Predicting Fertility in Sub-Saharan Africa Based on Patterns of Contraceptive Use

The relationship between contraceptive use and fertility rates, mostly commonly measured in terms of Contraceptive Prevalence Rate (CPR) and Total Fertility Rate (TFR), has long been recognized, measured and analyzed. This relationship is of particular interest to the demography of sub-Saharan Africa (SSA) where fertility rates are expected to drive world population growth throughout the 21st century (Gerland 2014).Thus, understanding the factors affecting fertility change in SSA is central to understanding the future of world population growth. Furthermore, many SSA countries have national family planning goals, sometimes justified by family planning's assumed impact on fertility; for these countries, it is of particular interest to understand how contraceptive use might impact fertility rates.

This work assesses the accuracy of existing methodologies that predict SSA fertility changes based on patterns of contraceptive use, focusing on the Proximate Determinants (PD) framework, and explores possible methodological improvements. The genesis of this work is the multiple examples of TFRs in SSA that were perceived to be 'inconsistent' with contraceptive use patterns: published examples include Tanzania,[1] Ghana,[2] Malawi,[3] Zimbabwe,[4] and Cote d'Ivoire.[5]

Given its dominance in existing analyses of the contraceptive-fertility relationship in SSA, our work focuses on the PD framework. Many analyses that use the PD to explore this relationship leave the error term unexamined, despite the fact that large error terms may limit the predictive power of the framework. Our work seeks to retroactively assess the PD framework in the SSA context, and look for causes & potential solutions to minimize errors terms.

First we assess the accuracy of the PD framework in predicting changes in TFR, using 88 historic SSA DHS surveys across 25 countries (yielding 63 inter-survey intervals). We used confidence intervals of the TFR estimates based on the sampling errors for each individual survey in order to create a binary count of how many TFR changes were accurately predicted, or within the possible range of TFR change calculated based on the range of possible TFR values. In our assessment, we consider the original PD framework, the revisions proposed by Stover [6] and alternate definitions of the population of women presumed to be at risk for pregnancy or sexually active. We looked for country-specific and fertility level specific patterns of the residuals between the predicted and observed TFR changes.

We then applied a series of refinements to the Proximate Determinants framework, in an effort to improve its predictive accuracy. These refinements include:

- *Accounting for the overlap between contraceptive use and postpartum amenorrhea*. The CPR is a simple percentage of women of reproductive age (all or married) who are using family planning. However, some women are more likely than others to get pregnant in the absence of contraceptive use. Women who are postpartum amenorrheic have a

very low probability of conceiving and thus their contraceptive use, while potentially of interest for other reasons, should not be expected to contribute significantly to fertility reduction. Our analysis removes these women from the pool of women whose protection from pregnancy is attributable to contraceptive use.

- *Customizing the total fecundity estimate for each country*. There may be indirect evidence that the total fecundity concept in the PD framework varies between different populations. This may be due to unexplained biological differences; variation in frequency of intercourse, which is difficult to measure; or mathematical errors.
- *Estimating contraceptive use during the time period when the live births that count towards the TFR estimate occurred.* This refinement addresses a misalignment in the time frame in which contraceptive use and fertility are measured. While CPR (contraceptive prevalence rate) is measured as "current use" at the time of the survey, TFR is estimated based on live births during the three years preceding the survey. In a context of rapidly changing contraceptive patterns, this discrepancy could have consequences for our understanding of how contraceptive use affects fertility. Thus, we estimated contraceptive use during the period between 44 and 9 months prior to the survey, since this period corresponds to the conception of the live births counted in the TFR estimate. Our historic CPR estimates are based on DHS calendar data.

We will also analyze three country examples in more depth: a country whose TFR change is underpredicted; one whose TFR change is overpredicted; and one whose TFR is well predicted. We will conduct further, in-depth analyses of these three examples. The in-depth analyses will include an age-disaggregated version of the PD model. Age is a highly relevant variable because of its impact on fecundity, but also because of the age structure of rapidly growing, young populations.

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[1] Weinberger, M., Coast, E. Fertility, Contraception and Method Mix in Tanzania: Trends and Changes Since 1990. London School of Economics (forthcoming).

[2] Blanc, A.K, Grey, S. (2002). Greater Than Expected Fertility Decline in Ghana: Untangling a Puzzle. JBS. 34. 475-495.

[3] Jain, A., Ross, J., Gribble, J. McGinn, E. (2014). Inconsistencies in the Total Fertility Rate and Contraceptive Prevalence Rate in Malawi. Health Policy Project. Futures Group.

[4] Thomas, N., Mercer, C. (1995) An Examination of the Fertility/Contraceptive Prevalence Anomaly in Zimbabwe. Genus, 51(3/4):179-203.

[5] Remez, L. (1996). Few Married Women Use a Method in Cote d'Ivoire, but Fertility is Decreasing. International Family Planning Perspectives, 22(3):130-132.

[6] Stover, J. (1997). Revising the Proximate Determinants of Fertility Framework: What Have we Learned in The Past Twenty Years. Futures Group.