# Race Inequalities in Education In Brazil: Using Twin and Sibling Fixed Effects Methods

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**Abstract:** Most of the literature on racial inequality of opportunities and outcomes (in Brazil and elsewhere) focuses on disadvantages due to variance between individuals in different families. Although critical, this line of research does not capture variation in outcomes due to distinct race labeling that occurs *within* families. The goal of this paper is twofold. First, I examine the contexts within which adolescents are racially labeled differently to determine the characteristics of families crossing racial boundaries. The second goal of this paper is to determine the extent of disadvantages in education due to different race labeling *within* families. I use twin data from the 1982, 1987-2009 nationally representative PNAD to examine the impact of race labeling within families using kappa correlations and twins fixed-effects models. Findings suggest that there remain educational disadvantages associated with race labeling even after shared family factors and unobserved characteristics are accounted for.

**Introduction**

A large body of research has examined racial inequalities and how such inequalities are associated with socio-economic outcomes in multi-racial societies (Telles 2004 for Brazil; Marx 1989 for South Africa, Brazil and the US, for example). There has also been a growing interest on the study of multiracialism, particularly in the U.S. (Lee and Bean 2004; Lichter and Qian 2004; Telles and Sue 2004). At the core of the 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 historically high levels of miscegenation, suggests that multiracial identities have not eliminated racial inequalities. Rather, extensive research has shown that non-white Brazilians have historically endured social and economic disadvantages, as in virtually all multi-racial societies (Marteleto 2012; Nobles 2002; Ribeiro 2011; Souza et al. 2011; Telles 2004). As compelling as the evidence documenting non-white disadvantages of social and economic opportunities and outcomes (in Brazil is elsewhere) is, an issue with this body of research is that the focus on the impact of race measured across families; such line of research provides evidence on how *between-family* variation in racial identification leads to social and economic disadvantages. Researchers have therefore examined the portion of the inequality in social and economic outcomes associated with race by comparing individuals raised in different families and living in different neighborhoods, therefore uncovering structural differences between individuals across families.

An alternative way of conceptualizing how race impinges social and economic outcomes is to consider *within-family* differences that capture variation in race and race labeling that occur within families. Because children in the same household share the same family and neighborhood characteristics, by measuring *within-family* differences attributed to different race labeling all factors shared by siblings, even *unobservables* shared by those coming from the same family, are controlled for.

For the specific question of the disadvantages in education associated with race, a line of investigation based on *within-family* variation in race labeling uncovers the portion of the effect of race on education due to factors that are not shared by children in the same family, that is, siblings' diverse experiences due to different race labeling. Because children living in the same household share the same family and neighborhood circumstances, I argue that examining the *within-family* effects of race on education uncovers whether adolescents experience social institutions such as schools differently due to being labeled in different race groups. Yet, the possibility of siblings labeled differently has not been explored mainly because race is often considered an ascribed characteristic in several contexts, particularly in the US.

In a setting where race is largely based on skin color and race labeling is a very fluid process, children in the same family may be labeled differently, with different implications for individuals' life chances and outcomes. Brazil offers such research possibility of examining *within-family* inequality in racial classification. In Brazil racial identification is a process based on skin color where persons often are not "racially pure", but are "relatively white" or "relatively black" (Telles 2004). In such context, race is largely based on appearance traits such as skin color, nose shape and hair type; as such, full siblings and twins can therefore be labeled differently if they look and are perceived differently. The existence of a large nationally representative sample of twins that were differently classified by race permits a natural experiment that can isolate race effects from various structural and family effects.

The goal of this paper is twofold. First, I examine the contexts within which adolescents are labeled differently by examining race correlations between twins across several social and demographic factors. This will allow me to determine the families that are crossing racial boundaries between their children, and whether this has changed over three decades marked by extensive social change on how race is understood. The second goal of this paper is to provide a better understanding of how race

inequalities in education are generated within families. I use data from the 1982, 1987-2009 nationally representative PNAD to examine the impact of race labeling within families using twins fixed-effects models. Here I attempt to answer weather there are educational disadvantages between twins labeled non-white compared to their white twins. Are there remaining educational disadvantages associated with non-white labeling after family and neighborhood factors, and *unobserved* characteristics are taken into account?

There are several important contributions of this research. First, the paper contributes to the literature on race and racial inequality by uncovering the portion of the educational disadvantage associated with non-white race labeling when holding several unobserved characteristics constant. Twins share the same social origin and family environment while growing up, in addition to in-utero conditions; the effect of non-white labeling on education is due to the non-shared experiences resulting from different race labeling of white and non-white twins. Second, there has been an emerging literature on the fluidity of race and crossing racial boundaries in multiracial societies. Importantly, recent research has argued that race labeling has been changing in the Brazilian context (Bailey 2009; Marteleto 2012). This article builds on this debate by examining the conditions under which parents cross racial boundaries with their own children. This discussion is also relevant for the U.S. with the growing proportions of multi-racial families and the 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. Another contribution of this paper is its focus on Brazil. Brazil offers a useful context to examine race inequality and the crossing of racial boundaries, with implications for racial inequality and race relations everywhere.

**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 U. S. 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 physical characteristics such as skin color, nose shape and hair type. As a consequence, racial categories are much more elusive in Brazil than in other contexts. Meanings about race are not fixed but relational and subject to redefinition and, as such, racial classification is left to individual perception, leading to a great deal of ambiguity (Telles 2004). Race labels can therefore differ even in individuals' day-to-day interactions.

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*, that is, a tendency for persons on the border of a color category to be classified in the lighter category, particularly those in the higher social classes (Ianni 1987; Schwartzman 2007). Another example of the subjectivity of race labeling in Brazil is evidence showing that the country has witnessed a surge in black labeling associated with education; high-educated black parents are more likely to label their children as black now, where this was not true three decades ago (Marteleto 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 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.

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[1] This 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 non-white females (Telles 1994).

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 (Schwartzman 2007; Marteleto 2012). At the same time, there has been a growing interest on multiracialism in the U.S. as a consequence of an increase in inter-racial 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 social location of *pardos*—although lower than whites—has been subject to a long-standing debate centering on whether *pardos* should be considered grouped with blacks in a collective *negro* category, thereby establishing a dichotomous racial categorization in Brazil[2]. 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 2012).

Yet, 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 non-whites suffer severe disadvantages on social and economic opportunity. Blacks and *pardos* are disproportionately represented among the lower social classes: non-whites have considerably lower

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[2] Those favoring such a dichotomy argue that the social disadvantages of *pardos* and blacks *vis-à-vis* whites are similar enough to justify examining them together (Silva 1985; Silva and Hasenbalg 1999). The Brazilian black movement has long pushed for this dichotomy, arguing that it yields a negro category, a term of ethnic pride and affirmation that would potentially diminish racial ambiguity and destigmatize blackness (Telles 2004). The policies of racial quotas in Brazilian universities also use a dichotomous understanding of race based on white versus nonwhite. Those arguing against dichotomization contend that blacks and *pardos* are sufficiently different to warrant separate categories. For those scholars, *pardos* and blacks are different because of their dissimilar historical backgrounds (Daniel 2006) and because *pardos* do not identify themselves in a collective negro category (Bailey 2009). The question of whether social disadvantages associated with race resemble a dichotomy has recently regained importance because the recent affirmative action policies implemented in Brazil are based on such a dichotomy.

incomes and greater precariousness of household conditions than whites (Henriques 2001); experience less social mobility than whites (Hasenbalg 1979); experience higher levels of racial segregation than whites (Telles 1992, 2004); and have lower levels of education than whites (Marteleto 2012; Silva 1985; Silva and Hasenbalg 1999). A recent study has also shown that the disadvantages in educational opportunity due to race inequality have remained stable despite the massive educational expansion Brazil has witnessed (Ribeiro 2011).

In this study, I extend the definition of the study of race inequality in education by considering that crossing racial boundaries between twins is yet another form of crossing racial boundaries. Although I examine twins and use a fixed-effects methodology, which will be explained in detail below, I am not by any means suggesting the treatment of race as biological and fixed categories. Rather, the idea is to hold constant several characteristics common to twins while assuming that race labeling is relational and subjective; as such, twins could be racially labeled differently in the Brazilian context.

**The Logics of using Twins for the Study of Educational Inequalities of Race Labeling**

The emphasis on skin color in race labeling in Brazil discussed above implies that members of the same family may be classified in two or more races or skin colors (Telles 2004; Telles and Lim 1998). This is particularly true of children of multiracial couples. Importantly, twins living in the same household share the same family background and neighborhood characteristics. Yet, their race labeling may differ depending on how they look.

I argue that examining race effects on the educational outcomes of twin adolescents is a rigorous test of the impact of race inequality. The labeling of children and adolescents best reflects the relational nature of racial classification in the Brazilian context when race labeling of children is being denominated by the same person. In the case of twins, the same respondent (usually parents) who knows

a great deal about the skin color and social outcomes of each twin answers the question on race for both twins.

In the specific case of educational inequality due to race, disadvantages can be attributed to differences in how whites and non-whites experience and interact with institutions and their social context. Telles (2004) has briefly examined differences in the educational success among siblings in multiracial families. He calls such approach as the "ultimate test" of racial discrimination and attributes the differences in siblings' educational outcomes he finds using the Brazilian 1991 census data to racial or color discrimination, including differences in treatment by parents and school personnel (Pp 149).

The conventional approach to examine the extent of racial inequality is to control for a number of key social origin and demographic variables—such as parents' education, child's sex and age, etc— with a focus on the marginal effect of family and demographic characteristics on educational outcomes, therefore exploring variance between individuals in different families. Although critical, this line of research does not capture variation in educational attainment due to distinct race labeling that occurs within families. Importantly, this approach does not allow for separating the two main mechanisms that generally explain race disparities in opportunities and outcomes everywhere: structural differences due to exposure to poverty and accumulated disadvantages, and the effects of race in itself.

**Research Questions and Hypotheses**

The first research question I examine is: Who are the families crossing racial boundaries across twins? To answer this question, I examine intra-family 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 if one group is systematically more or less similar with regards to racial labeling. I

also examine intra-family correlations of racial labeling over time. The main hypothesis is that twins who are socialized together have higher chances of being labeled similarly. As such, twins in two-parent families, who have lower levels of social control, 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 evince parenting strategies that may accentuate sibling differences in racial labeling by directing family resources unequally within the family unit. In fact, parents in high SES families act compensating for siblings' differences while low-SES families act reinforcing siblings' differences (Becker 1986).

The second research question I address is whether *within-family* differences in race labeling are important predictors of education for adolescents. I expect that there will be a statistically significant and negative effect associated with being labeled non-white in relation to years of education on both models of *between-* and *within-family*. The between-family associations have been demonstrated elsewhere. Educational disadvantages coming from being labeled non-white in twin models have not been uncovered. While few studies have examined *within-family* differences in education (Conley et al 2006), to the best of my knowledge, no study has examined how *within-family* differences in *race* are related to education.

**Data**

I 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. The results reported throughout

this paper use the sample weights provided by IBGE to produce a representative sample of individuals, although samples sizes reported refer to the unweighted number of observations.

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 years used in this analysis. The PNAD questionnaires include five categories of race: white, black, *pardo*, Asian, and native Indian.[3] Because of the nature of this paper's research questions, the analysis includes only individuals designated as white, black, or *pardos* in the survey. I 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. The final analytical sample for the pooled data from 1982 to 2009 in all regions of Brazil have 2,584 twins ages 17 and 18[4].

**Measures**

My measure of adolescents' outcome is completed years of education at the time of the survey. The choice of analysis is both theoretical and practical. Theoretically, these adolescents are at an age when they already have variation on their educational status, making this analysis relevant. Also adolescents are at the highest risk of dropping out of school. In practical terms, because the PNAD is a household survey, the data does not have information on parents' education for those who do not live with their parents[5]. Since parents' education is one of the most important determinants of children's schooling, and most 17 and 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

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[3] For a discussion on the categories of race used by the IBGE in Brazil, see Harris et al. 1993 and Telles 1995.
[4] An 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; Marteleto 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 I constructed using the household roster. I 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 17-18 year-olds.
[5] Exceptions are the 1982 and 1996 PNADs where a special module on social mobility was implemented.

education in the models, I therefore restrict the analytical samples to children of the head of the family[6].

I 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.

I measure race as a dichotomous variable of whites and non-whites (pardos and blacks) for two reasons. First, there is evidence that the recent social climate and socioeconomic gains in Brazilian society have produced real changes in the social position of blacks, one that currently yields a dichotomy in how race is associated with educational disadvantages (Marteleto 2012). The second reason is practical. Because twins are a rare event, sample sizes are small for each racial category implying that a dichotomous classification of white versus non-white yields more precise estimates. Children are labeled by the household respondent in the PNAD data. Rresearch has shown that respondents are likely to be either the father or the mother[7].

Table 1 reports the means and standard deviations of the variables used in the models for each analytical sample—singletons, twins and same-sex female and male twins. The mean educational attainment at ages 17-18 is 6.88 and 7.02 for singletons and twins, respectively. Females have about a year of schooling more than males among both singletons and twins. Another important point from Table 1 is that the Brazilian population is evenly divided between whites and non-whites.

**Methods**

In order to determine the social and demographic characteristics of families who cross racial boundaries

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

[7] In 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.

across twins, I estimate intra-class 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. The Kappa statistics does not assume a particular distance between skin color categories. A method for calculating the standard error of kappa is available that allows me 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 zero) (Villarreal 2010).

I next adopt a twins fixed-effects approach to assess the extent of race effects on education between twin pairs. The within-family factors I model are twin-specific factors that vary across twin pairs. Twin fixed-effects models will help me estimate the "purer" effects of race on educational outcomes by allowing me to control for unobserved variables. The logic behind twin fixed-effects models is to difference estimates across twins. The analogous OLS formulation is:

$$Y_{ij} = \beta X_{ij} + \alpha_i + \mu_{ij}$$

where $Y_{ij}$ corresponds to years of schooling for adolescent j in family i, X is a vector of explanatory variables, $\alpha_i + \mu_{ij}$ are the two components of the error term. $\alpha_i$ is the family fixed effect while $\mu_{ij}$ 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 $\alpha_i$ that corresponds to the unobserved family fixed effect:

$$Y_{ij} - Y_{iz} = \beta(X_{ij} - X_{iz}) + (\alpha_i - \alpha_i) + (\mu_{ij} - \mu_{iz})$$

While 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 twin fixed-effects models may still be biased. An additional

limitation of twins fixed-effects models is that these models only capture variation in explanatory variables and educational outcomes that occurs within families and between twins (Allison 2000). 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 I therefore test the robustness of my fixed-effects estimates for the full sample by estimating the corresponding models across different subgroups of years and levels of mother's education.

**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. The Table also reports the corresponding tests of statistical significance. 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 (0.942) than twins whose mothers have no formal training (0.880). Similarly, there is considerably more agreement regarding twins' race in families in the fifth than in the first quintile of family income distribution (0.906 versus 0.816). With regards 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. This suggests that socialization is an important factor in race labeling. Not surprisingly, another important factor in determining the level of agreement between the race labeling of twins is parental race. Adolescents in families where parents report the same race have higher levels of agreement in their race labeling than those in families of

parents reporting different races (0.860 versus 0.720). Among same-race parents, twins of black parents have higher levels of race labeling agreement (0.890), followed by whites (0.720) and pardos (0.620).

Figure 1 shows the kappa estimates by year. It is clear from the figure that the level of agreement regarding twins race labeling has declined significantly in the 2000s, suggesting that parents are now more frequently crossing racial boundaries. This is not surprising given recent findings that highly-educated parents identifying as black are now more likely to label their children as black, a trend that represents a shift in racial classification towards a valorization of blackness (Marteleto 2012).

*Within-family Effects of Race on Education*

The twelve columns of Table 3 show the associations between race and adolescents' years of schooling using ordinary least square regression models (OLS) on samples of singletons and twins, and fixed-effects models for the twin sample. The OLS models include control variables for age, sex, age, 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 six columns show the results for singletons; the first model (columns 1 to 3) includes multiple covariates, while the second model (columns 4 to 6) includes race and gender covariates only. Results for years of schooling indicate that, among singletons, non-white adolescents have a disadvantage of .488 year of schooling compared to their white peers after controlling for a set of social and demographic factors. For the race and gender models, the non-white coefficient reaches -1.312. The disadvantage associated with being non-white is .718 among twins when I estimate the models ignoring the paired nature of the data (columns 7 to 9).

When twins fixed-effects models are used to control for unobserved characteristics shared by twins (columns 10 to 12), the effect of race on education is smaller than in the previous models, but still

statistically significant at the .05 level. Twins labeled non-white have a .582 disadvantage in years of schooling vis-à-vis their twins labeled white. There are two important interpretations of this result. First, the smaller effect of race on twin 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 are controlled for, there is still an educational gap between twins associated with being labeled white versus non-white. This suggests that twins, who share the same family and neighborhoods, labeled differently experience social contexts and institutions differently. That is, environmental and school factors and discrimination account for a part of the educational disadvantage associated with race. 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). While the educational disadvantage of non-whites due to family and structural factors in Brazil has been well-documented (Marteleto 2012; Souza et al. 2011; Ribeiro 2011; Telles 2004), this new evidence shows that such disadvantage persists even among twins, when family unobserved characteristics are controlled for.

*Within-family effects of race and gender on education*

Table 4 examines the interaction between gender and race in determining adolescent schooling. I first examine twins of the same sex as a way to infer whether race has a differential effect on education depending on adolescents' gender. These models compare the effect of race on twins who are of the same sex, separately for females and males. Columns 1 and 4 show the non-white coefficients of twin fixed-effects models for females and males, respectively. An important finding is that the effect of race labeling on education is very similar for females and males, evidenced by the models when same-sex

twins are compared with each other. This suggests that the disadvantage associated with being labeled non-white vis-à-vis white is similar for boys and girls.

I next examine the interaction between gender and race in determining adolescent education. Columns 7 to 9 of Table 4 show results of models with gender and race interacted in a different way, by comparing mixed-sex twins. With this sample I am comparing non-white males with their female twins, either white or non-white. Non-white males have .409 fewer years of schooling than their female twin, irrespective of their race labeling. This suggests that non-white males are the most disadvantaged group with regards to education, showing the important interaction between race and gender in producing educational inequality.

**Conclusions and Discussion**

Brazil has been known for flexible racial relations that have long hidden racial disparities in social and economic opportunities and outcomes. While crucial for the understanding of racial inequalities, 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 paper, I use twin data from the nationally representative data from the National Household Survey (PNAD) to examine race inequalities in education using a twin fixed-effect approach. Such analytical approach allows for the control of *unobservable* characteristics. Importantly, the analysis allows for separating the two main theoretical mechanisms that generally explain race disparities in opportunities and outcomes everywhere: structural differences due to exposure to accumulated disadvantages and race effects due to whites and non-whites differently experiencing social institutions, such as schools. While 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 to 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, as it underscores the role of unobserved factors in *between-family* models of race inequality. This is evidence that most quantitative research measuring racial inequality of educational opportunity and outcomes comparing individuals across families encompass the issue of *unobservables,* underscoring the importance of recognizing data limitations and what quantitative variables can really measure.

The most remarkable finding emerging from this research is that there remains a sizeable disadvantage in schooling associated with non-white labeling even when accounting for *observable* and *unobservable* characteristics shared by twins. Importantly, because fixed-effect models explicitly account for *unobserved* characteristics, *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. 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 non-white Brazilians[8]. 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.

My findings also show that, among same-sex twin pairs, boys and girls share similar educational disadvantages when labeled non-white. The last set of models suggests that non-white males are the most disadvantaged group with regards to education. Combined, this is important evidence of the interaction between gender and race to produce educational inequality. That non-white males incur in

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[8] The project "Statute of Racial Equality" was proposed in May 2003 and approved in November 2005.

the highest levels of educational inequality is key to policies targeted at improving educational opportunities and outcomes.

There has been recent evidence suggesting that the overall gap in education attributed to race has declined over the last decades in Brazil (Marteleto 2012). This declining gap has been attributed to structural changes favoring adolescents in low-SES families, where non-white adolescents are disproportionately represented; as well as to changes in race labeling that suggest the high-educated Brazilian parents are more frequently labeling their children as black, which was not true in the past (Marteleto 2012). The present contribute to this debate by showing that an accompanying phenomena of the recent understandings of race in Brazil is that parents are increasingly crossing racial boundaries across their children, even across twins. My results indicate that the level of correspondence between the race of twins has declined in the 2000s compared to the 1980s and 1990s. This is not surprising, as current cohorts of adolescents and their parents live in a society that has increasingly recognized racial inequalities despite its long history of multi-racial identity.

Despite its significant findings, there are limitations to this research. Perhaps the most important of the study is also one of its main strengths, that is, the focus on twins. Although studying twins arguably controls for unobserved factors 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, for example, that 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. 2005), including cognitive development (Torche and Echevarría 2011).

In sum, findings from this research show that different race labeling has a substantial impact on schooling among twin adolescents. This discussion clearly resonates with the ongoing debate in the

United States regarding the future of racial and ethnic inequality 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 paper takes this evidence to the next level, by showing that even after controlling for unobservable that could explain race inequality in education, non-whites remain in disadvantageous positions, at least in terms of education.

# Tables and Figures

Table 1. Means, Standard Deviations and Percentage Distributions by Sample: Brazil, 1982, 1987-2009 (Standard Deviations between Pairs and within Pairs)

| | Singletons | | Twins | |
|---|---|---|---|---|
| Years of Schooling (mean) | 6.80 | 3.17 | 7.02 | 2.97 |
| Years of Schooling by Race (mean) | | | | |
| Non-White | 6.28 | 3.03 | 6.40 | 3.00 |
| White | 7.81 | 2.85 | 7.82 | 2.72 |
| White (%) | 49.49 | | 46.61 | |
| Female (%) | 48.50 | | 46.56 | |
| Female (mean) | 7.38 | 3.02 | 7.54 | 2.85 |
| Male (mean) | 6.32 | 3.21 | 6.66 | 3.00 |
| Urban Residence (%) | 78.91 | | 82.52 | |
| Region (%) | | | | |
| North | 6.32 | | 9.17 | |
| Northeast | 31.21 | | 33.17 | |
| Southeast | 40.84 | | 29.01 | |
| South | 14.50 | | 15.38 | |
| Center-West | 7.13 | | 13.28 | |
| Mother's Education (%) | | | | |
| None | 20.65 | | 21.12 | |
| Primary (some or complete) | 59.06 | | 54.99 | |
| Secondary (some or complete) | 14.70 | | 16.91 | |
| Tertiary (some or complete) | 5.58 | | 6.97 | |
| Mother's education, mean | 5.00 | 4.21 | 5.22 | 4.46 |
| [N] | 464,484 | | 2,584 | |

Source: PNAD 1982, 1987-2009. Adolescents ages 17-18 children of the head of the family.

Table 2. Correlation of Race of Twins according to Social and Demographic
Characteristics: Brazil, 1982 & 1987-2009

|  | Kappa | Std. Err. | Z | Prob>Z |
|---|---|---|---|---|
| Mother's Education |  |  |  |  |
| 0-4 | 0.880 | 0.020 | 48.81 | 0.000 |
| 5-8 | 0.910 | 0.030 | 31.38 | 0.000 |
| 9-11 | 0.890 | 0.030 | 26.95 | 0.000 |
| 12 + | 0.940 | 0.050 | 16.93 | 0.000 |
| Family Income |  |  |  |  |
| First Quintile | 0.816 | 0.051 | 15.92 | 0.000 |
| Second Quintile | 0.821 | 0.045 | 18.41 | 0.000 |
| Third Quintile | 0.847 | 0.033 | 25.38 | 0.000 |
| Fourth Quintile | 0.876 | 0.038 | 23.09 | 0.000 |
| Fifth Quintile | 0.906 | 0.039 | 23.12 | 0.000 |
| Family Structure |  |  |  |  |
| Both parents | 0.877 | 0.013 | 69.33 | 0.000 |
| Only mother | 0.838 | 0.024 | 35.02 | 0.000 |
| Number of Siblings |  |  |  |  |
| None | 0.881 | 0.040 | 22.30 | 0.000 |
| One | 0.874 | 0.032 | 27.21 | 0.000 |
| Two or more | 0.852 | 0.025 | 33.90 | 0.000 |
| Parents' Race |  |  |  |  |
| Same-Race | 0.860 | 0.020 | 54.11 | 0.000 |
| White | 0.720 | 0.020 | 31.75 | 0.000 |
| Mulatto | 0.620 | 0.020 | 26.13 | 0.000 |
| Black | 0.890 | 0.070 | 11.98 | 0.000 |
| Different Race | 0.720 | 0.030 | 23.90 | 0.000 |
| [N] | | 2,584 | | |

Source: PNAD 1982, 1987-2009. Adolescents ages 17-18 children of the head
of the family

Table 3. The Effect of Race on Adolescents' Years of Schooling, Brazil 1982, 1987-2009

| | Singletons OLS Multiple covariates | | | Singletons OLS Race and female covariates | | | Twins OLS Multiple covariates | | | Twins FE Race and female covariates | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b | 95% CI | Robust Std. Error | B | 95% C.I. | Robust Std. Error | b | 95% CI | Robust Std. Error | b | 95% C.I. | Robust Std. Error |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Non-White | -0.488*** | -0.505  -0.472 | 0.009 | -1.312*** | -1.330  -1.294 | 0.009 | -0.718*** | -0.908  -0.528 | 0.097 | -0.582** | -1.177  0.010 | 0.303 |
| Age | 0.590*** | 0.581  0.600 | 0.005 | | | | 0.603*** | 0.424  0.782 | 0.091 | | | |
| Female | -0.852*** | 0.837  0.868 | 0.008 | -0.920*** | 0.901  0.938 | 0.009 | 0.744*** | 0.566  0.922 | 0.091 | 0.439*** | 0.202  0.676 | 0.121 |
| Urban | 1.192*** | 1.172  1.213 | 0.011 | | | | 1.263*** | 0.976  1.550 | 0.146 | | | |
| Log Family Income | 0.288*** | 0.033  0.034 | 0.001 | | | | 0.650*** | 0.105  0.264 | 0.115 | | | |
| Mother's Education | 0.251*** | 0.249  0.253 | 0.001 | | | | 0.230*** | 0.207  0.252 | 0.011 | | | |
| Family Structure | -0.309*** | -0.328  -0.290 | 0.001 | | | | -0.413*** | -0.636  -0.191 | 0.113 | | | |
| Constant | -6.125*** | -6.288  -5.963 | 0.012 | 5.636 | 5.621  5.651 | 0.008 | -7.961*** | -11.115  -4.807 | 1.608 | 7.168*** | 6.817  7.520 | 0.180 |
| [N] | 352,068 | | | 352,068 | | | 2,584 (1,292 pairs) | | | 2,584 (1,292 pairs) | | |
| $R^2$ | 0.384 | | | 0.075 | | | 0.448 | | | 0.072 | | |

Source: PNAD 1982, 1987-2009. Adolescents ages 17-18 children of the head of the family. Also controlling for region of residence and year dummies in singleton models.

Table 4. The Effect of Race on Adolescents' Years of Schooling by Twin Sample and Gender, Brazil 1982, 1987-2009

| | | Twins FE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Same-sex Twins | | | | | | All Twins | | | |
| | Females | | | | Males | | | Gender*Race Interaction | | |
| | (1) | (2) | | (3) | (4) | (5) | | (6) | (7) | (8) | | (9) |
| | b | 95% C.I. | | Std. Error | b | 95% C.I. | | Std. Error | b | 95% C.I. | | Std. Error |
| Non-white | -0.600** | 0.111 | 1.089 | 0.249 | -0.559** | 0.008 | 1.110 | 0.281 | | | | |
| Non-white Male | | | | | | | | | 0.409*** | 0.208 | 0.610 | 0.102 |
| Constant | 6.972*** | 6.707*** | 7.236 | 0.135 | 6.116*** | 5.856 | 6.375 | 0.132 | 6.582*** | 6.519 | 6.645 | 0.032 |
| [N] | 866 (433 pairs) | | | | 1,006 (503 pairs) | | | | 2,584 (1,292 pairs) | | | |
| $R^2$ | 0.065 | | | | 0.046 | | | | 0.046 | | | |

Source: PNADs 1982, 1987-2009. Adolescents ages 17-18 children of the head of the family.

**Figure 1.**
**Kappa Correlation between Race of Twins**
**(Ages 17-18), Brazil: 1987-2009**
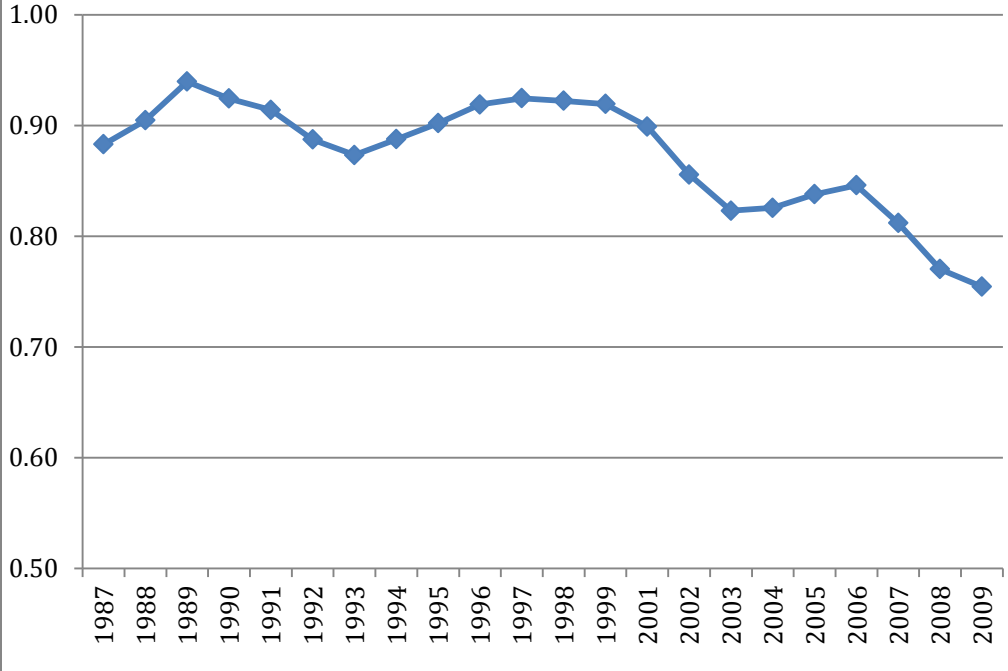
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