A Decomposition of the Black-White Differential in Birth Outcomes

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Abstract: Substantial racial disparities continue to persist in the prevalence of preterm births and low-birth-weight births. Health policy aimed at reducing these disparities could be better targeted if the differences in birth outcomes are better understood. This study decomposes these racial disparities in birth outcomes to determine the extent to which the disparities are driven by differences in measurable characteristics of black mothers and white mothers as well as the extent to which the gap results from differences in the impact of these characteristics. The analysis is focused on three adverse birth outcomes: preterm, early preterm birth (less than 32 weeks gestation), and low birth weight. The results suggest that differences in covariates accounted for approximately 25 percent of the gap in the incidence of preterm births. The specific characteristics that matter the most are marriage rates, father's characteristics, and prenatal care. For gestation-adjusted birth weight, approximately 16 percent of the racial gap for first births is explained by covariates; for subsequent births this covariate explanation rises to 22 percent of the gap. Furthermore, differences in coefficients explain about another quarter of the gap in preterm birth outcomes but very little of the gap in birth weight.

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1. Introduction

The substantial racial disparities in birth outcomes between whites and blacks are well documented. In 2007, 18.3% of births to black mothers were preterm (less than 37 weeks gestation) compared to 11.5% of white mother births.[1] A similar pattern holds for low birth weight (less than 2500 grams); 13.8% of black infants were born low birth weight compared with 7.2% of white infants in 2007 (Hamilton et al. 2009). Low birth weight and preterm infants are at a higher risk for health problems and death relative to full-term and heavier infants. Infant deaths occur disproportionately among these infants, accounting for over two-thirds of infant deaths in 2005 while low birth weight infants accounted for about 8% of live births and preterm infants accounted for about 12% of live births (Matthews and MacDorman 2008).

Racial disparities in birth outcomes have been attributed to black mothers having, on average, lower socio-economic status (SES) than white mothers (Oliver and Shapiro 1995, Zeitlin et al 2002, Raatikainen et al. 2005); being less likely to receive adequate prenatal care than white mothers (IOM 2007); and, having different health behaviors and experiencing higher levels of stress than white mothers (Lu and Halfon 2003, Geronimus 1996, IOM 2007). Empirical evidence indicates that these disparities increase with maternal age. This has been attributed to weathering; or the physical consequences of social inequality that leads to "early health deterioration" among black mothers (Geronimus 1996; Raus et al. 2001; and Wildsmith 2002).

[1] White and black in this analysis refers to non-Hispanic white and non-Hispanic black.

In spite of the volume of research on the topic, there is still much to be learned about how differences in characteristics across races impact birth outcomes. Specifically, health policy aimed at reducing disparities in birth outcomes could be better targeted if we understood whether differences in birth outcomes are driven by the variation in the characteristics of the two populations or whether it is the differences in the effects of those characteristics that matter. We use analytical methods from the labor economics literature that were originally used to decompose male/female differences in wages and apply these methods to decomposing racial disparities in birth outcomes. This decomposition allows us to measure the extent to which racial disparities in birth outcomes are driven by differences in measurable characteristics as well as the extent to which the gap results from differences in the impact of these characteristics on birth outcomes. We focus on three adverse birth outcomes: preterm and early preterm birth (less than 32 weeks gestation) as well as low birth weight.

This study uses a rich data set consisting of Vital Statistics birth records from the State of Georgia for the period 1994 to 2002 linked with three sets of state administrative records and the Public Use Microsample of the Census (PUMS). These data allow us to link employment characteristics and public program participation to the birth records, thus providing more information on the socioeconomic status of the mother, specifically work and welfare status.

While the data are limited to births in the State of Georgia, this analysis likely has wider relevance as the same racial gaps that exist nationally are present in Georgia. In both Georgia and the U.S., preterm births between 1994 and 2002 (the period of analysis) were 1.7 times higher for black births than white and early preterm births were 2.5 times higher for black births than white. For the U.S., low birth weight births were 2.19 times as high for black births as white births, whereas in Georgia it was 2.13 times higher for black births than white births. Our results indicate that approximately 25 percent of the black-white gap in the incidence of preterm birth is explained by the covariates, with most of this attributable to differences in marital status and reported characteristics of the father. For birth weight adjusted by gestation length, the results show that only around 20 percent of the black-white gap can be attributed to the covariates. The estimates for differences in the coefficients, or the effects of the covariates on outcomes, indicate that these account for about another 20 percent of the gap in preterm birth, but virtually none of the gap in gestation adjusted birth weight. Approximately half of the racial gap in birth outcomes remains unexplained. These results contribute to the conversation about decreasing racial health disparities by suggesting that bringing black women's socio-economic characteristics in line with those of white women will not be sufficient to close the racial gap in birth outcomes. In addition, the results demonstrate that even using a robust set of socio-economic, behavioral, medical, and contextual variables will leave about half the gap unexplained, suggesting that there are important factors as yet unmeasured.

2. Empirical Model

The probability of a preterm birth is determined by the following reduced-form stochastic equation:

$$\Pr(N_i = 1|x,\ yr) = f(\alpha_0 + x'_{i1}\alpha_1 + x'_{i2}\alpha_2 + x'_{i3}\alpha_3 + x'_{i4}\alpha_4 +\ yr_{it}\alpha_5) + \epsilon_{1i}$$

where each x_{ij} represents a vector of variables for covariate group. The variables denoted yr_{it} represent year dummy variables that take the value 1 for the year in which the birth occurred, which are included to capture any unobserved year-specific influences. This equation is estimated both as a linear probability model and using probit maximum likelihood. The equation was estimated separately for both preterm births (gestations less than 37 weeks in length) and early preterm births (gestations less than 32 weeks. The reason being that although the majority of preterm infants are born between 32 and 36 weeks, infants born prior to 32 weeks of gestation account for a disproportionate share of mortality and health care expenditures (IOM 2007). Thus from the standpoint of public health and public health policy, it is important to distinguish between preterm births (gestations less than 37 weeks in length) and early preterm births (less than 32 weeks).

Birth weight is adjusted for gestation length using the gender-specific percentile ranking of birth weight for a given length of gestation as computed by Oken at al. (2003), which allows for the disentanglement of the racial gap without the concern over the endogeneity of length of gestation. We estimate the following:

$$(1) \quad PCrank_i = \beta_0 + x'_{i1}\beta_1 + x'_{i2}\beta_2 + x'_{i3}\beta_3 + x'_{i4}\beta_4 + \ yr_{it}\beta_5 + \epsilon_{2i}$$

The age of the mother is broken into five categories in order to capture any nonlinearity in the data and to capture changes in birth outcomes over the life cycle due to aging. If the weathering hypothesis holds, one would expect the negative effect of advancing maternal age on birth outcomes to grow at a faster rate in the black model than in the white. Higher levels of education should be correlated with higher income and thus are expected to improve birth weight and lower the probability of preterm birth. Similarly, one might expect that marriage would confer positive effects as well. Previous research (Raatikainen et al. 2005, Waldron et al. 1996) attributes the positive effects of marriage on birth outcomes to the benefits associated with having a social support system, as well as improvements in financial security.

The effects of having health insurance through Medicaid and the receipt of income through AFDC/TANF on birth outcomes are unclear. That is, the positive effects of health care coverage and income may be offset by the effect of low income that is required to qualify. Thus, the effect of these variables cannot be determined a priori. Likewise, one could speculate that the stress of working would correlate with adverse birth outcomes, at least in some industries, but again the financial benefit could offset that effect. The medical risk factors, including cardiac disease, diabetes, renal disease, acute or chronic lung cancer, and chronic hypertension are expected to increase the probability of preterm birth and act to lower birth weight, with the exception of diabetes can lead to increased birth weight (Gillman et al. 2003).

Both length of gestation and birth weight are expected to increase if adequate prenatal care is received.[2] However, previous empirical findings have been mixed.[3] This is likely due to the benefits of prenatal care accruing primarily to women with complicated pregnancies with most normal pregnancies unaffected by prenatal checkups (Conway and Deb 2005). Furthermore, the medical literature has not consistently found prenatal care to be effective at preventing preterm birth (IOM 2007).

The state unemployment rate is used to capture any external economic stressors that may differ over time, while the characteristics of the mother’s county of residence are used to capture contextual variables that could affect birth outcomes.

2.1 Decomposition

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[2] Unfortunately, the data contain no information on the quality of prenatal care received, just information on the number and timing of visits. These data are used to compute the Kotelchuck (1994) index.

[3] For example, see Currie and Grogger, 2000, Kaestner 19999, or Grossman and Joyce 1990.

Decomposition methods developed by Oaxaca (1973) have been used in the labor economics literature to assess wage discrimination between various groups (e.g. male versus female or union versus nonunion). In applying the decomposition methods, wage equations are estimated for both groups, then the estimates are used to decompose theobserved wage differential into components that are explained by differences in observed factors (typically referred to as the endowment effect) and by differences in the estimated coefficients (often referred to as the coefficient effect or the discrimination effect). In the case of birth outcomes, the coefficient effect is not measuring a discrimination effect, but rather the differential effect of socioeconomic and health characteristics on the probability of preterm birth and the gestation-adjusted birth weight. The decomposition for a linear equation can be written as

$$\overline{\hat{y}_B - \hat{y}_W} = \hat{\beta}'_W(\bar{X}_W - \bar{X}_B) + \overline{X'}_B(\hat{\beta}_W - \hat{\beta}_B), \qquad (3)$$

where y_k represents the birth outcome variable for group k, and $\bar{X}_k$ represents the vector of average values for the covariates for group k. The vectors $\hat{\beta}_k$ are the estimated parameters for the groups.[4] In this case the groups are the two racial groups of mothers, with white mothers as the reference group.

Each term on the right hand side of equation (3) is further broken down so that we can measure the separate contributions of the characteristics of the mother; age, level of education, marital status, several income-related variables, the characteristics of the father, prenatal care, health risks, health behavior, and geographic characteristics of the county and the state unemployment rate. Because the covariates include a number of

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[4] The preterm birth and early preterm birth equations were estimated using linear probability models and using probit. The probit estimates are of course nonlinear, so that the decomposition written in equation (3) does not apply. We computed the nonlinear decomposition derived by Yun (2004). The overall decomposition can be written $\overline{\hat{y}_B - \hat{y}_W} = [\overline{F(X_B\beta_W)} - \overline{F(X_W\beta_w)}] + [\overline{F(X_B\beta_B)} - \overline{F(X_B\beta_w)}]$.

categorical variables, we transform the dummy variables prior to estimation, as proposed by Gardeazabal and Ugidos (2004), so that the decomposition results will not depend on the choice of the base category.

3. Data

This paper utilizes Vital Statistics birth records from the State of Georgia for the period 1994 to 2002 linked with two sets of state administrative records and the Public Use Microsample of the Census (PUMS). The Individual Wage File is compiled by the Georgia Department of Labor for the purposes of administering the state's Unemployment Insurance (UI) program. The third administrative data set is the State of Georgia Welfare data, which includes information on AFDC/TANF disbursements to the mother. All the data used in the analysis are highly confidential and strictly limited in their distribution.

The Vital Statistics live birth records contain information on the demographic characteristics for the mother and father; the timing and utilization of prenatal care, health behavior during pregnancy; medical risk factors, and Medicaid status at time of birth. The Individual Wage File contains quarterly earnings information for approximately 97 percent of non-farm workers in the state. The worker's employment information is tracked over time and is linked to the vital records data, along with the AFDC/TANF data, using an individual identifier.

The data means for all black and white mothers for first and subsequent births with non-missing data who gave birth in Georgia to a singleton in the years 1994-2002, are presented in Table 1. Because the focus of this research is racial disparities, the means are also presented by race. For first births, there are 246,170 births to white mothers and

132,048 births to black mothers. For subsequent births, there are 306,894 births to white mothers and 195,474 births to black mothers.

[Insert Table I here]

The health outcomes considered are the probability of a preterm and early preterm birth as well as gestation adjusted birth weight. Preterm birth is assigned a value of 1 if the length of gestation was less than 37 weeks and early preterm birth is assigned a value of 1 if length of gestation is less than 32 weeks.

The infant is assigned a percentile ranking based on birth weight, the length of gestation, and gender. Thus an infant born weighing five pounds at 28 weeks of gestation would achieve a higher percentile than a five pound infant born at 36 weeks.

The rate of preterm singleton first births in Georgia averaged 8.8% for white mothers and 13.5% for black mothers between 1994 and 2002. The rate for subsequent births was slightly lower for white mothers, 8.0% and slightly higher for black mothers, 14.3%, in the same time period. Figure 1 shows the shares of births that were preterm in Georgia over this time period, disaggregated by first birth, subsequent birth, and race. The share of preterm births to black mothers was constant to slightly declining throughout the 1990s, with a shift up in 2000, which is consistent with the national data. For white mothers the share of preterm births shows a steady upward trend throughout the time period, also consistent with the national data. The disparity between black and white mothers experiencing a first birth fell from a difference of 8.1 percentage points in 1994 to just under a six percentage point difference in 2002, although the declines are driven by an increase for white mothers rather than a decrease for black mothers. For subsequent births, the difference fell from just over six percent in 1994 to just over four percent in 2002. For subsequent births, a decline of early preterm births to black mothers and an increase in early preterm births to white mothers contributed equally to the reduction in the gap.

[Insert Figure 1 here]

Figure 2 displays the percent of singleton births that were early preterm in Georgia for 1994-2002. The rates of early preterm first births averaged 2.0% for white births and 4.8% for black births. For subsequent births, the rate of early preterm birth is lower for both racial groups, with 1.6% for white births and 4.3% for black births. The share for white births remained relatively stable while the percent for black births exhibited almost a percentage point decline. As is apparent, substantial racial disparities continue; black mothers have, on average, two and a half times the share of early preterm births relative to white mothers over this time period. Between 1994 and 2002, the racial gap in early preterm births fell from 2.7 percentage points to just less than two percentage points.

[Insert Figure 2 here]

Figure 3 shows the percent of births that were low birth weight in Georgia for 1994-2002. The rate for black mothers over this period is, on average, more than twice as large as the rate for white mothers. However, the ratio has declined recently due to the increasing rate of low-birth weight births for white mothers while the rate for black mothers has remained relatively stable.

[Insert Figure 3 here]

The Georgia data display the same maternal age trends found in the national data; the rate of preterm births for black mothers is higher at all ages relative to white mothers, and increases at a faster rate with age for all. For both groups, the share of births delivered preterm declines with age for a period and then begins to increase.

Prenatal care is measured with four categorical variables, based on the Kotelchuck index; inadequate, intermediate, adequate, and adequate plus/high risk.[5] The data indicate that black mothers are much more likely to receive inadequate prenatal care than white mothers, 15 percent versus less than six percent. White mothers are more likely to be classified as high risk, almost 34 percent, as compared to 31 percent of black mothers.

A woman is defined as being in the workforce if she worked in the year prior to the birth quarter. This definition of workforce participation is designed to capture women who are forced to take time out of their job due to pregnancy related issues and to remove issues of seasonality from the data.[6] The share of mothers in the work force is similar across racial groups. A mother is classified as covered by Medicaid if she received Medicaid coverage for the birth of her child. Among black women, 63 percent of births were covered by Medicaid, compared to 32 percent of white births. A mother is considered to be covered by AFDC/TANF if she received any funds in the quarter of birth, with 15.4 percent of black mothers covered by AFDC/TANF at birth compared to 3.1 percent of white mothers.

White mothers are more educated than black mothers, on average and are more likely to be married or, if single, are slightly more likely to name a father on the birth certificate. The smoking and alcohol dummy variables are equal to one if the mother

[5] The Kotelchuk, or the Adequacy of Prenatal Care Utilization Index, measures the adequacy of prenatal care utilizing information on both the timing and the amount of prenatal care visits. A mother is classified as either having inadequate, intermediate, or adequate amounts of prenatal care. A mother that receives 110% or more above the recommended number of visits is regarded as having a high risk pregnancy. This classification allows for the disentanglement of high risk pregnancies receiving more care and the benefits of more prenatal care to the average mother (Kotelchuk 1994)

[6] For example, if a woman gave birth in Quarter 1 of 2000 the prebirth labor force status would be based on Quarters 1 through 4 of 1999.

indicated the use of tobacco or alcohol during pregnancy. White mothers reported smoking while pregnant at three times the rate of black women; both races reported similar rates of alcohol consumption.

White mothers, on average, report fewer previous live births. Very few mothers of any race had one of the documented medical risk factors; cardiac disease, diabetes, renal disease, hypertension, or lung disease.

4. Results

In this analysis, both the probability of preterm birth and early preterm birth, as well as the birth weight equations, are estimated separately for first births and subsequent births, due to possible selection problems as women with poor outcomes from the first pregnancy are less likely to have subsequent pregnancies (Li and Poirier 2000). The covariates are grouped by the mother's socio-economic characteristics, the mother's health and behavior variables, the father's characteristics, contextual variables, and time effects. Race is fully interacted, so there are different sets of coefficients for each subsample: non-Hispanic white and non-Hispanic black.[7] Furthermore, given the complications associated with multiple births, the analyses is limited to singletons. These results, which are available from the authors, are used in the racial decomposition. An assessment of our regression results indicates that the estimated coefficients are consistent with findings in the literature and support the relevancy of the decomposition performed using Georgia data to the rest of the nation.

Decomposing our findings allows for the systematic assessment of racial disparities in birth outcomes. Decomposition results are reported in Tables 2 and 3.

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[7] The characteristics and size of the Hispanic population in Georgia changed dramatically in this time period, thus making it difficult to measure relative effects over time.

These decompositions are carried out based on the linear probability model estimates of the probability of preterm birth and the OLS estimates for percentile birth weight rank.[8] In this analysis, the reference group is white mothers.

[Insert Tables II and III here]

4.1 Preterm Birth

The decomposition model predicts that 13.5 percent of first births to black mothers will be preterm, compared to 8.8 percent of first births to white mothers, a difference of 4.77 percentage points.[9] The findings suggest that approximately 25 percent of this disparity is explained by differences in endowments, with differences in slope coefficients and the constant term explaining the remainder. Put differently, if black mothers had the same average values for the covariates as do white mothers, the gap in the incidence of preterm births would fall by 1.2 percentage points or approximately 25 percent of the gap would disappear.

The decomposition details reveal that the characteristics that contributed the most to the racial disparity in preterm births are marital status, father's characteristics, and prenatal care. If black women reported father's names and marriage at the same frequency as white women, the gap in the incidence of preterm birth for first births would be reduced by approximately 16% and the gap in early preterm births would be reduced by 10%. Similarly, if the average characteristics of the fathers for the black sample equaled those for fathers from the white sample, then the gap would fall by over 12 percent for preterm birth and nearly 18 percent for early preterm birth. The effect of

[8] The nonlinear decomposition results, which are virtually identical to the ones presented here, are available from the authors.

[9] The discussion of results focuses primarily on the results for first births, although the full results are provided in Tables 2 and 3.

prenatal care is smaller; if black women received the same levels of prenatal care as white women the disparity in preterm births would be reduced by 5.4% (2.8% for early preterm).

The age variables and the behavioral variables show different results. If black women's age profile was the same as that for white women, the racial disparity would actually worsen. This is attributed to the fact that there are more white women in the older age categories having a first birth than there are black women, with no significant difference for subsequent births. Similarly, many more white women report smoking during pregnancy; if black women were to smoke cigarettes at the same rate as white women, the racial disparity in birth outcomes would increase.

The decomposition details reveal that the age, education, and marriage estimates make the most substantial contributions to the coefficient gap. The effect of the age coefficient, in general, increases the racial disparity in birth outcomes. To clarify this result, we stratified the age variable into separate variables for five-year categories and re-estimated the model. This revealed that the racial differences in the coefficients occur mostly in the younger-, rather than the older-, age groups. Coefficients on the education variables, taken as a group, narrow the gap; if black women's characteristics are evaluated with the coefficients from the white sample, the gap narrows somewhat.

Married includes both a binary variable indicating whether the mother provided a father's name, as well as a binary variable indicating marriage. We find that if these variables had the same impact on preterm birth for black women as they do for white women, the racial gap would narrow for first births, but would actually widen for subsequent births. This latter finding might seem surprising given the generally beneficial effect of marriage and the father's name variable on preterm birth for both black and white women. It is likely attributed to the fact that the contribution of the coefficients is measured as the means of the covariates for the black sample, and many more black women move into the married category for subsequent births.

There is one notable difference in our findings for early preterm birth. The coefficient effects for prenatal care were not statistically different for preterm birth but were statistically significant in explaining racial differences in early preterm birth. The results indicate that the racial disparity would decline by about 1 in 20 early preterm births if prenatal care had the same impact on outcomes for black women as it does for white women. This suggests that the quality of prenatal care is better, on average, for white mothers than black mothers.

The decomposition results for subsequent births are quite similar to those for first births, in terms of both covariates and coefficients. The primary difference is that the models for subsequent births include covariates to control for the mother's past birth outcomes. The past outcomes include birth interval, previous live births, previous live births now deceased, fetal deaths, and previous low birth weight or preterm births. Black women have higher average values for both previous live births and previous live births now deceased. Thus, if the means of these variables equaled those of white women, the racial disparity in preterm births would narrow. The decomposition on the coefficients, however, indicates that it is the effect of previous fetal deaths and previous poor birth outcomes that contributes most to the racial disparities for both preterm and early preterm births. Once more these findings suggest that white women experiencing previous poor birth outcomes receive better prenatal care, on average, than black women.

4.2 Gestation-Adjusted Birth Weight Percentile Ranking

Infants born to white mothers in Georgia have an average predicted birth weight percentile ranking of 49.5 for first births while first infants born to black mothers have an average ranking of only 37.7, an 11.8 percentile difference. For subsequent births, the predicted birth weight percentile rankings were 55.7 (white mothers) and 43.4 (black mothers). Only about 16 percent of this difference can be attributed to differences in the covariates (22% for subsequent births), with another 10 percent due to differences in the coefficients, leaving the remainder unexplained.

The groups of covariates that make the largest contribution to the racial disparity in gestation-adjusted birth weight are similar to those that contributed most to the racial disparity in preterm birth, that is, mother's education, marital status, and prenatal care. Birth weights for infants born to black mothers would improve if these aforementioned characteristics had the same mean values as in the sample of white mothers. Father's characteristics are shown to affect birth weights for subsequent births, but not first births. The family income variables also affect the racial disparity in birth weight, which differs from the results for preterm births. If black mothers had the same health behavior as white mothers, the racial disparities would increase, as white women have a higher prevalence of smoking during pregnancy.

Differences in the coefficients contribute very little to the racial disparity in birth weight. The effects of the behavior variables widen the gap slightly, most likely due to the stronger impact of tobacco use on birth weights for infants born to black mothers. The coefficients on the variables in the income group would serve to widen racial disparities in birth weight rankings for subsequent births if the effect of these variables for black mothers equaled the coefficients on the variables in the analysis on white mothers. This comes from the estimates that indicate that receipt of Medicaid or AFDC/TANF benefits leads to much poorer birth weight outcomes for babies born to white mothers than to black mothers.

4.3 Discussion

For each decomposition, the results indicate that the constant term makes a large contribution to the racial disparity. This suggests that even with a rich set of covariates, after quantifying the contribution of characteristics and the impact of these characteristics, unmeasured differences account for most of the racial disparities in birth outcomes. The weathering hypothesis, which suggests that older black women have worse health outcomes due to the lifetime accumulation of stress, is a possible explanation. If the weathering hypothesis holds then one might expect the constant term on our models to account for a larger share of the racial disparities in birth outcomes at older ages. To examine this possibility, each of the three models was estimated by age group and a decomposition of the racial outcomes was performed. These results provide mixed support for stress/weathering as an explanation for the outcomes gap.

Moreover, the point estimates for preterm birth show that the contribution of the constant towards explaining the racial disparity increases as the mothers' age group increases. This effect is not precisely estimated for most samples. The contribution of the constant term is statistically different from zero only for mothers between the ages of twenty-six and thirty. For this age group, the estimated contribution of the constant term is very large and statistically significant, perhaps suggesting that the covariates in general have less explanatory power for birth outcomes for this age group. In the birth weight percentile ranking model, the constant term is statistically significant and positively associated with racial differences in rank only in the younger age groups, i.e. thirty and under. This suggests that the unmeasured factors matter more to younger than older mothers, and thus does not support the weathering hypothesis.

In general, if black mothers had the same endowment and the same coefficients on socioeconomic characteristics as the white mothers, including education, marital status, income, father's characteristics, and the characteristics of the county in which the mother lives, then the racial disparity in preterm and early preterm birth would be reduced by approximately 50%. For gestation adjusted birth weight, the disparity would be decreased by more than 60% if the black mothers had the same endowment as the white mothers, although if the coefficients were the same the racial disparity would increase.

5. Summary and Conclusions

In this research, racial disparities in birth outcomes are examined using decomposition techniques. These methods allow for the separation of the impact of differing characteristics of black and white mothers from the difference in the impact these characteristics have on outcomes. Using Vital Records data from Georgia over the period 1994 through 2002 merged with employer and Census data, equations for three birth outcomes were estimated: the probability of a preterm birth (fewer than 37 weeks gestation), the probability of an early preterm birth (fewer than 32 weeks gestation), and gestation-adjusted birth weight. The analyses were performed separately for first births and subsequent births due to selection for subsequent births and in order to control for women's previous birth outcomes in the subsequent birth.

The results indicated that differences in covariates accounted for approximately 25 percent of the gap in the incidence of preterm births. The specific characteristics that matter the most are marriage rates, father's characteristics, and prenatal care. For gestation-adjusted birth weight, approximately 16 percent of the racial gap for first births is explained by covariates; for subsequent births this rises to 22 percent of the gap. Furthermore, differences in coefficients, meaning the measure of the impact these covariates have on outcomes, explain about another quarter of the gap in preterm birth outcomes but very little of the gap in birth weight. One interesting finding was the difference in the impact of prenatal care in the probability of early preterm births; the impact of previous poor birth outcomes are stronger for black mothers than for white mothers, which suggests that white women with previous poor outcomes may receive better prenatal care, on average, than black women.

While this analysis makes progress in the goal of understanding racial disparities in birth outcomes, fully half the racial gap in outcomes is not explained by either the values of the covariates or the estimated effects of the covariates in spite of the rich set of covariates included in our models,. This suggests that although policies aimed at increasing access and quality of prenatal care or increasing the level of education for black mothers will work to eliminate a large portion of the racial gap, it will not fully address the racial disparities in outcomes.

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Table I
Means by Race
(std. error)

	First Births		Subsequent Births	
	white	black	white	black
Preterm (< 37 weeks)	0.0876	0.1353	0.0804	0.1428
	(0.2827)	(0.3421)	(0.2719)	(0.3499)
Early Preterm (< 32 weeks)	0.0205	0.0476	0.0155	0.0434
	(0.1418)	(0.2129)	(0.1233)	(0.2037)
Birth Weight Percentile Rank	49.5491	37.7318	55.5770	43.3973
	(28.5402)	(27.4159)	(28.6052)	(28.3368)
Mother's Characteristics				
Age < 20	0.2644	0.4704	0.0683	0.1553
	(0.4410)	(0.4991)	(0.2523)	(0.3622)
Age 20 to 25	0.2595	0.2632	0.2339	0.3342
	(0.4384)	(0.4404)	(0.4233)	(0.4717)
Age 26 to 30	0.2767	0.1523	0.3022	0.2531
	(0.4474)	(0.3593)	(0.4592)	(0.4348)
Age 31 to 35	0.1497	0.0821	0.2739	0.1732
	(0.3568)	(0.2745)	(0.4460)	(0.3784)
Age36 to 40	0.0441	0.0282	0.1078	0.0733
	(0.2053)	(0.1657)	(0.3101)	(0.2606)
Age > 40	0.0056	0.0038	0.0140	0.0110
	(0.0744)	(0.0618)	(0.1174)	(0.1042)
Less than High School	0.1778	0.2850	0.1639	0.2289
	(0.3824)	(0.4514)	(0.3702)	(0.4201)
High School	0.2937	0.3428	0.3318	0.4190
	(0.4555)	(0.4746)	(0.4709)	(0.4933)
Some College	0.2045	0.2187	0.2169	0.2366
	(0.4033)	(0.4134)	(0.4121)	(0.4250)
College or Graduate Degree	0.3239	0.1534	0.2874	0.1158
	(0.4679)	(0.3604)	(0.4526)	(0.3200)
Female	0.4870	0.4929	0.4882	0.4945
	(0.4998)	(0.5000)	(0.4999)	(0.5000)
Married	0.7533	0.2503	0.8547	0.3812
	(0.4311)	(0.4332)	(0.3524)	(0.4857)
Father Named	0.1450	0.3832	0.0905	0.2972
	(0.3521)	(0.4862)	(0.2869)	(0.4570)
Medicaid	0.3321	0.6480	0.3133	0.6262
	(0.4710)	(0.4776)	(0.4638)	(0.4838)
Received AFDC/TANF Benefits	0.0224	0.1303	0.0379	0.2395
	(0.1480)	(0.3367)	(0.1911)	(0.4268)
Worked while Pregnant	0.7979	0.7115	0.6230	0.7224
	(0.4016)	(0.4531)	(0.4846)	(0.4478)

Father's Characteristics (if married or father named)				
Age/10	28.2981	26.4600	31.3983	30.1035
	(6.393)	(6.765)	(6..1821)	(6.946)
Black	0.0227	0.9672	0.0234	0.9730
	(0.1489)	(0.1781)	(0.1512)	(0.1619)
Hispanic	0.0187	0.0071	0.2134	0.0065
	(0.1355)	(0.0842)	(0.1445)	(0.0804)
Less than High School Education	0.1449	0.1595	0.1469	0.1359
	(0.3520)	(0.3661)	(0.3540)	(0.3427)
High School	0.2871	0.3384	0.3289	0.4064
	(0.4524)	(0.4732)	(0.4698)	(0.4912)
Some College	0.1909	0.2251	0.1863	0.2170
	(0.3930)	(0.4176)	(0.3894)	(0.4122)
College or Graduate Degree	0.3327	0.1703	0.3200	0.1468
	(0.4712)	(0.3759)	(0.4665)	(0.3540)
Mother's Health and Health Behavior				
Mother Used Tobacco During Pregnancy	0.1117	0.0221	0.1503	0.0674
	(0.3151)	(0.1471)	(0.3573)	(0.2507)
Mother Used Alcohol During Pregnancy	0.0085	0.0040	0.0104	0.0135
	(0.0918)	(0.0629)	(0.1015)	(0.1155)
Adequate Plus PNC	0.3419	0.3334	0.3340	0.3147
	(0.4744)	(0.4714)	(0.4716)	(0.4644)
Inadequate PNC	0.0520	0.1190	0.0617	0.1702
	(0.2221)	(0.3238)	(0.2407)	(0.3758)
Intermediate PNC	0.1204	0.1309	0.1237	0.1318
	(0.3254)	(0.3373)	(0.3292)	(0.3382)
Adequate PNC	0.4957	0.4166	0.4806	0.3833
	(0.4998)	(0.4930)	(0.4996)	(0.4862)
Birth Interval			47.3336	49.1800
			(34.3833)	(39.1586)
Number of Previous Live Births Still Living			1.5175	1.8003
			(0.8601)	(1.1594)
Number of Previous Live Births No Longer Living			0.0227	0.0406
			(0.1722)	(0.2353)
Number of Previous Fetal Deaths			0.3291	0.2688
			(0.7247)	(0.6396)
Number of previous low birth weight births			0.0124	0.0113
			(0.1108)	(0.1055)
Cardiac Disease	0.0029	0.0016	0.0025	0.0014
	(0.0536)	(0.0397)	(0.0497)	(0.0380)
Diabetes (non-gestational)	0.0175	0.0146	0.0200	0.0186

	(0.1313)	(0.1201)	(0.1401)	(0.1349)
Renal Disease	0.0008	0.0006	0.0008	0.0007
	(0.0288)	(0.0240)	(0.0290)	(0.0271)
Acute or Chronic Lung Disease	0.0051	0.0071	0.0052	0.0096
	(0.0715)	(0.0839)	(0.0722)	(0.0973)
Year				
1995	0.1139	0.1095	0.1059	0.0999
	(0.3177)	(0.3123)	(0.3077)	(0.2999)
1996	0.1116	0.1090	0.1066	0.1024
	(0.3148)	(0.3117)	(0.3086)	(0.3032)
1997	0.1142	0.1137	0.1098	0.1075
	(0.3180)	(0.3174)	(0.3127)	(0.3097)
1998	0.1125	0.1112	0.1138	0.1127
	(0.3159)	(0.3144)	(0.3176)	(0.3162)
1999	0.1113	0.1089	0.1141	0.1151
	(0.3146)	(0.3115)	(0.3180)	(0.3191)
2000	0.1116	0.1149	0.1150	0.1203
	(0.3149)	(0.3189)	(0.3190)	(0.3253)
2001	0.1086	0.1131	0.1148	0.1185
	(0.3112)	(0.3168)	(0.3188)	(0.3232)
2002	0.1067	0.1135	0.1149	0.1193
	(0.3088)	(0.3172)	(0.3189)	(0.3241)
n	246170	130248	306894	195474

Table II
Decomposition of Black/White Birth Outcomes for First Births

	Preterm Birth	Early Preterm Birth	Birth Weight Ranking
Variables	**Differential**	**Differential**	**Differential**
Prediction: Black Infants	0.1353***	0.0476***	37.7318***
	(0.0009)	(0.0006)	(0.0760)
Prediction: White Infants	0.0876***	0.0205***	49.5491***
	(0.0006)	(0.0003)	(0.0575)
Difference	0.0477***	0.0271***	-11.8173***
	(0.0011)	(0.0007)	(0.0953)
Characteristics			
Age	-0.0033***	-0.0015***	-0.0027
	(0.0005)	(0.0003)	(0.0499)
Education	0.0025***	0.0013***	-0.4312***
	(0.0004)	(0.0002)	(0.0386)
Female	-0.0001***	-0.0000***	0.0016*
	(0.0000)	(0.0000)	(0.0008)
Marital Status	0.0081***	0.0028***	-1.1544***
	(0.0013)	(0.0007)	(0.1290)
Income Related	-0.0011	-0.0004	-0.5223***
	(0.0007)	(0.0004)	(0.0679)
Characteristics of the Father	0.0046*	0.0044***	-0.4060
	(0.0027)	(0.0015)	(0.2786)
Father’s Education	0.0016***	0.0006***	0.0194
	(0.0004)	(0.0002)	(0.0420)
Health Behavior	-0.0010***	-0.0004***	0.9219***
	(0.0002)	(0.0001)	(0.0189)
Prenatal Care	0.0026***	0.0007***	-0.0817***
	(0.0003)	(0.0001)	(0.0184)
Medical Risk Factors	0.0001	0.0001***	-0.0211***
	(0.0000)	(0.0000)	(0.0036)
Year	0.0001**	-0.0000**	0.0055***
	(0.0000)	(0.0000)	(0.0021)
County	-0.0016***	0.0004	-0.1875***
	(0.0006)	(0.0003)	(0.0598)
Total	0.0123***	0.0079***	-1.8585***
	(0.0026)	(0.0015)	(0.2583)

Coefficients			
Constant	0.0454***	0.0237***	-8.8639***
	(0.0097)	(0.0062)	(0.8769)
age	-0.0122***	-0.0077***	-0.0196
	(0.0037)	(0.0026)	(0.3000)
Education	0.0012***	0.0006**	0.0428
	(0.0004)	(0.0003)	(0.0411)
Female	0.0029***	0.0011*	0.0140
	(0.0010)	(0.0006)	(0.0929)
Marital Status	0.0012***	0.0014***	-0.0087
	(0.0004)	(0.0003)	(0.0386)
Income Related	0.0005	-0.0032**	0.3018
	(0.0027)	(0.0016)	(0.2417)
Characteristics of the Father	0.0015	0.0055	0.3363
	(0.0065)	(0.0041)	(0.6145)
Father's Education	-0.0001	0.0007	-0.2165**
	(0.0011)	(0.0007)	(0.1006)
Health Behavior	0.0002	0.0002*	0.1031***
	(0.0002)	(0.0001)	(0.0123)
Prenatal Care	0.0001	0.0016***	0.0519
	(0.0007)	(0.0004)	(0.0629)
Medical Risk Factors	0.0002	0.0002	0.0510***
	(0.0002)	(0.0001)	(0.0152)
Year	-0.0145***	-0.0090***	-1.1503***
	(0.0031)	(0.0020)	(0.2783)
County	0.0092***	0.0042**	-0.6007**
	(0.0029)	(0.0017)	(0.2741)
Total	0.0354***	0.0191***	-9.9588***
	(0.0028)	(0.0016)	(0.2751)
Observations	376418	376418	376418

Standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

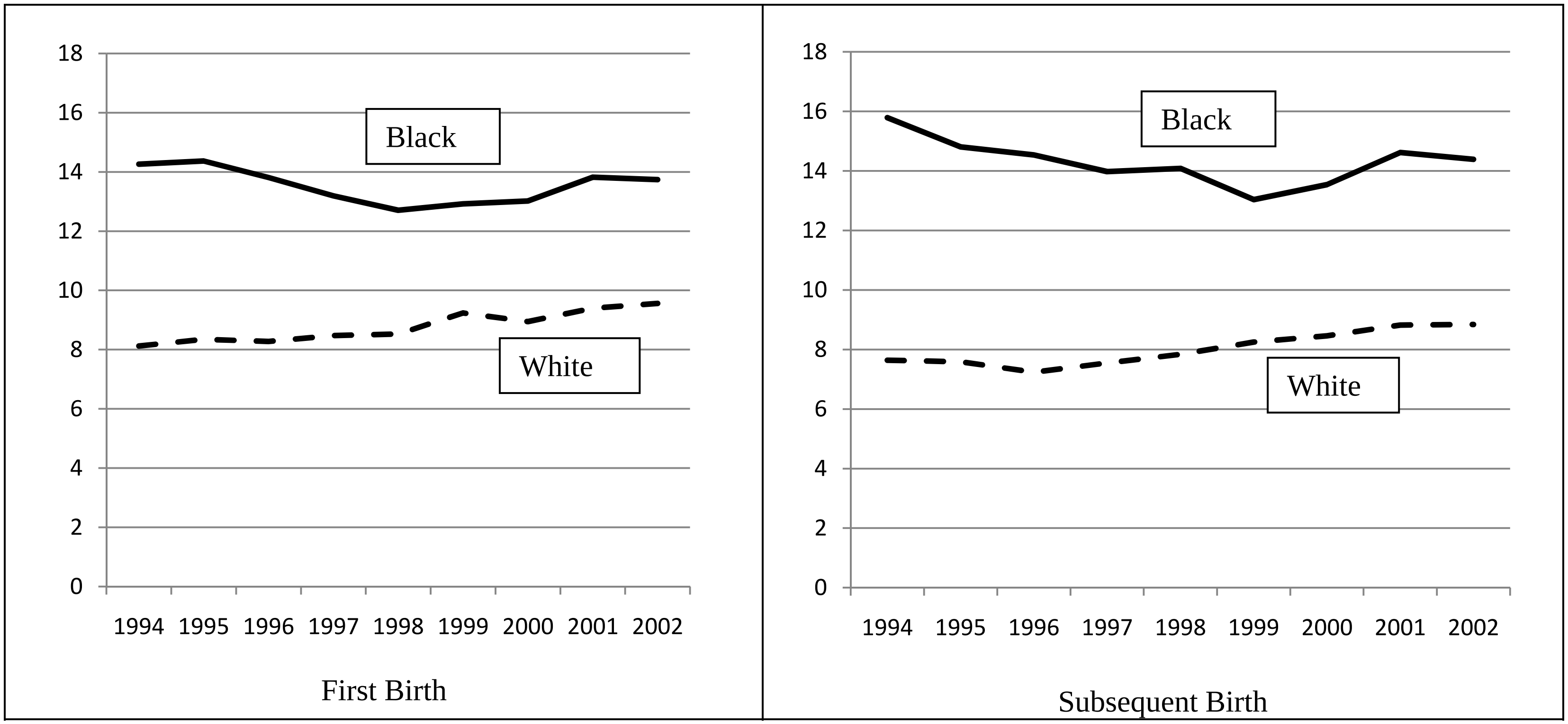
Table III
Decomposition of Black/White Birth Outcomes for Subsequent Birth

	Preterm Birth	Early Preterm Birth	Birthweight Ranking
VARIABLES	**Differential**	**Differential**	**Differential**
Prediction: Black Infants	0.1428***	0.0433***	43.3973***
Prediction: White Infants	(0.0008)	(0.0005)	(0.0659)
	0.0801***	0.0153***	55.6522***
	(0.0005)	(0.0002)	(0.0529)
Difference	0.0627***	0.0280***	-12.2549***
	(0.0010)	(0.0005)	(0.0845)
Characteristics			
Age	0.0004	0.0000	-0.2781***
	(0.0004)	(0.0002)	(0.0390)
Education	0.0022***	0.0007***	-0.4862***
	(0.0003)	(0.0001)	(0.0318)
Female	-0.0001***	-0.0000***	-0.0024***
	(0.0000)	(0.0000)	(0.0009)
Marital Status	0.0067***	0.0041***	-1.1255***
	(0.0013)	(0.0007)	(0.1310)
Income Related	0.0023***	0.0006	-0.7391***
	(0.0008)	(0.0004)	(0.0761)
Characteristics of the Father	0.0045*	0.0021	-0.8392***
	(0.0025)	(0.0013)	(0.2617)
Father's Education	0.0010***	0.0003**	-0.0328
	(0.0004)	(0.0002)	(0.0407)
Health Behavior	-0.0019***	-0.0007***	1.1002***
	(0.0001)	(0.0001)	(0.0182)
Prenatal Care	0.0034***	0.0010***	-0.1627***
	(0.0003)	(0.0001)	(0.0255)
Reproductive History	0.0009***	0.0001	0.3107***
	(0.0002)	(0.0001)	(0.0218)
Medical Risk Factors	0.0002***	0.0001***	-0.0244***
	(0.0000)	(0.0000)	(0.0047)
Year	0.0001***	-0.0000***	0.0036**
	(0.0000)	(0.0000)	(0.0017)
County	-0.0004	-0.0001	-0.4234***
	(0.0006)	(0.0003)	(0.0607)
Total	**0.0194*****	**0.0082*****	**-2.6991*****
	(0.0025)	**(0.0013)**	**(0.2485)**

Coefficients			
Constant	0.0722***	0.0315***	-8.8352***
	(0.0084)	(0.0048)	(0.7597)
Age	-0.0059***	-0.0028***	0.0097
	(0.0017)	(0.0011)	(0.1490)
Education	0.0013**	0.0009***	-0.0391
	(0.0005)	(0.0003)	(0.0477)
Female	0.0021**	-0.0005	0.0795
	(0.0009)	(0.0005)	(0.0815)
Marital Status	-0.0005***	-0.0002**	-0.0044
	(0.0002)	(0.0001)	(0.0145)
Income Related	-0.0074***	-0.0043***	1.4293***
	(0.0023)	(0.0014)	(0.2109)
Characteristics of the Father	-0.0087	-0.0046	0.0961
	(0.0064)	(0.0036)	(0.5894)
Father's Education	0.0018*	0.0013**	-0.4226***
	(0.0010)	(0.0005)	(0.0894)
Health Behavior	0.0019***	0.0013***	0.2451***
	(0.0003)	(0.0002)	(0.0220)
Prenatal Care	0.0011***	0.0011***	0.0869**
	(0.0004)	(0.0002)	(0.0412)
Reproductive History	0.0007	0.0042***	-0.3918
	(0.0027)	(0.0016)	(0.2385)
Medical Risk Factors	0.0003*	0.0000	0.0740***
	(0.0002)	(0.0001)	(0.0156)
Year	-0.0161***	-0.0076***	-0.8021***
	(0.0027)	(0.0017)	(0.2442)
County	0.0006	-0.0004	-1.0812***
	(0.0025)	(0.0014)	(0.2458)
Total	**0.0433*** **	**0.0198*** **	**-9.5557*** **
	(0.0026)	**(0.0014)**	**(0.2619)**
Observations	476731	476731	476731

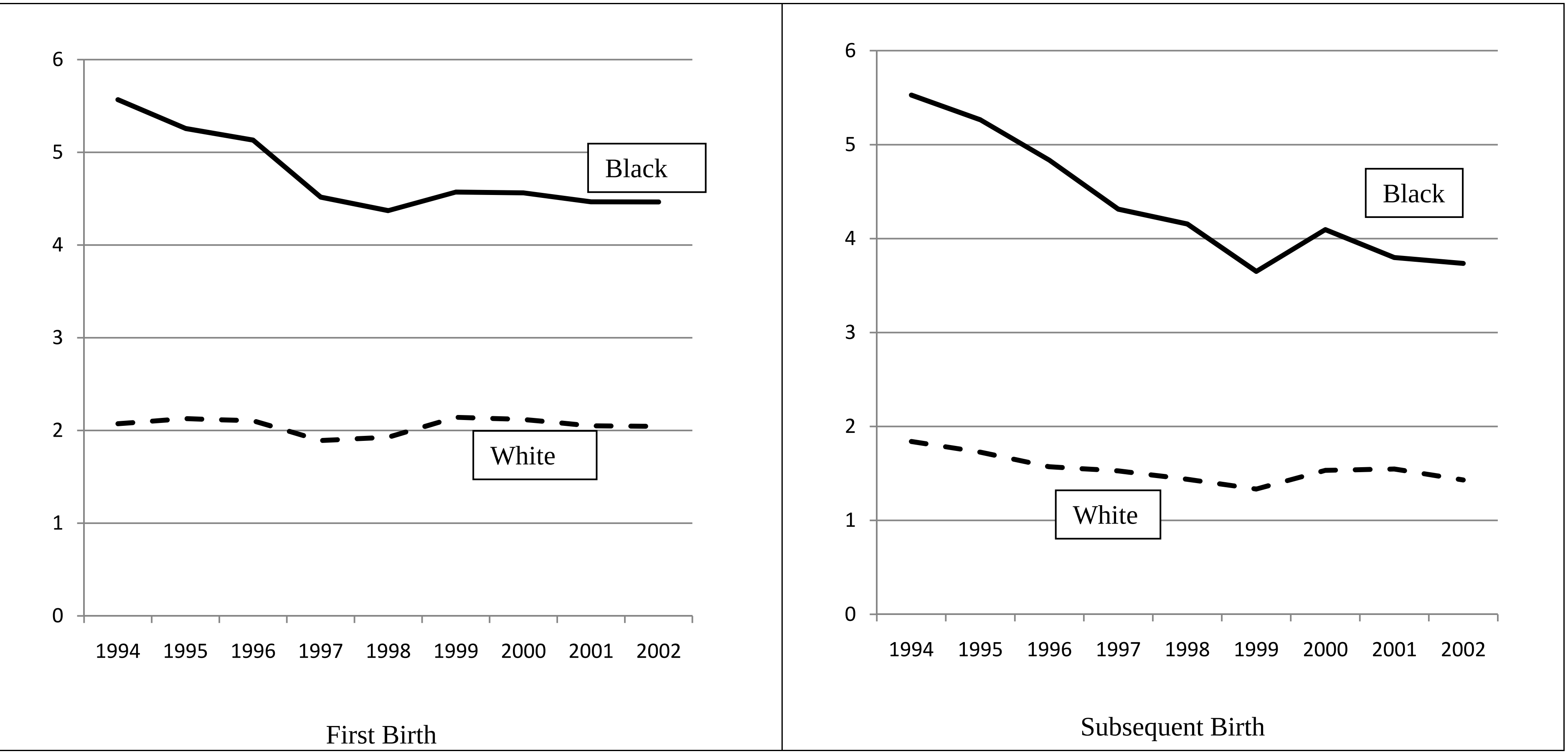
Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Figure 1
Preterm Birth in Georgia*
1994-2002



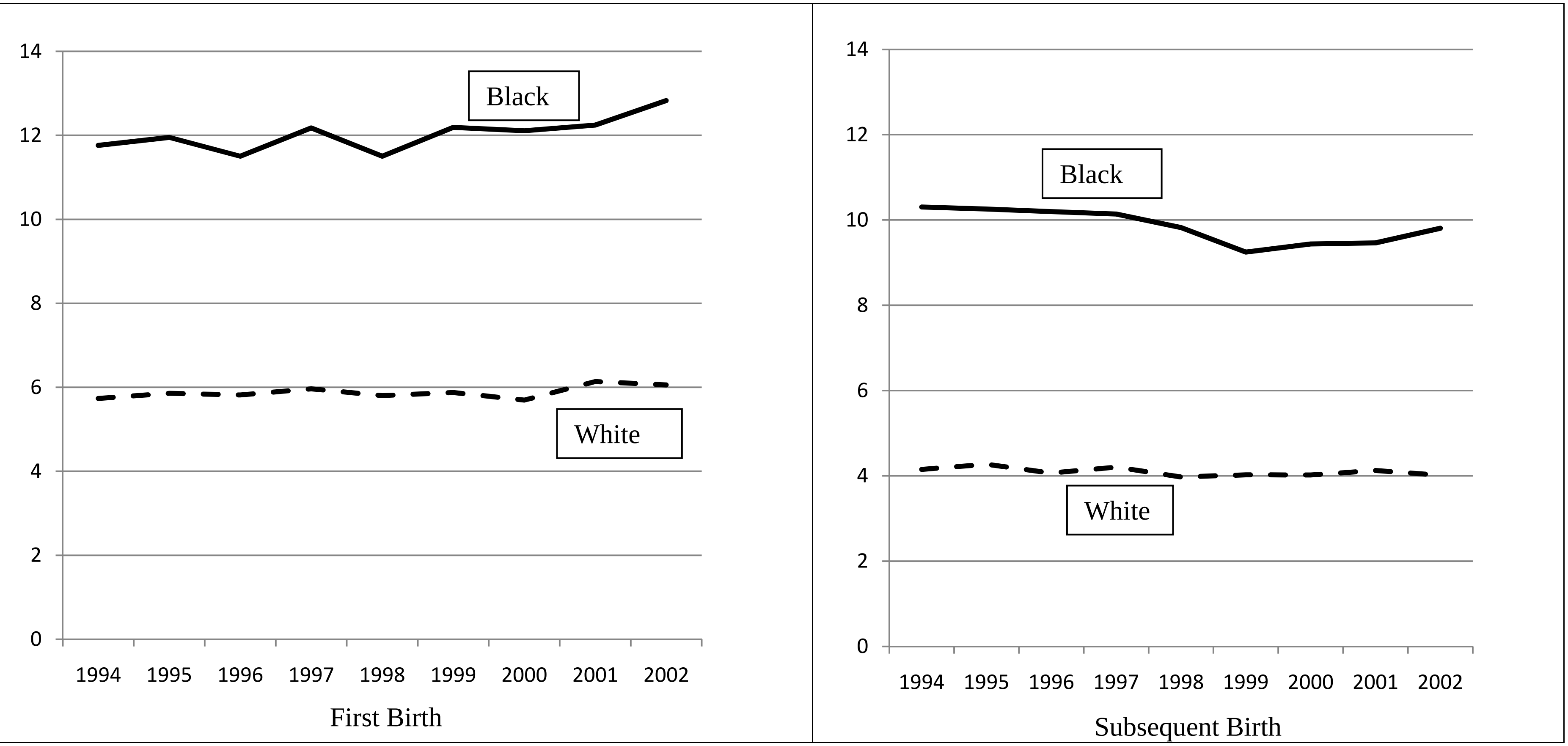
*As a percent of live births

Figure 2
Early Preterm Birth in Georgia*
1994-2002



*As a percent of live births

Figure 3
Low Birth Weight Births in Georgia*
1994-2002



*As a percent of live births