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HIGH AND HIGHER: FERTILITY OF BLACK AND WHITE WOMEN WITH COLLEGE AND POSTGRADUATE EDUCATION IN THE UNITED STATES

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Abstract

A postponement of first births among college graduates, and increases in childlessness in the US are well documented, as are black-white fertility differentials. However, little is known on how first birth postponement and childlessness differ between women with college and postgraduate education. Likewise, black-white fertility differentials among women with college and post-graduate education, in particular among recent birth cohorts, have not yet been addressed in the literature. We use the CPS Fertility Supplement 1979-2012 to estimate first birth survival functions for black and white women with college and post-graduate education for birth cohorts 1931-1980. Our findings show a significant postponement of the first birth by about 2 years among women with postgraduate education compared to college graduates. Median ages at first birth plateau around age 32-33 for this group. Differentials in childlessness between college graduates and women with postgraduate education are present in the 1940s and 1950s birth cohorts, but disappear for women born after 1960. Furthermore, black highly educated women have significantly more first births early in the life course and higher rates of non-marital fertility than their white counterparts across all birth cohorts. Our findings thus suggest diverging pathways into motherhood between black and white women, even among this most highly educated segment of the population.

Keywords

Fertility, education, race, inequality, childlessness, parenthood, first birth, postgraduate education.

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High and Higher: Fertility of Black and White Women with College and Postgraduate Education in the United States

Natalie Nitsche and Hannah Brückner

1. Introduction

Marked changes have occurred in family formation behavior over the course of the 20th and early 21st century in the US and other developed countries. Notably, a postponement of the entry into parenthood to later stages of the life course took place, and childlessness at older ages has become much more common (Gustafsson 2001, Cherlin 2010). Yet, both trends were not universal, but occurred primarily among women obtaining college education (Goldstein and Kenney 2001, Martin 2000, Shang and Weinberg 2012), leading to a widening of the educational gradient in women's ages at first birth and childlessness in the US over time (Rindfuss et al 1996, Martin 2000, Musick et al. 2009). Whether and when in the life course children are born is, in turn, consequential. First birth timing and childlessness have been linked to various outcomes, such as maternal life-time earnings (Leung et al. 2016), maternal future health (Ewertz et al. 1990, Mirowsky 2005), or the transmission of resources to the next generation (Maralani 2013). Furthermore, unrealized fertility can potentially have meaningful implications for individuals' well-being. Hence, childlessness and 'underachieving' of fertility goals deserve more attention than previously received (McQuillan et al. 2012, Casterline and Han 2017).

While it is well understood that later entry into parenthood and relatively high incidences of childlessness are strongly linked to high educational attainment, still little is known on variation in fertility among college educated women (and men). The group of college educated women, however, is ever growing and also increasingly heterogeneous, likely implying fertility differentials. For instance, the share of non-white individuals in tertiary education today is higher than ever before, as is the proportion of women who opt for post-graduate education after completing college (Snyder and Dillow 2013). Recent studies confirm variation in first birth timing and childlessness among college educated women by field of study in the US and Europe (Van Bavel 2010, Michelmore and Musick 2014), but less is known on whether these fertility components also vary systematically between highly educated women with and without postgraduate education, or between white and black women. First birth timing has been strongly linked to enrolment in education and age at graduation (Ni Bhrolchain and Beaujouan 2012, Neels at al. 2017). Consequently, later first births among advanced degree holders can be expected, which subsequently may or may not translate into higher levels of childlessness.

The US literature on fertility in general, and that of women of color in particular, has rather focused on childbearing behaviors of the lower educated, teenage childbearing, or

unintended fertility (Furstenberg 2003, Wu 2008, Musick et al. 2009). Less is known on family formation processes of highly educated women, late child-bearers, or those who 'underachieve' their fertility desires (Martin 2010, Michaelmore and Musick 2015). In this vein, previous research on black-white differentials in fertility timing and quantum among college educated women is limited. A convergence in the TFR among college educated black and white women between the 1960s to the early 1990s has been documented (Yang and Morgan 2003). However, less is known on white-black fertility differentials among women with postgraduate education, and on how such a differential may have changed over time or birth cohorts.

Our study addresses these gaps and uses Current Population Data (CPS) to examine the timing of first births and proportions childless at ages 40+ of white and black women with college and post-graduate education, for the birth cohort 1931-1980. We contribute to the literature by showing that the timing of the first birth differs significantly over the life courses of black and white women with postgraduate education, and that non-marital fertility is persistently higher among black than white women in this most highly educated segment. Our results also indicate that the childbearing behavior of this most highly educated group differs from that of college-educated women without post-graduate education, particularly among white women. Additionally, we document birth cohort changes in ages at first birth and childlessness and black-white variation therein.

2. Tertiary Education and Family Formation

A significant postponement of entry into parenthood among college graduates, but not among lower educated women, has been documented from the 1960s to the 1990s (Heck et al. 1997, Yang and Morgan 2003, Martin 2000). For instance, mean ages at childbearing among college educated women increased by about 2 years, from 28 to 30 years, during that time (Yang and Morgan 2003). Rindfuss et al. (1988) analyzed first birth timing using a cohort approach, but their study period ends in the 1980s, leaving the analysis of birth cohorts 1950+ largely uncovered. Vere (2007), and Tamborini and Iams (2011) offer evidence on cumulative fertility of college educated women from a cohort perspective, but only until women's ages of 27 or 28, thus capturing untypically early births in this educational segment. Their findings also conflict. While Vere documents continuous increases in birth rates until age 27 among college graduates of the generation X cohorts born after 1965 using CPS data, Tamborini and Iams do not find such increases using SIPP data. Little, thus, is known on averages or median ages at first birth among recent birth cohorts of highly educated women, and a comprehensive study covering first birth timing on a large array of birth cohorts of college educated women is lacking from the literature. At the same time, fecundability has been shown to decline only very modestly between the late 20s and the mid-30s of a woman's lifespan (McDonald et al. 2011), and likely even beyond the age of 35 (Eijkemans et al. 2014), theoretically allowing for a further delay of first motherhood and widening of the educational differential. Mean or median ages at first birth may thus have shifted to well beyond age 30 in recent and current birth cohorts, as many women today

are experiencing first births in their mid-to late 30s and even early 40s (Beaujouan and Sobotka 2017).

It has been suggested that the strategies of college educated women in navigating work and family and their resulting life course outcomes have changed considerably over the course of the 20th century (Goldin 2004). Goldin examined proportions of childlessness, labor force participation, and marriage rates of five cohorts of college educated women who graduated from college between 1900 and 1990. She found evidence for five distinct strategies in combining family and career, changing over cohorts: The oldest cohort (graduating 1900-19) chose between either a career or a family, the second cohort (graduating 1920-45) had a job first and then a family, the third cohort (graduating 1946-mid 1960s) had the family first and then the job, the fourth cohort (graduating in the late 1960-late 1970s) opted for a career first and then family, while the fifth cohort (graduating in the 1980s and 1990s) attempted to have career and family simultaneously (Goldin 2004). More evidence on first birth timing by birth cohorts of highly educated US women is needed to understand whether this fits in with the pattern Goldin describes. Also, it's unclear whether this pattern may apply to white and black women alike.

Childlessness in the US indeed increased, both over periods and birth cohorts (for women born after 1925), for college graduates as well as for women with less than college education alike (Abma and Martinez 2006, Lundquist et al. 2009, Rowland 2007). A recent paper has documented decreases in childlessness among women with college and post-graduate education for the cohorts born after 1960 (Shang and Weinberg, 2013), delivering some support for Goldin's 'have it all' hypothesis (Goldin 2004). Shang and Weinberg's (2013) findings on childlessness coincide with our results. Yet, the comparison between women with college and post-graduate education is not in the focus of their paper and no information on whether these groups differ significantly from each other is presented.

2.1 Tertiary Education and Black-White Fertility Differentials

Both education and race are salient stratification systems in family formation processes and other social outcomes in the US, and intersect in producing social and life outcomes. Investigations on the fertility of highly educated black women are, however, limited by small sample sizes in representative surveys, as they are a small group in the US, likely explaining the scarcity of literature on this topic. Existing literature, based on cross sectional analyses, unanimously reports that average parity (Johnson 1979, Goldschneider and Uhlenberg 1969, John and Grasmick 1985, Clarke 2002) does not significantly differ between white and black college educated women, while black lower educated women have a higher average number of children than their white counterparts. Furthermore, John and Grasmick (1985) report younger ages at childbearing initiation among college educated black compared to white women, suggesting that black highly educated women have a somewhat different childbearing process than white women, reaching similar average parity after a younger initiation of childbearing, either via spacing their children further

apart or ending their childbearing process earlier. Yang and Morgan have investigated total fertility rates of black and white women by education from 1960 to 1994 from a period perspective. The tempo-adjusted total fertility rate was lowest for blacks and whites with 13+ years of education, and was similar for both groups throughout. Their evidence suggests that the TFR of black women with 13+ years of education, purged of timing effects, was traditionally slightly above the TFR of white women with the same amount of education, but that it fell below the TFR of their white counterparts in the late 1980s (Yang and Morgan 2003). A cohort analysis of fertility of college educated black women is not available to date.

Several of the cited pieces have developed a hypotheses addressing why the educational gradient in the TFR or average parity is steeper among black than white women. They argue that black women who have or aspire high levels of education limit their family size in order to facilitate social upward mobility, in particular with respect to non-marital childbearing (Goldschneider and Uhlenberg, John and Grasmick 1985, Clarke 2002). Boyd (1994) tested this minority group status hypothesis with data from the NSFG. He examined predicted parity levels at age 44 for educationally upwardly mobile black women of different social origins, finding that upwardly mobile black college educated women from relatively high social origins (measured in father's education as 12+ years of education) have indeed lower predicted parity values than comparable white women. However, black college educated women from lower social origin (father's education 10 or less years) have higher predicted parity values compared to similar white women (Boyd 1994). While his findings show a possible childbearing self-limitation among black women of higher social class backgrounds, the mechanisms through which this may occur remain unclear.

Clarke offers such a mechanism, taking into account partnering behaviors. She argues that black women are the group that spends the least time of their reproductive careers married (compared to whites and Hispanics). This would likely imply lowest fertility rates if they would not compensate with non-marital childbearing (2002:133). Black women with college degrees, though, avoid non-marital childbearing due to stigma that is attached to having children out of wedlock among the college educated 'elite' (2002:317), making marriage rates the key puzzle piece to explain higher education gradients in fertility among black women. Based on qualitative data, Clarke concludes that college degreed black women appear to "end up in less committed relationships, because their race and gender location afforded them little power in the dating and romantic relationship market" (2004:375). She attributes this to be the main cause of lower marriage rates of black women with high levels of education, not their lack of willingness to marry.

These findings are supported by McClintock's research who uses a College Social Life Survey from Stanford University conducted in 2005 to demonstrate that black women college students attending the elite institution are less likely to engage in either hook-ups, dates, or committed relationships than other female or black male students (2010:67). In addition, black men in her study reported significantly more often to have hook-ups or

dates than long-term relationships, possibly further limiting the possibility of a long-term relationship for black highly educated women (2002:63). A key to understanding fertility outcomes of highly educated women and black-white differences therein would hence lie in examining their partnership formation behavior in general and differences in marital versus non-marital fertility in particular.

In the following we will therefore present Kaplan-Meier estimates for the first birth process for black and white women with post-graduate education stratified by marital status, in addition to the basic survivor functions. Additionally, we will show descriptive age-specific marriage rates for women with post-graduate education.

3. Data and Methods

3.1 Data

The data for the analyses come from the years 1979-2012 of the June Supplement on Fertility of the Current Population Survey (CPS). The pooled data enough cases to look at a representative group of women with post-graduate education, who were a very small group relative to their birth cohorts for much of the last century, separately. There are 30,930 women with post-graduate education in the pooled June fertility files (for detailed case numbers by birth cohorts see tables 1and 2 in Appendix). The June fertility supplement is available annually or bi-annually since 1971. The target population has changed over the years. From 1971-1977, only married women were asked to report their fertility histories. In order to avoid selection bias and to gain a full picture of the fertility process, we therefore limit the analysis to the data collected in and after 1979. With the purpose of keeping the sample population from year to year as comparable as possible, we selected 17 out of the 26 available survey years.[1] In recent years, only women up to age 44 were included in the fertility supplement. Because of the rather steep decline in number of first births after age 40, however, it should be possible to describe the first birth process well.

As a cross sectional dataset, the CPS does not allow following individuals over time, the only retrospective information collected is on the fertility history. Investigating the sequencing of family formation and career events is only possible with longitudinal data, though. .[2] As a further disadvantage, no information about educational trajectories of the

[1] The sample population of the years included in our analysis: 1979: all women 18-59 (and 14-18 if ever married), 1980: all women 18+ (and younger if ever married), 1981-83: all women 18-59 (and 15-18 if ever married), 1985: all women 18+ (and younger if ever married), 1990: all women 15-65, 1992: all women 15-44, 1998-2006: all women 15-44.

[2] Information on current schooling is missing in the June supplement on fertility. Hence, it is not possible to include women who are currently pursuing graduate education when estimating the age at first birth.

women is available, so that women are classified according to their educational status at the time of survey. It is possible that some women had a different educational status at the time of their first birth or that they have acquired more education after the time of the interview. The first scenario is not problematic, since we are interested in the eventual age at first birth and likelihood to remain childless for all women who end up with graduate education at any time in their life courses, which includes those who have children first and go to graduate school thereafter. The second scenario, however, might lead to bias in case black and white women have a different likelihood of going back to school after the birth of the first child (and after the interview). This would lead to downward bias of the fertility of the group who is more likely to acquire graduate schooling after the birth of a child.

3.2 Measurement of Key Indicators

Race. The measurement of race has changed in the CPS over the years. Surveyed individuals could self-identify with an increasing number of racial categories over time. Black, white and 'other' were the basic racial categories, Native American and Asian were added in 1989. In 2003, measurement of race was expanded into 21 categories switching from a single-race to a multi-race classification. For the purpose of simpler analyses, we re-classified into three categories, black, white and other. We coded everyone who self-identified as white only as white, and everyone who self-identified as black only as black[3]. In addition, for the survey years 2003 and later, we classified individuals as black who self-identified as a mixed-race category containing black and one other racial group. Categories containing three or more races were coded as 'other'. This decision was based on the argument made in the literature that mixed-race individuals with African American heritage are more likely to self-identify as black (Davis 1991; Qian and Lichter 2007). However, we did not make this assumption for mixed-race individuals with three or more races, because possible self-identification as black is less clear in these cases. The changes in the coding of race in the CPS are a potential concern in case individuals who identified as black in the scheme before 2003 did systematically self-identify differently after 2003 (or self-identified as non-black before and were reclassified by our strategy as black). This would mean that the population identified as black is different for the survey years before and after 2003. Qian and Lichter have shown with IPUMS data that the racial classification of mixed race individuals will likely make no significant difference for the group of the African Americans. This is due to historically low intermarriage rates between blacks and whites (and blacks and other minorities) and small numbers of mixed race offspring with

[3] There is no race category for Hispanics in the CPS. Individuals with Hispanic origin can, however, self-identify in a separate indicator. We did not exclude individuals who identified as Hispanics, hence, Hispanics are included in our data among Whites and Blacks, depending for which race they self-identified.

African American heritage relative to the black population as a whole (Qian and Lichter 2007:78).[4] We are therefore confident that our race indicator is not biased.

Education. Until 1990, in the CPS education was collected as years of schooling, from 0-18+.[5] In 1992 and later, the educational variable switched to a measurement of highest degree completed, with 16 categories in total. We collapsed those two variables into one educational variable with five categories: less than high school, high school, some college, college and postgraduate education. Our group of those with postgraduate education consists of individuals who had 17 or 18+ years of education (before 1992) or reported to have completed a Masters or Professional degree or a PhD (after 1992). In the June Fertility Supplement data, information on current school enrollment is incomplete and therefore we cannot distinguish between those enrolled in graduate school at the time of survey and those with completed graduate schooling.

3.3 Age at First Birth – Provided Information and Reconstruction

The June supplement has consistently collected information on the number of live births a woman has ever had and on the timing of her last birth throughout all survey years[6]. Survey years before 1998 and after 2010 also contain information on the year and month of birth of the women's first child, but, unfortunately, the CPS has discontinued collecting specific information on first births between 1998 and 2010. For survey years 1998-2010 (roughly 20% of our sample, since sample sizes decreased beginning in 1998), we therefore reconstructed the age at first birth based on the women's age, the number of live births she has ever had, her age at her last birth, and the household composition (the number of children and the age of the oldest child living in the household) where possible. Reconstructing the fertility history from household data has drawbacks, which we discuss below, but is common practice in demographic research in the absence of more comprehensive data sources (see Kreyenfeld 2002). To this end, in a first step, we derived the age at first birth for those women who report only one live birth directly from the 'age at last birth' variable, accounting for roughly 30% of mothers in survey years 1998-2010. Second, for mothers of two or more children, we compared the number of births a woman reported to have ever had to the number of children living in her household. If the two numbers matched, we

[4] In the pooled CPS October dataset, there were only 49 highly educated individuals who self-classified as mixed-race with three or more races, and who we recoded as 'other'. In contrast, there are 13,007 highly educated individuals that are classified as black by our strategy. Of those, only 78 originally self-identified as mixed-race within a two race group containing black, with all others self-identifying as black.

[5] Before 1992, respondents were asked some version of these two questions: What is the highest grade (or year) of school this person has ever attended? Did s/he finish the highest grade (or year) s/he attended?

[6] In the most recent survey from 2012, the information on the timing of the last birth has not been collected.

subtracted the age of the oldest child in the household from the age of the mother to calculate her age at first birth. If the numbers did not match, we assigned a missing value. The number of mothers without a match is about 30% throughout waves 1998-2010; however, this figure varies by education, with more missing values in the lower educational groups and fewer among women with college or more education[7].

In order to conduct a robustness check on the median age at first birth estimates, and in order to estimate levels of childlessness at age 44 with the Kaplan Meier estimator, we have, furthermore, developed a method to impute the age at first birth for those cases that could not be reconstructed based on the household information for surveys 1998+. This method relies on birth-spacing: the basic idea is to estimate average parity-, 5-year birth cohort-, and race-specific (black, white, Hispanic) spacing intervals for the women with the full birth history information (provided by the CPS survey years 1980, 85, and 90), and use this information to substitute a virtual imputed age at first birth for women with missing timing information on their first birth, subtracting the median parity specific monthly interval of birth spacing for each additional child from the date of last birth. This is possible because the CPS provides information on number of children and the timing of the last birth for all women interviewed.

We hence have calculated the median spacing for birth cohorts born up to 1965 between first and second, second and third, third and fourth, and fourth and fifth live birth for all women aged 35 or older (ages 30+ for cohort 1960-65) , and have used the spacing between the fourth and the fifth child for all higher parity births. We exclude younger women, because their fertility process is not yet finished, and younger women who have already achieved higher parities have an unusually close spacing compared to the older women in the sample. Approximately 85% (for black women) to 90% (white women) of those mothers with non-constructible ages at first birth have between 2-4 children. Since mothers of the

[7] We operate on the assumption that the missing values for age at first birth are random in the final sample. There is, however, a systematic component because the age at first birth is missing only for mothers at parity two or higher and we expect that among those mothers, some groups may be more likely to not be living with all and exclusively their own children in one household. For example women who had their children early, so that they already left the house compared to women of the same age who had their children later (the majority of women with missing values lives with fewer, not more children in the household than they ever gave birth to, tables not shown), women who are separated with children living with the father, or women with a new partner who brings own children into the household, and women who lost a child after its birth. We are nonetheless confident that we can adjust for this bias in the age at first birth by using the birth cohort approach in constructing the sample. This is because we can 'catch' birth cohort members early in their life course, when they were still living with all and exclusively their own children in one household (or when age at first birth was still collected by the CPS) so that we count them as a 'match' at least once. Also, there are certainly women having wrong positive matches, because the number of children living in the household coincidentally reflects the number of births a women has had, but those children are not (all) her own children. We of course cannot identify those cases, but at least exclude women who had a computed unrealistic age at first birth of 11 and younger from the analysis.

birth cohorts born after 1965 and surveyed before 1998 were relatively young, likely reflecting closer spacing if they were at higher parities (2+) at a young age already compared to their birth cohort counterparts who have achieved the same parity only in later years, we have used the spacing information of the cohort 1960-65 for all younger birth cohorts[8]. We found that spacing indeed differs according to birth cohort, parity and race, while there were only minor differences between educational groups within birth cohorts, parities and race (results not shown).

3.4 Methods

We estimate the age at first birth and levels of childlessness at age 44 using Kaplan Meier estimators for black and white women with the June CPS data. . All women are included in the estimate, including those that are still childless at the time of survey, thereby taking right censoring into account.[9] Since we are able to measure the exact time of the event of a first birth retrospectively, we can estimate the hazard of first birth for any age, measured in years. We will thus refer to rates of first birth and how they change with age for any given birth cohort. We furthermore present 95% confidence bands around the Kaplan-Meier estimates.

4. Results

4.1 Black White Differences in First Birth Timing and Childlessness

We begin by exploring cohort trends in first birth timing among white and black women with postgraduate education for cohorts born between 1931 and 1980. Figures 1 and 2 depict survivor functions of first births for birth cohorts 1931-1955 and 1956-80. The steeper survivor functions for black women during adolescence and the early 20s indicate that they have more first births at younger ages, up to their mid- to late-20s, throughout the cohorts.

[8] We refrained from using the 1956-60 cohorts' spacing because our results suggest that this cohort was special in terms of birth postponement and is likely less comparable to the fertility behavior of women born after 1965. Furthermore, we have included twin births (spacing of 0 months) into the calculation of median spacing intervals, because we cannot identify twins after 1998 and want the spacing intervals to be as comparable as possible in both groups.

[9] Confidence intervals for the survivor functions have been estimated, however, we have not shown them here due to limited space. We are, however, very open to include them in future version of this paper.

Figure 1: Survivor function of first birth, post-graduate educated black versus white women, birth cohorts 1931-55

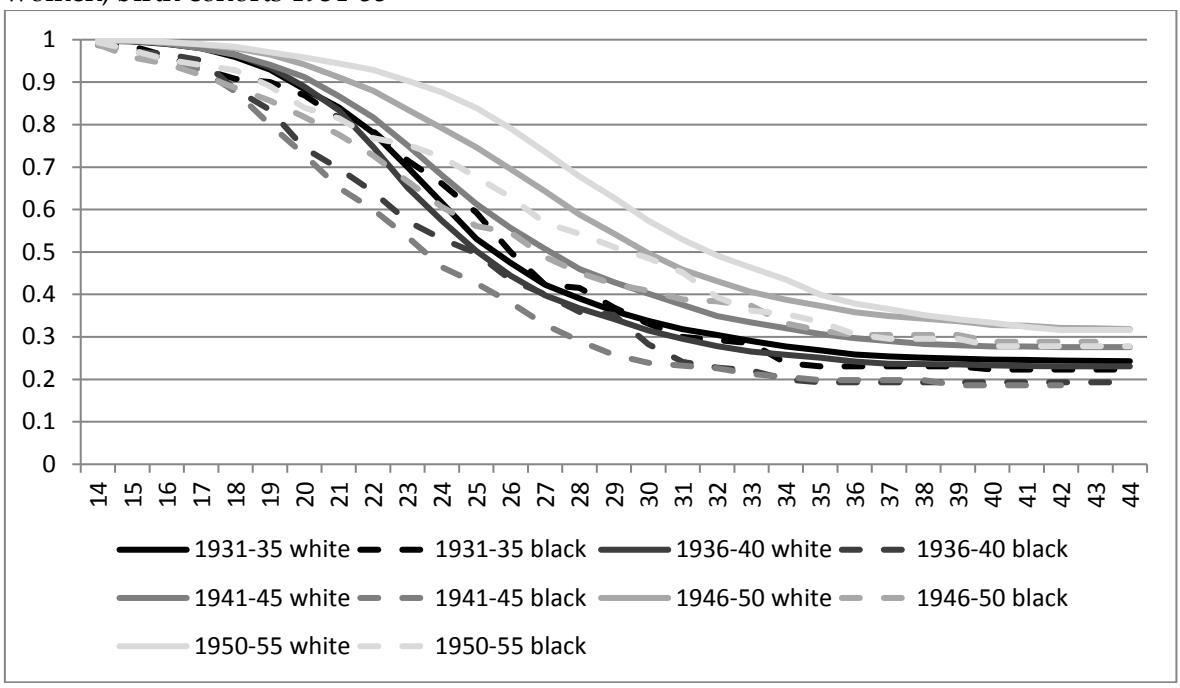
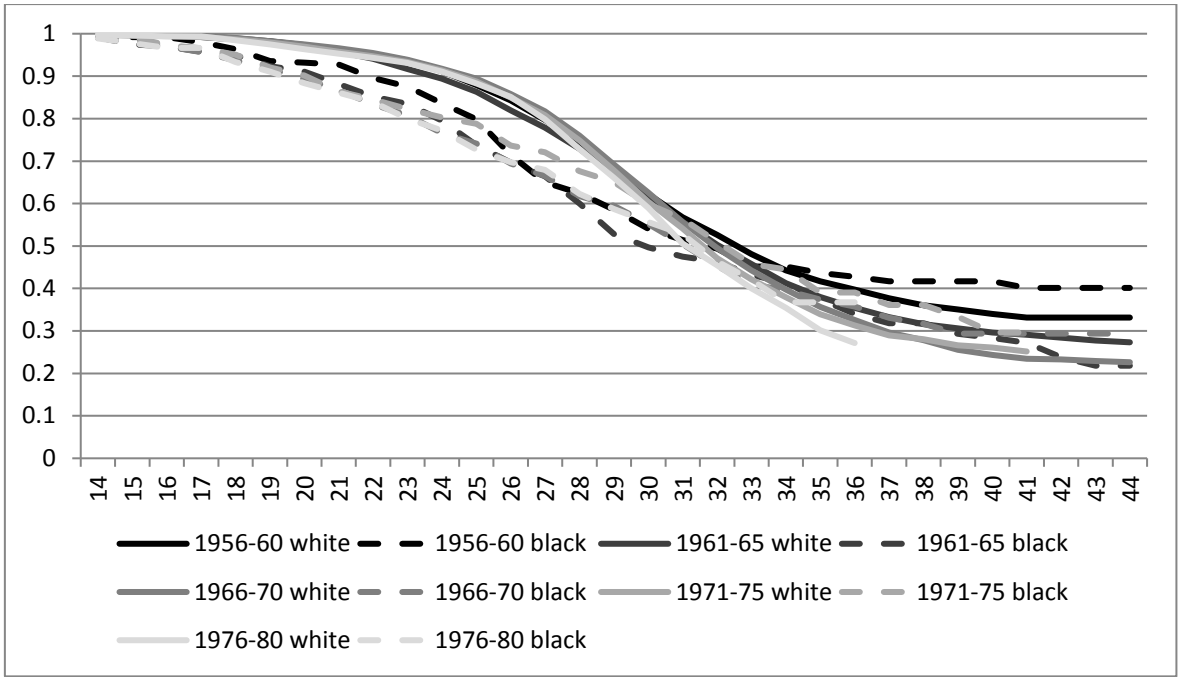


Figure 2: Survivor function of first birth, post-graduate educated black versus white women, birth cohorts 1956-1980



Source Figures 1& 2: CPS June Series 1979-2012

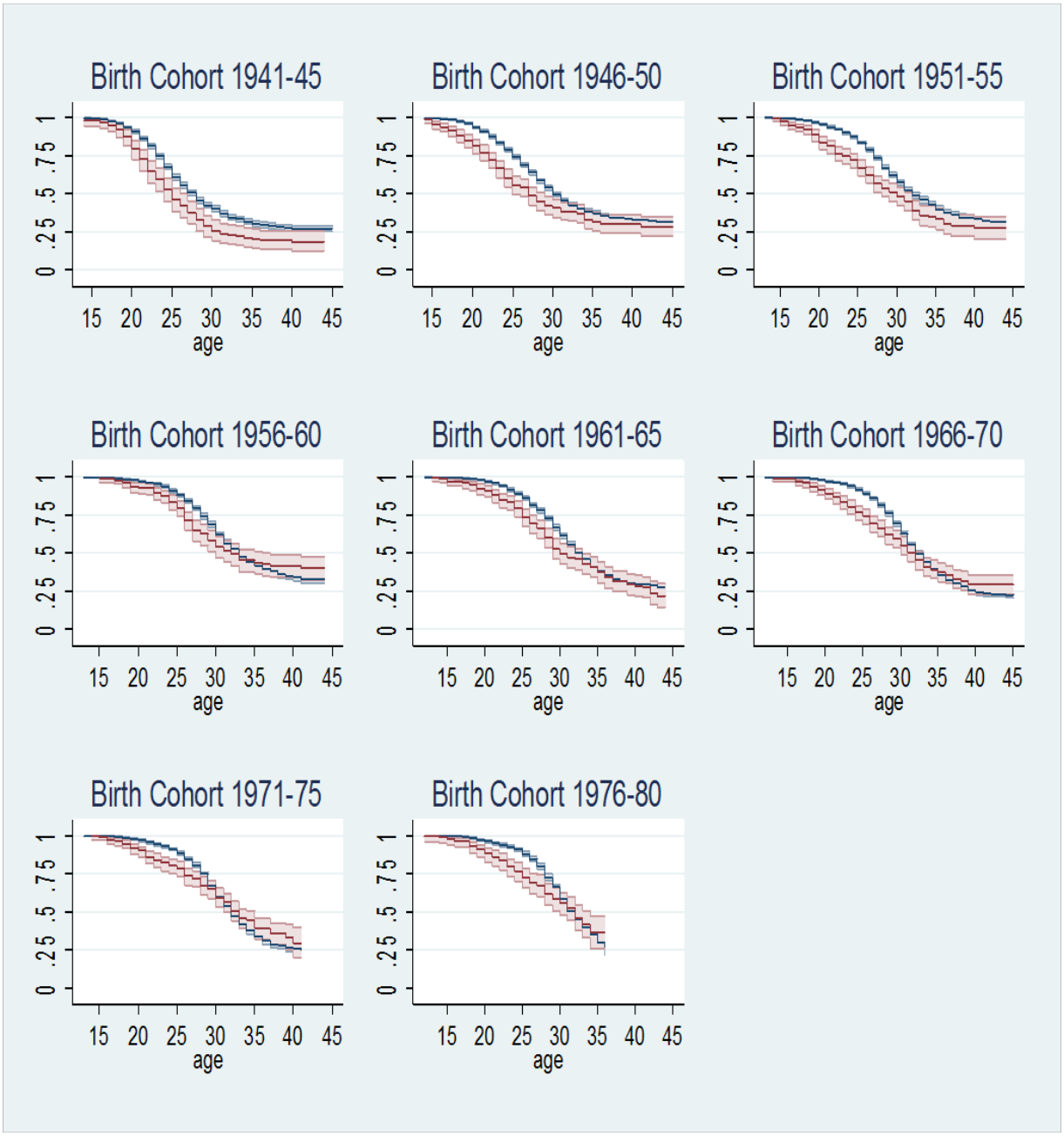
This pattern is significant for all but the 1931-35 birth cohort (figure 3), and holds also for women with college but without further post-graduate education (figure 4).

Significances are clearer here, due to larger sample sizes and narrower confidence intervals. Hence, black women with postgraduate education are more likely to experience the first birth early in the life course compared to their white counterparts, confirming the pattern which has been observed between black and white women in general (Rindfuss, Morgan and Swicegood 1988:122) also in this most highly educated segment. Conversely, first births after the age of 30 appear to be less likely among black women with eventual post-graduate (and also college) education compared to white women. Figures 3 and 4 depict flatter survivor functions for black postgraduate and college educated women compared to those of white women beyond age 30, and the lines even cross for the cohorts born after 1955 (with the exception of the 1961-66 cohort of post-graduate women).

Among postgraduate educated women, the earlier first birth timing of black women in the birth cohorts 1940-55 coincides with lower proportions of childlessness at ages 40 to 44. The crossing of the lines in the cohorts born after 1955, however, suggests that despite having more first births earlier in the life course, black postgraduate educated women born after 1955 may remain childless at ages 40+ more often than white women with the same educational attainment. Confidence intervals overlap, though, indicating that these trends at ages 30+ are not significantly different from each other. At the very least, it can be concluded that starting childbearing earlier in the life course does not translate into higher proportions of motherhood among black women with postgraduate education born after 1955. Trends differ slightly among women with college but without postgraduate education (figure 4). While we see the same differential in first birth timing, childlessness at age 40-44 is very similar for black and white women throughout cohorts.

In sum, first birth timing differs between white and black highly educated women, and this holds true not only for college graduates but also for women with post-graduate education and advanced degrees. Black highly educated women have significantly more births at young ages (during their teens and twenties), likely implying that they more often engage in post-graduate studies after becoming mothers. Yet their first birth rate slows down in the mid- to late 30s and the 40s more than the rate for whites, among the cohorts born after 1955, in particular among women with postgraduate education.

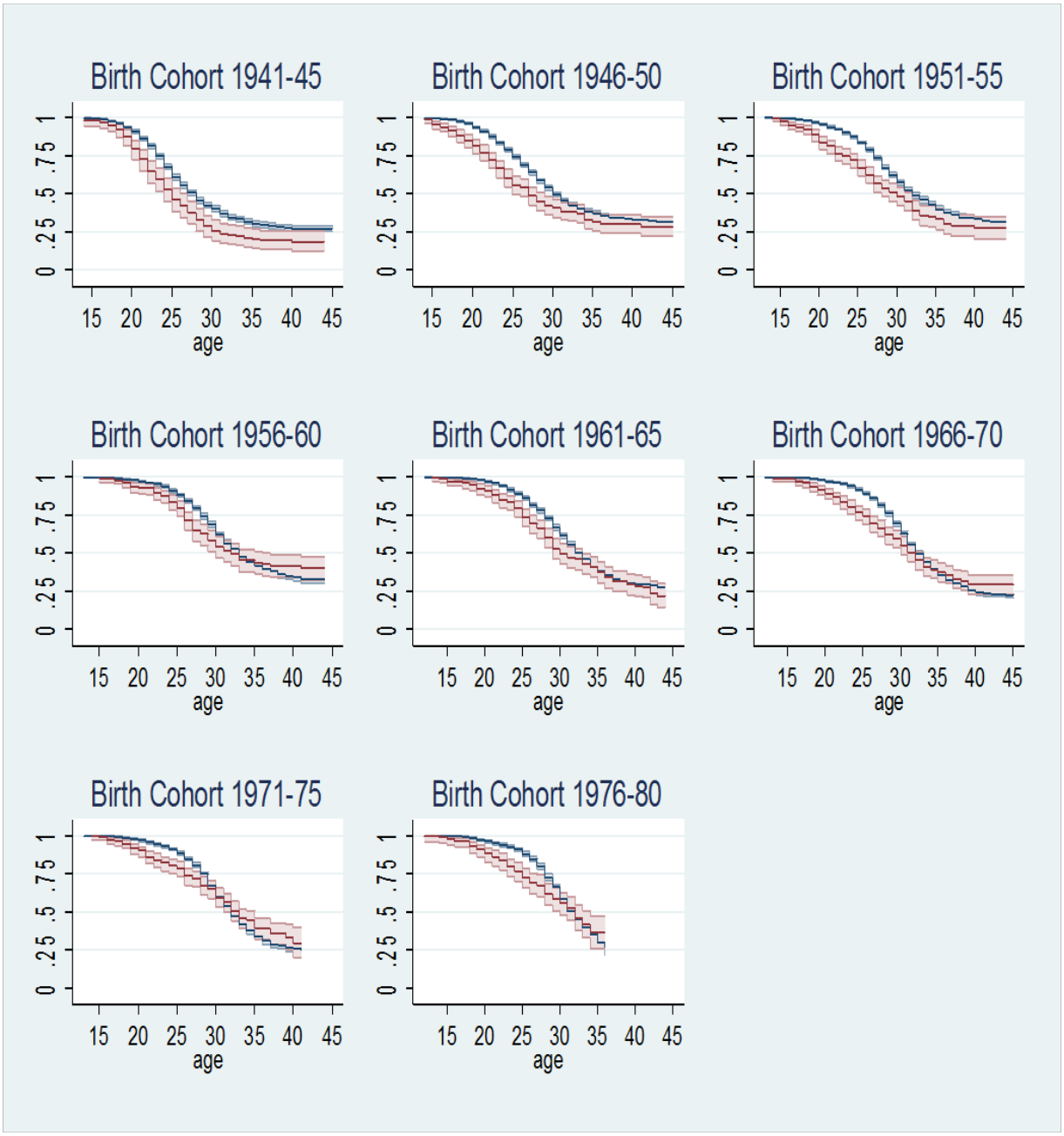
Figure 3: First birth survivor function, white versus black women with postgraduate education



LEGEND: White women —— Black women ——

95% Confidence Bands
Source: CPS June Series 1979-2012

Figure 4: First birth survivor function, white versus black women with college education



LEGEND: White women —— Black women ——

95% Confidence Bands
Source: CPS June Series 1979-2012

4.2 College-Postgraduate Differences in First Birth Timing and Childlessness

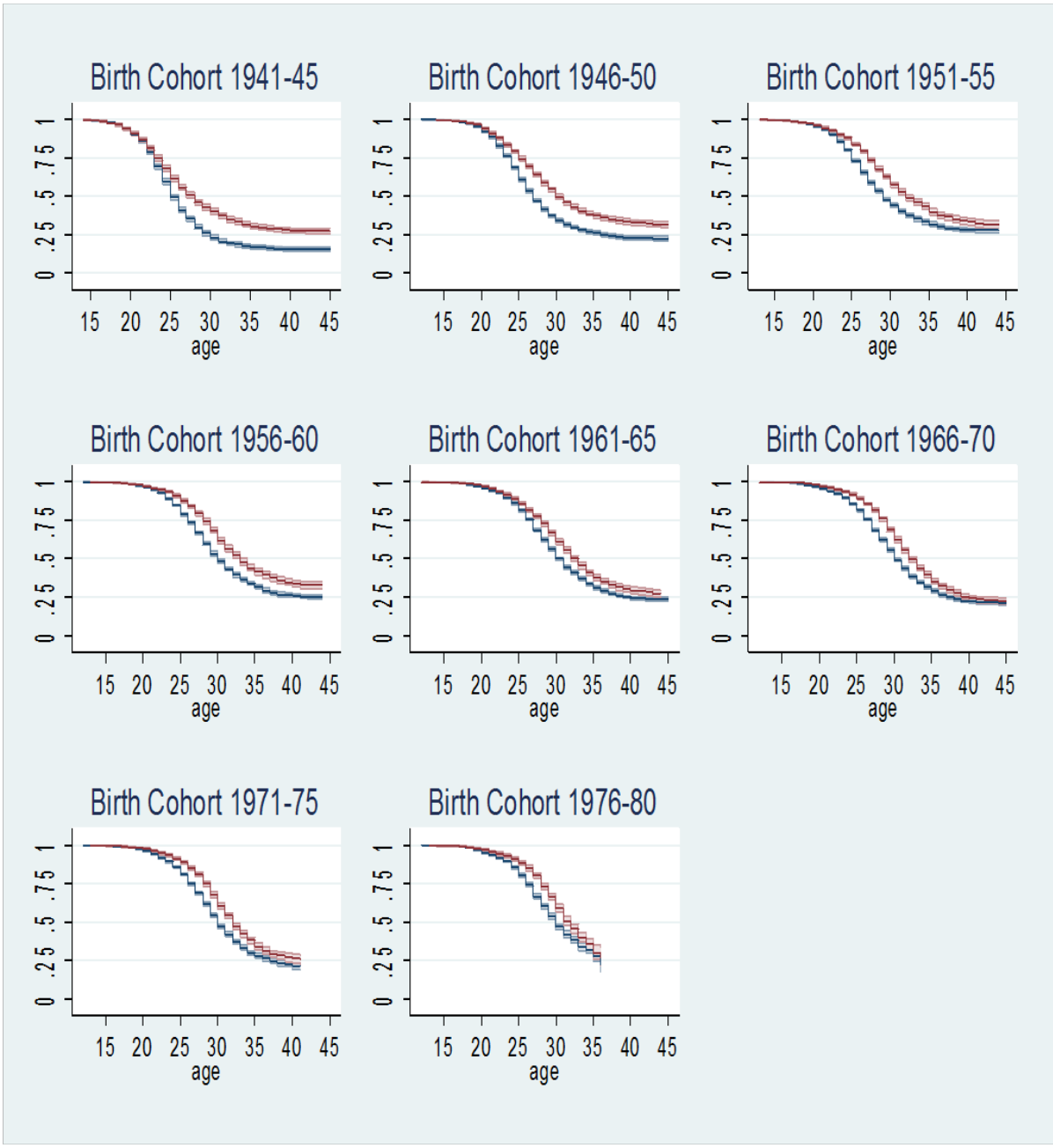
As expected, figures 5 & 6 indicate that women with eventual postgraduate education have their first birth, on average, later during the life course than women with college education. This applies to white and black women alike, but the differences between the two educational groups are only consistently significant among white women. Confidence intervals for black women are wider, and there is also more variation in the distance of the median ages between the two groups over cohorts than for white women. Median ages at first birth for white women with postgraduate education are around 32 or 33, in the cohorts born in and after the 1950s. Median ages at first birth for college graduates are younger by about 2-3 years, with wider gaps in the cohorts born before the mid-1950s. Among white women, the postponement of the first birth is indeed linked to significantly higher childlessness at ages 40+ for the cohorts born in the 1940s and 1950s. Among black women, substantive differences in childlessness between the two educational groups are present only in the birth cohorts 1946-50 and 1956-60, and even here, confident intervals overlap. There seem to be no differences in childlessness at the later stages of the reproductive life span among women with college and postgraduate education born in the 1960s and 1970s, neither among blacks or whites, despite significant differences in first birth timing. This suggests that the relationship between first birth timing and childlessness has changed over birth cohorts for women with post-graduate education.

4.3 First Birth Postponement and Childlessness over Cohorts

Figure 1 shows clear differences between black and white women with postgraduate education in how the postponement of the first birth unfolded over birth cohorts. For birth cohorts 1931-1940, the median age at first birth is around age 25-26 for both black and white women and thus still alike, and levels of childlessness of 20-25% at age 44 differ only slightly between the two groups. However, the white cohorts born in the 1940s are the first to significantly delay the first birth. The median age at first birth increases to age 27 for birth cohort 1941-45 and to age 30 for birth cohort 1946-50. For these cohorts of white post-graduate educated women, childlessness increases to 27% and 30% respectively, up from ca. 23% of the cohorts born between 1926 and 1939 (1920s cohorts not shown).

Among black women with postgraduate education, this postponement did not take place simultaneously with white women, but occurred about one 5-year birth cohort later. Black women born 1946-50 are the first to postpone the first birth until a median age of 27, and birth cohort 1950-55 until age 30.

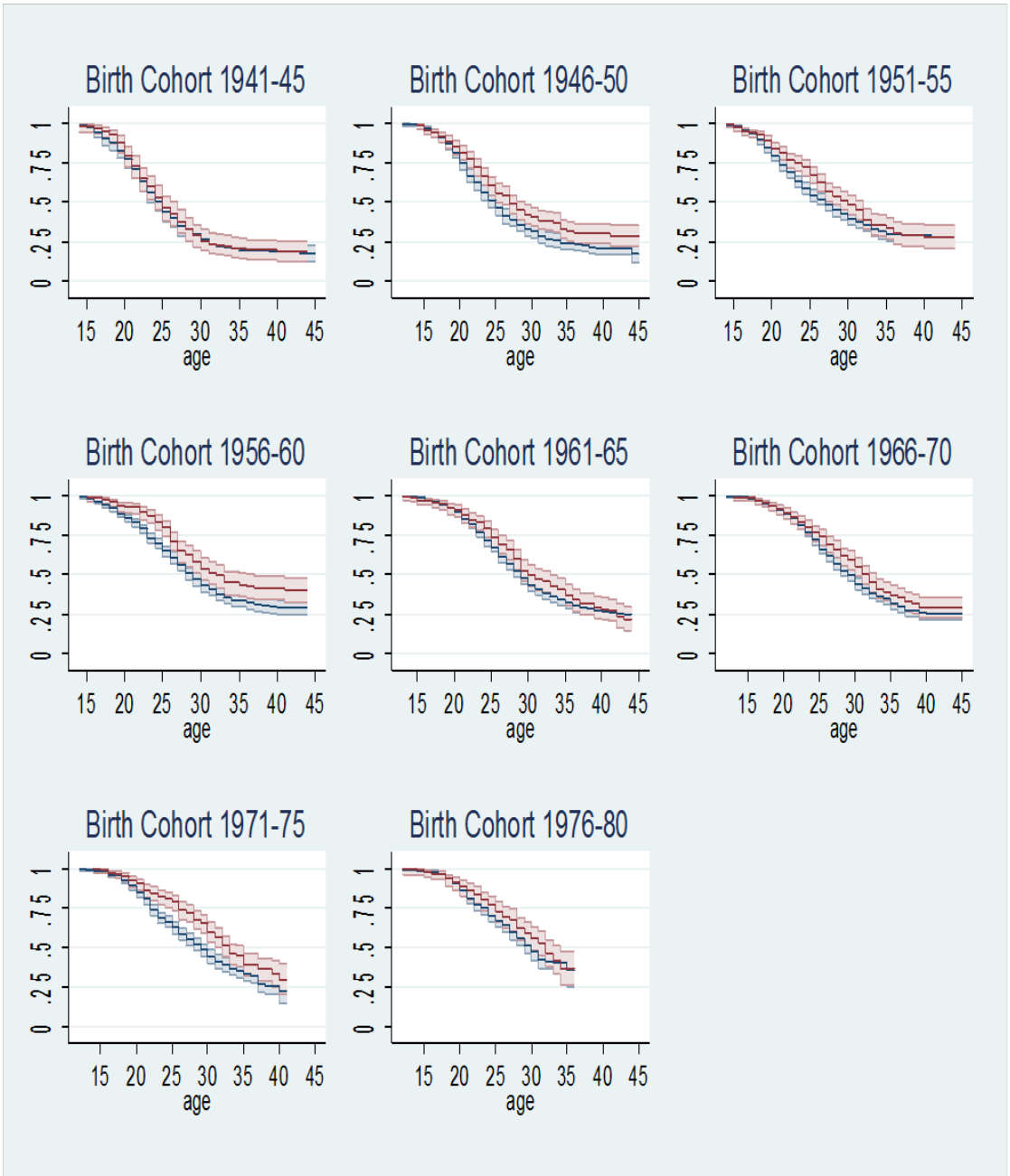
Figure 5: First birth survivor function, white women, postgraduate versus college education



LEGEND: Postgrad. Educ. —— College Educ. ——

95% Confidence Bands
Source: CPS June Series 1979-2012

Figure 6: First birth survivor function, black women, postgraduate versus college education



LEGEND: Postgrad. educ. —— College educ. ——

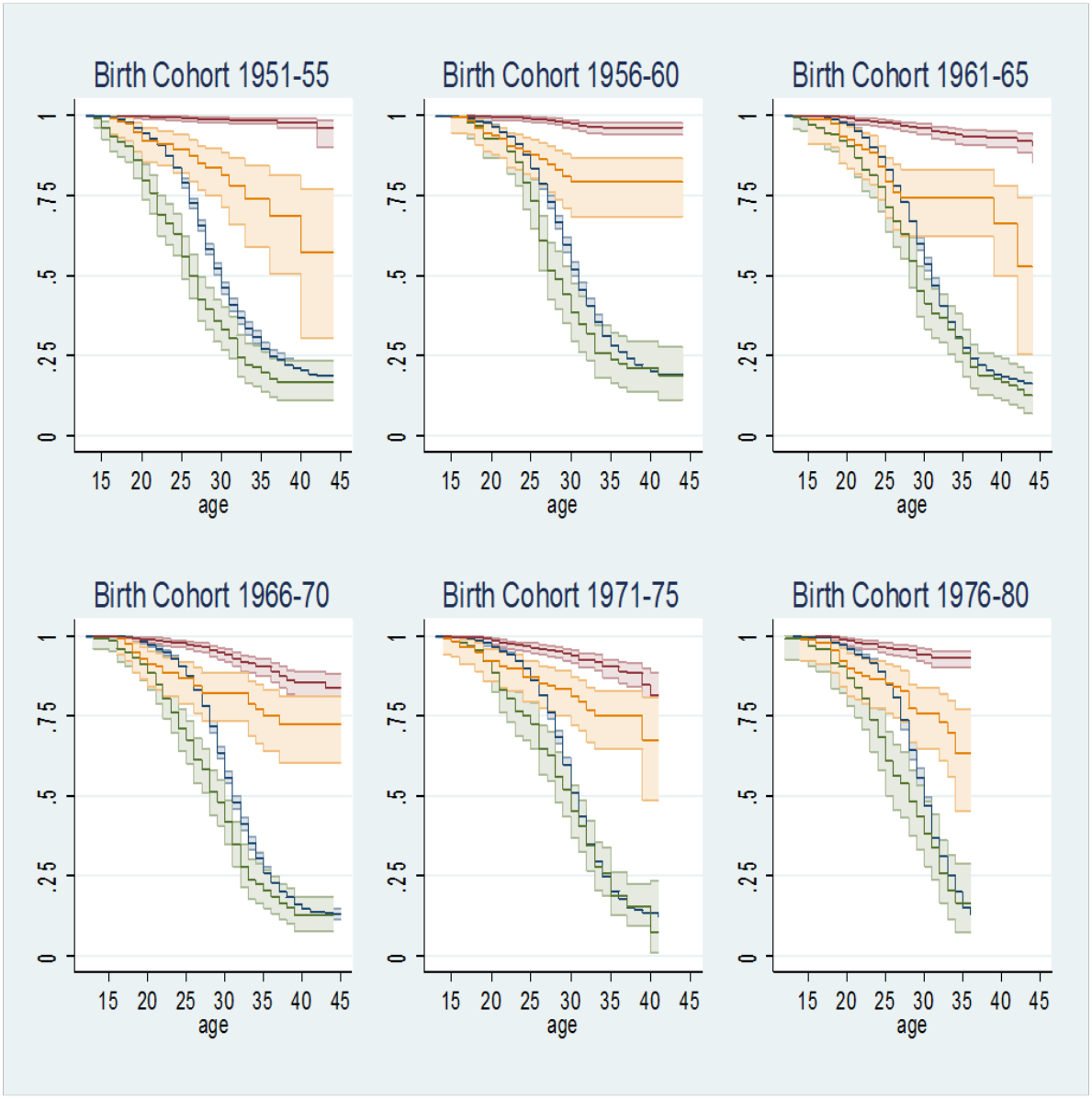
95% Confidence Bands
Source: CPS June Series 1979-2012

4.4 Childlessness, and Marital and Non-Marital Fertility

While the point estimates of childlessness at ages 40+ of black and white highly educated women fall within each other's confidence intervals, they consistently indicate possibly higher childlessness among black women obtaining postgraduate education born after 1955 (expect for the 1961-65 cohort). We further explore whether and how fertility levels among never married and ever married women differ. Figure 7 shows first birth survivor functions for white and black women who were never versus ever married (including women who are divorced, widowed, or separated). Obviously, childlessness of ever married women at ages 40+ doesn't differ between black and white women with postgraduate education, even though the timing of first births during the life course differs significantly between the two groups, as seen previously.

The sample size gets small for black never married women, expressed in the choppy curves and wide confidence bands for this group. Significant differences in non-marital fertility exist between white and black women with postgraduate education, with much higher childlessness for white never married than for black never married women. For all cohorts born before 1961, most never married white women remain childless, with levels of childlessness at age 44 of 95% and higher. There is some change for women born in the 1960s and 1970s, likely related to increasing numbers of births occurring in cohabitation. Rates of childlessness among never married black women are significantly lower with around 60% in the 1951-55 and 1961-65 cohorts. Moreover, never married black women with postgraduate education of the birth cohorts 1956-1970 (and cohort 1940-49) remain childless to about 80%, which is higher than among most of the older cohorts born in the 1920s & 1930s (not shown). Our results confirm earlier findings, which show that being never married has a stronger impact on remaining childless for white than for black women with college education (Lundquist et al. 2009:752). On the other hand, our results show that avoidance of non-marital fertility may be a factor behind our particularly high estimates of childlessness for black women with postgraduate education of the birth cohort 1956-60. Proportions of women never married at ages 35-44 have increased substantially among black women with postgraduate education from the cohort born in the 1940s to the cohort born in the 1950s (table 3, own estimates based on data of the October CPS series on education). The process of family formation hence significantly differs between black and white highly educated women, despite comparable levels of childlessness at ages 40-44. Highly educated black women have more births early and fewer later in the life course, remain unmarried much more often, and experience significantly more non-marital births.

Figure 7: First birth survivor function, black and white never versus ever married women with postgraduate education



LEGEND: White ever married — Black ever married — White never married — Black never married —

95% confidence bands
Source: CPS June Series 1979-2012

5. Discussion and Conclusions

Using data from the CPS June Fertility Files, we have investigated cohort changes and differences in first birth timing, childlessness, and marriage behavior between black and white women with completed college and with postgraduate education, for the birth cohorts 1931-1980. We extend the literature by documenting differences in the family formation behavior between 1) women with postgraduate education and college education, and 2) black and white women within these educational groups. Our findings remain descriptive. Case numbers are large enough to present meaningful descriptive results for highly educated black women by birth cohort. They are, however, too small for statistical modeling involving covariates, as cell sizes would get too small. Nonetheless, our results are an important extension to the literature on the fertility of highly educated women in the US, and provide meaningful evidence for previously unknown finer-grained differences in how educational and race intersect in relating to family formation processes. Further research is needed to look more deeply into how and why pathways into family formation, education, and possibly career development contingent on childbearing behavior diverge between these highly educated groups.

We present three main findings. First, we document significant and persistent differences in first birth timing between college graduates and women with postgraduate education. As expected, women with advanced education have higher median ages at first birth by 2-3 years, but significantly so only among white women. Timing differentials are larger in older cohorts and start to decline among cohorts born after 1950. Median ages at first birth reach the age of 33 among the cohorts born in the mid to late 1950s and plateau thereafter among women with postgraduate education. Thus, the most highly educated women postpone their first births the most, but the postponement has stalled in recent cohorts, and does not extend to or beyond the age of 35 in the US, despite recent reports that fecundity declines less slowly than previously suggested during the third decade of women's lives (McDonald 2011).

The second major findings speaks to linkages between first birth timing and childlessness later in life. The postponement of first births among women with postgraduate education translates into higher childlessness at ages 40+ for the cohorts born in the 1940s and 1950s. Among these two cohorts, women with postgraduate education remain childless more often than college-educated women without postgraduate education. However, childlessness of postgraduate educated women decreases for birth cohorts 1960+. No significant differences in childlessness between white postgraduate educated and college educated women are present anymore in the 1960+ birth cohorts, despite the persistent later first birth timing of the women with postgraduate education. There are several potential explanations for this change in the linkage between first birth timing and childlessness. With educational expansion, more women have entered postgraduate education, leading to a less selected group of women opting for advanced degrees. It is well possible that the few women enrolling in postgraduate education of the

1940s and 1950s birth cohort were more selected and less family oriented, on average, and this underlying preference may have been driving both first birth postponement and higher childlessness. Also, combining advanced education and careers with motherhood, including postponing parenthood to later life stages, may have become more manageable and accepted over the course of time. Goldin (2004) suggests that the generation of women born in the 1960s and 1970s is the first who can 'have it all'. The weakening linkage of first birth postponement and childlessness in these birth cohorts may partly be driven by such a development. Then, the usage of medically assisted reproduction (MAR) has become available and more common, perhaps encouraging further first birth postponement and facilitating pregnancy at later ages if needed (Schmidt et al 2011). Another contributing factor may be a possible slight shift in the age at menopause to later ages, accompanying increases in longevity, possibly leading to upticks in fecundity at later ages among younger birth cohorts (Nichols et al. 2006).

The third, and possibly most interesting and relevant finding concerns differences in the fertility process between black and white highly educated women. Both black college graduates and women with postgraduate education have significantly more first births early in their life courses up to the age of 25 than their white counterparts. In addition, they appear to have fewer first births after the age of 30, the latter finding being not statistically significant across the cohorts, though. Due to the lack of adequate data, we have not been able to examine the sequencing of major life events such as marriage, and graduation from college or graduate school over the life course. Yet, the differences in first birth timing between black and white women with postgraduate education hint at possibly differing pathways and sequencing strategies with respect to combining career and family between black and white women within birth cohorts. The higher likelihood of having a first birth during adolescence or the early 20s among black women with eventual postgraduate and college education may imply that they may more often opt for the strategy of having children first, and obtaining tertiary education and engaging in a career thereafter than their white counterparts. This notion is backed up by the fact that we tended to overestimate the age at first birth for black but not white women with postgraduate education when we used the non-imputed version of the data, which excluded women who did not have a match of number of children they ever gave birth to and number of children living with them in the household. This suggests that among blacks with postgraduate education, there are more women who have had the children early in life, before they obtain their highest degree of education, so that the oldest kid(s) had already moved out at the time of the survey. This does not seem to apply to white women, however, in turn leading to biased estimates only in the former group but not the latter when using the un-imputed data. Our results thus confirm an earlier onset of childbearing in the life courses of black women compared to white women, also among those who will eventually obtain college and advanced degrees.

It is well known that marriage rates for African American women are below those of white women (Attwell et al. 2004, Tucker and Mitchell-Kernan 1995). We confirm this findings for women with postgraduate education, and also find never married black women with post-graduate education to have significantly more births than never married

white women. Sex ratios in tertiary education are more unbalanced for blacks than whites, with larger proportions of women attending college and graduate school among blacks than whites. It has been shown that an imbalanced sex ratio among blacks can be linked to a lower likelihood of black women to find a partner, get married or stay married (Attwell et al. 2004; Ferguson et al. 2006; Schoen and Kluegel 1988). Imbalanced sex ratios among college educated African Americans might thus play a significant role in the family formation processes of black women we described, as they affect mating markets and likely partnering changes for black highly educated women given strong and persistent racial homogamy in the US (Kalmijn 1993; Quian 1997; Quian and Lichter 2007; Rosenfeld 2008). More research is needed on racial and ethnic inequalities in the family formation process and its consequences for other life outcomes among the most highly educated women today. In particular, the question of differential partnering and marriage changes among black and white highly educated women and what those mean for childbearing choices and trajectories deserves more attention.

Finally, our study is not without limitations. We need to point out that the composition of the group of women who enrolled in college and graduate schools has changed profusely over the last decades. With educational expansion, selectivity into higher education has decreased. Hence, it is not clear whether changes in childbearing behavior over time within the educational groups are based upon differing behavior of those within that educational group or of changing selections of women into educational pathways. Additionally, these selection processes into education over time may well differ between black and white women. Also, the composition of black and white women within post-graduate education may be substantially different in terms of final degree achieved (Master's degrees versus professional degrees versus PhDs), which in turn may have an effect on family formation strategies as the length of these courses of study differ.

To close, two further fields for more extensive research based on the findings just presented can be identified. First, the differences in marriage and fertility outcomes for black women with graduate education might have consequences on their well-being, life satisfaction or career outcomes. Second, linking the fertility behavior of the birth cohorts to an analysis of social historical changes will enrich the understanding of challenges those different birth cohorts encountered and of behavioral change regarding family formation as a possible response to social change.

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Appendix Tables

Table 1: October CPS sample

Women with Postgrad. Education		
Birth Cohort	white	black
1921-1930	8,096	642
1931-1939	9,984	942
1940-1949	25,029	1,778
1950-1955	18,309	1,303
1956-1960	10,140	808
1961-1970	12,119	1,025
1971-1975	3,198	312
>=1976	1,763	164
Total	**88,638**	**6,974**

Source: CPS October series 1970-2007

Table 2: Proportion of never married women with postgraduate education, by age group, birth cohort, and race

Birth Cohort	**15-24 Whites**	**15-24 Blacks**	**25-34 Whites**	**25-34 Blacks**	**35-44 Whites**	**35-44 Blacks**
1931-1940			17	9.3	14.5	9.2
			(13.1-21.9)	(1.3-44.0)	(13.0-16.1)	(6.0-13.9)
1941-1950	47.1	41.5	20.1	31.6	12.8	12.7
	(39.9-54.5)	(10.2-81.5)	(19.5-22.1)	(26.1-37.7)	(12.0-13.7)	(9.9-16.2)
1951-1960	62.4	73.4	28.8	39.9	14.7	27.6
	(57.6-67.0)	(46.1-89.9)	(27.7-30.1)	(34.9-45.1)	(13.9-15.6)	(23.9-31.7)
1961-1970	72.6	85.8	32	44.5	15.4	24
	(67.3-77.4)	(62.2-95.7)	(30.5-33.5)	(38.7-50.5)	(14.3-16.5)	(20.1-28.4)
1971-1975	64.5	78.9	33.1	49.5	21.4	47
	(51.7-75.5)	(28.0-97.3)	(31.0-35.3)	(42.3-56.7)	(16.4-27.4)	(28.1-66.7)
1976+	71.9	76.3	42.1	66.2		
	(63.3-77.8)	(51.9-90.6)	(39.0-45.2))	(55.9-75.2)		

Note: 95% confidence intervals are in parentheses
Source: CPS October series 1970-2007

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