Evaluating the Sex Ratio Hypothesis: County-level Sex Ratios and Nonmarital Fertility for African Americans

Marie Luise Neumann

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Hedwig Lee

Stewart E. Tolnay

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Abstract

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Marie Luise Neumann

Chair of the Supervisory Committee:

Hedwig Lee, PhD

Department of Sociology

This research examines the association between county-level sex ratios for African Americans and births to unmarried African American women. Utilizing Census Bureau intercensal population estimates and CDC natality data as well as measures for urbanicity and residential segregation, the analysis considers whether low sex ratios for African Americans are associated with out-of-wedlock fertility and explores the context in which this association is strongest. I find a negative association between male-to-female sex ratios and nonmarital fertility for African Americans, but only in highly-segregated metropolitan counties. The results suggest that a county's level of segregation and metropolitan classification are important factors when considering the association between sex ratios and nonmarital fertility for African Americans.

INTRODUCTION

In the United States, racial disparities in reproductive health are substantial. Minority women, particularly African Americans, report excessively high rates of unintended pregnancy and abortion (Finer & Zolna, 2013). In 2010, the non-marital fertility rate among black women was twice as high as that among white women, standing at 65.3 births for every 1,000 women for African Americans and 32.9 births per 1,000 women for white women (Joyce A. Martin et al., 2012). The drivers behind such disparities are complex and interrelated and include socioeconomic factors (Harling, Subramanian, Bärnighausen, & Kawachi, 2013; Owusu-Edusei, Chesson, Leichliter, Kent, & Aral, 2013) as well as differences in sexual networks and partner concurrency (Adimora et al., 2013; Adimora & Schoenbach, 2005a; Newman & Berman, 2008).

The proximate determinants framework (Bongaarts, 1978) offers a useful tool for disentangling some this complexity as it pertains to fertility. Bongaarts identifies four factors- marriage, contraception, lactation, and induced abortion- as the primary proximate causes of fertility differences between populations. Importantly, the influence of social context on differential fertility outcomes across population subgroups works via these four proximate factors, and each factor involves different social processes. In the following study, I assess whether one characteristic of the social context- sex ratios- is associated with fertility patterns for African Americans, arguing that its impact on nonmarital fertility functions by shaping the likelihood for marriage and contraception use. In this paper, my goal is not to tell a causal story; rather, I aim to clarify the type of setting in which sex ratios are associated with non-marital fertility for African Americans.

THEORY AND PREVIOUS RESEARCH

Sex Ratios, Bargaining Power, and Reproductive Health

According to the sex ratio hypothesis advanced by Guttentag and Secord over three decades ago (Guttentag & Secord, 1983), a low male-to-female sex ratio (a lack of men relative to women) disturbs the balance of power between men and women. The theory asserts that gender roles are shaped by both structural power (which nearly always favors men) and dyadic (relationship) power. The latter depends largely on the expectations each partner has of the relationship, and these expectations are tied closely to alternatives—especially in tentative or new relationships. Guttentag and Secord note that an awareness of alternatives does not take the shape of conscious calculations; rather, there exists an "unconscious assessment of the balance between outcomes, expectations, and alternatives"(Guttentag & Secord, 1983, 22). When sex ratios are low (meaning women significantly outnumber men), the dyadic power balance in heterosexual relationships shifts toward men. This occurs as a consequence of men's reduced dependence on their female partners due to the large number of alternative partners available to them.

A number of studies support the assumptions and implications of the sex ratio hypothesis. For example, a study of college undergraduates found romantic alternatives to be the single largest predictor of relationship commitment (Crawford, Feng, Fischer, & Diana, 2003). Other research has found that female students on college campuses with markedly low sex ratios indicated that women have less relationship power (Ferguson, Quinn, Eng, & Sandelowski, 2006), thought of men as less trustworthy and willing to commit to a relationship, reported in higher numbers that their relationships don't work out, and were more likely to agree with the statement that a woman cannot have a boyfriend if she will not have sex with him (Uecker &

Regnerus, 2010). Uecker and Regnerus also found that women at college campuses with low sex ratios were less likely to currently have a boyfriend, but more likely to have had sex. Some qualitative research has found that a shortage of men seems to be an indirect source of relationship power for men (Adimora et al., 2001; Senn, Carey, Vanable, & Seward, 2009).

A dyadic power shift toward men (within the larger context of male-biased structural power) may have a number of implications for sexuality and reproductive health. For one, it may decrease women's bargaining power within their sexual relationships, making it harder for them to negotiate monogamous relationships and safe-sex practices. A number of studies have found an association between low sex ratios and an increase in risky sexual behaviors including partner concurrency and reduced condom use (Adimora et al., 2013; Adimora & Schoenbach, 2005b; Pouget, Kershaw, Niccolai, Ickovics, & Blankenship, 2010). Additionally, because women may have few alternative partners, they may choose to stay longer in unsatisfying relationships or make more concessions in order to keep their partner.

Sex Ratios among African Americans

Much of the existing research on sex ratios focuses on the implications of high sex ratios- an overabundance of men- particularly in China and India (for example, see South & Trent, 2010). Some researchers have studied sex ratios cross-nationally; in one such study, Nigel Barber found a negative association between rural and urban sex ratios and the pregnancy rate for teenagers (Barber, 2001). Recent studies have found there to be significant variation in sex ratios across the United States- particularly by race (Fossett & Kiecolt, 1991; Johnson et al., 2005; South & Trent, 2010). Pouget et al. found the mean matched county-level sex ratio for non-Hispanic Blacks to be 84.8 men to every 100 women (84.8/100), 99.5/100 for whites, and

113/100 for Hispanics (Pouget et al., 2010). Older research by Robert Sampson indicates that city-level sex ratios for African Americans ranged from lows of 75/100 in Birmingham, Macon, and Yonkers to highs of 150/100 or more in Eugene, Salt Lake City, and El Paso (in Tucker & Mitchell-Kernan, 1995). In fact, the variation in sex ratios is so highly specific to African Americans that researchers have been unable to conduct within-ethnic group comparisons because of the scarcity of low sex ratios among whites and Hispanics, and the scarcity of balanced sex ratios for blacks (for example, see Adimora et al., 2013).

This racial variation in sex ratios can be at least partially attributed to disproportionately high incarceration rates among African American men. Over the last four decades, the US incarceration rate has grown at an annual rate of about 4.7 percent; this growth has been most pronounced among black men who have not completed high school (Pettit, 2012; Travis, Wester, & Redburn, 2014). According to the Bureau of Justice Statistics, Black men were six times more likely than white men to be incarcerated in 2010 (Glaze, 2011). In 2008, 37.2 percent of black men with less than 12 years of education were behind bars, compared to just 12 percent of white men without high school diplomas. In especially impacted neighborhoods, up to 25 percent of the adult male population may be behind bars on a given day (Clear, Rose, & Ryder, 2001). The disproportionate incarceration of young black men has clear implications for sex ratios. Incarceration is highly concentrated in poor African American communities; the forced relocation of young men from these neighborhoods into largely rural counties in which correctional facilities are located entails the unintended consequence of shifting sex ratios both in the county of origin and the destination county, as will be discussed in the next section.

The “marriage-squeeze” for African American women that results from a lack of marriageable men has recently received much attention in both the scholarly literature (for

example, see Crowder & Tolnay, 2000) and popular press (e.g. Price, 2011). High incarceration rates, along with increased mortality, high unemployment, and the inter-racial marriage of educated black men, have all been implicated in the relative lack of economically-attractive marriage partners for black women. At the same time, marital homogamy by race (i.e., partnering within one's own race) is particularly common among African Americans. For example, one study found that blacks are 110 times more likely to marry within their race than to marry inter-racially, 63 times more likely to cohabit with a black partner than with a partner of another race, and 46 times more likely to date someone of their own race (Blackwell & Lichter, 2004) than to date a member of another racial group.

Much of the research examining the effect of partner availability on family formation indicates a positive association between sex ratios and marriage rates (Charles & Luoh, 2010) or marital stability (Lopoo & Western, 2005). For example, Fosset and Kiecolt (1993) found the sex ratio to have a positive effect on marriage rates for African American women as well as on the percentage of marital births (Fossett & Kiecolt, 1993). Similarly, South and Loyd (1992) report a positive effect of the sex ratio on marriage- as well as divorce-rates, and find that greater mate availability is associated with a decrease in illegitimacy ratio (the ratio of nonmarital births to all births) (South & Lloyd, 1992). Further, in a study examining the effect of sex ratios on marriage rates and labor force participation for first- and second generation immigrants in the US, Josh Angrist finds that higher sex ratios are associated with higher marriage rates for both men and women (Angrist, 2002).

Studies examining the association between sex ratios and reproductive health for African Americans have turned up mixed results. While much of the research seems to indicate that low sex ratios are associated with increases in partner concurrency and STI rates, some studies have

not found significant effects of sex ratios on reproductive health (Fichtenberg, Jennings, Glass, & Ellen, 2010; Senn, Carey, Vanable, Urban, & Sliwinski, 2010) and others have even reported a *positive* effect of the sex ratio on fertility (e.g. Mechoulan, 2011). The research outlined in this paper engages with this complexity by exploring this variation in the association between the sex ratio and non-marital fertility across contexts. Specifically, I examine whether the association between sex ratios and nonmarital fertility is shaped a county's metropolitan/non-metropolitan classification and the level of county-level residential segregation.

I expect for the association between county-level sex ratios and non-marital fertility for African Americans to vary by these contextual features and test the hypotheses that:

1. There is a negative association between county-level sex ratios and non-marital fertility for African Americans in metropolitan counties

2. The strongest negative association between county-level sex ratios and non-marital fertility for African Americans exists in highly-segregated metropolitan counties

DATA AND METHODS

Data Sources

Data used for this analysis were obtained from a number of different sources. Annual county-level sex ratios by race and age group were calculated using decennial- as well as inter-censal population estimates provided by the Census Bureau; years included in this study are 2000 through 2010. Non-marital birth counts by race, age group, year, and county were obtained from the Center of Disease Control and Prevention (CDC) using the CDC Wonder tool. County-level fertility data were only available for counties with a total population size of at least 100,000. In

the case of this study, births were lagged by two years; hence, the fertility data included here consists of annual data for the years 2002 through 2012. The county-level isolation index for African Americans, a measure of residential segregation, was obtained from the University of Arizona's GeoDa Center (https://geodacenter.asu.edu) for the year 2000, and county-level estimates of the population behind bars by race were created using the 2000 and 2005 Census of State and Federal Adult Correctional Facilities, obtained through the *Interuniversity Consortium for Political and Social Research* (*ICPSR*). County metropolitan/ non-metropolitan classification data were obtained from the CDC.

Data Included in Final Analysis

When all US counties with a total population greater than 100,000 are included in the analysis, the range of the sex ratio for African Americans is exceptionally and unrealistically large (for a "naturally occurring" county population in the US), from a low of 36 to a high of 878 men to every 100 women. This range is much larger than what is usually reported in the literature. **Figure 1** indicates that the extremely high- as well as the extremely low- sex ratios are driven primarily by counties that have small black populations (left graph). Further, the graph on the right plots the county-level sex ratio against the county's total incarcerated black population (incarceration estimates by race were created using data from the Survey of Inmates in State or Federal Correctional Facilities). The plot indicates that the highest sex ratios are found exclusively in counties that house significant African American inmate populations. Further exploration of the data revealed that these are exclusively rural counties with very small African American populations but one or more all-male correctional facilities (such as Kings County, CA, Jackson County, MI, and Oneida County, NY). On the opposite extreme, the one outlier

with the lowest sex ratio is Madera County in California, a rural county with a very small African American population but three all-female prisons. The other counties reporting low sex ratios are primarily large urban centers with a significant black population, but no prisons such as Kings County, NY (Brooklyn) and St. Louis County, MI.

The fact that a significant population of African American men is counted by the census in counties in which they are not technically members of the local "relationship market" is an important consideration. This counting issue leads to particularly extreme sex ratios in mostly rural counties with small African American populations but one or more prisons. Unfortunately, precise annual county-level estimates of the population behind bars by race, age group, and sex are not available. The inmate census data that was utilized to create the plot above, while helpful, is collected only sporadically (last data collection took place in 2005). Similarly, Census estimates of the institutionalized population are only published along with the decennial census, and no county-level intercensal estimates of the incarcerated population by county are available. Given this unfortunate lack of data, I limit my analysis to include only those counties that do not house a significant African American population behind bars. The final dataset excludes any county with an incarcerated African American population greater than 500. Further, I exclude any county in which the age group-specific size of the female or male black population is below 500. When counties with very small African American populations as well as counties with a significant black population behind bars are excluded, the sex ratio ranges from a low of 61.75 to a high of 253.8 men to every 100 women. The final data file is limited to only those counties which fall between the 5^{th} and the 95^{th} percentiles for the sex ratio to exclude extreme outliers. With this final modification, the sex ratio ranges from 75/100 to 115/100, with a mean of 91.63.

Variables and Descriptive Statistics

The aim of this analysis is to assess whether age group-specific county-level sex ratios of African Americans are associated with out-of-wedlock fertility for African American women, and whether this association varies across county context. Hence, all data included in this analysis are calculated for African Americans only. Descriptions of all variables included as well as descriptive statistics are included in **Table 1**. The table includes means and standard deviations for all continuous variables as well as a frequency tabulation for the dichotomous "metro" variable.

The dependent variable consists of the *count* of births to unmarried African American women. The outcome consists of a count rather than a rate because the at-risk population (county female population), which is required to calculate a rate, is also to be included as a covariate in the analysis. County-level sex ratios are calculated by dividing the male population by the female population and multiplying by 100 for each of the five age groups included (15-19, 20-24, 25-29, 30-34, 35-39); a sex ratio of 80 can be interpreted as 80 men to 100 women in a given age group.

Covariates included in the model are the female population (logged in the analysis), as well as the county-level proportion of African Americans with an income below the poverty level and the county isolation index, a measure of segregation. Lastly, the model includes dummy variables for age group as well as year.

Research assessing the effect of the sex ratio on reproductive health has yielded inconsistent results. It is probable that this is at least in part due to the variations in "relationship environments" that depend on county characteristics such as the size and concentration of the African American population. For this reason, the models include a measure of county-level segregation as well as a dichotomous variable for whether a county is metropolitan. The isolation

index (II) is included in the model as a measure of segregation and can be interpreted as the probability that blacks will encounter others of their racial group; the higher this index is, the higher the level of segregation. The dichotomous *metro* variable indicates whether a county is classified as a central metropolitan county (located in a metropolitan statistical area (MSA) of 1 million or more residents).

It can further be hypothesized that the true effect of these two variables cannot be captured by merely adding their main effects to the model. It is likely that the association between the sex ratio and births is shaped by the level of segregation of African Americans, particularly in large urban counties. In a highly-segregated urban environment, where the concentration of African Americans is high, and the probability of encountering individuals of other racial groups is low, the relationship market may be especially closed for African Americans and the likelihood of interracial dating may be much smaller than in a more integrated urban county. Hence, the relative lack of black men may be felt especially strongly in highly-segregated urban counties. Therefore, the final model includes a three-way interaction between the sex ratio, segregation, and county metropolitan classification.

It can also be expected that the effect of the sex ratio on fertility varies by age group. Women in younger age groups may be less likely to be involved in steady relationships than older women, and may therefore be more likely to be involved in the "relationship market" and hence more affected than older women by a lack of men. Again, because this effect is not solely additive, the final model also includes an interaction term between the sex ratio and age-group. Lastly, it is likely that the effect of the sex ratio on fertility is non-linear meaning, for example, that a sex ratio of 80 men to 100 women may have a stronger effect than a sex ratio of 95 men to

every 100 women. For that reason, the final model also includes a quadratic term for the sex ratio.

Analytic Strategy

Several considerations about the outcome measure of interest are required when deciding on a modeling strategy. For one, the focal dependent variable consists of the county-level *event count* of all the births to unmarried African American women per year; hence a variant of the Poisson model is indicated. As is to be expected, this variable is highly overdispersed (mean= 220.91, SD= 418.04). Because of this overdispersion, and because the data do not have an upper bound, a negative binomial model, which incorporates a dispersion parameter, rather than a Poisson model, is the preferred statistical model in this case.

This analysis, then, models county-level births to unmarried African American women utilizing a negative binomial regression where:

$$\textit{County-level count of non-marital births for Blacks} = exp(X_i\beta)$$

and X_i is a vector of the covariates (including interaction terms) listed in **Table 1:** the M:F sex ratio , the logged county-level total female population , the percentage of African Americans living below the poverty line , the segregation index for Blacks, and the county's metropolitan classification, as well as dummy variables for year and age group. The analysis will begin with estimating a basic model (**Model 1)**. Subsequent models build on Model 1 by adding additional contextual variables and interaction terms. **Model 6** is the final model and includes all covariates as well as all interaction terms.

RESULTS

The results of the analysis are displayed in **Table 2**, and reveal a very complex association between the sex ratio and nonmarital fertility for African American women. *Model 1* is the most basic model and includes only the sex ratio as well as age group, year, and the logged female population as control variables. The results indicate a statistically-significant negative association between the sex ratio and non-marital births to African American women when age group, female population size, and year are held constant. *Model 2* includes additional contextual variables including the percent of African Americans living below poverty (percent poor), the isolation index (segregation), and a metropolitan dummy variable (metro). *Model 3* builds upon Model 2 by including a quadratic term for the sex ratio. *Model 4* further includes interaction terms between the sex ratio and age group. *Model 5* includes two additional interaction terms: the sex ratio is interacted with segregation as well as with metro, a dummy variable indicating whether a county is a central metropolitan county. Finally, *Model 6* additionally features a three-way interaction between the sex ratio, metro, and isolation.

Given the complexity of the model, and the difficulty in disentangling the effect of the sex ratio on non-marital fertility due to the inclusion of multiple interaction terms in the final model, the results are visualized in **Figures 2-5** to ease in interpretation. These three figures plot the results of *Model 6*, estimating the expected values and confidence intervals for three different county types: highly-segregated metropolitan counties, metropolitan counties with average levels of segregation, and nonmetropolitan counties.

Figure 2 visualizes the association between the sex ratio and non-marital fertility for African American women by age group for nonmetropolitan counties. Because the other predictor variables (female population size, percent poor, and the isolation index) vary greatly by

county type, they are fixed at their *means for nonmetropolitan counties*. The graph indicates that, in non-metropolitan counties, there is a curvilinear association between the sex and out-of-wedlock fertility for African American women. Importantly, counter to what the sex ratio hypothesis would predict, low sex ratios are generally associated with *lower* fertility. The slight downward trend past the parity mark for the sex ratio further indicates a negative association between the sex ratio and non-marital fertility for higher sex ratios. Interestingly, all but the oldest age group (in pink) follow roughly the same trend; there seems to be no association between the sex ratio and non-marital fertility for African American women between the ages of 35 and 39.

Figure 3 explores the association between the sex ratio and non-marital fertility for metropolitan counties with average levels of segregation (segregation level fixed at the average for all metropolitan counties at 0.26, percent poor and female population size are fixed at the mean for all metropolitan counties with average levels of segregation). As indicated by the graph, the association between the sex ratio and fertility remains curvilinear in metropolitan counties with an average level of segregation. Here, however, low sex ratios (75 men to every 100 women) are not necessarily associated with lower levels of out of wedlock childbirth. The highest levels of non-marital fertility for all but the oldest age group (35-39) seem to hover at sex ratios of 85-95 men to every 100 women. Nonetheless, there is no negative association between the sex ratio and fertility for sex ratios below parity, counter to what the sex ratio hypothesis would suggest.

Figure 4 plots the association between the sex ratio and non-marital fertility in highly-segregated metropolitan counties (segregation level fixed at the 90^{th} percentile for all metropolitan counties at 0.52; percent poor and female population size are held at the mean for

all metropolitan counties with high levels of segregation). The graph indicates that the association between the sex ratio and non-martial fertility for African American women is further complicated by the level of segregation. In highly-segregated counties, there is a strong negative association between the sex ratio and fertility, particularly for the age groups 20-24 and 25-29. Importantly, this negative association continues as the sex ratios move past parity and men outnumber women.

While these findings are interesting on their own, it is useful to imagine what they might mean empirically. **Table 3** lists the effect predicted by *Model 6* of a ten-point increase in the sex ratio on non-marital fertility for age group 20-24 in a select set of metropolitan counties. The metropolitan counties included in the table are all moderately to highly-segregated (above the 0.33 threshold). Model 6 performs fairly well in predicting the births to unmarried mothers in this age group, at times over estimating or underestimating. In each case, when the sex ratio is increased by 10 points, the predicted number of non-marital births for this age group decreases. Particularly for Cook County, this 10-point shift in the sex ratio is associated with a substantial predicted reduction of 1,886 (±161.1) births to unmarried African American mothers between the ages of 20-24 in one year.

DISCUSSION

My analysis reveals a complex association between the sex ratio and non-marital fertility at the county level. Interestingly, I find an unexpected *positive* association between the two at low sex ratios in non-metropolitan counties. Counter to what the sex ratio hypothesis would predict, in these counties, the more men there are relative to women, the more county-level non-marital births occur. Further, low sex ratios are only weakly associated with out-of-wedlock

births in metropolitan counties with average levels of segregation. This is somewhat intuitive: black women living in more integrated urban counties may be more likely to date interracially and may therefore be less affected by the lack of available partners in their own racial group.

It is only in highly-segregated metropolitan counties that the strong *negative* association between low sex ratios and non-marital fertility exists. These are precisely the kinds of counties in which one may expect the "relationship market" to be highly segregated. In this setting, the scarcity of African American men due to incarceration and high homicide rates may be felt most acutely because dating alternatives from other racial groups may not be readily available. Here, sex ratios may affect non-marital fertility via the two of Boongarts' four proximate factors, shifting power away from women and reducing their likelihood to marry and use contraception. The hypothesis that relationship power in such communities shifts toward men, making it more difficult for women- especially those not bound to their partners by marriage- to negotiate safe sexual relationships seems the most plausible in this type of a setting.

These findings help to clarify why much of the research examining the effect of sex ratios on reproductive health for African Americans may lead to inconclusive or even conflicting findings. My analysis indicates that sex ratios are only negatively associated with non-marital fertility in a very particular environment: in urban counties in which African Americans are highly segregated from other racial groups. In these counties, the black population- and with it its "relationship market"- is highly concentrated. Factors such as high incarceration rates for young African American men as well as a higher mortality rate for these men than for local women result in highly skewed sex ratios in these relationship markets. Sex ratios in highly-segregated urban counties included in this analysis are exclusively below parity and many of them well

below 100. It is precisely in this type of a dating environment that we would predict the effect of the sex ratio on fertility to be the greatest.

Clearly, one of the limitations of this project is that this is an ecological analysis of a mechanism that I hypothesize exists on the individual level. I argue that low sex ratios lead African American women in the communities most affected by incarceration to have reduced bargaining power because men have many more alternative partners available to them. However, I rely on county-level data to attempt to measure this phenomenon. While this is an obvious drawback of my analysis, and one that bars me from making any causal claims, this research project makes an important contribution precisely because of its largely descriptive nature. My intent is not to tell a causal story; rather, I want to contribute to our understanding of *how* and *where* sex ratios seem to be negatively-associated with reproductive health (in this case non-marital fertility). These findings are important in that they indicate that sex ratios for African Americans don't matter uniformly and similarly across contexts.

CONCLUSIONS

These findings make several notable contributions. Importantly, my findings suggest that, when aiming to assess the association between sex ratios and reproductive health on the county level, it is crucial to handle the counties with a significant black inmate population with care. Many of these counties are rural, with very small African American populations but several (usually all male) correctional institutions. Because the men housed at these facilities are not part of the local community, the "relationship markets" for African Americans in these counties have artificially inflated sex ratios. The preferred method of accounting for this census counting issue

would be to mathematically subtract the population behind bars from the actual resident population of these counties. However, because good annual data on the inmate population by age group, sex, and race on the county-level do not exist, this solution is not feasible. For this reason, it may be advisable to exclude all counties with a significant incarcerated African American population from future analyses.

Furthermore, my findings indicate that, when aiming to assess the effect of the county-level male-to-female sex ratio on fertility (or other reproductive health outcomes), all counties are not created equal. Attempting a broad analysis that throws all counties into one pot ignores the very different relationship/dating environments that African Americans face depending on the context in which they reside.

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TABLES AND FIGURES

TABLE 1. Variable Descriptions and Descriptive Statistics			
Variable	Measure/Coding	Mean	SD
Dependent Variable:			
Nonmarital births	Annual county-level count of births to unmarried African American women in 5-year age groups (15-19, 20-24, 25-29, 30-34, and 35-39)	***220.91***	***418.04***
Key Independent Variable:			
M:F Sex Ratio	calculated annually by age group; multiplied by 100	***91.63***	***10.29***
Other Covariates			
Female Population	County black female population by age group (logged in model)	***3784***	***6027.81***
Percent Poor	Percentage of African American individuals with income below poverty level in the last year (2000 ACS estimates used for years 2002-2004, 2009 ACS estimates used for years 2005-2012)	***0.25***	***0.08***
Segregation	Isolation Index for blacks, summed up from tracts within a county; this can be interpreted as the probability that blacks will encounter other blacks; the closer this index is to 1, the more segregated the county is (2000 estimates used for all years)	***0.17***	***0.17***
Metro	Binary variable for whether a county is a large central metropolitan county of MSA of 1million+; all other counties are coded as 0 Unique Metropolitan counties in sample: **36** (370 county-years) Unique Non-metropolitan counties in sample: **219** (2,141 county-years)		
age group	dummies for age groups 15-19,20-24, 25-29, 30-39		
year	dummies for years 2002-2012		

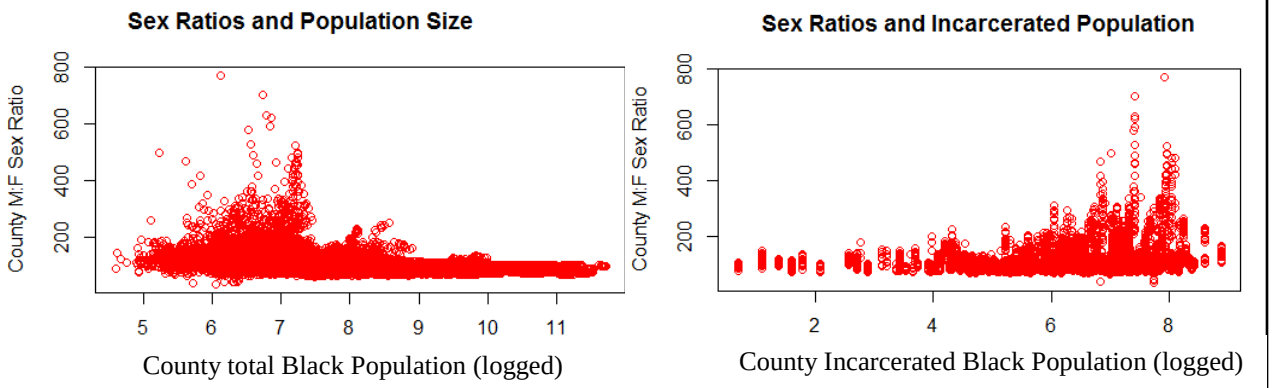
TABLE 2. Negative Binomial Regression Estimates of the Association between County-level Sex Ratios and Non-marital Births (count) for African Americans

Covariate	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Intercept	-4.28***	0.06	-5.28***	0.07	-6.05***	0.30	-2.76***	0.08	-2.77**	0.84	-2.15*	0.85
M:F Sex Ratio	-0.001***	0.00	0.003***	0.00	0.02**	0.00	-0.05**	0.01	-0.06**	0.02	-0.07***	0.01
M:F Sex Ratio ^2					-0.00008**	0.00	-0.0003***	0.00	-0.0004***	0.00	-0.0004***	0.00
Female Population Size (log)	1.00***	0.00	1.03***	0.004	1.03***	0.00	1.02***	0.00	1.02***	0.00	1.02***	0.00
Age Group												
15-19	1.45***	0.01	1.33***	0.01	1.33***	0.01	-9.54***	1.48	-11.04***	-1.47	-10.9***	1.46
20-24	2.13***	0.01	2.06***	0.01	2.06***	0.01	-0.93	1.04	-1.29	1.03	-1.35	1.02
25-29	1.66***	0.01	1.64***	0.01	1.63***	0.01	-3.79***	1.04	-4.01***	1.02	-4.12***	1.02
30-34	0.94***	0.01	0.94***	0.01	0.94***	0.01	-4.44***	1.04	-4.59***	1.02	-4.64***	1.02
35-39 (comparison)	-	-	-	-	-	-	-	-	-	-	-	-
Contextual Variables												
Percent poor			1.89***	0.04	1.88***	0.04	1.88***	0.04	1.86***	0.04	1.87***	0.04
Isolation Index			0.05*	0.02	0.05*	0.02	0.06**	0.02	1.75	1.71	-2.85	2.05
Metro (dummy)			0.004	0.01	0.004	0.01	0.007	0.01	0.97	0.79	-1.76	1.24
Interactions:												
Sex Ratio x Age 15-19							0.22***	0.03	0.26***	0.03	0.25***	0.03
Sex Ratio x Age 20-24							0.07**	0.02	0.08***	0.02	0.08***	0.03
Sex Ratio x Age 25-29							0.12***	0.02	0.13***	0.02	0.13***	0.03
Sex Ratio x Age 30-34							0.12***	0.02	0.13***	0.02	0.13***	0.03
Sex Ratio^2 x Age 15-19							-0.001***	0.00	-0.001***	0.00	-0.001***	0.00
Sex Ratio^2 x Age 20-24							-0.0004**	0.00	-0.0004***	0.00	-0.0005***	0.00
Sex Ratio^2 x Age 25-29							-0.0007***	0.00	-0.0007***	0.00	-0.0008***	0.00
Sex Ratio^2 x Age 30-34							-0.0007***	0.00	-0.0007***	0.00	-0.0007***	0.00
Sex Ratio x Isolation									-0.02	0.04	0.08	0.04
Sex Ratio ^2 x Isolation									0.00003	0.00	-0.0005*	0.00
Sex Ratio x Metro									-0.01	0.02	0.05	0.03
Sex Ratio^2 x Metro									0.000003	0.00	-0.0003	0.00
Metro x Isolation											12.55***	3.75
Sex Ratio x Metro x Isolation											-0.27**	0.08
Sex Ratio^2 x Metro x Isolation											0.001**	0.00
AIC	109692		107775		107771		107690		107399		107312	
LL	-54828.21 (df=18)		-53866.72 (df=21)		-53863.29 (df=22)		-53814.94 (df=30)		-53665.38 (df=34)		-53618.81 (df=37)	
n	10,772											

Note: the categorical variable year was excluded from the table for brevity and because it does not comprise an important theoretical component of this analysis

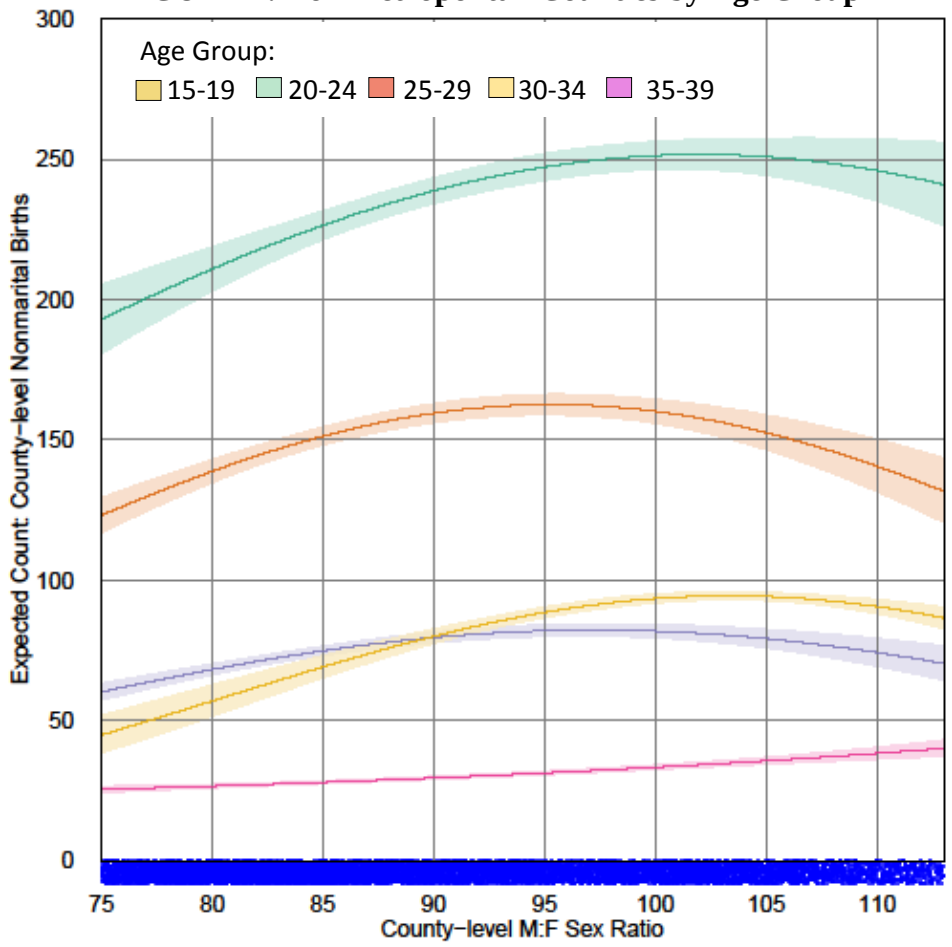
Table 3: Expected and Predicted Non-marital Births to African American Women Ages 20-24, High-Segregation Metropolitan Counties					
	Actual Sex Ratio	Actual births, year 2005	Predicted births, year 2005	Predicted number of unmarried births with 10-unit increase to the sex ratio	Predicted decrease in nonmarital births with increase of sex ratio
Cook County, IL (Chicago)	89.88	6,024	6,441 (±135.3)	5,645 (±125.8)	1,886 (±161.1)
Bronx County, NY	92.24	2,384	2,722 (±59.6)	2,392 (±56.8)	330 (±116.4)
Philadelphia County, PA	89.57	3,816	3,602 (±61.0)	3,274 (±60.9)	214 (±121.9)
Milwaukee County, WI	86.97	1,877	1,601 (±25.8)	1,454 (±25.2)	147 (±51)

FIGURE 1. Sex Ratio for African Americans and Select County Characteristics: all counties



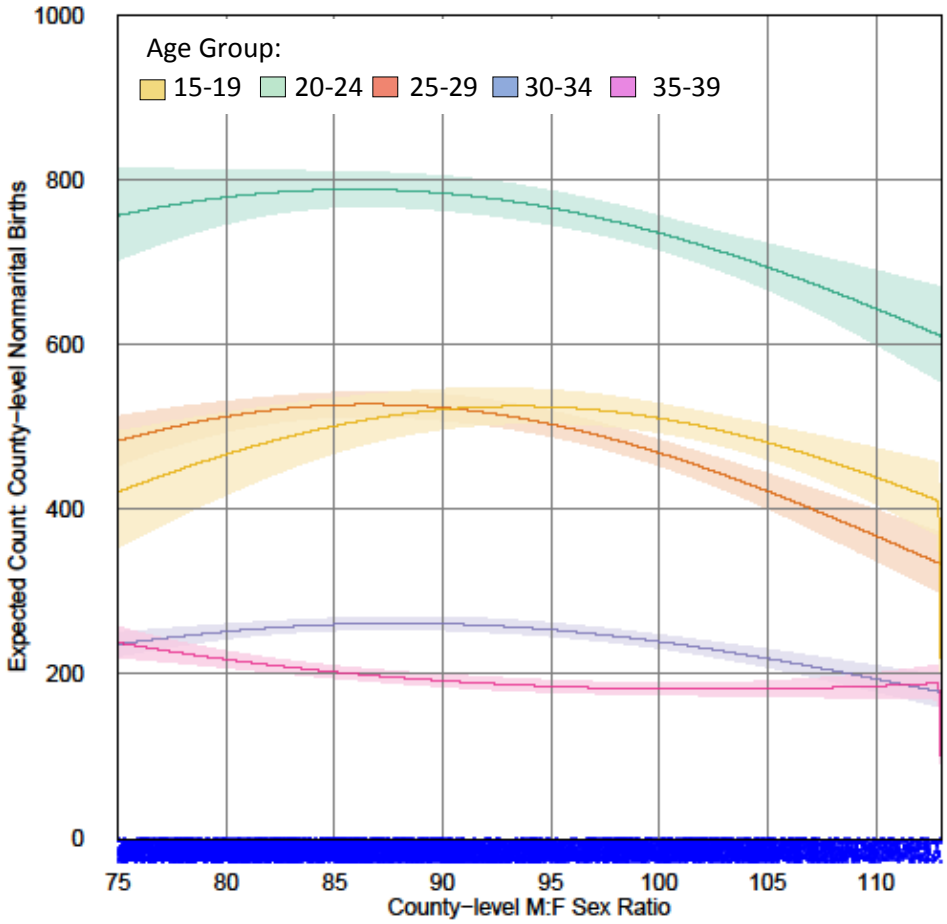
Sex ratios plotted against (logged) county total black population size (left) and the total (logged) black incarcerated population (right).

FIGURE 2: Non-metropolitan Counties by Age Group



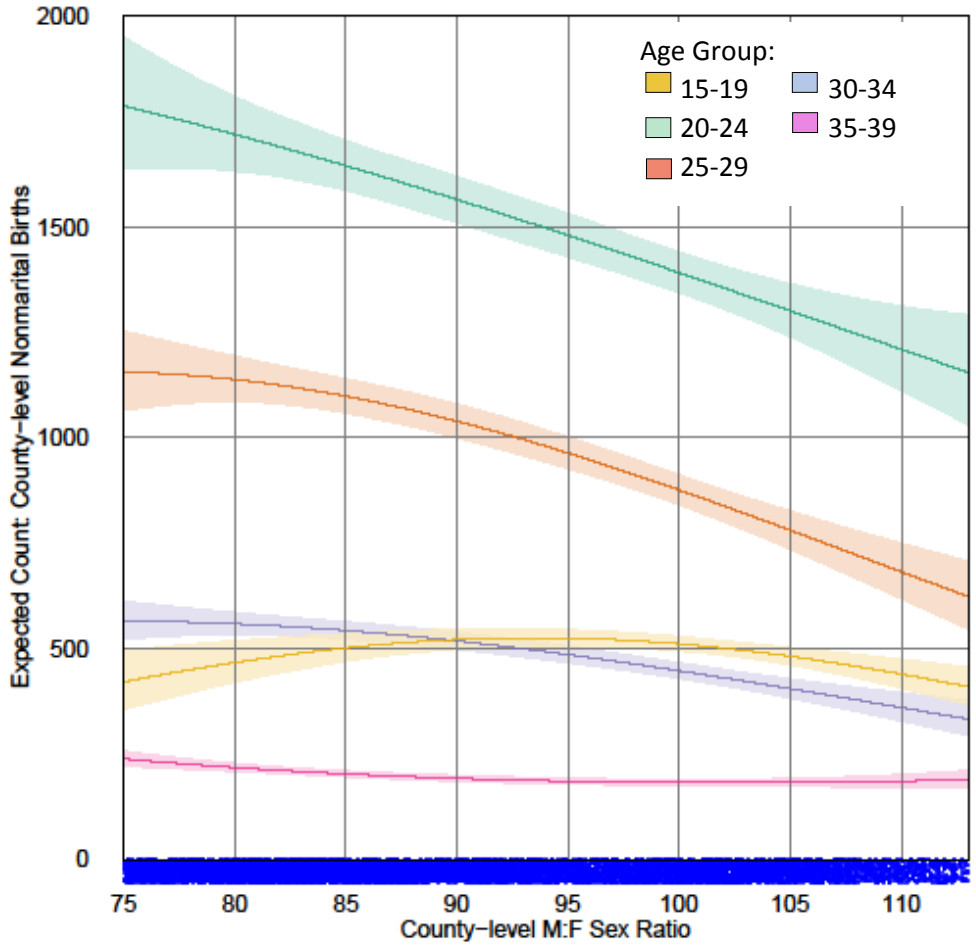
Negative binomial estimates of the effect of county-level sex ratios on the number of county-level births to unmarried African American women in non-metropolitan counties (all other variables (female population size, percent poor and segregation held at their mean for this county type).

FIGURE 3: Metropolitan Counties, Average Segregation by Age Group



Negative binomial estimates of the effect of county-level sex ratios on the number of county-level births to unmarried African American women in metropolitan counties with average levels of segregation (female population size, percent poor and segregation held at their mean for this county type).

FIGURE 4: High Segregation Metropolitan Counties by Age Group



Negative binomial estimates of the effect of county-level sex ratios on the number of county-level births to unmarried African American women in highly-segregated metropolitan counties (segregation held at the 90th percentile for metropolitan counties- an isolation index of 0.52; other variables are held at the mean for this particular county type.