

RESEARCH ARTICLE

The role of premarital childbearing in fertility intensity and reproductive intentions: Insights from sub-Saharan Africa

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Abstract

Sub-Saharan Africa (SSA) continues to have the highest total fertility rates (TFRs) globally. While existing fertility frameworks emphasize the proportion of women in union as a key determinant, fertility outside marriage, particularly premarital childbearing, remains underexplored. This study examines premarital childbearing and its impact on fertility intensity across 35 SSA countries using data from the Demographic and Health Surveys. Conway–Maxwell–Poisson regression models were used to assess the effects of premarital childbearing on fertility levels and reproductive intentions, controlling for maternal education, wealth, age at first childbirth, contraceptive use, age at sexual debut, and place of residence, including the interactions of premarital childbearing with maternal age. Moreover, demographic measures, including age-specific fertility rates, TFRs, and parity progression ratios (PPRs), were used to examine the impact of premarital childbearing on fertility levels and reproductive intentions. Premarital childbearing is increasingly prevalent, with substantial variation across countries. In approximately 83% of the countries analyzed, premarital childbearing is associated with a decline in fertility intensity, with interactions showing a stronger decline with advancing maternal age. PPRs and survival analysis indicate lower progression between consecutive parities, particularly from first to fourth parity, highlighting delayed childbearing among women with premarital births. These findings position premarital childbearing as a key determinant of fertility intensity alongside marriage and union dynamics. Its interaction with maternal age reveals cumulative effects across the reproductive life course, with the strongest influence observed at early parity transitions, thereby refining existing fertility frameworks by explicitly incorporating non-marital fertility, particularly premarital childbearing, as a key factor shaping reproductive trajectories in SSA.

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1. Introduction

Sub-Saharan Africa (SSA) exhibits the highest fertility rates globally and is projected to account for a substantial share of global population growth throughout the 21st century (Bongaarts & Casterline, 2013; United Nations, 2022). Although fertility has declined in

parts of the region, total fertility rates (TFR) remain above replacement level in nearly all countries, with regional fertility levels remaining roughly double the global average (Canning *et al.*, 2015; United Nations, 2019). At the same time, fertility patterns are highly heterogeneous: Several countries in Southern Africa are approaching replacement-level fertility, whereas fertility decline in Western Africa has been slower and more uneven, with several countries remaining in pre-transitional regimes (Bongaarts & Casterline, 2022; Ojaka, 2022). These persistently high yet uneven fertility patterns have substantial implications for population dynamics, reproductive health, and socioeconomic development, underscoring the need for a better understanding of the mechanisms shaping fertility behavior in SSA (Cleland & Machiyama, 2017).

Fertility research in SSA, as in other regions, has long been grounded in classical demographic frameworks that emphasize marriage and union formation as the primary determinants of exposure to childbearing (Bongaarts, 1978; Caldwell *et al.*, 1992). Historically, marriage has been nearly universal across much of the region and is characterized by early marriage, large spousal age gaps, polygamy, and relatively high levels of union dissolution and remarriage, particularly in Western and Central Africa (Clark *et al.*, 2017; John & Adjiwanou, 2022; Shapiro & Gebreselassie, 2014; Tabutin *et al.*, 2020). Within this framework, fertility behavior has been understood primarily in terms of marital status, the timing of marriage, and marital fertility patterns, while non-marital fertility has remained marginal to broader fertility dynamics (Garenne, 2004; Smith-Greenaway & Clark, 2018).

Nevertheless, recent demographic shifts and social transformations increasingly challenge marriage-centered interpretations of fertility in SSA. Rising female education, expanding employment opportunities, urbanization, and shifting gender norms, particularly in Southern and Eastern Africa, have contributed to delayed marriage and more heterogeneous partnership trajectories (Amoo, 2020; Dunn *et al.*, 2022; Kebede *et al.*, 2022). While delayed marriage has enhanced women's autonomy, contraceptive use, and access to reproductive health services, it has also extended the period of exposure to sexual activity outside formal unions. As a result, premarital childbearing, once relatively uncommon in many settings, has become an increasingly salient feature of reproductive behavior in several countries across the region (Clark *et al.*, 2017; Ikamari, 2024).

Globally, fertility outside marriage takes diverse forms. In Europe, North America, and much of Latin America, premarital fertility occurs primarily within stable cohabiting or informal unions, whereas in East Asia it remains rare

but is gradually increasing alongside delayed marriage and low fertility (Oláh, 2015; Perelli-Harris & Amos, 2015; Raymo *et al.*, 2015; Sobotka, 2021). These contrasts highlight the strong contextual dependence of premarital fertility (Perelli-Harris & Kuang, 2024). In SSA, premarital childbearing often occurs outside long-term cohabiting unions. It may therefore carry distinct social meanings and life-course consequences, particularly with respect to marriage timing, parity progression, and subsequent fertility behavior (Sennott *et al.*, 2016). This global diversity underscores the strongly context-dependent consequences of premarital childbearing. In SSA, where cohabitation is less institutionalized and marital norms remain strong in many settings, a premarital birth may represent a distinct disruptive event in the life course, with unique implications for subsequent fertility. Yet despite persistently high fertility levels in the region, fertility occurring outside marriage, especially premarital childbearing, remains insufficiently integrated into dominant fertility frameworks (Bongaarts & Casterline, 2022).

Existing research on premarital childbearing in SSA has focused primarily on prevalence and key sociodemographic correlates, such as education, household wealth, and age at sexual debut (Clark *et al.*, 2017; Dunn *et al.*, 2022; Ikamari, 2024; Kravdal, 2002). Related fertility research has examined how nuptiality structures, including marriage timing, polygamy, divorce, and remarriage, influence fertility outcomes (John & Adjiwanou, 2022; Monica & Hans-Peter, 2022). However, the effects of premarital childbearing on fertility levels and fertility preferences across the reproductive life course remain poorly understood. Three key gaps persist. First, there is limited cross-national evidence on whether premarital childbearing is associated with higher or lower fertility intensity and level. Second, few studies examine how premarital childbearing shapes parity-specific transitions and cumulative fertility outcomes. Third, little is known about how premarital childbearing interacts with maternal age to influence fertility trajectories across diverse SSA contexts. Addressing these gaps is crucial for refining fertility models and for designing policies that account for the growing share of fertility occurring outside formal marriage in the region.

From a life-course perspective, premarital childbearing may represent a critical turning point that reshapes subsequent reproductive behavior (Bernardi *et al.*, 2019; Buhr & Huinink, 2014; Elder *et al.*, 2003). Rather than uniformly increasing fertility, an early non-marital birth may delay marriage, alter partnership trajectories, and influence the timing and spacing of subsequent births, with effects that accumulate as women age (Kuang *et al.*,

2025; Schoen, 2023; Sennott *et al.*, 2016; Smith-Greenaway & Clark, 2018). These dynamics suggest that premarital childbearing functions not only as a marker of early fertility exposure but also as a determinant of fertility intensity and timing across the reproductive lifespan (Beaujouan, 2023).

Against this backdrop, the present study examines the relationship between premarital childbearing and fertility levels and intensity across 35 SSA countries using harmonized, nationally representative Demographic and Health Survey (DHS) data. Specifically, the study examines whether premarital childbearing is associated with differences in fertility intensity, parity progression, and reproductive timing, and whether these associations vary by maternal age.

This study makes three contributions to population and fertility research. First, it provides a comprehensive cross-national assessment of the association between premarital childbearing and both fertility levels and fertility intensity across SSA. Second, it combines demographic measures (i.e., age-specific fertility rates [ASFRs], TFRs, and parity progression ratios [PPRs]) with regression-based modeling to examine how premarital childbearing shapes fertility trajectories over the reproductive life course. Third, by applying Conway–Maxwell–Poisson (COM–Poisson) regression models, which are robust to both overdispersed and underdispersed count data, the study produces more reliable estimates of the effects of premarital childbearing on fertility intensity across diverse national contexts. By explicitly incorporating premarital childbearing into fertility analysis, this study refines existing fertility frameworks and highlights premarital childbearing as an important proximate determinant that can suppress fertility intensity and alter reproductive timing in SSA.

2. Data and methods

2.1. Data source and variables

This study used data from the DHS conducted in 35 countries in SSA since 1990. Trend analyses included countries with at least two survey rounds. The primary independent variable was premarital childbearing, defined as having a first birth before first marriage. Fertility outcomes encompassed fertility intensity (children ever born), TFR, ASFR, and the PPR, which represent the probability of progressing from one parity to the next.

Covariates included maternal age, education, wealth index, age at first childbirth, current contraceptive use, age at first sexual debut, and place of residence. All women with at least one child were included in the analysis, regardless of marital status.

2.2. Model specification

To assess the association between premarital childbearing and fertility intensity, country-specific COM–Poisson count regression models were estimated. Premarital childbearing was included as the main predictor, and an additional model incorporated an interaction term between premarital childbearing and maternal age to examine age-related variation in fertility intensity. While Poisson regression is commonly used for count data, its assumption of equidispersion—equal mean and variance—often does not hold in practice. Negative binomial models relax this assumption by allowing the variance to exceed the mean, but they are designed to address overdispersion only. When data exhibit underdispersion, where the variance is smaller than the mean, alternative approaches, such as generalized Poisson, quasi-Poisson, and COM–Poisson models have been proposed (Ahmed *et al.*, 2024; Harris *et al.*, 2012; Ibeji *et al.*, 2020; Wang & Famoye, 1997; Winkelmann & Zimmermann, 1994). The COM–Poisson model was chosen for its flexibility in managing both overdispersion and underdispersion through a two-parameter framework, providing a robust approach for estimating the effects of premarital childbearing on fertility outcomes (Esin, 2018; Sellers *et al.*, 2012; Sellers & Shmueli, 2010). The COM–Poisson distribution is given by,

$$P(Y = y | \lambda, \nu) = \frac{\lambda^\nu}{(y!)^\nu Z(\lambda, \nu)}, y = 1, 2, 3, \dots \quad (1)$$

where λ represents the fertility intensity (rate) parameter of the COM–Poisson distribution and ν is the dispersion parameter ($\nu > 1$ = Under-dispersion; $\nu < 1$ = overdispersion). The COM–Poisson intensity parameter λ was linked to the covariates using a log link function, such that

$$\text{Log}(\lambda_i) = X_i\beta = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_j X_{ij} \quad (2)$$

2.3. Statistical analysis

All analyses were conducted using R (version 4.4.3) on the RStudio platform, with Stata (version 17) used for data cleaning. Descriptive statistics were computed to summarize sample characteristics. The effects of premarital childbearing on fertility outcomes were estimated using COM–Poisson regression models, which account for potential overdispersion or underdispersion in count data. Comparative analyses were performed using ASFR, TFR, and PPRs. The p -values for model coefficients were adjusted using the Benjamini–Hochberg procedure to control the false discovery rate. Statistical significance was set at a two-sided $p < 0.05$.

3. Results

3.1. Patterns of premarital childbearing

Premarital childbearing is widespread across Africa, with substantial cross-national variation, ranging from approximately 4% to over 75% (Figure 1 and Table 1). South Africa (77.1%) and Namibia (73.7%) in Southern Africa exhibit the highest prevalence. Gabon (64.0%) in Central Africa and Liberia (54.7%) in Western Africa show the highest rates of premarital childbearing. On the other hand, countries, such as Niger (3.8%), Ethiopia (7.5%), Chad (8.0%), Senegal (8.1%), Mauritania (8.4%), Comoros (10.0%), and Burundi (11.0%) have the lowest proportions of premarital childbearing. Countries, including Angola, Tanzania, Kenya, Côte d'Ivoire, Cameroon, and Ghana fall within the middle range of the distribution of premarital childbearing across the continent. This marked heterogeneity underscores the need for fertility studies to incorporate marital dynamics, moving beyond traditional approaches to better capture the interplay between fertility behaviors and marriage patterns.

Comparing proportions across maternal age groups provides valuable insights into generational patterns of

premarital childbearing. A higher prevalence among younger women suggests an increasing trend, whereas a higher proportion among older mothers indicates a decline across generations. These shifts reflect changes in social norms, generational dynamics, and reproductive behaviors. In nearly all countries, a decline in prevalence—measured in percentage points—is observed between the youngest mothers (under 24 years) and the oldest mothers (35 years and older), as shown in Table 1. Positive differences in percentage points (under 24 years minus 35 years and older), signal a rising cohort trend, suggesting that premarital childbearing may become more prevalent in future generations. Conversely, small differences in percentage points suggest stabilization of premarital childbearing across cohorts, while negative differences indicate a generational decline, as younger women exhibit a lower prevalence than older mothers. For example, countries, such as Kenya (+21.22% points), Zambia (+24.59), Rwanda (+25.97), and Ghana (+19.08) exhibit significantly higher prevalence among women under 24 compared to those aged 35 and older, indicating that premarital childbearing is becoming more common in these societies. This trend is likely driven by factors,

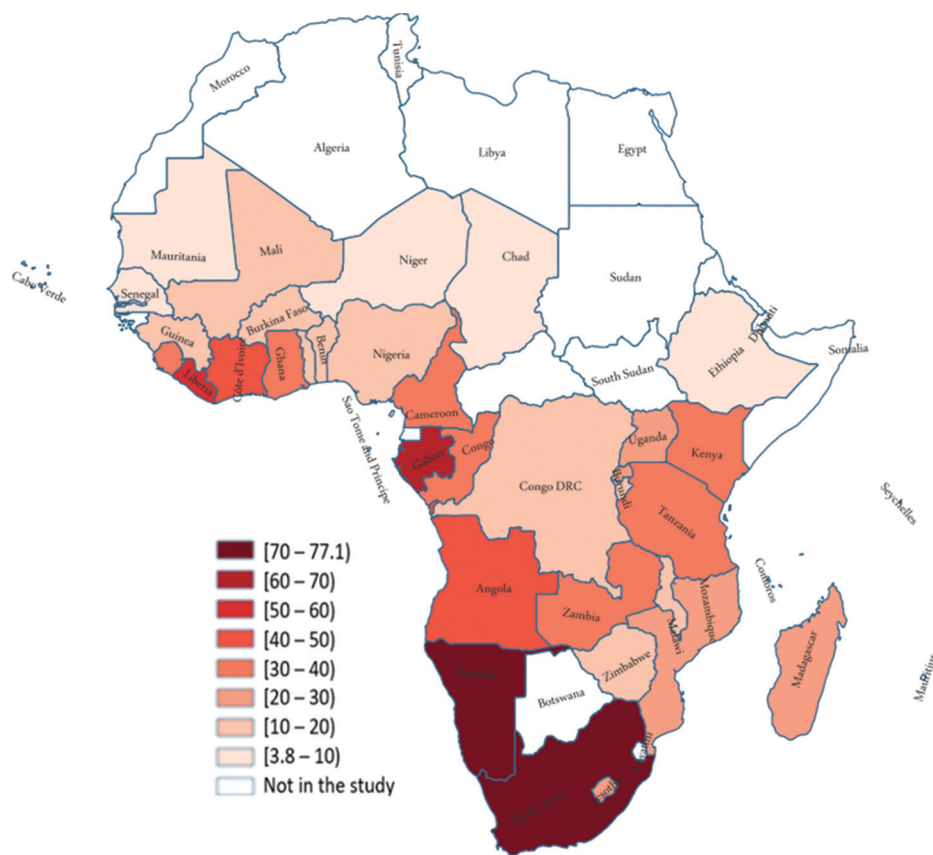


Figure 1. Distribution of premarital childbearing prevalence across the study countries, based on Demographic and Health Survey data

Table 1. Weighted proportions of premarital childbearing overall and by maternal age, based on the most recent Demographic and Health Surveys data (2012–2022)

Country	Survey	N (%)	<24 (N [%])	25–34 (N [%])	35+ (N [%])
Angola	2015	10,793 (48.8)	3,314 (56.58)	3,935 (47.22)	3,544 (43.43)
Benin	2017	11,783 (18.2)	2,481 (19.23)	4,902 (17.32)	4,400 (18.59)
Burkina Faso	2021	12,834 (16.2)	2,707 (15.63)	4,850 (16.85)	5,277 (15.88)
Burundi	2016	11,359 (11.0)	2,024 (21.49)	4,794 (9.18)	4,541 (8.15)
Cameroon	2018	9,482 (35.3)	2,175 (39.08)	3,944 (35.52)	3,363 (32.65)
Chad	2014	14,142 (8.0)	3,678 (9.14)	5,609 (6.94)	4,855 (8.30)
Comoros	2012	2,940 (10.0)	533 (6.57)	1,153 (7.89)	1,254 (13.40)
Congo	2012	8,285 (32.3)	2,071 (34.81)	3,271 (30.94)	2,943 (32.11)
Congo DRC	2013	13,894 (15.6)	3,445 (22.82)	5,691 (13.25)	4,758 (13.16)
Côte d'Ivoire	2021	10,530 (41.9)	2,234 (47.22)	4,163 (41.10)	4,133 (39.85)
Ethiopia	2016	10,587 (7.5)	1,867 (4.93)	4,638 (6.73)	4,082 (9.68)
Gabon	2022	7,007 (64.0)	1,320 (67.88)	2,812 (64.22)	2,875 (61.98)
Gambia	2019	7,543 (17.2)	1,279 (24.32)	3,198 (16.39)	3,066 (15.10)
Ghana	2022	10,159 (30.2)	1,554 (44.40)	3,752 (30.52)	4,853 (25.32)
Guinea	2018	7,689 (16.0)	1,718 (20.61)	2,957 (15.39)	3,014 (14.07)
Kenya	2022	23,122 (35.9)	4,110 (50.73)	9,273 (36.07)	9,739 (29.51)
Lesotho	2014	4,542 (23.6)	1,029 (32.56)	1,791 (25.01)	1,722 (16.84)
Liberia	2019	6,250 (54.7)	1,537 (61.42)	2,328 (55.11)	2,385 (49.94)
Madagascar	2019	14,277 (23.0)	3,839 (27.72)	5,080 (22.52)	5,358 (20.16)
Malawi	2015	19,030 (18.5)	5,231 (21.64)	7,352 (17.82)	6,447 (16.75)
Mali	2018	8,361 (16.2)	2,118 (18.04)	3,413 (16.38)	2,830 (14.56)
Mauritania	2019	10,048 (8.4)	1,909 (6.97)	4,003 (8.09)	4,136 (9.26)
Mozambique	2022	10,118 (27.2)	3,036 (28.56)	3,529 (26.55)	3,553 (26.77)
Namibia	2013	6,222 (73.7)	1,265 (80.00)	2,377 (75.68)	2,580 (68.76)
Niger	2012	9,461 (3.8)	2,306 (3.12)	4,001 (4.40)	3,154 (3.65)
Nigeria	2018	29,948 (13.0)	5,525 (11.11)	11,842 (13.01)	12,581 (13.84)
Rwanda	2019	9,329 (22.0)	1,137 (41.07)	3,577 (24.97)	4,615 (15.10)
Senegal	2019	5,478 (8.1)	1,025 (9.07)	2,216 (8.66)	2,237 (7.20)
Sierra Leone	2019	11,457 (35.7)	2,389 (47.76)	4,320 (35.42)	4,748 (29.91)
South Africa	2016	6,153 (77.1)	997 (87.06)	2,428 (78.25)	2,728 (72.32)
Tanzania	2022	11,380 (30.9)	2,424 (34.16)	4,271 (32.66)	4,685 (27.66)
Togo	2013	6,844 (17.4)	1,142 (22.77)	2,780 (16.44)	2,922 (16.15)
Uganda	2016	13,693 (25.8)	3,657 (30.41)	5,303 (25.08)	4,733 (23.05)
Zambia	2018	10,319 (35.9)	2,742 (50.26)	3,794 (35.71)	3,783 (25.67)
Zimbabwe	2015	7,309 (18.9)	1,562 (20.49)	3,055 (18.13)	2,692 (18.80)

such as delayed marriage, urbanization, and changing social attitudes. Similarly, moderate increases in Angola (+13.15), Sierra Leone (+17.85), and South Africa (+14.74) further underscore generational shifts.

In some countries, differences in premarital childbearing between younger and older women are negligible or negative, suggesting stabilization or slight declines across

cohorts. For example, Mozambique (+1.79), Zimbabwe (+1.69), Cameroon (+6.43), and Senegal (+1.87) show small increases in premarital childbearing among younger women, indicating limited generational shifts. Conversely, countries, such as Comoros (−6.83), Ethiopia (−4.75), Mauritania (−2.29), and Nigeria (−2.73) display negative differences, although the magnitude of these declines remains relatively modest.

3.2. Trends and change in premarital childbearing

Analysis of the earliest and most recent surveys reveals substantial changes in premarital childbearing across the region, as presented in Table 2. For instance, Ghana experienced a striking increase, rising from 9.8% in 1993

to 30.2% in 2022, reflecting a dramatic shift over nearly three decades. Liberia similarly recorded a notable rise of approximately 20 percentage points between 2007 and 2019, while Zambia exhibited a consistent upward trajectory over the study period.

Table 2. Weighted trends and changes in premarital childbearing and births across countries, based on comparisons of the earliest and most recent Demographic and Health Surveys data

Country	Earliest survey year	Premarital childbearing %—earliest	Latest survey year	Premarital childbearing %—latest	Premarital childbearing change (%)	Years between survey periods	Annualized change in childbearing (%)	Premarital births (%)—earliest	Premarital births (%)—latest	Premarital births change (%)	Annualized change in births (%)
Angola	-	-	2015	48.8	-	-	-	-	64.5	-	-
Benin	1996	9.0	2017	18.2	9.2	21.50	0.43	12.3	27.1	14.8	0.69
Burkina Faso	1993	7.8	2021	16.2	8.3	28.80	0.29	10.6	21.9	11.3	0.39
Burundi	2010	7.2	2016	11.0	3.7	6.10	0.61	9.7	15.0	5.3	0.86
Cameroon	1991	19.5	2018	35.3	15.8	27.30	0.58	27.0	43.6	16.5	0.61
Chad	1996	2.6	2014	8.0	5.4	17.80	0.30	3.4	12.5	9.1	0.51
Comoros	1996	3.4	2012	10.0	6.7	16.70	0.40	6.1	17.0	11.0	0.66
Congo	2005	42.4	2011	32.3	-10.1	6.20	-1.63	52.8	40.3	-12.5	-2.01
Congo DRC	-	-	2013	15.6	-	-	-	-	21.5	-	-
Côte d'Ivoire	1994	31.9	2021	41.9	10.0	27.10	0.37	44.7	53.6	9.00	0.33
Ethiopia	2000	3.1	2016	7.5	4.5	16.00	0.28	4.0	11.6	7.62	0.48
Gabon	2000	51.7	2019	64.0	12.3	20.10	0.61	66.1	70.8	4.73	0.24
Gambia	2013	12.3	2019	17.2	4.9	6.11	0.80	16.6	22.7	6.15	1.01
Ghana	1993	9.8	2022	30.2	20.3	28.10	0.72	12.9	39.4	26.43	0.94
Guinea	1999	8.8	2018	16.0	7.2	18.10	0.40	13.5	23.1	9.61	0.53
Kenya	1993	32.5	2022	35.9	3.4	28.11	0.12	40.7	43.1	2.34	0.08
Lesotho	2004	18.3	2014	23.6	5.4	9.10	0.59	23.9	30.3	6.33	0.70
Liberia	2007	34.7	2019	54.7	20.0	12.60	1.58	46.9	69.7	22.80	1.81
Madagascar	1992	23.4	2021	23.0	-0.3	28.70	-0.01	32.2	31.0	-1.20	-0.04
Malawi	1992	12.6	2015	18.5	5.9	23.30	0.25	17.6	25.2	7.57	0.33
Mali	1995	6.5	2018	16.2	9.6	22.50	0.43	9.3	21.8	12.44	0.55
Mauritania	-	-	2019	8.4	0.0	-	-	-	13.6	-	-
Mozambique	1997	17.9	2022	27.2	9.3	25.60	0.36	26.3	36.5	10.15	0.40
Namibia	1992	59.1	2013	73.7	14.6	20.10	0.73	77.1	85.0	7.91	0.39
Niger	1992	3.8	2012	3.8	0.1	19.11	0.00	5.5	5.8	0.28	0.01
Nigeria	1990	9.3	2018	13.0	3.7	28.10	0.13	13.0	20.6	7.61	0.27
Rwanda	1992	7.6	2019	22.1	14.5	27.90	0.52	10.0	30.5	20.55	0.74
Senegal	1992	11.3	2019	8.1	-3.2	26.80	-0.12	15.1	11.0	-4.03	-0.15
Sierra Leone	2008	24.1	2019	35.7	11.7	11.20	1.04	35.4	49.2	13.85	1.24
South Africa	1998	62.2	2016	77.1	14.9	18.10	0.82	73.8	85.7	11.83	0.65
Tanzania	1991	22.0	2022	30.9	8.9	30.40	0.29	30.3	41.1	10.76	0.35
Togo	1998	14.4	2013	17.4	2.9	15.10	0.19	19.3	21.7	2.48	0.16
Uganda	1995	17.8	2016	25.8	8.0	21.40	0.37	25.2	37.1	11.84	0.55
Zambia	1992	19.3	2018	35.9	16.6	14.00	1.18	23.8	44.3	20.54	1.47
Zimbabwe	1994	19.5	2015	18.9	-0.6	21.00	-0.03	25.8	25.1	-0.66	-0.03

Conversely, a few countries experienced minimal or even negative changes in premarital childbearing trends. Madagascar, for example, showed a negligible decline of 0.3 percentage points over a 28-year period, indicating stability over time. Senegal and Zimbabwe also exhibited slight declines, with reductions of 3.2 and 0.6% points, respectively.

Annualized changes further highlight heterogeneity in the pace of change across countries. Liberia and Zambia, for instance, showed high annualized growth rates of 1.58% and 1.18%, respectively, reflecting steady increases in premarital childbearing over the survey periods. On the other hand, countries, such as Niger and Zimbabwe exhibit annualized rates close to zero, indicating stability and negligible changes in their premarital childbearing trends over time.

Analyses of premarital births offer additional insights into these patterns. In Ghana, the percentage of premarital births rose from 12.9% to 39.4%, illustrating a substantial increase in the proportion of children born outside of marriage. Similarly, Liberia recorded a sharp rise from 46.9% to 69.7%, reinforcing the broader trend observed in premarital childbearing. Together, these findings underscore the growing prevalence of births occurring outside marriage in these countries, reflecting broader social and demographic transformations.

3.3. Conway–Maxwell–Poisson regression model results

A COM–Poisson model was fitted to evaluate the effect of premarital childbearing on fertility, adjusting for covariates, such as current maternal age, maternal education, wealth index, age at first childbirth, current contraceptive use, age at first sexual debut, and place of residence. Table 3 presents estimates from models, including both the main effects and interaction effects. The model incorporated an interaction term between premarital childbearing and maternal age, and a separate model was fitted to account for the cumulative impact of childbearing among older women. The country-specific models were fitted separately for each country, with complete results for all individual models provided in the supplementary materials (Tables S1 and S2).

In the majority of countries (82.9%, or 29 of 35), premarital childbearing is associated with a significant decline in fertility intensity. The largest reductions in childbearing intensity associated with premarital births are observed in countries, such as Rwanda, South Africa, and Burundi. In Rwanda, childbearing intensity decreases by 33.2% (rate ratio [RR] = 0.668), while South Africa and Burundi show declines of 27.8% (RR = 0.722) and

25.8% (RR = 0.742), respectively. Moderate reductions in childbearing intensity are observed in Kenya (19.0%; RR = 0.810), Senegal, and Cameroon (17.4%; RR = 0.826). Conversely, premarital childbearing is linked to an increase in subsequent childbearing intensity in some countries. For example, in Comoros, childbearing intensity increases by 10.4% (RR = 1.104), while Niger and Chad exhibit increases of 9.5% (RR = 1.095) and 6.7% (RR = 1.067), respectively. These patterns suggest that, in certain cultural contexts, premarital births may align with pronatalist norms and do not disrupt overall fertility trajectories. In other countries, the impact of premarital childbearing on subsequent childbearing intensity is minimal. In Burkina Faso, Ethiopia, and Mauritania, the association is small and statistically insignificant, indicating limited influence on fertility behaviors.

Interaction terms were adjusted for the accumulation of children ever born among older women to evaluate the impact of premarital childbearing on overall lifetime childbearing intensity. In Angola, Congo, the Democratic Republic of the Congo (Congo DRC), Gabon, Guinea, Liberia, Madagascar, Sierra Leone, Uganda, Zambia, and Zimbabwe, premarital childbearing is associated with a decline in the number of children a woman has in her lifetime, although the interaction terms are not statistically significant. In Burundi, women who experienced premarital childbearing have a 23.1% lower fertility rate. A similar pattern is observed among women aged 25–34, who experience a 13.8% reduction in fertility compared to those women under age 24, underscoring that premarital childbearing is consistently associated with a lower lifetime number of children, regardless of maternal age. In Cameroon, Chad, Comoros, Côte d'Ivoire, Kenya, Mauritania, Namibia, Niger, Nigeria, Rwanda, and Tanzania, the impact of premarital childbearing on reducing fertility becomes increasingly pronounced with age. Among women aged 25–34, premarital childbearing is associated with a significant reduction in fertility compared with women under 24, indicating a noticeable decline in childbearing intensity within this age group. For women aged 35 and older, the reduction is even greater, underscoring an amplified decline in the impact of premarital childbearing on lifetime fertility as women age. This trend reflects a generational pattern, where the long-term effects of premarital childbearing on fertility intensify with advancing age.

3.4. TFR and ASFR by premarital and marital first birth status

Consistent with earlier findings on fertility intensity (children ever born), the cross-national analysis reveals that women with premarital first births consistently have lower

Table 3. Main and interaction effects of premarital childbearing and maternal age on rate ratios, based on the most recent Demographic and Health Surveys data (2012–2022)

Country	Main effects		Interaction effects			
	Premarital	Premarital	25–34	35+	Premarital: 25–34	Premarital: 35+
Angola	0.868 (0.011)***	0.864 (0.026)***	3.432 (0.106)***	7.426 (0.275)***	1.016 (0.038)	0.997 (0.036)
Benin	0.937 (0.016)***	0.97 (0.052)	4.302 (0.138)***	11.034 (0.441)***	1.01 (0.062)	0.932 (0.054)
Burkina Faso	0.972 (0.018)	1.007 (0.058)	4.683 (0.155)***	14.041 (0.59)***	1.006 (0.065)	0.937 (0.058)
Burundi	0.742 (0.018)***	0.769 (0.045)***	4.129 (0.14)***	11.846 (0.521)***	0.862 (0.061)*	1.029 (0.069)
Cameroon	0.826 (0.012)***	0.964 (0.037)	3.165 (0.101)***	6.221 (0.236)***	0.854 (0.038)***	0.823 (0.035)***
Chad	1.067 (0.02)***	1.158 (0.058)**	3.6 (0.083)***	7.87 (0.236)***	1.01 (0.059)	0.845 (0.047)**
Comoros	1.104 (0.04)***	1.373 (0.165)**	2.625 (0.134)***	5.109 (0.312)***	0.839 (0.113)	0.769 (0.098)*
Congo	0.9 (0.014)***	0.856 (0.036)***	3.313 (0.116)***	7.308 (0.307)***	1.08 (0.054)	1.05 (0.049)
Congo DRC	0.797 (0.013)***	0.8 (0.03)***	3.337 (0.077)***	7.057 (0.205)***	1.015 (0.047)	0.979 (0.043)
Côte d'Ivoire	0.851 (0.012)***	0.916 (0.038)*	3.511 (0.123)***	8.256 (0.339)***	0.948 (0.045)	0.905 (0.041)*
Ethiopia	0.989 (0.022)	1.022 (0.102)	3.136 (0.091)***	6.613 (0.238)***	1.091 (0.117)	0.905 (0.094)
Gabon	0.868 (0.015)***	0.879 (0.043)*	2.396 (0.115)***	4.341 (0.221)***	1.026 (0.057)	0.963 (0.051)
Gambia	0.882 (0.02)***	0.964 (0.067)	4.2 (0.164)***	10.444 (0.512)***	0.878 (0.069)	0.927 (0.07)
Ghana	0.865 (0.016)***	0.902 (0.051) #	3.979 (0.167)***	11.056 (0.542)***	0.979 (0.062)	0.941 (0.056)
Guinea	0.891 (0.02)***	0.873 (0.051)*	3.353 (0.117)***	7.199 (0.31)***	1.013 (0.07)	1.034 (0.068)
Kenya	0.81 (0.01)***	0.933 (0.031)*	3.706 (0.1)***	8.551 (0.265)***	0.883 (0.034)**	0.829 (0.03)***
Lesotho	0.83 (0.029)***	0.935 (0.073)	3.706 (0.222)***	10.708 (0.771)***	0.869 (0.083)	0.857 (0.081)
Liberia	0.872 (0.015)***	0.845 (0.042)***	3.699 (0.181)***	8.323 (0.466)***	1.005 (0.059)	1.051 (0.058)
Madagascar	0.89 (0.012)***	0.885 (0.031)***	3.096 (0.077)***	7.135 (0.221)***	1 (0.042)	1.012 (0.04)
Malawi	0.929 (0.014)***	0.929 (0.035) #	5.317 (0.144)***	15.943 (0.558)***	1.068 (0.048)	0.951 (0.041)
Mali	0.91 (0.018)***	0.933 (0.05)	3.691 (0.118)***	8.215 (0.337)***	0.965 (0.06)	0.978 (0.059)
Mauritania	1.031 (0.023)	1.461 (0.11)***	3.133 (0.091)***	7.142 (0.264)***	0.722 (0.061)***	0.668 (0.053)***
Mozambique	0.875 (0.015)***	0.983 (0.04)	3.785 (0.125)***	8.715 (0.349)***	0.93 (0.046)	0.834 (0.039)***
Namibia	0.87 (0.021)***	1.011 (0.075)	3.916 (0.309)***	10.392 (0.852)***	0.89 (0.076)	0.822 (0.066)*
Niger	1.095 (0.034)**	1.627 (0.15)***	4.047 (0.121)***	10.095 (0.404)***	0.739 (0.075)**	0.557 (0.057)***
Nigeria	0.883 (0.01)***	0.938 (0.036)	3.401 (0.058)***	7.272 (0.153)***	0.96 (0.04)	0.924 (0.038) #
Rwanda	0.668 (0.015)***	0.83 (0.059)*	4.084 (0.221)***	14.268 (0.885)***	0.803 (0.064)**	0.776 (0.06)**
Senegal	0.815 (0.028)***	0.949 (0.091)	3.991 (0.176)***	10.968 (0.625)***	0.824 (0.09) #	0.853 (0.09)
Sierra Leone	0.891 (0.012)***	0.883 (0.037)**	3.037 (0.103)***	6.726 (0.262)***	1.002 (0.048)	1.016 (0.047)
South Africa	0.722 (0.023)***	0.814 (0.102)	3.636 (0.469)***	9.865 (1.273)***	0.909 (0.124)	0.865 (0.113)
Tanzania	0.818 (0.012)***	0.944 (0.041)	3.254 (0.104)***	7.36 (0.272)***	0.895 (0.045)*	0.825 (0.039)***
Togo	0.888 (0.022)***	0.977 (0.076)	4.059 (0.183)***	10.268 (0.554)***	0.908 (0.08)	0.893 (0.075)
Uganda	0.914 (0.012)***	0.908 (0.031)**	3.575 (0.093)***	8.224 (0.263)***	0.976 (0.039)	1.028 (0.039)
Zambia	0.82 (0.013)***	0.859 (0.034)***	4.609 (0.175)***	12.367 (0.569)***	0.95 (0.046)	0.943 (0.043)
Zimbabwe	0.867 (0.023)***	0.862 (0.061)*	5.008 (0.24)***	12.91 (0.749)***	1.065 (0.088)	0.965 (0.078)

Notes:*** FDR-adjusted $P < 0.001$; ** FDR-adjusted $P < 0.01$; * FDR-adjusted $P < 0.05$; # FDR-adjusted $P < 0.1$.

Abbreviation: FDR: False discovery rate.

TFRs compared to those with marital first births. Notably, across all countries analyzed, the TFR among women with premarital childbearing is lower than that of women whose first birth occurred within marriage (Figure 2). This

pattern suggests that premarital childbearing is associated with lower TFRs. In most countries, the lower fertility rates among women with premarital births align closely with trends observed among their counterparts. ASFRs further

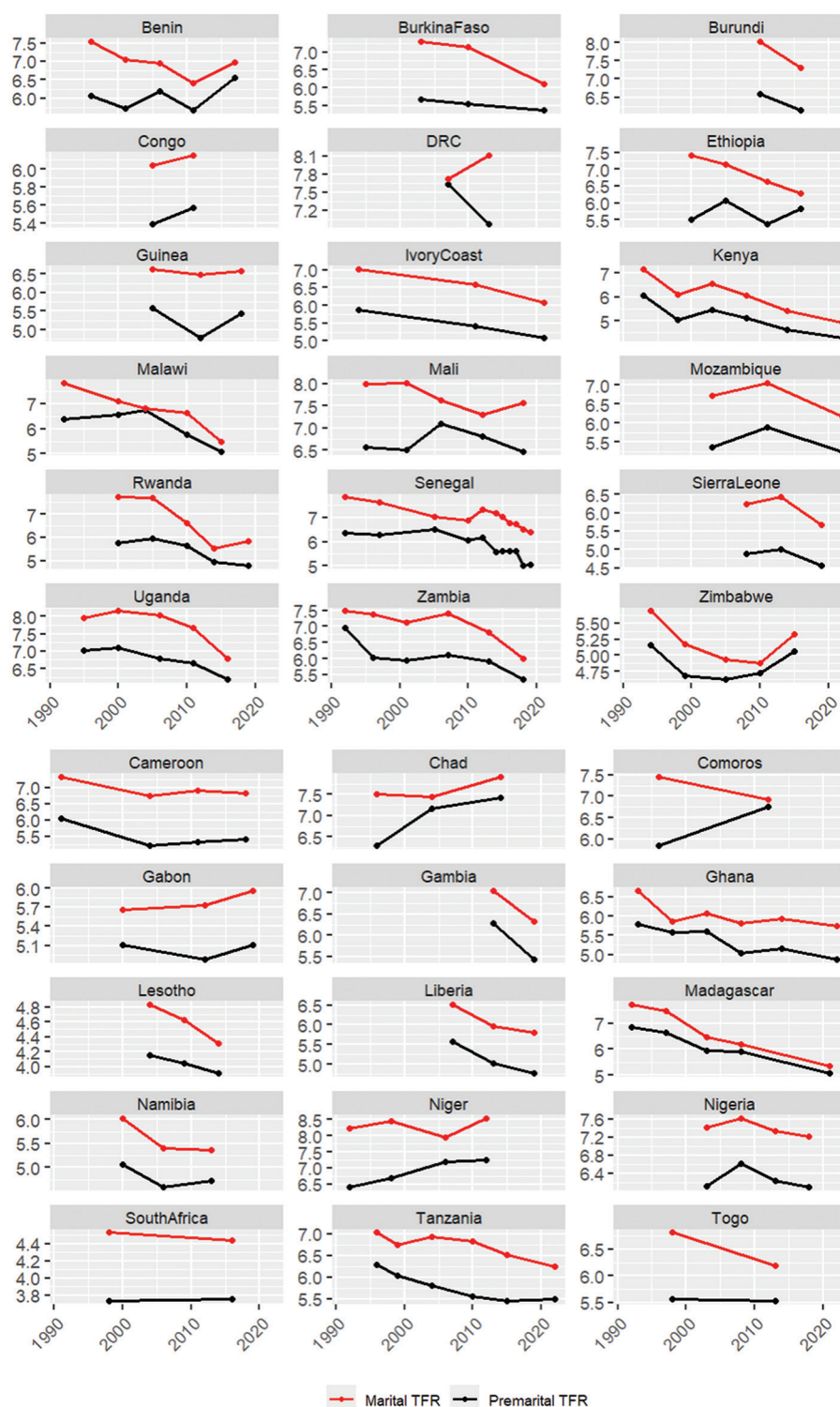


Figure 2. Trends and comparison of total fertility rate between women with premarital and marital first births

support this pattern (Figures S1-S5), indicating that women with premarital births generally have lower fertility. The gap is most pronounced among women in their 20s and

tends to narrow at older ages, suggesting that women with premarital births attempt to “catch up” on reproductive opportunities missed earlier in life, potentially due to

birth postponement. In some countries, such as Ghana, Comoros, Mali, Namibia, Nigeria, and Uganda, premarital childbearing rates are higher at younger ages compared to those within marriage, which may signal a higher incidence of teenage childbearing in these contexts.

3.5. Effects of premarital childbearing on PPRs

While TFRs and ASFRs offer a broad overview of fertility patterns, they do not capture reproductive intentions or the timing of parity transitions. PPRs, combined with survival analysis, provide deeper insights into the pace of transitions between parities and how childbearing decisions align with desired family size. This section analyzes PPRs for transitions up to the sixth parity. Table 4 presents five-year PPRs for these transitions. The results show a consistent decline in progression as parities increase among women whose first birth occurred within marriage, with the highest progression observed from parity 1 to parity 2. In contrast, among women who had their first child premaritally, the highest progression occurs from parity 2 to parity 3 and from parity 3 to parity 4. The results reveal a significant gap in parity progression between women with premarital first births and those without, particularly in the transitions to parity 2, 3, and 4. In contrast, the gap between the two groups diminishes at higher parities. This pattern suggests birth postponement, followed by efforts to “catch up” and recover lost reproductive opportunities among women with premarital childbearing. However, in countries, such as South Africa, Namibia, and Lesotho, where fertility levels are relatively low and premarital childbearing is more common, the marital difference in parity progression appears less pronounced. These countries also exhibit lower percentages of progression to consecutive parities.

Consistent with the PPR results, survival analysis of parity progression examines the pace at which women with premarital and marital first births transition to subsequent parities. Overall, women with premarital births show a higher likelihood of delayed or non-progression to subsequent parities compared with their counterparts.

The comparison, based on the Kaplan–Meier survival method, is visually represented using Kaplan–Meier curves (Figures S6–S22). The difference in parity progression is most pronounced for transitions from parity 1 to 4 across most countries, with no statistically significant differences observed at higher parities, as indicated by log-rank test results presented in Table 5. In all countries studied except Comoros, women with premarital childbearing take longer to progress from parity 1 to parity 2 than women with marital first births. Namibia and South Africa, which have high premarital childbearing rates and lower fertility levels relative to other SSA countries, show insignificant

differences except for the transition from parity 1 to parity 2. Similarly, Madagascar and Zimbabwe exhibit significant differences only for this transition. In nine countries (Benin, Burkina Faso, Congo DRC, Congo, Ghana, Guinea, Sierra Leone, Uganda, and Zambia), women with premarital childbearing take significantly longer to progress from parity 1 to parity 4, though this gap narrows at higher parities. Consistent with the PPR results, the largest differences occur in transitions from parity 1 to parity 4. In contrast, in Côte d’Ivoire, Cameroon, Kenya, Nigeria, Togo, and Tanzania, women with premarital childbearing experience consistently longer progression times across all parity transitions.

4. Discussion

This study examined the prevalence, trends, and fertility effects of premarital childbearing across 35 SSA countries, situating premarital fertility within classical demographic frameworks and life-course theory. The findings show that premarital childbearing is widespread, increasing in most countries, and strongly predictive of subsequent fertility trajectories. Importantly, premarital childbearing extends beyond early fertility timing and reflects a distinct reproductive pathway associated with enduring differences in fertility intensity, parity progression, and reproductive timing across the life course.

4.1. The limits of marriage-centered fertility frameworks

Classical demographic models have long emphasized marriage and union formation as the primary determinants of exposure to childbearing (Bongaarts, 1978; Caldwell *et al.*, 1992). These frameworks were developed in contexts where marriage was nearly universal and closely synchronized with the first birth. Our findings, however, challenge the continued adequacy of marriage-centered interpretations of fertility behavior in contemporary SSA. While earlier studies treated non-marital fertility as marginal or exceptional (Garenne, 2004), we show that in many countries, particularly in Southern and parts of Central Africa, a substantial share of fertility now occurs before first marriage, indicating a growing decoupling of marriage and reproduction.

These patterns are consistent with trend analyses documenting the rise in premarital fertility in the region (Clark *et al.*, 2017). Still, our study extends the existing literature by demonstrating that premarital childbearing fundamentally reshapes lifetime fertility outcomes, rather than merely shifting the timing of first birth. Premarital childbearing is no longer peripheral to fertility dynamics; instead, it represents a significant and increasingly influential component of reproductive behavior that alters life-course exposure to childbearing. Therefore, fertility models that focus exclusively

Table 4. Parity progression ratios over 5-year intervals for each country, by premarital childbearing status, based on the most recent Demographic and Health Surveys data (2012–2022)

Country	Parity 1 to 2		Parity 2 to 3		Parity 3 to 4		Parity 4 to 5		Parity 5 to 6	
	Marital	Premarital	Marital	Premarital	Marital	Premarital	Marital	Premarital	Marital	Premarital
Benin	0.8899	0.7615	0.8660	0.8256	0.8367	0.8005	0.7913	0.7807	0.7575	0.7347
Burkina Faso	0.8487	0.7125	0.8054	0.7690	0.7711	0.7289	0.7230	0.7202	0.6645	0.7005
Burundi	0.9324	0.6344	0.9022	0.8485	0.8712	0.7926	0.8517	0.7650	0.8046	0.7688
Congo DRC	0.8847	0.6894	0.8846	0.7921	0.8783	0.8294	0.8616	0.8607	0.8476	0.8255
Congo	0.8106	0.6837	0.7823	0.7530	0.7791	0.7382	0.7352	0.7532	0.7118	0.7246
Côte d'Ivoire	0.8284	0.6357	0.7933	0.7067	0.7705	0.7113	0.7378	0.7127	0.7201	0.6592
Cameroon	0.8603	0.6612	0.8375	0.7278	0.8059	0.7221	0.7828	0.7288	0.7499	0.7146
Ethiopia	0.8229	0.6958	0.8187	0.7635	0.8143	0.7867	0.8088	0.7988	0.7932	0.7735
Gabon	0.7587	0.6402	0.7381	0.6507	0.7157	0.6768	0.7026	0.6626	0.7040	0.6896
Ghana	0.7769	0.5909	0.7480	0.6909	0.7043	0.6683	0.6678	0.6072	0.6412	0.6101
Gambia	0.8713	0.6995	0.8530	0.7583	0.8288	0.8087	0.8070	0.7652	0.7675	0.7284
Guinea	0.8183	0.6879	0.8133	0.7758	0.7877	0.7492	0.7440	0.7166	0.7306	0.6650
Kenya	0.7898	0.5963	0.6878	0.6090	0.6666	0.5757	0.6574	0.5707	0.6814	0.5568
Comoros	0.8387	0.8169	0.8347	0.8541	0.7861	0.8126	0.7596	0.7573	0.7398	0.7244
Liberia	0.8288	0.6877	0.7984	0.7200	0.7688	0.7090	0.7556	0.6828	0.7156	0.6840
Lesotho	0.7003	0.4977	0.5590	0.4974	0.5245	0.4903	0.5254	0.4294	0.5312	0.6455
Madagascar	0.7765	0.6449	0.7025	0.6971	0.6614	0.6754	0.6690	0.6318	0.6599	0.6504
Mali	0.8795	0.7143	0.8732	0.8036	0.8520	0.8447	0.8352	0.7947	0.8003	0.8084
Malawi	0.8695	0.7401	0.7969	0.7698	0.7428	0.7194	0.7074	0.6726	0.6554	0.6315
Mozambique	0.8164	0.6721	0.7559	0.6729	0.7266	0.6665	0.6976	0.6283	0.6709	0.6563
Nigeria	0.8966	0.7256	0.8746	0.8002	0.8462	0.8119	0.8130	0.7846	0.7919	0.7491
Niger	0.9262	0.8142	0.9223	0.8870	0.9114	0.8790	0.9097	0.8678	0.8983	0.8472
Namibia	0.7061	0.5749	0.6046	0.5673	0.5756	0.5294	0.6406	0.5429	0.6521	0.5349
Rwanda	0.8658	0.5547	0.7373	0.6234	0.7052	0.6308	0.6583	0.5592	0.6180	0.5958
Sierra Leone	0.8019	0.6542	0.7818	0.6918	0.7384	0.7021	0.7026	0.6622	0.6616	0.6413
Senegal	0.8471	0.6164	0.8449	0.7700	0.8243	0.7947	0.7797	0.7351	0.7839	0.7652
Chad	0.9316	0.8830	0.9208	0.9027	0.9129	0.9312	0.8899	0.9248	0.8701	0.8479
Togo	0.8330	0.6370	0.8097	0.7294	0.8059	0.7517	0.7752	0.6748	0.7527	0.6311
Tanzania	0.8368	0.6596	0.7639	0.6685	0.7335	0.6464	0.7290	0.6222	0.7215	0.6607
Uganda	0.9178	0.7892	0.8639	0.8219	0.8551	0.8261	0.8246	0.8073	0.8021	0.7827
South Africa	0.6124	0.4056	0.3911	0.3752	0.4248	0.3729	0.4087	0.4028	0.3663	0.4029
Zambia	0.8713	0.6894	0.8245	0.7434	0.7987	0.7210	0.7684	0.7476	0.7545	0.7196
Zimbabwe	0.7396	0.6045	0.5763	0.6179	0.5240	0.5322	0.5126	0.4907	0.5284	0.5099

on marital status and marital fertility underestimate the complexity and heterogeneity of contemporary fertility regimes in SSA (Smith-Greenaway & Clark, 2018).

4.2. Premarital childbearing as a life-course turning point

From a life-course perspective (Bernardi *et al.*, 2019; Elder *et al.*, 2003), a premarital birth functions as a turning point that redirects subsequent reproductive

trajectories rather than simply accelerating early fertility. This conceptualization moves beyond earlier studies that focused primarily on the prevalence and sociodemographic correlates of premarital childbearing (Dunn *et al.*, 2022; Ikamari, 2024) by emphasizing its long-term consequences for fertility behavior.

The concentration of premarital childbearing among younger women reflects extended exposure to sexual

Table 5. Parity progression ratios over 5-year intervals for women with premarital versus marital first births: Log-Rank test results, based on the most recent Demographic and Health Surveys data (2012–2022)

Country	Parity 1 to 2		Parity 2 to 3		Parity 3 to 4		Parity 4 to 5		Parity 5 to 6	
	χ^2	<i>p</i> -value	χ^2	<i>p</i> -value	χ^2	<i>p</i> -value	χ^2	<i>p</i> -value	χ^2	<i>p</i> -value
Benin	181.89	0.0000	15.01	0.0001	6.48	0.0109	0.21	0.6478	2.76	0.0967
Burkina Faso	197.21	0.0000	10.67	0.0011	5.14	0.0233	0.22	0.6383	1.56	0.2124
Burundi	615.61	0.0000	30.13	0.0000	19.77	0.0000	8.09	0.0044	3.55	0.0595
Congo DRC	387.23	0.0000	62.46	0.0000	18.55	0.0000	0.41	0.5209	1.89	0.1695
Congo	172.29	0.0000	16.93	0.0000	10.25	0.0014	0.06	0.8093	0.06	0.8056
Côte d'Ivoire	474.47	0.0000	82.96	0.0000	32.25	0.0000	5.57	0.0182	7.68	0.0056
Cameroon	509.45	0.0000	118.40	0.0000	39.79	0.0000	8.59	0.0034	6.68	0.0098
Ethiopia	58.30	0.0000	4.44	0.0350	0.59	0.4413	1.65	0.1988	0.59	0.4434
Gabon	124.24	0.0000	40.81	0.0000	5.42	0.0200	0.16	0.6928	0.04	0.8399
Ghana	329.39	0.0000	16.16	0.0001	4.02	0.0449	9.62	0.0019	1.95	0.1627
Gambia	187.72	0.0000	37.22	0.0000	0.58	0.4464	3.04	0.0813	1.36	0.2440
Guinea	97.65	0.0000	7.75	0.0054	5.85	0.0155	0.74	0.3892	3.62	0.0572
Kenya	1160.2	0.0000	146.73	0.0000	85.37	0.0000	44.79	0.0000	45.72	0.0000
Comoros	0.22	0.6406	2.36	0.1241	3.51	0.0608	0.13	0.7176	0.00	0.9907
Liberia	176.75	0.0000	34.16	0.0000	16.85	0.0000	12.03	0.0005	2.36	0.1242
Lesotho	113.17	0.0000	4.79	0.0287	1.92	0.1658	0.43	0.5126	0.83	0.3637
Madagascar	244.28	0.0000	0.55	0.4580	0.08	0.7777	2.88	0.0898	0.19	0.6652
Mali	200.33	0.0000	28.72	0.0000	0.98	0.3213	10.84	0.0010	0.00	0.9463
Malawi	340.71	0.0000	18.61	0.0000	8.42	0.0037	7.12	0.0076	0.49	0.4831
Mozambique	230.06	0.0000	55.56	0.0000	24.73	0.0000	15.39	0.0001	0.75	0.3860
Nigeria	728.81	0.0000	92.66	0.0000	13.24	0.0003	5.21	0.0225	14.96	0.0001
Niger	51.46	0.0000	5.30	0.0213	2.86	0.0909	9.06	0.0026	1.52	0.2173
Namibia	122.30	0.0000	2.61	0.1061	0.36	0.5481	4.96	0.0260	5.67	0.0173
Rwanda	795.39	0.0000	82.60	0.0000	19.31	0.0000	6.69	0.0097	0.08	0.7802
Sierra Leone	265.93	0.0000	69.61	0.0000	6.44	0.0112	3.59	0.0581	1.99	0.1586
Senegal	147.76	0.0000	8.19	0.0042	0.90	0.3428	0.27	0.6063	0.45	0.5034
Chad	35.10	0.0000	11.16	0.0008	0.29	0.5934	1.54	0.2150	0.01	0.9117
Togo	169.71	0.0000	22.50	0.0000	9.92	0.0016	14.01	0.0002	11.86	0.0006
Tanzania	430.09	0.0000	88.14	0.0000	41.78	0.0000	26.66	0.0000	14.65	0.0001
Uganda	450.03	0.0000	17.99	0.0000	6.40	0.0114	0.38	0.5351	0.00	0.9463
South Africa	186.88	0.0000	0.18	0.6683	5.29	0.0214	0.37	0.5408	0.19	0.6665
Zambia	531.83	0.0000	61.14	0.0000	47.93	0.0000	3.41	0.0648	3.28	0.0702
Zimbabwe	96.24	0.0000	2.72	0.0994	0.48	0.4882	0.33	0.5654	0.02	0.8901

Note: Log-Rank tests assess whether parity progression differs between women with premarital and marital first births. For each country and parity transition (1→2 through 5→6), the table reports the log-rank χ^2 statistic and corresponding P-value, quantifying evidence that the timing and distribution of progression differ between the two groups over the 5-year interval framework used to construct the progression curves.

activity before marriage, often occurring in contexts of limited contraceptive access and constrained educational and economic opportunities (Garenne & Zwang, 2006; Wood & Jewkes, 2006). Existing evidence shows that a premarital birth can delay or complicate entry into marriage, increase union instability, and reshape

partnership trajectories (Smith-Greenaway & Clark, 2018). In parallel, marital disruption processes, such as divorce and remarriage, are associated with lower fertility levels in SSA (John & Adjiwanou, 2022). The observed decline in premarital childbearing prevalence with age is therefore more likely to reflect transitions into marriage rather than

a cessation of childbearing, underscoring the importance of reproductive sequencing in shaping fertility careers.

4.3. Mechanisms linking premarital childbearing to reduced fertility intensity

In the majority of countries analyzed, premarital childbearing is associated with significantly lower fertility intensity. These findings challenge the assumption that premarital births merely reflect an earlier onset of high fertility. Instead, it is consistent with mechanisms implied by both proximate determinants theory and life-course models. Although a premarital birth increases early fertility exposure, it often reduces completed fertility through multiple pathways, including delayed or foregone stable union formation, prolonged birth intervals, higher risks of marital disruption, and competing educational or economic priorities (Schnor & Jalovaara, 2020; Wu & Martin, 2002).

Our results provide cross-national empirical support for mechanisms previously identified in single-country studies, particularly in South Africa, where premarital childbearing has been shown to delay marriage, destabilize unions, and reduce subsequent fertility through longer birth intervals and altered partnership trajectories (Sennott *et al.*, 2016; Smith-Greenaway & Clark, 2018). Extending this evidence, our findings demonstrate that similar fertility-suppressing dynamics operate across a broad range of SSA contexts. In societies where non-marital childbearing carries social or economic penalties, premarital births may reshape reproductive intentions and life-course planning, leading some women to limit or delay subsequent childbearing.

4.4. Contextual heterogeneity: Pronatalist settings and persistent traditional regimes

The relationship between premarital childbearing and fertility intensity is not uniform across SSA. In a subset of countries, most notably Comoros, Niger, and Chad, premarital childbearing is associated with higher fertility intensity. These exceptions underscore the limitations of universal theories of premarital fertility that implicitly assume a fertility-suppressing effect. Instead, they reflect contexts characterized by strong pronatalist norms, early and nearly universal marriage, and limited access to contraception (Atorudibo, 2021). In such settings, premarital childbearing is less closely linked to processes of modernization or women's educational expansion and may function instead as a mechanism that accelerates marriage and subsequent childbearing (Poulin *et al.*, 2021).

Although these findings contrast with evidence from Southern Africa and other transitional contexts, they

are consistent with research from Sahelian and other high-fertility settings where traditional reproductive regimes remain dominant. In these contexts, childbearing, including premarital births, is socially valued and may facilitate, rather than disrupt, union formation and parity progression. This observed heterogeneity reinforces Bongaarts & Casterline (2022) argument that extramarital fertility is highly context dependent, while extending it by demonstrating that the direction of the association between premarital childbearing and fertility intensity itself reflects a country's position within the demographic transition.

4.5. Age interactions and cumulative reproductive constraints

The interaction between premarital childbearing and maternal age further supports a life-course interpretation of fertility behavior. Women whose first birth occurred outside marriage experience lower fertility intensity at older ages compared to those whose first birth occurs within marriage. This finding extends earlier work on age patterns in premarital childbearing (Garenne & Zwang, 2006) by demonstrating its cumulative consequences across the reproductive life span.

These patterns reflect the accumulation of constraints over time. Delayed marriage, disrupted birth sequencing, and biological limits associated with advancing age reduce opportunities to compensate for earlier reproductive delays (Beaujouan, 2023; Zhao *et al.*, 2023). As reproductive horizons shorten, the capacity to "catch up" through higher-order births diminishes. Consequently, premarital childbearing amplifies age-related fertility differentials, contributing to long-term divergence in completed fertility.

4.6. Parity progression and altered fertility tempo

Analysis of PPRs provides additional evidence that premarital childbearing reshapes fertility trajectories. Women with premarital first births experience slower transitions to subsequent parities, particularly from second to higher-order births. To our knowledge, this is the first multi-country study to explicitly examine parity progression by premarital childbearing status in SSA, addressing a gap identified in earlier fertility transition research (Mboup & Saha, 1998; Rutstein, 2002).

These delayed transitions suggest altered reproductive pacing, likely driven by union instability, economic constraints, or intentional birth spacing (Sennott *et al.*, 2016). Although partial recuperation occurs at higher parities in some contexts, overall parity progression remains lower among women with premarital births. This pattern challenges fertility models that assume progression

rates are primarily determined by marital status or socioeconomic characteristics alone.

4.7. Theoretical and policy implications

Taken together, these findings underscore the need to integrate premarital childbearing more explicitly into fertility theory and demographic models for SSA. While Bongaarts & Casterline (2022) have called for greater attention to extramarital fertility in low-income settings, this study provides the comparative empirical evidence and theoretical framing necessary to operationalize such integration. Premarital childbearing functions as a key determinant that can suppress fertility intensity, alter reproductive timing, and reshape life-course fertility trajectories. Ignoring fertility outside marriage risks mischaracterizing both the pace and structure of fertility change in the region.

From a policy perspective, the results highlight the importance of expanding reproductive health services, contraceptive access, and educational opportunities for unmarried women and adolescents. This approach extends beyond the maternal and child health orientation of much existing programming (Smith-Greenaway, 2016) by addressing the long-term fertility consequences of premarital childbearing. Interventions narrowly focused on marital fertility are insufficient. Effective responses require life-course-oriented and context-sensitive approaches that account for delayed marriage, extended premarital sexual exposure, and the diverse meanings and consequences of premarital childbearing—ranging from fertility-suppressing in transitional settings to fertility-enhancing in persistent pronatalist regimes (Cleland & Machiyama, 2017).

4.8. Limitations of the study

This study has several limitations. First, premarital childbearing is defined by the timing of the first birth relative to first marriage; however, the DHS does not distinguish formal from informal unions, so some births in stable informal partnerships may be classified as premarital. Second, the analysis relies on retrospective self-reported birth and marriage histories, which may be affected by recall or social desirability biases, particularly in contexts where premarital childbearing is stigmatized. Third, DHS surveys were conducted in different years across countries, although this variation allows cross-national comparisons to capture changes in premarital childbearing over time. Finally, although the COM–Poisson model handles overdispersed and underdispersed fertility counts, the study is observational. Unmeasured factors may influence premarital childbearing and subsequent fertility, so associations should not be interpreted as causal.

Despite these limitations, the study's strengths include its use of high-quality, nationally representative data across 35 countries, providing robust, multi-country evidence on the fertility implications of premarital childbearing.

5. Conclusion

This study examined the prevalence of premarital childbearing and its impact on fertility intensity across 35 SSA countries, thereby extending existing fertility research beyond a marriage-based framework. The findings reveal a significant rise in premarital childbearing in SSA, with higher prevalence in countries, such as South Africa and Namibia and lower rates in nations, such as Niger and Ethiopia, where early marriage traditions dominate. Using a COM–Poisson model, the analysis revealed that premarital childbearing is significantly linked to reduced lifetime fertility intensity in 83% (29 of 35) of countries, although considerable variation exists across nations. The interaction between premarital childbearing and maternal age highlights an amplified decline in fertility as women age, with the long-term impact becoming more pronounced among older cohorts. Comparative analyses of ASFRs and TFRs consistently show that women with premarital first births experience lower fertility across reproductive ages and reduced overall fertility compared to women with marital first births.

Furthermore, premarital childbearing is associated with reduced PPR and a more prolonged delay in transitioning to subsequent parities. These findings underscore the substantial influence of premarital childbearing on fertility patterns and the dynamics of parity progression, providing critical insights into the mechanisms shaping reproductive behavior.

In conclusion, this study advances the fertility framework by emphasizing premarital childbearing as a pivotal determinant of fertility intensity, alongside established factors, such as marriage and union dynamics.

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Conflict of interest

The authors declare they have no competing interests.

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Ethics approval and consent to participate

Ethics approval was not required for this study, as it is based on publicly available DHS datasets. Permission to use the data was obtained from the DHS program.

Consent for publication

Not applicable. The analysis is based on secondary, anonymized, and publicly available DHS data.

Availability of data

The data used in this study are publicly available from the DHS program and can be accessed upon reasonable request and registration at <https://dhsprogram.com/data/>.

Further disclosure

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