FERTILITY AND NUMBER OF UNIONS: EMPIRICAL EVIDENCE FROM SUB SAHARAN AFRICAN COUNTRIES

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I. INTRODUCTION

As of the 1990s there was evidence of fertility decline in most countries of sub-Saharan Africa, and it appeared that sub-Saharan Africa was following the historical pattern of the other major regions. With a slow pace of fertility decline, or even stagnation at relatively high levels in various countries (Bongaarts, 2008), the question of Africa's exceptionality has resurfaced. The fertility level in sub-Saharan Africa is the world's highest (5.1 children per woman versus 2.2 in Latin America and Asia in 2010–15; United Nations 2015).

Looking the United Nation report of World Population Prospects published in 2015, the onset of fertility decline has occurred late and is pursuing more slowly in most African countries than in other developing regions, upsetting the different conventional explanatory theories on fertility. To justify these mitigated results in fertility outcomes Bongaarts (2017) propose three possible explanations. First the response of fertility to development could be fundamentally different in Africa than elsewhere in the developing world due to its unique pronatalist features; Secondly countries fertility levels in Africa is inversely related to socio economic indicator and finally the adoption of voluntary family planning programs could be slower and less pervasive in Africa than in other regions of developing world.

The idea of inverse relationship between socio economic indicators and fertility is not really new in literature review on the phenomenon. Indeed, the empiric literature on fertility held that many variables by different mechanism can affect fertility both negatively and positively, and the dominant effect in the entire society gives the final direction of the link between this variable and fertility. For examples education can decrease fertility by the rise of age at first marriage and also increase it by reducing the time of breastfeeding (Easterline 1983; United Nations, 1987; Joshi and David, 2002); on the other hand Schoumaker and Tabutin (1999) have found five great categories of relation between the standard of living of household and fertility.

Our study intend to enrich the debate on the inverse relation between socio economic indicator and fertility, by taking into account conjugal mobility. Indeed, while some studies have investigated relationship between fertility and conjugal mobility and conclude such as Locoh (2006) and Hertrich (2006) founded a weak effect of remarriages on fertility outcomes, other studies sustain a positive effect of number of unions on fertility outcomes (Zamwangana, 2005).

Within a context of change in marital pattern in African societies such as change in age at first marriage (Hertrich, 2017) and declining in divorce (Clark Shelley and Brauner-Otto Sarah, 2015) , it appear relevant to reinvestigate *1) the net effect of number of unions, controlling other proximate determinants of fertility and 2) the role play number of unions in fertility change.*

II. LITERATURE REVIEW

Our literature review will be divided in two parts. First we stating the level of our analyze and secondly we make a literature review on the relationship between nuptiality and fertility outcome.

II.1 The different channels by which Nuptiality affect fertility

Different mechanism have been advanced to explain the positive effect of nuptiality regime on high-fertility in Africa. The pronatalist nature of the traditional African nuptiality system has been widely documented and can be summarized by two aspects.

First, it maximizes the span of a woman's reproductive life that is assigned to reproduction. Unlike pre-transitional Europe, where late marriage and permanent celibacy restricted the potential of fertility, in sub-Saharan Africa the traditional fertility-inhibiting factors operate mainly within marriage by means of the postpartum infecundity that results from long breastfeeding and postpartum abstinence (Page and Lesthaeghe 1981). A woman's life course is structured by marriage and reproduction: she is married at a young age; and if the marriage ends (through divorce, separation or widowhood), she quickly remarries. Therefore marriage duration appear as an important determinant of fertility outcomes (Bongaarts, Frank, and Lesthaeghe 1984). Polygyny is also helping greatly to the smooth running of this system, because in case of marital disruption, a woman can remarry rapidly without waiting for a single partner to become available (Locoh 2006; Hertrich 2006).

The second aspect of the association between the nuptiality and high-fertility regimes is related to the organization of the conjugal unit and of gender relations. The traditional

marriage system largely contributes to building weak relationships between spouses and, therefore, to hindering the elaboration of common and independent fertility decisions (Caldwell 1982; Lesthaeghe 1980; Lesthaeghe et *al.*, 1989; Mason 1993; National Research Council 1993; Ryder 1983). Polygyny and the high risk of marital disruption are other causes of a frail conjugal bond, because they create uncertainty and a climate of distrust between spouses (Antoine 2006; Hertrich and Locoh 1999).

In addition to these two possible explanation of the positive effect of nuptiality in fertility stagnation, we consider in this study the role of number of union a women had had in their fecundity life. Many researches questioning the effect of nuptiality pattern on fertility have considered the negligible effect of remarriages as given. However other mechanism can play to make this effect more significant. Indeed, women who have had many unions, have also made face to distinct husband/partner children demand, when many authors underline the primal place of male strategy in determination of couple children demand (Zamwangana, 2005).

II.2 The others Proximate Determinants of Fertility

Approaches on proximate determinants of fertility coming from Davis and Blake (1956) works, underline eleven variables by which the other determinants at political, economic and sociocultural levels affect fertility outcomes. They distinguish factors affecting exposure to intercourse such as age to entry into sexual unions, celibacy, amount spent after and between unions, abstinence and coital frequency; factors affecting exposure to conception notably fecundity, use of contraception and factors affecting gestation and successful parturition foetal mortality (Gérard Hubert, 1995, p.54).

Following this seminal work after testing empirically the model, Bongaarts (1978) underline four intermediates variables that explain mostly fertility difference within a given society: nuptiality, contraception, postpartum infecundity and abortion.

Nuptiality constitutes a central determinant of fertility in numerous societies (Locoh, 2002; Hertrich, 2017) and is usually measured by age at first union and intensity of first marriage. This component was detailed above.

Concerning contraception, literature review distinguish between traditional and moderns methods (Bongaarts, 2015) and being variable of family planning, it concern only women in union. However, because fertility is not affected by women who are not at risk of

pregnancy for many reasons such as abstinence, infecundity or sterility (Frank, 1983 cited by Bongaarts, 2015), amenorrhea, already pregnant or menauposal (Adamchak and Mbizvo 1990; Stover 1998; Thapa et *al.*, 1992; Bongaarts, 2015) it appear important to control these aspects.

Even if postpartum infecundity is taken into account in contraception, the duration of postpartum infecundity vary among women. So it is important to consider the time spent into postpartum infecundity (Bongaarts, 2015).

Abortion is also seen as a proximate determinant of fertility. But due to lack of data on this phenomenon, Bongaarts and Westoff (2000) cited by Bongaarts (2015) deduced the number of births averted per abortion based on the tradeoff between abortion and contraception. The aim of our study not being to estimates abortion, an introduction of abortion proxy build on contraception information would be source of multicollinearity problem in our estimations. For this reason, in absence of this variable in our data base, we shall not take it into account in our econometric estimation.

III. DATA AND METHODS

In this study we make use of 88 DHS women sample datasets from 20 sub Saharan Africa countries, to which we apply successively a Poisson regression to determinate the net effect of number of unions on fertility outcomes for each country, completed by a pooled regression for some African regions to explain the effect of evolution of number of unions on fertility pattern. We focus in this study only in women who are 15 years old and more at the date of the survey. Supposing that total children ever born (TCEB) of women follow a Poisson distribution we can write that:

$$P(Y_i = y_i) = \frac{e^{-\mu}\mu^{yi}}{y_i!} \ (yi = 0, 1, 2, \dots, n)$$

Where

P: represent the probability for the variable Yi to take the value yi.

μ: a positive constant given, principal parameter of poisson distribution, which is equal to the average and the variance of the distribution, either $\pi = \sigma^2 = \mu$

yi: the number of events observed for individual i, here the total children ever born alive

e: the base of logarithm (e=2,71828…).

The principle of Poisson regression is to consider that the logarithm of the average number of events observed among individuals, possessing a combination of a set of explanatory variables, is a linear function of these variables, whether:

$lnE(Y_i|X_i) = \ln(\mu_i) = \beta_{0i} + \beta_{1i}X_{1i} + \beta_{2i}X_{2i} + \cdots + \beta_{pi}X_{pi} = X_i\beta_i$

Where:

E(Yi|Xi)= μ_i: the average number of children ever born alive;

β_{pi}: The Poisson coefficients, giving the effect of explanatory variable considered on dependent variable;

β_i: Vector of β_{ki} k=1, 2,….., p

X_{pi}: Each of independents variables. Among these variables we have: for *nuptiality* age at first marriage, current marital status, number of others wives of the husband/partner to take into account of polygyny effects, and numbers of unions a women had had in their life; for *contraception* we have the type of contraception method used for family planning; and for *Post-partum infecundity* we have a variable that measure exposition to pregnancy completed by a variable measuring the duration of post-partum amenorrhea for last births.

X_i: The vector of X_{ki} k=1, 2,….., p.

Finally, the equation of regression to be estimated is:

$$P(Y_i = y_i) = \frac{e^{-e^{X_i\beta_i}} X_i\beta_i{}^{yi}}{y_i!}$$

The Poisson regression model is estimated using maximum likelihood method and the estimation for the twenty African countries is followed by a pooled regression for East, West and Middle Africa regions.

Finally, a demographic decomposition method is perform to highlight the type of contribution of number of unions in fertility dynamic. Demographic decomposition, as formalized by Eloundou-Enyegue Parfait and *al.* (2017) allow to highlight sources of change observed in Total Fertility Rate (TFR), be given the fact that TFR can be rewrited as the weighted sum of TFRs for different groups or modalities for any chosen variable. It allow also to determinate the contribution of groups to change in global TFR.

Considering t (=1, 2) representing either start year (1) or end year (2) for each country, and j (=1, 2 et 3) the different modalities of number of union (corresponding respectively to

never in union, one union and more than one union), the demographic decomposition of change in Total Fertility Rate (TFR), by number of union is given by:

$$TFR_t = \sum w_{jt} TFR_{jt} \quad (1)$$

$$\Delta TFR = \sum \overline{w_j} \Delta TFR_j + \sum \overline{TFR_j} \Delta w_j \quad (2)$$

IV. ANALYSES AND RESULTS

In this section we shall first estimate Poisson regression and discuss results obtained for the 20 Africa countries, and also for Western, Easter and Central region of Africa. Secondly we decompose fertility change by number of union and interpret the results.

IV.1 Descriptive statistics

From descriptive we can observe in **Table 1** hereby that, the ten countries of East African are mostly represented with 52% of all the sample, followed by the eight countries of West African regions with 37.5% of all the sample and finally central African countries.

Table 1: Sample for the 20 African countries

COUNTRIES AND REGIONS	SAMPLES	WEIGHT OF SAMPLE (%)
Cameroon 1991	3871	0,008
Cameroon 2011	15426	0,034
Congo Democratic Republic 2007	9995	0,022
Congo Democratic Republic 2013-14	18827	0,041
Total for Central Africa	**48119**	**0,105**
Benin 1996	5491	0,012
Benin 2011	16599	0,036
Ghana 1988	4488	0,010
Ghana 2014	9396	0,020
Guinea 1999	6753	0,015
Guinea 2012	9142	0,020
Cote d'Ivoire 1994	8099	0,018
Cote d'Ivoire 2011	10060	0,022
Mali 1987	3200	0,007
Mali 2012	10424	0,023
Niger 1992	6503	0,014
Niger 2012	11160	0,024
Nigeria 1990	8781	0,019
Nigeria 2013	38948	0,085
Burkina Faso 1993	6354	0,014
Burkina Faso 2010	17087	0,037
Total for West Africa	**172485**	**0,375**
Ethiopia 2000	15367	0,033

Ethiopia 2011	16515	0,036
Kenya 1989	7150	0,016
Kenya 2014	31079	0,068
Madagascar 1992	6260	0,014
Madagascar 2008	17375	0,038
Malawi 1992	4849	0,011
Malawi 2016	24562	0,053
Mozambique 1997	8779	0,019
Mozambique 2011	13745	0,030
Rwanda 1992	6551	0,014
Rwanda 2014	13497	0,029
Zimbabwe 1988	4201	0,009
Zimbabwe 2015	9955	0,022
Uganda 1988	4730	0,010
Uganda 2011	8674	0,019
Tanzania 1991	9238	0,020
Tanzania 2015	13266	0,029
Zambia 1992	7060	0,015
Zambia 2013	16411	0,036
Total for East Africa	**239264**	**0,520**
Total for Africa	**459868**	

Sources: **Authors calculations from STATA 14.**

From the description of independent variables in **Table 2** we can underline some observations. At sub-Saharan African level most of women (41.94%) get married between 15 and 19 years old. This is also the case for central, east and African regions.

As in sub-Saharan African level and Central, East and West African the women in union are in most cases lone wife. Regarding declaration of women, contraception usage is very weak in African countries (both for tradition and modern methods). Looking at exposure to pregnancy, most women are fecund and exposed to pregnancy.

Most of women are currently married when we look at current marital status distribution with 67.16 for all the 20 countries of our sample, 65.62% for central African region, 62.54% for East African region and 74% for West African region.

Finally, whatever the region considered, women who had had one union in their life are mostly represented group in number of union distribution (respectively 62.42% at sub-Saharan Africa level, 59.34% for central African countries, 59.91% for East African countries and 66.76% for West African countries).

Table 2: Description of independent variables

INDEPENDENT VARIABLES	SUB-SAHARAN AFRICA		CENTRAL AFRICAN REGION		EAST AFRICAN REGION		WEST AFRICAN REGION	
	Frequency	(%)	Frequency	(%)	Frequency	(%)	Frequency	(%)
Age at first Marriage								
Under 15	61747	13.43	6209	12.90	25746	10.76	29792	17.27
15 - 19	192859	41.94	19992	41.55	99949	41.77	72918	42.27
20 - 24	72721	15.81	7297	15.16	40910	17.10	24514	14.21
25 - 29	17889	3.89	1856	3.86	9086	3.80	6947	4.03
30 and Beyond	5269	1.15	629	1.31	2584	1.08	2056	1.19
Never married	109383	23.79	12136	25.22	60989	25.49	36258	21.02
Number of wives								
Lone wife	215490	46.86	22690	47.15	113603	47.48	79197	45.92
One cospouse	54122	11.77	5494	11.42	15591	6.52	33037	19.15
2 co spouse	16615	3.61	1486	3.09	4062	1.70	11067	6.42
3 cospouse and more	9317	2.03	1866	3.88	3317	1.39	4134	2.40
Missing	4746	1.03	40	0.08	4500	1.88	206	0.12
Not In Universe	159578	34.70	16543	34.38	98191	41.04	44844	26.00
Contraception								
Never used	104414	22.71	7217	15.00	61797	25.83	35400	20.52
Used traditional or folkloric method	20054	4.36	3797	7.89	8971	3.75	7286	4.22
Used modern method	30627	6.66	2852	5.93	20792	8.69	6983	4.05
Missing	304773	66.27	34253	71.18	147704	61.73	122816	71.20
Exposure to pregnancy								
Fecund	245397	53.36	25167	52.30	128189	53.58	92041	53.36
Pregnant	40720	8.85	5380	11.18	17855	7.46	17485	10.14
Amenorrheic	74345	16.17	8750	18.18	34273	14.32	31322	18.16
Infecund, menauposal	59299	12.89	8822	18.33	26528	11.09	23949	13.88
Missing	40107	8.72			32419	13.55	7688	4.46
Duration of Post-partum infecundity								
within one month	20094	4.37	2017	4.19	11966	5.00	6111	3.54
1-3 months	30157	6.56	3449	7.17	14531	6.07	12177	7.06
3 - 6 months	29029	6.31	3335	6.93	14214	5.94	11480	6.66
6 - 12months	47211	10.27	5222	10.85	22144	9.26	19845	11.51
1 to 2 years	27144	5.90	3106	6.45	12578	5.26	11460	6.64
2 years and more	2190	0.48	159	0.33	1389	0.58	642	0.37
Period Not returned	80745	17.56	8959	18.62	38059	15.91	33727	19.55
Inconsistent/Don´t Know/Missing/Not in Universe	223298	48.56	21872	45.45	124383	51.99	77043	44.67
Number of unions								
One	287037	62.42	28552	59.34	143334	59.91	115151	66.76
More than one	62192	13.52	7311	15.19	34409	14.38	20472	11.87
Missing	1256	0.27	120	0.25	532	0.22	604	0.35

NIU (not in universe)	109383	23.79	12136	25.22	60989	25.49	36258	21.02
Current marital Status								
Never married	109377	23.78	12136	25.22	60984	25.49	36257	21.02
Currently married	308854	67.16	31576	65.62	149637	62.54	127641	74.00
Formerly married	41628	9.05	4407	9.16	28637	11.97	8584	4.98
Missing	9	0.00			6	0.00	3	0.00
Total	459 868	100	48119	100	239264	100	172485	100

Sources: **Authors calculations from STATA 14.**

IV.2 The explicative power of number of unions in TCEB

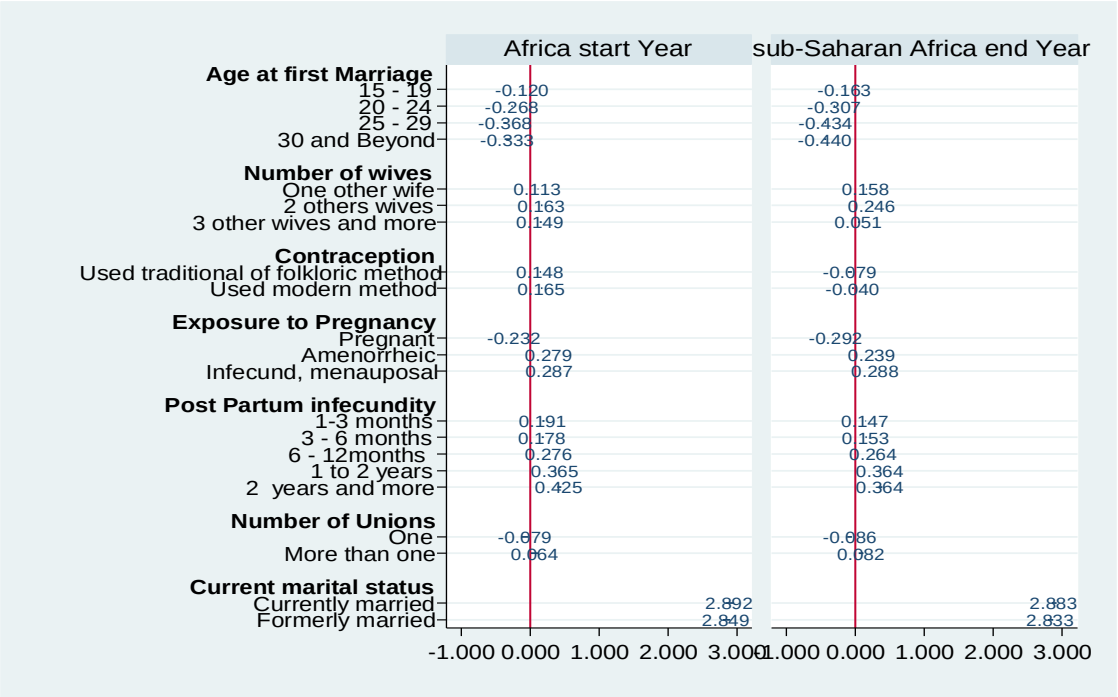
From Chi-square statistical test Poisson regressions fit very well with data and all the models are globally significant. Regarding the number of unions, all the coefficients are significant when the model is performed for all the 20 African countries (P-value are reported in **Table 5** in Annex). Specifically, in **Graphic 1** below, we observe that women who had had more than one union are likely to have a high level of TCEB compared to women who had never been married. Curiously. On the other hand women who had had only one union are less likely to have a high level of TCEB than women who had never been married. These results are corroborating the effect of number of unions on fertility outcomes at the level of the 20 African countries.

The rise of single motherhood phenomenon underlined by many studies in lead in the continent (Bisillat, 1996; Pilon, 1996; Pilon and *al.*, 1997; Tichit, 2002 cited by Adjamago Agnes and Philippe Antoine, 2004) can explain the fact women who having known one union are less likely to have a high level of fertility outcome than those who never been in union. It is only that the fact to having known more than one union that allow women to reach a level of fertility outcomes higher than women who never been in union.

Therefore, we can tell that in Africa multiplication of unions act more in determining the effect of union in fertility outcomes in Africa societies. Indeed, in patriarchal Africa societies, where men that support the most childcare expenses within a union (Locoh Thérèse, 1995), women can respond freely to fertility desires of their new husband in another union. This mechanism is source of high fertility outcomes for women who had had more than one union in their life.

However we don´t know if this effect is the same in each African regions. Does these results vary significantly when we launch our regression across African region?

<u>Graphic 1</u>: Coefficients plotted from Poisson regressions in African countries for start year and end year



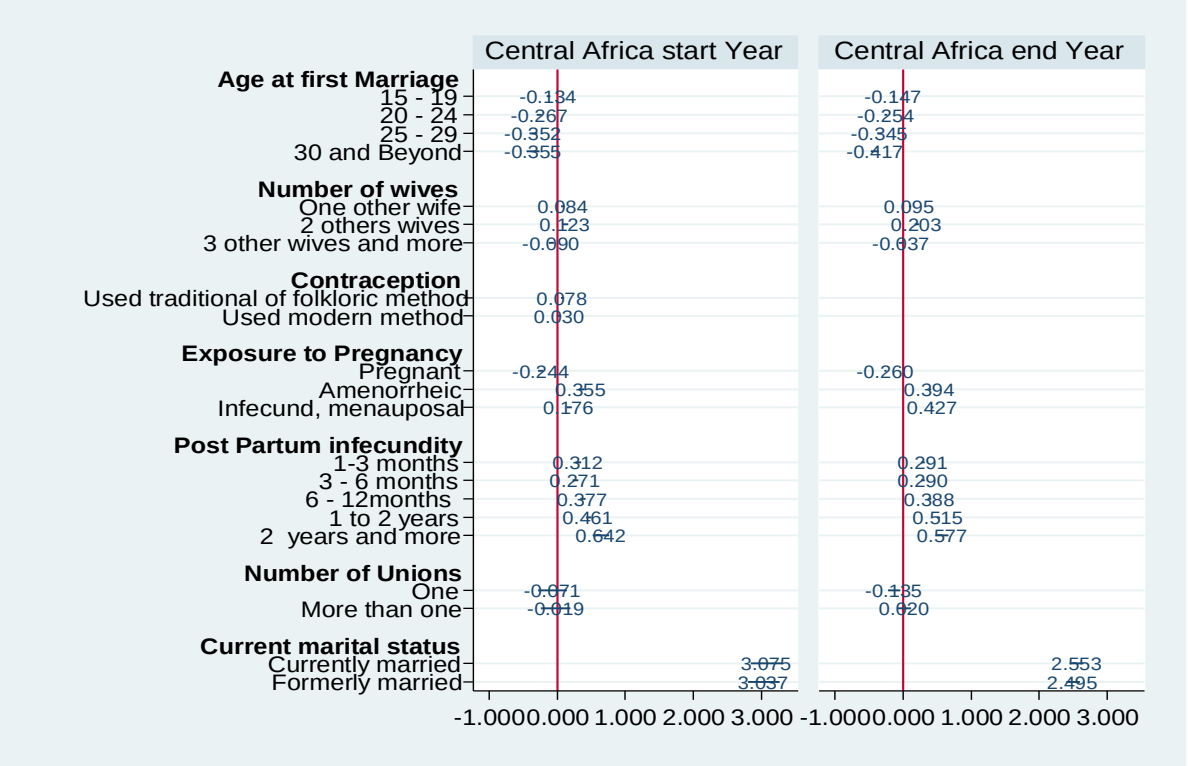
<u>Sources:</u> **Authors calculations from STATA 14.**

From Poisson regression in the two central African countries (Cameroon and Republic Democratic of Congo) in our data base, we observe that number of union doesn´t significantly explain variation in the level of TCEB among women in the start year (see p-value at **Table 6** in Annex) but significant in the end year.

So, the mechanism that walked in this period was those highlight by Locoh (2006) and Hertrich (2006) that underlined the negligible effect of conjugal mobility in fertility outcomes.

In the end year, the multiplication of union remain not significant while, women who had had one union in their life are less likely to have a high level of fertility outcomes than women who never been in union (see **Graphic 2** hereafter).

<u>Graphic 2</u>: Coefficients plotted from Poisson regressions in Central African countries for start year and end year

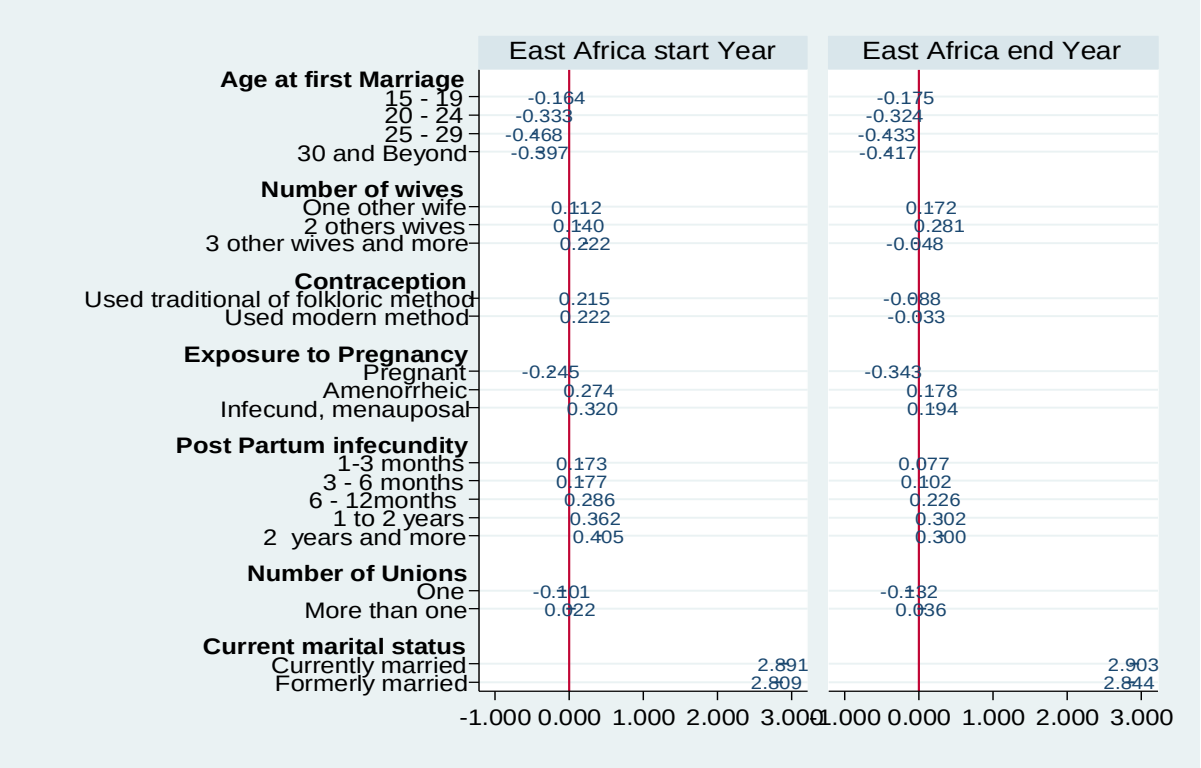


***<u>Sources:</u>* Authors calculations from STATA 14.**

From Poisson regression in the ten Eastern African countries in our data base, we observe that number of unions significantly and positively affect the level of TCEB among women (see p-value at **Table 7** in Annex). It is not as in central Africa region, multiplication of unions that act significantly on fertility outcomes. However, women who had had one union in their life are less likely to reach a high level of fertility outcome than women who never been in union. The coefficients of these regression are plotted in **Graphic 3** below.

So in Central and East African regions, union is not a prerequisite for reproduction activities. Three ways can be mobilized to explain these results: first the response of union are just based on women declaration in Demographic and health Surveys; secondly marriage market with a sex ratio significantly in favor of women, may not allowing to all women to get married and involve reproduction activities in a formal environment; finally with the increase of women autonomy due to schooling and participation to labor market, women may don´t need to get married to take care of themselves, they can do it by their own resources.

<u>Graphic 3</u>: Coefficients plotted from Poisson regressions in Eastern African countries for start year and end year

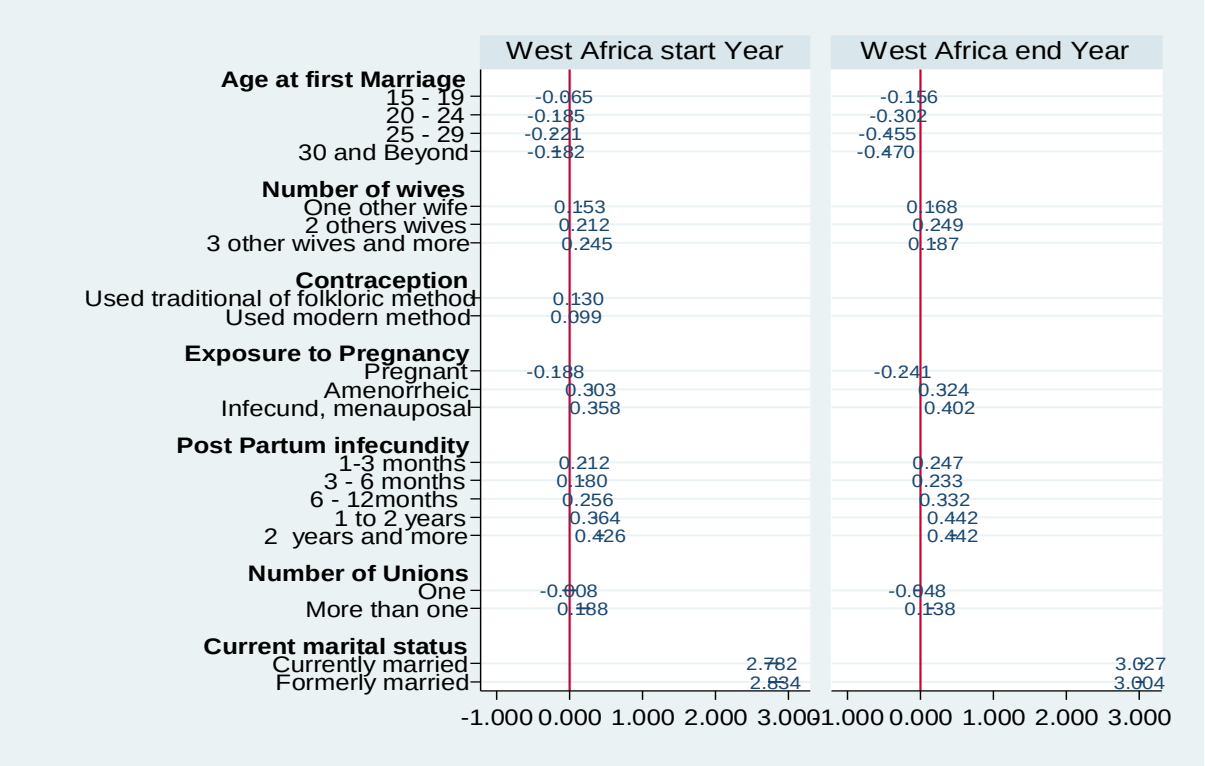


<u>Sources:</u> **Authors calculations from STATA 14.**

According to results reported in **Table 8** (in Annex of the document) from the eight Western African countries in our data base, we observe that number of unions significantly explain variation in the level of TCEB among. More precisely, multiplication of union tend to be a factor that positively affect fertility outcomes compare to women who never been in union. The coefficients of poison regression are plotted in **Graphic 4** below.

From these results it appear that the sense by which number of union affect fertility outcomes, observed before at the level of African region is mostly due to behaviors in West African countries.

<u>Graphic 4</u>: Coefficients plotted from Poisson regressions in Western African countries for start year and end year



<u>Sources:</u> **Authors calculations from STATA 14.**

Indeed significance of the number of unions vary across regions, but the significance at the level of all the 20 African countries allow us to implement a demographic decomposition, in a bid to see by which ways groups of women by their number of unions changes affect changes in Total Fertility Rates (TFR).

The results observed at the level of the other variables introduced in the models globally corroborates literature review with a negative effect of age at first marriage and the positive effect of marital status on fertility outcomes. Regarding polygyny we observe that there is a positive effect of number of wives on fertility outcomes but this relation become less important or even negative (for the case of central African countries) at the level of 3 wives and more. Women who use contraception methods (modern or traditional) are inmost case in union so their fertility outcomes are higher than women who had never be in union. Finally, the likelihood to have high fertility outcomes increase with the duration of post-partum infecundity

IV.3 Demographic decomposition of TFR by number of unions

The demographic decomposition allow to compare between composition effects, due to change in weight of each group, and differential effect resulting from behavioral change in

terms of fertility in a given group. The different effects are derived from weight and TFR estimations for start and end year considered for each country of our sample. The **Table 3** hereafter report Weights and TFR estimates for end and start years by country.

Table 3: Estimations of Total Fertility Rates by countries for start year and end year

	Weights of groups			Estimates of Total Fertility Rate by group			Global TFR
	One union	*More than One union*	*Never union*	*One union*	*More than One union*	*Never union*	
Cameroon 1991	0.59	0.20	0.22	6.05	6.09	2.30	5.25
Cameroon 2011	0.57	0.15	0.28	5.38	6.27	2.40	4.69
Congo Democratic Republic 2007	0.60	0.15	0.25	5.83	7.02	1.07	4.83
Congo Democratic Republic 2013-14	0.62	0.14	0.24	5.98	7.01	3.20	5.45
Benin 1996	0.64	0.18	0.18	6.21	8.58	1.66	5.83
Benin 2011	0.68	0.09	0.23	4.91	7.61	1.70	4.40
Ethiopia 2000	0.51	0.23	0.26	5.85	6.78	0.47	4.67
Ethiopia 2011	0.57	0.16	0.27	5.68	7.44	0.38	4.54
Ghana 1988	0.53	0.27	0.20	5.71	8.37	0.65	5.42
Ghana 2014	0.53	0.14	0.32	4.38	6.24	1.59	3.75
Guinea 1999	0.70	0.15	0.14	5.87	7.39	0.92	5.38
Guinea 2012	0.67	0.11	0.22	5.52	7.20	1.34	4.80
Cote d'Ivoire 1994	0.59	0.14	0.27	6.06	7.69	3.71	5.65
Cote d'Ivoire 2011	0.59	0.12	0.29	5.27	6.89	1.96	4.48
Kenya 1989	0.69	0.05	0.26	6.63	7.54	2.85	5.70
Kenya 2014	0.67	0.05	0.28	4.87	6.53	1.84	4.11
Madagascar 1992	0.51	0.20	0.29	6.16	7.22	1.50	5.03
Madagascar 2008	0.60	0.21	0.18	4.91	6.33	1.08	4.50
Malawi 1992	0.59	0.23	0.17	6.56	7.84	1.92	6.06
Malawi 2016	0.62	0.16	0.22	5.11	9.27	2.16	5.15
Mali 1987	0.79	0.17	0.05	6.38	8.08	1.02	6.41
Mali 2012	0.80	0.06	0.14	5.56	6.67	1.37	5.03
Mozambique 1997	0.60	0.23	0.18	5.35	6.38	3.50	5.26
Mozambique 2011	0.64	0.15	0.21	4.95	6.85	2.55	4.74
Niger 1992	0.60	0.25	0.14	6.98	7.85	1.32	6.39
Niger 2012	0.75	0.14	0.11	6.76	8.01	0.23	6.25
Nigeria 1990	0.69	0.12	0.19	5.82	7.13	2.54	5.34
Nigeria 2013	0.66	0.09	0.03	5.52	8.97	0.54	4.43
Rwanda 1992	0.55	0.11	0.33	6.17	8.92	1.43	4.91
Rwanda 2014	0.54	0.07	0.39	4.53	6.61	0.98	3.31
Zimbabwe 1988	0.63	0.10	0.27	5.86	7.27	2.24	5.03

Zimbabwe 2015	0.61	0.12	0.27	3.77	5.57	1.01	3.25
Uganda 1988	0.59	0.19	0.22	6.97	7.62	2.12	6.05
Uganda 2011	0.61	0.14	0.26	6.41	8.19	2.26	5.60
Tanzania 1991	0.59	0.17	0.24	6.19	7.10	3.62	5.72
Tanzania 2015	0.60	0.14	0.26	5.24	7.18	1.80	4.61
Burkina Faso 1993	0.71	0.13	0.16	6.24	7.51	2.47	5.78
Burkina Faso 2010	0.72	0.09	0.18	5.84	7.76	0.93	5.12
Zambia 1992	0.58	0.17	0.25	6.74	8.39	2.38	5.94
Zambia 2013	0.58	0.13	0.29	5.74	7.15	1.57	4.71

Sources: **Authors calculations from EXCEL 13.**

Decomposition results are organized regarding the contribution of the group of women who had had more than one union in their life and the sense of composition and differentiation effect in this group (See **Table 4** below).

Democratic republic of Congo is the lone country in ***Category 1***, where differentiation effect is the most important source of increase in fertility (97.85%), we observe the negative effect of the decrease in the weight of women who had had more than one union in their life on TFR increase. So, when the number of unions rise it decrease fertility. Adversely, in this country it is the change among of women who had never been married toward a pro-natalist behavior that mostly explain fertility increase in this country. Fertility increase only in this country in our sample.

Differentiation effect remain the most important source of fertility decline in ***Category 2*** comprising Zimbabwe (101.83%) and Madagascar (185.67%). For these two countries, change among women who had had more than one union in their life toward anti-natalist behavior explain decrease in fertility. However, all group exhibit a change toward anti-natalist behavior and the most important contribution is not observed among women who had had more than one union, but among women who had had one union for Zimbabwe (76.25%) at first hand and within the group of women who had never been married in Madagascar (44.31%) on the other hand.

In ***Category 3***, differentiation effect is the most important source of decrease in fertility observed in Tanzania (90.11%), Mozambique (65.91%), Niger (174.64%), Burkina-Faso (79.24%), Cameroon (58.38%) and Malawi (60.80%). Adversely to fertility decrease observed in these countries, change among women who had had more than one union toward a pronatalist behavior is observed, but this effect overwhelmed by the effect of

decrease in the weight of the group. Despite its positive effect on fertility decline, the group of women who had had more than one union have the most important contribution only in Mozambique (80.16%) and Niger (591.31%).

In ***Category 4***, it is composition effect that represent the most important source of fertility decrease in Ethiopia (109.09%), Uganda (53.30%), Guinea (67.83%) and Nigeria (74.86%). Despite the prominent contribution of composition effect, we observed similarly to ***Category 3*** a pronatalist behavior within the group of women who had had more than one union but this effect is overpassed by the decrease of the proportion of women belonging to this group. The contribution of the aforementioned group to fertility decline is most important in Ethiopia (294.24%) and Uganda (68.78%).

Fertility decreases in countries belonging to ***Category 5***, is mostly due to differentiation effect: Mali (56.02%), Benin (68.54%), Ghana (53.82%), Zambia (80.41%), Rwanda (79.54%), Ivory-coast (90.82%) and Kenya (95.88%). In this Category, both composition effect and differentiation effect among women who had had more than one union contribute positively to fertility decline. But it is important to note that composition effect is most important than differentiation effect if all countries belonging to this category excepted in Kenya. The contribution of the group of women who had had more than one union to fertility decline is most important in Mali (69.06%), Benin (64.80%), Ghana (80.48%) and Zambia (44.87%).

Table 4: Decomposition of Total Fertility Rates (TFR) changes by countries and number of unions

Countries and period covered		*One union*	*More than One union*	*Never Married*	*Decomposition of change*	*Contribution to change (%)*
Category 1	Composition	-0.09	0.07	0.01	-0.01	2.15
Congo Democratic	Differentiation	-0.09	0.00	-0.52	-0.61	97.85
Republic 2007 -	Leading group					
2013/14	(%)	29.98	-10.79	80.81	Change=-0.63	
Category 2		***One union***	***More than One union***	***Never Married***	***Decomposition of change***	***Contribution to change (%)***
Zimbabwe 1988-	Composition	0.07	-0.10	0.00	-0.03	-1.83
2015	Differentiation	1.29	0.19	0.33	1.81	101.83
	Leading group (%)	76.25	4.92	18.83	Change=1.78	
Madagascar 1992-	Composition	-0.53	-0.06	0.13	-0.45	-85.67
2008	Differentiation	0.69	0.18	0.10	0.98	185.67
	Leading group (%)	32.03	23.65	44.31	Change=0.53	

Category 3		*One union*	*More than One union*	*Never Married*	*Decomposition of change*	*Contribution to change (%)*
Tanzania 1991-2015	Composition	-0.04	0.21	-0.06	0.11	9.89
	Differentiation	0.56	-0.01	0.46	1.00	90.11
	Leading group (%)	46.40	18.10	35.50	Change=1.12	
Mozambique 1997-2011	Composition	-0.23	0.50	-0.09	0.18	34.09
	Differentiation	0.25	-0.09	0.18	0.34	65.91
	Leading group (%)	2.77	80.16	17.07	Change=0.52	
Niger 1992-2012	Composition	-1.01	0.87	0.03	-0.11	-74.64
	Differentiation	0.14	-0.03	0.13	0.25	174.64
	Leading group (%)	-606.12	591.31	114.81	Change=0.14	
Burkina Faso 1993-2010	Composition	-0.09	0.26	-0.03	0.14	20.76
	Differentiation	0.29	-0.03	0.27	0.53	79.24
	Leading group (%)	30.37	34.53	35.09	Change=0.67	
Cameroon 1991-2011	Composition	0.11	0.27	-0.15	0.23	41.62
	Differentiation	0.38	-0.03	-0.03	0.33	58.38
	Leading group (%)	88.65	42.64	-31.29	Change=0.56	
Malawi 1992-2016	Composition	-0.16	0.60	-0.09	0.36	39.20
	Differentiation	0.88	-0.28	-0.05	0.55	60.80
	Leading group (%)	79.86	34.99	-14.85	Change=0.91	
Category 4		***One union***	***More than One union***	***Never Married***	***Decomposition of change***	***Contribution to change (%)***
Ethiopia 2000-2011	Composition	-0.37	0.51	0.00	0.14	109.09
	Differentiation	0.09	-0.13	0.03	-0.01	-9.09
	Leading group (%)	-210.91	294.24	16.67	Change=0.13	
Uganda 1988-2011	Composition	-0.08	0.40	-0.09	0.24	53.30
	Differentiation	0.34	-0.09	-0.03	0.21	46.70
	Leading group (%)	57.63	68.78	-26.42	Change=0.45	
Guinea 1999-2012	Composition	0.21	0.27	-0.08	0.40	67.83
	Differentiation	0.24	0.02	-0.08	0.19	32.17
	Leading group (%)	76.90	50.51	-27.41	Change=0.58	
Nigeria 1990-2013	Composition	0.14	0.28	0.26	0.68	74.86
	Differentiation	0.20	-0.19	0.22	0.23	25.14
	Leading group (%)	37.65	9.79	52.57	Change=0.91	
Category 5		***One union***	***More than One union***	***Never Married***	***Decomposition of change***	***Contribution to change (%)***
Mali 1987-2012	Composition	-0.07	0.79	-0.11	0.61	43.98
	Differentiation	0.65	0.16	-0.03	0.77	56.02
	Leading group (%)	41.57	69.06	-10.63	Change=1.38	

Benin 1996-2011	Composition	-0.26	0.79	-0.09	0.45	31.46
	Differentiation	0.86	0.13	-0.01	0.98	68.54
	Leading group (%)	41.88	64.80	-6.69	Change=1.43	
Ghana 1988-2014	Composition	0.01	0.91	-0.14	0.77	46.18
	Differentiation	0.71	0.44	-0.25	0.90	53.82
	Leading group (%)	42.64	80.48	-23.12	Change=1.68	
Zambia 1992-2013	Composition	-0.05	0.36	-0.08	0.24	19.59
	Differentiation	0.58	0.19	0.22	0.98	80.41
	Leading group (%)	43.56	44.87	11.58	Change=1.22	
Rwanda 1992-2014	Composition	0.05	0.34	-0.06	0.33	20.46
	Differentiation	0.90	0.21	0.16	1.28	79.54
	Leading group (%)	59.26	34.71	6.03	Change=1.60	
Cote d'Ivoire 1994-2011	Composition	0.01	0.16	-0.07	0.11	9.18
	Differentiation	0.47	0.10	0.49	1.06	90.82
	Leading group (%)	41.19	22.68	36.14	Change=1.17	
Kenya 1989-2014	Composition	0.09	0.02	-0.04	0.07	4.12
	Differentiation	1.20	0.05	0.27	1.52	95.88
	Leading group (%)	80.89	4.64	14.48	Change=1.59	

Sources: **Authors calculations from EXCEL 13.**

Globally we can tell having known more than one union play an important role in fertility decline through composition and differentiation effects and the contribution of this group to fertility reduction is most important on the one hand in Ethiopia (294.24%), Mozambique (80.16%), Uganda (68.78%), Zambia (44.87%) for East African Countries, and on the other hand in Ghana (80.48%), Niger (591.31%), Mali (69.06%) and Benin (64.80%) for Western African countries. For all these countries fertility decrease is mostly explained by decline in the proportion of women who had had more than one union among women between 15 and 49 years old. This decline is due to the reduction in divorce and separations as already underlined by Clark Shelley and Brauner-Otto Sarah (2015) in their estimation of divorce trend on 33 sub-Saharan African countries.

Besides, regarding the different component of decomposition, the differentiation effect or change toward anti-natalist behavior is the major source of fertility decline in most countries of our sample, the composition effect in predominant only in Ethiopia, Uganda, Guinea and Nigeria.

V. CONCLUSIONS/POLICY IMPLICATIONS

The debate on determinants of fertility is ongoing in Africa countries due to recent figures that have not follow expectations. Besides that, the reduction of fertility level dwell central for poverty alleviation by the path of demographic dividend. By a reexamination the effect of remarriages on fertility, this study intended to enrich the debate on fertility determinants in Sub Saharan Africa countries, and thereby to improve population policy maker's comprehension of this major demographic phenomenon in their fertility reduction planning.

From results of our study, the number of union affect significantly fertility level and pattern in sub-Saharan Africa. The demographic decomposition of fertility change by the number of union for the 20 sub-Saharan African countries of our sample, exhibit an important contribution of differentiation effect in fertility change. More precisely it is change in composition and fertility behavior within the group of women who had had one union in their life that play the most important role in fertility decline. Changes within the group of women who had had more than one union in their life appear as the second group where variation in terms of composition and behavior explain fertility decline.

So if in the past unions instability followed by multiplication of unions had leaded to an increase in fertility, the stability of unions and reduction of the proportion of women who had had more than one union in their life in Africa, as highlight in Clark Shelley and Brauner-Otto Sarah (2015) study, is actually source of fertility decline.

Further studies may update and test Bongaarts (1978) models based on proximate determinants of fertility, by distinguishing in marriage index, women who had had more than one union in their life and women who had had only one union in their life. In this case marriage intensity will be measured by a weighted sum of intensity of one union and intensity of more than on union.

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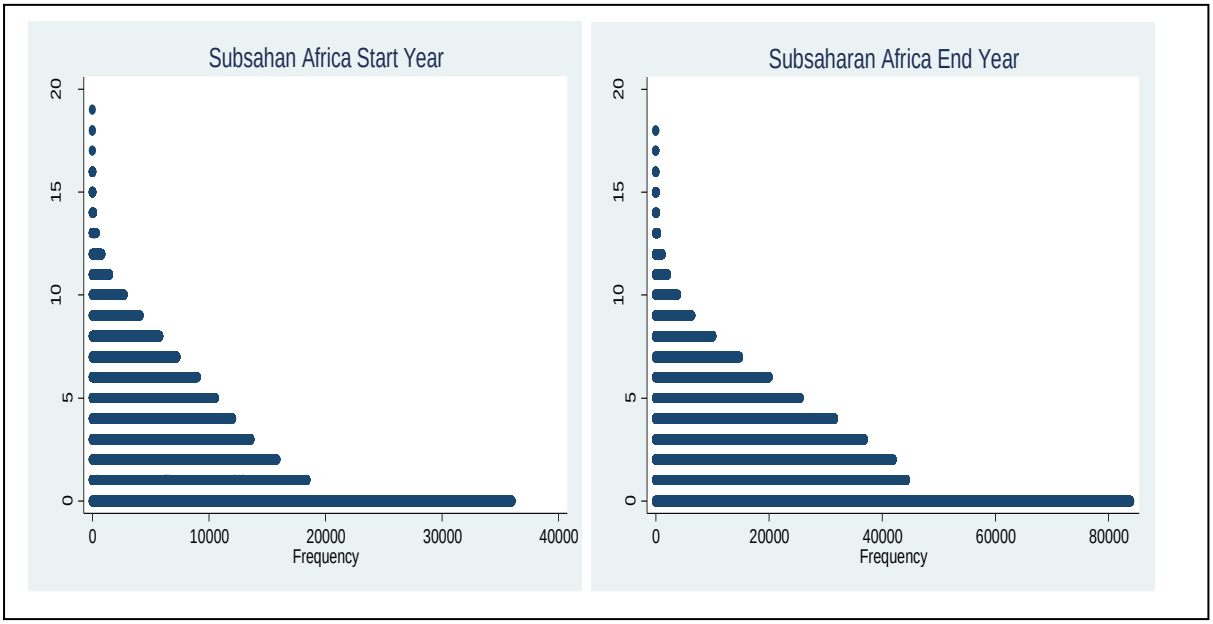
VII. ANNEXES

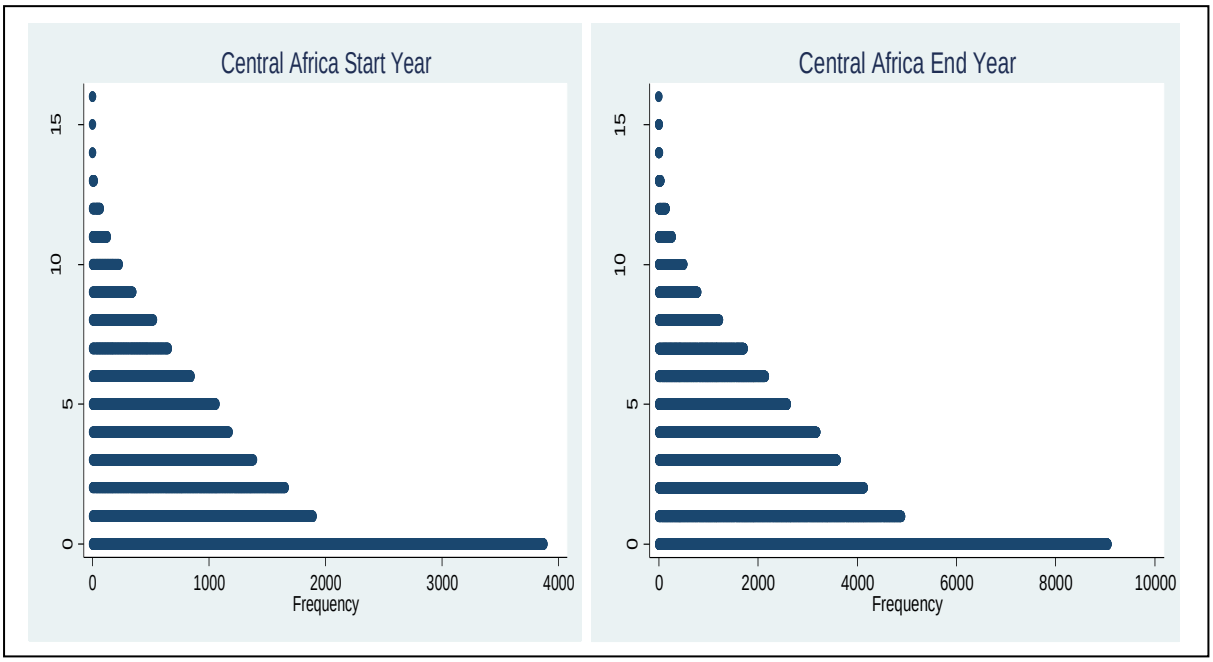
VII.1 GRAPHICS

Graphic 5. Plotting of TCEB for Subsaharan African Countries for end and Start Year



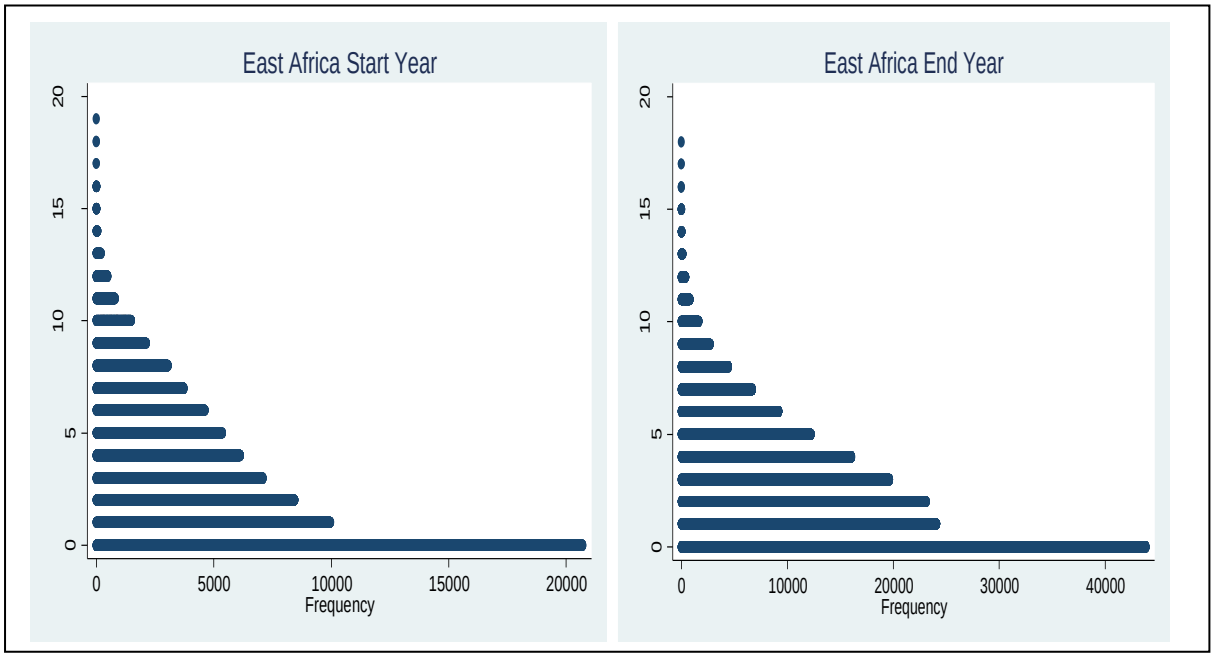
Sources: **Authors calculations from STATA 14.**

Graphic 6. Plotting of TCEB for Central African Countries for end and Start Year



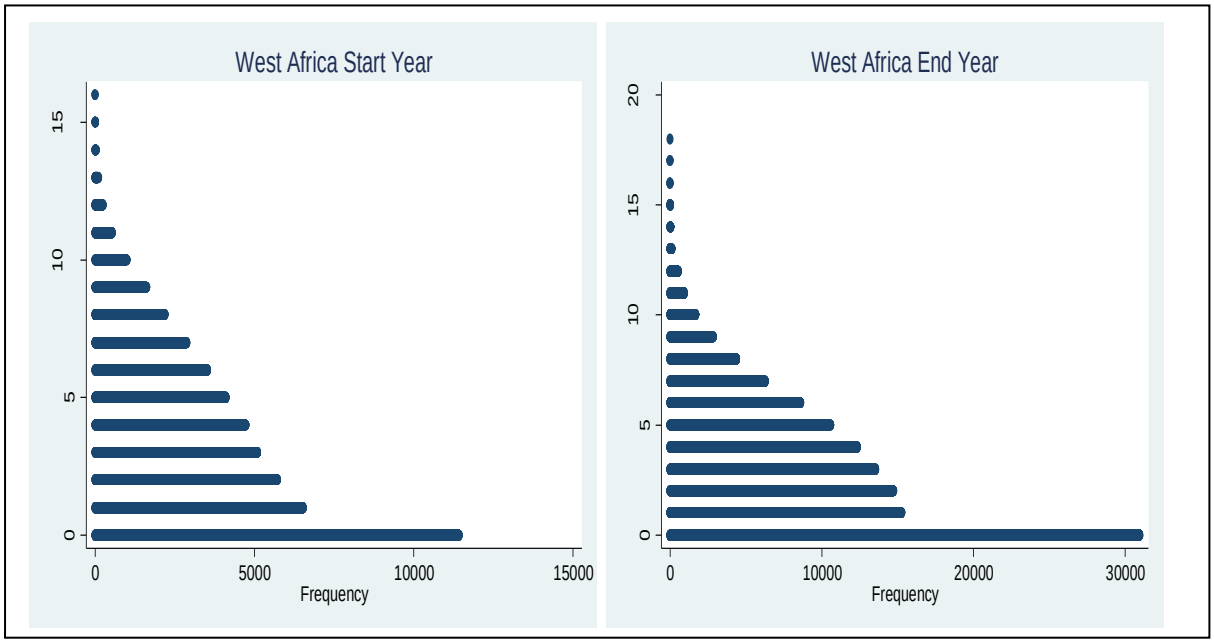
Sources: **Authors calculations from STATA 14.**

Graphic 7. Plotting of TCEB for East African Countries for end and Start Year



Sources: **Authors calculations from STATA 14.**

Graphic 8. Plotting of TCEB for West African Countries for end and Start Year



Sources: **Authors calculations from STATA 14.**

VII.2: TABLES

Table 5: Results of Poisson regressions for the 20 African countries

	Africa Start Year			Africa end Year		
	Coefficients	Std.err	P-Value	Coefficients	Std.err	P-Value
Age at first Marriage						

Under 15 years old	*Reference*					
15-19	-.1202831	.0037468	0.000	-.1633919	.0027433	0.000
20-24	-.2683589	.0051321	0.000	-.3069993	.0033803	0.000
25-29	-.3678303	.0101847	0.000	-.4335375	.0055167	0.000
30 and Beyond	-.3328281	.0196271	0.000	-.4400601	.0092463	0.000
Number of wives of women husband						
Lone wife	*Reference*					
One other wife	.1126015	.004311	0.000	.157697	.0027914	0.000
Two others wives	.1629697	.0054452	0.000	.2460821	.0051717	0.000
Three others wives and more	.1486319	.0079363	0.000	.0505777	.0069204	0.000
Contraception						
Never married	*Reference*					
Use Traditionnal of folkloric method	.1479713	.0042692	0.000	-.0786039	.0151209	0.000
Use modern method	.1649629	.0040476	0.000	-.0398628	.0066304	0.000
Exposition risk to of pregnancy						
Fecund	*Reference*					
Pregnant	-.2319143	.0057703	0.000	-.2922671	.0038864	0.000
Amenorrheic	.2786858	.0044234	0.000	.2392833	.0030984	0.000
Infecund, menauposal	.2871206	.0049473	0.000	.2877232	.0031423	0.000
Duration of Post-partum infecundity						
Under 1 month	*Reference*					
1 - 3months	.1908388	.0066348	0.000	.1474524	.0040762	0.000
3-6months	.1784712	.0067247	0.000	.1529054	.0041617	0.000
6-12 months	.2760333	.0050958	0.000	.2644177	.0034082	0.000
1 to 2 years	.3649596	.0055484	0.000	.3641623	.0041258	0.000
2 years and more	.4250462	.0142893	0.000	.3643197	.0142445	0.000
Number of unions						
Not in Universe (never married)	*Reference*					
One union	-.0790611	.0260912	0.002	-.0863198	.0165895	0.000
More than one union	.0642056	.0262115	0.014	.0823395	.0167188	0.000
Current marital status						
Never married	*Reference*					
Currently married	2.891621	.0289026	0.000	2.882671	.0182993	0.000
Formerly married	2.849405	.0292247	0.000	2.833126	.0185377	0.000

Sources: **Authors calculations from STATA 14.**

Table 6: Results of Poisson regressions for the Central African countries

	Central Africa Start Year			Central Africa End Year		
	Coefficients	**Std.err**	**P-Value**	**Coefficients**	**Std.err**	**P-Value**
Age at first Marriage						
Under 15 years old	*Reference*					

15-19	-.1335304	.0130692	0.000	-.1466756	.0082059	0.000
20-24	-.2666231	.0167686	0.000	-.2543837	.0102569	0.000
25-29	-.3523214	.0290082	0.000	-.3446377	.0168886	0.000
30 and Beyond	-.3554164	.0476607	0.000	-.416538	.0282441	0.000
Number of wives of women husband						
Lone wife	*Reference*					
One other wife	.0839144	.0142577	0.000	.0951536	.0087156	0.000
Two others wives	.1232157	.0213221	0.000	.2026329	.0154173	0.000
Three others wives and more	-.0897162	.0200088	0.000	-.0367976	.0167211	0.028
Contraception						
Never married	*Reference*					
Use Traditionnal of folkloric method	.0781185	.0114157	0.000	0	(omitted)	
Use modern method	.0300129	.0134824	0.026	0	(omitted)	
Exposition risk to of pregnancy						
Fecund	*Reference*					
Pregnant	-.2440564	.017295	0.000	-.2598077	.0107035	0.000
Amenorrheic	.3548171	.0173442	0.000	.3935945	.0098232	0.000
Infecund, menauposal	.1764594	.0165589	0.000	.4270132	.0104158	0.000
Duration of Post partum infecundity						
Under 1 month	*Reference*					
1 - 3months	.3123827	.0207737	0.000	.2909795	.0129501	0.000
3-6months	.2706926	.0218527	0.000	.290424	.0129499	0.000
6-12 months	.3774027	.0183767	0.000	.3880867	.0108195	0.000
1 to 2 years	.4611398	.0203373	0.000	.5153604	.012217	0.000
2 years and more	.6419593	.060651	0.000	.5771112	.0440045	0.000
Number of unions						
Not in Universe (never married)	*Reference*					
One union	-.0711045	.110054	0.518	-.1350097	.0471514	0.004
More than one union	-.0191034	.1104247	0.863	.0199035	.0474279	0.675
Current marital status						
Never married	*Reference*					
Currently married	3.075455	.1177144	0.000	2.552844	.0512861	0.000
Formerly married	3.03738	.1182174	0.000	2.495283	.0519362	0.000

Sources: **Authors calculations from STATA 14.**

Table 7: Results of Poisson regressions for the East African countries

	East Africa Start Year			East Africa End Year		
	Coefficients	**Std.err**	**P-Value**	**Coefficients**	**Std.err**	**P-Value**
Age at first Marriage						
Under 15 years old	*Reference*					

15-19	-.1641387	.0052982	0.000	-.1753526	.0043372	0.000
20-24	-.3330556	.007034	0.000	-.3242442	.0050742	0.000
25-29	-.4678658	.0142643	0.000	-.4334843	.0080765	0.000
30 and Beyond	-.3965248	.028492	0.000	-.4170828	.0132781	0.000
Number of wives of women husband						
Lone wife	*Reference*					
One other wife	.1120834	.0068787	0.000	.1716296	.0051508	0.000
Two others wives	.1396101	.0098262	0.000	.280887	.011369	0.000
Three others wives and more	.2217703	.0159912	0.000	-.0482427	.0110309	0.000
Contraception						
Never married	*Reference*					
Use Traditionnal of folkloric method	.2149466	.006528	0.000	-.0881151	.0151637	0.000
Use modern method	.2222321	.005222	0.000	-.0333896	.0067416	0.000
Exposition risk to of pregnancy						
Fecund	*Reference*					
Pregnant	-.2446046	.0081992	0.000	-.3434811	.0061871	0.000
Amenorrheic	.2735668	.0060231	0.000	.1780743	.0043557	0.000
Infecund, menauposal	.3197442	.0070918	0.000	.1944516	.0045447	0.000
Duration of Post partum infecundity						
Under 1 month	*Reference*					
1 – 3 months	.1729288	.0093869	0.000	.0765569	.0058356	0.000
3 – 6 months	.1771599	.0091489	0.000	.101877	.0059305	0.000
6 - 12 months	.2857674	.006905	0.000	.2259517	.0048718	0.000
1 to 2 years	.3622873	.007607	0.000	.3021831	.0061504	0.000
2 years and more	.404938	.0177547	0.000	.2998724	.0188298	0.000
Number of unions						
Not in Universe (never married)	*Reference*					
One union	-.1011877	.0322125	0.002	-.1324761	.0302276	0.000
More than one union	.022197	.0323735	0.493	.0358947	.0303719	0.237
Current marital status						
Never married	*Reference*					
Currently married	2.891247	.0357926	0.000	2.902729	.0318642	0.000
Formerly married	2.809062	.0361726	0.000	2.844278	.0321091	0.000

Sources: **Authors calculations from STATA 14.**

Table 8: Results of Poisson regressions for the West African countries

	West Africa Start Year			West Africa End Year		
	Coefficients	**Std.err**	**P-Value**	**Coefficients**	**Std.err**	**P-Value**
Age at first Marriage						

Under 15 years old	*Reference*					
15-19	-.0652313	.0058556	0.000	-.1556025	.0039743	0.000
20-24	-.1849426	.0085493	0.000	-.3023634	.0052103	0.000
25-29	-.2212901	.016929	0.000	-.4548673	.0085368	0.000
30 and Beyond	-.1824773	.033094	0.000	-.4702141	.0145457	0.000
Number of wives of women husband						
Lone wife	*Reference*					
One other wife	.1529032	.0062726	0.000	.1675585	.0037803	0.000
Two others wives	.2115906	.0072375	0.000	.249309	.0064349	0.000
Three others wives and more	.2453587	.0105866	0.000	.186801	.0105624	0.000
Contraception						
Never married	*Reference*					
Use Traditionnal of folkloric method	.1300978	.0067769	0.000	0	(omitted)	
Use modern method	.0991713	.0075761	0.000	0	(omitted)	
Exposition risk to of pregnancy						
Fecund	*Reference*					
Pregnant	-.1879589	.009293	0.000	-.2408266	.0057291	0.000
Amenorrheic	.3025764	.0071953	0.000	.3244098	.0053201	0.000
Infecund, menauposal	.3582589	.0081292	0.000	.4017854	.0051906	0.000
Duration of Post-partum infecundity						
Under 1 month	*Reference*					
1 - 3months	.2116549	.0107941	0.000	.247396	.0066033	0.000
3-6months	.180271	.0113409	0.000	.2334453	.0068034	0.000
6-12 months	.2556998	.0083973	0.000	.3323329	.0056227	0.000
1 to 2 years	.3640292	.0089423	0.000	.442252	.0065646	0.000
2 years and more	.42598	.0263528	0.000	.4423043	.0251069	0.000
Number of unions						
Not in Universe (never married)	*Reference*					
One union	-.0081489	.0487856	0.867	-.0480796	.0219039	0.028
More than one union	.1877902	.0489787	0.000	.1380096	.0222259	0.000
Current marital status						
Never married	*Reference*					
Currently married	2.782281	.0543811	0.000	3.027208	.0265511	0.000
Formerly married	2.833889	.0551855	0.000	3.00419	.0273144	0.000

Sources: **Authors calculations from STATA 14.**