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## **Marital Life Courses in sub-Saharan Africa: All Cause Union Dissolution, Its Timing, and Time Spent Outside Marriage**

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# **Marital Life Courses in sub-Saharan Africa: All Cause Union Dissolution, Its Timing, and Time Spent Outside Marriage**

Short title: Dynamics of union dissolution in Africa

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## **Abstract**

Not only whether but also when a union ends and how long individuals remain unpartnered subsequently is consequential for social and demographic outcomes. However, in sub-Saharan Africa (SSA), information about the timing of union dissolution and the reproductive time ‘lost’ due to union dissolution is unknown. We close this gap by applying novel and standard indirect demographic techniques to Demographic Health Survey data collected in 34 SSA countries to document the level and timing of all-cause union dissolution and the time women spend outside of marriage due to union dissolution. Results revealed that in 28/34 countries, over one-fifth of first unions end within 15 years, and in 14/34 countries, the proportion of first unions ending within 25 years exceeds 40%. The average marital duration at first union dissolution varies between 4.8 and 9.4 years. The pace of remarriage is rapid across all countries, with the average duration between first union dissolution and first remarriage ranging between 0.2 and 2.9 years. The overall reproductive years lost to union dissolution varies between 1.3 and 5.3 years, and it accounts for 4.0% to 16.3% of the total reproductive life expectancy. We discuss the implications of these dynamics for fertility outcomes in SSA.

**Keywords:** Marriage, Union dissolution, Remarriage, Reproductive life expectancy, Fertility, sub-Saharan Africa

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## Introduction

Union dissolution and remarriage are common features of sub-Saharan Africa (SSA) nuptiality regimes. In most countries, over 30% of first unions end in divorce (Tilson and Larsen 2000, Reniers 2003, Clark and Brauner-Otto 2015), and at least one-fifth of women aged 40-49 are married more than once (John and Adjiwanou 2021). The experience of union dissolution and the time individuals spend in and outside marriage are likely consequential for various social and demographic outcomes in Africa and beyond. For example, women who experience union dissolution generally end up with significantly fewer children than women who remain in intact first unions (Meggiolaro and Ongaro 2010, Thomson, Winkler-Dworak et al. 2012, John and Nitsche 2021). These differences are thought to be connected to reproductive time lost due to union dissolution, amongst other (Davis and Blake 1956, Griffith, Koo et al. 1985, John and Nitsche 2021). Thus, it is important to know not only if a union dissolution is experienced over the life course but also when it occurs, whether the individual remarries, and how much time is spent in partnered versus unpartnered states. In high-income countries, data sources depicting these detailed marital life courses are usually available.

In the African context, however, such detailed information is often lacking. Most countries in SSA do not have established civil registration systems that permit a continuous and systematic collection of nuptiality data. In addition, the available data from nationally representative surveys, such as Demographic Health Surveys (DHS), lacks such critical information as the date of union dissolution, whether the union dissolution was due to divorce or widowhood, and the number of union dissolutions experienced. Thus, the direct estimation of the timing and quantum of union dissolution and remarriage using traditional statistical methods is impossible. Consequently, population estimates of union dissolution and remarriage trajectories in SSA have been based on data from small geographical areas, usually longitudinal studies in selected populations (Tilson and Larsen 2000, Reniers 2008, Grant and Soler-Hampejsek 2014, Guirking, Gross et al. 2021). By design, estimates from these studies limit cross-country comparisons as they are not nationally representative, thus offering less clarity on Africa's union dissolution and remarriage patterns. Particularly, it remains unclear how long women in SSA are partnered before experiencing a first union dissolution, how much reproductive time is 'lost' due to union dissolution and how these dynamics differ across SSA regions. Exploring these marital life courses using available nationally representative nuptiality data is, thus, a necessary step for advancing scholarship on union dissolution, remarriage and its consequences for social and demographic outcomes, in particular reproductive behaviors, in this region.

This paper, therefore, applies novel and traditional indirect demographic techniques to Demographic Health survey data to produce group-level estimates of marital life courses. More precisely, it documents country and period variation in the timing of first union dissolution, and the expected duration women spend in and outside marriage. Because DHS does not specify how the first union ended for women who are married more than once, it is not possible to produce these estimates for divorced and widowhood women separately. Thus, we focus on *all-cause union dissolution* –a measure which combines divorce and widowhood-related union dissolution events. It is important to note that considering all-cause union dissolution is substantively relevant for SSA

research because a considerable portion of marriages ends in widowhood in this region (Clark and Brauner - Otto 2015). Moreover, the likelihood of a woman becoming a widow during the reproductive ages is higher in SSA than in other world regions (see regional differences in male mortality in United Nations (2019)), and remarriage is generally common, regardless of whether the first union ended because of a divorce or the death of a spouse (Lesthaeghe, Kaufmann et al. 1986, Locoh and Thiriat 1995, Ntozi 1997, Reniers 2003, Guirking, Gross et al. 2021). Thus, understanding whether and if so, when the union ended and how long one spends outside marriage due to union dissolution, irrespective of how the union ended, is essential for understanding the realities of marital life course in SSA.

Specifically, this paper responds to three key questions: First, what are the levels of all-cause union dissolution in SSA, and how have they changed over the years? How much of such change is attributable to changes in marital instability during the early, middle or later years of the first union? Second, how long, on average, do first unions persist among women who experience a union dissolution? Third, how many years, on average, do women spend outside marriage due to a union dissolution, and how long do they spend in second or higher order unions? We produce and present four different types of estimates to answer these questions. First, we show proportions of dissolved first unions by duration since the first union. Second, we apply new indirect estimation techniques to estimate quantum adjusted median durations at first union dissolution and the Singulate Mean Duration at First Union Dissolution (SMDUD). Third, we estimate the risk of remarriage and the average duration spent between first union dissolution and first remarriage. Fourth, we document the average reproductive years lost to union dissolution and the average reproductive years spent in remarriage. All our estimates are at the population level; they pertain to averages or median values for specific countries and periods. As desirable as individual-level estimates would be, these are impossible to produce without more complete individual-level data.

## **Background**

In 2015, Clark and Brauner-Otto applied indirect demographic techniques to DHS data to present the first-ever nationally representative divorce estimates in 33 SSA countries. Their findings are parallel to prior research conducted in small populations and generally highlight that marital dissolution is common in SSA. For example, Clark and Brauner-Otto (2015) noted that at least half of unions end within the first 20 years of a union in Liberia, Congo, and Congo DRC. In earlier studies, Reniers (2003) noted that 40% of first marriages in rural Malawi ended in divorce within the first 20 years. Grant and Soler-Hampejsek (2014) found that only 58% of first marriages of young women in Malawi persisted after the first five years. In Ethiopia, Tilson and Larsen (2000) documented a fraction of 45% of first unions that end in divorce within 30 years. Concerning changes in levels of marital stability over time, Clark and Brauner-Otto (2015) found that divorce rates declined or remained stable in SSA countries. It is not clear, however, whether the documented decline or stability of the divorce rates primarily rose from changes in union dissolution during the early, middle or later years of the first union.

The few studies that have considered the dynamics of remarriage in SSA demonstrate that the majority of women who experience union dissolution quickly form new partnerships. For example, John and Adjiwanou (2021) estimated that in 18 out of 34 SSA countries, over 25% of ever-married women aged 40-49 had been married more than once. Reniers (2003) found that in three rural districts in Malawi, 40% of women who experienced a divorce remarried within two years. This proportion reached 70% after five years and 90% after ten years. Locoh and Thiriat (1995) documented a similar pattern in Togo, where 67% of women who divorced/separated had remarried within three years. A recent study in rural northern Burkina Faso (Guirkinger, Gross et al. 2021) showed that 45% of women remarried immediately after a divorce, 75% did so within the first year, and 84% were remarried within two years after a divorce. Largely missing from this body of literature is a systematic analysis (country and period variation) of how long, on average, first unions persist among women who experience a union dissolution (either through divorce or widowhood) and how much time, on average, women spend outside marriage because of a union dissolution.

Country and period variation in the likelihood of union dissolution, its timing, and how long women spend outside marriage due to union dissolution could emerge from different pathways. These mechanisms include but are not limited to marriage systems and type (Rotz 2016, Odimegwu, Somefun et al. 2017), HIV pandemic conditions (Porter, Hao et al. 2004, Anglewicz and Reniers 2014, Grant and Soler-Hampejsek 2014) and women's education and labour force participation (Takyi and Broughton 2006).

Marriage systems may relate to union dynamics in at least two ways: First, marriages are likely more unstable in societies where polygamous unions are socially acceptable and expected. The cost of a union dissolution is likely to be minimal in such communities in terms of both finding an alternative partner and the stigma associated with a failing relationship. Second, societies where first marriages are relatively delayed experience more stable unions (Clark and Brauner-Otto 2015, Rotz 2016). This inverse link is attributed to weak maturity and the inability to negotiate relationships that suit one's preferences when unions are initiated at younger ages (Clark and Brauner-Otto 2015, Rotz 2016). Concerning time spent outside marriage, in communities where polygamous unions are common, time spent outside marriage following a union dissolution is minimal (Lesthaeghe, Kaufmann et al. 1986), most likely because of the availability of the marriage market for higher older unions. Similarly, in communities where first marriages are postponed to later ages, women would, on average, experience a union dissolution at older ages, a factor that reduces the propensity for remarriage (Wu and Schimmele 2005, Schimmele and Wu 2016). Thus, time spent outside marriage could be relatively prolonged compared to communities where marriages are formed early.

The association of women's education with union dissolution and time spent outside marriage following a union dissolution can be discussed in two dimensions - a negative link (Lyngstad 2004, Clark and Brauner-Otto 2015, Odimegwu, Somefun et al. 2017) or a positive association (Takyi 2001, Härkönen and Dronkers 2006). The negative relationship between women's education and union dissolution is theorized to result from high-quality marital

communication and conflict resolution skills in unions where couples have high levels of education (Boertien and Härkönen 2018, Damme 2020). A positive effect of education on union dissolution is explained through the lens of women's autonomy, which affects power relations in family life (Takyi 2001, Härkönen and Dronkers 2006). Some scholars have argued that educated women are more likely to be economically self-reliant; thus, the economic cost of dissolving a union might be bearable (Van Damme and Kalmijn 2014). Concerning the time spent outside marriage following a union dissolution, less educated women are more likely to form new partnerships sooner following a union dissolution (Smock 1990, Régnier-Loilier and van Hoorn Alkema 2019) probably because remarriage, in part, is considered for economic security reasons (Dewilde and Uunk 2008).

The influence of the HIV pandemic on union dissolution can be modulated through an individual's perception of the risk of contracting HIV under the prevailing marriage arrangement (Reniers 2008, Grant and Soler-Hampejsek 2014) and the high probability of losing a husband through death. For example, Grant and Soler-Hampejsek (2014) noted that women in rural Malawi who perceived a risk of infection from their spouses were 40% more likely to consider divorce than their counterparts who perceived no likelihood of contracting HIV from their partners. The divorce risk is also high among women with HIV (Porter, Hao et al. 2004, Anglewicz and Reniers 2014, Mackelprang, Bosire et al. 2014). Thus, societies which are hit hard by HIV are likely to experience high levels of union dissolution. In addition, time spent outside unions following a union dissolution is likely to be longer in these societies since HIV lowers the likelihood of remarriage (Anglewicz and Reniers 2014).

Marriage systems and type, the evolution of the HIV pandemic, education expansion and women's autonomy differ across SSA countries. However, there are regional patterns concerning these dynamics. For example, the timing of first marriage is relatively earlier in West Africa than in East, Central and Southern Africa (John and Nitsche 2021), but polygamous unions are more common in West Africa (Fenske 2015). Furthermore, although female education expanded across all SSA regions, early and significant improvements in female education dominated South and East Africa (Frye and Lopus 2018, John and Nitsche 2021). On the other hand, the HIV pandemic hit harder in East and South Africa than in West and Central Africa (Dwyer-Lindgren, Cork et al. 2019). Thus, we expect to observe substantial country variation in all the three dimensions of all-cause union dissolution we investigate (level, timing, and duration spent in and outside union), which mirrors these regional patterns. Because of higher HIV infection rates and more improved female education in East and Southern Africa than in West and Central Africa, we expect that all-cause union dissolution would be high and occurs early in East and Southern Africa than in West and Central Africa. However, due to lower female education levels, early first union formation, and the high prevalence of polygamous unions in West Africa than in East and Southern Africa, we anticipate the reproductive time loss due to union dissolution to be lower in West African countries.

## **Data and Methods**

## Data

We use data from 139 Demographic and Health Surveys (DHS) collected between 1986 and 2019 in 34 SSA countries (Appendix 1). DHS are nationally representative surveys introduced in SSA in the early 1980s. They collect three key nuptiality variables essential to our current questions. These are current marital status, whether a woman married once or more than once, and the date the first union started. The definition of marriage and divorce in DHS is fluid. It identifies both formal and informal unions as marriages and formal and informal separations as divorce. This flexibility is necessary because marriages in SSA are more of a process than an event, and how women conceptualize marriage might differ across societies (Meekers 1992, Chae 2016). Similarly, divorce is less likely to follow formal legal proceedings (Chereji and Wratto 2013, Kariuki 2015).

The marital histories in DHS make it possible to separate women who never formed any union (*never-married*) and women who married at least once (*ever-married*). Among ever-married women, it is possible to directly compute the age at first marriage and the duration since the first union for each woman ( $\text{duration since first union} = \text{age at survey} - \text{age at first marriage}$ ). We can also precisely identify women who were in an intact first union ( $\text{intact first union} = \text{married once}$ ) and those whose first union dissolved ( $\text{dissolved first union} = \text{currently divorced/separated/widowed or married more than once (remarried)}$ ). Unfortunately, DHS does not collect detailed information on union dissolution and remarriage, such as the date or age at which a first union is dissolved, the number of union dissolutions experienced, how the first union ended (divorced/separated vs widowed), or for those who are married more than once, the date or age at which new partnerships are formed.

The pooled primary analytical sample consists of 1,475,445 women aged 15-49 with known marital status at the survey<sup>1</sup>. We use two different analytic samples. For estimating the level and timing of all-cause union dissolution, we restricted the analysis to ever-married women (1,089,830) and excluded those with an unknown number of unions (3,639). For computing the time women spend in and out of union, we add women who never married (385,615) to the first analytic sample, yielding a sample size of 1,471,806.

## Measures and methods

The lack of detailed marriage histories in DHS data raises several methodological issues. First, because the DHS does not specify how the first union ended for women who are married more than once, it is impossible to generate separate estimates for divorce and widowhood. Thus, our focus is on all-cause union dissolution. The main limitation of this approach lies in the fact that divorce is dominant during the early years of marriage, and widowhood dominates later years. Thus, widowhood events would somehow stretch the estimates of the timing of union dissolution. Nevertheless, considering all-cause union dissolution is methodologically and substantively advantageous in some ways. Methodologically, it offers an advantage of producing estimates free from uncertainty of assumptions intrinsic to methods used to disentangle divorce from widowhood

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<sup>1</sup> Sample excludes those with an unconsummated union (41 observations).



rates when detailed marriage histories are lacking (see Clark and Brauner - Otto (2015)). Substantively, it is relevant for understanding the implications of union dissolution for social and demographic outcomes in SSA where a considerable portion of marriages ends in widowhood (Clark and Brauner-Otto 2015), and remarriage is generally common (Lesthaeghe, Kaufmann et al. 1986, Locoh and Thiriat 1995, Ntozi 1997, Reniers 2003, Guirking, Gross et al. 2021).

The second methodological issue concerns measuring the timing of union dissolution and the time women spend in and out of marriage. Because information about dates or age at which union dissolution occurs or higher order unions are formed is not available, such estimates cannot be directly estimated from DHS data using traditional methods such as the Kaplan Meier estimator. We rely instead on novel and standard indirect demographic techniques to produce these estimates (Sullivan 1971, John and Nitsche 2022). These techniques produce estimates reflecting the experience of synthetic cohorts - i.e. they reflect what one would observe if a particular group of women were to experience the conditions observed at the survey throughout their lives. Synthetic cohort estimates, e.g. the total fertility rate, life expectancy estimates, or the divorce rates documented in Clark and Brauner-Otto (2015), form a fundamental component of demographic knowledge in both developed and developing regions. The subsequent sections describe the specific measures and methods we use to assess the level and change of all-cause union dissolution, the timing of all-cause union dissolution and the time women spent in and outside marriage during reproductive ages in SSA.

### *The level and changes in all-cause union dissolution*

Our measure of all-cause union dissolution level is the *proportion of the first unions ending  $t$  years following their onset ( $P(t)$ )*. We estimate  $P(t)$  for each country and survey by first calculating duration-specific survival rates of the first union ( $S(t)$ ) in two steps. The first step involves calculating the proportion of ever-married women in an intact first union according to the duration (in single years) since first union ( $\rho(t)$ ). We compute  $\rho(t)$  from a tabulation of all ever-married women according to duration, classified by first union survival status (intact first union vs dissolved first union). For a given marriage cohort and in the absence of any errors,  $\rho(t)$  is equivalent to the probability of a first union surviving for  $t$  years since its onset – i.e.  $\rho(t) \equiv S(t)$ . Ideally,  $\rho(t)$  estimates should decline monotonically with increasing duration. However, this is not usually the case with DHS data (see Appendix 2). This discrepancy can, in part, be attributed to limited sample size and changes in first union survival rates across marriage cohorts. Nevertheless, much of these deviations likely arise from misreporting marriage histories (particularly omission of earlier marriages as women get older). Our data quality assessment revealed that the  $\rho(t)$  estimates were conceptually implausible, that is,  $\rho(t)$  did not decrease monotonically even if we recorded the duration since first union in five-year intervals. Indeed, prior research revealed data quality issues in the DHS marriage histories, noting that older women (generally corresponding to older marriage durations) tend to shift their ages at first marriage towards the date of the survey (Gage-Brandon 1995, Mensch, Grant et al. 2006). This forward displacement of age at first marriage is attributable

to recall bias and the omission of early marriages (Reniers 2008, Chae 2016), which leads to reporting the date of the second or higher older unions as the date of the first marriage.

The second step addresses these data problems by smoothing the  $\rho(t)$  estimates to yield a non-increasing survival function of the first union. These smoothed  $\rho(t)$  estimates measure the duration-specific survival rates of first union ( $S(t)$ ). We smooth  $\rho(t)$  estimates corresponding to marriage duration 0 – 29 years using a third-degree polynomial function. Thus, the measure of all-cause union dissolution is  $P(t) = 1 - S(t)$ . All-cause union dissolution rates produced in this manner are comparable to corresponding estimates obtained using traditional survival analysis techniques such as the Kaplan Meier estimator when complete marriage histories are available (John and Nitsche 2022).

To assess the country and period differences in all-cause union dissolution, we focus on the proportion of marriages ending within the first 5, 15, and 25 years of first union ( $P(5)$ ,  $P(15)$  and  $P(25)$ ).  $P(15)-P(5)$  indicates the level of all-cause union dissolution corresponding to the middle (5 - 14) years of first marriage, and  $P(25)-P(15)$  indicates the equivalent level occurring during the later (15-24) years of first union. Our assessment of the trends in all-cause union dissolution overtime involves apportioning the period change (between early and most recent survey) in all-cause union dissolution occurring within 25 years of the first union ( $P(25)$ ) into components due to change in all-cause union dissolution during the early, middle or later years of the first union. This apportioning is shown in equation 1. We adjust the estimates produced using equation 1 for years between early and most recent surveys to produce annualized rate of change in all-cause union dissolution.

$$\Delta P(25) = \Delta P(5) + \Delta(P(15) - P(5)) + \Delta(P(25) - P(15)); \quad (1)$$

where  $\Delta P(t) = P(t)_{\text{recent survey}} - P(t)_{\text{early survey}}$

#### *The timing of all-cause union dissolution*

We use two measures to assess the timing of the first union dissolution. Both measures produce estimates adjusted for the quantum of all-cause union dissolution. This adjustment is essential for understanding the country and period variation in the timing of all-cause union dissolution because not every woman experience union dissolution, and the level of union dissolution varies across countries and period. The first measure we use is the *median<sup>2</sup> duration at first union dissolution*. It measures the duration at which 50% of women of a given marriage cohort would be expected to have their first unions dissolved if the first-union duration-specific survival rates observed during the survey apply. The advantage of using median estimates for this analysis is that they are a good measure of the central tendency for skewed distributions like the hazard of union dissolution (see an example in Jalovaara and Kulu (2018)).

The step-by-step procedure for estimating these medians is discussed in John and Nitsche (2022). This estimation uses the  $S(t)$  estimates we described above and the distribution of women

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<sup>2</sup> We also estimate the 25th and 75th percentiles

in intact first unions according to duration since first union to calculate the number of first marriages ending each year for a given marriage cohort. Specifically, this calculation is achieved by rearranging the lifetable function for estimating survival rates (equation 2) to show that the number of first marriages ending in year  $t$  ( $\theta_t$ ) since the first union can be calculated iteratively using equation 3 (see John and Nitsche (2022) for derivation).

$$S(t) = \prod_{j=1}^t \frac{\left(n_j - \frac{\omega_j}{2}\right) - \theta_j}{\left(n_j - \frac{\omega_j}{2}\right)} \quad (2)$$

$$\theta_t = \left(n_t - \frac{\omega_t}{2}\right) \left(1 - \frac{S(t)}{S(t-1)}\right), \quad t > 1, \text{ and } n_{1[0,1)} = \text{sample size} \quad (3)$$

$n_t$  in equation 3 is the number of ever-married women in intact first union at the beginning of year  $t$  (i.e. interval  $[t-1, t)$ ). For a given marriage cohort, all women are in intact first unions at the beginning of the first year of marriage. Thus,  $n_1$ , corresponding to the interval  $[0, 1)$ , is equivalent to the number of ever-married women included in the analysis.  $\omega_t$  represents censored observations during year  $t$ , which is equivalent to the number of women in intact first unions during year  $t$ .  $S(t)$  is the smoothed first union survival rate during year  $t$ . Using the distribution of  $\theta_t$  (generated using equation 3), we use equation 2 while setting  $\omega_t = 0$  and  $n_1 = \sum \theta_t$  to derive the quantum adjusted survival rates of first union ( $S^*(t)$ ). The quantum adjusted median duration at first union dissolution is the value of  $t$  where  $S^*(t) = 0.5$ .

The second measure is analogous to Singulate Mean Age at First Marriage (SMAM) (Retherford, Ogawa et al. 2001) which we name *Singulate Mean Duration at first Union Dissolution (SMDUD)*. SMDUD estimates the average duration at first union dissolution for women of a given marriage cohort whose first union would eventually end within the first 25 years of marriage if the first union duration-specific survival rates observed during the survey apply. Averages offer intuitive and complementary useful information to median estimates for skewed data, hence our interest in this measure.

SMAM is calculated based on the distribution of never-married and ever-married women using equation 4. It estimates the average age at first union for ever-married women.  $S(x)$  in equation 4 is the proportion of never-married women at age  $x$ .  $\delta$  and  $\gamma$  are the possible minimum and maximum ages observed in the data, respectively.  $\sum_{\delta}^{\gamma} S(x)$  yields the number of years a given birth cohort is expected to stay in a never-married state if the observed first marriage rates apply.  $(\gamma + 1)S(\gamma + 1)$  corresponds to the number of years lived by never-married women as they turn exact age  $\gamma + 1$ . Usually,  $S(\gamma + 1)$  is approximated as  $S(\gamma)$ , and five-age intervals are used instead of single-year age groups.

$$SMAM = \delta + \frac{1}{1 - S(\gamma + 1)} \left( \sum_{x=\delta}^{\gamma} S(x) - (\gamma + 1)S(\gamma + 1) \right), \quad S(\gamma + 1) = S(\gamma) \quad (4)$$

We compute SMDUD estimates based on the distribution of ever-married women by duration since first union ( $t$ ) classified by first union dissolution status (intact first union vs dissolved first union). Thus,  $t$  replaces  $x$  in equation 4,  $\delta = 0$ ,  $S(x)$  becomes  $S(t)$  and measures the proportion of women still in intact first union at marriage duration  $t$ . We calculated  $S(t)$  in the same manner as described above, except now that we have followed the tradition of using five-year instead of single-year intervals. Because of the data errors we highlighted above and to be consistent with the estimates of all-cause union dissolution we discuss in our results, we base the calculation of SMDUD on women whose first unions were formed no later than 24 years before the survey, i.e. excluding women with marital durations  $\geq 25$  years. Thus, the summation of  $S(t)$  becomes  $\sum_0^{25} S(t)$  and gives the total number of years a given marriage cohort is expected to stay in intact first unions within the first 25 years of marriage.  $(\gamma + 1)S_{\gamma+1}$  reduces to  $25S_{25}$  and corresponds to the total number of years lived in intact first unions by those who never experienced a union dissolution by exact 25 years since first marriage.

#### *The time spent in and outside marriage*

The primary focus of this component of our analysis is to quantify the amount of the reproductive lifespan women, on average, spend outside marriage because of union dissolution. Our measure for this analysis is the *marital state life expectancy*. It estimates the average number of years that a woman of a given birth cohort would be expected to spend in a given marital state given the observed marital status distribution and mortality rates. The Sullivan method (Sullivan 1971) is a traditional indirect demographic technique for producing such estimates. It involves apportioning the person-years lived between age  $x$  and  $x + n$  ( ${}_nL_x$  in life table notation) into years lived in distinct states based on the prevalence rates of the states in question. Thus, for marital state  $i$ , with age-specific prevalence rate  ${}_nW_{x,i}$ , the expected years lived in marital state  $i$  during the reproductive lifespan ( ${}_{35}EY_{15,i}$ ) would be calculated as

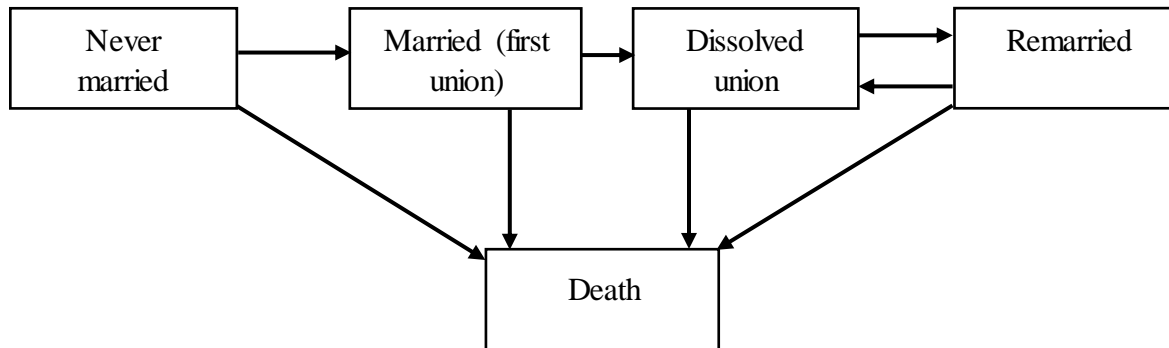
$${}_{35}EY_{15,i} = \frac{1}{{}_nL_{15}} \sum_{15}^{49} {}_nL_x {}_nW_{x,i} ; \quad n > 0 \quad (5)$$

Where  ${}_nL_{15}$  is initial life table survivors at age  $[15, 15 + n)$ .

The marriage histories available in the DHSs allow us to define four distinct marital states necessary for this analysis. Figure 1 depicts these states based on information on current marital status (never married, married/ living together, widowed and divorced/separated) and lifetime remarriage status (married once or more than once). The arrows in Figure 1 indicate the direction of state transition. The initial state consists of never-married women. Women in this state can transition into being married for the first time. If a first union dissolves, a woman moves into a dissolved union state, and in the event of forming a new union, a woman moves into a remarried state. A woman with a higher order union can move back and forth to a dissolved union and remarriage state. Thus, the marital state life expectancy for a dissolved union state is a cumulative measure of all intervals a woman spends outside marriage because of union dissolution. Similarly,

marital state life expectancy in a remarried state includes all remarriage episodes. During any state, a woman can experience death.

**Figure 1:** A diagrammatic representation of marital states transitions during the reproductive life-course



We use the mortality estimates derived from United Nations (UN) 2019 population prospects life tables (United Nations 2019) to produce these marital state life expectancies. UN lifetables are published in 5-year age intervals and five-year periods spanning 1950 and 2019 for all SSA countries. Thus, it is possible to use lifetables corresponding to each survey period in each country. For example, we use a female lifetable corresponding to 2000-2004 if the mean date of interview of a given survey is April 2003. The only exceptions to this rule are the Gambia 2019-20 and Rwanda 2019-20 surveys. The mean interview dates for these two surveys fall slightly outside the 2015-2019 period (early 2020), for which the mortality estimates are not available. Thus, we used 2015-2019 life tables for these surveys.

Period and country-specific lifetables could be problematic for cross country and period comparison of marital state life expectancies. Indeed, the Sullivan method implies that if mortality experience over time or across countries varies substantially, period or country differences in marital state life expectancies will reflect the differences in marital transition rates and mortality. Thus, for robustness checks, we computed the marital life expectancies based on a standard mortality schedule, the standard being the sub-Saharan Africa 2000-2004 female lifetable. The use of SSA lifetable as a standard is desirable as it broadly reflects the mortality pattern in this region, while the 2000-2004 period was preferred because it corresponds to the middle period of all survey dates included in the analysis. This exercise returned identical results to those based on the country and period-specific life tables (see supplementary material 1). Thus, we have presented results based on the country and period-specific lifetables.

## Results

### *Levels and changes in all-cause union dissolution in SSA*

Figure 2 shows the percentage of dissolved first unions within 0-4 (early=  $P(5)$ ), 5-14 (middle= $P(15)-P(5)$ ), and 15-24 (later = $P(25)-(P(15))$ ) years of first union in 34 SSA countries. We group these countries into three major regions -West Africa, Middle Africa, and East and South

Africa. Within regions, countries are ordered from lowest to highest estimated rates of all-cause first union dissolution.

**Figure 2:** Percentage of dissolved first unions within 0-4 (P(5)), 5-14 (P(15)-P(5)), and 15-24 (P(25)-(P(15))) years of the first union in 34 sub-Saharan Africa countries

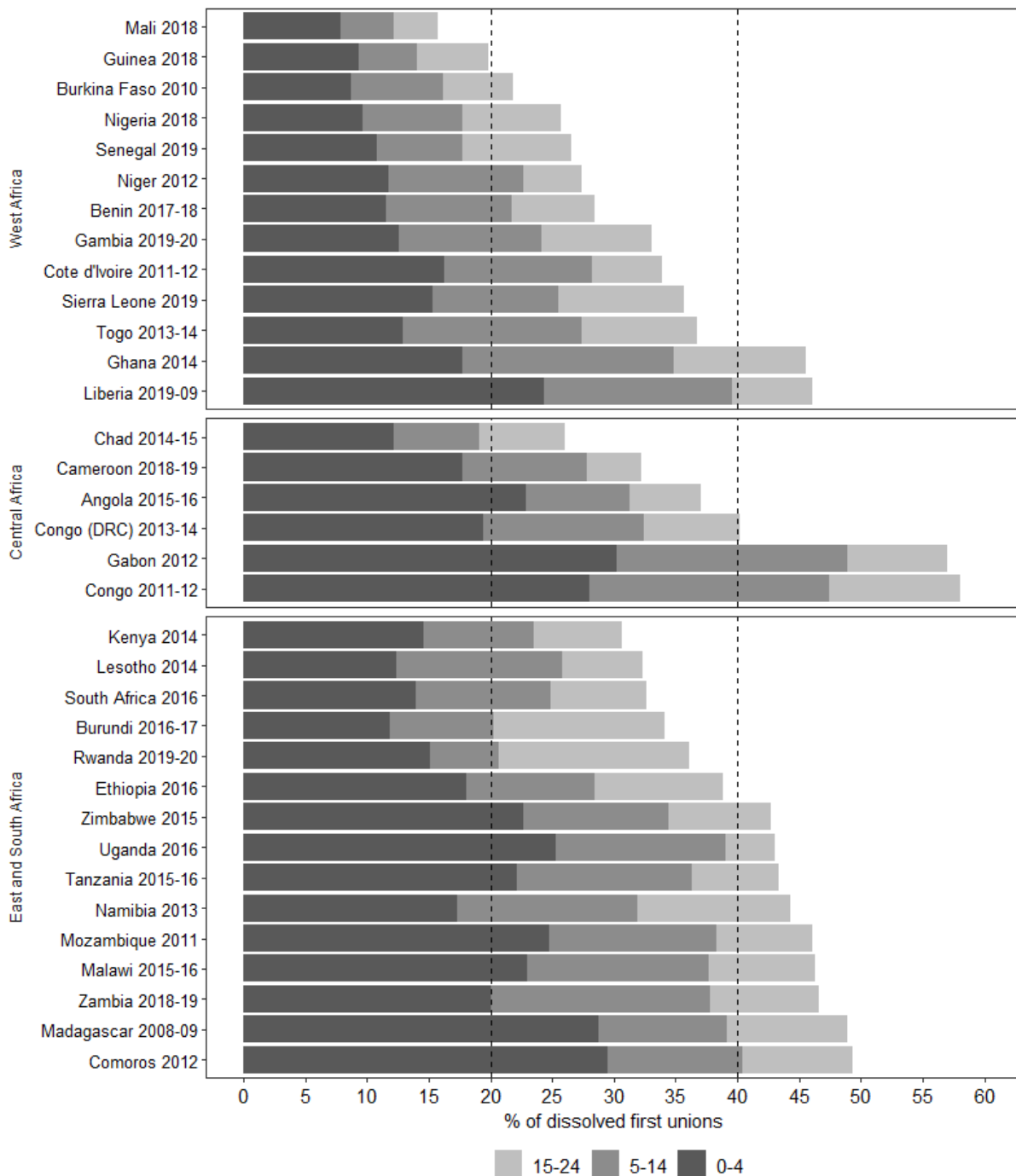


Figure 2 reveals three key findings. First, all-cause union dissolution is common and there is significant variation across countries. For example, the probability of a first union ending within five years varies between 7.9% in Mali and 30.2% in Gabon. A corresponding range for first unions ending within the first 15 years is from 12.2% in Mali to 48.9% in Gabon, and within the first 25 years, from 15.7% in Mali to 58.0% in Congo. Over one-fifth of first unions end within 15 years in 28/34 countries, and 14 countries surpass a 40% risk of a first union ending within 25 years. Second, countries in West Africa have relatively lower rates of first union dissolution. For example, in West Africa, the average probability of a first union ending within 15 years is 23.2%, with only 2/13 countries (Ghana and Liberia) having an estimate above 30%. The corresponding average is 34.5 in Central Africa, with 4/6 countries exceeding the 30% mark, and 30.7% in East and South Africa, with 9/15 countries exceeding 30%. Third, while all-cause union dissolution is concentrated mainly within the first five years, a considerable proportion of marriages end during the middle and later years of the first union. For example, 15.5% to 41.5% of first unions that dissolved within 25 years ended between 5-14 years of first marriage. Most of the first unions (~40%) in Rwanda and Burundi, which terminated within 25 years, ended between 15 and 24 years. This generally reflects high levels of unions that end due to widowhood in these two countries (Clark and Brauner-Otto 2015).

In Figure 3(a), we show the trend of all-cause union dissolution within 5, 15, and 25 years of the first union for 33 SSA countries with at least two surveys. Overall, all-cause union dissolution declined in 28/33 countries. However, we observe rising union dissolution in four countries – Gambia in West Africa and Kenya, Namibia, and Zimbabwe in East and Southern Africa. Figure 3(a) also illustrates that the direction or magnitude of the change in all-cause union dissolution is not always the same for the early, middle and later years of first marriage. For example, in Sierra Leone, the percentage of first marriages ending within the first five years increased while the level of all-cause union dissolution within the first 25 years of marriage declined. We summarize these aspects in Figure 3(b). The dots represent the annualized rate of change in the percentage of first marriages ending within 25 years, while the shaded areas represent the portion of this change attributable to the annual change in first union dissolution within 0-4, 5-14 and 15-24 years of the first union.

Figure 3(b) reveals that the most significant decrease in all-cause union dissolution per annum is observed in Sierra Leone, where the percentage of first marriages ending within 25 years dropped from 48.6 to 35.7 over 11 years. This decrease translates to a drop of nearly 12 first union dissolutions for every 1000 unions every year. A large decrease in all-cause union dissolution is also noted in Benin, Chad, Ethiopia, and Niger. In these countries, the first union dissolution within 25 years dropped by about 7 to 9 for every 1000 first unions every year. Union dissolution declined more in West Africa, followed by East and South Africa. The average annual decrease in the percentage of first marriages ending within 25 years is about 4.3 for every 1000 unions in West Africa, 1.3 in East and South Africa and about 0.2 in Central Africa.

**Figure 3(a)** Trend of the level of all-cause union dissolution within the first 5, 15 and 25 years of the first union for 33 sub-Saharan African countries

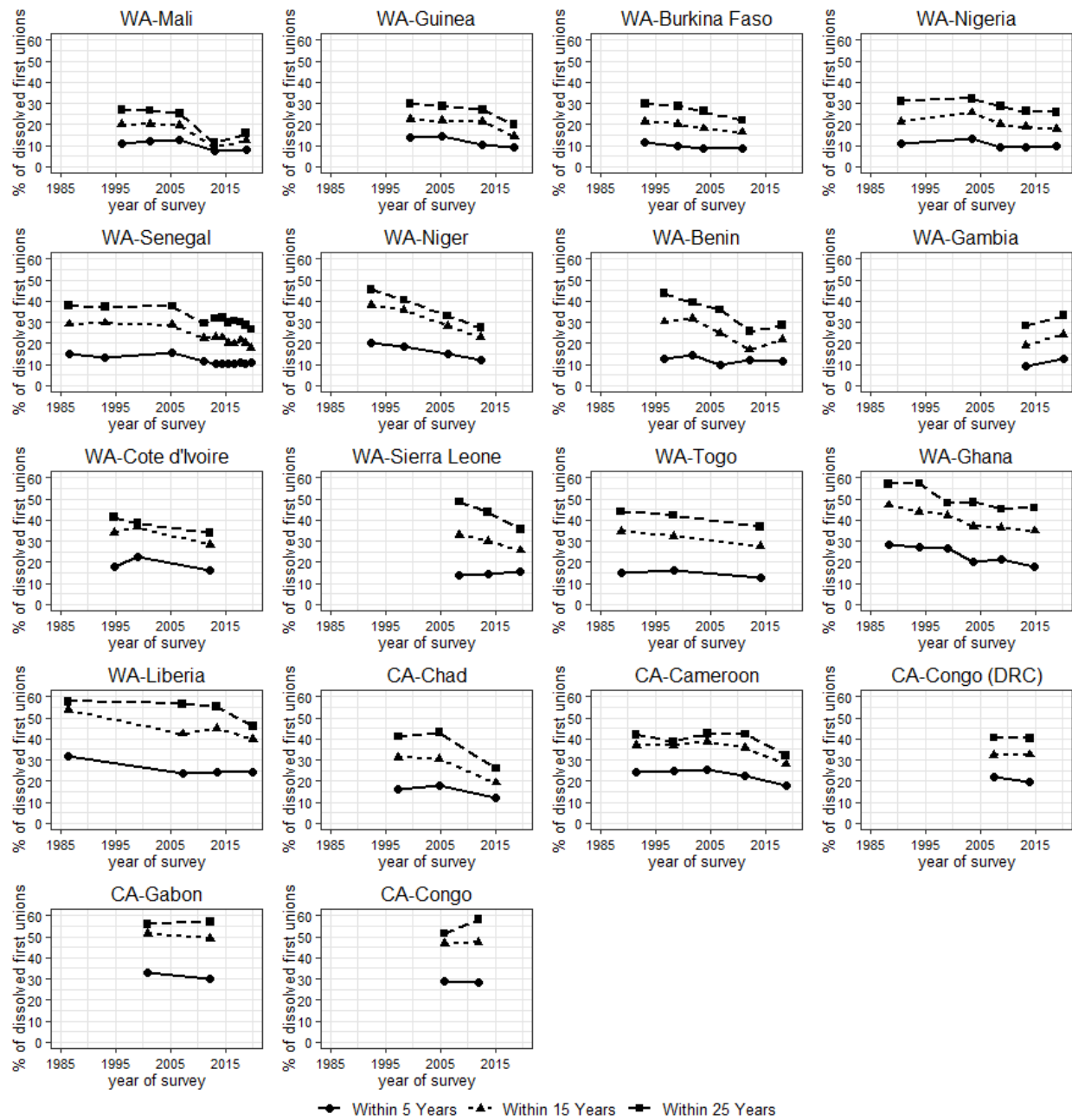
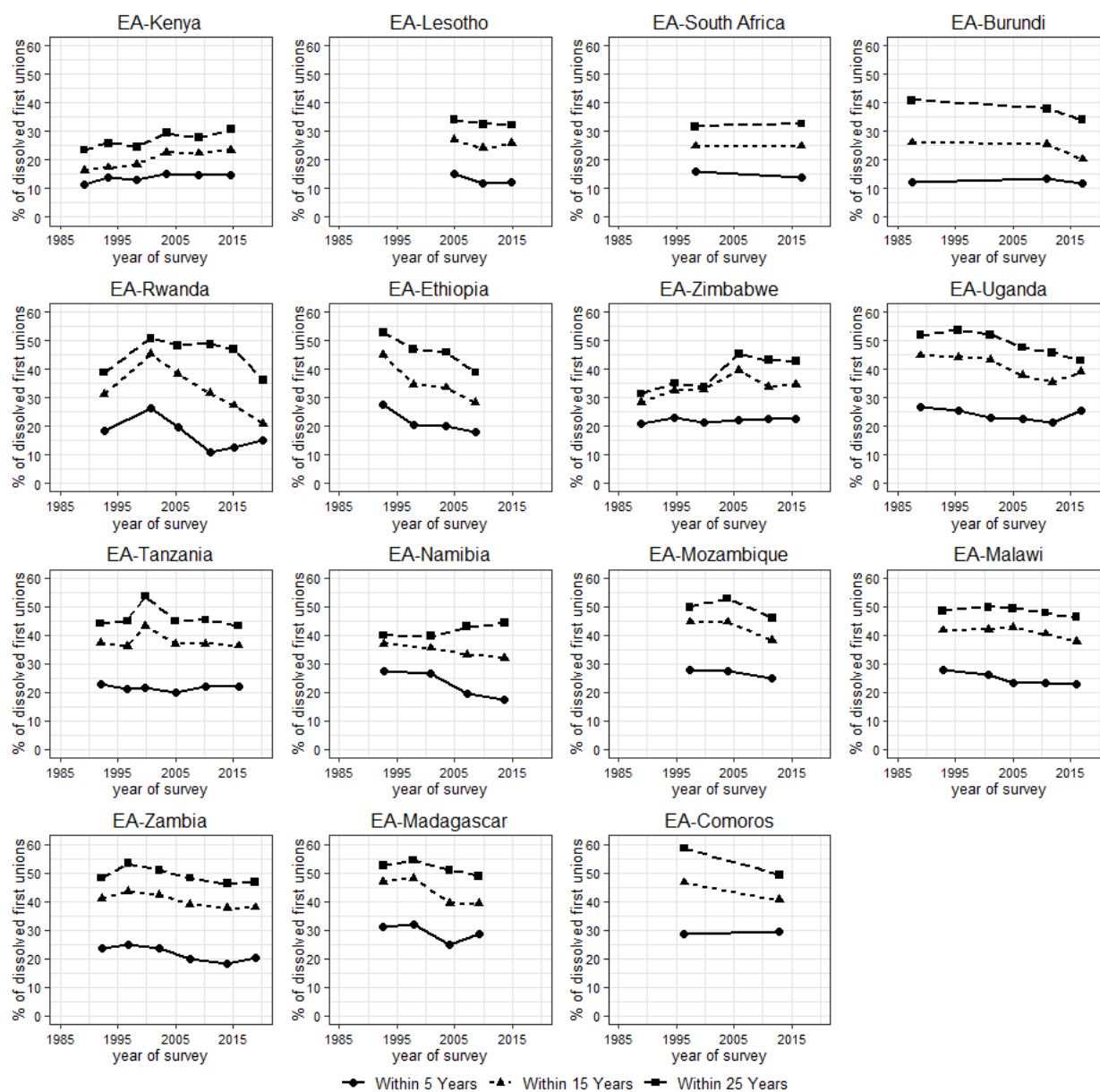




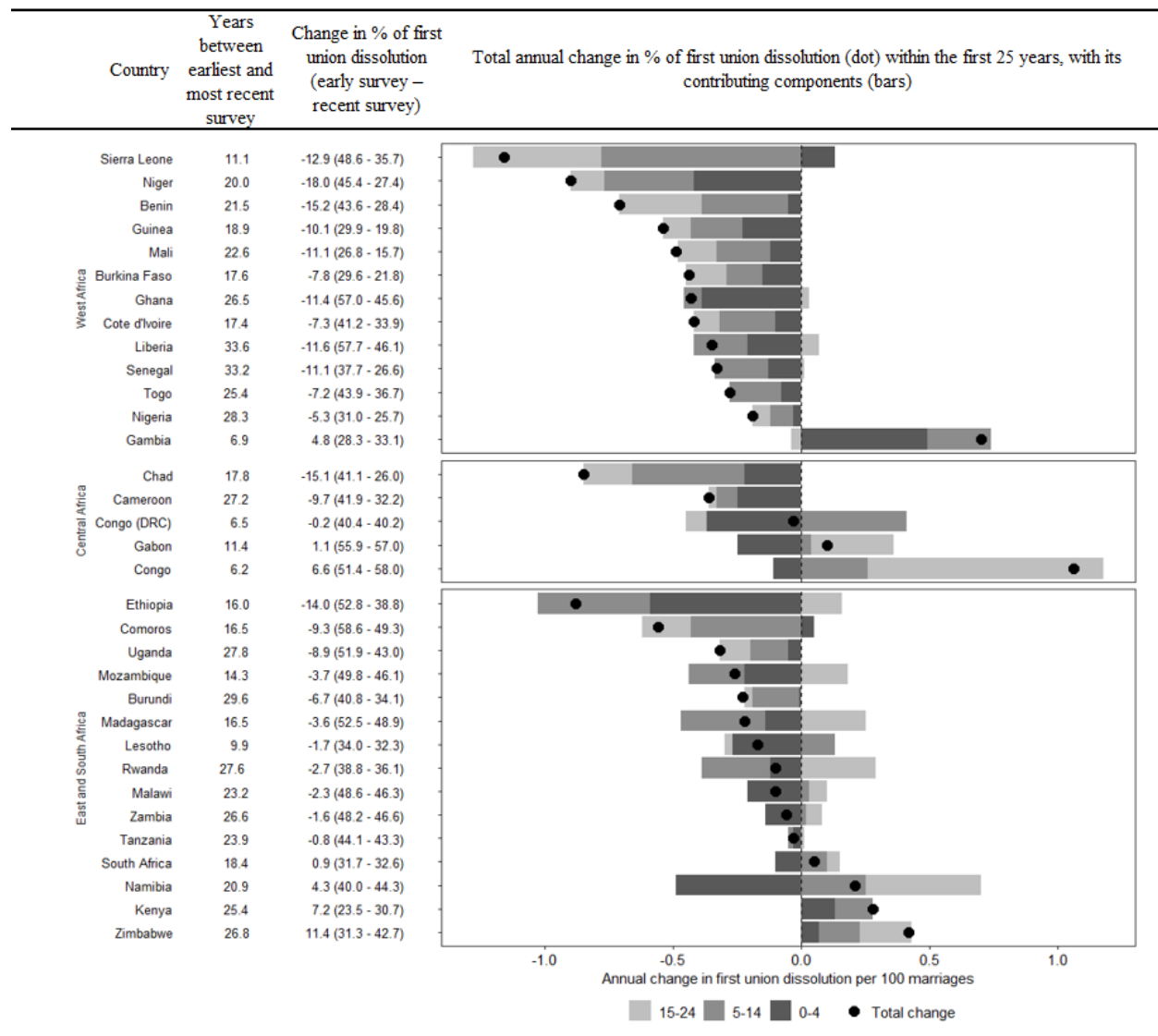
Figure 3(a) cont...



Note:

1. Countries are arranged as in Figure 2
2. WA indicate countries in West Africa, CA refers to countries in central Africa, and EA denotes countries in East and South Africa.
3. Data Source, as in Figure 2

**Figure 3(b):** Change (early – recent survey) in the level of all-cause union dissolution within 25 years (dots), with its contributing components, for 33 sub-Saharan African countries with at least two survey



The increase in the percentage of first marriages ending within 25 years in Namibia is generally due to increasing all-cause union dissolution within 5-14 and 15-24 years of first union. First union dissolution within five years declined in this country. In Gambia, Kenya and Zimbabwe, the increase in union dissolution within 25 years is due to increases in all-cause union dissolution across all interval durations (0-4, 5-14 and 15-24). Broadly speaking, Figure 3(b) illustrates that in countries where all-cause union dissolution declined, the change has primarily been driven by the decline in union dissolution within 0-4 and 5-14 years of the first union. Whereas in countries

where all-cause union dissolution within 25 years of the first union increased, the rise has mainly been due to increased union dissolution at longer durations.

### *The timing of all-cause union dissolution*

We present estimates of the timing of all-cause first union dissolution for the most recent surveys for 34 SSA countries in Table 1. These estimates are fully adjusted for the level of all-cause union dissolution (i.e. they measure only timing rather than a combination of timing and quantum). Specifically, Table 1 shows the median duration (in years) at first union dissolution with 25th and 75th percentiles. It also displays the Singulate Mean Duration at first Union Dissolution (SMDUD).

**Table 1:** Median duration (in years) at first union dissolution with corresponding 25th and 75th percentiles, and the Singulate Mean Duration at first Union Dissolution (SMDUD) for the most recent surveys in 34 sub-Saharan African countries

Country and year of survey (sorted from low to high level of all-cause union dissolution – see Figure 2)	Median duration (in years) at first union dissolution with corresponding 25th and 75th percentiles (in years)			SMDUD (in years)
	25th percentiles	Median	75th percentiles	
<b>West Africa</b>				
Mali 2018	0.6	1.8	6.7	6.8
Guinea 2018	0.4	0.7	9.2	7.4
Burkina Faso 2010	1.5	4.3	9.2	8.6
Nigeria 2018	0.6	3.2	10.9	8.2
Senegal 2019	1.3	3.7	8.3	8.6
Niger 2012	1.0	3.9	8.5	7.6
Benin 2017-18	0.6	3.1	9.2	7.6
Gambia 2019-20	1.7	4.5	9.5	7.8
Cote d'Ivoire 2011-12	0.8	3.1	7.4	6.1
Sierra Leone 2019	0.5	1.6	9.7	8.1
Togo 2013-14	2.0	5.0	10.0	9.0
Ghana 2014	1.7	4.7	9.7	7.4
Liberia 2019-09	0.7	2.5	7.0	6.5
<b>Central Africa</b>				
Chad 2014-15	0.6	2.0	8.4	6.3
Cameroon 2018-19	0.5	1.3	6.1	5.7
Angola 2015-16	0.4	0.8	4.1	4.8
Congo (DRC) 2013-14	0.7	2.7	7.4	6.8
Gabon 2012	0.7	2.4	6.6	6.2
Congo 2011-12	0.7	2.7	7.6	6.7

**Table 1 cont..**

Country and year of survey (sorted from low to high level of union dissolution – see Figure 2)	Median duration (in years) at first union dissolution with corresponding 25th and 75th percentiles (in years)			SMDUD (in years)
	25th percentiles	Median	75th percentiles	
<b>East and South Africa</b>				
Kenya 2014	0.6	2.4	7.7	7.7
Lesotho 2014	0.8	4.1	9.3	8.0
South Africa 2016	0.6	2.6	8.4	6.4
Burundi 2016-17	0.5	2.2	11.6	9.4
Rwanda 2019-20	0.5	1.0	10.1	8.1
Ethiopia 2016	0.5	1.4	8.6	7.0
Zimbabwe 2015	0.5	1.2	6.1	5.5
Uganda 2016	0.6	1.6	5.7	5.2
Tanzania 2015-16	0.7	2.7	7.1	6.4
Namibia 2013	0.7	3.2	8.4	8.0
Mozambique 2011	0.6	1.7	6.2	6.1
Malawi 2015-16	0.6	2.3	7.2	6.6
Zambia 2018-19	1.0	3.9	8.5	6.7
Madagascar 2008-09	0.4	0.9	4.9	5.6
Comoros 2012	0.5	0.9	4.5	5.0

Notes:

1. *Median duration at first union dissolution* indicates the duration in years at which 50% of women of a given marriage cohort would be expected to have their first unions dissolved if the first union duration-specific survival rates observed during the survey apply.
2. *Singulate Mean Duration at first Union Dissolution (SMDUD)* indicates the average duration in years at first union dissolution for women of a given marriage cohort whose first union would eventually end within the first 25 years of marriage if the first union duration-specific survival rates observed during the survey apply.

The critical finding of Table 1 is that women are more likely to experience a union dissolution within the early years of the first union. In nearly all countries, 25% of first union dissolution occurs within the first year of marriage, 50% occurs within the first three to five years, and 75% occurs within ten years. The mean duration at first union dissolution among women whose first union ended within 25 years ranges between 4.8 years in Angola and 9.4 years in Burundi. These dynamics persisted even when we considered early surveys (Appendix 3). Table 1 also shows that in Central, East and South Africa, where union dissolution rates are high, union dissolutions are more concentrated within the early years of the first union than in West Africa, where union dissolution rates are relatively low. For example, the average median at first union dissolution is 3.2 years in West Africa, and the average SMDUD is 7.7 years. These estimates are 2.0 and 6.1 years, respectively, for Central Africa, and 2.1 and 6.8 years, respectively, for East and South Africa.

Overall, the findings in Table 1 imply that women who experience a union dissolution do so during the early reproductive ages. We indeed found that, when age instead of duration since

the first union is considered, the Singulate Mean Age at First Union Dissolution (SMAUD)<sup>3</sup> among ever-married women whose first union ended before age 50 varies between 25 and 29 years in 25/34 countries (Appendix 4). This estimate is below 25 years in Comoros, Congo, Gabon, Liberia, Madagascar, and Tanzania. At the regional level, the average Singulate Mean Age at First Union Dissolution is 28.8 years in West Africa, 26.6 years in Central Africa and 25.9 years in East and South Africa. This finding underscores the likely importance of the experience of all-cause union dissolution for women's childbearing trajectories, as it occurs within the prime childbearing years for most women.

### *The time spent in and outside union*

Table 2 shows the reproductive life expectancies (between age 15-49) in four marital states (never married, intact first union, dissolved union and remarried) based on recent surveys in 32 SSA countries. We observe that in most countries, total reproductive life expectancy varies around 33 years (thus, women, on average, lose around two reproductive years to mortality). Much of these reproductive years are spent in first intact unions. Except for Namibia and Rwanda, a woman spends on average 41% to 75% of reproductive life expectancy in an intact first union. Namibia and Rwanda have higher reproductive life expectancies in never-married states than intact first unions. This should be expected given exceptional delays in the timing of first unions in these countries (John and Nitsche 2021). The reproductive life expectancy in a dissolved union state (here after 'outside marriage' for simple exposition) varies between 1.3 in Burkina Faso and 5.3 years in Malawi. It accounts for 4% to 9% of the total reproductive life expectancy in 14/32 countries and about 10% to 16% in 18 countries. Reproductive life expectancy in remarriage ranges between 1.6 years in Kenya and 7.2 years in Comoros. It accounts for 10% to 22% of the total reproductive lifespan in over two-thirds of the countries

The reproductive life expectancies outside marriage and in remarriage are strongly correlated with the level of union dissolution. Thus, countries in West Africa have a lower reproductive life expectancy outside marriage and in remarriage than countries in Central Africa and East and South Africa. However, the key finding and of particular interest in Table 2 is that women in West Africa spend more years in remarriage than they do outside marriage compared to women in Central and East and South Africa. For example, all countries in West Africa have higher life expectancy in remarriage than outside marriage, 3.7 versus 2.2 years. In contrast, only 2/15 countries in East and South Africa have higher reproductive life expectancy in remarriage than outside marriage. In this region, the average reproductive life expectancy outside marriage is 4.1 years compared to 3.2 years in remarriage.

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<sup>3</sup> Calculated in the same manner as SMDUD. We only replace duration with age

**Table 2:** Marital states life expectancies during reproductive ages (15-49) for 32\* sub-Saharan African countries

Country and year of survey (sorted from low to high level of all-cause union dissolution – see Figure 2)	Marital states life expectancies during reproductive ages (15-49)				Reproductive life expectancy (in years)
	Never married	Intact first union	Dissolved union	Remarried	
<b>West Africa</b>					
Mali	4.3	24.6	1.4	2.2	32.6
Guinea	5.9	22.8	1.5	2.5	32.7
Burkina Faso	4.7	23.2	1.3	3.2	32.5
Nigeria	6.8	20.2	2.0	2.4	31.3
Senegal	6.7	22.0	1.7	3.5	33.9
Niger	3.1	23.4	1.6	4.7	32.8
Benin	6.1	21.2	2.3	3.5	33.1
Gambia	6.7	19.9	1.9	4.4	32.9
Cote d'Ivoire	7.7	17.5	2.5	3.9	31.5
Sierra Leone	8.1	17.0	1.8	4.2	31.1
Togo	7.2	18.6	2.7	3.8	32.3
Ghana	9.1	15.6	3.6	4.4	32.7
Liberia	8.8	15.5	3.7	5.3	33.3
<b>Central Africa</b>					
Chad	3.8	21.9	3.1	2.6	31.4
Cameroon	8.9	17.4	3.7	2.6	32.5
Angola	8.7	16.8	4.1	3.6	33.2
Congo (DRC)	6.0	18.1	3.7	4.8	32.7
Gabon	8.7	13.6	4.1	6.6	33.1
Congo	6.1	14.8	5.3	6.5	32.6
<b>East and South Africa</b>					
Kenya	7.6	19.6	4.3	1.6	33.0
Burundi	8.9	18.4	3.4	1.8	32.5
Rwanda	11.2	17.2	3.6	1.7	33.8
Ethiopia	6.7	17.8	3.9	3.8	32.3
Zimbabwe	6.8	17.0	4.8	3.5	32.2
Uganda	6.0	17.3	5.2	4.6	33.1
Tanzania	6.6	17.8	4.7	4.5	33.5
Namibia	16.7	11.3	2.6	1.7	32.3
Mozambique	5.2	16.9	5.0	4.3	31.4
Malawi	5.2	17.9	5.3	5.0	33.3
Zambia	7.8	16.4	5.2	3.8	33.3
Madagascar	4.4	17.4	4.7	6.3	32.9
Comoros 2012	7.4	16.0	2.9	7.2	33.4

Note

1. Lesotho and South Africa are excluded because of the implausible age-specific proportion of ever-remarried women (see Table 3 notes)

This pattern points to two aspects of union dissolution and remarriage in SSA. First, it indicates that the propensity to remarry following a union dissolution is relatively higher in West Africa than in Central, East, and South Africa. We indeed observe that the ratio of ever remarried women to those who experienced a union dissolution within the first 15 years of the first union (Table 3) varies between 0.59 to 0.85 in West Africa, with an average of 0.74. In Central Africa, it varies between 0.57 to 0.72 with a mean of 0.66, and in East and South Africa, it ranges from 0.29 to 0.86 with an average of 0.60. Second, the pattern in Table 2 indicates that remarriage following union dissolution is more rapid in West Africa. This observation became more apparent when we considered the average duration between first union dissolution and first remarriage among ever-remarried women. These estimates were calculated using the SMDUD approach (see Table 3 notes for details). We found that the mean duration women spend between first union dissolution and first remarriage varies between 0.2 and 2.5 years, with an average of 1.3 years in West Africa, between 1.1 and 2.7 years with an average of 1.8 years in Central Africa, and between 0.9 and 2.9 years with an average of 1.9 years in East and South Africa.

**Table 3:** Risk of remarriage within the first 15 years of the first union and average duration (in years) between first union dissolution and first remarriage, based on recent surveys for 34 sub-Saharan Africa.

Country and year of survey (sorted from low to high level of all-cause union dissolution – see Figure 2)	Risk of remarriage within the first 15 years of the first union	Average duration (in years) between first union dissolution and first remarriage
<b>West Africa</b>		
Mali 2018	0.69	1.7
Guinea 2018	0.59	1.7
Burkina Faso 2010	0.83	0.5
Nigeria 2018	0.71	0.6
Senegal 2019	0.67	1.6
Niger 2012	0.85	1.4
Benin 2017-18	0.69	0.2
Gambia 2019-20	0.83	1.6
Cote d'Ivoire 2011-12	0.71	1.1
Sierra Leone 2019	0.82	0.9
Togo 2013-14	0.71	1.2
Ghana 2014	0.77	1.5
Liberia 2019-09	0.76	2.5
<b>Central Africa</b>		
Chad 2014-15	0.67	2.0
Cameroon 2018-19	0.57	1.4
Angola 2015-16	0.60	1.1
Congo (DRC) 2013-14	0.72	2.7
Gabon 2012	0.65	1.2
Congo 2011-12	0.72	2.3

Country and year of survey (sorted from low to high level of all-cause union dissolution – see Figure 2)	Risk of remarriage within the first 15 years of the first union	Average duration (in years) between first union dissolution and first remarriage
<b>East and South Africa</b>		
Kenya 2014	0.34	1.8
Burundi 2016-17	0.45	1.9
Ethiopia 2016	0.65	1.9
Zimbabwe 2015	0.71	1.9
Uganda 2016	0.76	1.3
Tanzania 2015-16	0.65	2.1
Namibia 2013	0.29	0.9
Mozambique 2011	0.56	1.6
Malawi 2015-16	0.73	1.9
Zambia 2018-19	0.54	2.5
Rwanda 2014-15	0.48	2.9
Madagascar 2008-09	0.72	2.0
Comoros 2012	0.86	1.6

**Notes:**

1. Risk of remarriage within first 15 years of the first union = the proportion of married more than once women within first 15 years of first marriage divided by the proportional of dissolved first unions within first 15 years of marriage.
2. The risk of remarriage within the first 15 years of the first union indicates a propensity to remarry following a union dissolution.
3. Average duration (in years) between first union dissolution and first remarriage = Singulate Mean Duration at first Remarriage (SMDRE) minus Singulate Mean Duration at first Union Dissolution (SMDUD)
4. Singulate Mean Duration at first Remarriage (SMDRE) is calculated in the same manner as SMDUD, where  $S(t)$  measures the proportion of women married only once at duration  $t$
5. The analysis focused on the first 15 years of the first union because estimates of the proportion of women married more than once rapidly become problematic with increasing union duration.
6. The difference between SMDUD and SMDRE also provides an internal consistency check for the marriage histories. Ideally, SMDRE should be greater than SMDUD. If union dissolution is reasonably reported well, but the proportion of remarried women is severely underreported, subtracting SMDUD from SMDRE will yield negative values. Lesotho and South Africa data revealed some possibility of underreporting remarriages; thus, they are excluded in this analysis and marital state life expectancies presented in Table 2 and Figure 4 in the paper.

In Figure 4 we present the trend in the reproductive life expectancy spent outside marriage due to a dissolved union (dotted) and in remarriage (solid) for 31 SSA countries with at least two surveys (South Africa and Lesotho excluded). What is essential to focus on in this figure is the change in the gap between the reproductive life expectancy in dissolved unions and remarriages and whether such change is driven by changes in reproductive life expectancy in one state or both. These dynamics explicate whether the change in the reproductive life expectancy in Figure 4 is mainly emerging due to declining union dissolution or a lower propensity to remarry following a union dissolution. For example, in West Africa, the gap between the reproductive life expectancy in dissolved unions and remarriages narrowed across all countries. This decline is primarily due to the drop in the reproductive life expectancy in remarriage. Reproductive life expectancy outside marriage remained dominantly stable. This pattern implies that a substantial decline in union dissolution in this region translated more into the reduced proportion of women in second or higher order unions and had no significant influence on the distribution of women with a dissolved union.



Such stability of the reproductive life expectancy outside marriage when the level of union dissolution is declining can only emerge if the risk of remarriage decreased in the recent surveys.

**Figure 4:** Trends in the reproductive life expectancy in a dissolved union (dotted) and remarriage (solid) in 31 sub-Saharan African countries.

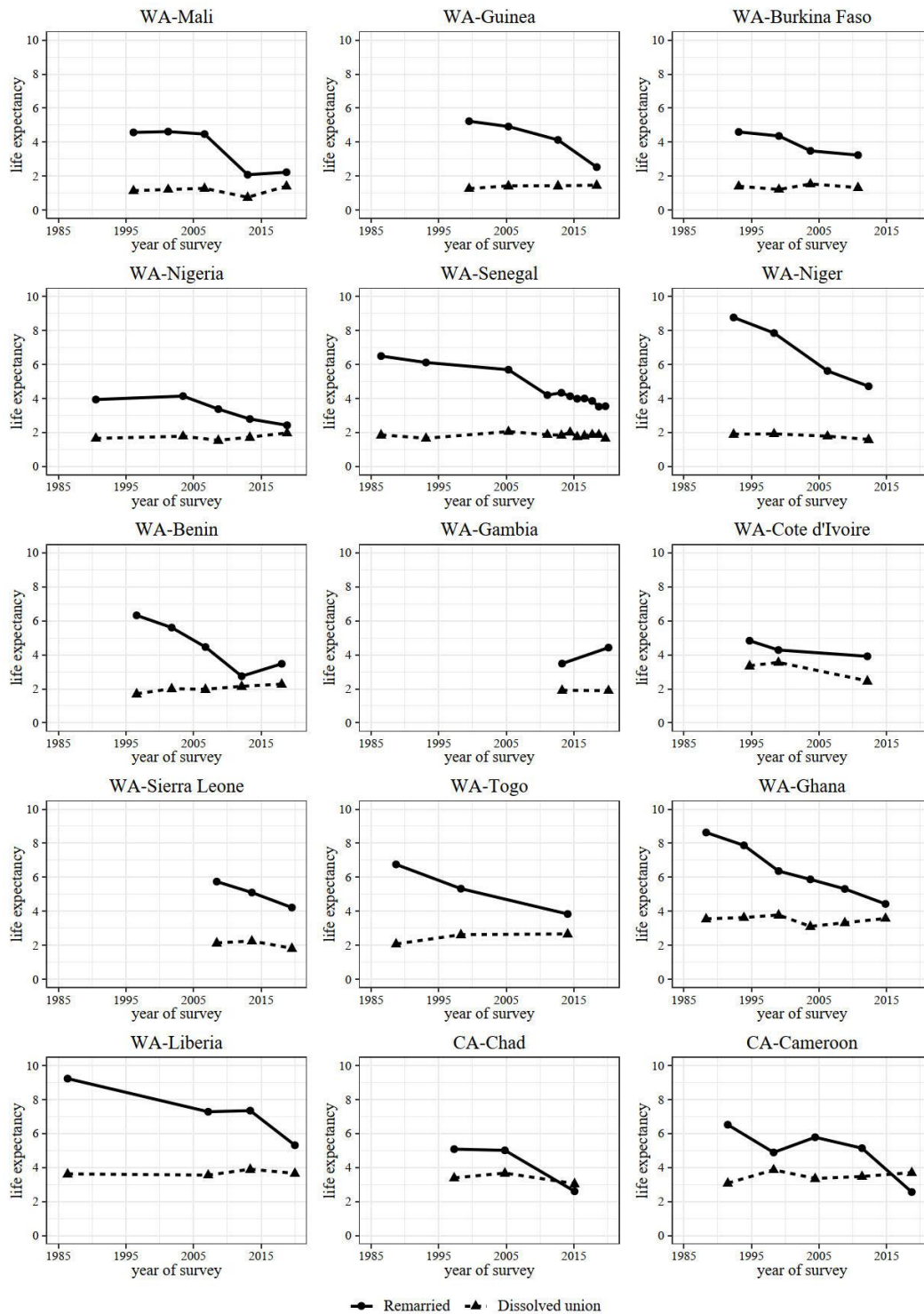
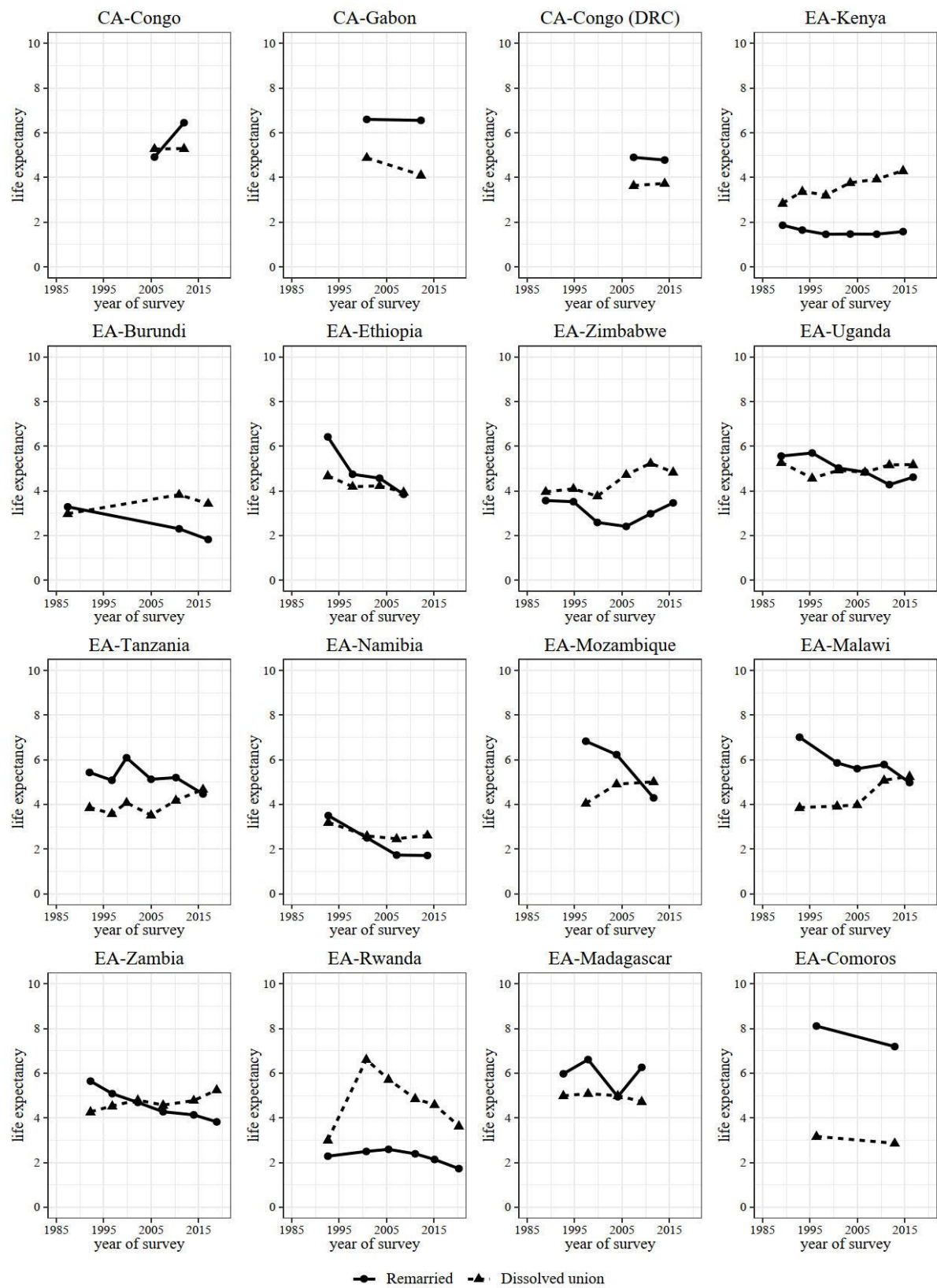


Figure 4 cont...



For most countries in Central and East and South Africa, the difference between reproductive life expectancy in dissolved unions and remarriage is different from what we see in West Africa. The conclusion is, however, the same - the risk of remarriage has declined. In these regions, the reproductive life expectancy in dissolved union states increased or remained stable as reproductive life expectancy in remarriage states decreased, and all-cause union dissolution dropped. In countries such as Kenya, Namibia and Zimbabwe, where the level of union dissolution increased, this rise translated more into an increase in the reproductive life expectancy in dissolved unions than in remarriage. These dynamics can only emerge if the risk of remarriage following a union dissolution is declining – and thus implying that women are now, on average, spending relatively more years between first union dissolution and first remarriage than before. It is important to note that the ‘relatively more years’ we refer to here is what we document in Table 3, thus confirming that SSA has indeed had a history of rapid remarriages.

## **Discussion**

Union dissolution and remarriage are common in SSA and they are consequential for different social and demographic outcomes (Clark and Brauner-Otto 2015, Adjiwanou, Boco et al. 2021, John and Adjiwanou 2021). However, other important aspects of union dissolution and remarriage dynamics – (1) the timing of first union dissolution and (2) the time women spend outside marriage due to union dissolution and the time spend in remarriage – that are necessary for understanding the consequences of experiencing these events for individual’s social and demographic life outcomes are unknown. This paper addresses this gap by applying novel and standard indirect demographic techniques to Demographic Health survey data collected in 34 SSA countries. First, we documented the levels and changes of all-cause union dissolution – either divorce or widowhood. The focus on all-cause union dissolution is ideal because the likelihood of a woman losing a husband through death during the reproductive ages is much more common in SSA than in other world regions (see regional differences in male mortality in United Nations (2019)). Moreover, as we noted and as other prior studies revealed (Locoh and Thiriat 1995, Reniers 2003, Guirking, Gross et al. 2021), remarriage following a union dissolution is common in SSA. Thus, focusing on all-cause union dissolution represent well the realities of family life in this region. Second, we estimated how long first unions persist among women who experience a union dissolution. Third, we examined the duration women spend outside marriage due to a union dissolution and the time they spend in second or higher order unions. All the estimates we produced reflect the experience of synthetic cohorts. With this interpretation in mind, our analysis reveals four aspects of all-cause union dissolution and remarriage in SSA.

First, as we anticipated, we found high all-cause union dissolution rates that varied markedly across regions. In 28/34 countries, over one-fifth of first unions end within 15 years, and in 14/34 countries, the percentage of first unions ending within 25 years exceeds 40%. Countries in West Africa exhibit lower union dissolution rates than those in Central, East, and South Africa. However, our estimates for early surveys indicated that West Africa had high union dissolution rates comparable to Central and East Africa. It is the significant decrease in first union dissolution

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in West Africa that has created a relatively low union dissolution context there. We indeed found that although most countries experienced a decline in union dissolution rates, countries where union dissolution increased or decreased slightly are mainly from Central, East and South Africa. The average annual decrease in the proportion of first unions ending within 25 years is about 4.3 for every 1000 unions in West Africa compared to 1.3 and 0.2 per 1000 marriages in Central and East and South Africa, respectively.

The sharp decline in all-cause union dissolution in West Africa should be linked to substantial decreases in divorce/separation rates rather than improvements in male mortality. Indeed, the UN mortality estimates show that for the past two decades, the mortality of males aged 15 to 64 (corresponding to the population of males who generally forms unions with women of reproductive age) declined more steeply in Central, East and South Africa than in West Africa (United Nations 2019). If male mortality were the dominant force driving changes in all-cause union dissolution, we would have observed much greater declines in union dissolution in Central, East and South Africa than in West Africa. It is important to note that women in West Africa have social and demographic attributes that are a recipe for a high risk of divorce/separation (Takyi 2001, Reniers 2003, Bertrand-Dansereau and Clark 2016). For example, compared to women in Central, East and South Africa, women in West Africa are less likely to have secondary education, more likely to marry at a younger age, and more likely to be in polygamous unions (Fenske 2015, Frye and Lopus 2018, John and Nitsche 2021). Thus, the fact that union dissolution is low and has declined substantially in this region than in Central, East and South Africa suggests that cultural rather than individual factors are the most dominant force shaping union stability in West Africa.

The levels and patterns of union dissolution in Central, East, and South Africa can partially be attributed to high levels of women's autonomy, intimate partner violence, and HIV prevalence. Female education and women's participation in the paid labour force has improved significantly in these regions (Frye and Lopus 2018, Van den Broeck and Kilic 2019). Besides, women in these regions face a high level of intimate partner violence than women in West Africa (Cools and Kotsadam 2017). Thus, the high levels of union dissolution in these regions potentially reflect how women respond to this violence. Since more women are more likely to be self-reliant, the economic cost of ending an abusive relationship might be bearable. Indeed, a positive association between Intimate partner violence and marital dissolution has been documented in this region (Wagman, Charvat et al. 2016).

Second, the results revealed that all-cause union dissolution declined in most countries. However, there is strong evidence of increasing all-cause union dissolution in Gambia, Kenya, Namibia and Zimbabwe. Moreover, in some countries such as Sierra Leone, all-cause union dissolution increased during the early years of marriage but declined at later years. Male mortality in Gambia, Kenya, Namibia and Zimbabwe improved substantially at least since the mid-2000s (United Nations 2019). Thus, increasing all-cause union dissolution in these countries implies rising divorce rates. This finding differs from Clark and Brauner-Otto (2015) conclusion that divorce rates declined or remained stable in SSA. This discrepancy can largely be explained by

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differences in the estimation procedure. In this paper we focused on all-cause union dissolution. Thus, our estimates are free from uncertainty of assumptions that Clark and Brauner-Otto (2015) considered to disentangle divorce from widowhood rates. One of their key assumption is that remarriage is equally likely across all marriage duration. Thus, because divorce dominates early years of marriage, this assumption could somehow lead to underestimation of divorce probabilities (as Clark and Brauner - Otto recognize). Moreover, Clark and Brauner - Otto (2015) used unsmoothed all-cause union dissolution estimates as input data in their model. Thus, because of the data problems we discussed earlier, some of the input parameters in Clark and Brauner-Otto (2015) are, in some cases, conceptually improbable and could somehow lead to underestimation of divorce estimates. For example, in some cases, the risk of union dissolution in a given interval (which they calculated by subtracting the proportion of women who ever experienced a union dissolution in the previous interval from the corresponding estimate in the interval in question) is negative.

Third, our findings revealed that union dissolution occurs relatively early, and the reproductive time lost due to union dissolution is minimal. The average duration at first union dissolution varies between 4.8 and 9.4 years, while the reproductive time loss due to union dissolution ranges between 1.3 and 5.3 years, accounting for 4.0% to 16.3% of the total reproductive life expectancy. Among women who remarry, the mean duration spent outside marriage before the first remarriage does not exceed three years across all the countries. Furthermore, we found that reproductive life expectancy in remarriage range between 1.6 and 7.2 years, and it accounts for 10% to 22% of the total reproductive lifespan in over two-thirds of the countries. These findings parallel selected studies in small geographical areas that considered the pace of remarriage (Locoh and Thariat 1995, Reniers 2003). However, we provide more robust evidence by showing that this pattern is dominant across all the countries.

The dynamics of the timing of union dissolution and the time women spend outside marriage because of union dissolution we documented offers essential insights into the role of marital instability and repartnering in shaping individual's fertility outcomes in SSA. In theory, the influence of marital instability and repartnering on fertility is hypothesized to arise from at least two dominant mechanics. First is the loss of exposure to regular sexual intercourse, which reduces the risk of pregnancy (Davis and Blake 1956), particularly in societies where sexual intercourse inside intact unions is regarded as the ideal (Cohen and Sweet 1974). Second is the fertility motivations in newly formed partnerships (Griffith, Koo et al. 1985). The timing of union dissolution modulates the reproductive ages at which the risk of pregnancy is likely reduced. The intensity of union dissolution and the pace of remarriage modulates the total reproductive years women lose to union dissolution. There is generally little knowledge on whether and how the timing of union dissolution and repartnering may matter for childbearing behavior in SSA. One exception is a recent study by John and Adjiwanou (2021), which examined how union dissolution and repartnering events may influence lifetime fertility in 34 SSA countries. Their findings illustrate that women who experience union dissolution and remarriage generally have significantly

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fewer children than women who remain in intact first unions. John and Adjiwanou (2021) hypothesized that this fertility difference most likely arises from fertility limiting behaviour in the second union rather than loss of reproductive years to union dissolution. Our findings appear to provide strong evidence in support of this hypothesis. Indeed, given a history of early marriages in SSA, the findings we observed imply that women who experience union dissolution do so at relatively younger reproductive years. Those who remarry return to an institution where sexual intercourse is likely regular at ages where childbearing is still predominant. Thus, it looks plausible that loss of exposure due to union dissolution has little if any effect on lifetime fertility differentials between women who marry more than once and those who remain in intact first unions in SSA.

Our fourth contribution relates to understanding regional differences in the propensity and pace of remarriage following a union dissolution. We found that while all-cause union dissolution is low and occurs at relatively older ages in West Africa, the propensity to remarry is high, and the pace of remarriage is more rapid in this region than in East and Central Africa. The mean duration spent outside the union before the first remarriage is, on average, 1.3 years in West Africa, while it is 1.8 years in Central Africa and 1.9 years in East and South Africa. In part, this pattern can be connected to the vibrant marriage market for separated and widowed women in West Africa due to the high prevalence of polygamy (Fenske 2015). It can also be connected to the high dependency on marriage for economic security. As we have highlighted, women in West Africa are less educated and thus less likely to participate in paid wage employment. Thus, remarriage could be considered as a pathway to financial security.

Our results raise important questions for future consideration to improve our knowledge of union dissolution in SSA. We have suggested explanations for patterns we observed based on our reasonable understanding of women's demographics and social profile in this region. We do not claim that these are the sole processes shaping these patterns, nor do we say they outweigh other possible mechanisms. Our analysis was purely descriptive of the timing of union dissolution and the time women spend outside the union due to union dissolution. Thus, our explanations are hypotheses open for empirical scrutiny in future studies. What our findings emphasize is that all-cause union dissolution is high and occurs relatively early during reproductive ages and that women do not spend substantial years outside marriage following a union dissolution. Thus, we reinforce the idea that reproductive time loss due to union dissolution is likely to have little if any effect on fertility. The results we have documented also underscore that West Africa is unique from other SSA regions concerning the level and timing of union dissolution and the duration women spend outside marriage due to union dissolution.

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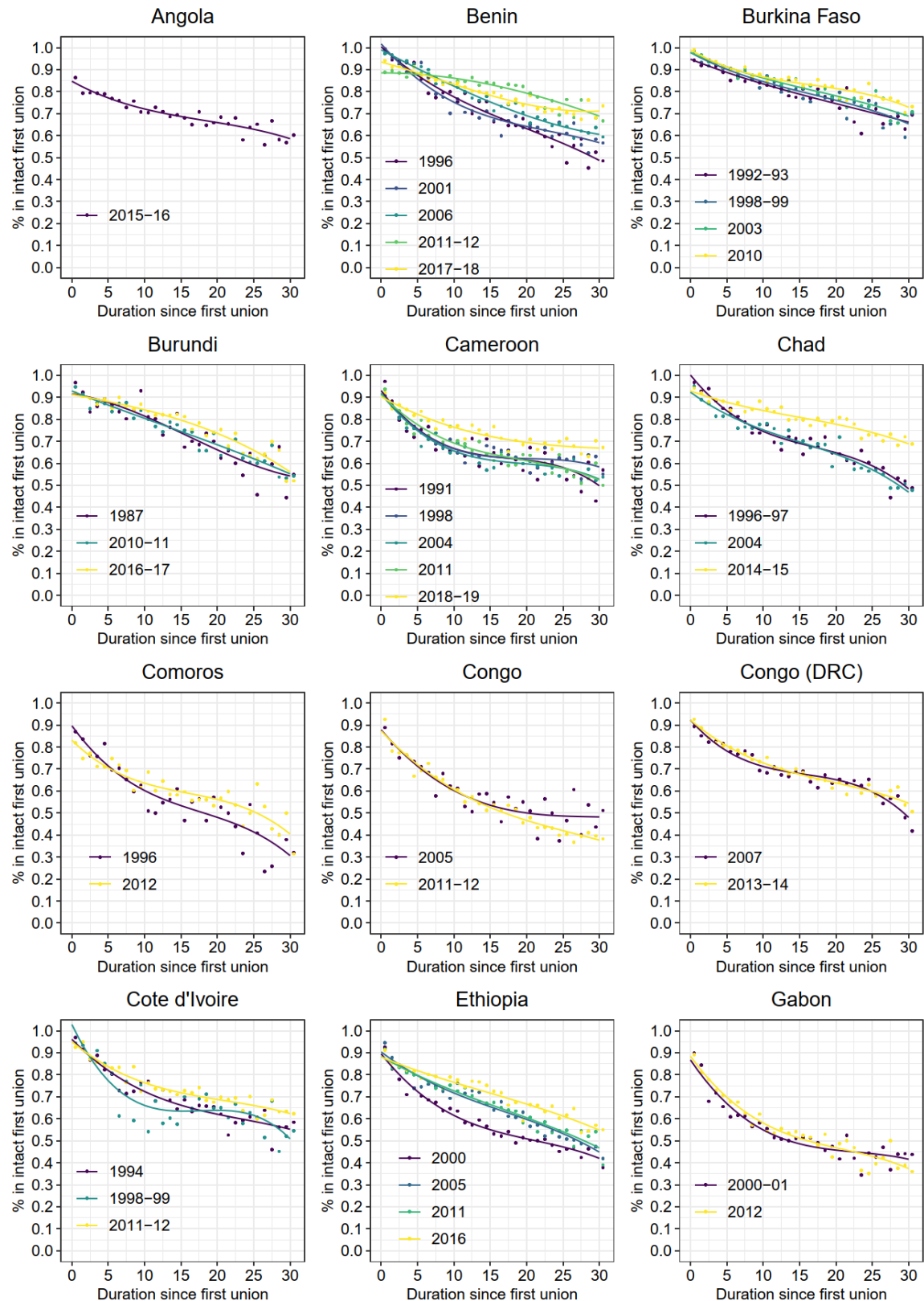
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**Appendix 1:** DHS surveys included in the analysis according to region

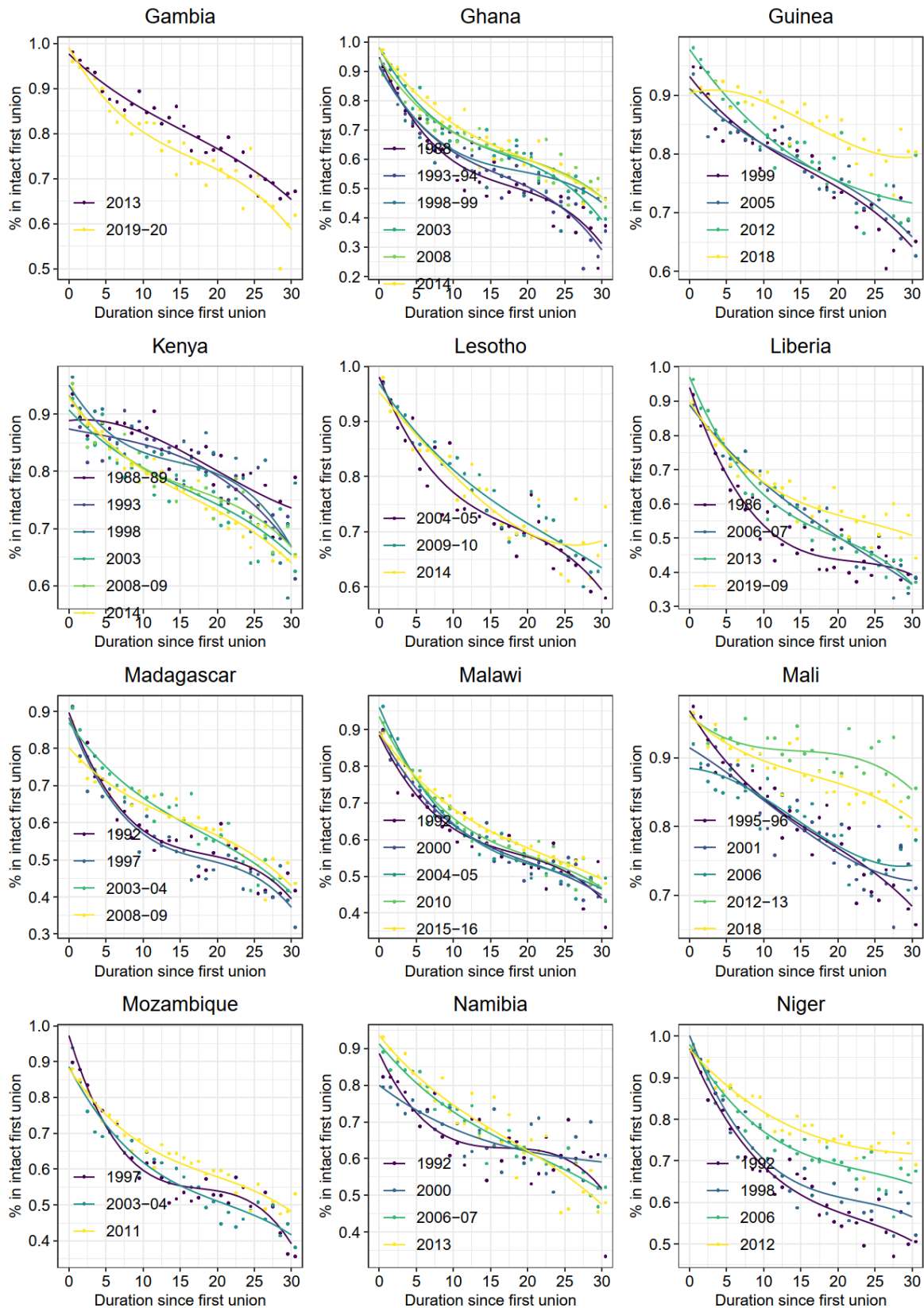
Region and Subregion	Year of Survey						N
	Survey 1	Survey 2	Survey 3	Survey 4	Survey 5	Survey 6	
<b>West Africa</b>							<b>58</b>
Benin	1996	2001	2006	2011-12	2017-18		5
Burkina Faso	1993	1998-99	2003	2010			4
Cote d'Ivoire	1994	1998-99	2011-12				3
Gambia	2013	2019-20					2
Ghana	1988	1993	1998	2003	2008	2014	6
Guinea	1999	2005	2012	2018			4
Liberia	1986	2007	2013	2019-09			4
Mali	1995-96	2001	2006	2012-13	2018		5
Niger	1992	1998	2006	2012			4
Nigeria	1990	2003	2008	2013	2018		5
Senegal*	1986	1992-93	2005	2010-11	2012-13	2014	10
Sierra Leone	2008	2013	2019				3
Togo	1988	1998	2013-14				3
<b>Middle Africa</b>							<b>15</b>
Angola	2015-16						1
Cameroon	1991	1998	2004	2011	2018-19		5
Chad	1996-97	2004	2014-15				3
Congo	2005	2011-12					2
Congo (DRC)	2007	2013-14					2
Gabon	2000	2012					2
<b>East and South Africa</b>							<b>66</b>
Burundi	1987	2010	2016-17				3
Comoros	1996	2012					2
Ethiopia	2000	2005	2011	2016			4
Kenya	1989	1993	1998	2003	2008-09	2014	6
Madagascar	1992	1997	2003-04	2008-09			4
Malawi	1992	2000	2004	2010	2015-16		5
Mozambique	1997	2003	2011				3
Rwanda	1992	2000	2005	2010	2014-15	2019-20	6
Tanzania	1991-92	1996	1999	2004-05	2010	2015-16	6
Uganda	1988-89	1995	2000-01	2006	2011	2016	6
Zambia	1992	1996	2001-02	2007	2013-14	2018-19	6
Zimbabwe	1988	1994	1999	2005-06	2010-11	2015	6
Lesotho	2004	2009	2014				3
Namibia	1992	2000	2006-07	2013			4
South Africa	1998	2016					2
<b>SSA</b>							<b>139</b>

\* Senegal has a continuous DHS program – they have conducted DHS every year since 2014

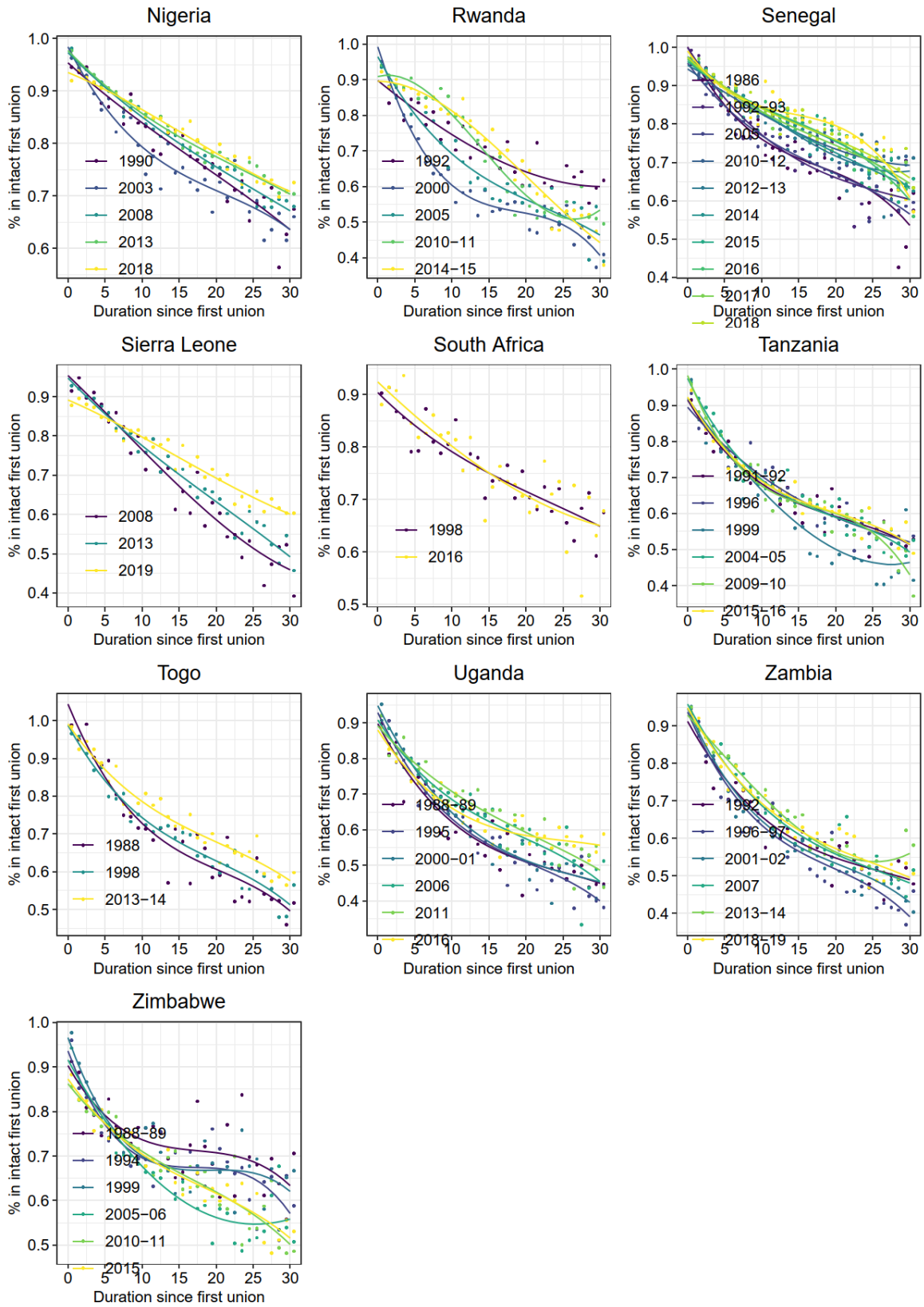
**Appendix 2.** Observed (dots) and Smoothed (lines) proportion of first intact unions by union duration, according to survey year, in 34 SSA countries



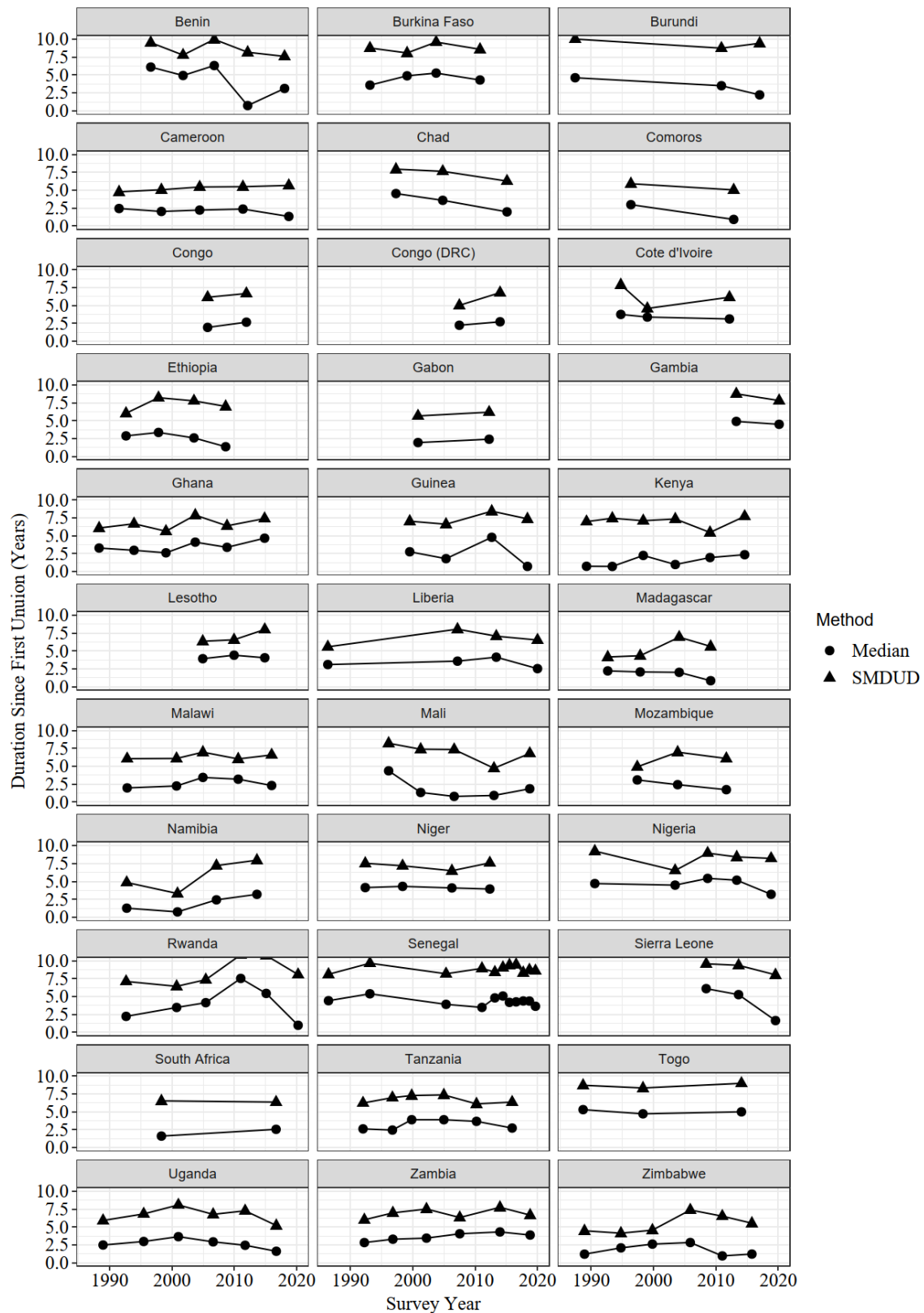
## Appendix 2 continued



Appendix 2 continued



### Appendix 3. Trends in the median and Singulate Mean Duration at First Union (SMDUD)



**Appendix 4: Singulate Mean Age at First Union Dissolution (SMAUD)**

Country Year	SMAUD
<b>West Africa</b>	
Mali 2018	31.7
Guinea 2018	30.3
Burkina Faso 2010	28.5
Nigeria 2018	30.0
Senegal 2019	29.9
Niger 2012	27.1
Benin 2017-18	30.9
Gambia 2019-20	29.8
Cote d'Ivoire 2011-12	28.4
Sierra Leone 2019	29.7
Togo 2013-14	28.2
Ghana 2014	27.7
Liberia 2019-09	22.4
<b>Central Africa</b>	
Chad 2014-15	29.5
Cameroon 2018-19	27.5
Angola 2015-16	27.4
Congo (DRC) 2013-14	28.0
Gabon 2012	23.8
Congo 2011-12	23.1
<b>East and South Africa</b>	
Kenya 2014	26.9
Lesotho 2014	29.4
South Africa 2016	28.5
Burundi 2016-17	28.6
Rwanda 2019-20	29.3
Ethiopia 2016	25.3
Zimbabwe 2015	25.2
Uganda 2016	26.2
Tanzania 2015-16	23.9
Namibia 2013	25.9
Mozambique 2011	25.4
Malawi 2015-16	26.6
Zambia 2018-19	29.9
Madagascar 2008-09	21.4
Comoros 2012	16.5