Demographic Transitions, Solidarity Networks and Inequality Among African Children: The Case of Child Survival?

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Abstract

Asymmetric demographic transitions could raise inequality among African children. Since fertility declined faster among urban middle class women, and, transitions occurred during periods of economic decline, resource inequality among children could widen. These resource inequalities may lead to divergence in multiple outcomes, including child survival. This study estimates infant mortality and income inequality trends, investigates the contribution of demographic change to inequality, and determines contextual factors that condition mortality inequality. I use World Bank data and 72 DHS surveys from 35 countries to estimate and decompose standard inequality indices. Additionally, I estimate multilevel regression models that determine the role of contextual factors. I expect demographic transitions and economic reversals to have disequalizing influences but fosterage networks to buffer inequality. Results suggest that infant mortality inequality is rising and in all countries income predicts child survival. Contextual factors like levels of child fosterage could be an important buffer for mortality inequality.

Introduction

Recent demographic and economic transitions within and across African countries raise questions about children's wellbeing including survival, and education. While the region has begun its fertility transition, some vanguard countries made ground while trends stalled others (Bongaarts 2006). At the same time these fertility transitions tend to occur in a staggered fashion within countries such that urban middle class women reduce their fertility much faster than poor rural women (Shapiro and Tambashe 2001). Considering that these fertility transitions occurred at a time of major economic downturns -- spurred by economic structural adjustment programs-- it is likely that they had significant disequalizing outcomes. In particular, many societies could see widening gaps in resource inequality among children (Eloundou-Enyegue and Rehman 2009; Eloundou-Enyegue and Williams 2006). In turn, these resource inequalities would fuel divergence in a variety of outcomes, including child survival. The link between economic and demographic shifts on children's wellbeing is one that has recently been demonstrated among children at a global scale (Eloundou-Enyegue and Rehman 2009) but it is unclear to what extent it holds among African children? Other studies previous studies examined the individual determinants of inequality but not estimated the country's overall levels of mortality inequality, let alone how this inequality may depend on key contextual influences. Among these key influences are the possible effects of demographic transitions, economic transformations and associated health policies, and solidarity networks. For instance, do countries with stronger networks of social solidarity observe infant mortality rates that are even across socio-economic groups? I seek to examine these questions by posing three pertinent questions:

(i) What are the levels of inequality in income and infant mortality among African countries and how have they changed over time?

(ii) What is the contribution of demographic change to these trends in inequality among children?

(iii) What contextual factors account for the inequality trends.

The rest of this extended abstract is organized as follows: First, I discuss the sources, the type, and the limitations of data that are used in this study. Second, I present the inequality measures that are used to determine the levels and trends in mortality and income inequality. This is followed by a brief presentation of decomposition techniques and multi-level modeling regression methods applied to determine the drivers of inequality, and the contextual factors that explain the income-mortality gradient observed across countries. Last, I give a preview of preliminary findings.

Data

To estimate the levels and trends in between country income and infant mortality the study draws from the World Bank's World Development Indicators. The World Bank's Development Indicators database contains over 850 economic, environmental and social variables for 209 countries and territories spanning the years from 1960 to 2008. Pertinent variables for this study include country's population, countries child population, infant mortality rate (death per 1000 live deaths), and resources per child. Population data is generally complete for most countries but infant mortality data is sparse for earlier years hence I limited my analysis to the period 1980-2008. This part of the study includes 42[1] out of the 53 countries in sub Saharan Africa.

Second, to determine the steepness of infant mortality gradient along socio-economic groups within countries in sub Saharan Africa the study draws on Demographic and Health Surveys. Demographic and Health Surveys (DHS) data are drawn from nationally representative surveys of between 3000 and 30000 households in 83 developing countries including former Russian States. So far, DHS collected up to 278 surveys across these countries typically within

[1] Countries include; Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Brazzaville, the Democratic Republic of Congo, Cote d'Ivoire, Eritrea, Ethiopia, Gabon, the Gambia, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia and Zimbabwe.

five year intervals. DHS collected up to 97 surveys in 39 sub Saharan countries starting the mid to late 1980. This study uses data from 71 surveys collected in 35 countries[2] of which 22 have two or three waves of surveys and 13 have a single survey (see Appendix 1). DHS capture data from women of reproductive age (15-49) covering diverse issues such as child health and nutrition; child and infant mortality; maternal health including female genital mutilation; family planning; fertility and fertility preferences; malaria; socio economic variables such as education, gender and domestic violence; women empowerment; HIV AIDS prevalence, knowledge, attitudes, and behavior. Additionally, the surveys collect standard information on household characteristics such as family size, ages of household members. These data make it possible for Macro to divide households across five distinct wealth profiles in ways that allow analysis of infant mortality differentials across wealth status. To the extent that the wealth categories are derived from observed household assets such as type of roof, walls, electricity, radio, television, fridge, bicycle, toilet, drinking water and floor type, these data are less affected by standard weaknesses associated with self reported financial wealth (Filmer and Pritchett 1998).

Last, to discern the contextual factors that potentially account for differences in mortality inequality across social class in various countries in sub Saharan Africa, I apply macro level variables from the World Bank's World Development indicators that include income per capita (GDP), public expenditure on health per capita, transparency rating, female literacy, population age dependency ratios, and levels of child fosterage in a country.

Measures

The study applies standard inequality measures to estimate the levels and trends in income and mortality inequality among 42 countries in sub Saharan Africa. In particular, it applies the Gini Coefficient, the Theil Index, the Squared Coefficient of Variation (CV), as well as the Mean

[2]Countries include; Benin, Burkina Faso, Cameroon, CAR, Chad, Comoros, Congo Brazzaville, Congo Democratic, Cote d'Ivoire, Eritrea, Ethiopia, Gabon, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia, and Zimbabwe.

Logarithmic Deviation (MLD) to World Bank infant mortality and income data. The three inequality indices (MLD, CV and Theil) are a function of population shares and resource shares.

$$\sum_j p_j f(r_j)$$

Where p_j indicates the population shares and r_j indicates resource (mortality) ratios. And ***f*** is the functional form that is used to transform the resource ratios.

The three indices can be further represented as below:

$$\text{MLD} = \sum_j p_j \log(1/r_j) \qquad \text{Gini} = \sum_j p_j r_j (q_j - Q_j)$$

$$\text{Theil} = \sum_j p_j r_j \log r_j \qquad \text{CV}^2 = \sum_j p_j (r_j - 1)^2$$

Where:

p_j indicates the share of the total population living in country j

r_j indicates resource ratios, that is , observed mortality levels in country j divided by the regional (sub Saharan African) average.

Q_j is the proportion of countries below index country when resource ratios are ranked according to size.

q_j is the proportion of countries above index country when resource ratios are ranked according to size

Methods

1. Decomposition

In order to determine the key drivers of observed trends in resource (mortality) inequality, the study applies standard decomposition techniques. Specifically, The MLD can be decomposed to reflect the changes in levels of inequality to their two respective components; inequality due to changes in demographic components and inequality due to changes in resource endowments.

Since; MLD = $\sum_j p_j \log(1/r_j)$

Following Firebaugh and Goesling (Firebaugh and Goesling, 2004), changes in the MLD measure can be decomposed into its resource and demographic components;

$$\Delta MLD = [\sum_j \overline{r_j} - \overline{\ln r_j})\Delta p_j] + [\sum_j (\overline{p_j r_j} - \overline{p_j})\Delta \ln(r_j)]$$

Where:

r_j = country j's resource ratio = $r_{j/} \sum_j p_j r_j$

p_j = country j's population shares ; $\overline{r_j}$ = [r_j (t+1) + r_j (t)]/2 = average resource share across two time periods; $\overline{\ln r_j}$ = [(lnr_j (t+1) + lnr_j (t)]/ 2 = average of natural logarithm of resource share between two time periods; Δ p_j = [p_j (t+1)- p_j (t)] = absolute change in population share between two time periods; $\overline{p_j r_j}$ = [[(p_{j*} r_j) (t) + (p_{j*} r_j) (t +1)]/2 = average of the product of population and resource shares between two respective time periods; $\overline{p_j}$ = p_j (t+1) + p_j (t)]/2 = average of population share between two time periods; Δln r_j = ln r_j (t+1) - ln r_j (t) = change in the natural logarithm of resource ratios between two time periods.

2. Multilevel Regression Modeling

Second, the study applies multi-level regression techniques to understand the relationship between social class position, child mortality, and contextual factors. The first part task is to determine how income is associated with infant mortality across social classes within individual countries. This is made possible by DHS data that captures mortality and family wealth. I therefore regress observed levels of infant mortality on income quintiles using 72 DHS survey data from 35 sub Saharan African countries. This simple model is reflected by equation 1 below:

$$Y_{ij} = \alpha + \beta income_{ij} + \varepsilon \qquad [1]$$

Where:

Y = infant mortality in country I at time period j

$Income_{ij}$ = change in income along wealth profile in country i at time period j.

Once the extent to which income explains mortality inequality is determined, the next step is to evaluate how this relationship is conditioned or mediated by contextual variables? I therefore take the estimated β coefficients from equation [1] and regress them on a select set of macro level contextual variables for each respective country as shown in Model 2 below:

$$Y_{ij} = \alpha + X_{ik} + \varepsilon \qquad [2]$$

Where:

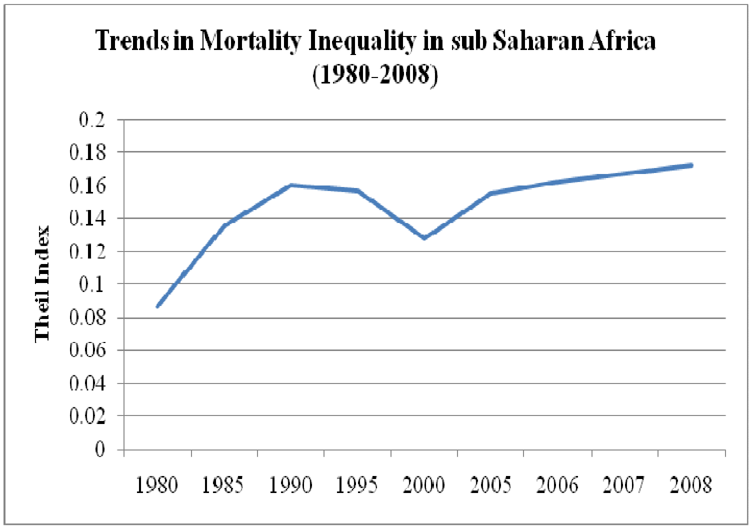
Y_{ij} is the observed income-mortality elasticity observed in country i at time period j, equivalent to β coefficients above.

X_{ik} is a vector of contextual variables obtaining in country i. The time period k represents the average value of contextual factors lagged by five years prior to the date of the DHS survey observation. The model includes variables such as income (GDP per capita calibrated for purchasing power parity), public expenditure on health per capita, transparency index, age dependency, female literacy, levels of child fosterage in a country.

Preliminary Findings

1. Levels and Trends in Infant Mortality inequality

Preliminary results show that while infant mortality inequality between countries in sub Saharan Africa is modest, it has been rising over the past twenty eight years (see Figure 1 below). Future decomposition analysis will determine what is driving the mortality inequality trends shown below, as well as income inequality trends that are not presented here.



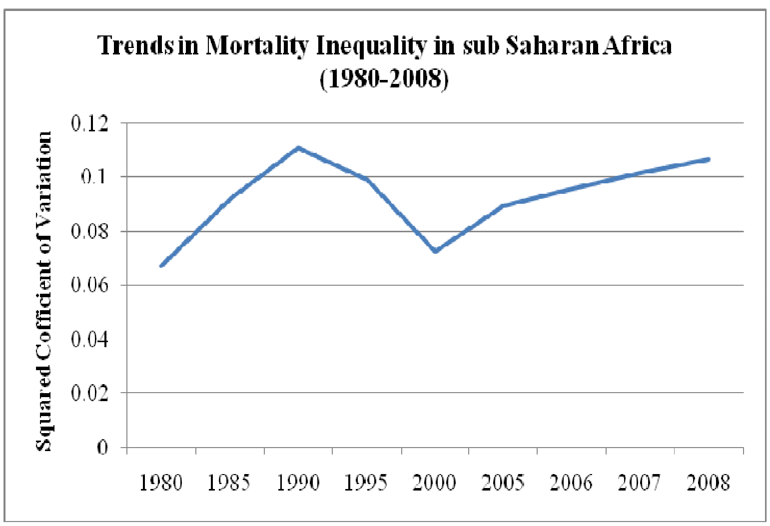


Figure 1: Levels and Trends in Infant Mortality Inequality in sub Saharan Africa (1980-2008)

2. To what extent does infant mortality vary by social class within countries in sub Saharan Africa and how has the effect changed over time?

Except for one country (Chad 2004), all other 34 countries included in this study show a negative association between social class and child survival. The effect is greatest for Tanzania (in 2004) but this country is not unique in any way because several other countries including Senegal, Togo, Nigeria, Niger, Mali, Mozambique, Rwanda, and Uganda show evidence that social class position affects child survival. But, what contextual factors affect the strength of the infant mortality-income relationship? Preliminary multivariate regression results suggest that countries with stronger networks of social solidarity are better able to buffer the negative impact of social class. Modeling this relationship is still underway.

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Appendix 1: Income-Mortality Gradient Among Countries in sub Saharan Africa

Country and Survey Year	α child mortality	β income quintile	R^2 adj child mortality
Benin 2001	108.84	-12.18	0.835
Benin 1996	123.78	-12.08	0.63
Burkina Faso 2003	140.7	-10.72	0.506
Burkina Faso 1998/99	171.18	-14.84	0.606
Burkina Faso 1993	119.05	-3.73	-0.181
Cameroon 2004	111.07	-14.18	0.969
Cameroon 1998	117.01	-15.83	0.943
Cameroon 1991	120.37	-17.07	0.936
CAR 1994-5	81.49	-6.21	0.777
Chad 2004	80.36	5.98	0.16
Chad 1996-97	109.07	-2.13	-0.192
Comoros 1996	46.86	-5.56	0.691
Congo Brazza 2003	52.49	-2.27	-0.21
Congo Democratic 2007	93.84	-9.2	0.788
Cote d'Ivoire 1998-99	115.12	-16.08	0.853
Cote d'Ivoire 1994	97.82	-11.7	0.95
Eritrea 2002	72.6	-7.22	0.386
Eritrea 1995	110.46	-9.48	0.13
Ethiopia 2005	68.46	-4.44	0.094
Ethiopia 2000	90.62	-2.16	-0.228
Gabon 2000	47.96	-5.42	0.799
Ghana 2008	53.85	-7.61	0.942
Ghana 2003	68.77	-7.47	0.58
Ghana 1998	80.06	-10.08	0.829
Ghana 1993	107.27	-15.35	0.92
Guinea 2005	128.46	-14.62	0.774
Guinea 1999	143.66	-15.66	0.976
Kenya 2003	59.13	-6.73	0.595
Kenya 1998	57.74	-7.3	0.759
Kenya 1993	52.67	-6.85	0.883
Lesotho 2004	26.94	-2.2	-0.06
Liberia 2009	63.13	-0.09	-0.333
Liberia 2007	46.38	2.52	-0.043
Madagascar 2003-4	76.32	-11.16	0.846
Madagascar 1997	99.01	-9.83	0.83
Malawi 2004	96.83	-8.61	0.761
Malawi 2000	127.94	-9.06	0.716
Malawi 1992	151.62	-10.84	0.266
Mali 2006	161.67	-16.39	0.325

Appendix 1 Continued.

Country and Survey Year	α child mortality	β income quintile	R^2 adj child mortality
Mali 2001	171.26	-15.42	0.276
Mali 1995-6	52.67	-6.85	0.883
Mauritania 2000-01	56.4	-6.34	0.213
Mozambique 2003	76.91	-5.33	0
Mozambique 1997	121.87	-13.95	0.952
Namibia 2006-7	38.16	-5.84	0.765
Namibia 2000	31.89	-3.51	0.048
Namibia 1992	51.52	-6.34	0.733
Niger 2006	148.87	-4.37	-0.232
Niger 1998	240.65	-17.03	0.017
Nigeria 2008	164.69	-26.17	0.977
Nigeria 2003	205.67	-30.63	0.671
Nigeria 1990	184.3	-25.78	0.977
Rwanda 2005	122.1	-11.44	0.614
Rwanda 2000	135.81	-11.47	0.856
Rwanda 1992	83.63	-1.11	-0.322
Senegal 2008-09	81.41	-14.57	0.956
Senegal 2005	125.5	-20.22	0.989
Senegal 1997	138.99	-21.91	0.903
Sierra Leone 2008	70.99	-2.47	0.006
South Africa 1998	32.26	-5.94	0.946
Swaziland 2006-07	39.86	-2.88	0.118
Tanzania 2004-5	205.67	-30.63	0.671
Tanzania 1999	62.93	-1.09	-0.318
Tanzania 1996	73.22	-5.92	0.391
Togo 1998	109.94	-14.66	0.971
Uganda 2000-01	108.67	-11.83	0.986
Zambia 2007	68.95	-3.25	-0.115
Zambia 1996	116.44	-7.22	0.52
Zimbabwe 2005-06	26.09	-1.75	-0.129
Zimbabwe 1999	47.09	-5.01	0.673
Zimbabwe 1994	40.51	-4.97	0.469
min	26.09	-30.63	-0.333
max	240.65	5.98	0.989
avg	97.40169014	-9.573943662	0.510887324
stdev	46.90308028	7.161526669	0.427666778