Monitoring the African Fertility Transition: How tempo, locus, quantum and "wantum" are shaping the prospects for a demographic dividend

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ABTRACT

Fertility declines in sub-Saharan Africa are setting the stage for the possibility of significant demographic dividends. Using three decades of cross-sectional DHS files from 26 African countries, this study monitors the quantum, tempo, locus, and "wantum" of African fertility transitions. We argue that these four components are essential to understanding the future course and consequences of transitions. The quantum (pace, magnitude, and continuity of decline) affects the possibility of a clear time window of low age-dependency. The locus (distribution across socioeconomic group) shapes the extent to which fertility transitions shift the burden of reproduction to the poor. Changes in the tempo of births affect how births are increasingly concentrated among the older age groups, with implications for children's household environments. The wantum speaks to the possibility of a regime of family by choice. We apply a decomposition analysis, making it possible to adjudicate between competing explanations of African fertility transitions.

INTRODUCTION

Future fertility declines in sub-Saharan Africa are setting the stage for a context where governments might expect significant demographic dividends- via growth and improvements in savings, education and health. With 44 percent of its population under age 15 in 2006, sub-Saharan Africa is the youngest region of the world and only 11 counties are projected to reach their maximum working age population before 2050 (Ashford 2007; UN 2004). There is growing consensus however that this dividend is not automatic. Rather, it depends on both extant policies (Bloom, Canning and Sevilla 2002) and the nature of the transitions themselves, salient features of which include their pace, distribution, and volition. Recent evidence suggests that the future of fertility transitions in SSA remains uncertain. Despite dropping from 6.72 in 1the 1970s, fertility in the region continues to be high at 4.76 in 2010. Moreover, research by many scholars (Bongaarts 2006; Bongaarts 2008; Shapiro & Gebreselassie 2008) has documented both stalls and reversals in fertility decline. Using DHS data from 19 sub-Saharan countries, Bongaarts (2006) finds that two countries (Ghana and Kenya) show evidence of a fertility stall, twelve show a declining trend in fertility, and five are still in the early stages of their transitions. Shapiro and Gebreselassie followed up on these findings in a 2008 paper that examined 24 SSA countries and find that the fertility transition has begun in nearly all countries, and in 65 percent of the cases show a persistent fertility decline. However, the rate of fertility decline is low in many of these cases, and in 35 percent of cases stalls (in both early and mid-transitions) were evident. These stalls follow Lesthaeghe's (1989) prediction over 20 years ago that fertility decline in sub-Saharan Africa might stall at high levels (4-5 children), given the importance of children in the production of old age support.

Transitions that are swift and continuous –rather than stalled – are more likely induce the clear period of low-age dependency on which the bonus depends. Transitions that occur across all groups or those driven by younger women will more likely improve opportunities for human capital investments

within families. And transitions driven by reductions in unwanted fertility will more likely favor the emergence of a bonus. In that light, it is useful to monitor the patterns of African fertility transitions. This paper adds to this literature in three ways. One is to provide a summary description that makes it easy to compare the experience of various African countries so far. Second it examines several aspects of the distribution that are relevant to family environment, primarily focusing on age, but also SES and marital status (the locus of fertility transitions). Third, it addresses the extent to which transitions are driven by wanted versus unwanted births. Methodologically, the paper proposes a range of simple but innovative decomposition frameworks to examine the sources of demographic change. In addition to classic demographic and regression decomposition, we introduce two new methods. The first one is well-suited to ordinal independent variables and the second can combine demographic and regression decompositions. Together, these permit a wide range of analyses that exploit the repeated cross-sectional demographic surveys fielded by DHS across many African countries over the last two decades.

Using these data, the study monitors the quantum, tempo, locus, and "wantum" of African fertility transitions. We argue that all these four components are essential to understand the future course and consequences of these transitions. The quantum (pace, magnitude, and continuity of decline) affects the extent to which a clear time window of low age-dependency. The locus (distribution across socioeconomic group) shapes the extent to which fertility transitions will shift the burden of reproduction to the poor and therefore breed inequality. Changes in the tempo of births likewise affect how births are increasingly concentrated among the older age groups, with implications for the household environments under which children are raised. The wantum speaks to question of choice and the extent to which fertility do indeed mark the advent of regime of family by choice.

The theoretical connections of this analysis are manifold. First, it connects with Bongaarts & Feeney (1998) previous work noting the widespread use of total fertility rates (TFRs) as the measure masks tempo effects, or distortions due to changes in the timing of births. While they propose an adjusted TFR, we instead seek to determine how much of the total change in TFR is driven by changes quantum vs tempo, and propose a ratio measure that can be used to compare the transitions across countries. Second, the paper examines the posited rise in unwanted fertility in the early phases of transitions (Casterline 2000, Bongaarts 2005). Third, the paper will also test the role of demand versus family planning policy as results of these decompositions will be used in meta-analytical tests of the influences of family planning policy (FPP) and economic change.

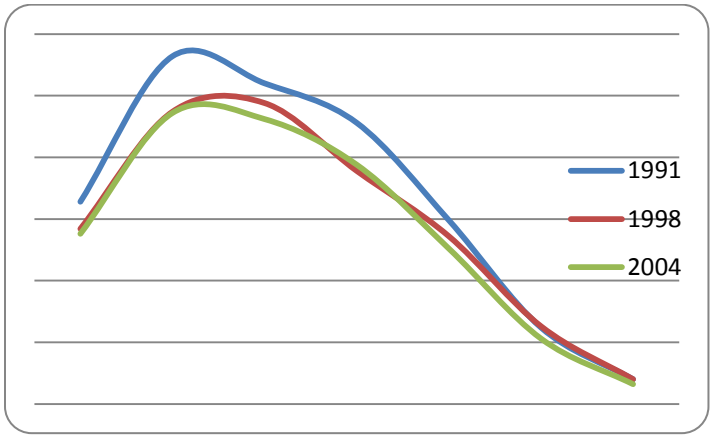
BACKGROUND

These analyses will build on our previous work on reproductive inequality trends (Giroux et al. 2008) and decompositions for the contributions of "*tempo*," "*locus*" "*quantum*," and "*wantum*" effects in accounting for fertility declines across multiple African countries (Eloundou-Enyegue and Habibou, *in progress*). Studies have accordingly begun to document the pace and patterns of these transitions (Tabutin, 1997; Cohen, 1998; Schoumaker, 2001; Garenne and Joseph, 2002; Shapiro and Tambashe, 2002 ; Bongaarts, 2007; Westoff and Cross, 2005). Rates in Cameroon fell from an average of 6,4 births per woman in 1978 to 5 in 2004, a decline of 1,4 child (INS, 2004). Although many studies have explored the determinants of fertility in that country (Lamlenn, 1992 ; Wakam, 1994 ; Yana, 1995 ; N. Bella, 1995 ; Rwenge, 1999 ; Eloundou Enyegue, 2002 ; Nouetagni, 2004), few have looked at the determinants of historical change across generations. The only exception to date is Omar (2011) estimates that Cameroon's decline between 1991 and 2004 reflected a generalized decline that was not concentrated within a few groups only.

Figure 1 (below) illustrates the use of an ordinal decomposition in studying changes in Cameroon fertility. From 1991 to 2004, there were significant declines in fertility at younger ages (15-34). Among the very oldest however, there is little change and perhaps a slight increase during the 1991- 1998 period.

Because the decline in fertility did not occur uniformly across all age groups and because some of the births might have just been delayed, it is useful to examine the relative contributions of quantum and tempo effects in explaining the total change in fertility rates observed during these years.

Figure 1: Trends in age-specific fertility rates in Cameroon 1991 -- 2004



Data & Methods

Data

These analyses draw upon Demographic Health Survey (DHS) data from 26 sub Saharan countries[1]. The decomposition approach requires countries to have at least 2 surveys; for each case we examine country couplets. The sample includes 70 country couplets. Although the sample does not represent sub-Saharan Africa as a whole, it covers 65% of all countries and over 80% of the region's total population (World Bank 2007). The data come from the individual recode files for women age 15-49.

Tempo & Quantum Effects

The study uses a decomposition method that permits detailed examination of the sources of demographic change. Unlike classic regression approach that relies on statistical correlation to assess the influence of variables, decomposition analysis relies on differentiation of rates between two or multiple time periods to identify the sources of change. Given our interest in «quantum» versus "tempo" effect, we apply a slightly different approach where specific fertility rates for each age group (y_j) are expressed as a ratio of the fertility rates of all the age groups older than the index group ($y_>$). So for instance the fertility rate for the 15-19 year-olds is expressed as a ratio of the average fertility among all those between ages 20-49; whereas the fertility rate for women between the ages of 30-34 will be expressed as a ratio of the fertility among those 35-49. What this approach makes possible is to see the extent to which fertility changes between the two periods as a results of birth being pushed back (a tempo effect) versus birth rates changing generally (a quantum effect)

Formally with r_j being defined as $y_j / f_>$,

[1] Benin, Burkina Faso, Burundi, Cameroon, Chad, Cote d'Ivore, Eritrea, Ethiopia, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali Mozambique, Niger, Nigeria, Rwanda, Senegal, Tanzania, Togo, Uganda, Zambia, and Zimbabwe. The specific survey years are listed in Appendix Table 1.

$$y_j = r_j * y_> \qquad (3)$$

and the total fertility rate is defined as usual as the sum of age-specific fertility rates

$$\mathbf{Y}_t = \sum \mathbf{r}_{jt} * \mathbf{y}_{jt} \qquad (4)$$

And the above expression can be decomposed as in Eq (2), where the two terms now reflect tempo and quantum components respectively.

Table 1. Decomposition results for the "quantum" and "tempo" contributions to the Cameroon fertility, 1991-1998.

	1991					1998				DECOMPOSITION 1998-1991	
	fertility rates					fertility rates					
Age group (j)	annual	5-year equiv	average fertility after i	ratio of i vs later fertility		annual	5-year equiv	average fertility after i	ratio of i vs later fertility	tempo effect	quantum effect
15-19	164	0.82	*0.834*	*0.983*		137	0.69	*0.687*	*0.998*	0.0111	-0.146
20-24	282	1.41	*0.719*	*1.961*		226	1.13	*0.598*	*1.890*	-0.047	-0.233
25-29	260	1.30	*0.574*	*2.266*		221	1.11	*0.471*	*2.345*	0.0413	-0.236
30-34	228	1.14	*0.385*	*2.961*		185	0.93	*0.320*	*2.891*	-0.025	-0.19
35-39	149	0.75	*0.205*	*3.634*		123	0.62	*0.173*	*3.565*	-0.013	-0.117
40-44	62	0.31	*0.100*	*3.100*		49	0.25	*0.100*	*2.450*	-0.065	0
45-49	20	0.10	*0.020*	*5.000*		20	0.10	*0.020*	*5.000*	0	0
	TFR	5.825					4.805				
						change	-1.02			-0.098	-0.923
										10%	90%

Table 1 shows the results of this "tempo vs. quantum" decomposition using the 1991 and 1998 rounds of DHS data from Cameroon. Basically, the results indicate that a good 10% of a decline in fertility rate reflected a postponing of fertility, with the rest reflecting a generalized decline in birth rates across all ages. These results have implications for the prospects for future declines as well as for the wellbeing of children born in these new circumstances of more delayed fertility. We will perform more advanced analyses that will refine our conclusions and permit comparison across a wide range of African countries. This wide-ranged analysis will thus contribute not only to the literature on the pace and patterns of African transitions but also and more importantly to the socioeconomic consequences of these transitions. Insofar as they clarify the changing family circumstances of births, they shed light on potential wellbeing of children as countries advance in their transitions.

Locus and "wantum" components

More advanced decomposition can then be attempted that take advantage of the fact that the y_{jt} can be further understood as functions of various proximate determinants of fertility. For instance, age specific fertility (y_j) can be expressed as a weighted function of marital versus non-marital fertility

$$y_j = (s*f_s)+(m*f_m) \quad (5)$$

Where s and m reflect the proportion of unmarried and married women respectively and f_s and f_m reflect the non-marital and marital fertility respectively. By inserting (3) into (5) and the result into (4), one obtains a more detailed formula that expresses the national fertility rate as a function of age-specific marital and non marital fertility as well as proportions married. A decomposition of the resulting formula thus gives a more detailed explanation for the changes in national fertility. What is done here in terms of marital versus non marital fertility will also be done for wanted versus unwanted fertility, and for the fertility influences of various policy and socioeconomic factors. In sum, we will be able to give a very detailed account of the sources of fertility change for various African countries at different stages of their transitions