HEALTH POLICY P R O J E C T



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

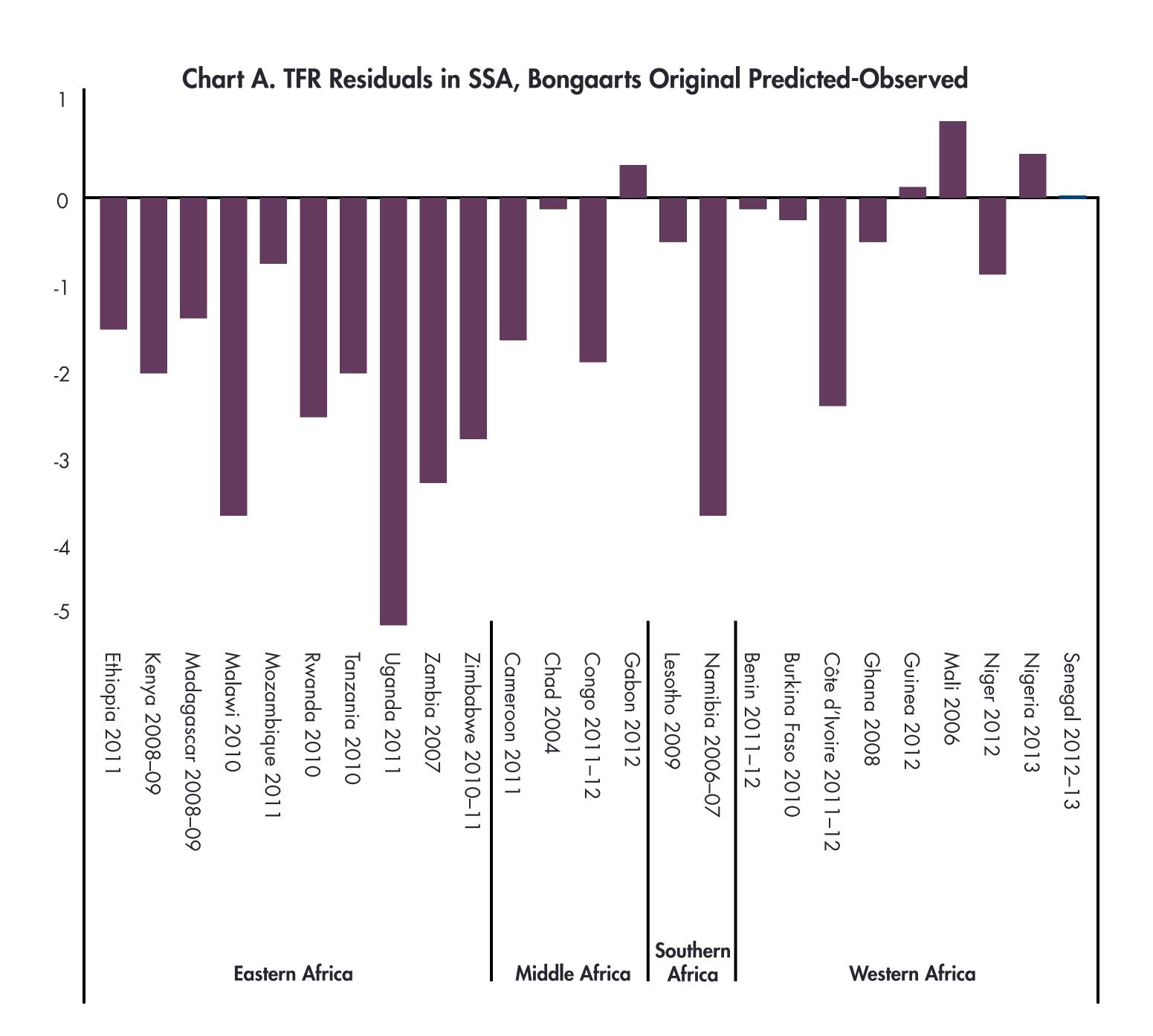
BACKGROUND

- In sub-Saharan Africa (SSA), expected national fertility levels and country-level observations demonstrate repeated mismatches in magnitude and/or direction.
- Bongaarts' Proximate Determinants (PD) model (1978)—the most robust and commonly used method for examining fertility changes—does not account for all the variation in observed fertility, often producing sizeable residuals.

Bongaarts' Proximate Determinants Framework:

Total Fertility Rate (TFR) = $C_m * C_c * C_a * C_i * TF$

- index of marriage, or union
- index of contraception
- index of induced abortion
- index of lactational infecundability
- total fecundity



Thus there is an unfulfilled demand for better explaining, understanding, and communicating how fertility changes. Accurately predicting fertility is critical for understanding how populations may be expected to change, and for managing expectations about the possible impacts of TFR-affecting policy levers

Research Question

To what extent can the accuracy of predicting fertility in SSA using the proximate determinants framework be improved by implementing revisions, with emphasis on the contraception index?

METHODOLOGY

Identical adjustments were applied to three variations of the proximate determinants model. Revisions to the contraceptive index are prioritized because contraception is the most commonly recognized and intuitive fertility inhibitor with a rights-based policy lever:

- . Bongaarts' Original PD Model, with a focus on married/in-union women
- 2. Sexually Active Variation, identical to Bongaarts' original with the exception of customization for sexually active women
- 3. John Stover Variation, which features Stover's revisions (1998) to the original indices

Predicted TFRs – 65 for TFR level and 40 for changes in TFR between surveys – were computed before and after these adjustments, for all three variations.



Adjustment A Eliminating CPR-Postpartum Insusceptibility (PPI) Overlap

Contraceptive users who were also considered postpartum insusceptible were removed from the CPR estimate. This adjustment eliminates the problem of double counting PPI contraceptive users as protected against the risk of pregnancy, since these women are also counted as protected in the Ci index.

Adjustment B Accounting for the CPR-TFR Timing Mismatch

We interpolated CPR for 27 months prior to each survey date. Twenty-seven months was used because it is the midpoint of when the births that contribute to the TFR were conceived. This adjustment aligns the timing of the CPR and TFR metrics.

Adjustment C Customizing Total Fecundity (TF) to Each Country

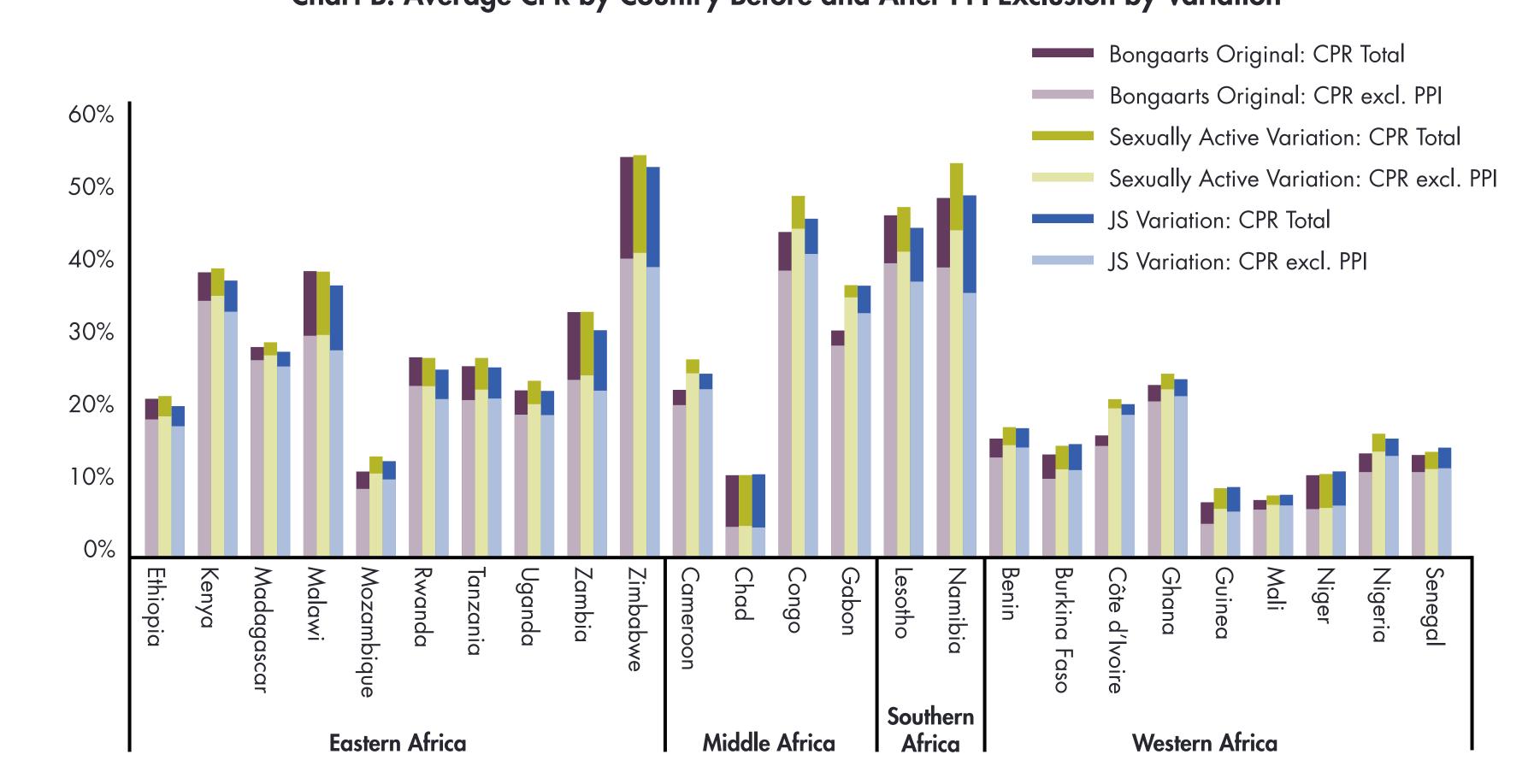
TF was customized for each country, rather than assuming a constant 15.3 (Bongaarts) or 21 (Stover). We estimated TF for each survey by algebraically solving the PD equation for fecundity [TF = TFR / (Cm * Cc * Ci * Ca)]. Survey-specific TFs were averaged for each country.

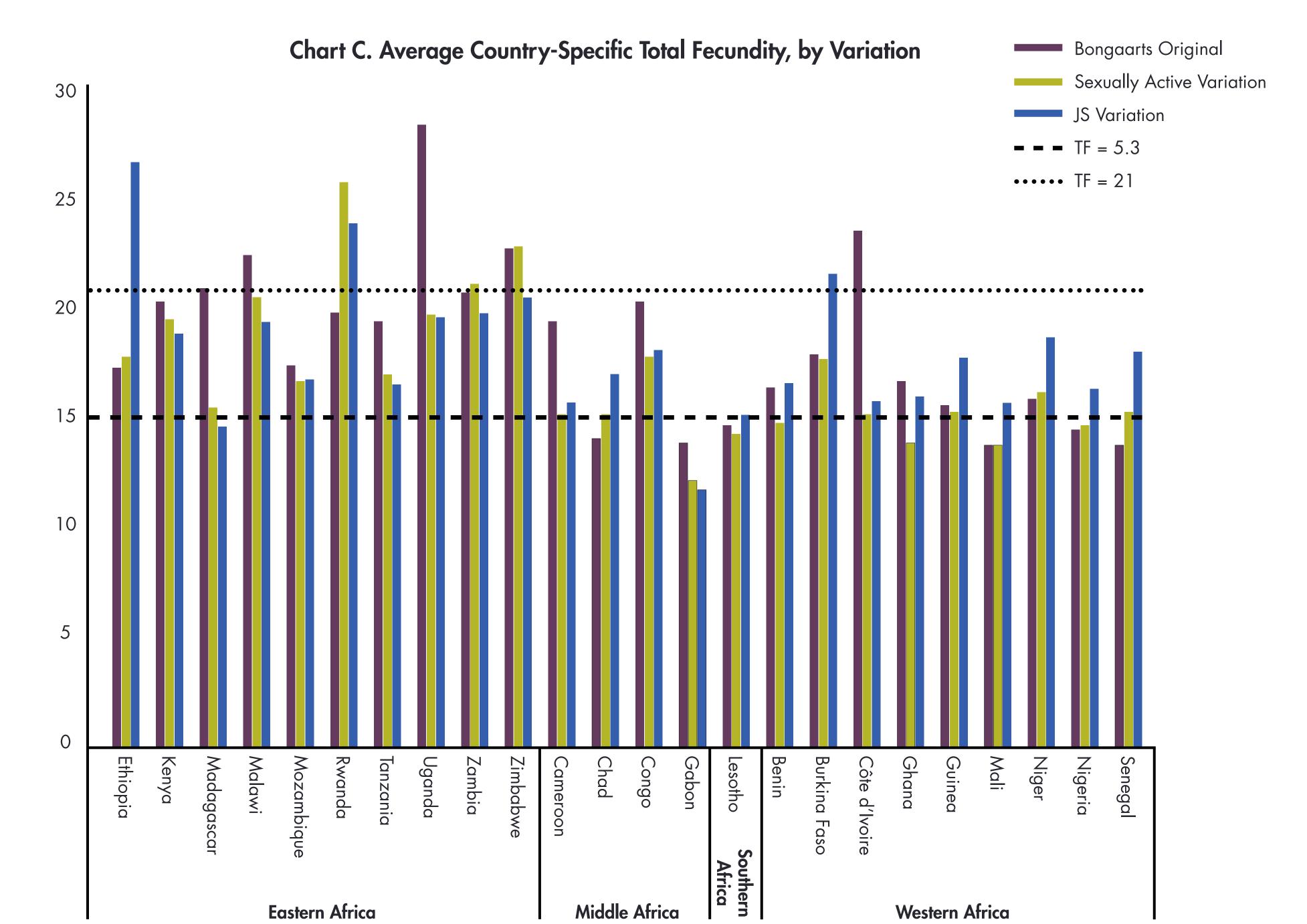
Judging Predictive Accuracy TFR Confidence Intervals

All previous analyses used arbitrary cutoffs, such as \pm 0.5, when judging the accuracy of TFR predictions. For a more evidence-based approach, we used a 95% confidence interval to judge our TFR predictions. The confidence intervals were based on reported sampling errors.

INDIVIDUAL ADJUSTMENTS

Chart B. Average CPR by Country Before and After PPI Exclusion by Variation





RESULTS

TFR Level Results

Table A. TFR Predictive Accuracy and Residuals

		Bongaarts Original	Sexually Active Variation	John Stover Variation
Before Adjustments	Accuracy	12%	17%	14%
	Average Residual (absolute)	1.27	1.02	1.01
After Adjustments	Accuracy	55%	63%	45%
	Average Residual (absolute)	.39	.30	.32

Table B. TFR Predictive Accuracy After Each Adjustment

	Bongaarts Original	Sexually Active Variation	John Stove Variation
CPR-PPI Overlap	14%	23%	18%
Interpolated CPR	9%	26%	12%
Country-Specific TF	51%	58%	51%

TFR Intersurvey Change Results

Table C. TFR Intersurvey Change Predictive Accuracy

		Bongaarts Original	Sexually Active Variation	John Stover Variation
Е	Before Adjustments	50%	50%	47.5%
After Adj	After Adjustments	50%	50%	57.5%

DISCUSSION: TFR LEVEL

- Low accuracy of predicted TFR without adjustments.
- When adjustments are implemented simultaneously, predictive accuracy reaches at least 50% across variations, a marked
- Though the CPR-PPI overlap and CPR interpolation adjustments are commonly suggested in the literature, their application does not render a notable improvement in predictive accuracy.
- The customized TF adjustment produced the largest individual and combined improvement on predicted TFR. It is unlikely that the range of TF values is due to true variation in biological fertility. Instead, the range of TF values points to the importance of country-level factors exogenous to the PD framework.

DISCUSSION: TFR INTERSURVEY CHANGE

- Approximately half of all unadjusted TFR change predictions fell within the relevant 95% confidence interval.
- Unlike TFR level, the adjustments, when combined, do not lead to substantial improvements in predictive accuracy.
- When applied individually, the adjustments to any PD variation do not produce major improvements in the accuracy of predicted TFR intersurvey change.

CONCLUSION

- Following all adjustments to both TFR level and TFR intersurvey change, the overall accuracy rates are still not suitable for the degree of certainty that policy and program planners need.
- The key to improving accuracy may lie in better understanding country-specific patterns (e.g. variation in behaviors and sociological patterns), as evidenced by the range of calculated TF values.
- New or revised methods for measuring determinants are also required.
- Until more research is done, it will remain difficult to predict short-term fertility change to a pragmatic level of certainty. It is therefore important to adjust expectations about the certainty of fertility predictions—and the impact of determinants—among demographic researchers, donors, policymakers, and program planners in the field.

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