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Racial Inequality in Education in Brazil: A Twins Fixed-Effects Approach

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Abstract

Racial disparities in education in Brazil (and elsewhere) are well documented. Because this research typically examines educational variation between individuals in different families, however, it cannot disentangle whether racial differences in education are due to racial discrimination or to structural differences in unobserved neighborhood and family characteristics. To address this common data limitation, we use an innovative within-family twin approach that takes advantage of the large sample of Brazilian adolescent twins classified as different races in the 1982 and 1987–2009 *Pesquisa Nacional por Amostra de Domicílios*. We first examine the contexts within which adolescent twins in the same family are labeled as different races to determine the characteristics of families crossing racial boundaries. Then, as a way to hold constant shared unobserved and observed neighborhood and family characteristics, we use twins fixed-effects models to assess whether racial disparities in education exist between twins and whether such disparities vary by gender. We find that even under this stringent test of racial inequality, the nonwhite educational disadvantage persists and is especially pronounced for nonwhite adolescent boys.

Keywords

Race; Education; Brazil; Fixed effects

Introduction

In most multiracial societies, racial inequalities in education and other socioeconomic outcomes are pervasive and persistent (e.g., Marx 1998 for South Africa, Brazil, and the United States; Telles 2004 for Brazil). In recent years, there has been growing interest in the study of multiracialism, particularly in the United States (Lee and Bean 2004; Lichter and Qian 2004; Telles and Sue 2009). At the core of this debate is the question of whether blurred racial boundaries will attenuate racial inequalities and ultimately even eliminate racial categories. The evidence coming from Brazil, a country with high levels of

miscegenation and fluidity in race labeling, suggests that multiracial identities have not eliminated racial inequalities. On the contrary, nonwhite Brazilians continue to endure marked social and economic disadvantages, as do their counterparts in virtually all multiracial societies (Martelete 2012; Nobles 2000; Ribeiro 2011; Souza et al. 2010; Telles 2004).

Racial disparities in education are particularly pronounced. Although the body of evidence of racial inequality in education in Brazil is large and compelling, it suffers from a data limitation common in much research on racial disparities: unobserved variables. In such studies, researchers are often interested in identifying evidence of racial discrimination, or unequal treatment of the basis of race (Pager and Shepard 2008). However, because racial discrimination is difficult to measure directly and thus is not included in most large-scale surveys, researchers typically rely on indirect methods of capturing it. The most common approach is to regress education on race among individuals from different families and attribute the unexplained variance in education that remains after controlling for other factors to racial inequality. However, this approach cannot distinguish whether racial disparities in education result from racial inequality due to discrimination or from differences in unobserved structural and familial characteristics.

The Brazilian case offers a unique way to circumvent this problem through an analysis of within-family racial disparities in education. The existence of a large nationally representative sample of twins classified differently by race permits a natural experiment that can isolate the social effects of race—that is, how individuals experience social institutions differently because of race—from various structural and family effects. Brazil's historically high levels of miscegenation along with its fluidity in racial labeling means that a sizable number of siblings—even twins—are labeled as different races. Racial identification in Brazil is largely based on phenotypic traits, such as skin color, nose shape, and hair type; thus, individuals often are not considered “racially pure” but instead are “relatively white” or “relatively black” (Telles 2004). In addition, racial classification is also associated with behavioral characteristics and with social status (Saperstein and Penner 2012; Telles 2004). As a result, twins can be labeled differently if they look or are perceived differently. Because twins share most family and neighborhood characteristics—many of which are often not included in large-scale survey data—a within-family analysis using twins includes inherent “controls” for these unobserved characteristics that are shared by twins. It thus allows us to uncover the portion of the effect of race on education due to factors not shared by twins in the same family: that is, their racial classification. Although family and neighborhood factors remain that are not shared by twins, we argue that by holding constant a plethora of family and neighborhood characteristics shared by twins, this approach is as close as we can get to a natural experiment. Examining the within-family effects of race on education uncovers whether adolescents experience social institutions, such as families and schools, differently as a result of being labeled in different race groups.

In this study, we use an innovative within-family analytical approach to examine three research objectives. Our first objective is to provide a descriptive portrait of the sociodemographic characteristics of the families of adolescent twins who are labeled differently by race in order to assess the ways in which families who cross racial boundaries

might differ from those who do not. To do this, we examine race correlations between twins across several social and demographic factors. Our second objective is to examine whether within-family educational disadvantages associated with nonwhite labeling exist. To answer this question, we use twins fixed-effects models to assess whether educational differences exist between twins labeled as different races. Our third objective is to explore whether racial disparities in education vary by gender, given the overall female advantage in education and the particularly disadvantaged educational position of black males in Brazil.

This study makes several important contributions. First, the study contributes to the literature on racial inequality by uncovering the portion of the educational disadvantage associated with nonwhite race labeling when holding several observed and unobserved characteristics constant. To our knowledge, this innovative twin approach to the study of racial disparities in education has not been used, primarily because race is often considered an ascribed characteristic in several contexts, particularly in the United States. Second, there has been an emerging literature on the fluidity of race and crossing racial boundaries in multiracial societies. Recent research has argued that race labeling has been changing in the Brazilian context (Bailey 2009; Martelete 2012). This article builds on this debate by examining the conditions under which parents cross racial boundaries with their own children. We focus on Brazil because it is one of the largest multiracial societies in the world and thus offers a useful context to examine racial inequality and the crossing of racial boundaries. However, this discussion is also relevant for other multiracial societies and informs ongoing debate regarding the future of racial and ethnic inequality. Third, we examine nationally representative samples of the Brazilian population, which is not always the case with studies of racial inequality in Brazil.

Race and Race Labeling in Brazil

The racial context of Brazil is complex and resembles a continuum of interactions based on skin color, which differs from dichotomous forms of racial stratification, such as the “one-drop rule” in the United States that generated a black-white split based on any trace of African ancestry (Bailey 2008; Telles 2004).¹ Race labeling in Brazil is based on a combination of phenotypic characteristics, such as skin color, nose shape and hair type; behavioral characteristics, such as dress and language; and social status markers, such as income and education (Freeman et al. 2011; Saperstein and Penner 2012; Telles 2004). Consequently, racial categories are much more elusive in Brazil than in other contexts. Meanings about race are not fixed but relational and subject to redefinition; as such, racial classification is left to individual perception, leading to a great deal of ambiguity (Telles 2004). Race labels often depend on the observer and can differ over time and even in individuals’ day-to-day interactions (Saperstein and Penner 2012; Telles 1995).

The boundaries of race and racial categorization in Brazil are quite tenuous, generating high levels of racial group subjectivity. One example of how racial ambiguity is rooted in the racial understandings in Brazil is an ideology of *whitening*, the tendency for persons on the

¹This emphasis on skin color over racial identity is partly due to the multifaceted racial ancestry of most Brazilians. For much of the colonial period, white men outnumbered white women, yielding high levels of miscegenation between white men and nonwhite females (Telles 1995).

border of a color category to be classified in the lighter category, particularly those in higher social classes (Ianni 1960; Schwartzman 2007). Another example of the subjectivity of race labeling in Brazil is evidence of a surge in black labeling associated with education (Francis and Tannuri-Pianto 2013): highly educated black parents are more likely to label their children as black, but this was not true three decades ago (Marteleteo 2012). Such historical change in race labeling suggests that parents may also be crossing racial boundaries within their children. Because of Brazil's emphasis on skin color, members of the same family—even twins—may be classified in two or more races or skin colors (Telles 2004; Telles and Lim 1998), therefore constituting a form of crossing racial boundaries.

The labeling of children and adolescents best reflects the relational nature of racial classification in the Brazilian context when race labeling of children is denominated by the same person. In the case of twins, the same respondent (usually a parent) who knows a great deal about the skin color and social and behavioral characteristics of each twin answers the question on race for both twins (Telles 2004). Although twins living in the same household share the same birth date and several family background and neighborhood characteristics, their race labeling may differ depending on how they look and/or how they are perceived by others. This is particularly true of children of multiracial couples.

The study of crossing racial boundaries in Brazil has generally focused on the children of parents who self-identify in separate racial categories or individuals who self-identify as multiracial (Marteleteo 2012; Schwartzman 2007). At the same time, there has been a growing interest on multiracialism in the United States as a consequence of the increase in interracial marriages of whites and immigrants from Latin America and Asia (Lee and Bean 2004; Lichter and Qian 2004). In Brazil, on the other hand, multiracialism has been at the forefront of sociological research on race and racial inequality mainly because of the country's long history of miscegenation. For example, the lower social position of *pardos*, Brazil's large population of multiracial individuals, relative to whites has been subject to a long-standing debate centering on whether *pardos* should be considered together with blacks in a collective *negro* category, thereby establishing a dichotomous racial categorization in Brazil. More recently, research has suggested the importance of a skin color continuum in Brazil's race classification by showing that substantial skin color inequality remains in attainment processes (Ribeiro 2011).

Racial Disparities in Education in Brazil

Despite such fluid racial boundaries and a history of multiracialism, the consequences of race labeling are very concrete and can be measured through several social and economic opportunities and outcomes, including education. A long line of research has provided empirical support for the notion that nonwhites suffer severe disadvantages in social and economic opportunities. In Brazil, blacks and *pardos* are disproportionately represented among the lower social classes: nonwhites have considerably lower incomes and greater precariousness of household conditions (Henriques 2001) and experience less social mobility (Hasenbalg 1979) and higher levels of racial segregation than whites (Telles 2004). Nonwhites also have markedly lower levels of education than whites (Marteleteo 2012; Silva 1985; Silva and Hasenbalg 1999). Furthermore, a recent study showed that the disadvantages

in educational opportunity due to race inequality have remained despite the massive educational expansion Brazil has experienced since the latter half of the twentieth century (Ribeiro 2011). Although nonwhites have achieved gains in the last two decades, a marked disadvantage associated with race persists in a wide array of educational outcomes (Marteletto 2012).

The Intersection of Race and Gender in Educational Outcomes in Brazil

Additional research has shown that racial disparities in education tend to be more pronounced among adolescent boys compared with adolescent girls (Alves and Corrêa 2009). In general, Brazilian girls have higher educational attainment and lower dropout rates compared with Brazilian boys (Alves and Corrêa 2009). The female advantage in education appears among cohorts born as early as in the 1950s (Alves and Corrêa 2009). However, when considering both gender and race, findings show little or no female advantage among whites; it is among the nonwhite population where an educational gap in favor of females is found (Beltrão and Novellino 2002). Nonwhite Brazilian males, particularly those who are black, suffer the greatest educational disadvantages compared with all other racial and gender groups. For example, Querino and colleagues (2011) found that 15.1 % of white girls versus 19.5 % of white boys presented age-for-grade disparity in 2007. However, the gender gap in favor of females is higher among nonwhites: 34.8 % of nonwhite males presented an age for grade disparity, compared with only 26.4 % of nonwhite females (Querino et al. 2011). These gender and race gaps in education suggest that the study of educational inequality in Brazil warrants an intersectional approach that takes into account how race and gender simultaneously shape educational outcomes among adolescents in Brazil (McCall 2005).

The Logic of Using Twins for the Study of Racial Inequality in Education

The conventional approach to examining racial inequality in education is to model variance between individuals in different families, controlling for a number of key social origin and demographic variables—such as parents' education and child's sex and age—with a focus on the marginal effect of family and demographic characteristics on educational outcomes. Although critical, this approach does not allow for separating the two main mechanisms that generally explain race disparities in opportunities and outcomes: (1) structural differences due to exposure to poverty and accumulated disadvantages, and (2) the social effects of race in itself.

Examining racial disparities in the educational outcomes of twin adolescents is a rigorous test of the impact of race inequality. The advantage of using a sample of twins labeled as different races to study racial inequality is that shared neighborhood and family characteristics are essentially held constant: after all, twins living in the same household share most family and neighborhood characteristics. Although most of the family and neighborhood characteristics considered in quantitative analysis are likely shared by twins, some factors, such as unequal treatment by parents and school personnel, are not. For this reason, we argue that most of the educational variation between twins of different races can

likely be attributed to differences in how whites and nonwhites experience social institutions, such as families and schools.

Telles (2004:149) briefly examined differences in the educational success among siblings in multiracial families, referring to such an approach as the ultimate test of racial discrimination. He attributed the differences in siblings' educational outcomes that he found using the Brazilian 1991 census data to racial or color discrimination, including differences in treatment by school personnel and parents. Other work has revealed similar patterns of racial disparities in education among siblings, suggesting that these patterns appear as early as preschool and persist through college. Rangel (2015) found that lighter-skinned siblings are more likely to be enrolled in preschool or school, to attend private school, and to complete primary school than their darker-skinned siblings, and that the disparities are particularly pronounced for boys. On the postsecondary level, Francis and Tannuri-Pianto (2012) found that siblings who identify as black have lower scores on college entrance exams and higher enrollment discontinuity compared with their siblings who identify as white.

At least two additional advantages of using twins rather than siblings can be identified. First, age does not vary within twin pairs. Although age can be controlled in models using siblings, it may be associated with racial classification or perception in ways that cannot be captured by controlling for it. Physical, behavioral, and social characteristics associated with perceptions of race may vary systematically with age. Other work has found that that in families with different-race children, the younger siblings were disproportionately more likely than their older siblings to be classified in the lighter-skin category (Mill and Stein 2016). Second, inferring from household or census data whether siblings are full or half-siblings can be difficult if the data do not contain detailed information about the nature of family relationships. This is an important detail for the research objectives of this study because without knowing the nature of sibling relationships, we cannot be certain about the extent to which siblings shared many unobserved family, household, and neighborhood characteristics prior to the time of the survey interview. Using a sample of twins circumvents this problem.

We argue that educational variation between different-race twins can likely be attributed to differential treatment on the basis of race by schools, families, and/or other key social institutions. Researchers have long considered that racial inequities in education might be attributable to discrimination by teachers and school administrators (Farkas 2003; Mickelson 2003). Racial or color discrimination, including differences in treatment by school personnel and a racially insensitive curriculum that excludes African history and black history, are not uncommon and have been well documented in the ethnographic literature on race relations within Brazilian schools (Silva 2008). Other related research, most of which has been conducted in the U.S. context, has suggested that the disproportionate grade retention and placement of minorities in lower-level and remedial courses reflects discriminatory actions on the part of school personnel that create and reinforce racial disparities in education (Mickelson 2001). Additional research has suggested that discriminatory attitudes in the form of teachers' lower expectations and less favorable perceptions of nonwhite students underlie such actions (Downey and Pribesh 2004; Oates 2003).

Differential treatment within families might also contribute to different educational outcomes for twins. A long line of research on family resource allocation shows that parents differentially allocate resources to their children on the basis of children's characteristics, such as gender and birth order (Becker 1981). It is conceivable that parents may also treat children differently on the basis of race (Rangel 2015), especially in a country like Brazil, which has a pervasive ideology of racial hierarchy favoring whites.

Indeed, ethnographic evidence from Brazil cites the family as a key site of the social reproduction of racial hierarchy in Brazil and suggests that some parents treat their children differently because of their racial features (Hordge-Freeman 2013). If parents have internalized the dominant racial hierarchy ideology in Brazil, they might hold lower educational expectations or provide less material and emotional support for nonwhite children compared with white children, all of which may negatively impact educational outcomes. Rangel's (2015) finding that lighter-skinned siblings were more likely than their darker-skinned siblings to be enrolled in school at all and to attend private school lends support to the idea that parents may make fewer educational investments in darker-skinned children. On the other hand, some parents might make a conscious effort to mitigate external racial discrimination at schools by investing more heavily in the education of their nonwhite children. Although the data do not allow us to explore these potential school and family mechanisms, we nevertheless mention them here because they likely represent the key social institutions where adolescents might experience racial discrimination that affects their educational outcomes.

Research Questions and Hypotheses

The key objective of our study is to examine whether within-family racial disparities in education exist among a sample of adolescent twins in Brazil. However, an important first research question precedes this objective: What are the characteristics of families crossing racial boundaries across twins? To answer this question, we examine intrafamily correlations of racial labeling among twins across various social and demographic characteristics. For example, race correlations between twins with mothers with high versus low levels of education or in mother-only versus two-parent families will be compared to examine whether one group is systematically more or less similar with regard to racial labeling. The main hypothesis is that twins who likely experience more consistent parenting have higher chances of being labeled similarly. As such, twins in two-parent families, who may experience higher levels of social control with two available parents in the household, are more likely to be labeled similarly. Younger parents are less equipped to handle childrearing, and therefore their children receive less consistent parenting. Limited social and economic opportunities may be associated with parenting strategies that may accentuate sibling differences in racial labeling by directing family resources unequally within the family unit. In fact, parents in families with high socioeconomic status (SES) often act to compensate for siblings' differences, while low-SES families often act to reinforce siblings' differences (Becker 1981).

The second research question that we address is whether within-family differences in race labeling are important predictors of education for adolescents. We expect a statistically

significant and negative effect on years of education associated with being labeled nonwhite in both between- and within-family models. The between-family associations have been demonstrated elsewhere (Francis and Tannuri-Pianto 2013; Martelete 2012), but educational disadvantages associated with being labeled nonwhite in twin models have not been uncovered.

The third research question that we address extends the previous research question by examining whether racial disparities in education among twins vary by gender. The female advantage in education in Brazil suggests the importance of considering gender in studies of racial inequality in education. In addition, the low educational attainment of black Brazilian males relative to all other racial and gender groups suggests that race and gender interact to shape educational outcomes in Brazil.

Data

We use data from the 1982, 1987–2009 *Pesquisa Nacional por Amostra de Domicílio* (PNAD), a nationally representative household survey collected annually by the Brazilian Census Bureau (Instituto Brasileiro de Geografia e Estatística). The PNAD is a probability-based, stratified, multistage survey of Brazilian households. The sampling design follows a three-step probabilistic procedure based first on counties, then census tracts within counties, and finally households within sectors.

With the exception of its inclusion in 1982, the question on race has been asked in the PNAD only since 1987, which explains the selection of survey years used in this analysis. The PNAD questionnaires include five categories of race: white, black, *pardo*, Asian, and native Indian.² Our analysis includes only individuals designated as white, black, or *pardos* in the survey.

We identify twins as children living in the same household who are classified as child of the head of the household and who share the same month and year of birth. Note that the PNAD data do not allow us to distinguish dizygotic twins from monozygotic twins. Therefore, we cannot be certain of the extent to which the twins in the sample share phenotypical features; we rely only on their racial classification in the survey.³

We compare educational disparities across three analytic subsamples of 12- to 18-year-olds: singletons, same-sex twins in all families, and same-sex twins in multiracial families (families with parents of two races). Because of the female advantage in education in Brazil and also because gender intertwines with race labeling (Rangel 2015), we use same-sex twin pairs in our sample in order to eliminate any confounding effects of gender differences. We

²For a discussion on the categories of race used by the IBGE in Brazil, see Harris et al. (1993) and Telles (1995).

³Monozygotic (MZ) twins would be the ideal analytical sample for this study because they share genetic characteristics and are of the same sex. Thus, twins fixed-effects models using a sample of MZ twin pairs would control for not only shared observed and unobserved family and neighborhood factors, as is the case in the current analytic sample of same-sex twins, but also for shared genetic characteristics that could potentially affect race labeling. Following past studies with lack of information on zygosity, we used the Weinberg method (Conley et al. 2006; Torche and Echevarría 2011) to estimate a race effect on education for MZ twins. This method accurately estimates the number of MZ twins in the sample, therefore yielding an estimated race coefficient for MZ twins, for whom there is no issue of confounding zygosity or gender. Using the Weinberg method and the parameter estimates of our models, we obtained weighted race coefficients (available upon request) for MZ twins in all families that are consistent with the results presented here.

examine the samples of twins in all versus in multiracial families separately because the race labeling of twins in multiracial families has a higher chance of discordance in the racial labeling of twins. The sample twins in multiracial families are, by necessity, in two-parent households because both parents need to be living in the household in order for us to know their race. The sample of twins in all families, on the other hand, is not based on parental race and therefore includes twins in both single and two-parent households. We also use an analytic sample of singletons for comparative purposes because they represent the typical sample used in studies using the standard regression approach in studies of racial disparities in education. The final analytical samples for the pooled data from 1982, and 1987 to 2009 in all regions of Brazil have 177,483 singletons, 7,042 twins in all families, and 1,256 twins in multiracial families.⁴

Measures

Our outcome variable is completed years of education at the time of the survey. The choice of outcome is both theoretical and practical. Theoretically, the adolescents in our sample are at an age when they already have variation in their educational status. Also, adolescents are at the highest risk of dropping out of school. In practical terms, because the PNAD is a household survey, the data do not have information on parents' education for those who do not live with their parents.⁵ Because parents' education is one of the most important determinants of children's schooling, and most 12- to 18-year-olds live with at least one parent in Brazil (79.80 %), the use of this adolescent sample permits analyses of schooling accounting for parental education. To accurately include parental education in the models, we therefore restrict the analytic samples to children of the head of the family.⁶ We tested for differences in the samples of children who do and who do not belong to the head of the family and did not find significant differences by family income, race, or educational outcomes between the two groups.

Our key independent variable is racial classification of the child. Children are labeled by the household respondent in the PNAD data, typically the father or the mother.⁷ We measure race as a dichotomous variable of whites and nonwhites (i.e., *pardos* and blacks) for two reasons. First, evidence suggests that the recent social climate and socioeconomic gains in Brazilian society have produced real changes in the social position of blacks that yield a white-nonwhite dichotomy in how race is associated with educational disadvantages (Martelete 2012). The second reason is practical. Because twins are a rare event, sample sizes are small for each racial category, so a dichotomous classification of white versus

⁴An issue with using household data to determine children's relationships also found in previous research is that we may be missing children living outside the household (Cáceres-Delpiano 2006; Conley and Glauber 2006; Martelete 2012). We may therefore be missing twin pairs if one sibling lives in the household and the other does not. One way to determine the severity of this problem is to compare a measure of number of siblings based on mother's reports of their number of living children with the count measure we constructed using the household roster. We find a 94 % concordance rate between the count measure and the report measure provided by the PNAD. Although this measure does not provide information on twins, it assures us that we are not missing a large portion of siblings living outside the household, at least for 12- to 18-year-olds.

⁵Exceptions are the 1982 and 1996 PNADs, for which a special module on social mobility was implemented.

⁶Several researchers have employed this approach using the PNAD data to examine a variety of children and adolescent outcomes (e.g., Barros and Lam 1996; Duryea and Arends-Kuenning 2003).

⁷In most cases, the household head or the spouse of the head is the respondent of the questionnaire (Telles 2004). Because the analytical sample in this study is composed of children of the head of the family, in most cases, one of the parents of the children examined identifies the child's race.

nonwhite yields more precise estimates. As shown in Table 1, white/*pardo* twin pairs account for the large majority of the different-race twins in the PNAD sample; as such, they drive the results that we present here. This is not surprising given that blacks are the smallest group of the three we examine; approximately 45 % of the Brazilian population is classified as white, and another 45 % is classified as *pardo*, with only roughly 10 % classified as black. We include white/black twins in the sample, but because of their small numbers, their inclusion or exclusion from the sample does not change the results.

Table 1 also reports the means and standard deviations of the variables used in the models for each analytical sample: singletons, same-sex twins in all families, and same-sex twins in multiracial families. The mean educational attainment at ages 12–18 is 5.39 for both singletons and twins. When all families are considered, nonwhite twins have approximately 1.2 fewer years of schooling than white twins. Another important point from Table 1 is that the sample is evenly divided between whites and nonwhites.

Methods

To address the first research question, regarding the social and demographic characteristics of families who cross racial boundaries across twins, we estimate intraclass correlations using the Cohen's kappa statistics (Cohen 1960, 1968; Fleiss 1981). Kappa has a value of 1 when there is perfect agreement and a value of 0 when the level of agreement is what would be expected by chance, and does not assume a particular distance between skin color categories. A method for calculating the standard error of kappa is available that allows us to test the hypothesis that the level of agreement regarding the skin color categories is greater than would be expected by chance alone (i.e., kappa is greater than 0) (Villarreal 2010).

To address the next research question, regarding within-family racial disparities in education, we adopt a twins fixed-effects approach to assess racial differences in education between twin pairs. Our analytic strategy compares three groups: singletons, same-sex twins in all families, and same-sex twins in multiracial families. Although our main focus is on the twin models, we include the singleton models as a reference point for comparison to the more standard approach to modeling racial disparities in education.

The within-family factors that we model are twin-specific factors that vary across twin pairs. Twins fixed-effects models will help us estimate the pure social effects of race on educational outcomes by allowing us to control for unobserved variables. The logic behind twins fixed-effects models is to difference estimates across twins. The analogous ordinary least squares (OLS) formulation is

$$Y_{ij} = \beta \mathbf{X}_{ij} + \alpha_i + \mu_{ij},$$

where Y_{ij} corresponds to years of schooling for adolescent j in family i , $\mathbf{X}$ is a vector of explanatory variables, and $\alpha_i + \mu_{ij}$ are the two components of the error term. α_i is the family fixed effect, while μ_{ij} is the portion of the error term specific to each adolescent j in family i .

When we difference across twins in each family, we eliminate the portion of the error term α_j that corresponds to the unobserved family fixed effect:

$$Y_{ij} - Y_{jz} = \beta (\mathbf{X}_{ij} - \mathbf{X}_{jz}) + (\alpha_i - \alpha_i) + (\mu_{ij} - \mu_{iz}).$$

Although this paired-difference values approach eliminates the unobserved family fixed effect, this method does not eliminate errors that are specific to each twin j in family i . If such errors are correlated with the explanatory variables, estimates from twins fixed-effects models may still be biased. An additional limitation of twins fixed-effects models is that these models capture only variation in explanatory variables and educational outcomes that occurs within families and between twins (Allison 2009). As such, twins fixed-effects models in particular yield inefficient estimators in that variation between families is not captured. As a way to minimize this issue, we test the robustness of the fixed-effects estimates for the full sample by estimating the corresponding models across different subgroups of years and levels of mother's education (not shown, available upon request).

Results

Patterns of Crossing Race-Color Lines

Table 2 shows kappa statistics reporting the levels of agreement between race labeling across twin pairs according to social and demographic characteristics and the corresponding tests of statistical significance. It also reports the proportions of same-race and different-race twins within each category of the social and demographic characteristics. All kappa estimates are statistically significant at the .001 level, but the values of kappa vary for each social and demographic characteristic. There is more agreement in twin race labeling in high-SES families. For example, twins whose mothers have high school or more years of formal education report higher agreement in race labeling (.94) than twins whose mothers have no formal training (.88). The proportions shown also illustrate this point: 54.48 % of same-race twins have mothers are in the lowest educational category (0–4 years) compared with 61.17 % of different-race twins.

Similarly, there is considerably more agreement regarding twins' race in families in the fifth quintile than in the first quintile of family income distribution (.91 vs..85). With regard to family structure and family size, as expected, there is slightly more agreement in smaller than in larger families, and in two-parent than in single-mother families. Not surprisingly, another important factor in determining the level of agreement between the race labeling of twins is parental race.

Findings from Table 2 show overall a higher level of concordance on the race of twins in families with higher levels of SES status and in two-parent and smaller families, which is in line with an emerging literature that examines within-family sibling and twin differences. In terms of family structure, siblings in single-parent families consistently have significantly lower correlations on educational and developmental outcomes (e.g., Conley et al. 2006). Children in single-parent families are more subject to extrafamilial influences and are not subject to the stability and social control that a second parent may offer. In terms of

socioeconomic differences, there is evidence showing high levels of concordance in siblings and twins characteristics in families with high SES; a high SES enables families to “buy” equality within the home (Conley 2008; Turkheimer et al. 2003). Overall, in lower-SES households and in one-parent households, siblings are less likely to have the same characteristics/outcomes because experiences are less cohesive.

Within-Family Effects of Race on Education

Table 3 shows the associations between race and adolescents’ years of schooling using OLS regression models on samples of singletons and twins, and fixed-effects models for the twin samples. The OLS models include control variables for age, sex, region of residence, urban status, log of family income, family structure, and mother’s education. The OLS specifications adjust for the clustering of standard errors within twin pairs for estimating the 95 % confidence intervals and *p* values. The first four columns show the results for singletons; the first model (columns 1–6) includes race and gender covariates only, and the second model (columns 7–12) includes multiple covariates. Results for years of schooling indicate that among singletons, nonwhite adolescents have a disadvantage of –0.134 years of schooling compared with their white peers after a set of social and demographic factors are controlled for. The disadvantage associated with being nonwhite is –0.403 among twins when we estimate the models ignoring the paired nature of the data (column 5).

When twins fixed-effects models are used to control for unobserved characteristics shared by twins in all families (columns 7 and 8), the effect of race on education is smaller than in the previous models but is still statistically significant at the .05 level. Twins labeled nonwhite have a –0.308 disadvantage in years of schooling *vis-à-vis* their twins labeled white. There are two important interpretations of this result. In the sample of twins from multiracial families (columns 11 and 12), the educational disadvantage associated with being labeled nonwhite remains but reaches only marginal statistical significance. The smaller effect of race on twins fixed-effects models versus singletons and twins linear models suggests that a large part of the race effect on schooling is due to factors common to twins that are now controlled in the within-family models. Importantly, these results also show that even when unobserved factors shared by twins are controlled for, an educational gap remains between twins associated with being labeled white versus nonwhite. This suggests that twins, who share most family and neighborhood characteristics but are racially labeled differently experience social contexts and institutions, such as families and schools, differently. Although the educational disadvantage of nonwhites due to differences in family and structural factors between whites and nonwhites in Brazil has been well documented (Marteleteo 2012; Ribeiro 2011; Souza et al. 2010; Telles 2004), this new evidence shows that such disadvantage persists even among twins, when most family and neighborhood unobserved characteristics are controlled for.

Also interesting are differences in results according to whether families are multiracial. Table 3 shows that the standard error is larger in multiracial families than in all families combined, suggesting that there is more variation in race labeling in multiracial families. This finding is not surprising given that in these families, the race of the mother and the race of the father are different, which allows for more disagreement in the race labeling of twins.

Further, although the magnitude of the negative coefficient representing race is larger in multiracial families, the interaction term between race and family type is not statistically significant (results not shown).

Within-Family Effects of Race and Gender on Education

Table 4 addresses our third research question about whether the educational disadvantage associated with nonwhite labeling varies by gender. Here, we continue with the twins fixed-effects modeling among the samples of twins in all families and in multiracial families, but we stratify the models by gender. Turning first to the results for twins in all families (columns 1 to 4), we see that for both adolescent boys and girls, the coefficient for being labeled as nonwhite is negative, indicating that twins labeled as nonwhite incur an educational disadvantage relative to their white twin. Although the coefficients are similar in magnitude, the coefficient for girls is not statistically significant, whereas the coefficient for boys reaches marginal significance. Taken together, these models provide modest evidence that racial disparities in education vary by gender. However, models for twins in multiracial families (columns 5 to 8) provide stronger evidence of gender variation in racial disparities in education. Among adolescent twin girls in multiracial families, the association between being labeled as nonwhite and years of education is not significant. However, for adolescent twin boys, there is a large and significant negative association. The coefficient for nonwhite (-0.902) indicates a gap of almost one full year of education between nonwhite adolescent boys and their white twin. This suggests that nonwhite boys are the most educationally disadvantaged group.

Discussion and Conclusion

Brazil has been known for flexible racial relations that have long hidden racial disparities in social and economic opportunities and outcomes. Although crucial for the understanding of racial inequalities in Brazil and elsewhere, past evidence comes from comparisons of individuals growing up in different families and neighborhoods who therefore do not share several factors that are not accounted for with existing data. In this article, we use a twin sample from nationally representative data to examine race inequalities in education using a twins fixed-effect approach. This analytic approach allows for the control of unobservable characteristics shared by twins. That is, it allows for separating the two main theoretical mechanisms that generally explain race disparities in opportunities and outcomes: (1) structural differences due to exposure to accumulated disadvantages and (2) race effects due to whites and nonwhites differently experiencing social institutions, such as schools. Although the first mechanism has been extensively documented, the second has been largely ignored in quantitative studies of racial inequality.

The larger between-family twin race estimates (parallel with most research on race inequality) compared with the within-twin estimates of the race coefficient suggest that aspects shared by twins explain large portions of the association between race and education. This is an important finding because it underscores the role of unobserved factors in between-family models of racial inequality. This is evidence that most quantitative research measuring racial inequality of educational opportunity and outcomes comparing individuals

across families encompass the issue of unobservable characteristics, underscoring the importance of recognizing data limitations and what quantitative variables can really measure.

The most remarkable finding is that an educational disadvantage associated with nonwhite labeling remains even after accounting for observable and unobservable characteristics shared by twins. Because fixed-effect models explicitly account for unobserved characteristics shared by twins, within-family twin variation in race labeling accounts for differences in education between twin adolescents sharing family and neighborhood conditions but who are labeled differently. We speculate that the remaining variation between twins' years of schooling can be attributed to twins' differential experiences on the basis of race in families and schools. Importantly for the overall educational stratification by race in Brazil, this finding underscores the importance of affirmative action policies in Brazilian universities. Several Brazilian public universities have adopted race-targeted policies, and legislation has recently passed before the national congress mandating that all federal universities reserve as much as 50 % of their spots to nonwhite and socioeconomically disadvantaged students. Such debate has placed racial inequality at the forefront of social life in Brazil, a new development in a context in which racial democracy has been an enduring myth for decades.

Although we generally interpret this finding as probable evidence of racial discrimination on the part of schools or families, we cannot rule out the possibility that parents may label twins differently on the basis of their education. That is, rather than educational disparities emerging on the basis of twins' racial classification, differences in racial classification may emerge because of existing educational disparities between twins. As discussed earlier, racial classification (both self-classification and classification by others) is influenced by social markers, such as education, and can change over time (Saperstein and Penner 2012). Therefore, parents may label their children differently based on how they perform at school. With the PNAD data, we are not able to empirically disentangle the causal relationship between racial labeling and educational outcomes. However, no matter the direction of the relationship, in both cases, the association contributes to racial inequality in Brazil by creating racial disparities in education or—in the case of parents who may base their child's race label on education—by reinforcing racial stereotypes associated with education.

Our findings also suggest that nonwhite males are the most disadvantaged group with regards to education. Combined, this is important evidence that gender and race intersect to produce educational inequality in Brazil. The finding that the association between race and education varies by gender suggests that intersectionality may be a useful framework for understanding educational inequality in Brazil (McCall 2005). This framework emphasizes that individuals inhabit multiple social positions (such as race and gender) simultaneously and that the meaning of one social position may vary between and within groups. A more thorough understanding of the ways in which education inequality is distributed along diverse social status configurations in Brazil is needed in order to develop targeted policies for improving educational opportunities and outcomes.

Despite its significant findings, this research has limitations. Perhaps the most important limitation of the study is also one of its main strengths: that is, the focus on twins. Although studying twins arguably controls for unobserved factors shared by twins and gives significant leverage in questions of causation, we cannot assume that twins estimates can be generalized to the larger population. One source of concern is that twins are significantly different from singletons; twins have disproportionately low birth weights (Behrman and Rosenzweig 2004), which has been found as a determinant of disadvantages in several outcomes (Conley et al. 2006), including cognitive development (Torche and Echevarría 2011). A second limitation associated with using the sample of twins concerns the small sample size, which precluded the possibility of conducting more detailed subgroup analyses exploring other potentially important dimensions of racial and educational stratification, such as age and SES.

In sum, findings from this research show that different race labeling within the same family has a substantial impact on schooling among twin adolescents in Brazil. This discussion clearly resonates with the ongoing debate regarding the future of racial and ethnic inequality in multiracial societies and the growing interest in the study of multiracialism. At the core of these questions is whether blurred racial boundaries will eliminate racial inequality and ultimately even racial categories. The evidence based on between-family analysis coming from Brazil, a country with historically high levels of miscegenation, has suggested that multiracial identities do not eliminate racial inequalities. Findings from this article take this evidence to the next level by showing that even after unobservable factors that are shared by twins and could explain race inequality in education are controlled for, nonwhites remain in disadvantageous positions, at least in terms of education.

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References

- Allison, PD. Fixed effects regression models. Thousand Oaks, CA: Sage Publications; 2009.
- Alves JED, Corrêa S. Igualdade e desigualdade de gênero no Brasil: Um panorama preliminar, 15 anos depois do Cairo [Gender equality and inequality in Brazil: A Preliminary Overview, 15 Years After Cairo]. *Brasil*. 2009; 15:121–223.
- Bailey, S. Legacies of race: Identities, attitudes, and politics in Brazil. Stanford, CA: Stanford University Press; 2009.
- Barros, R.; Lam, D. Income and educational inequality and children's schooling attainment. In: Birdsall, N.; Sabot, R., editors. *Opportunity foregone: Education in Brazil*. Washington, DC: Inter-American Development Bank; 1996. p. 337–366.
- Becker, GS. *A treatise on the family*. Cambridge, MA: Harvard University Press; 1981.
- Behrman JR, Rosenzweig MR. Returns to birthweight. *Review of Economics and Statistics*. 2004; 86:586–601.

- Beltrão, KI.; Novellino, MS. Alfabetização por Raça e Sexo no Brasil: Evolução no Período 1940–2000 [Literacy by race and sex in Brazil: Evolution in the period 1940–2000] (ENCE Texto para Discussão No. 1). Rio de Janeiro: Brazil: Escola Nacional de Ciências Estatísticas; 2002.
- Cáceres-Delpiano J. The impacts of family size on investment in child quality. *Journal of Human Resources*. 2006; 41:738–754.
- Cohen J. A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*. 1960; 20:37–46.
- Cohen J. Weighted kappa: Nominal scale agreement with provision for scaled disagreement or partial credit. *Psychological Bulletin*. 1968; 70:213–220. [PubMed: 19673146]
- Conley, D. Bringing sibling differences in: Enlarging our understanding of the transmission of advantage in families. In: Lareau, A.; Conley, D., editors. *Social class: How does it work?*. New York, NY: Russell Sage Foundation; 2008. p. 179–201.
- Conley D, Glauber R. Parental educational investment and children's academic Risk. *Journal of Human Resources*. 2006; 41:722–737.
- Conley D, Pfeiffer K, Velez M. Explaining sibling differences in achievement and behavioral outcomes: The importance of within- and between-family factors. *Social Science Research*. 2006; 35:1087–1104.
- Conley D, Strully K, Bennett N. Twin differences in birth weight: The effects of genotype and prenatal environment on neonatal and post-neonatal mortality. *Economics and Human Biology*. 2006; 4:151–183. [PubMed: 16439189]
- Downey DB, Pribesh S. When race matters: Teachers' evaluations of students' classroom behavior. *Sociology of Education*. 2004; 77:267–282.
- Duryea S, Arends-Kuenning M. School attendance, child labor and local labor market fluctuations in urban Brazil. *World Development*. 2003; 31:1165–1178.
- Farkas G. Racial disparities and discrimination in education: What do we know, how do we know it, and what do we need to know? *Teachers College Record*. 2003; 105:1119–1146.
- Fleiss, JL. The measurement of interrater agreement. In: Fleiss, JL.; Levin, B.; Paik, MC., editors. *Statistical methods for rates and proportions*. 2. New York, NY: John Wiley & Sons, Inc; 1981. p. 212–304.
- Francis AM, Tannuri-Pianto M. The redistributive equity of affirmative action: Exploring the role of race, socioeconomic status, and gender in college admissions. *Economics of Education Review*. 2012; 31:45–55.
- Francis AM, Tannuri-Pianto M. Endogenous race in Brazil: Affirmative action and the construction of racial identity among young adults. *Economic Development and Cultural Change*. 2013; 61:731–753.
- Freeman JB, Penner AM, Saperstein A, Scheutz M, Ambady N. Looking the part: Social status cues shape race perception. *PLoS One*. 2011; 6(9):e25107. [PubMed: 21977227]
- Harris M, Consorte J, Long J, Byrne B. Who are the whites? Imposed census categories and the racial demography of Brazil. *Social Forces*. 1993; 72:451–462.
- Hasenbalg, C. Discriminação e desigualdades raciais no Brasil [Discrimination and racial inequality in Brazil]. Rio de Janeiro, Brazil: Graal; 2005.
- Henriques, R. Desigualdade racial no Brasil: Evolução das condições de vida na década de 90 [Racial Inequality in Brazil: Evolution of living conditions in the 1990s] (IPEA Texto para Discussão, No. 807). Rio de Janeiro, Brazil: Instituto de Pesquisa Econômica Aplicada; 2001.
- Hordge-Freeman E. What's love got to do with it?: Racial features, stigma and socialization in Afro-Brazilian families. *Ethnic and Racial Studies*. 2013; 36:1507–1523.
- Ianni, O. *Segunda parte* [Second part]. In: Cardoso, FH.; Ianni, O., editors. *Côr e mobilidade social em Florianópolis* [Color and social mobility in Florianópolis]. São Paulo, Brazil: Companhia Editora Nacional; 1960. p. 153–226.
- Lee J, Bean FD. America's changing color lines: Immigration, race/ethnicity, and multiracial identification. *Annual Review of Sociology*. 2004; 30:221–242.
- Lichter, DT.; Qian, Z. *Marriage and family in a multiracial society*. New York, NY: Russell Sage Foundation and Population Reference Bureau; 2004. (The American People: Census 2000 series)

- Martelete LJ. Educational inequality by race in Brazil, 1982–2007: Structural changes and shifts in racial classification. *Demography*. 2012; 49:337–358. [PubMed: 22259031]
- Marx, AW. Making race and nation: A comparison of the United States, South Africa, and Brazil. Cambridge, UK: Cambridge University Press; 1998.
- McCall L. The complexity of intersectionality. *Signs: Journal of Women in Culture and Society*. 2005; 30:1771–1800.
- Mickelson RA. Subverting Swann: First- and second-generation segregation in the Charlotte-Mecklenburg schools. *American Educational Research Journal*. 2001; 38:215–252.
- Mickelson RA. When are racial disparities in education the result of racial discrimination? A social science perspective. *Teachers College Record*. 2003; 105:1052–1086.
- Mill, R.; Stein, LCD. Race, skin color, and economic outcomes in early twentieth-century America (Working paper). 2016. Retrieved from <http://www.public.asu.edu/~lstein2/research/mill-stein-skincolor.pdf>
- Nobles, M. Shades of citizenship: Race and the census in modern politics. Stanford, CA: Stanford University Press; 2000.
- Oates GLSC. Teacher-student racial congruence, teacher perceptions, and test performance. *Social Science Quarterly*. 2003; 84:508–525.
- Pager D, Shepherd H. The sociology of discrimination: Racial discrimination in employment, housing, credit, and consumer markets. *Annual Review of Sociology*. 2008; 34:181–209.
- Querino, AN.; de Lima, CE.; Madsen, N. Genero, raca, e educacao no Brasil contemporaneo: Desafios para a igualdade [Gender, race, and education in contemporary Brazil: Challenges for equality]. In: Bonetti, A.; Abreu, MA., editors. *Faces da desigualdade de genero e raca no Brasil*. Rio de Janeiro, Brazil: Instituto de Pesquisa Economica Aplicada; 2011. p. 129-149.
- Rangel MA. Is parental love colorblind? Human capital accumulation within mixed families. *Review of Black Political Economy*. 2015; 42:57–86.
- Ribeiro CAC. Desigualdade de oportunidades educacionais no Brasil: Raça, classe e gênero [Inequality in educational opportunities in Brazil: Race, class, and gender]. *Educação on-Line (PUC-RJ)*. 2011; 8(1):1–42.
- Saperstein A, Penner AM. Racial fluidity and inequality in the United States. *American Journal of Sociology*. 2012; 118:676–727.
- Schwartzman LF. Does money whiten? Intergenerational changes in racial classification in Brazil. *American Sociological Review*. 2007; 72:940–963.
- Silva, NdV; Hasenbalg, CA. Relações raciais no Brasil contemporâneo [Racial relations in contemporary Brazil]. Rio de Janeiro, Brazil: Rio Fundo; 1992.
- Silva, NdV; Hasenbalg, CA. Race and educational opportunity in Brazil. In: Reichmann, R., editor. *Race in contemporary Brazil: From indifference to inequality*. University Park: Pennsylvania State University Press; 1999. p. 53-65.
- Silva, PVBd. Racismo em livros didáticos: Estudo sobre negros e brancos em livros de língua Portuguesa [Racism on textbooks: A study of blacks and whites in Portuguese language textbooks]. Belo Horizonte, Brazil: Autêntica Editora; 2008.
- Souza, PFd; Ribeiro, CAC.; Carvalhaes, F. Desigualdade de oportunidades no Brasil: Consideracoes sobre classe, educacao e raca [Inequality in opportunities in Brazil: Considerations about class, education, and race]. *Revista Brasileira de Ciências Sociais*. 2010; 25:77–100.
- Telles EE. Who are the morenas? *Social Forces*. 1995; 73:1609–1612.
- Telles, EE. Race in another America: The significance of skin color in Brazil. Princeton, NJ: Princeton University Press; 2004.
- Telles EE, Lim N. Does it matter who answers the race question? Racial classification and income inequality in Brazil. *Demography*. 1998; 35:465–474. [PubMed: 9850470]
- Telles EE, Sue CA. Race mixture: Boundary crossing in comparative perspective. *Annual Review of Sociology*. 2009; 35:129–146.
- Torche F, Echevarría G. The effect of birthweight on childhood cognitive development in a middle-income country. *International Journal of Epidemiology*. 2011; 40:1008–1018. [PubMed: 21362701]

- Turkheimer E, Haley A, Waldron M, D'Onofrio B, Gottesman II. Socioeconomic status modifies heritability of IQ in young children. *Psychological Science*. 2003; 14:623–628. [PubMed: 14629696]
- Villarreal A. Stratification by skin color in contemporary Mexico. *American Sociological Review*. 2010; 75:652–678.

Table 1

Means, standard deviations and percentage distributions by sample: 12- to 18-year-olds, Brazil, 1982 and 1987–2009 (standard deviations between pairs and within pairs)

	Singletons in Multiracial Families	Twins in All Families	Twins in Multiracial Families
Years of Schooling	5.39 (2.70)	5.39 (2.69)	5.34 (2.51)
Years of Schooling by Race			
Nonwhite	5.24 (2.69)	4.81 (2.66)	5.14 (2.59)
White	5.58 (2.69)	5.99 (2.59)	5.61 (2.39)
Nonwhite (%)	56	51	57
Female (%)	50	50	56
Urban Residence (%)	80	83	83
Region (%)			
North	13	9	11
Northeast	36	30	32
Southeast	27	31	29
South	9	17	10
Center-West	15	13	18
Mother's Education (mean)	5.10 (4.10)	5.32 (0.05)	4.95 (4.33)
Age (mean)	14.91 (1.99)	14.78 (0.02)	14.70 (1.95)
Twin Race Pairs			
White/Nonwhite		5.34	15.29
Black/White		0.23	0.48
Black/ <i>Pardo</i>		0.51	0.32
<i>Pardo</i> White		5.11	14.81
Black/Black		5.28	3.18
<i>Pardo</i> / <i>Pardo</i>		42.77	46.02
White/White		46.09	35.19
<i>N</i>	177,483	7,042	1,256

Notes: Standard deviations are shown in parentheses for continuous variables. Samples include children of the head of household only. Twins samples include same-sex twins only.

Source: PNAD 1982, 1987–2009.

Correlation of race of twins by social and demographic characteristics and distribution of social and demographic characteristic by twin race pairings: 12- to 18-year-olds, Brazil, 1982 and 1987–2009

Table 2

	Twins in All Families						Twins in Multiracial Families					
	Kappa	SE	Z	Prob > Z	Same Race (%)	Different Race (%)	Kappa	SE	Z	Prob > Z	Same Race (%)	Different Race (%)
Mother's Education												
0–4 years	.88	.02	45.96	.00	54.48	61.17	.71	.05	0	.00	57.92	57.14
5–8 years	.91	.03	29.27	.00	21.48	19.42	.74	.08	9.11	.00	21.32	18.37
9–11 years	.89	.04	25.00	.00	16.29	16.50	.58	.09	6.41	.00	14.34	21.43
12+ years	.94	.06	16.05	.00	7.75	2.91	.84	.16	5.17	.00	6.42	3.06
Family Income												
First quintile	.85	.04	22.46	.00	12.67	18.93	.71	.10	7.35	.00	14.34	14.29
Second quintile	.86	.04	24.33	.00	16.47	20.87	.63	.08	7.49	.00	17.17	22.45
Third quintile	.90	.03	30.09	.00	21.75	20.87	.77	.08	10.08	.00	21.32	16.33
Fourth quintile	.90	.03	30.56	.00	25.19	24.27	.70	.07	10.17	.00	26.04	26.53
Fifth quintile	.91	.03	27.90	.00	23.92	15.05	.70	.09	8.09	.00	21.13	20.41
Family Structure												
Both parents	.90	.02	55.06	.00	81.48	74.27	.70	.04	19.47	.00	100.00	100.00
Only mother	.87	.03	28.77	.00	18.52	25.73	—	—	—	—	—	—
Number of Additional Siblings												
None	.92	.03	26.34	.00	17.59	12.14	.69	.10	6.62	.00	13.02	13.27
One	.91	.03	35.84	.00	32.52	27.67	.78	.06	12.92	.00	36.42	26.53
Two or more	.88	.02	43.46	.00	49.89	60.19	.66	.05	13.08	.00	50.57	60.20
N	7,042 (3,251 pairs)						1,256 (628 pairs)					

Note: Samples include same-sex twins of the head of the household only.

Source: PNAD 1982, 1987–2009.

Table 3

OLS and fixed-effects models of years of schooling, singletons, and twins sample: 12- to 18-year-olds, Brazil 1982 and 1987–2009

Singletons OLS			Twins OLS			Twins FE			Twins OLS			Twins FE		
Baseline			Multiple Covariates			All Families			Multiracial Families			Multiracial Families		
b (1)	Robust SE (2)		b (3)	Robust SE (4)		b (5)	Robust SE (6)		b (7)	Robust SE (8)		b (9)	Robust SE (10)	
Nonwhite	−0.286***	0.012	−0.134***	0.010		−0.403***	0.052		−0.308*	0.149		−0.298**	0.112	−0.427 [†]
Age	0.586***	0.003	0.580***	0.002		0.681***	0.012		0.596***			0.596***	0.028	
Female	0.507***	0.011	0.457***	0.010		0.622***	0.047		0.487***			0.487***	0.111	
Urban			0.824***	0.013		0.780***	0.067		0.718**			0.718**	0.157	
Log Family Income			0.036***	0.000		0.326***	0.055		0.358***			0.358***	0.129	
Mother's Education			0.194***	0.001		0.205***	0.006		0.188**			0.188**	0.014	
Single Mother			−0.117***	0.005		−0.134*	0.060		—			—		
Constant	−3.450***	0.044	−4.613***	0.040		−6.548***	0.194		5.544***	0.077		−4.968***	0.464	5.585***
N	177,483		177,483			7,042 (3,521 pairs)			7,042 (3,521 pairs)			1,256 (628 pairs)		1,256 (628 pairs)
R ²	.200		.413			.478			.003			.408		.015

Notes: Samples include children of the head of household only. Twins samples include same-sex twins only. OLS models also control for region of residence and survey year.

Source: PNAD 1982, 1987–2009.

[†] $p < .10$;
* $p < .05$;
** $p < .01$;
*** $p < .001$

Table 4
Twins fixed-effects models by gender: 12- to 18-year-olds, Brazil 1982 and 1987–2009

Twins FE							
All Families, Girls		All Families, Boys		Multiracial Families, Girls		Multiracial Families, Boys	
<i>b</i> (1)	Robust SE (2)	<i>b</i> (3)	Robust SE (4)	<i>b</i> (5)	Robust SE (6)	<i>b</i> (7)	Robust SE (8)
Nonwhite	−0.281	−0.33 [†]	0.200	−0.073	0.266	−0.902 [*]	0.362
Constant	5.817 ^{***}	5.266 ^{***}	0.105	5.594 ^{***}	0.148	5.603 ^{***}	0.215
<i>N</i>	3,550 (1,775 pairs)	3,584 (1,792 pairs)		704 (353 pairs)		552 (276 pairs)	
<i>R</i> ² (within)	.002	.003		.001		.049	

Note: Samples include same-sex twins only.

Source: PNAD 1982, 1987–2009.

[†] *p* < .10;
^{*} *p* < .05;
^{***} *p* < .001