from each country's most recent survey, shows that the mean ideal number of children is highly correlated with total fertility rates: the correlation is +0.84.

Fig. 1. Total Fertility Rate and Mean Ideal Number of Children (most recent survey)



The population-weighted averages for the first and last survey in all of the countries taken together, in the last row of the table, show that the mean ideal number of children has declined by close to half a child between the first and last surveys. Population-weighted averages are used throughout the paper when the focus is on individuals and aggregates, in order to accurately reflect the situation in the region (in a few cases where the focus is on differences among countries, unweighted averages are used). Two of the three most populous countries – Nigeria and the Democratic Republic of the Congo (DRC) – have comparatively high levels of ideal number of children, while a number of smaller countries have comparatively low levels (e.g., Gabon, Lesotho, Namibia). Consequently, failure to weight would understate population preferences for numbers of children. Indeed, unweighted averages are lower than the weighted averages shown in the table by about 0.15 for the first survey and by just over 0.35 as of the last survey. Hence, the unweighted averages overstate the aggregate pace of decline between the first and last surveys, where that pace is based on numeric responses.

In each survey, however, there are respondents who provided nonnumeric responses and hence were not included in the means reported in Table 1. Table 2 shows the percentage of respondents with such responses from the first and last DHS. Again, there is a general tendency for these percentages to decline over time, evident in 25 countries. Chad, Comoros, Cote d'Ivoire, Guinea, Senegal, and Togo are the exceptions, which show increases.

There is also considerable variation across countries in the frequency of nonnumeric responses, especially in the first surveys. Ten percent or more of respondents had nonnumeric responses in 14 of the countries in those initial surveys. Nigeria stands out with more than 60 percent of respondents providing such responses in the first survey, but Burkina Faso, Chad, Liberia, and Mali all had more than 20 percent of respondents with nonnumeric responses. As of

the last survey, by contrast, only five countries had 10 percent or more of respondents with such responses, and Chad was the only country with more than 20 percent of respondents with nonnumeric responses. Over all, more than 22 percent of responses were nonnumeric as of the first survey, while this weighted average had fallen to 6 percent as of the last survey.

Table 2. Percentage of Nonnumeric Responses Regarding Ideal Number of Children, First and Last Survey

Country	First Survey	Last Survey
Benin	5.6	0.2
Burkina	25.0	3.5
Burundi	10.1	2.1
Cameroon	9.9	7.1
Chad	21.9	23.1
Comoros	7.7	10.5
Congo	11.6	4.2
Cote d'Ivoire	2.4	7.2
DRC	7.9	6.5
Ethiopia	18.0	10.7
Gabon	9.7	4.7
Ghana	12.8	1.8
Guinea	4.1	11.0
Kenya	3.9	2.1
Lesotho	0.3	0.2
Liberia	24.4	4.2
Madagascar	6.5	5.9
Malawi	13.2	1.3
Mali	25.1	3.1
Mozambique	14.8	0.9
Namibia	8.1	1.4
Niger	13.8	7.4
Nigeria	60.8	7.3
Rwanda	1.3	0.9
Senegal	11.4	18.8
Sierra Leone	5.5	4.9
Tanzania	13.5	4.0
Togo	0.5	3.1
Uganda	7.9	2.4
Zambia	6.1	3.4
Zimbabwe	7.3	0.4
Averages	22.2	6.1

N.B. Averages are weighted.

If the women with nonnumeric responses were a random sample of all women, the mean values reported in Table 1 would be representative of the likely preferences for numbers of children of all women. However, it turns out that, consistent with some early research suggesting that nonnumeric answers are more prevalent among women with low education (McCarthy and Oni, 1987; Riley, Hermalin, and Rosero-Bixby, 1993), nonnumeric responses disproportionately come from women with no schooling, and underrepresent women with six or more years of schooling.

This may be seen in the averages in Table 3 (detailed data by country are available in Appendix Table A-1). At the level of individual countries, in some cases the overrepresentation of women with no or little schooling is only modest, while in others it is substantial. For example, in the first survey, there were nine countries in which the overrepresentation of women with no schooling was greater or equal to 20 percentage points (Cameroon, Cote d'Ivoire, Ghana, Kenya, Tanzania, Togo Uganda, Zambia, and Zimbabwe), and two countries in which the overrepresentation was five percentage points or less (Congo and Niger). As of the last survey, in which women's schooling overall had increased (Shapiro and Tenikue, 2017), in seven countries (Cameroon, Cote d'Ivoire, Ethiopia, Liberia, Nigeria, Sierra Leone, and Togo) the overrepresentation of women with no schooling is 20 or more percentage points, while in eight countries (Benin, Burundi, Chad, Comoros, Kenya, Mozambique, Niger, and Zimbabwe) the overrepresentation is less than or equal to five percentage points. Other things equal, these situations would correspond to more substantial downward bias and modest downward bias, respectively.

Table 3. Average Distribution by Years of Schooling, Women with Nonnumeric Responses to Question on Ideal Number of Children and All Women, First and Last Surveys (percentages)

	Years of schooling	0	1-5	6	7-8	9-10	11-12	13+	All
First survey	Nonquantifiable responses	62	21	6	6	3	1	1	100
	All Women	48	20	7	12	7	4	2	100
Last survey	Nonquantifiable responses	45	22	7	12	7	4	3	100
	All Women	32	19	8	15	12	9	6	100

Note: Numbers may not add to 100 due to rounding.

The strong inverse association between schooling and mean ideal numbers of children is apparent from the averages in Table 4. Those with 1-5 years of schooling typically have the second-highest ideal number of children, after those with no schooling, with an average decline on the order of a full child for both the first and last survey. The averages decline monotonically as years of schooling increase, with distinctly smaller declines than those between the two lowest schooling groups. Between the first and last survey, the average ideal number of children declines for each schooling group. But apart from women with no schooling, these declines are modest, and distinctly smaller than the overall decline. The more substantial decline for all women is a consequence of the increased schooling of women that has taken place in all countries (Shapiro and Tenikue, 2017).

Table 4. Mean Ideal Number of Children, by Years of Schooling, First and Last Survey

Years of schooling	0	1-5	6	7-8	9-10	11-12	13+	All
First survey	6.5	5.4	4.9	4.5	4.3	4.0	3.7	5.8
Last survey	6.0	5.1	4.7	4.4	4.1	3.8	3.4	5.3

As may be seen in Appendix Table A-2, women with no schooling have the highest ideal number of children in 61 of the 62 first and last surveys in the 31 countries (the exception is the last survey in Gabon). At the level of individual countries, as of the first survey, in 16 countries the mean ideal number of children declines monotonically as years of schooling increase. In three countries there is stability between two adjacent schooling groups, and in the remaining 12

countries there are occasional small upticks in mean ideal number of children as schooling increases.

With respect to the last survey, monotonic declines in the mean ideal number of children as years of schooling increase are apparent in 18 out of the 31 countries, in five other countries there are monotonic declines except for a single case of stability between two adjacent groups, and in the other eight countries there are occasional cases of small upticks within each country. In addition, close examination of Appendix Table A2 reveals that, controlling for years of schooling, several countries have comparatively high levels of ideal number of children: Cameroon, Chad, the Democratic Republic of the Congo, Niger, and Nigeria stand out in this regard.

Given the overrepresentation of women with no schooling among those with nonnumeric responses, in conjunction with the fact that these women typically have the highest average ideal number of children and highest TFRs of all schooling groups (Shapiro, 2018b), it is clear that calculated mean ideal number of children, by excluding women who do not provide numeric responses, will understate the preferences and likely fertility aspirations and the actual fertility of all women of reproductive age.

III. A Better Indicator of Preferences for Children and Prospective Fertility

In this section, we propose and create an adjusted measure of the mean ideal number of children at the population level for each country, incorporating the likely preferences of women with nonnumeric responses. It turns out that, in addition to schooling, there are a number of other variables that are predictive of women's ideal number of children among women with numeric responses to the question on ideal number of children.

The basic idea is to impute, for each woman with a nonnumeric response, the ideal number of children for women with her years of education, place of residence, and numerous other characteristics found to be related to the ideal number of children, based on regression analysis of the data from women providing numeric responses. This will typically increase the calculated mean, because of the concentration of women with nonquantifiable responses in the no-schooling category, which almost always has the highest mean ideal number. As noted in the Introduction, the extent to which the adjusted measure deviates from the simple mean of quantitative responses depends on the relative frequency of nonnumeric responses, the extent to which the schooling and other relevant characteristics of those with such responses differs from schooling and other characteristics of the sample of all women, and the magnitudes of the differences by schooling group and other characteristics in mean ideal number of children.

To generate the predicted values, we estimate ordinary least squares regressions separately for each country, for both the first and last survey. In these regressions, a woman's ideal number of children was regressed on her age, a series of dummy variables representing her years of schooling (0, 1-5, 6, 7-8, 9-10, 11-12, and 13+), dummy variables indicating whether she lives in a capital city, in smaller urban places, or in rural areas, variables indicating her contraceptive status (current user of a modern method, current user of a traditional method, not a current user but intends to use contraception in the future, and non-user with no intentions of future use), her marital status (never married, married, cohabiting, and widowed, divorced, and separated), whether she had had one or more of her children die, whether she was Muslim, and a dummy variable identifying women who did not know a modern method of contraception.

There are multiple reasons for the choice of independent variables in these ideal number regressions. We have already seen the importance of years of schooling (Table 4), and previous

research (Gebreselassie and Shapiro, 2018; Shapiro, 2018a) has identified age, place of residence, and being a Muslim as significantly related to ideal number of children, other things equal.

Frye and Bachan (2017), in their discussion of nonnumeric responses to the question on ideal number of children, emphasize the importance of women transitioning to a numeric perspective about their childbearing as part of the unfolding of fertility transition. In addition to education, they also mention uncertainty stemming from high mortality as contributing to nonnumeric responses. Here, with ideal number of children as the dependent variable, we hypothesized that experiencing the loss of a child would increase the ideal number of children. And we included contraceptive status on the supposition that either currently practicing contraception or intending to do so in the future signaled a numeric perspective that, other things equal, would be associated with lower ideal number of children compared to their counterparts with no intentions of using contraception.

Marital status was included because women not currently married (including those cohabiting rather than in a formal union) face a more uncertain future than their married counterparts, especially regarding childbearing. In the same way that this might be expected to increase the likelihood of a nonnumeric response, we hypothesized that women with more uncertain marital futures who provide numeric responses would have lower ideal number of children, other things equal. And by the same logic, we assumed that not knowing about modern contraception might, in addition to increasing the likelihood of a nonnumeric response (Frye and Bachan, 2017), contribute to higher ideal number of children among women with a numeric response.

Table 5 shows the mean values of the estimated coefficients from the first and last surveys in the 31 country regressions. Typically, these country-specific coefficients were statistically significant. The positive coefficient on age implies that, other things equal, there is a tendency for the ideal number of children to decline as one moves from older to younger cohorts. The increasingly negative mean coefficients for the different schooling groups are consistent with the bivariate data in Table 4, demonstrating a clear inverse relationship between ideal number of children and schooling, after controlling for other relevant factors. The differences across schooling groups are similar to but slightly smaller to what was found in Shapiro (2018a), presumably because of the addition of the contraceptive status, marital status, experience of child death, and knowledge of contraception variables that are included here.

Table 5. Mean Values of Coefficients, Regressions for Ideal Number of Children, First and Last Survey

Variable	First survey	Last survey
Age	0.037	0.036
	Years of schooling	
0	---	---
1-5	-0.444	-0.432
6	-0.685	-0.638
7-8	-0.895	-0.792
9-10	-1.001	-0.928
11-12	-1.204	-1.142
13+	-1.585	-1.352
	Place of residence	
Rural	---	---
Other urban	-0.527	-0.431
Capital	-0.872	-0.750
	Contraceptive status	
Modern method user	-0.571	-0.438
Traditional method user	-0.395	-0.256
Nonuser intending future use	-0.546	-0.306
Nonuser not intending future use	---	---
	Marital status	
Married	---	---
Never married	-0.462	-0.448
Cohabiting	-0.308	-0.328

Widowed, divorced, separated	-0.430	-0.585
	Additional variables	
One or more children deceased	0.446	0.498
Muslim	0.238	0.379
Knows no modern cont. method	0.374	0.117
Intercept	5.327	4.913

Other things equal, residents of capital cities have ideal numbers of children that average the better part of a child less than those of their rural counterparts. The corresponding difference for those in other urban places is in the neighborhood of half a child. And Muslim women have higher ideal number of children than non-Muslim women, cet. par. This is just under half of what was found in Shapiro (2018a), and again, this is presumably due to the additional variables used here.

The coefficients of the contraceptive status variables were quite variable across countries, but on average we found lower ideal numbers of children for both current and prospective users of contraception, other things equal, by about half a child as of the first surveys and by a slightly smaller amount in the most recent surveys. Similarly, women who were not currently married on average had lower ideal numbers of children by about half a child. Women who had lost one or more children had higher ideal number of children by nearly half a child, cet. par. And those who did not know a modern contraceptive method also tended to have higher ideal numbers of children, although this differential was considerably smaller in the most recent surveys, when this group had shrunk considerably compared to the initial surveys.

These regressions were used to generate predicted ideal number of children for women with nonnumeric responses, in order to estimate ideal number of children for all women. Results are in Table 6 for each country. For the first survey (Table 6a), the imputed mean values for women with nonnumeric responses are always higher than the calculated means for those with

numeric responses, by a weighted average of about three-quarters of a child. The inordinately high percentage of nonnumeric responses in Nigeria results in a substantial increase in the overall mean as compared to the mean for women with numeric responses. Seven other countries (Burkina Faso, Cameroon, Ethiopia, Ghana, Liberia, Namibia, and Tanzania) showed an overall mean that was higher than the mean based on numeric responses only by 0.1 or greater. But in the majority of countries, the bias due to omission of nonnumeric responses in calculation of mean ideal number of children was rather small. Over all, the inclusion of women with nonnumeric responses raised the mean ideal number of children by 0.2.

Table 6a. Mean Ideal Number of Children, Women with Numeric Responses, Predicted Mean Ideal Number of Children, Women with Nonnumeric Responses, and Predicted Mean Ideal Number, All Women, First Survey

	Numeric responses		Nonnumeric responses		All women
Country	Mean	Proportion	Mean[a]	Proportion	Mean[a]
Benin	5.54	0.9436	6.06	0.0564	5.57
Burkina Faso	5.74	0.7496	6.35	0.2504	5.89
Burundi	5.34	0.8991	5.58	0.1009	5.36
Cameroon	6.82	0.9009	7.95	0.0991	6.93
Chad	8.30	0.7813	8.68	0.2187	8.38
Comoros	5.31	0.9233	5.72	0.0767	5.34
Congo	5.09	0.8841	5.39	0.1159	5.12
Cote d'Ivoire	5.52	0.9764	6.43	0.0236	5.54
DRC	6.34	0.9208	6.46	0.0792	6.35
Ethiopia	5.26	0.8203	6.61	0.1797	5.50
Gabon	4.87	0.9035	5.77	0.0965	4.96
Ghana	5.26	0.8721	6.10	0.1279	5.37
Guinea	5.67	0.9588	6.01	0.0412	5.68
Kenya	4.43	0.9608	5.19	0.0392	4.46
Lesotho	3.01	0.9972	3.76	0.0028	3.01
Liberia	5.98	0.7558	6.81	0.2442	6.18
Madagascar	5.52	0.9346	6.41	0.0654	5.58
Malawi	5.06	0.8676	5.37	0.1324	5.10
Mali	6.92	0.7490	7.06	0.2510	6.96
Mozambique	5.87	0.8525	6.17	0.1475	5.91
Namibia	5.01	0.9195	6.27	0.0805	5.11
Niger	8.23	0.8625	8.53	0.1375	8.27
Nigeria	5.82	0.3920	6.82	0.6080	6.43

Rwanda	4.24	0.9867	4.42	0.0133	4.24
Senegal	6.83	0.8863	7.38	0.1137	6.89
Sierra Leone	4.97	0.9455	5.43	0.0545	5.00
Tanzania	6.05	0.8652	6.81	0.1348	6.15
Togo	5.27	0.9955	6.11	0.0045	5.27
Uganda	6.49	0.9206	7.19	0.0794	6.55
Zambia	5.79	0.9395	6.69	0.0605	5.84
Zimbabwe	4.89	0.9272	6.10	0.0728	4.98
Averages	5.81	0.7783	6.57	0.2217	6.01

[a] Mean values for women with nonnumeric responses are predicted based on regression equations described in the text.

Table 6b. Mean Ideal Number of Children, Women with Numeric Responses, Predicted Mean Ideal Number of Children, Women with Nonnumeric Responses, and Predicted Mean Ideal Number, All Women, Last Survey

	Numeric responses		Nonnumeric responses		All women
Country	Mean	Proportion	Mean[a]	Proportion	Mean[a]
Benin	4.57	0.9985	4.97	0.0015	4.57
Burkina Faso	5.54	0.9648	5.96	0.0352	5.55
Burundi	3.86	0.9787	4.07	0.0213	3.86
Cameroon	5.53	0.9292	6.94	0.0708	5.63
Chad	8.17	0.7687	8.52	0.2313	8.25
Comoros	5.32	0.8949	5.23	0.1051	5.31
Congo	4.98	0.9577	5.46	0.0423	5.00
Cote d'Ivoire	5.25	0.9284	5.89	0.0716	5.30
DRC	6.10	0.9350	6.77	0.0650	6.14
Ethiopia	4.45	0.8930	5.44	0.1070	4.56
Gabon	4.59	0.9530	5.15	0.0470	4.62
Ghana	4.33	0.9824	5.03	0.0176	4.34
Guinea	5.76	0.8901	6.01	0.1099	5.79
Kenya	3.61	0.9789	5.15	0.0211	3.64
Lesotho	2.64	0.9981	3.25	0.0019	2.64
Liberia	4.83	0.9578	5.26	0.0422	4.85
Madagascar	4.66	0.9413	5.70	0.0587	4.72
Malawi	3.66	0.9869	4.12	0.0131	3.67
Mali	5.86	0.9690	6.16	0.0310	5.87
Mozambique	4.85	0.9909	5.04	0.0091	4.85
Namibia	3.22	0.9863	3.46	0.0137	3.22
Niger	9.21	0.9257	9.19	0.0743	9.21
Nigeria	6.53	0.9267	7.37	0.0733	6.59
Rwanda	3.36	0.9907	3.86	0.0093	3.36
Senegal	5.21	0.8116	5.67	0.1884	5.30
Sierra Leone	4.90	0.9506	5.56	0.0494	4.93
Tanzania	4.74	0.9596	5.69	0.0404	4.78

Togo	4.32	0.9690	4.89	0.0310	4.34
Uganda	4.79	0.9764	5.48	0.0236	4.81
Zambia	4.66	0.9658	5.33	0.0342	4.68
Zimbabwe	3.95	0.9965	4.61	0.0035	3.95
Averages	5.33	0.9388	6.09	0.0612	5.38

[a] Mean values for women with nonnumeric responses are predicted based on regression equations described in the text.

In Table 6b, for the last survey, again (with the exception of Comoros and Niger) those with nonnumeric responses have a higher imputed value than women with numeric responses, and again by a weighted average of about three-quarters of a child. In these more recent surveys, the percentage of nonnumeric responses had typically declined, and consequently, the means for all women were frequently only slightly higher than those for women with numeric responses. On average, incorporating imputed values for women without numerical responses raised the mean ideal number of children modestly, by only 0.05 children.

There were only two countries with an overall mean that exceeded the mean for numeric responses by at least 0.1: Ethiopia (0.11) and Cameroon (0.10). Five other countries had differences of 0.05 or higher: Senegal (0.09), Chad (0.08), Madagascar (0.06), Nigeria (0.06), and Cote d'Ivoire (0.05).

Following the logic of James Heckman (1979), one can make a good case that there is a likely sample selection bias issue here. We've already seen that women who fail to provide numeric responses are disproportionately less well-educated. But even given their years of schooling and other characteristics, those with nonquantifiable responses may be different from those with numeric responses. In particular, they may have stronger preferences for children. From this perspective, then, our adjusted mean ideal number of children figures should be seen as lower bound estimates.

Indeed, we attempted to analyze the data using the Heckman procedure in Stata. However, while there were numerous statistically significant variables associated with choosing a nonnumeric response, they could only account for a very small proportion of the variance, and it was not possible to generate useful results using that procedure. Indeed, the imputation procedure that we have proposed here corresponds precisely to what was done in estimating wages for women not working in the labor market prior to Heckman's paradigm-changing contribution.

Finally, comparison of the averages in Tables 6a and 6b shows that the decline over time in mean ideal number of children is about 30 percent larger when preferences of all women are taken into consideration, as opposed to looking only at women with numeric responses. The latter shows a decline of 0.48 children, while for the former the decline is 0.63.

IV. Discussion and Conclusions

Responses to a survey question about the ideal number of children provide useful information about the strength of preferences for children and the demand for numbers of children. However, the usefulness of that data is limited by the existence of responses to the question that are not numeric. This paper has shown that such responses disproportionately come from women with no schooling, and with other characteristics that result in these women typically having especially high ideal number of children.

We calculate an adjusted mean ideal number of children for all women, by estimating regressions looking at determinants of ideal number of children based on numeric responses to the question on ideal number of children, and then using the regression coefficients to impute ideal number of children for women with nonnumerical responses. Concern for sample selection suggests that this adjustment may well be only partial, providing a lower-bound estimate of the

increase in mean ideal number of children once women with nonnumeric responses are taken into account.

By including women with nonnumeric responses, we provide a more complete set of data for purposes of considering the strength of preferences for children, the demand for numbers of children, and prospects for future fertility. At the same time, with the exception of Nigeria and several other countries in the first DHS, and a small number of countries in the last survey, the magnitude of the bias associated with omission of nonnumeric responses is modest.

A point of note is the large decrease in mean ideal number of children in moving from women with no schooling to those with 1-5 years of schooling. The average for the 31 countries entails a drop of close to a full child in both the first and last surveys. This suggests that a strong case can be made for a "No child left behind" policy, meaning that efforts should be made to enroll every child in school. This is desirable in and of itself. But it is desirable also for its implications for ideal number of children. While progress in school may not be good, the evidence presented here suggests that one consequence of such a policy would be to reduce mean ideal number of children, and presumably fertility, since for both variables women with 1-5 years of schooling have distinctly lower levels than those with no schooling.

Finally, we emphasize that this procedure provides a more accurate assessment of trends in the ideal number of children. As noted early on, the frequency of nonnumeric responses has been declining over time, in general. But that means that the bias associated with the existence of such responses has been declining over time as well. Hence, comparisons of mean ideal number of children that rely only on numeric responses – which show an average decline of 0.48 children between the first and last surveys – will understate the magnitude of the declines, because of the reduction in bias. The procedure used here suggests that when all women are taken into account,

the decline over time in preferences for numbers of children is 0.63, or about 30 percent larger as compared to when only those with numeric responses are considered.

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Appendix Table A1a. Distribution by Years of Schooling, Women with Nonquantifiable Responses to Question on Ideal Number of Children and All Women (percentages), First Survey

Country	Years of schooling	0	1-5	6	7-8	9-10	11-12	13+	All
Benin	Nonquantifiable responses	85	11	1	2	1	0	0	100
	All Women	72	17	2	4	3	1	1	100
Burkina	Nonquantifiable responses	94	4	2	0	0	0	0	100
	All Women	83	6	5	2	3	1	1	100
Burundi	Nonquantifiable responses	89	8	3	0	0	0	0	100
	All Women	80	13	5	1	1	0	0	100
Cameroon	Nonquantifiable responses	63	22	8	3	3	1	0	100
	All Women	41	21	10	12	10	4	2	100
Chad	Nonquantifiable responses	85	14	1	1	0	0	0	100
	All Women	79	16	1	2	1	1	0	100
Comoros	Nonquantifiable responses	73	14	5	3	3	0	1	100
	All Women	54	19	7	7	7	3	2	100
Congo	Nonquantifiable responses	13	32	12	22	14	4	3	100
	All Women	8	21	11	22	25	8	6	100
Cote d'Ivoire	Nonquantifiable responses	87	7	2	3	1	0	0	100
	All Women	61	19	7	5	5	2	1	100
DR Congo	Nonquantifiable responses	34	36	8	12	7	3	0	100
	All Women	22	30	9	15	12	11	2	100
Ethiopia	Nonquantifiable responses	91	7	0	1	0	0	0	100
	All Women	77	13	2	4	2	2	1	100
Gabon	Nonquantifiable responses	13	45	14	11	12	4	1	100
	All Women	6	29	13	21	17	8	6	100
Ghana	Nonquantifiable responses	66	11	4	8	11	1	1	100
	All Women	40	11	5	10	29	3	2	100
Guinea	Nonquantifiable responses	88	7	1	2	0	0	1	100
	All Women	81	8	3	3	2	1	2	100
Kenya	Nonquantifiable responses	52	21	8	13	2	4	0	100
	All Women	25	20	8	29	8	9	1	100
Lesotho	Nonquantifiable responses	19	40	23	7	11	0	0	100
	All Women	2	18	13	36	20	10	1	100
Liberia	Nonquantifiable responses	77	13	3	3	3	1	0	100
	All Women	63	14	4	6	6	6	1	100
Madagascar	Nonquantifiable responses	34	60	1	3	2	0	0	100
	All Women	23	54	3	11	3	5	1	100
Malawi	Nonquantifiable responses	57	30	5	7	1	0	0	100
	All Women	48	31	5	11	2	2	0	100
Mali	Nonquantifiable responses	92	5	1	1	0	0	0	100
	All Women	85	7	2	2	2	0	1	100
Mozambique	Nonquantifiable responses	57	41	1	1	0	0	0	100
	All Women	47	42	4	5	2	1	0	100
Namibia	Nonquantifiable responses	24	40	13	16	5	0	1	100

	All Women	15	27	11	22	15	8	2	100
Niger	Nonquantifiable responses	93	6	0	1	0	0	0	100
	All Women	90	7	1	1	1	0	0	100
Nigeria	Nonquantifiable responses	74	8	11	2	2	3	0	100
	All Women	57	9	15	4	5	9	2	100
Rwanda	Nonquantifiable responses	50	29	7	7	1	5	0	100
	All Women	39	30	10	13	2	4	1	100
Senegal	Nonquantifiable responses	89	6	3	0	0	1	1	100
	All Women	78	7	7	0	1	3	5	100
Sierra Leone	Nonquantifiable responses	79	10	3	5	1	2	0	100
	All Women	66	9	4	9	4	5	2	100
Tanzania	Nonquantifiable responses	55	16	4	25	0	0	0	100
	All Women	34	16	4	42	2	2	0	100
Togo	Nonquantifiable responses	83	11	6	0	0	0	0	100
	All Women	59	20	9	5	5	1	0	100
Uganda	Nonquantifiable responses	64	29	3	3	1	0	0	100
	All Women	38	35	9	11	4	3	1	100
Zambia	Nonquantifiable responses	41	34	9	15	1	0	0	100
	All Women	18	26	9	37	5	3	2	100
Zimbabwe	Nonquantifiable responses	35	39	8	12	2	3	1	100
	All Women	14	25	9	26	12	13	1	100
Averages	Nonquantifiable responses	62	21	6	6	3	1	1	100
(unweighted)	All Women	48	20	7	12	7	4	2	100

Note: Numbers may not add to 100 due to rounding.

Appendix Table A1b. Distribution by Years of Schooling, Women with Nonquantifiable Responses to Question on Ideal Number of Children and All Women (percentages), Last Survey

Country	Years of schooling	0	1-5	6	7-8	9-10	11-12	13+	All
Benin	Nonquantifiable responses	64	11	0	6	15	5	0	100
	All Women	60	13	5	6	9	3	4	100
Burkina	Nonquantifiable responses	88	7	2	1	1	0	0	100
	All Women	74	10	4	4	5	2	1	100
Burundi	Nonquantifiable responses	38	27	12	8	8	3	5	100
	All Women	36	26	15	9	6	4	4	100
Cameroon	Nonquantifiable responses	52	26	10	4	5	2	2	100
	All Women	20	19	16	11	16	9	8	100
Chad	Nonquantifiable responses	68	20	4	3	3	1	1	100
	All Women	63	18	5	6	4	2	3	100
Comoros	Nonquantifiable responses	33	16	8	12	11	9	11	100
	All Women	31	13	7	11	13	10	16	100
Congo	Nonquantifiable responses	12	27	12	18	21	6	5	100
	All Women	6	17	9	21	27	10	10	100
Cote d'Ivoire	Nonquantifiable responses	74	14	7	2	2	0	1	100
	All Women	53	16	9	4	8	3	6	100
DR Congo	Nonquantifiable responses	24	35	9	15	8	7	1	100
	All Women	16	28	10	17	13	13	3	100
Ethiopia	Nonquantifiable responses	71	17	3	3	3	1	1	100
	All Women	48	22	5	10	8	2	5	100
Gabon	Nonquantifiable responses	16	24	16	16	17	4	7	100
	All Women	5	15	10	23	25	10	13	100
Ghana	Nonquantifiable responses	31	27	7	8	23	0	4	100
	All Women	19	12	7	13	28	1	20	100
Guinea	Nonquantifiable responses	75	12	4	5	3	1	1	100
	All Women	67	11	3	5	5	3	5	100
Kenya	Nonquantifiable responses	8	9	7	36	10	20	11	100
	All Women	7	9	7	36	11	20	11	100
Lesotho	Nonquantifiable responses	NA	NA	NA	NA	NA	NA	NA	100
	All Women	1	9	13	44	15	10	8	100
Liberia	Nonquantifiable responses	56	24	4	10	4	2	2	100
	All Women	35	26	7	11	8	9	3	100
Madagascar	Nonquantifiable responses	32	54	3	8	2	1	0	100
	All Women	20	50	5	12	5	5	2	100
Malawi	Nonquantifiable responses	32	37	10	11	4	4	2	100
	All Women	13	31	10	22	11	10	3	100
Mali	Nonquantifiable responses	83	9	2	2	2	1	1	100
	All Women	76	7	3	6	4	3	2	100
Mozambique	Nonquantifiable responses	36	46	9	6	1	1	0	100
	All Women	32	37	6	12	8	4	1	100
Namibia	Nonquantifiable responses	14	17	9	27	23	8	2	100

	All Women	5	9	4	17	34	22	9	100
Niger	Nonquantifiable responses	83	7	3	2	3	1	1	100
	All Women	80	10	2	3	3	1	1	100
Nigeria	Nonquantifiable responses	58	6	14	3	4	11	3	100
	All Women	38	5	12	5	8	22	9	100
Rwanda	Nonquantifiable responses	27	48	8	14	1	2	1	100
	All Women	13	42	18	12	5	7	3	100
Senegal	Nonquantifiable responses	66	22	2	4	3	2	2	100
	All Women	49	20	3	8	8	6	5	100
Sierra Leone	Nonquantifiable responses	76	8	4	7	2	2	1	100
	All Women	56	9	5	11	8	8	3	100
Tanzania	Nonquantifiable responses	32	12	1	45	4	4	1	100
	All Women	15	10	2	53	8	10	3	100
Togo	Nonquantifiable responses	54	24	9	8	4	1	1	100
	All Women	32	25	11	11	11	5	5	100
Uganda	Nonquantifiable responses	23	40	14	10	4	5	4	100
	All Women	10	30	114	18	11	8	9	100
Zambia	Nonquantifiable responses	21	36	11	20	8	3	1	100
	All Women	9	21	9	26	19	11	5	100
Zimbabwe	Nonquantifiable responses	5	8	4	36	21	11	14	100
	All Women	1	5	6	24	23	31	9	100
Averages	Nonquantifiable responses	45	22	7	12	7	4	3	100
(unweighted)	All Women	32	19	8	15	12	9	6	100

Note: Numbers may not add to 100 due to rounding.

Appendix Table A2. Mean Ideal Number of Children by Years of Schooling, First and Last Survey (women with quantitative responses)

Country	Years of schooling	0	1-5	6	7-8	9-10	11-12	13+	All
Benin	First survey	6.1	4.4	3.9	3.6	3.5	3.3	3.2	5.5
	Last survey	5.1	4.2	4.0	3.8	3.7	3.3	3.1	4.6
Burkina	First survey	6.1	4.8	4.3	3.7	3.7	3.4	3.5	5.7
	Last survey	6.0	4.8	4.5	4.0	3.7	3.4	3.2	5.5
Burundi	First survey	5.5	4.9	4.6	4.2	4.2	3.5	3.6	5.3
	Last survey	4.0	3.9	3.8	3.7	3.7	3.7	3.7	3.9
Cameroon	First survey	8.8	6.6	5.7	4.2	4.7	4.4	4.3	6.8
	Last survey	7.7	6.4	5.4	4.8	4.5	4.1	4.1	5.5
Chad	First survey	8.7	7.2	5.8	6.2	5.8	5.0	4.7	8.3
	Last survey	8.8	8.1	7.4	6.9	6.0	5.7	5.4	8.2
Comoros	First survey	5.8	5.0	4.9	4.4	4.8	4.4	3.8	5.3
	Last survey	6.1	5.6	5.1	4.9	5.0	4.7	4.5	5.3
Congo	First survey	6.3	5.4	5.3	5.0	4.8	4.6	4.5	5.1
	Last survey	6.0	5.5	5.3	5.0	4.8	4.4	4.3	5.0
Cote d'Ivoire	First survey	6.1	4.9	4.7	4.4	4.0	3.7	3.5	5.5
	Last survey	5.9	5.0	5.0	4.4	4.1	3.8	3.6	5.2
DR Congo	First survey	7.2	6.7	6.6	5.9	5.6	5.3	4.5	6.3
	Last survey	7.2	6.7	6.4	5.8	5.4	5.0	4.2	6.1
Ethiopia	First survey	5.7	4.5	3.8	3.5	3.5	3.7	3.6	5.3
	Last survey	5.2	4.1	3.8	3.6	3.8	3.1	3.6	4.5
Gabon	First survey	5.7	5.4	5.1	4.7	4.4	4.4	4.1	4.9
	Last survey	5.1	5.4	5.0	4.5	4.5	4.1	4.0	4.6
Ghana	First survey	6.4	5.3	4.9	4.8	4.5	4.1	3.5	5.3
	Last survey	5.7	4.6	4.3	4.2	4.0	3.8	3.5	4.3
Guinea	First survey	6.0	4.6	4.7	4.2	4.4	4.1	4.0	5.7
	Last survey	6.3	5.2	4.9	4.6	4.5	4.3	4.2	5.8
Kenya	First survey	5.4	4.7	4.3	4.0	3.7	3.6	2.9	4.4
	Last survey	7.0	4.2	3.7	3.5	3.1	3.0	2.9	3.6
Lesotho	First survey	4.2	3.4	3.2	3.0	2.7	2.4	2.4	3.0
	Last survey	3.2	3.0	2.6	2.7	2.4	2.3	2.6	2.6
Liberia	First survey	6.8	5.4	5.0	4.7	4.5	4.3	4.1	6.0
	Last survey	5.8	4.8	4.4	4.2	4.2	3.8	3.7	4.8
Madagascar	First survey	7.2	5.5	4.6	4.1	3.9	3.3	3.3	5.5
	Last survey	6.4	4.7	3.8	3.7	3.5	3.0	3.1	4.7
Malawi	First survey	5.3	5.0	4.7	4.5	4.3	3.9	2.8	5.1
	Last survey	4.6	3.9	3.6	3.5	3.2	2.9	2.8	3.7
Mali	First survey	7.2	6.5	5.8	4.9	4.6	4.1	4.0	6.9
	Last survey	6.1	5.7	5.4	5.0	4.8	4.5	4.4	5.9
Mozambique	First survey	6.6	5.7	4.5	3.9	3.4	3.0	3.5	5.9
	Last survey	5.7	5.1	4.1	3.7	3.4	3.2	2.9	4.8
Namibia	First survey	6.6	5.8	5.0	4.5	4.2	3.2	3.1	5.0

	Last survey	4.2	4.1	3.5	3.1	3.1	2.9	3.0	3.2
Niger	First survey	8.5	6.7	5.2	4.7	4.6	4.5	4.6	8.2
	Last survey	9.6	8.4	7.6	7.0	6.5	5.7	5.6	9.2
Nigeria	First survey	6.9	6.1	5.8	5.1	4.9	4.7	4.4	5.8
	Last survey	8.6	6.7	6.4	5.3	5.3	5.0	4.5	6.5
Rwanda	First survey	4.5	4.3	4.0	3.9	3.4	3.7	3.1	4.2
	Last survey	3.9	3.4	3.3	3.3	2.9	3.0	3.2	3.4
Senegal	First survey	7.4	5.9	5.3	NA	4.2	4.7	4.4	6.8
	Last survey	5.9	5.1	5.0	4.5	4.4	4.2	4.0	5.2
Sierra Leone	First survey	5.5	4.5	4.4	3.9	3.7	3.5	3.2	5.0
	Last survey	5.6	4.8	4.4	4.0	3.7	3.5	3.2	4.9
Tanzania	First survey	7.3	6.3	6.0	5.3	4.4	4.0	3.9	6.1
	Last survey	6.2	5.3	5.1	4.7	3.8	3.6	3.3	4.7
Togo	First survey	5.9	4.6	4.2	4.0	3.7	3.5	3.8	5.3
	Last survey	5.5	4.3	3.9	3.8	3.4	3.0	2.8	4.3
Uganda	First survey	7.2	6.5	6.0	5.7	5.3	4.8	4.0	6.5
	Last survey	6.3	5.1	4.7	4.5	4.3	4.0	3.9	4.8
Zambia	First survey	6.8	6.4	5.9	5.3	4.9	3.9	3.7	5.8
	Last survey	5.6	5.4	5.0	4.7	4.1	3.7	3.5	4.7
Zimbabwe	First survey	6.4	5.9	5.0	4.5	4.0	3.5	3.2	4.9
	Last survey	6.3	5.1	4.6	4.4	3.8	3.6	3.1	3.9
Averages	First survey	6.5	5.4	4.9	4.5	4.3	4.0	3.7	5.7
(unweighted)	Last survey	6.0	5.1	4.7	4.4	4.1	3.8	3.7	4.9