

Unequal Transitions to Adulthood: Widening Disparities in Age at First Union, Sex and Birth in Many Low- and Middle-Income Countries

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Abstract

Research on the timing of events during transition to adulthood, such as first union, sex and, birth in low- and middle-income countries (LMICs) focused predominately on measures of central tendency, notably median or mean ages. In this report, we adopt a different perspective on this topic by examining disparities in the timing of these events in 46 LMICs, spanning four decades. Using Demographic and Health Surveys, we estimate ages at which 25%, 50%, and 75% of women have first union, birth, and sex. We compute interquartile ranges to measure within-country variation and disparities in the timing of sexual initiation and family formation. Variation in the timing of first union, birth, and sex generally increases as the median ages at these events increase. Disparities in the timing of first union and birth grew in West Africa and Latin America, and women who experience these events relatively early increasingly lag behind women who experience them relatively late. Documenting trends in measures of central tendency is insufficient to capture complexity of ongoing changes because they mask growing disparities in the timing of family formation across many LMICs. These results are important for assessing progress towards achievement of SDGs related to reduction of early marriages and pregnancies and highlight a need for more holistic approaches to measuring timing of family formation.

Keywords: transition to adulthood, family formation, sexual initiation, inequality, LMICs, DHS

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Introduction

In the last three decades, the average age at the first union, birth, and sex increased among women in many low- and middle-income countries (LMICs), with the notable exception of Latin America where the age at first sex decreased and the timing of fertility remained relatively unchanged until the 2000s (e.g., Bongaarts et al. 2017; Esteve and Florez-Paredes 2018; Garbett et al. 2021; Garenne 2004; Lima et al. 2018; Pesando et al. 2021; Rosero-Bixby et al. 2009). Trends in the timing of these events have been widely documented because they are critical for the understanding of the patterns of family formation, gender relations, and sexual and reproductive health behaviors and risks. Decades of research delivered a detailed overview of changes in measures of central tendency, such as median or mean age at the first union, birth, or sex. Although instrumental in enhancing the knowledge of demographic shifts, the primary focus on the behavior of average individuals provides only a partial picture of changes in the timing of these vital events. Changes in measures of central tendency conceal variation and disparities in the age at sexual initiation and family formation, i.e., the fact that shifts in the timing of these events might not be universal within populations.

Documenting such variation and disparities is important given that very early sexual initiation and family formation can have adverse effects on a range of outcomes, to name a few, women's health, empowerment, or job quality. Consequently, in LMICs where many women marry and have children very early, increasing average ages at the first union and birth have been suggested to be associated with enhanced women's well-being, status, and opportunities outside of the domestic spheres (e.g., Yount et al. 2018; Urdinola and Ospino 2015; Sunder 2019). However, the comprehensive understanding of the extent to which these increases represent a uniform trend towards later sexual initiation and family formation within countries is less clear. Little research delved into examining the long-term trends in disparities in the timing of first union, birth, and sex across a diverse set of contexts as well as how within-population variation in the timing of these three events change as the average ages increase at the population level.

Recent studies provide evidence that such analysis is particularly important in the context of LMICs. Castro Torres et al. (2022) highlighted that income inequality is associated with larger disparities in the age at first birth within the global South countries. Focusing on selected sub-Saharan African nations, Stoebenau et al. (2021) suggested that in countries where economic inequalities were high or increased, highly educated women postponed marriage and childbearing to a larger extent than low educated women, resulting in growing social stratification in family formation. Given emerging evidence on the link between socioeconomic inequalities and

disparities in the timing of family formation, as well as increasing economic inequalities in many countries, it is vital to explore long-term changes in disparities in the timing of events during transition to adulthood and their variation across settings.

A challenge in conducting such analysis is to capture within-country disparities and their changes over time in a manner that is comparable across a diverse set of contexts and time periods. The most conventional approach involves disaggregating trends in the mean or median age in the age at first union, birth, or sex, or comparing the risks of these events by measures of socioeconomic status, most notably education (e.g., Bongaarts et al. 2017; Frye and Lopus 2018). However, when populations and cohorts differ in terms of educational composition, within-country changes captured that way might be partially reflecting compositional differences and shifts, as opposed to behavioural changes within particular groups. In an attempt to offer an alternative approach, Batyra et al. (2021) computed percentiles and interquartile ranges (IQR) of the distributions of the age at first union and sex in 24 African countries to document growing disparities in the timing of union formation across cohorts within many nations. The use of percentiles and IQR has an advantage in that it allows quantifying within-population diversity as well as divergences or convergences in the timing of events within populations using indicators that are directly comparable, as they do not rely on disaggregation by characteristics which meaning differs across time and space.

In this report we build on that approach to deliver a cross-regional examination of patterns in within-country disparities (variation or heterogeneity) in the ages at the first union, birth, and sex, as well as their changes over time by analysing 46 countries across Asia, Latin America, and Africa and four decades. Using 169 Demographic and Health Surveys, we focus not only on the central ages, but also the other parts of the distribution of the age at first union, birth, and sex, and estimate ages at which 25% (25th percentile), 50% (median) and 75% (75th percentile) of women experience these three events, as well as corresponding IQRs. IQR is particularly useful for our analysis as it is a straightforward measure that permits quantifying in a parsimonious manner the extent of variation and disparities in the timing of these three events within countries, as well as changes across cohorts, in a manner that is comparable between the diverse set of nations we focus on. Moreover, studying the evolution of the 25th and 75th percentiles reveal information about the extent to which changing disparities are driven by shifts in the lower or the upper parts of the distributions of these events, thus by changes in relatively early or relatively late union formation, childbearing, and sexual initiation.

Our study contributes to the existing body of research by examining long-term trends in disparities in the age at first union, birth and sex using an alternative set of indicators as well as by exploring regional differences. In that, we go beyond existing studies discussed above that focused on estimating disparities at one point in time, disaggregating trends by education level, often for one event only (it being mainly either first union or first birth) and heavily focusing on (selected) African countries. A novelty of our research is that we also explore the relationship between the median age and the 25th and 75th percentiles as well as the IQRs. This examination unveils how disparities in the timing of family formation and sexual initiation within countries, proxied with IQRs, change with the postponement of these events at the population level (i.e., with increasing median age). Ultimately, by examining different parts of the distributions of the age at the first union, birth, and sex across a large set of countries, and the relationship between measures of central tendency and disparity, this study offers a holistic perspective on patterns of and changes in the timing of family formation and sexual initiation.

It is important to document such patterns, trends, and relationships for at least three reasons. First, the study of the relationship between measures of central tendency (medians) and variation (IQRs) constitutes a novel way of examining changes in demographic processes and can enhance the knowledge of the determinants of population change. Development has been associated with increasing mean ages at first sex, union, and birth among women (Pesando and GFC-team 2019). Documenting trends in measures of disparities in the timing of sexual initiation and family formation within countries can cast light on the extent to which women benefit (un)equally from changes associated with development, such as, for example, increasing education or opportunities outside of the domestic spheres. This is important to enhance theories about the relationship between developmental processes, socioeconomic inequalities and women's empowerment, gender inequalities, and family dynamics more broadly.

Second, it is important to study disparities in the timing of sexual initiation and family formation to monitor the progress towards the achievement of Sustainable Development Goals (SDGs) related to the reduction of early marriages and pregnancies. Addressing the high levels of these practices requires that progress be taking place across all population strata. For that, it is important to quantify the extent of disparities in the timing of sexual initiation, union formation, and childbearing, as well as to identify where they are largest and how they are changing. This knowledge could be helpful for policymakers aiming to design interventions ensuring that the progress is achieved not only on average but also that “no one is left behind” (UNDP 2018).

Finally, sexual initiation, marriage, and childbearing are critical early life-course events that affect later-life outcomes. While early family formation has been associated with worse health, as well as educational and labor market outcomes of women and their children, there is evidence that later family building could correlate with positive long-term offspring outcomes (e.g., Barclay and Myrskylä 2016; Urdinola and Ospino 2015; Sunder 2019). Increasing disparities in the timing of the first union, sex, and birth across cohorts, may therefore lay the foundation for life-course inequalities that could not only persist but also worsen across generations. Thus, documenting how heterogeneity in the timing of sexual initiation and family formation change over time and space is important to understand better the determinants and consequences of social and economic inequalities.

Data & Methods

We use nationally representative data about women aged 15-49 from the Demographic and Health Surveys (DHSs) for 46 countries in Africa, Latin America, and Asia (South & Southeast), grouped into six sub-regions: East Africa, West Africa, Central Africa, Central America, South America, and Asia (Table 1) (The DHS Program 2021). We excluded surveys for countries where the information about the age at the first union, birth, or sex was not available, for which only ever-married women were interviewed or for which we were not able to reconstruct long-term trends due to insufficient number of surveys. We focus on women born between 1945 and 1985, nonetheless, since DHSs were conducted in different years and the number of waves differs by country, this cohort coverage differs between regions. We excluded countries from Central Asia and South Africa altogether. For these regions, only a few surveys were available, and the cohort coverage substantially differed by country, preventing us from reconstructing comparable, regional trends. We pooled all the surveys available for each country to generate a long-term series of indicators and account for the survey design following the DHS guidelines (ICF International 2012).

[Table 1 here]

We use three retrospective questions about women's age at the first union, age at first birth, and age at first sex. The information about the timing of these events from DHS is the most comprehensive available for LMICs when it comes to geographical coverage, making it particularly useful for a cross-country comparative analysis. It should be noted however that retrospective data on the timing of sexual initiation and family formation from DHS are subject

to some limitations. For example, the age at first union corresponds to the age at first marriage or the age at first cohabitation, since no distinction is made between these two types of unions when this information is collected. Relatedly, in some contexts, such as in Africa, union formation might be a long process involving several stages and it might be difficult for individuals to identify the start of a union (Bledsoe and Pison 1994; Meekers 1992). Another limitation is that data can be affected by recall errors, with older respondents prone to having bigger difficulties recalling events that happened early in life (Gage 1995; Pullum 2006). Questions about marital status and sexual initiation can be subject to biases related to interviewer effects (Randall et al. 2013) as well as the unwillingness of young individuals to report that they are sexually active (Neal and Hosegood 2015; Weiss et al. 1996). Reporting of sexual initiation might also be influenced by young peoples' hesitancy to disclose information about their sexual lives in settings where premarital sexual activity is considered inappropriate (Mensch et al. 1998). While we acknowledge these limitations of DHS data, they are the only source of information that can be used for the purpose of a comprehensive, cross-national study of the timing of family formation and sexual initiation in LMICs.

For each country, we estimate cohort trends in the age at the first union, birth, and sex, grouping women into 5-year cohorts. We use survival analysis and follow individuals from age 8 onwards until they experience these events or censor them at the age at the time of the interview. We use Kaplan-Meier estimator to calculate the median ages and the ages at which 25% and 75% of the population experiences first union, birth, and sex, providing interquartile ranges (IQRs) (Forthofer and Lee 1995; Singer and Willett 2003). The 25th percentiles of the distributions of the age at the first union, birth, and sex (i.e., the ages at which 25% of women experience these events) reflect the ages at which women with the early timing of these events initiate sexual activity, form first union, and have first birth, relative to other members of a cohort. The 75th percentiles, provide corresponding information about women who experience these events later. The IQRs, calculated as the differences between the 75th and 25th percentiles, are measures of dispersion of the age at the first union, birth, and sex within cohorts. Larger IQRs denote greater differentials in the timing of the first union, birth and, sex within a given cohort. Changes in the IQRs across cohorts provide insights into whether these differentials are increasing or decreasing. For example, if the IQR in the age at first union increases, this means that the gap in the timing of first union formation widens between women who transition to unions relatively early and those who do so relatively late. This in turn provides evidence that disparities in the timing of first union formation are increasing across cohorts. The possibility to capture changes in disparities in this manner is an advantage of our approach over other ways of measuring disparities, for example using measures

of deviation, e.g., standard deviation, which do not reveal where in the distribution changes that contribute to growing dispersion are taking place. By examining various percentiles and IQR, we in turn identify whether changes are taking place in the upper or lower parts of the distribution of the events we focus on.

Using the above-described indicators, we conduct two sets of analyses. First, we examine the cross-sectional relationship between the median age and the ages at which 25% and 75% of women experience first union, birth, and sex, as well as corresponding IQRs. We conduct analyses separately by event and for all countries and regions together to examine how disparities - described by IQRs - are changing within countries as postponement of the first union, birth, and sex progresses at the population level. In our analysis, a unit of analysis is a country-cohort, as described above. Second, we show trends in all the indicators across cohorts within each region to provide an examination of the regional and temporal variation in the levels and trends in disparities in the timing of the three events in the last four decades. To obtain the regional trends, we use the country-specific estimates (country-cohorts) and fit a smoothed line using local regression (loess).

Results

Figure 1 shows data for all cohorts, countries, and regions, separately for the three events; each point corresponds to a country-cohort. This cross-sectional analysis shows the existence of a positive relationship between the median age at the first union, birth, or sex (x-axes) and the corresponding IQRs (y-axis, black dots). For example, according to the linear fit, for country-cohorts with a median age at the first union of around 15 years, the IQR is around 3 years; corresponding IQR for country-cohorts with a median age of 23 is around 9 years. The patterns for the other two events are substantively similar.

Figure 1 thus provides evidence of an increasing gap between the ages at which 25% and 75% of women form their first union, have their first child and sex, as median ages at these events increase (yellow and grey dots for the 25th and 75th percentiles, respectively). These cross-sectional results mean that the higher the median ages at the first union, birth, or sex in a given cohort, the greater the disparities in the timing of these events (i.e., the gaps are larger between women who form families and initiate sexual activity relatively early and relatively late, as captured with the 25th and 75th percentiles, respectively). In other words, in country-cohorts characterized by higher median age, women who form families and initiate sexual activity early

lag behind women who do so late to a greater extent. In almost all country-cohorts, 25% of women still experience these events in their teenage years, which is known to correlate with poorer health and well-being of women and their children. These results can be thus interpreted as evidence of growing inequality in the timing of sexual initiation and family formation with increasing median ages at these events.

It should be noted that the documented relationships between the median, the 25th, and 75th percentiles are not “mechanistic”, in that the increase in the IQR with increasing median does not exist by construction. The 25th and 75th percentiles can move in a direction independent of the direction of change in the median. Namely, with increasing median, the 25th and 75th percentiles can change with the same slope or remain constant, resulting in a constant IQR. Conversely, the median may remain constant, even if the 25th and 75th percentiles change.

[Figure 1 here]

Figures 2-7 show changes in the four measures across cohorts and regions, and highlight that the above described, cross-sectional associations are visible when examining trends across cohorts (x-axis), albeit not in all regions. Figures 2, 4 and 6 show to the values of the 25th, 50th, and 75th percentiles; Figures 3, 5, 7 depict the values of the IQR. The bolded line in each plot shows the regional trend and the thin lines in the background depict country-specific lines (three per country for each of the percentiles and one per country for IQR), based on which the regional trends for each percentile and IQR are calculated.

When it comes to the age at the first union, increasing disparities across cohorts can be clearly noted in the Americas and West Africa (upward trends in IQRs (Figure 3) with increasing 50th percentile across cohorts (Figure 2)). While the regional lines in Figure 2 suggest that the age at which 75% of women enter the first union increased in these settings (grey line), the age at which 25% of women marry remained stable or increased to a much smaller extent (yellow line). Thus, across cohorts, the largest increases in the age at first union took place in the upper half of the age-at-first union distributions, thereby leading to growing gaps across cohorts in the age at marriage between women with a relatively early and relatively late pattern of marriage-timing. The above-described pattern is most pronounced in West Africa, where the regional line suggests an increase in the IQR by around three years. However, changes in some countries in that subregion have been much more dramatic than the regional line points to. Regional changes in a similar direction, but smaller in magnitude than in West African and the Americas took place in East Africa; the smallest regional change in IQR took place in Central Africa and Asia.

Even though changes across cohorts point to a link between increases in medians and growing IQRs in many settings under study, it is important to note that there is a variability across regions and countries. This highlights that, first, as described in the methods section, this relationship does not exist by construction and, second, that it should not be assumed that, as social change happens, variation in the timing of the events under study increases inevitably. Rather, this feature of change, i.e., growing within-country heterogeneity, is a characteristic of some contexts more than others. For example, while the increase in the regional median in Central America and Asia was not too different, IQR changed to a much larger extent in the former region. These results highlight that within country-variation in the timing of union formation, as well as first birth and sex as we show next, might follow different patterns across settings. To highlight this point further, in the supplemental materials we provide an example of two countries from Central America and Asia – Haiti and Indonesia - depicting distinct scenarios of changing disparities with increasing median age (Supporting information 2). In the former, delays in the timing of first union are associated with an increasing IQR, while in the latter, postponements of first unions did not go along with markedly increasing heterogeneity in the age at this event.

[Figure 2 here]

[Figure 3 here]

Changes in the timing of first birth were overall less pronounced than in the timing of the first union, however there is more variation between the regions, as well as individual countries (Figure 4 and 5). In Africa, the regional median age at first birth increased slightly across the three sub-regions (Figure 4), but only in West Africa did corresponding regional IQR showed signs of growth (Figure 5). The changes in west Africa are complex as, in line with previous studies (Garbett et al. 2021), some countries have experienced an increase, and others decrease in the central age at first birth. Our study shows that such differentiated patterns of change between countries are also visible when it comes to the age at which 75% of women have their first child, which, together with a relatively stable 25th percentile, has ultimately led to an increase in IQRs in some countries but a decrease in others.

Changes in Central America have been similar to those in South America in that the IQR has increased (Figure 5). Nonetheless, South America represents a unique pattern in other respects: while the age at which 25% and 50% of women have their first birth decreased slightly, the age at which 75% of women have their first child exhibited changes rather in the opposite direction, particularly among the youngest cohorts. These contrasting trends resulted in the divergence in the timing of first birth between women who transition to childbearing relatively early and

relatively late. As in the case of first unions, and similarly to the pattern observed in Central and East Africa for first births, regional-level change across the three percentiles was more homogenous in Asia and the IQR did not change substantially.

[Figure 4 here]

[Figure 5 here]

Changes in the timing of sexual initiation were different from those in the age at first union and birth, particularly in South America (Figure 6 and 7). First, in Africa, increases in the regional medians (Figure 6) and the IQRs (Figure 7) are only noticeable in east and west parts. While in Central America the regional median and the IQR in the age at first sex have been relatively stable, IQR decreased in South America, concurrently with decreasing median. Trends in measures of the age at first sex in the Americas further highlight the existence of a relationship between changes in the measures of central tendency and variation, in line with the results for the age at first birth in some West African countries. Namely, not only are increases in the median age accompanied by growing dispersion of the distributions of the events but decreases in the median age are accompanied by decreasing dispersion. In the context of the age at first sex in South America, women across cohorts have become more homogenous when it comes to the timing of this transition, as represented by a generally downward regional trend in the IQR. Asia is the region where the changes in the percentiles and IQR when it comes to the age at first sex were similar as for the two other transitions, which could be related to the stronger link between sexual initiation, marriage, and childbearing.

[Figure 6 here]

[Figure 7 here]

Conclusions

The novelty of this report is to explore the relationship between measures of central tendency and variation in the ages at the first union, birth, and sex, as well as to provide a comprehensive analysis of trends in these indicators across cohorts and regions, focusing on 46 countries. Our initial analyses document a strong cross-sectional pattern whereby countries and cohorts with higher median ages are characterized by greater disparities in the timing of these vital events. Our subsequent analyses utilize the life course data in the DHS, and these cohort analyses reveal a substantial degree of variation in the strength of this association between the delay of, and heterogeneity in the transition to adulthood across countries and regions. The most pronounced pattern of growing disparities is evident for events related to family formation, i.e., the first union

and birth, and within West African and Latin American countries. These diverging trends are driven by a limited change in the timing of family formation among women with the early pattern of first marriage- and birth-timing and concurrent postponement of family formation in the upper parts of the age at first union and birth distributions.

Our results have several implications for research on population dynamics in LMICs and are valuable from a policy perspective. First, our results highlight that to enhance the understanding of the ongoing changes, it is useful to turn to more holistic approaches to measuring the timing of family formation and sexual initiation that involve both measures of central tendency and variation. By exploring regional differences and changes over time, we shown that, although growing disparities with increasing median age are not a universal pattern, they are observed across many settings. These findings suggest that increasing inequalities in the timing of family formation have been a salient feature of social change across many LMICs. Beyond providing evidence of a link between postponement of family formation at the population level and growing within-country differentials in the timing of these events, this study complements our knowledge of family formation by uncovering not only where inequalities in family formation are largest but also where they have been growing most in recent decades.

Regarding region-specific patterns, we provide insights about changes in the timing of first union formation and childbearing in the Americas and West Africa. When it comes to the Americas, a large body of research highlighted the uniqueness of the region, whereby the median or mean age at first union and birth did not change or even decreased in some countries (Batyra 2016; Miranda-Ribeiro and Garcia 2013; Esteve and Florez-Paredes 2018; Rosero-Bixby et al. 2009). Our study provides a more complete picture of changes in the timing of these two events by documenting that, even though the median ages did not change considerably, or in the case of first birth in South America decreased, there is evidence of postponement of first unions and births. Increases in the ages at these two events took place in the upper parts of the distributions. This postponement pattern could not have been captured with measures of central tendency that previous studies on the region focused on. Our analyses also provide a more holistic understanding of changes in the timing of family formation in West Africa. By documenting the variability of changes across different parts of the distribution of the age at the first union, our analysis reconciles results of recent studies that, on the one hand, documented an evident union postponement pattern (captured with increasing mean age) (Pesando et al. 2021) and, on the other hand, one of the highest in Africa and persistent levels of child marriages (Koski et al. 2017). Similarly, our results complement accounts of persistence of teenage pregnancies in West Africa

(Garbett et al. 2021), adding that, nonetheless, there is evidence that the age at which 75% of women have their first birth increased in some countries, driving a divergence in the timing of transition to motherhood in the region.

Overall, our analyses document that the postponement of family formation is far from homogeneous within many countries across low- and middle-income world, with the evidence of ages at which 75% of women enter their first union and birth increasing while the bottom 25% of women continuing to initiate unions and motherhood very early. These results can be interpreted such that women among whom delaying family formation could potentially be most beneficial - i.e., those who have children and marry earliest - are increasingly lagging in terms of their behavior behind women who form families relatively late. These findings highlight that to ensure progress towards achievement of SDGs related to reductions of early marriage and childbearing, attention needs to be paid to understanding not only why decreases in early marriage and childbearing in some settings have been slow, but also why women who form families earliest are increasingly lagging behind women who do so late. Understanding of factors behind these divergences is important in order to capture the root causes of the persistence of early family formation in LMICs as well as to better understand the mechanisms behind the often-negative consequences of marrying and having children early on women's and their children's well-being. It is also vital to monitor whether the disparities in the ages at first union and birth within countries that we documented will continue growing in the future and the extent to which these divergences could contribute to the perpetuation of social inequalities across generations.

Answering why disparities in the timing of family formation are increasing is not the aim of this paper, nonetheless, exploiting information available in DHS, we explore two possible determinants of these changes (see Supporting materials). Our supplemental analysis suggests that, although unlikely to fully explain them, growing disparities could partially be driven by diverging patterns between urban and rural areas (Figure A2). In line with literature highlighting a link between socioeconomic inequalities and disparities in the timing of family formation in the global South (Stoebenau et al. 2021; Castro Torres et al. 2022), our supplemental analysis also points to the relevance of increasing differentials in investments in human capital, which we proxied with a measure of within-country disparities in the number of years of schooling completed (Figure A3). Relatedly, given the strongest evidence of growing heterogeneity in the timing of family formation in West Africa and the Americas – two regions characterized by particularly high levels of income inequality – and the evidence of a link between income inequality and disparities in the age at first birth in the global South, economic inequalities are

also a plausible mechanism. Finally, the fact that disparities in the age at first union and birth – the two events that are closely linked to opportunities outside the domestic spheres – grew more than disparities in the age at first sex also points to the role of inequalities in women’s socioeconomic status in shaping the patterns we documented.

Future research on global family changes could benefit from exploring and comparing various indicators of disparities in the timing of family formation and sexual initiation, such as measures of deviation or those capturing the shape of the distributions of the events. Further investigation of the factors contributing to heterogeneities in when women experience important events during transition to adulthood would also be beneficial in order to expand our knowledge about the determinations of family changes in increasingly diverse populations more comprehensively.

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Tables

TABLE 1 Regional classification of countries with the number of DHS surveys (n)

Central Africa (n= 12)	East Africa (n= 48)	West Africa (n= 50)	Central America (n= 18)	South America (n= 22)	Asia (South & Southeast) (n= 19)
Cameroon	Burundi	Benin	Dominican Rep.	Bolivia	Cambodia
Chad	Ethiopia	Burkina Faso	Guatemala	Brazil	India
Congo	Kenya	Gambia	Haiti	Colombia	Indonesia
DRC	Madagascar	Ghana	Honduras	Guyana	Nepal
Sao Tome and Principe	Malawi	Guinea	Nicaragua	Paraguay	Philippines
	Mozambique	Ivory Coast		Peru	Timor-Leste
	Rwanda	Liberia			
	Tanzania	Mali			
	Uganda	Niger			
	Zambia	Nigeria			
	Zimbabwe	Senegal			
		Sierra Leone			
		Togo			

*DRC- Democratic Republic of the Congo

Figures

FIGURE 1 Association between (assoc. btw.): (i) the median age (x-axis) and (ii) 25th percentile, 75th percentile, interquartile range (IQR) (y-axis), age at the first union, age at first birth and age at first sex. All regions, countries, and surveys pooled.

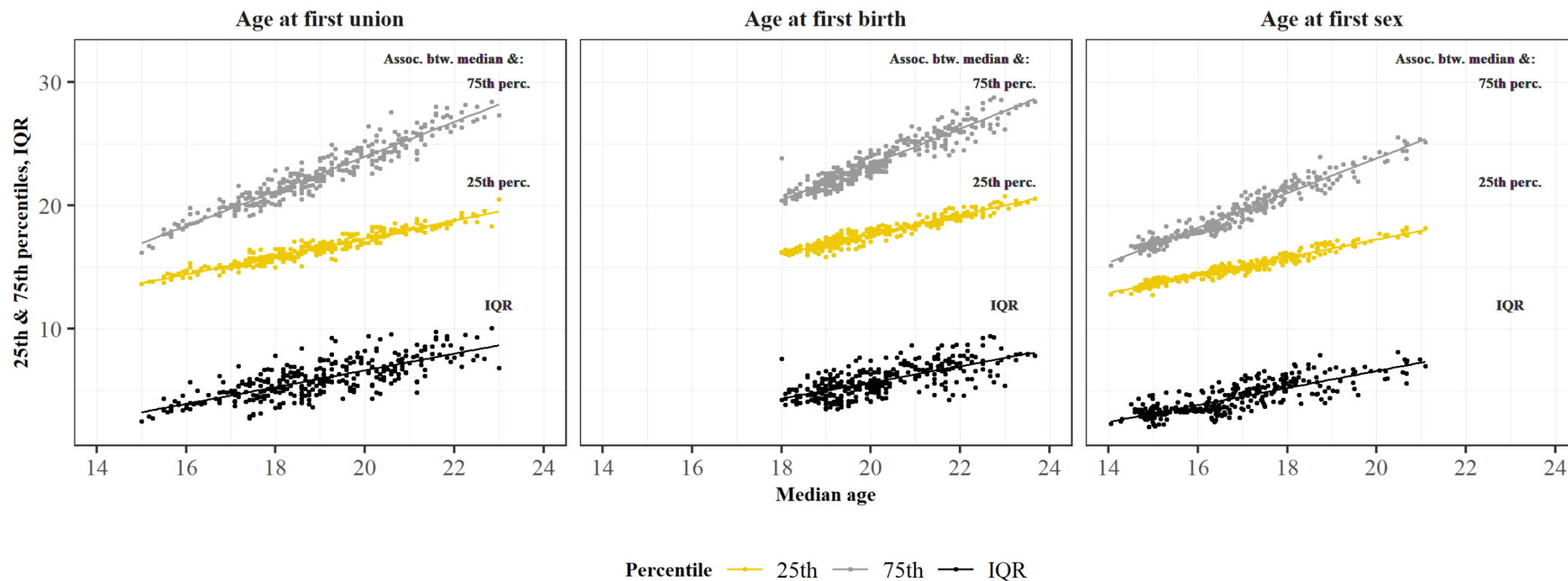


FIGURE 2 Changes in the 25th, 50th, 75th percentiles across cohorts, age at the first union.

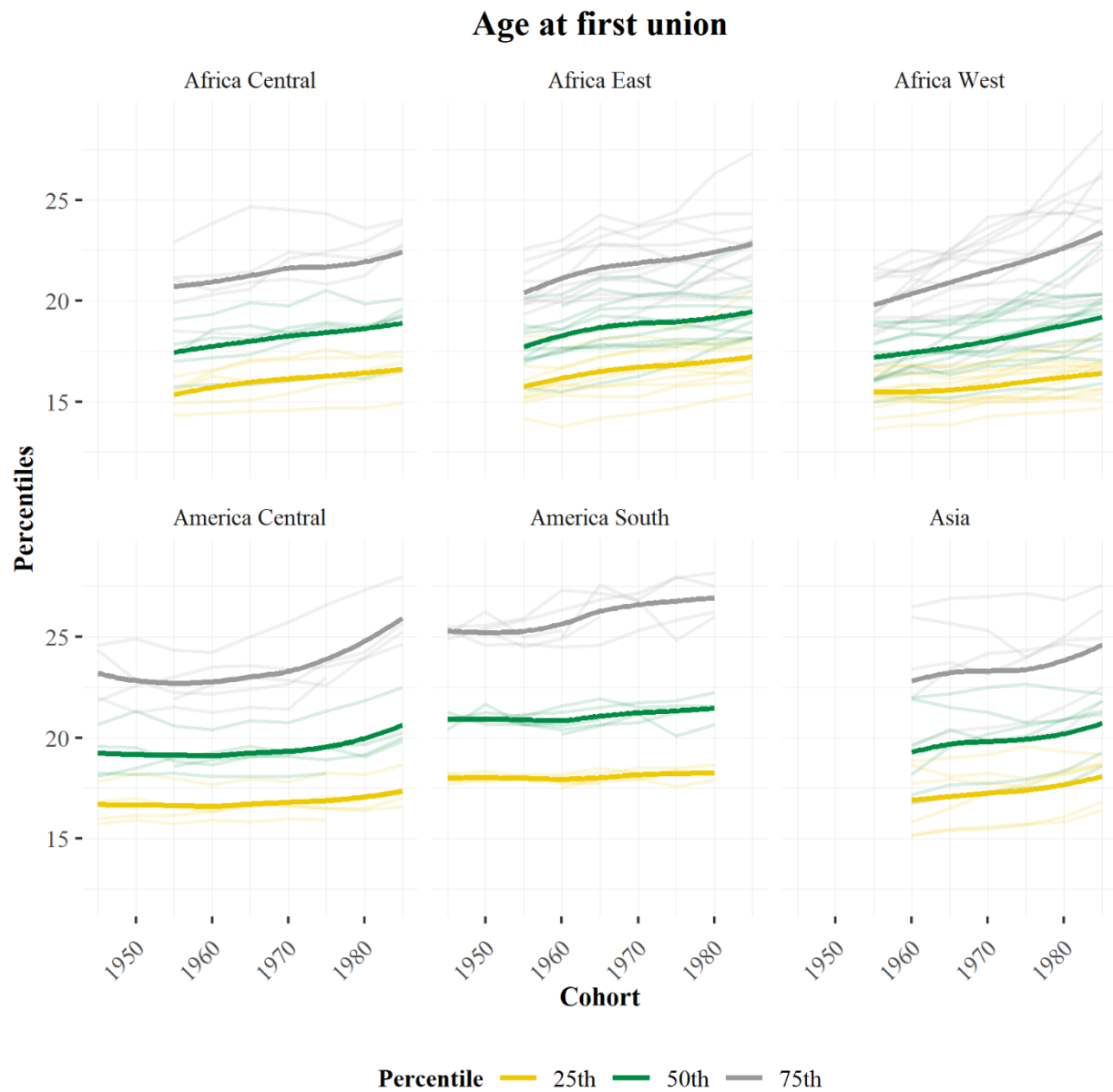


FIGURE 3 Changes in the interquartile range across cohorts, age at the first union.

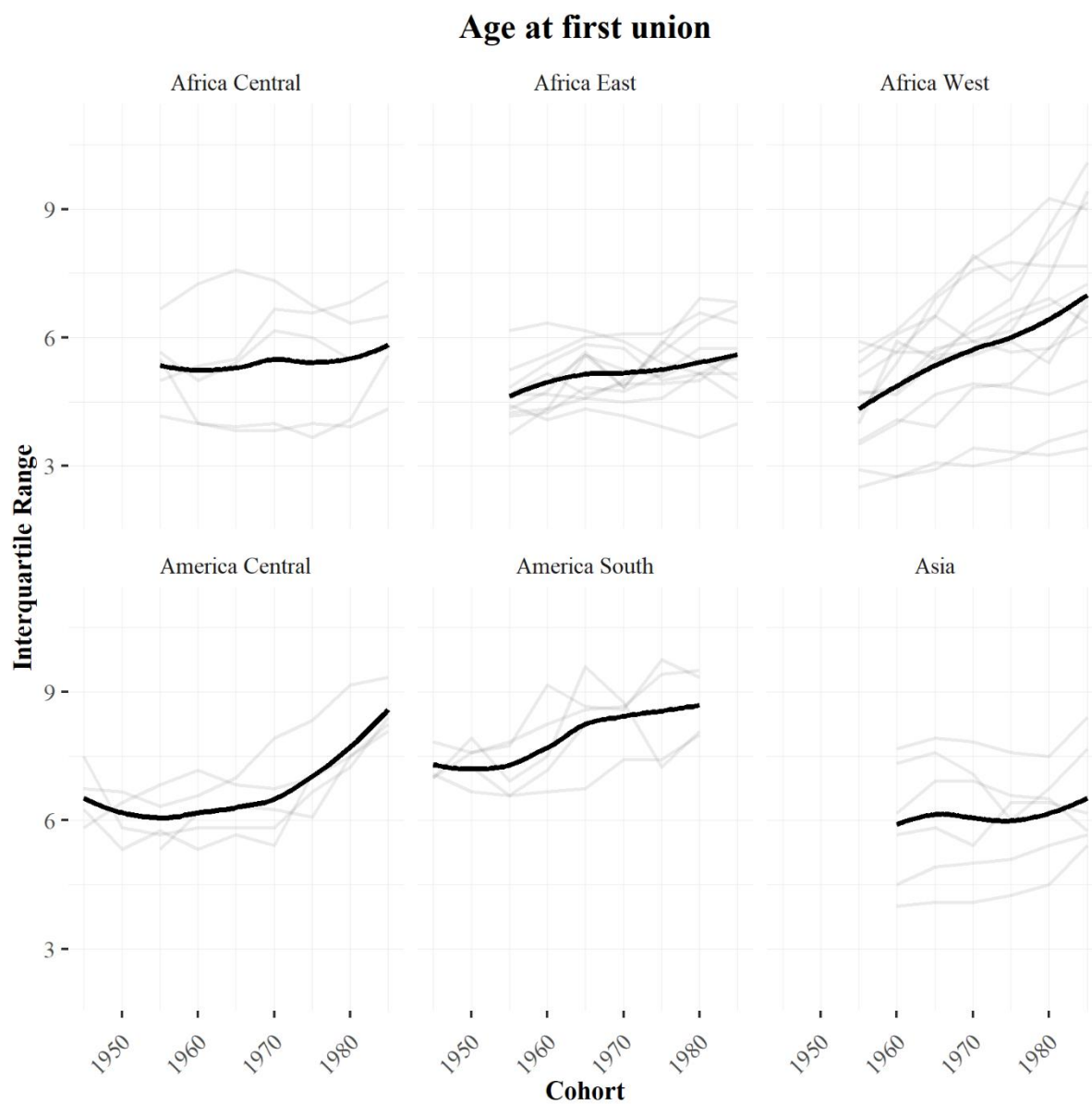


FIGURE 4 Changes in the 25th, 50th, 75th percentiles across cohorts, age at the first birth.

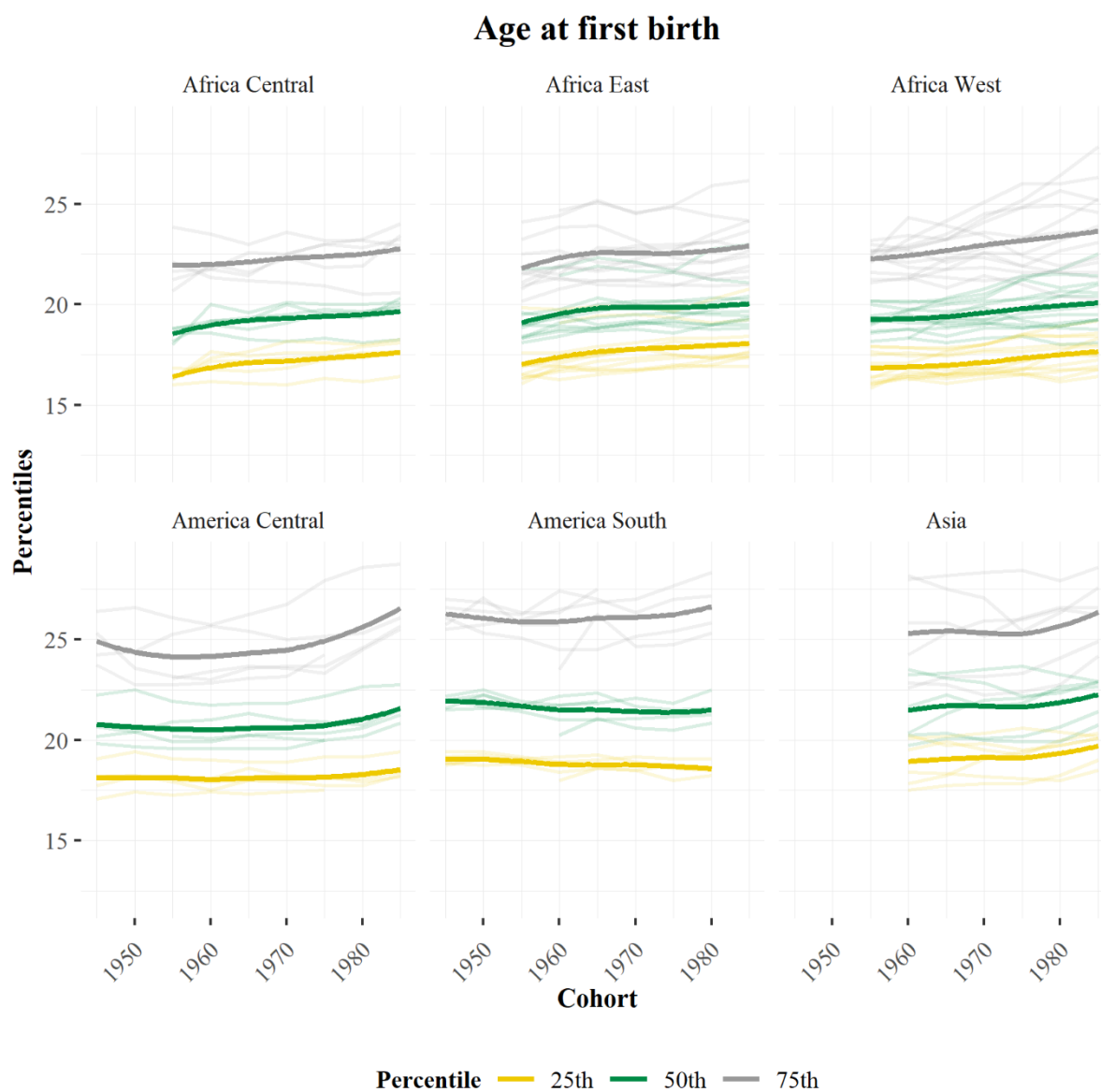


FIGURE 5 Changes in the interquartile range across cohorts, age at the first birth.

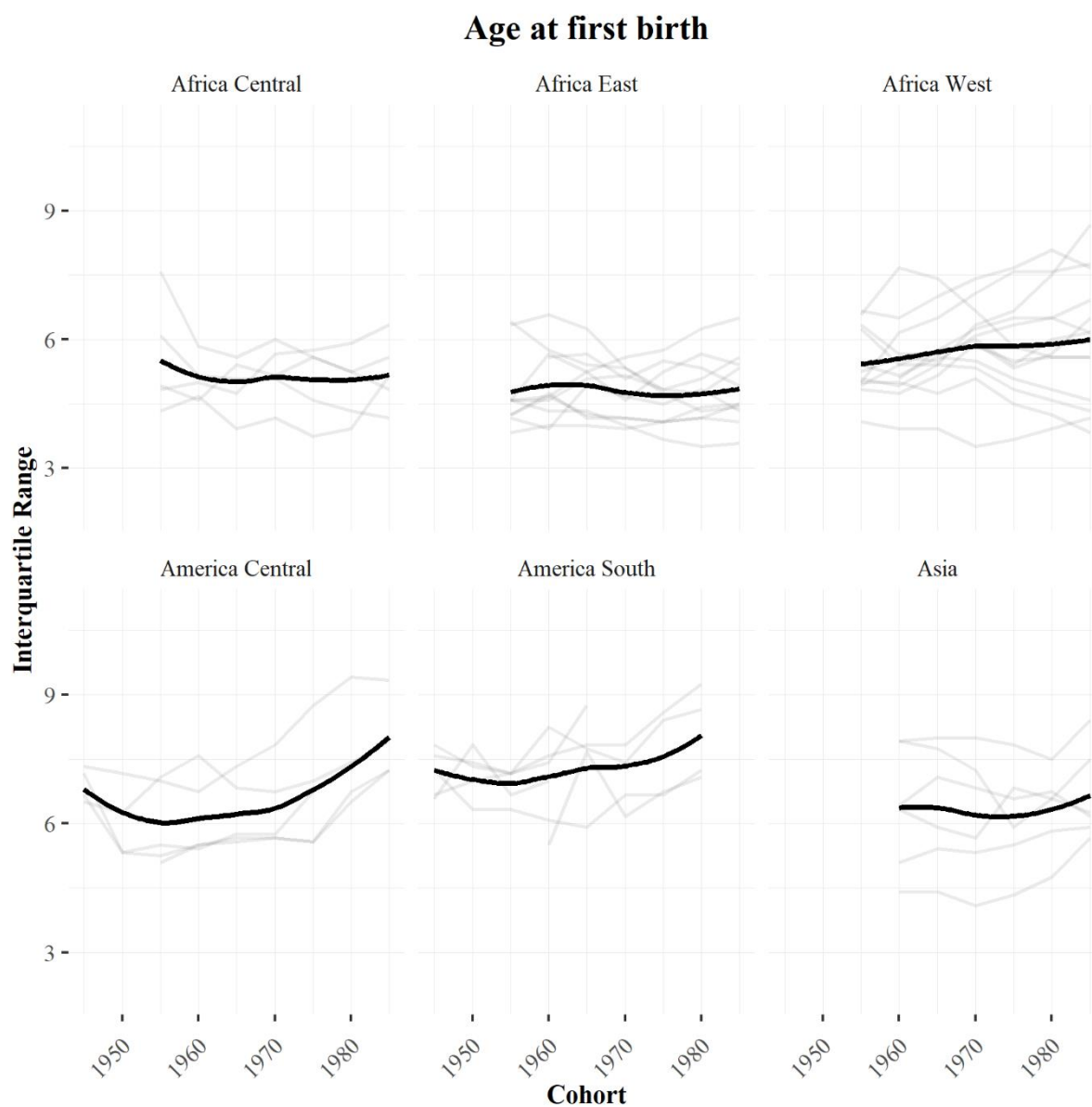


FIGURE 6 Changes in the 25th, 50th, 75th percentiles across cohorts, age at the first sex.

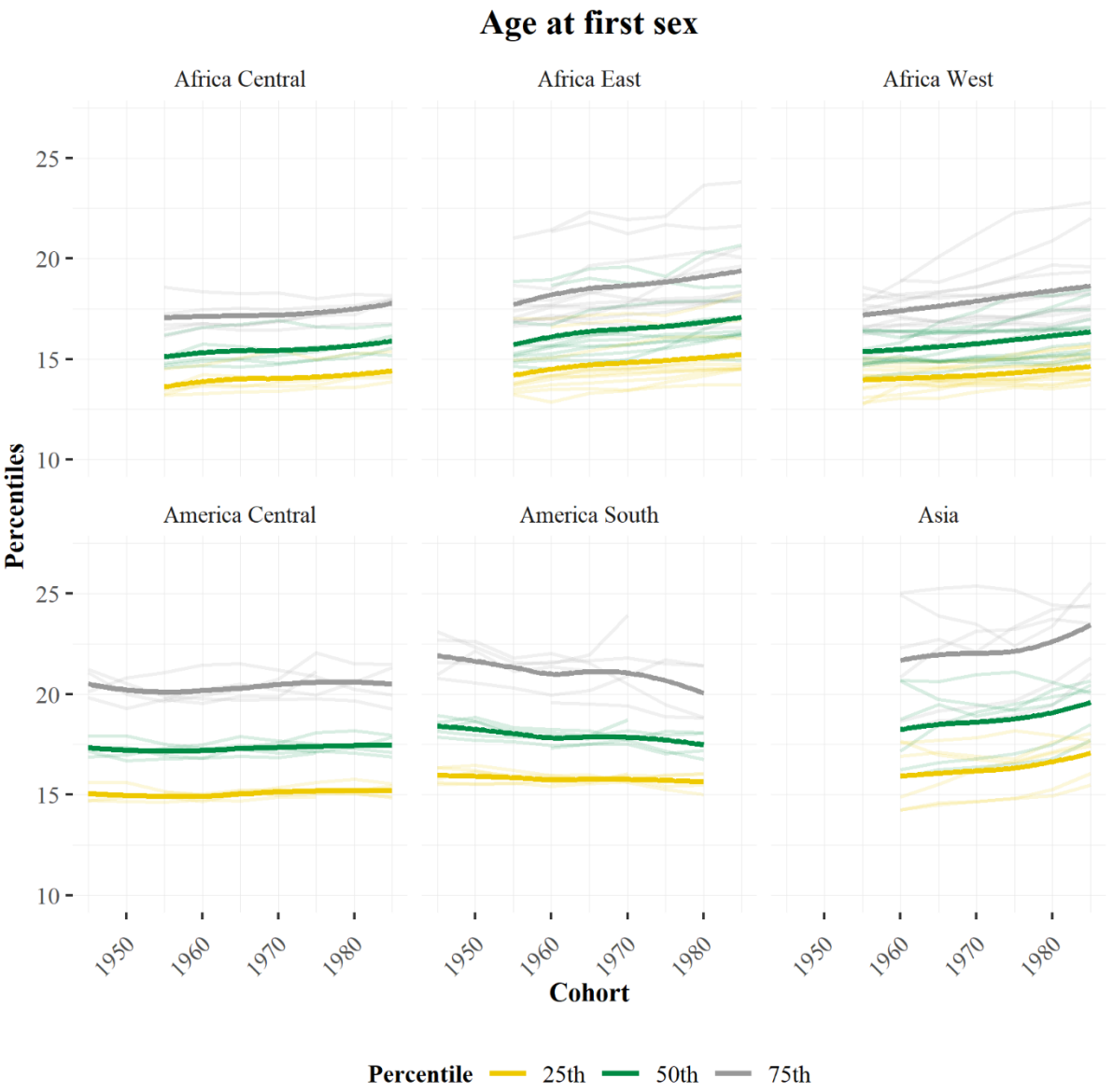
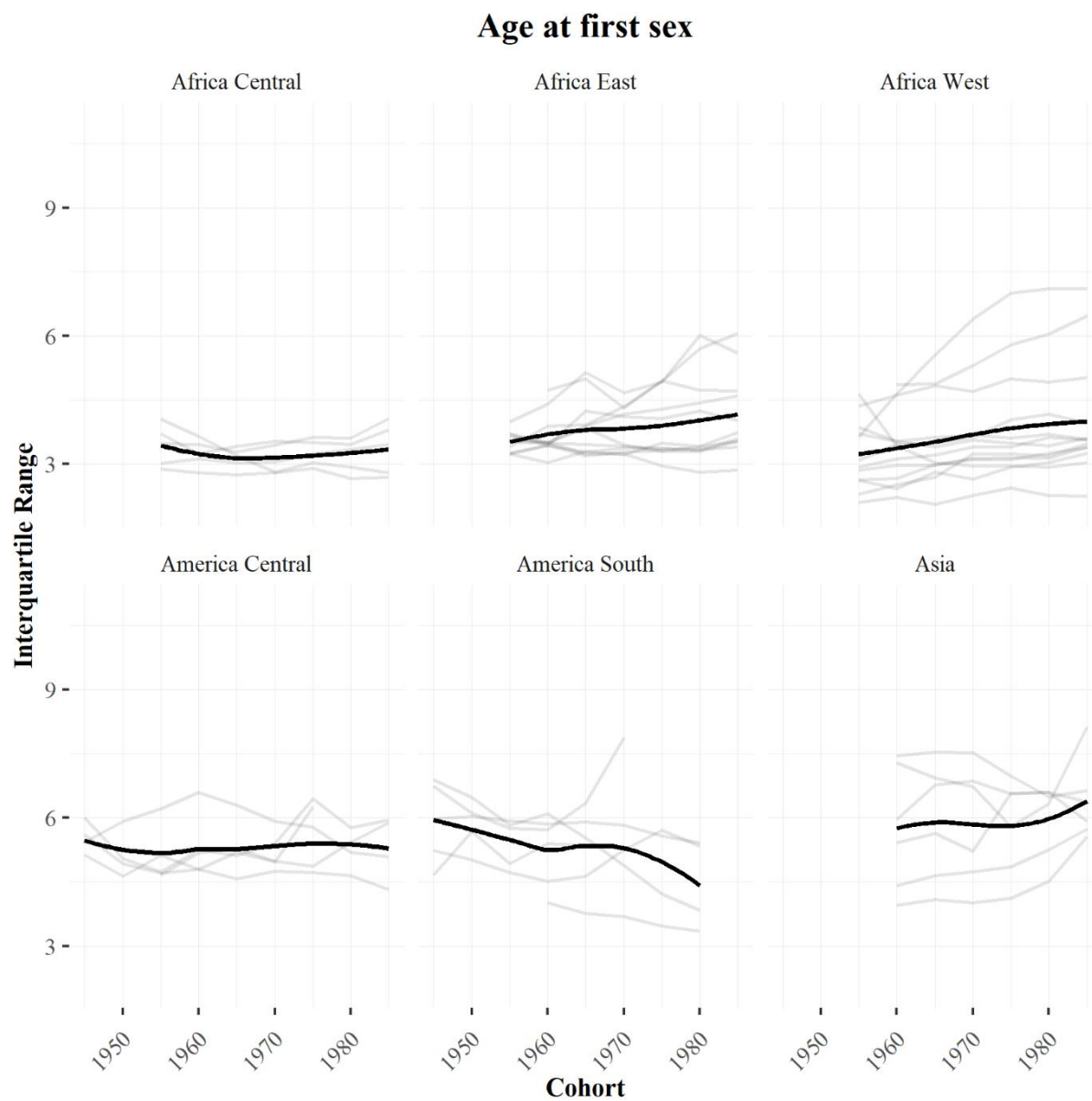


FIGURE 7 Changes in the interquartile range across cohorts, age at the sex.



Supporting Information

Supporting Information 1: Sample sizes

TABLE T1 Sample sizes by country and cohort (grouped into 5-year intervals)

Africa Central			c1955	c1960	c1965	c1970	c1975	c1980	c1985
Cameroon			1755	2954	3798	4909	5055	5659	5374
Chad			1260	1390	3102	3656	4904	4431	4712
Congo			349	1062	1719	2274	2719	3241	3310
DRC*			331	1107	2250	2927	3757	4636	5642
STP**			39	235	294	295	419	439	454
Africa East			c1955	c1960	c1965	c1970	c1975	c1980	c1985
Burundi			.	512	1342	2441	2657	3898	4388
Ethiopia			2008	3278	4924	6988	9036	10923	10068
Kenya			2312	3820	6500	8335	9463	9136	8866
Madagascar			2449	4275	4994	5932	6143	5130	4210
Malawi			1662	3823	5300	8183	10839	13793	11217
Mozambique			1837	3061	3787	4824	6071	5746	4552
Rwanda			2552	4247	5426	7042	7528	9640	7920
Tanzania			2772	4770	6338	8568	8234	6804	6135
Uganda			1565	2823	4278	6348	7488	7168	6749
Zambia			2310	3566	4925	7017	7511	6572	4966
Zimbabwe			1661	2786	3480	5274	6529	6502	5594
Africa West			c1955	c1960	c1965	c1970	c1975	c1980	c1985
Benin			1833	3309	5198	7772	9602	10365	9293
Burkina Faso			2510	4236	5006	6152	6528	6638	5347
Gambia			.	147	605	875	1146	1672	1834
Ghana			1677	2500	3657	4305	4393	3971	3352
Guinea			1216	1977	2938	4317	4554	5325	4657
Ivory Coast			1030	1908	2609	3158	3850	2393	1994
Liberia			335	964	1522	1992	2278	2705	2853
Mali			2773	4409	5955	7415	9070	9327	7104
Niger			1076	2175	3227	3628	3872	4000	4067
Nigeria			2285	6477	9483	14617	15436	19887	20436
Senegal			2622	4206	7295	10898	12247	13152	15973
Sierra Leone			62	837	1935	2633	3368	3944	4000
Togo			817	1248	2322	2474	2955	2658	1679
America Central	c1945	c1950	c1955	c1960	c1965	c1970	c1975	c1980	c1985
Dominican Republic	968	2552	5614	8177	10662	11376	11399	10692	9122
Guatemala	895	1699	2028	2323	4618	5695	7113	5244	4014
Haiti	390	1347	2238	3427	5008	6530	7783	8104	7572
Honduras	.	.	1157	2855	4219	4998	6032	6906	8251
Nicaragua	294	1673	2524	3191	3665	4078	4874	.	.
America South	c1945	c1950	c1955	c1960	c1965	c1970	c1975	c1980	
Bolivia	998	2139	4531	6377	7180	7878	8908	7683	
Brazil	1439	2022	2419	2706	3051	3182	.	.	
Colombia	1577	3142	7857	14467	20271	21173	21054	21316	
Guyana	.	.	.	596	617	689	674	659	
Paraguay	560	688	794	965	991	.	.	.	
Peru	2711	6535	11039	22430	28165	31332	31052	28062	

Asia (South & Southeast)	c1960	c1965	c1970	c1975	c1980	c1985
Cambodia	5935	8456	8464	7435	12835	9804
India	12154	66690	92973	107729	118620	138237
Indonesia	2347	8278	12958	14122	14891	13774
Nepal	1722	3184	4028	5016	5702	6559
Philippines	7774	11394	13267	13852	11844	10000
Timor-Leste	1135	1963	3112	2656	3536	4231

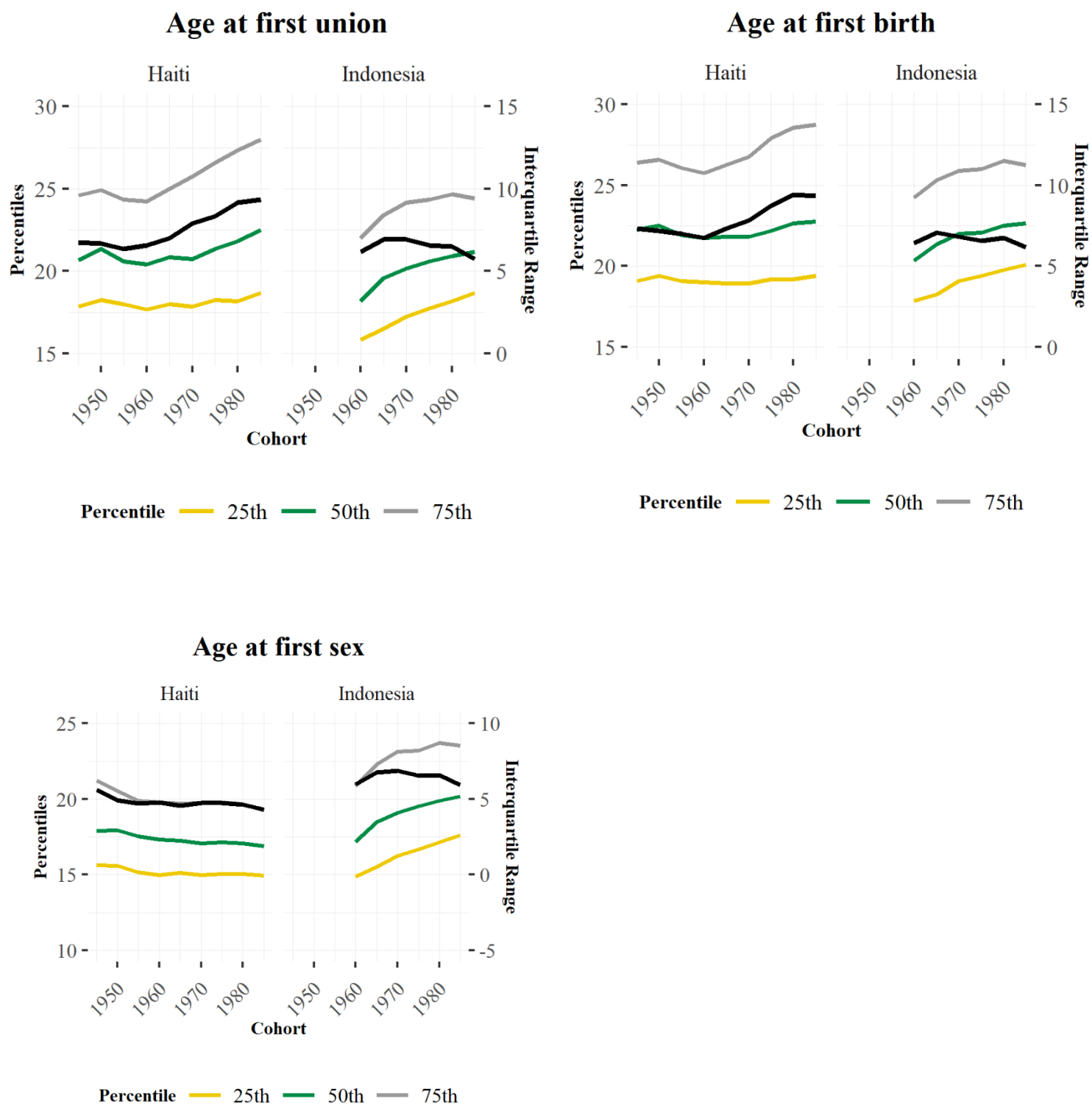
*DRC – Democratic Republic of the Congo

**STP – Sao Tome and Principe

Note: Cohorts are grouped into 5-year interval, starting at a year indicated in the table (e.g., c1960 is 1960-1964)

Supporting information 2: Cases of Haiti and Indonesia

FIGURE A1 Changes in the 25th, 50th, 75th percentiles (left y-axis) and interquartile range (right y-axis, black line) across cohorts, age at first union, birth, and sex. Haiti and Indonesia.



We provide examples of two countries from Central America and Asia – Haiti and Indonesia – depicting that although there is a clear relationship between the direction of change in the measure of central tendency and variation across many settings in our study, there is also a substantial degree of heterogeneity in this association across regions and countries. Figure A1 shows that both in Haiti and Indonesia the median age at first union and birth increased across cohort (green line), however, the change in the IQR was different, exhibiting an upward trend in Haiti but relative stability in Indonesia. The reason for this difference is different pattern of change in the bottom and in the upper parts of the distributions. In Haiti, there was little change in relatively early union formation and childbearing, while in Indonesia relatively early family formation was on a decline, as represented with increasing 25th percentile. Conversely, the increase in the 75th percentile was larger in Haiti than Indonesia. Overall, our results highlight that growing within-country heterogeneity in the timing of family is an important feature of the many settings we focus on, but it is not a universal pattern.

Supporting Information 3: Potential determinants of increasing disparities in the age of first union, sex, and birth

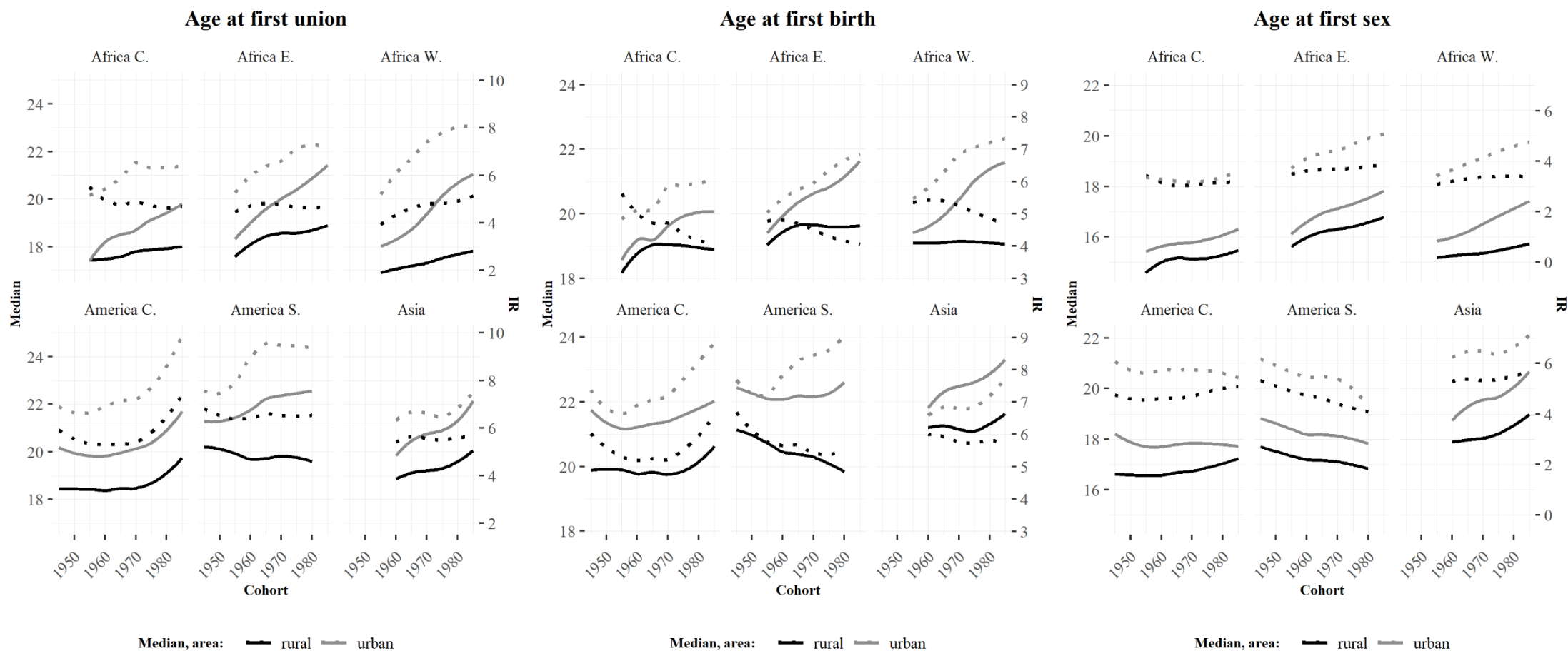
We conduct supplemental analysis to highlight two potential determinants of changing disparities in the timing of first union, birth, and sex: (i) urban-rural differentials and (ii) differentials in parental and societal investments in children. Since in LMICs demographic processes differ substantially between urban and rural areas (Montgomery et al. 2003), we document changes in urban-rural disparities in the medians and IQRs of the age first union, birth, and sex. Second, across both the higher- and lower-income settings, the ages at these three events have been shown to differ by women's socioeconomic background (e.g., Bongaarts et al. 2017; Frye and Lopus 2018; Singh et al. 2001; Stoebenau et al. 2021). DHSs do not provide information about parental socioeconomic status or investments in children, but they include information about women's height and years of schooling. Adult height proxies early childhood conditions such as nutritional intake, parental resources devoted to children's health, and economic conditions of the family and the household in childhood (Peck and Lundberg 1995; Behrman and Hoddinott 2001; Alderman et al. 2006). Years of schooling proxy parental investments in children's human capital. We study whether changes in disparities in the timing of the first union, birth, and sex follow the patterns of change in disparities in parental investments in children. We proxy the latter disparities with IQRs of the distributions of women's adult height and years of schooling achieved. Since height and schooling achievements are likely to change until individuals are in their twenties, we restrict analyses to women older than 25 years at the time of the survey. Moreover, the information about height is available for a smaller number of countries and surveys, than for other variables. Due to these differences, the cohort coverage of trends in height is shorter. The regional averages shown in the Figure A2 and Figure A3 are calculated as those in the results presented in the main text (see methods section).

Figure A2 shows that in most regions where disparities in the timing of first union, birth, and sex increased (as shown with IQRs in Figures 2-4 in the main text), the median ages at these events generally increased to a greater extent in urban than in rural settings (solid lines). Thus, growing differences in the behavior of women living in urban and rural areas could be one of the drivers of increasing disparities in the timing of family formation and sexual initiation. Nonetheless, they are unlikely to be the only explanation. First, not in all regions where disparities increased, did trends by place of residence diverge. Although IQRs in the age at first union and birth increased in Central America (as shown in Figures 2-3 in the main text), there is no evident sign of growing urban-rural gaps in the median ages (Figure A2). Second, Figure A2 shows that

interquartile ranges increased also *within* urban and, in some cases, rural areas (dotted lines). Growing IQRs in the age at first union, birth, and sex *within* urban areas are generally evident across regions where variation in the timing of these events increased (as shown in Figures 2-4 in the main text). Among the youngest cohorts, interquartile ranges grew also *within* rural areas in Central America in the case of the age at first union and birth and in West Africa for the age at first union. These results suggest that the timing of these events is becoming more heterogeneous not only *between* individuals living in urban and rural areas but in some settings also between women living *within* these areas.

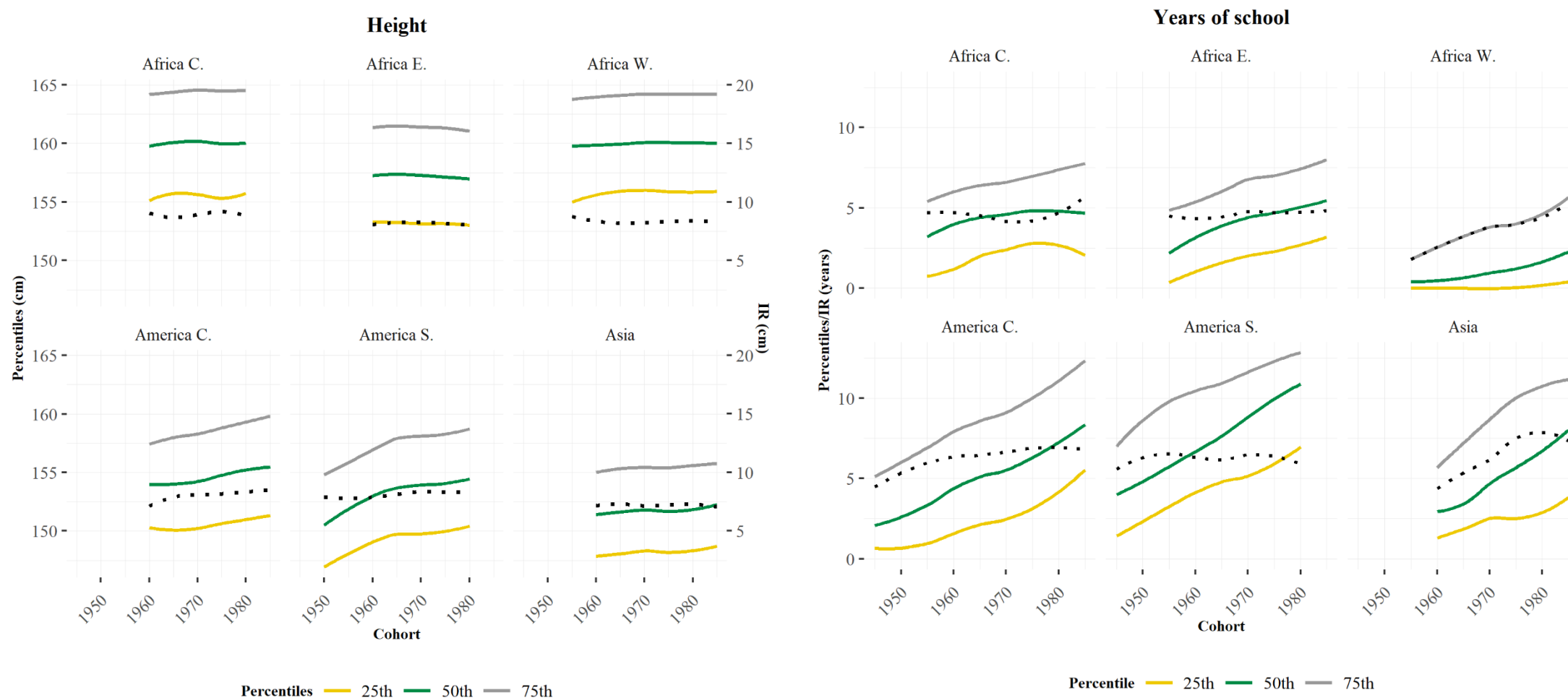
Figure A3 (left panel) shows that the IQRs pertaining to women's height have been stable in all regions, thus we do not find evidence of growing disparities in women's height within countries across cohorts. Conversely, Figure A3 (right panel) shows that IQRs pertaining to years of schooling increased in West Africa, Central America, and Asia. In Central and East Africa as well as South America, the IQRs pertaining to the distribution of the years of schooling have been relatively stable across cohorts. Overall, we find no correspondence between changes in measures of disparities in the ages at the first union, birth, and sex, and disparities in height. Divergences in the timing of transition to union formation and motherhood took place concurrently with growing disparities in years of schooling completed in West Africa and Central America, highlighting a potential role of divergences in parental investments in human capital in these two subregions.

FIGURE A2 Changes across cohorts (x-axis) in the medians (solid lines, left y-axis) and IQRs (dotted lines, right y-axis) for the age at the first union, birth, and sex, by region and place of residence (urban - grey, rural - black).



Note: Africa C. – Central Africa, Africa E. – East Africa, Africa W. – West Africa, America C. – Central America, America S. – South America, Asia – South and Southeast Asia.

FIGURE A3 Changes across cohorts (x-axis) in the 25th, 50th and 75th percentiles (solid lines, left y-axis) and IQRs (dotted lines, right y-axis) in height (left panel) and years of schooling (right panel), by region.



Note: Africa C. – Central Africa, Africa E. – East Africa, Africa W. – West Africa, America C. – Central America, America S. – South America, Asia – South and Southeast Asia.

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