TRENDS IN REPRODUCTIVE INEQUALITY IN SUB-SAHARAN AFRICA: A Micro-Macro Distinction

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Abstract

Previous research on reproductive inequality in developing countries has focused on micro-level inequality. We complement this work with a macro-level analysis using DHS data from sub-Saharan Africa and find that cross-country comparisons and historical analyses of reproductive inequality yield different conclusions, depending on whether one focuses on micro or macro-inequality. For instance, while micro-level inequalities do not change during the early stages of African fertility transitions, aggregate inequality have increased in most countries. In some countries, these increases in macro inequality were predominantly driven by differentiation in fertility behavior, while in others, the main driver was a change in the educational composition of the population.

These findings underscore the potential importance of on-going educational (and social) transitions in Africa as an additional driver of reproductive inequality. Moreover, they reveal a growing reproductive inequality that would be missed by micro-level analyses.

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1. Introduction

Reproductive inequality –how unevenly births are distributed within a population–is a central topic in demography. So far however, research on this topic has predominantly focused on micro-level inequalities, typically measured using fertility differentials. The few studies on aggregate reproductive inequality have covered developed countries (Lutz 1987; Vaupel and Goodwin 1987; Lichter and Wooton 2004; Shkolnikov et. al 2004; Spielauer 2005) but not developing countries, where the emphasis has been on micro-level inequality, whether associated with parental education, socioeconomic status, ethnicity, urban residence or other socioeconomic characteristics (Castro-Martin 1995; Jejeebhoy 1995; Ainsworth et al. 1996; Diamond et al. 1998; Weinreb 2001 Shapiro and Tambashe 2002; Schoumacher and Tabutin 2004).

Although measures of micro level inequality, most often fertility differentials, are an informative and convenient gauge, there are known theoretical reasons why they may not fully capture overall inequality. First, from a measurement standpoint, differentials are not a full-information measure: they often compare a limited number of sub-groups and fail to consider the relative size of these groups (Lam 1986; Kremer and Chen 2002; Lichter and Wooton 2004). Second, from a policy standpoint, reliance on individual-level differences can yield inappropriate recommendations for policy, because they ignore aggregate influences at the community or national levels where policies are enacted (Smith 199x; Kravdal 2002; Bongaarts 2005). Third, from a substantive standpoint, focusing on differentials can mask the trends in overall inequality. Inequality depends on both group differentials and group size and, therefore, can change even where differentials remain constant, so long as the composition of the national population changes. Analysts thus often decompose trends in inequality into the influences fertility and socioeconomic transformations (Lichter and Wooton 2005).

Against this background, our paper examines the empirical and substantive value of a micro-macro distinction in studying reproductive inequality in sub-Saharan Africa. At issue is whether the understandings of inequality derived from micro-level investigations resemble those that would be observed at the aggregate level. We address three specific questions:

(1) Do cross-country comparisons of reproductive inequality yield the same general findings whether one focuses on micro or macro-levels?

(2) Do assessments of historical trends in reproductive inequality yield the same general findings whether one focuses on micro or macro-levels?

(3) How much of the change in reproductive inequality in the region is driven by micro-level differentials versus aggregate changes in the composition of the national population?

The paper is organized as follows. First, we review the literature on reproductive inequality. We then outline the conceptual distinction between micro-level and macro-level inequality and state our hypotheses about how they may differ empirically in the context of sub-Saharan Africa. To examine these hypotheses, we use data from 65 DHS surveys fielded in sub-Saharan Africa over the past two decades, as well as simple correlation and decomposition methods. After presenting the findings, we conclude with a discussion of research and policy implications.

2. Background and Previous Studies

Reproductive inequality matters for demographic as well as socioeconomic reasons. Beyond generic concerns over a fair distribution of the burden (or joy) of reproduction (Lichter and Wooton 2005), reproductive inequality can affect the pace of fertility change and perpetuate socioeconomic inequality across generations: while reproductive inequality stems from socioeconomic inequality in the parental generation (Becker 1993) it also affects resource inequality among children (Blake 1989; Downey 1995; Desai 1995; McLanahan 2004). Accordingly, a large body of demographic research has investigated this inequality across many countries. The studies in developing countries have focused on micro-level inequality, especially those associated with maternal education (Castro-Martin 1995; Jejeebhoy 1995; Ainsworth et al. 1996; Diamond et al. 1998; Bongaarts 2005; Kravdal 2002). Such studies find contextually-variable results. Thus, Castro-Martin's review of 26 countries finds that:

> *In general, the impact of individual schooling on reproductive behavior is weak in poor, mostly illiterate societies, grows stronger as societies improve their overall education and advance in their fertility transition, and becomes less prominent once a relatively low level of fertility has been reached (Castro-Martin 1995, p. 199)*

In her review of 59 studies, Jejeebhoy (1995) finds evidence in only 26 of fertility falling monotonically with increases in schooling. Similarly, Diamond (1999) found that years of schooling was positively associated with higher fertility in some study settings and negatively associated in others. Bongaarts (2005) has more recently found little evidence for a relationship between reproductive inequality and stage in the demographic transition.

In contrast to this rich documentation of micro-level inequality, few studies have examined macro-level reproductive inequality in developing countries. In general, the studies concerned with macro-level inequality in developed countries have found an increasing concentration of reproduction in the even in the later stages of demographic transitions. (Lutz 1987; Vaupel and Goodwin 1987; Lichter and Wooton 2004, Shkolnikov et. al 2004; Spielauer 2005). In the case of the U.S., Lichter and Wooton (2004) find evidence for increasing concentration of reproduction over the past 100 years, as evidenced by a strong correlation (-.52) between cohort fertility and concentration of reproduction (p.222). However, they also find that this concentration is not primarily among poor women, suggesting that the increasing concentration of the reproductive burden may not result in an increasing divergence of access to resources among children (Lichter and Wooton 2004) Similarly, Speilauer (2005) finds evidence of an increasing concentration of reproduction in Austria, primarily as a result of increasing childlessness among recent birth cohorts.

Again, similar assessments have not been undertaken in developing countries. The research in this paper will therefore extend previous studies in developing countries, by adding a macro-level perspective. At the same time, it will extend current research on aggregate reproductive inequality by contributing evidence from developing countries, specifically sub-Saharan Africa.

As a region undergoing the early stages of its transition, Sub-Saharan Africa is an appropriate setting for studying change in reproductive inequality, as 1) the experience of fertility transitions in the region is both widespread and diverse (Caldwell et al. 1992; Cohen 1998, Kirk and Pillet 1998); 2) some of these transitions are stalling (Bongaarts 2005); and 3) in many countries these fertility transitions are accompanied by important educational transitions (Lloyd and Hewett 2002; DeRose and Kravdal 2006), one can examine and compare the changes in both micro-level and aggregate inequality during these important social transformations.

3. Macro versus Micro Inequality

The most basic distinction between micro and macro-level reproductive inequality is that the first is a comparison of the experience of the average women in two groups (i.e. high versus low education) while the latter is an aggregate measure. Micro-level inequality is assessed using fertility differentials, which capture the difference in average fertility between two or more groups defined along some criterion such as education, income, or ethnicity, with the result expressed as nominal difference or as a ratio. Thus previous studies on education differentials have often compared the

fertility rates of non-educated women to women with some secondary schooling (Castro-Martin, 1995).

Although differentials are easy to calculate and interpret, they have three limitations as an indicator of overall inequality. First, from a measurement standpoint, differentials are not a full-information measure: analysts often focus comparison on two groups (e.g., highly educated versus non-educated women) and omit intermediate groups whose influence on inequality could be important. Additionally, differentials can be sensitive to sampling error when comparison involves two groups that are under-represented in the national population. This is particularly problematic in fertility analysis since the computation of total fertility rates (TFR) typically requires sufficient fertility data for multiple age-groups.[2] Second, from a policy standpoint, differentials do not consider the relative size of groups, and this can bias policy inference (Bongaarts 2005).[3] Third, from a substantive standpoint, aggregate inequality includes both a *behavioral* and a *compositional* component. The first reflects differentiation in fertility behavior across groups, while the second represents changes in the relative size of groups. Researchers can therefore decompose change in inequality into these behavioral and compositional components.

For these various reasons, fuller measures of inequality are necessary. Such measures include classic measures such as the Gini coefficient, the Theil index, or the coefficient of variation (CV). We chose the CV over other measures because it is close to the variance (a familiar measure of inequality) and because it evaluates variation relative to the average fertility, thereby permitting meaningful comparisons of variance across different stages in fertility transition. Furthermore, the

[2] To illustrate, only 2.2 percent of Burundi women in 1987 had some secondary education (DHS 2006), for a total of fewer than 90 women. Thus, the age-specific fertility rates used to compute the TFR among this group of women were based on fewer than 15 cases on average!

[3] Consider for instance a country X with TFRs of 6.5 and 3.2 for women with no education and those with secondary education, respectively. Consider a second country Y, where these rates are 5.2 and 3.8, respectively. Based on these differentials alone, it would seem that a policy to raise female education and bring all the non-educated women to a secondary schooling level would have a greater impact in reducing fertility within country X than in country Y. Suppose however that country X has much higher levels of female education than country Y, so that only 3% of all women in X have no schooling while the corresponding percentage in Y is 30%. In this case, the above policy will reduce fertility to a far greater extent in country Y (0.3*(5.2-3.8)=0.42) than in country X (0.03*(6.5-3.2)=0.099) even if the latter has a larger fertility differential.

CV can be decomposed relatively easily, making it possible to address our third research question. The CV can be obtained as in Firebaugh (2004):

$$\mathbf{CV^2} = \left[\sum_{i}^{k} w_i (1 - r_i)^2 \right] \qquad [1]$$

where

i indexes education groups,

w_i indicates the relative size of these education groups, and

r_i indicates the ratio of group's total fertility rate to the national fertility rate

The formula in [1] captures the difference between micro and macro level inequality. While the former only consider differences between some groups (roughly some r_i values), the latter has the advantage of considering all education groups, as well as the relative size of these groups (the w_i values). To further understand *why* micro-level measures may differ from aggregate measures, we also considered an intermediary measure, the unweighted CV, calculated as below.

$$\boldsymbol{U}\mathbf{CV^2} = \left[\sum_{i}^{k} (1 - r_i)^2 \right] \qquad [2]$$

While this unweighted CV does consider all education groups, it does not consider their relative size. As such, it offers an intermediary step for understanding any potential discrepancies between micro and macro-level measures. In other words, do discrepancies occur because of failure to consider *all education groups* or failure to consider *group size?* A comparison of the TFR ratio and the unweighted CV captures the effect of failure to consider all education groups, while comparison of the unweighted CV and the weighted CV will capture the effect of relative group size. Finally, comparison of the TFR ratio with the weighted CV captures the combined effects of including all the groups as well as their relative group size.

4. Hypotheses

We expect to find empirical differences between the patterns of micro-inequality and macro-inequality. We also expect the changes in aggregate inequality to reflect, in varying degrees, the combined influences of fertility and educational transitions, rather than the effects of fertility transitions only. Indeed, if African fertility transitions occur homogenously across all groups,

behavioral differentiation will play a minor role in accounting for changes in reproductive inequality during Africa's fertility transitions. Our specific hypotheses are as follows:

H1. Geographically, the patterns of inequality observed at the micro-level differ from those at the macro-level. Thus multi-country comparisons will yield different results, depending on whether one focuses on micro-level or macro-level inequality.

H2. Historically, the trends in inequality observed at the micro-level will differ from those at the macro-level. Thus, assessments of historical trends will yield different results, depending on whether one focuses on micro-level or macro-level inequality.

H3: Compositionally, the historical change in aggregate reproductive inequality during the recent fertility transitions will be mostly due in to the influence of educational transitions, rather than fertility transitions, per se.

5. Data and Methods

Our analyses use on-line data from the Demographic and Health Surveys (DHS 2005). We specifically use data from 66 surveys fielded in 31African countries over the last 16 years. The list of countries is provided in appendix Table 1 and includes 10 that were surveyed once, 9 that were surveyed twice, 10 that were surveyed three times and 2 that were surveyed four times. Because these surveys cover many countries and a time of substantial demographic change, the resulting data are appropriate for examining both spatial and historical variation in reproductive inequality in this region. Most of our analyses use country-periods as units of analysis. For each country period, we estimate the fertility inequalities associated with education, at the micro and macro-levels, respectively. We then apply three complementary statistical methods to examine our three research hypotheses, including cross-country correlation, trend, and decomposition analyses. Each of these is described below.

5.1 Correlation Analyses

In examining our first hypothesis, --i.e., whether the geographic patterns of inequality revealed at the micro-level differ from those observed at the macro-level-- we used a rank correlation. We

preferred a correlation of ranks rather than a direct correlation of raw values of inequality because the former is easier to interpret and standardizes the scales relative to each other. Moreover, as Table 2 in the appendix suggests, there is little difference in the correlations whether we use ranked or raw values.

In order to create rankings, we order all countries by their level of micro-level inequality, then similarly order them based on macro-level inequality. By examining the bivariate correlation between the two rankings, we can assess similarity in rankings, i.e., therefore determine whether geographical patterns of inequality are the same whether one focuses at the micro or macro levels. One expects a non-significant correlation between the two rankings if micro-level inequality has no bearing on macro-level inequality. In order to better understand the sources of any potential difference between micro and macro inequality, we also examined the correlation between the unweighted CV (the intermediary measure) and the micro-level and macro-level measures, respectively.

5.2 Trend Analyses

The second hypothesis has to do with historical trend in inequality across fertility transitions. Specifically, do the trends revealed by micro-level analysis match those observed at the aggregate level? For this analysis, using data for all 65 surveys, we scatter plot reproductive inequality (micro and macro measures, alternatively) against national TFRs. The resulting plots indicate how inequality changes as national fertility declines. Comparison of plots for micro and macro inequality shows whether the historical trends are similar whether one focuses on micro or macro-level analysis. We also repeated the analysis, while restricting observation to the countries where more than one survey was fielded. This specific analysis has the benefit of not relying on cross-sectional evidence and, instead, examining the actual change in inequality within the same country.

5.3 Decomposition

To examine our third hypothesis, we sought to decompose the change in inequality into its behavioral and compositional components; i.e., how much of the change in reproductive inequality attributable to differentiation in fertility behavior across education groups (associated with fertility transitions) versus change in the educational composition of the population (associated with educational transitions)? The decomposition formula used was:

$$\Delta \mathrm{CV}^2 = \sum_i^k \overline{w} * \Delta(1 - r_i)^2 + \sum_i^k \Delta w (1 - \bar{r})^2 \qquad [3]$$

where the first bracketed term represents the behavioral differentiation, and the second reflects compositional change; $\bar{r}$ and $\overline{w}$ represent average r and w values between successive surveys.

We summarize the results of this decomposition analysis in a four-cell table that shows the overall change in reproductive inequality along with the proportion of this change that was due to differentiation in fertility behavior. The four possible scenarios in this table include (1) *behavioral convergence* (reproductive inequality decreases, mostly because of growing similarity in fertility behavior across education groups) (2) *behavioral divergence* (increases, mostly because of growing differentiation in fertility behavior across education groups) (3) *compositional convergence* (reproductive inequality decreases, mostly because of declining disparities in education among women); (4) *compositional divergence* (reproductive inequality increases, mostly because of growing disparities in education among women)

6. Findings

This section highlights our main findings regarding the empirical relevance of a macro-micro distinction in assessing reproductive inequality. We first examine geographic patterns in reproductive inequality, then turn to consider historical trends, and finally conclude with a decomposition of aggregate inequality.

6.1. Geographic patterns of inequality

This section reviews our findings about the differences in patterns of micro and macro-level inequality. Figure 1 is designed to examine whether cross-country comparisons of reproductive inequality would yield similar results whether one uses micro or macro-level measures of inequality. To this end, we plotted the country rankings based on micro-level inequality (based on differentials) against the rankings based on macro-level inequality (based on CV). If the level of analysis does not affect patterns of geographic variation, we should find a high correlation between the two rankings. Our results show a statistically significant correlation. However, this correlation is modest (r~ 0.56) compared to what one expects if the two measures were in fact indicators of the same concept. Detailed examination shows remarkable departures for some countries. For instance, while some countries such as Mali (1987) and Tanzania (1996) ranked very low among African

countries in terms of its aggregate inequality (CV), they have some of the highest micro-level differentials, as indicated by their high rank on the chart. Specifically, Tanzania ranked 13th in terms of its micro-level differentials, as against 53rd in terms of its aggregate inequality. Likewise, while Mali (1987) was virtually the last country (65th) in the region in terms of aggregate inequality, it is included in the top tier of countries (19th) in terms of the magnitude of its micro-level differentials. Conversely, countries such as Ghana (98) and Gabon (00) have comparatively high levels of aggregate inequality but relatively low differentials. Gabon ranks 56th in terms of its differential but 13th in its aggregate inequality, while Ghana ranks 39th and 9th in terms of micro-level and aggregate inequality, respectively. In sum, cross-country comparisons would yield quite different results, depending on whether one focuses on the micro-level or the macro-level picture. Such findings clearly warrant a distinction between the two levels of analysis.

[Figure 1 about here]

Why are the two measures distinct? As suggested earlier (see equation [1]), aggregate measures of inequality such as the CV differ from micro-level measures because they consider (a) all the education groups and (b) the relative sizes of these groups. An interesting question, therefore, is which of these two pieces of information makes the greatest difference? To answer this question, Figure 2 shows a more gradual comparison. Frame A compares differentials and the unweighted CVs, as a way to assess the importance of failure to consider all education groups. The findings show a tight correlation, with a r value of 0.95. Thus, assessments of reproductive inequality will be very similar whether one uses the two extreme groups versus all three education groups. In other words, failure to consider the middle education group is not enough to distort our understanding of fertility inequality. This finding is consistent with much of the literature on this question where, with a few early exceptions, fertility has generally been found to decline monotonically with education level (Diamond et al. 1999).

[Figure 2 about here]

On the other hand, failing to consider the relative size of sub-groups appears to be more problematic. Frame B, which compares the rankings based on un-weighted and weighted CVs, show a much lower correlation with an r value of 0.59. In other words, cross-country comparisons of reproductive inequalityamong African countries can yield quite different results, depending on whether or not they consider the distribution of women across different education groups. Clearly, consideration of the distribution of women across different educational categories matters.

6.2. Historical Trends in Inequality

How does reproductive inequality change as countries undergo their fertility transition? Do the changes observed at the micro-level mirror those occurring at the aggregate level? The charts in Figure 3 display the relationship between countries' stage in the demographic transition (as measured by total fertility rates) and the extent of reproductive inequality, as measured at the micro (Frame A) and macro-level (Frame B).

The findings in Figure A show no significant change in micro level inequality across stages in the fertility transition. With each unit decline in TFR, the fertility differential increases by about 0.02 units but this marginal change is statistically insignificant (p=.66). Further, variation in transition stage accounts for virtually 0% of all variation in differentials within this region. Had one relied on differentials as a gauge of reproductive inequality, one could have concluded that *African fertility transitions are accompanied with little change in fertility inequality*. However, the macro-level picture is quite different. In Frame B, a much stronger relationship is found between a country's fertility transition stage and its level of reproductive inequality. On average, each unit decline in TFR is accompanied with about a 0.04 unit increase in the size of the CV. This marginal increase is statistically significant (p=.000) and variation in fertility transition stage accounts for about one third (33 percent) of all variation in reproductive inequality observed among this set of sub-Saharan countries.

[Figure 3 about here]

The analyses in Figure 3 are not truly historical and a better test would involve examining the actual changes in reproductive inequality within countries. Essentially, this analysis uses countries (rather than country-periods) as units of analysis and is restricted to countries where multiple DHS surveys were fielded. The results (not shown but available on request) show the same general patterns, i.e., differentials did not change within most countries but the aggregate inequality increased. Such findings empirically underscore the importance of distinguishing between trends in micro versus macro-level inequality. Whereas micro-level inequalities may not have changed substantially, the inequalities at the macro-level have increased in these early stages of many African fertility transitions.

6.3. Decomposition of inequality

Given that aggregate reproductive inequality has increased in some countries, the final challenge is to explain this transition. Specifically, how much is this total change in inequality associated with increased differentiation in fertility behavior versus change in the educational composition of the population? Results from this decomposition are shown in Figure 4. This Figure shows both the total change in inequality between the last two survey periods (X axis) and the proportion of this change that is attributable to changes in the educational composition of the national population (Y axis). The findings indicate that, for most countries, aggregate inequality has increased over time, but a few countries (Rwanda, Zimbabwe, and Benin for instance) have also experienced a nominal decline in inequality.

[Figure 4 about here]

Where reproductive inequality has declined, the main driver was always the influence of fertility transitions, rather than educational transitions. As the lower left quadrant of this chart shows, there is no single country in this region that has experienced a decline in reproductive inequality that was driven by changes in the educational composition of the national population. In other words, reproductive inequality was declining because non-educated women were catching up to other women in terms of their fertility outcomes. Countries that experienced such behavioral convergence are listed in the upper left quadrant and include such nations as Rwanda, Benin, Zimbabwe, and Senegal. For these countries, fertility differences across groups were narrowing, whether as a result of improved contraceptive access to all socioeconomic groups (Zimbabwe) or generalized unavailability (Rwanda).

Where reproductive inequality has increased, the reasons for this increase vary widely across countries. For a majority of countries, the fertility transitions themselves were the main drivers of increased inequality (upper right quadrant). Interestingly, in all countries where the largest gains in inequality were registered Malawi, Togo, Mozambique, Cote d'Ivoire, Kenya), the fertility transitions were the main driver. However, there is also a sizeable number of countries (lower right quadrant), including Ghana, Mali, and Niger, where the increases in reproductive inequality were primarily associated with educational, rather than fertility, transitions. For some countries where more than two surveys were fielded the patterns noted during the first study interval can differ from those observed during the second interval. The rising inequality in Ghana was at first driven by behavioral differentiation (1988-93 period) then by compositional change (1993-98 period). Nigeria, conversely, shows the opposite pattern. The country's growing reproductive inequality was

driven initially by compositional change (1990-99 period) then by fertility differentiation (1999-2003 period).

7. Conclusions

Our analysis of patterns of reproductive inequality in sub-Saharan Africa suggests three general conclusions. First, cross-national comparisons of reproductive inequality will yield different conclusions, depending on whether one examines micro-level versus macro-level inequality. Second, historical assessments of variation in reproductive inequality during fertility transitions will likewise depend on the research focus, whether micro or macro-level. Third, in countries where reproductive inequality has changed, these changes were driven by a variable mix of behavioral and compositional effects. In some countries, the dominant driver of change in inequality was differentiation in fertility behavior across groups, whether behavior was converging across educational groups (Rwanda 1992-2000; Zimbabwe 1988-1999) or diverging (Cote d'Ivoire 1994-98, Cameroon 1991-2004, Togo 1988-98). In other countries however, the dominant driver was the change in educational composition of the population (Mali 1987-2001; Burkina Faso 1998-2003).

The research and policy implications of these findings are as follows. First, they suggest the value making a micro-macro distinction when assessing inequality. We find that cross-country comparisons and historical analyses of reproductive inequality yield different conclusions, depending on whether one focuses on micro or macro-inequality. Whereas micro-level inequalities do not appear to change over time, the aggregate reproductive inequality has significantly increased in most sub-Saharan countries, though a few instances of declining inequality were also observed. Overall, we propose that researchers interested in reproductive inequality incorporate use caution when interpreting micro measures, especially in the context of countries undergoing significant educational transitions.

Second, our results further suggest the value of understanding the main drivers of trends in reproductive inequality. Because most researchers are interested in the changes in inequality during the course of fertility transitions, these transitions are likely to be seen (or explored) as the main factor. Our analysis suggests that this is the case for many countries. However, in at least 8 of the SSA nations surveyed, fertility changes themselves did not contribute the lion's share to the transformations in aggregate inequality. Rather, it is the educational transitions that have occurred in this region over the last two decades that account for the increasing inequalities. Moreover, in at

least 8 other countries, while not the dominant driver, the education transition does appear to play an important role in changes in inequality. Attention to the influence of educational transitions is particularly warranted because important transformations have been noted on this front in recent years (Derose and Kravdal 2006; Lloyd and Hewett 2002).

Our results also highlight an alarming trend in reproductive inequality in sub-Saharan Africa. While Lichter and Wooton (2005) found an overall concentration of reproduction in the US, their results found that there was declining concentration of births to women with low levels of education. Conversely, our results indicate that in SSA women with less education are increasingly bearing the reproductive burden, and thus a greater share of children will born in contexts that increase the likelihood of them experiencing negative health and socioeconomic outcomes.

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Figure 1. Correlation between micro-level and macro-level inequality

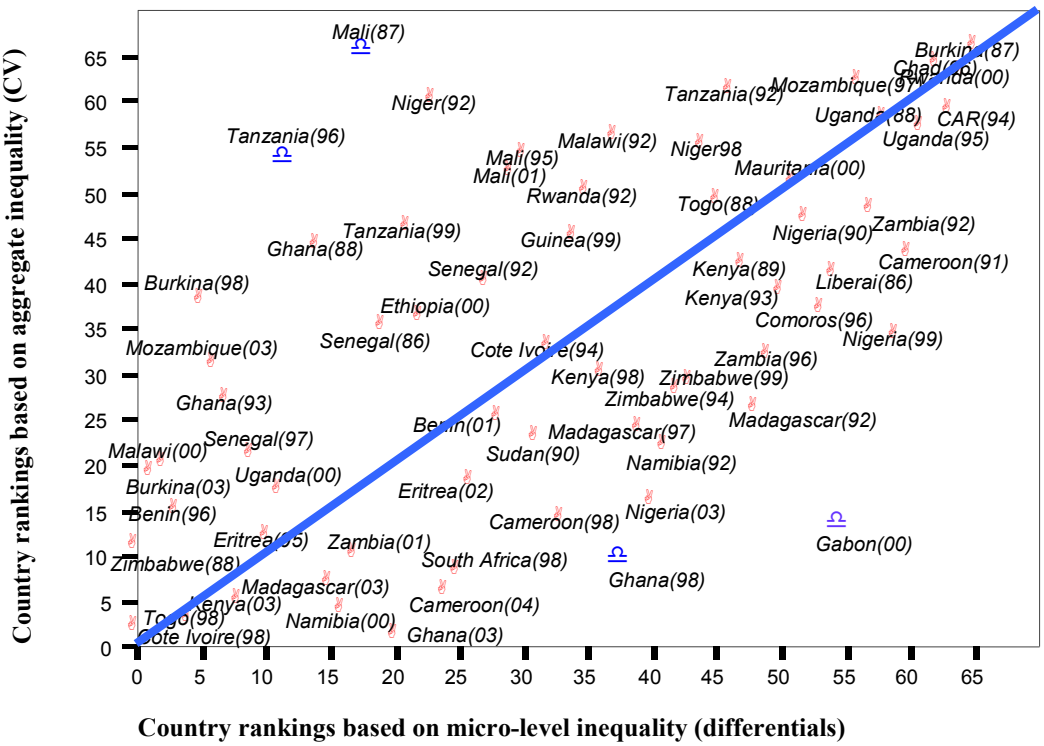
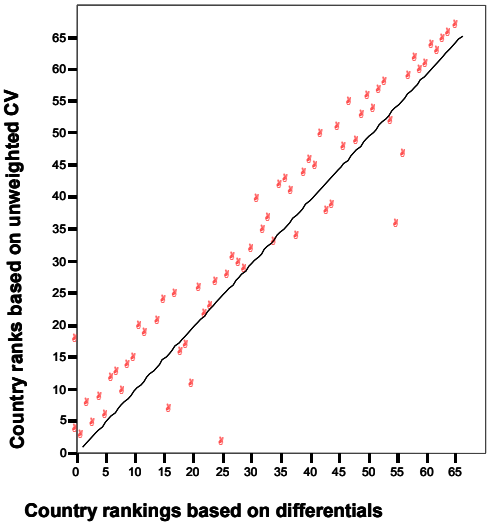


Figure 2. Correlation between alternative measures of reproductive inequality

Frame A: Differentials vs unweighted CV



Frame B: Unweighted vs weighted CV

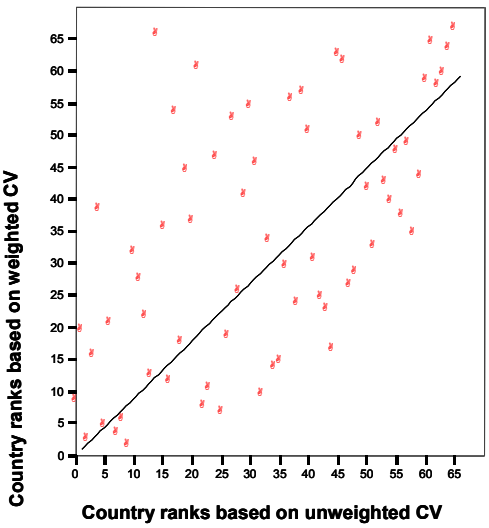


Figure 3. Relationship between fertility transition stage and reproductive inequality (micro-level (frame A) vs macro-level trends (frame B))

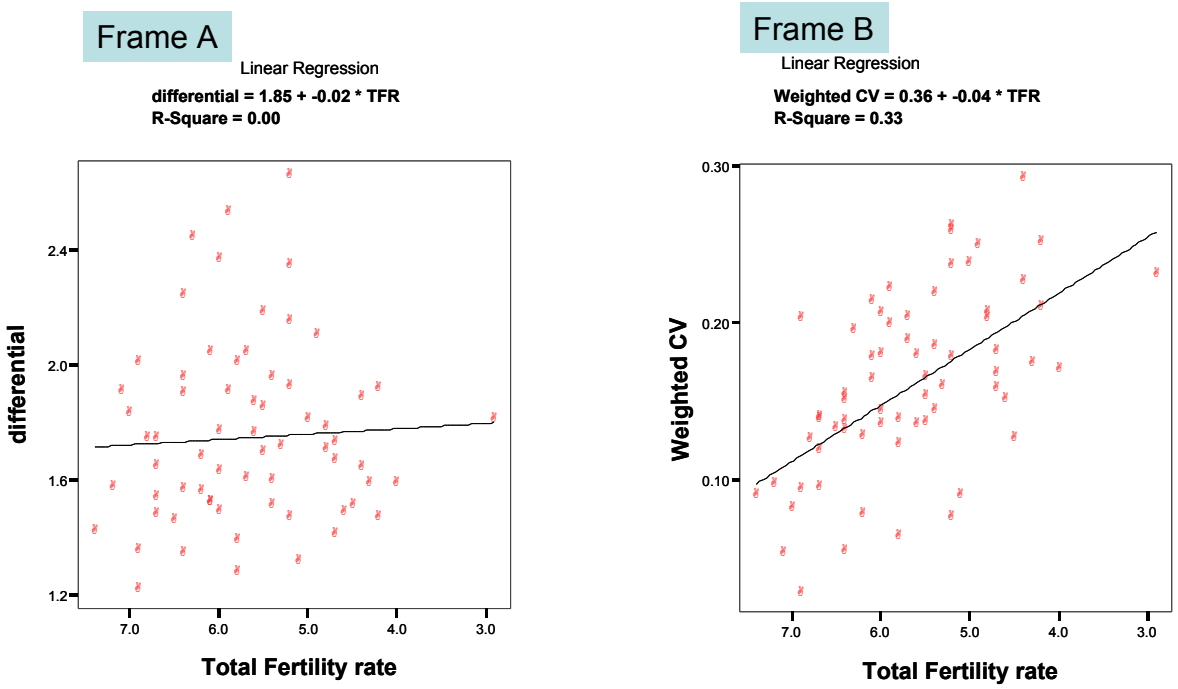
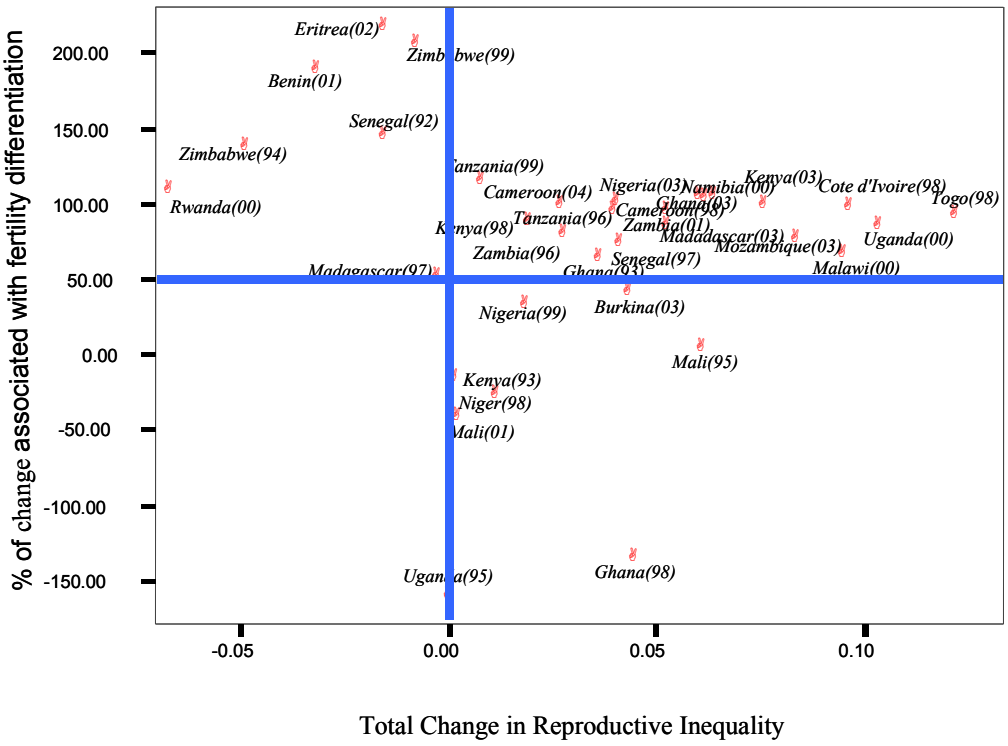


Figure 4. Distribution of sub-Saharan countries, by magnitude and source of change in reproductive inequality between successive DHS surveys



Appendix Table 1

COUNTRY	YEAR	Fertility TFR	Measures of Inequality Differential	Unweight	Weighted CV	Country rankings based on Differential	Unweighted	Weighte
Benin	1996	*6*	2.36	0.33	0.20	4	4	15
Benin	2001	*5.6*	1.75	0.23	0.18	29	29	25
Burkina	2003	*5.9*	2.52	0.36	0.20	2	2	19
Burkina	1998	*6.4*	2.23	0.33	0.15	6	5	38
Burkina)	1987	*6.9*	1.21	0.09	0.03	66	66	66
Cameroon	1991	*5.8*	1.38	0.15	0.14	61	60	43
Cameroon	1998	*4.8*	1.69	0.21	0.21	34	36	14
Cameroon	2004	*5*	1.80	0.24	0.24	25	26	6
Central African Repul	1994	*5.1*	1.31	0.14	0.09	64	64	59
Chad	1996	*6.4*	1.33	0.15	0.05	63	62	64
Comoros	1996	*4.6*	1.47	0.16	0.15	54	57	37
Cote Ivoire	1998	*5.2*	2.65	0.34	0.26	1	3	2
Cote Ivoire	1994	*5.3*	1.71	0.22	0.16	33	34	33
Eritrea	1995	*6.1*	2.03	0.28	0.21	11	14	12
Eritrea	2002	*4.8*	1.77	0.23	0.20	27	27	18
Ethiopia	2000	*5.5*	1.84	0.26	0.15	23	21	36
Gabon	2000	*4.2*	1.46	0.22	0.21	56	35	13
Ghana	1993	*5.2*	2.14	0.28	0.18	8	12	27
Ghana	1998	*4.4*	1.63	0.22	0.23	39	33	9
Ghana	1988	*6.4*	1.94	0.26	0.14	15	20	44
Ghana	2003	*4.4*	1.88	0.29	0.29	21	10	1
Guinea	1999	*5.5*	1.69	0.23	0.14	35	32	45
Kenya	1989	*6.7*	1.53	0.17	0.14	48	54	42
Kenya	1998	*4.7*	1.66	0.20	0.17	37	42	30
Kenya	1993	*5.4*	1.50	0.17	0.14	51	55	39
Kenya	2003	*4.9*	2.09	0.30	0.25	9	9	5
Liberia	1986	*6.7*	1.47	0.18	0.14	55	51	41
Madagascar	1997	*6*	1.62	0.20	0.18	40	43	24
Madagascar	2003	*5.2*	1.91	0.25	0.24	16	23	7
Madagascar	1992	*6.1*	1.51	0.19	0.18	49	48	26
Malawi	1992	*6.7*	1.64	0.20	0.09	38	40	56
Malawi	2000	*6.3*	2.43	0.32	0.19	3	7	20
Mali	1987	*7.1*	1.89	0.27	0.05	19	15	65
Mali	1995	*6.7*	1.73	0.23	0.12	31	31	54
Mali	2001	*6.8*	1.73	0.23	0.12	30	28	52
Mauritania	2000	*4.5*	1.50	0.17	0.13	52	53	51
Mozambique	1997	*5.2*	1.46	0.19	0.08	57	46	62
Mozambique	2003	*5.5*	2.17	0.29	0.16	7	11	31
Namibia	1992	*5.4*	1.59	0.19	0.18	42	44	22
Namibia	2000	*4.2*	1.91	0.33	0.25	17	6	4
Niger	1998	*7.2*	1.56	0.21	0.10	45	38	55
Niger	1992	*7*	1.82	0.26	0.08	24	22	60
Nigeria	2003	*5.7*	1.60	0.19	0.20	41	45	16
Nigeria	1990	*6*	1.48	0.16	0.13	53	56	47
Nigeria	1999	*4.7*	1.40	0.15	0.16	60	59	34
Rwanda	1992	*6.2*	1.67	0.20	0.13	36	41	50
Rwanda	2000	*5.8*	1.27	0.10	0.06	65	65	63
Senegal	1986	*6.4*	1.89	0.27	0.15	20	16	35
Senegal	1992	*6*	1.76	0.23	0.14	28	30	40
Senegal	1997	*5.7*	2.03	0.28	0.19	10	13	21
South Africa	1998	*2.9*	1.80	0.37	0.23	26	1	8
Sudan	1990	*4.7*	1.72	0.21	0.18	32	39	23
Tanzania	1992	*6.2*	1.55	0.19	0.08	47	47	61
Tanzania	1996	*5.8*	2.00	0.27	0.12	13	18	53
Tanzania	1999	*5.6*	1.86	0.24	0.13	22	25	46
Togo	1988	*6.4*	1.56	0.18	0.13	46	50	49
Togo	1998	*5.2*	2.33	0.31	0.26	5	8	3
Uganda	1988	*7.4*	1.41	0.15	0.09	59	61	58
Uganda	2000	*6.9*	2.00	0.26	0.20	12	19	17
Uganda	1995	*6.9*	1.35	0.14	0.09	62	63	57

Appendix Table 2. Bivariate correlations between the measures of inequality used in the study.

Correlation between	Using Country Rankings	Using Raw Measure of Inequality
Differentials and Unweighted CV	0.95**	0.92**
Differentials and Weighted CV	0.57**	0.56**
Unweighted CV and Weighted CV	0.59**	0.62**

** denotes statistical significance at the .01 level.